Fuji Electric

Innovating Energy Technology

User's Manual

USER'S MANUAL

FRENIC-VG Series

UPAC Edition

24A7-E-0044a

Description in this manual is subject to change for improvement without prior notice.
Though description in this manual is carefully prepared, contact the shop where you purchased this product, or our sales outlet as listed at the end of this manual, for any uncertainties or errors.

Introduction

Thank you for purchasing option OPC-VG1-UPAC (hereinafter referred to as UPAC) and OPC-VG1-SIU (hereinafter referred to as Optical Link) of Fuji's general-purpose vector inverter FRENIC VG.

This User's Manual describes the procedure for operating FRENIC-VG using UPAC only or UPAC and Optical Link. Read through this User's Manual for correct operation.

This manual is prepared for those familiar with the operation methods of the SX-Programmer Expert (D300win) software and FRENIC-VG hardware. Therefore the operation method of each piece of software and the unit itself is not described in this manual. Refer to the following relevant manuals together with this manual.

Title	Reference No.	Remarks
High performance vector control inverter catalog FRENIC-VG Series	24A1-E-0002	Product explanations, characteristics, specifications, outer dimensions, options, etc.
Instruction manual FRENIC-VG	INR-SI47-1563	Instruction manual attached to product Description concerning test operation and connection only (attached to purchased product)
FRENIC-VG USER'S MANUAL Unit Type, Function Code	24A7-E-0019	FRENIC-VG Unit Explanations
FRENIC-VG USER'S MANUAL Stacks	24A7-E-0018	FRENIC-VG Unit Explanations, Stacks
FRENIC-VG USER'S MANUAL Options	24A7-E-0045	FRENIC-VG Option Cards and RS-485 Explanations
User's Manual for MICREX-SX Series SPH, Instructions (Expert Loader)	FEH200	Explanation of memory, language, system definition and other items of MICREX-SX Series
User's Manual for MICREX-SX Series SPH SX-Programmer Expert (D300win) Reference	FH257	Description of menus and icons of SX-Programmer Expert (D300win) and explanation of all operation methods

Structure of This Manual

This manual is structured as follows.

Chapter 1. Preparation of System and Startup

Explains about the basic configuration of UPAC-based system, and preparations before starting operation.

Chapter 2. Preparation and Basic Operation Examples

Explains basic operations with trial operation methods.

Chapter 3. FRENIC-VG Interface

Explains detailed settings for operation and control configuration inside UPAC.

Chapter 4. Package Software

Introduces package software for UPAC.

Chapter 5. UPAC Programming Specification

Explains about UPAC programming specifications and connection with the VG unit.

Chapter 6. Maintenance and Inspection

Explains about details of periodic inspection and procedures for battery exchange.

Comprehensive Contents

■ Safety Precautions

Read this manual carefully before installing, connecting (wiring), operating, servicing, or inspecting the inverter. Familiarize yourself with all safety features before using the inverter.

In this manual, safety messages are classified as follows:

⚠**WARNING**	Improper operation may result in serious personal injury or death.
⚠**CAUTION**	Improper operation may result in slight to medium personal injury or property damage.

Situations more serious than those covered by CAUTION will depend on prevailing circumstances.

Always follow instructions.

Instructions on use

⚠WARNING

- This inverter is designed to drive a 3-phase induction motor and is not suitable for a single-phasemotor or others.

  A fire or malfunction may occur.
- This inverter may not be used (as is) as a component of a life-support system or other medical device directly affecting the personal welfare of the user.
- This inverter is manufactured under strict quality control standards. However, safety equipment must be installed if the failure of this device may result in personal injury and/or property damage.

  Accident may result.

Installation

⚠WARNING

- Mount this inverter on an incombustible material such as metal.
- Do not mount it near a combustible material.

  There is a risk of fire.
- The protective structure for inverters of 30 kW or more is IP00, and the main circuit terminal block section (active power section) may be touched. This also applies to cases where an optional DC reactor is used. In such cases, take care to mount the inverter in a place that is not easily accessible, etc.

  Electric shock or injuries could occur.

⚠CAUTION

- Do not hold or carry this inverter by the surface cover.

  Inverter may be dropped causing injury.
- Ensure that the inverter and heat sink surfaces are kept free from foreign matter (lint, paper dust,small chips of wood or metal chips).
- When changing installation bracket position, use the attached screws.

  A fire or malfunction may occur.
- Do not install or operate an inverter with a damaged external or internal component.

  A fire, accident or injury may occur.

Instructions on wiring

⚠WARNING

- In cases where a device to detect leakage (zero phase current) appropriate for the power supply system is not attached, because it is not operationally favorable if the entire power supply system is stopped due to operation of a ground fault relay, etc., or for other reasons, attach individual circuit breaker (ELCB) to only shut down the inverter system.
- Connect each inverter to the power supply via wiring circuit breaker, leakage breaker (with overcurrent protection function). Use recommended types of wiring breakers and leakage breakers. Do not use units that exceed recommended capacity.
- Use the cables of the specified size.
- Fasten terminals with the specified fastening torque.
- When there are multiple combinations of inverter and motor, do not use a multi-core cable to house wirings for such multiple combinations.
- Do not attach a surge absorber to the output side (secondary side) of the inverter.
- When the power supply transformer has a capacity of 500 kVA or more, and when that capacity is ten times the larger than the rated capacity of the inverter, then the optional DC reactor must be connected.

  There is a risk of fire.
- Carry out grounding work of Type C or D in accordance with the inverter's input voltage system.
- Make sure to ground the grounding wire for the inverter's grounding terminal [⏚G].

  Electric shock or fire could occur.
- A licensed specialist must perform the wiring works.
- Wiring work must be done after verifying that power supply has been cut off.

  Electric shock may result.
- Make sure to install the unit prior to wiring work.

  Electric shock or injuries could occur.
- Confirm that the phases and rated voltage of this product match those of the AC power supply.
- Do not connect power supply lines to the inverter's output terminals (U, V or W).
- When a braking resistor is to be connected, do not connect it to terminals other than P(+)-DB.

  A fire or malfunction may occur.
- Usually, reinforced insulation is not applied to the coating of control signal lines. Therefore, the insulated coating may be damaged for some reasons if control signal lines come into direct contact with the main circuit active power section. In such cases, take care to prevent the control signal lines from getting into contact with the main circuit active power section, in order to avoid the risk of high voltage of the main circuit getting applied to the control signal lines.

  Accident or electric shock may result.

⚠WARNING⚠

- Before any switching, **keep the power off for at least five minutes for 22 kW or less, and for at least ten minutes for 30 kW or less**, make sure that the LED monitor and charging lamp are turned OFF. Further, make sure, using a multimeter or a similar instrument, that the DC link bus voltage between the terminals P(+) and N(-) has dropped to the safe level (+25 VDC or below).

  Electric shock may result.

⚠CAUTION

- Electric noise is generated from the inverter, motor and wiring, which may cause surrounding sensors and devices to malfunction. In order to prevent such malfunction, take noise-proof measures.

  Accident may result.

Instructions on Operation

⚠WARNING

- Be sure to install the surface cover before turning on the power (closed). Do not remove the cover while power to the inverter is turned on.
- Do not operate the inverter with a wet hand.

  Electric shock may result.
- When the retry function is selected, the inverter may restart automatically after tripping. Design the machine to ensure personal safety in the event of restart.
- When the torque limiting function is selected, operating conditions may differ from preset conditions (acceleration/deceleration time or speed). In this case, personal safety must be assured.

  Accident may result.
- The STOP key on the keypad is only valid when the keypad operation is selected by function code F02. Separately prepare an emergency stop switch. If the operation command source is switched from the keypad by the link operation selection [LE], the STOP key becomes invalid.
- Eliminate the cause for the protective function to operate, verify that the operation command has been turned OFF, and cancel the alarm. If the alarm is cancelled while the operation command is still ON, the inverter starts to supply power to the motor, which may cause the motor to rotate and result in injury.

  Accident may result.
- If you select "Restart Mode after Momentary Power Failure" (F14 = 3 to 5), the inverter restarts upon power recovery. Design the machine to ensure personal safety in the event of restart.
- Fully understand this instruction manual and the user's manual before setting function codes. Careless alteration to function codes may cause motor rotation at a torque or speed that is not tolerable for the machine.

  Accident or injury may result.
- Even if the inverter has shut down power supply to the motor, voltage may be output to the inverter's output terminals U, V and W, while voltage is applied to the main power supply input terminals L1/R, L2/S and L3/T.
- Voltage is also output to the inverter's output terminals U, V and W, while the motor is stopped during DC braking action or pre-exciting action.

  Electric shock may result.
- High-speed setting can be easily set on this inverter. Fully understand the specifications of the motor and the machine before changing the settings.

  Injury may result.

⚠CAUTION

- The heat sink or braking resistor become very hot. Do not touch.

  Burns may result.
- Do not use the inverter braking function for mechanical holding.

  Injury may result.
- The digital input terminals have functions to command start and stop (operation command [FWD], coast to stop command [BX]), or to change the speed command. Depending on the terminal states of digital input, operation may be started abruptly or speed may be changed substantially by simply changing the setting of function codes. Ensure sufficient safety before changing setting of function codes.
- In digital input, command sources for operation steps and speed commands may be assigned to switching functions ([SS1, 2, 4, 8], [N2/N1], [KP/PID], [IVS],[LE], etc.). When such signals are switched, operation may be started abruptly or speed may be changed substantially.

  Accident or injury may result.

Instructions on maintenance, inspection, and replacement

⚠WARNING⚠

- Before proceeding to the maintenance/inspection jobs, **turn OFF the power and wait at least five minutes for inverters of 22 kW or below, or at least ten minutes for inverters of 33 kW or above**. Make sure that the LED monitor and charging lamp are turned OFF. Further, make sure, using a multimeter or a similar instrument, that the DC link bus voltage between the terminals P(+) and N(-) has dropped to the safe level (+25 VDC or below).

  Electric shock may result.

Only authorized personnel should perform maintenance, inspection, and replacement operations.

- Take off metal jewelry, such as watches and rings.
- Use insulated tools.
- Never modify the product.

  Electric shock or injuries could occur.

Instructions on disposal

⚠CAUTION

- Treat as industrial waste when disposing it.

  Injury may result.
- Battery used for this product is categorized as "primary battery", and should be disposed of in accordance with the locally stipulated disposal method.

Speed control mode

⚠CAUTION

- When the control constant of the Automatic Speed Regulator (ASR) is not appropriate, etc., operation may be continued even if operation command is turned OFF, becuase deceleration control is not enabled due to the occurrence of hunting state based on high-gain setting, and stopping conditions do not take effect.

  Even if deceleration is undertaken, hunting state may occur due to high response in the low-speed area, resulting in deviation of the speed detection value from the zero-speed area before the zero-speed control continuation time (F39) is elapsed. In such cases, operation may be continued after returning to the deceleration mode, because stopping conditions do not take effect.

  Take appropriate measures, such as adjusting the ASR control constant to an appropriate value and applying the speed disagreement alarm function; ensuring alarm trip in the case of deviation between the speed command and the actual speed; enabling switching of the ASR control constant by speed; distinguishing stop speed detection by command value; etc.

  Accident or injury may result.

Torque control mode

⚠CAUTION

- If rotation is in progress on the load side at a torque exceeding the torque command under torque control, operation may be continued even if the operation command is turned OFF, because stopping conditions do not take effect.

  In order to shut down inverter output in such cases, take appropriate measures such as deceleration to stop by switching to speed control; shutting down output by the coast to stop command: etc.

  Accident or injury may result.

General Instructions

⚠CAUTION

Although figures in this manual may show the inverter with covers and safety screens removed forexplanation purposes, do not operate the device until all such covers and screens have been replaced.

Icons

The following icons are used in this manual.

Note Ignorance of these indications and incorrect handling may invalidate FRENIC-VG's intended performances, or cause such incorrect operations and settings to result in an accident.

Tip Convenient tips for reference in inverter operations and settings

📖 References

Chapter 1 Preparation of System and Startup

This chapter describes the basic system configuration of UPAC and startup preparation before the operation.

Contents

1.1 System Configuration of UPAC

1.1.1 System Configuration

Install SX-Programmer Expert (D300win) + UPAC Upgrade to the PC to use it as a programming tool for the FRENIC-VG + UPAC + SIU system shown below. In the system without OPC-VG1-SIU, one FRENIC-VG unit can be controlled by UPAC.

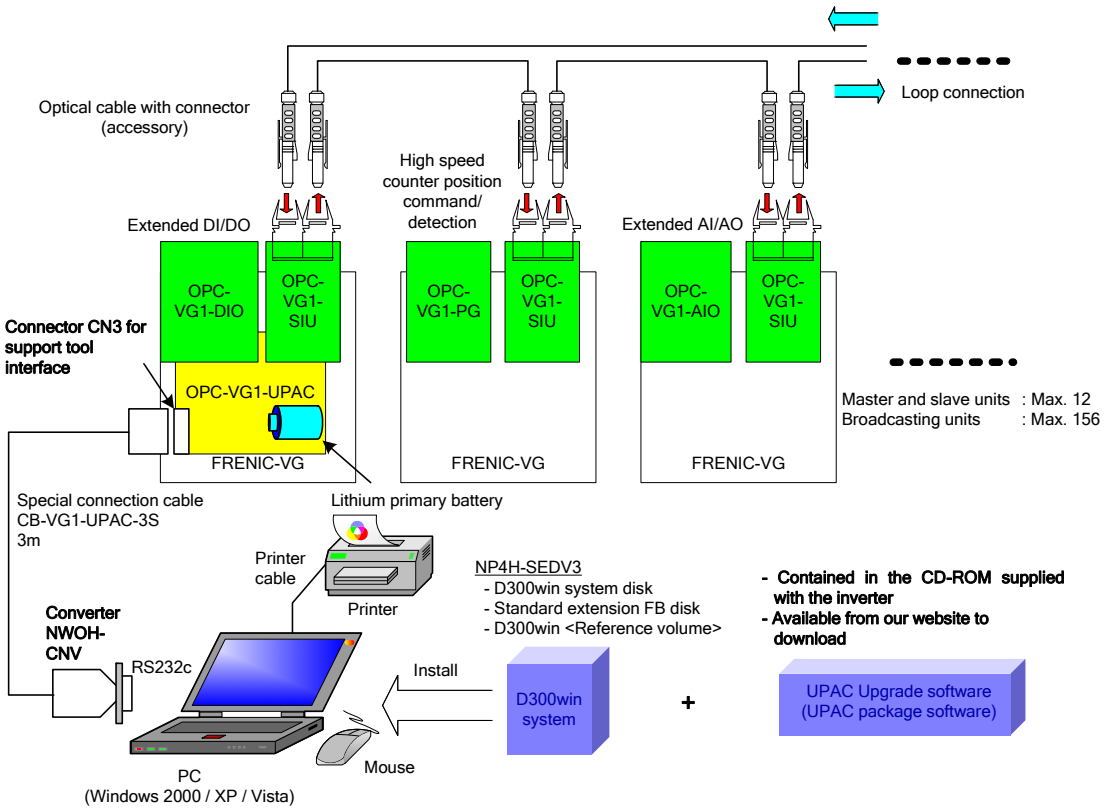


Fig. 1-1-1

Table 1-1-1 Option card and other system component list

Category	Name	Type	Function switch by software	Specifications	
Analog card	F/V converter	OPC-VG1-FV (*1)		F/V converter	
	Synchronous interface	OPC-VG1-SN		Synchronous interface for dancer control	
	Aio expansion card	OPC-VG1-AIO		Ai2-point + Ao2-point expansion card	
Digital 8-bit (for A or B port only)	Di interface card	OPC-VG1-DI	OPC-VG1-DIA	Used for 16-bit Di binary or BCD 4 digits + sign speed command, torque command, torque current specification. (Setting needs to be switched at the mounted port.)	
			OPC-VG1-DIB		
	Dio expansion card	OPC-VG1-DIO	OPC-VG1-DIOA	For function selection Di x 4-bit + function selection Do x 8-bit expansion	
			OPC-VG1-DIOB	For UPAC I/O expansion Di x 16-bit + Do x 10-bit	
	T-Link interface card	OPC-VG1-TL		T-Link interface card	
	CC-Link interface card	OPC-VG1-CCL		CC-Link compatible card	
	PG interface card	OPC-VG1-PG	OPC-VG1-PG(SD)	For +5V line driver type encoder interface (A, B, and Z signals) (500kHz) Used for motor speed detection, line speed detection, positioning command, and position detection.	
			OPC-VG1-PG(LD)		
			OPC-VG1-PG(PR)		
			OPC-VG1-PG(PD)		
		OPC-VG1-PGo	OPC-VG1-PGo(SD)	For open-collector type encoder interface (A, B, and Z signals) (100kHz) Used for motor speed detection, line speed detection, positioning command, and position detection.	
			OPC-VG1-PGo(LD)		
			OPC-VG1-PGo(PR)		
			OPC-VG1-PGo(PD)		
		OPC-VG1-SPGT		For 17-bit high-resolution ABS encoder interface	
	Synchronous motor drive PMPG interface card	OPC-VG1-PMPG		+5V line driver output supported	A and B magnetic pole position (max.4-bit)
		OPC-VG1-PMPGo		Open-collector output supported	
	High-speed serial card for UPAC communication	OPC-VG1-SIU(*1) (*2)		A single VG inverter with UPAC is used for link control of multiple inverters.	
Field bus interface card (For C port only)	PROFIBUS-DP interface card	OPC-VG1-PDP(*2)		PROFIBUS-DP interface card	
	DeviceNet interface card	OPC-VG1-DEV(*1) (*2)		DeviceNet interface card	
Digital 16-bit (for D port only)	SX bus interface card	OPC-VG1-SX		SX bus interface card	
	E-SX bus interface card	OPC-VG1-ESX		E-SX bus interface card	
	User Programable Application Card	OPC-VG1-UPAC(*2)		Custom software is created by the user and used for inverter control.	
Safety card(For E port only)	Function safety card	OPC-VG1-SAFE(*2)		Safety standard compatible card	
Control circuit terminal (For F port only)	High-speed serial communication compatible terminal block	OPC-VG1-TBSI(*2)		Used for multiplex system including multi-winding motor driver system or direct para system.	

(*1) To be supported soon

(*2) If the following options are used, the ROM version of the main unit should be as shown below.

OPC-VG1-UPAC,-PDP, SAFE, TBSI	MAIN: H10020 or later	MTR: H20020 or later
OPC-VG1-DEV	MAIN: H10030 or later	MTR: H20030 or later
OPC-VG1-SIU	MAIN: H10040 or later	MTR: H20040 or later

Combination of control option configurations (number of units allowed)

Table 1-1-2

CN	Port	Category	Pattern 1	Pattern 2	Pattern 3
3	A	Digital 8-bit, analog card	1	1	1
2	B	Digital 8-bit	1	0	0
6	C	Field bus interface card	0	0	1
10	D	Digital 16-bit	1	1	0
16	E	Safety card	0	1	1
1	F	Control circuit terminal	1	1	1

Limitations for installation of OPC control option

There are limitations for simultaneous installation, as shown in Table 6.1.3. OK: Can be installed simultaneously. NG: Cannot be installed simultaneously.

Table 1-1-3

Type OPC-VG1 -□□□□	SN	FV	AIO	DI	DIO	TL	CCL	PG	PMPG	SPGT	SIU	SX	ESX	UPAC	PNET	PDP	DEV	SAFE	TBSI
SN	NG																		
FV	NG	NG																	
AIO	NG	NG	NG																
DI	OK	OK	OK	OK															
DIO	OK	OK	OK	OK	OK														
TL	OK	OK	OK	OK	OK	NG													
CCL	OK	OK	OK	OK	OK	NG	NG												
PG/o	OK	OK	OK	OK	OK	OK	OK	*2											
PMPG/o	OK	OK	OK	OK	OK	OK	OK	*2	NG										
SPGT	*1	*1	*1	OK	OK	OK	OK	NG	NG	NG									
SIU	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	NG								
SX	OK	OK	OK	OK	OK	OK	NG	OK	OK	OK	NG	NG							
ESX	OK	OK	OK	OK	OK	NG	NG	OK	OK	OK	NG	NG	NG						
UPAC	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	NG	NG	NG					
PNET	OK	OK	OK	OK	OK	NG	NG	OK	OK	OK	NG	NG	NG	NG	NG				
PDP	OK	OK	OK	OK	OK	NG	NG	OK	OK	OK	NG	NG	NG	NG	NG	NG			
DEV	OK	OK	OK	OK	OK	NG	NG	OK	OK	OK	NG	NG	NG	NG	NG	NG	NG		
SAFE	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	NG	
TBSI	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	NG	OK	OK	OK	OK	OK	OK	OK	NG

*1) If this combination is required, contact our sales personnel.

*2) The following limitations will be applied when installing the PG interface card (OPC-VG1-PG/PGo) and synchronous motor drive PMPG interface card (OPC-VG1-PMPG/PMPGo).

Table 1-1-4

	VG1-PG/PGo(SD) VG1-PMPG/PMPGo	VG1-PG/PGo(LD)	VG1-PG/PGo(PR)	VG1-PG/PGo(PD)
VG1-PG/PGo(SD) VG1-PMPG/PMPGo	NG			
VG1-PG/PGo(LD)	OK	NG		
VG1-PG/PGo(PR)	OK	NG	NG	
VG1-PG/PGo(PD)	OK	NG	NG	NG

1.1.2 Requirements of PC

Table 1-1-5

Item		Requirement
PC		IBM-AT PC
CPU		Intel Pentium 400MHz or higher * 800MHz or higher is recommended.
Hard disk		Free space of 220MB or more (D300win:120MB, Standard expansion FB: 100MB) Note 1)
External storage device		Required for installation
	CD-ROM drive	1 or more * 4x or faster is recommended.
Memory capacity		64MB or more * 256MB or more is recommended.
Communication interface		RS-232C port
Mouse		One or more of USB mouse, bus mouse, or PS2 mouse should be supported.
Keyboard		106 Japanese (A01) keyboard (Ctrl + Alphanumeric keys)
Display		Resolution: 800 x 600 dots * 1024 x 768 dots or more are recommended.
Operating system		Windows2000 Japanese or English edition
		Windows XP Japanese or English edition
		Windows Vista Japanese or English edition
		Windows 7 Japanese or English edition
Other software		Internet Explorer 5.0 or later .NET Framework 2.0
Installer		Windows standard installer

Note 1) For FAT16 format, free space of 340MB or more (D300win:140MB, Standard expansion FB:180MB, UPAC: 20MB) is required.

1.1.3 Difference from VG7 series UPAC option card

This product differs from OPC-VG7-UPAC as described below. Be very careful if you are reusing a project file or application program used with the VG7 series UPAC.

(1) Support tool interface

VG7 used a converter (NW0H-CNV) and connection cable (NP4H-CB2) to connect the UPAC card and PC.

FRENIC-VG uses a converter (NW0H-CNV) and dedicated connection cable (CB-VG1-UPAC-3S) for connection. If you are using a support tool (D300win) to control UPAC, you must prepare the dedicated connection cable (CB-VG1-UPAC-3S).

If you are using OPC-VG7-UPAC, you can use the current converter (NW0H-CNV). Refer to Figure 1-1-1 for the connection diagram.

(2) Function code

Since the function codes of the VG7 series are almost the same as those of the FRENIC-VG series, the project files and/or application programs used with VG7 can be used without modification in many cases. However, some function codes are different.

If you are using the project files and/or application programs using these function codes with the FRENIC-VG series, you must modify them.

Refer to Section 12.5 of "FRENIC-VG USER'S MAMUAL" for the details.

[Outline]

- The function codes A35 to A50 for the third motor are changed to A101 to A154 with the FRENIC-VG series.

  Note that the function list of the global variable worksheet uses the VG7 series function code system and does not need modification. (E.g., The VG7 function code A35 is changed to A102 with FRENIC-VG, but the variable name is still a35_f.) If you are using high-speed data update to manipulate the function codes, you need modification because the function code addresses are different.

- The following function codes use different value definitions:

  Torque boost: A46, ASR-I integral constant: F62, magnetic pole position offset: o10, PTC operation level: E32

- Some M codes, including the model code: M23 and inverter ROM (main control) version: M25 need to be changed to the values for the FRENIC-VG series, project files and application programs using them need modification.

(3) Package software

Package software for VG7 also conforms to (2) above, and the following versions are required. You can download them from our Web site.

- WPS-VG1-DAN: To be supported soon
- WPS-VG1-POS: Version 13009 or later
- WPS-VG1-TEN: To be supported soon

(4) Support tool SX-Programmer Expert (D300win), UPAC upgrade software

Use D300win version 3.6.1.3 or later. Also use the UPAC upgrade software version 3.6.1.3 or later. (You can download them from our Web site.)

If you open a program created by an older version (2.x.x.x) of D300win, it may be launched with "no PC connection". In this case, open the "Communication Setting" screen shown in Figure 1-3-51 in Section 1.3.4.2 of "MICREX-SX Series USER 'S MANUAL - UPAC", and then click [OK] to change the status to "Operating".

1.2 Preparation of Option

1.2.1 OPC-VG1-UPAC option

1.2.1.1 Description of product

This card (User Programmable Application Card, UPAC hereafter) is an optional card for the inverter control installed on FRENIC-VG. This card gives you an additional higher level control over your inverter. You can also use engineering support tool SX-Programmer Expert (D300win) to facilitate programming the control applications being used for this card.

UPAC is an optional PLC card integrated into the inverter conforming to MICREX-SX series high performance CPU module (NP1PS-32). Since UPAC is slightly different in programming specification such as memory map and available instructions from that for the high performance CPU module, refer to "5) Programming Specifications" for more information. We recommend you to refer to "MICREX-SX Series USER 'S MANUAL - INSTRUCTIONS" when you design your application program.

■Main features

(1) Application execution function
Running application program
Task management (default, period, event) of application program

(2) Support tool interface
RS485 1 line
A dedicated cable (CB-VG1-UPAC-3S) and converter (NW0H-CNV) are used to connect UPAC and PC.

(3) RAS function
Executes self-diagnosis and notifies to the inverter.

(4) Other
Data memory backup with battery

This card enables you to realize controls such as dancer control, tension control, and orientation control easily.

With inverter link option (OPC-VG1-SIU), you can designate an inverter with UPAC installed as a master and connect up to twelve slave inverters (156 inverters for broadcasting) to control these individual inverters.

An application program of UPAC runs at minimum execution period of 1ms. The execution period increases to 2, 3, 4, ... or 32000ms depending on the size of a program.

You can assign up to 64W from static variables used in an application program to the function codes U01 to U64 (user area) of FRENIC-VG. When you assign parameters for adjustment to this user area, you can use the KEYPAD of FRENIC-VG to refer to or change the data.

UPAC has some restrictions over SX series high performance CPU module (NP1PS-32). The calendar function is not available and SX specific instructions are removed. Read this document thoroughly for complete understanding.

[Limitation]

UPAC is equipped with a high-performance CPU installed in MICREX-SX, but the functions of UPAC are not fully equivalent. There are limitations in the following functions.

- Calendar and clock function is not supported.
  Because of this, nothing is displayed in the "major failure time information" and "power shutdown history information" of detail RAS. The calendar/clock function of D300win always shows "January 01, 1970, 00:00:00."
- Because UPAC is not equipped with the key switch of MICREX-SX, the key state is always "TERM."
- HELP of UPAC system definition of D300win is not supported.
- "MICREX-SX" is displayed as the title of each dialog box of D300win.

• Batteries cannot be replaced while the inverter is powered on.

1.2.1.2 Specifications

Table 1-2-1 Performance

Item		Requirement	Note (restrictions)
Instruction	Language	IEC language compatible (IEC61131-3)	
	Speed	Sequence command: 0.12μs or higher Integer addition/subtraction command: 0.14μs or higher Multiplication command: 0.16μs or higher Division command: 1.94μs or higher Floating-point addition/subtraction command: 0.18μs or higher Multiplication command: 0.18μs or higher Division command: 1.4μs or higher Timer command: 1.0μs (including CAL/RET process) Counter command: 0.7μs (including CAL/RET process)	
Memory capacity	Program memory	32kStep	
	Data memory	8kW	32kW for MICREX-SX series NP1PS-32
	Control function elements	Timer: 256 points Counter: 128 points Differential relay: 256 points Hold relay: 256 points	
No. of I/O points	FRENIC-VG control variable	Max. 302W 6-unit system : 50W 6 units+2W 12-unit system : 22W 12 units+2W	
Task	Level types	0,1, default level	
	Priority	0>1>default level	
	Number	Default task (cyclic scan): 1 Fixed cycle task: 2 Event task : 2 } Up to two in total	
Cause of task start	Cause of interruption	Constant period, event	Up to two
	Fixed period cycle	Integer multiple of fixed cycle interruption up to 32000ms	Fixed cycle interruption from FRENIC-VG. Period is adjustable through loader.
	Default task execution	Based on interrupt, executed in a period rounded up according to task execution time. Example) Executed in 3ms cycle where interrupt is 1ms and task execution period is 2.3ms.	
PG number	64		
1POU length	max. 8kstep		
Operation nesting	max.1024		
FB•FCT numbers	System FCT	185 types (such as transmission, string, analog, and 32 or more bit operation)	
	System FB	28 types (such as flip-flop, timer, counter, file, analog, and pulse)	Calendar, message, and BANK_CHG available for MICREX-SX series NP1PS-32 are not available.
	User FCT	256	
	User FB	256	
User FCT •FB nesting	max.128-2		128 nestings including task switch available
Loader Interface	Transmission specification	RS485 4-line type	
	Transmission rate	38400bps,19200bps,9600bps,4800bps	
	Transmission distance	Max. 10m	
	Isolation	None	
Memory backup specification	Backup area	Retention area	
	Back up period	5 years (storage temperature: 25°C)	Never replace the batteries while the inverter is powered on.

1.2.1.3 External dimensions and accessories

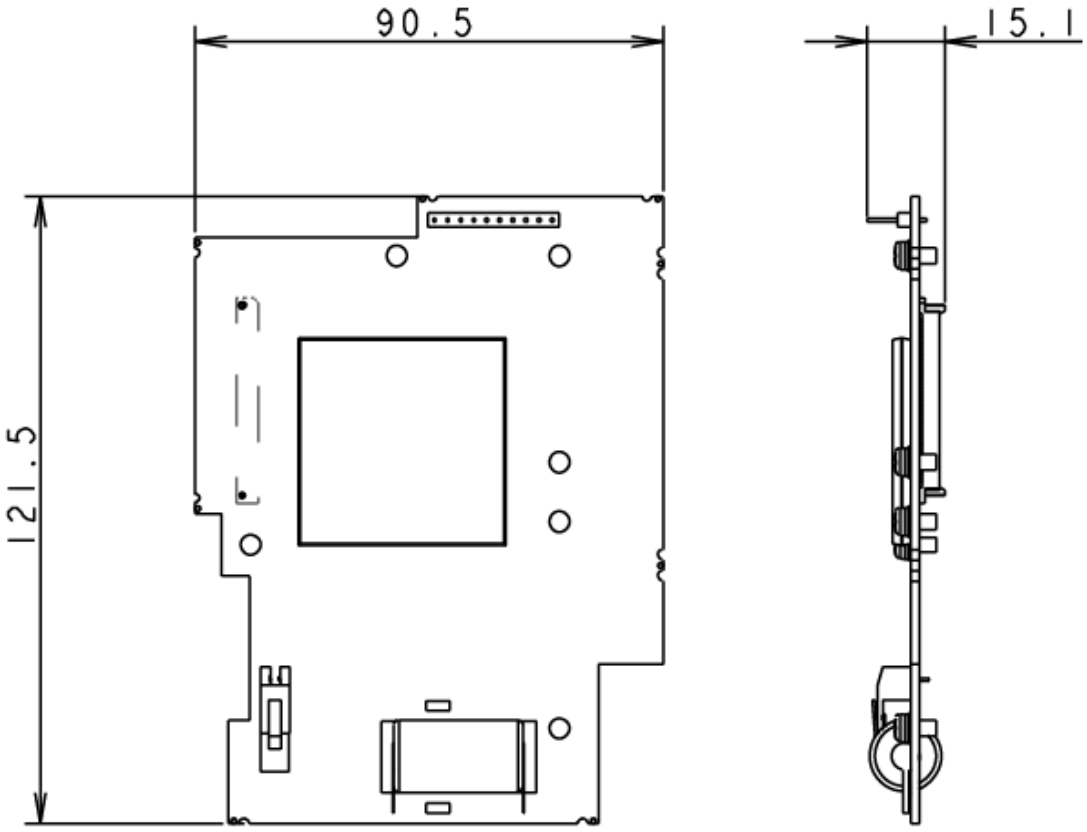


Fig. 1-2-1

Table 1-2-2 Backup battery (accessory)

Type	OPK-BP
Voltage/capacity	3.6 V／1100 mAh
Type	Thionyl chloride lithium battery
Replacement period	5 years (Ambient temperature: 60°C, inverter powered off)

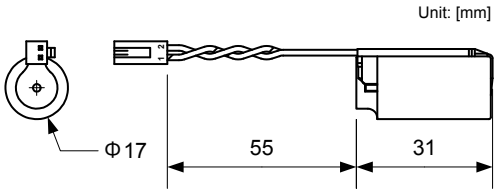


Fig. 1-2-2

⚠WARNING

Safety Precautions

This battery is a high-energy density battery using lithium (hazardous material) and thionyl chloride (toxic substance) sealed inside. If it is used in a wrong way, it may get deformed or the internal fluid may leak out, causing heat, bust, fire, or stimulative or corrosive gas. These may cause human injury or damage to the equipment. You must follow the safety precautions below.

- Do not swallow the battery.
- Do not apply excessive force to the positive terminal.
- Do not drop the battery.
- Do not short both of the poles of the battery.
- Do not charge the battery.
- Do not forcibly discharge the battery.

- Do not heat the battery.
- Do not throw the battery into fire.
- Do not dismantle the battery.
- Do not apply pressure to deform the battery.
- Insert the battery into the inverter in the correct direction.
- Do not touch fluid which leaked out from the battery.
- Do not leave a damaged battery in the inverter.

⚠CAUTION

Store the battery in a place where direct sunlight, high temperature, and high humidity as well as rain drops are not applied.

The battery used with this product is a "primary battery" which must be discarded according to the local regulation or law.

⚠CAUTION

- An ErA alarm may be developed when the option is turned on for the first time. If this happens, leave the power turned on for about 30 seconds, and turn the power off then on again.

1.2.1.4 Installation method

Refer to the Instruction Manual supplied with the OPC-VG1-UPAC option card.

1.2.2 OPC-VG1-SIU option (To be supported soon)

1.2.2.1 Description of product

The UPAC option is designed for a small to medium system for generalizing and driving about 10 inverters.

UPAC is installed on an arbitrary FRENIC-VG inverter. In order to control the second and later FRENIC-VG units from UPAC, the high-speed serial communication card

OPC-VG1-SIU (optical option, hereafter) is required.

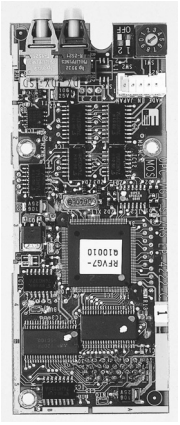


Fig. 1-2-3

Rigid digital system configured through optical communication

In conventional small to medium systems, a PLC, computer board or the like is installed externally and each inverter is generalized and driven through input/output basis or analog basis. When network connection is possible, digital control via the network (including open and private ones) can be made.

Using this optical option, the control based on inputs and outputs or analog signals can be replaced with a rigid high-speed maintenance-free digital system where a small wiring length can result in a reduced cost and noise immunity is high.

Load distribution system

When a PLC or computer board in an upper-level system administrates each drive control group, deploying UPAC control groups at lower-level systems reduces the processing load, constructing a load distribution system. This allows the lower-level system to implement higher-response control dedicated for each drive control and the upper-level system to dedicated itself to administration of data from each drive control group.

Here, preparation for operation of multiple inverters using a link (optical link) connected via optical fiber cable (hereinafter referred to as optical cable) with UPAC being the master, is described, for customers having purchased the optical option of the FRENIC-VG inverter.

Read through this manual carefully before operating because there are some limitations in operation.

1.2.2.2 Specifications

Table 1-2-3 Hardware specifications

Item	Specification	Remarks
Model	OPC-VG1-SIU	High-speed serial communication card (optical option)
Connector	Transmission (TX) / reception (RX) connector	
Definition	Define "SIU using SW 2 on the option. (1,2) = (ON,ON)	
Power supply	The power is supplied through the connector.	
Accessory	Plastic optical fiber cable (5 m)	

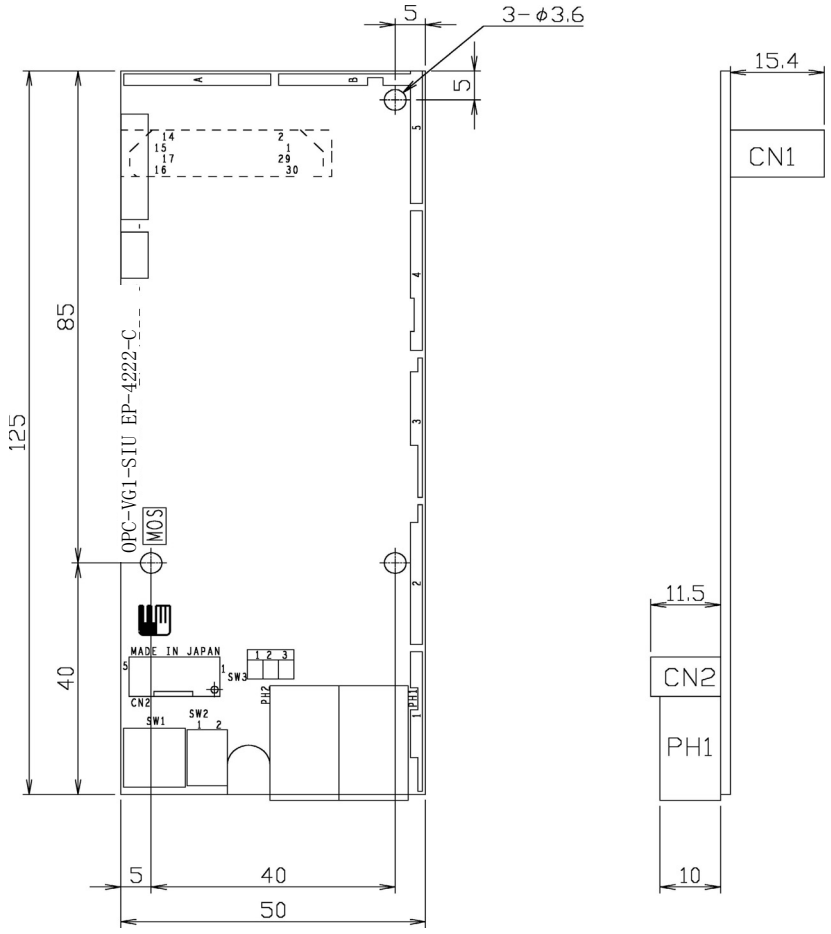
Communication specifications

Item	Specification	Remarks
Connection style	Loop-back connection through plastic optical fiber cable	
Communication speed	1Mbps	
Communication distance	5m Contact us when a longer distance is required.	
Connection method	Master-slave method (Max. 12 units) Broadcasting method (Max. 156 units)	Selection with function code
Number of connected units	Master-slave method 6-unit system: Max. 6 units (50 W inputs/outputs per unit) 12-unit system: Max. 12 units (22W inputs/outputs per unit) Broadcasting method Max. 156 units (32 W outputs per unit)	Selection in D300win screen. The broadcasting method indicates the function where the same data is written from the master to all inverters.
Writing time	Master-slave method Time = (n-1) x 2 (ms) (n: n > 1; number of units) 2 units: 2ms 3 units: 4ms 4 units: 6ms 5 units: 8ms 6 units: 10ms 7 units: 12ms 8 units: 14ms 9 units: 16ms 10 units: 18ms 11 units: 20ms 12 units: 22ms * The reading period is twice the value written on the left. Broadcasting method: 1ms	
Communication link establishment confirmation	Blinking green LED on option The digital output indicates the communication state.	The lamp blinking at 500 ms interval indicates establishment of the communication link. [0-D07] is used: 1 indicates establishment of the communication link.
Protective function	Inverter being stopped; The protective function does not work if the communication link is not established. Inverter running; Protective function “inverter-to-inverter link error” is developed if the communication link is not established.	The conditions for failure of establishment of the communication link are: • Illegal setting (function code, System Definition) • Broken wire in communication link (broken wire, bending at 35 mm or larger curvature, etc.)
Fail-soft operation	The option is not compatible with fail-soft operation. → When inverters are connected via optical link in a system consisting of total n units ($2 \leq n \leq 156$: n is an integer), the communication link is lost if x ($1 \leq x \leq n-1$: x is an integer) units of inverters are turned off. Turn on all n units of inverters (or control power of the inverters) .	

Software specifications

Item	Specification	Remarks
Main unit ROM version	H10040 or later, H20040 or later Operate at the above ROM versions. (Use the I/O check at the keypad panel to check the ROM version) .	
Definition of connection	• Master-slave function code o35, o36 • o38 set only at master	If these settings are wrong, the communication link is not established.
Input/output data	Master-slave method I/Q area; 50W, 22W selection Function code area; Only the master (with UPAC) can read and write all codes. The slave inverter can only write 4W function code data. Broadcasting method Q area only; 32W (Only the master can refer to 18W in the I area.)	Selected in 6-/12-unit system With the broadcasting method, only the output selection of inverter 1 of a 6-unit system can be used.

1.2.2.3 External dimensions and accessories



Unit: mm

Fig. 1-2-4 External dimensions of option PCB

Plastic optical fiber cable

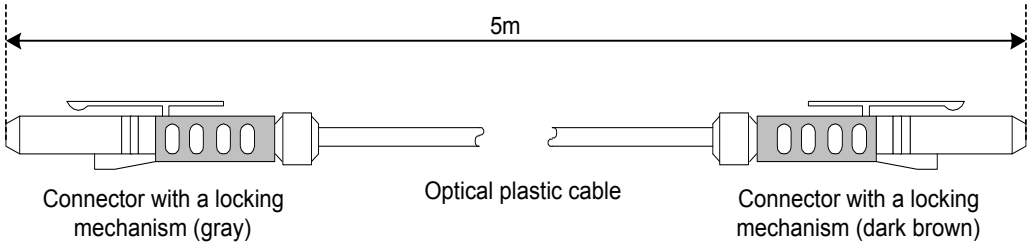


Fig. 1-2-5 Plastic optical fiber cable

1.2.2.4 Installation method

Refer to the Instruction Manual supplied with the OPC-VG1-SIU option card.

1.2.2.5 Confirmation and setting procedures

1) Confirmation, connection and setting of optical option
Perform the following setting and connection.

(1) Set the rotary switch (SW1) on the optical option. Master = 0, each slave = 1.
(2) Check the setting of DIP switch SW2. (SW 2-1, SW 2-2) = (ON, ON) fixed.
(3) Connect the optical cable attached to the optical option (5-meter long, one cable attached to each optical option).

2) Switch setting

⚠CAUTION

- If the settings of the switches (SW1 and SW2) on the optical option are wrong, the UPAC system does not operate correctly. Read the following description about the setting carefully and set correctly.
- Turn the power (control power) off before changing the switch setting. If the switch setting is changed with the power ON, turn the power off then on again to reset.

Table 1-2-4 Switch on card (SW1)

Part No.	SW1 setting	Function	Remark
SW1 rotary switch	0	Master	Define the inverter, on which UPAC is installed, to be the master. If "0" is set for an inverter without UPAC, operation procedure alarm "Er6" is caused.
	1	Slave 1 to 11	Set all slaves to "1". Setting a slave to other than "1" causes the operation procedure error "Er6."
	2 to 9	Invalid	Do not set in these positions. Otherwise operation procedure alarm "Er6" is caused.

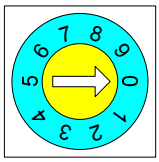


Fig. 1-2-6

Set the station switch of the master at "0" and that of all the slaves at "1."

The station with SW1 being 0 is defined to be the master, while that with SW1 being 1 is defined to be a slave.

Table 1-2-5 Switch on card (SW2)

Part No.	SW2-1 setting	SW2-2 setting	Function	Remark
SW2 DIP switch	OFF	OFF	–	Do not set.
	ON	OFF		
	OFF	ON		
	ON	ON	UPAC+ SIU system	The optical option is used in the UPAC system. Set all optical options to the same settings whether it is a master or slave.

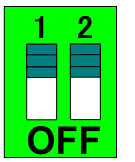


Fig. 1-2-7

DIP switch SW2 shown on the left is located at the lower end of the option. Set to ON, ON.

After the above settings are given, the optical option becomes available as a UPAC system.

3) Connection of optical cable

⚠CAUTION

- If the optical cable is bent at a curvature smaller than 35 mm for a long time, optical communication does not function correctly and inverter-to-inverter link error "Erb" is caused. Avoid routing the cable at curvatures smaller than 35 mm.

Connect the optical option via the accessory optical cable.

As shown in the figure on the right, the connectors for transmission and reception are located at the lower end of the optical option.

Each connector is identified with the color. Connect the gray plug with the gray connector, and the dark brown plug with the dark brown connector.

Configure a loop when connecting. The communication originated at the master is sent to a slave and the communication sent from the slave is received at the adjacent slave. The communication received at the last slave is sent and returns to the master in the connection pattern.

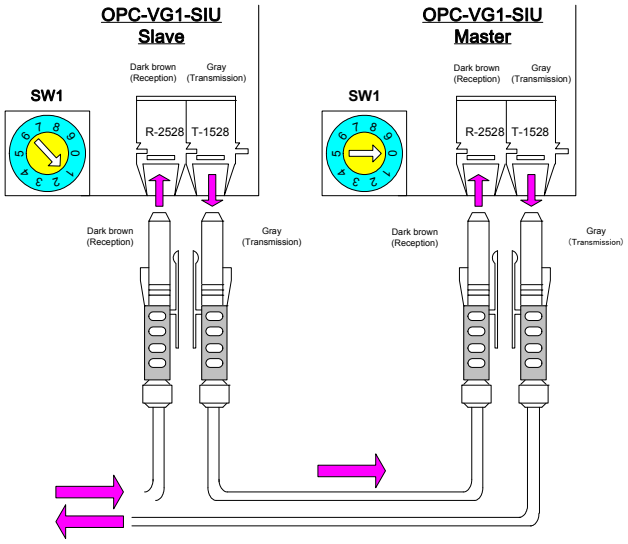


Fig. 1-2-8

Table 1-2-6 Optical connector on SIU card

Part No.	Name	Color	Outline
T-1528	TX	Gray	Transmitter (transmission)
R-2528	RX	Dark brown	Receiver (reception)

Notes) If the optical cable is not connected or it is inserted improperly, correct communication is impossible.

- If the communication link fails due to a broken line in the communication path under power application, an inverter-to-inverter link error "Erb" is caused.
- If the communication link is not established when power is turned on, the communication link is not established but no alarm is displayed. When an operation command is issued, an inverter-to-inverter link error "Erb" is caused as a protective action.

Table 1-2-7 Absolute maximum rating of optical cable (accessory)

Item	Min.	Max.	Unit	Remark
Storage temperature range	-40	+75	°C	
Tensile force		50	N	Within 30 minutes
Short-time bending radius	**10**	—	mm	Failure to operate within one hour; an inverter-to-inverter link error "Erb" is caused.
Long-time bending radius	**35**	—	mm	A curvature shorter than 35 mm for a long time may cause an inverter-to-inverter link error "Erb." Be sure to assure 35 mm or a larger curvature.
Tensile strength (long time)	—	1	N	
Flexibility	—	1000	times	Bending at 90° on 10 mm mandrel (core rod, spindle)
Impact	—	0.5	Kg	Impact test as per MIL-1678, Method 2030, Procedure 1
Guaranteed maximum distance	**10**		m	Guaranteed minimum value due to transmission loss (0 to 70°C)
Weight	4.6		g/m	

1.3 Preparation of Software

1.3.1 Installation Method

1.3.1.1 Installing the SX-Programmer Expert (D300win) software package

This section describes how to install the D300win software package using a Windows XP PC as an example. The same procedure can be used to install the standard expansion FB.
The procedures are the same for other OSes (e.g., Windows 2000).

◆ Stop any application programs running and disable the anti-virus software as well as the screen saver.

◆ When you insert the product CD-ROM into the CD-ROM drive while Windows is running, the following screen will automatically appear.

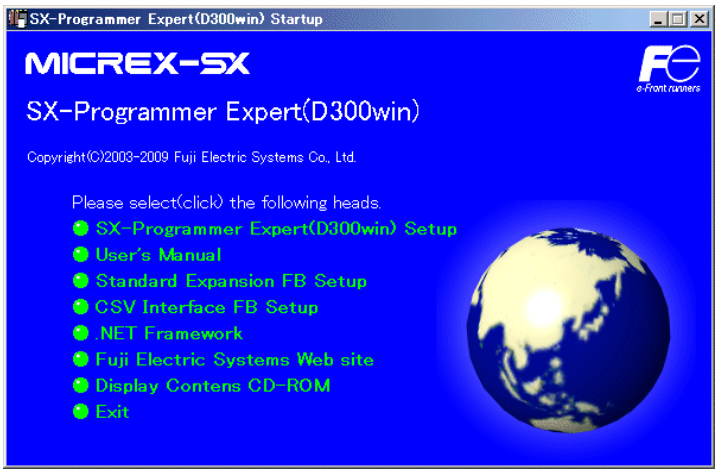


Fig. 1-3-1

Note) If the installation screen does not automatically appear, follow the procedure below.
Click the [Start] -> [Run] on the Windows desktop, enter "CD-ROM_drive_name¥autorun.exe", and then click [OK].

◆ Click "Set up SX-Programmer Expert (D300win)" on the initial screen to open the following screen.

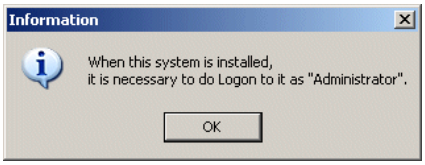


Fig. 1-3-2

Note 1) Be sure to install it as "Administrator."

Note 2) If the following warning appears while installing the software on a Windows 2000 PC, Install the Windows installer by clicking [.NET Framework]→[Windows installer 3.1 (2000/XP)] on the initial screen, and set up SX-Programmer Expert (D300win) again.

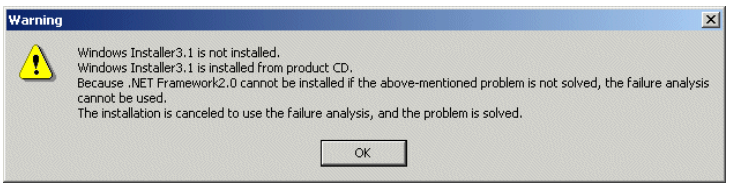


Fig. 1-3-3

◆ Clicking [OK] on the information screen launches the installer.

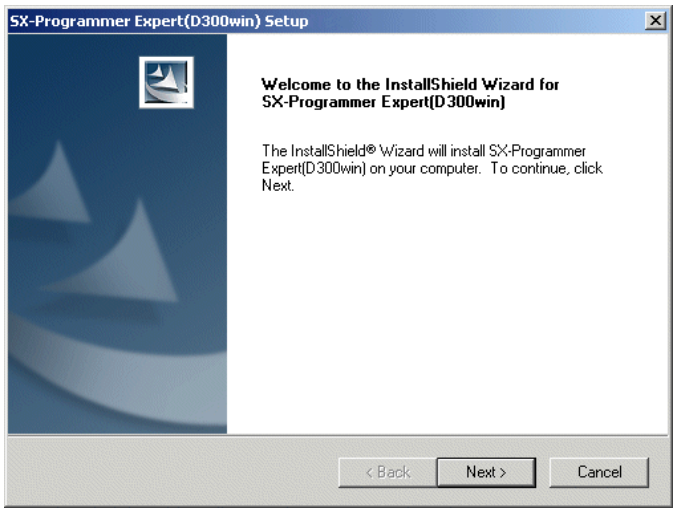


Fig. 1-3-4

◆ Clicking [Next] displays the License Agreement screen. Read the contents and click [Yes] if you agree with them.

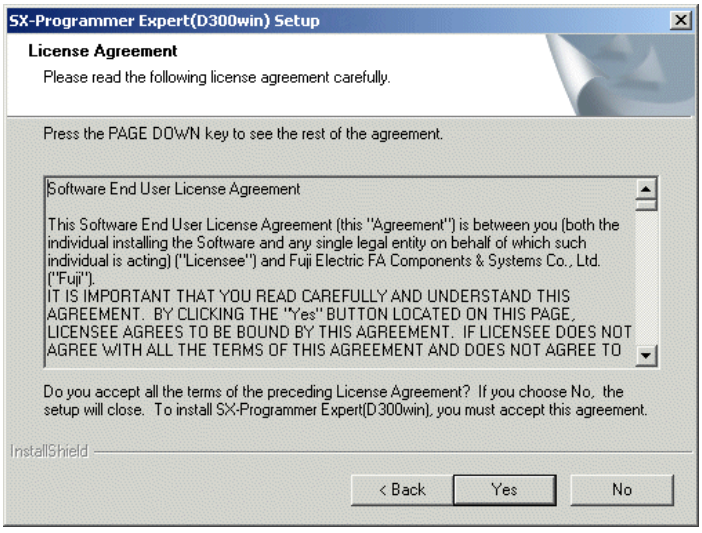


Fig. 1-3-5

◆ The "Select installation folder" screen appears. The default is "C:¥ D300win."
Click [Next] if you accept the default location.

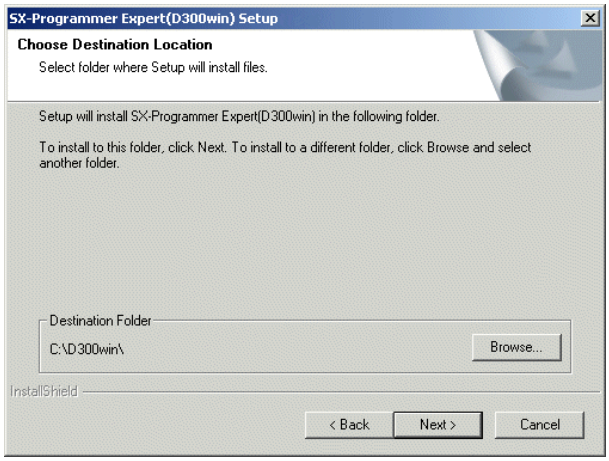


Fig. 1-3-6

◆ If you want to change the installation folder, click [Browse] button to open "Choose directory" dialog box. Choose or enter the desired directory name and click [OK].

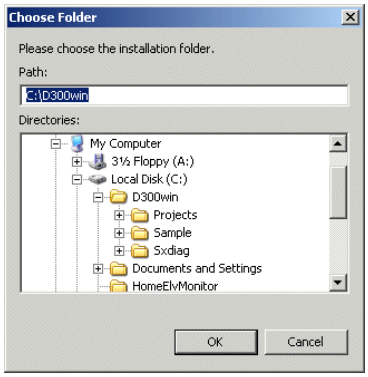


Fig. 1-3-7

◆ The "Setup type" screen appears. Choose the setup type from "Standard", "Compact", and "Custom", and then click [Next].

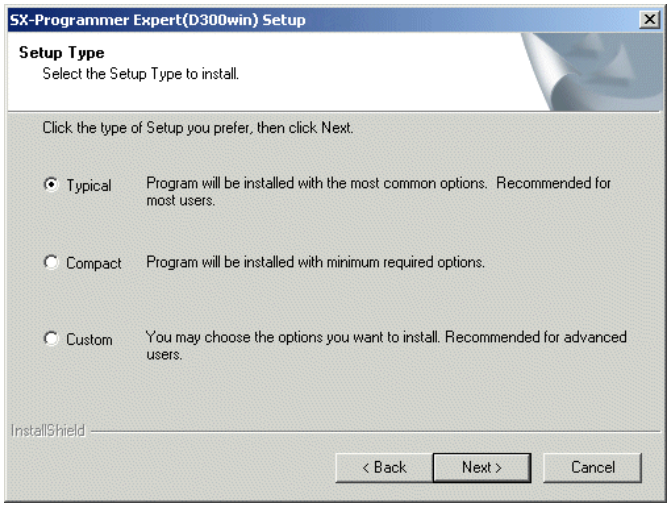


Fig. 1-3-8

<Setup types>
Each of the "Standard", "Compact", and "Custom" setup types installs the components listed below.

■ The standard setup type installs the following components.

- SX-Programmer Expert (D300win) program
- MICREX-SX definition file
- MICREX-SX PU256E template
- MICREX-SX PU048E template
- MICREX-SX PS245 template
- MICREX-SX PS117 template
- MICREX-SX PS74 template
- MICREX-SX PS74D template
- MICREX-SX PS32 template
- MICREX-SX PM256E template
- MICREX-SX PM256H template
- MICREX-SX PM48R template
- MICREX-SX PM48E template
- MICREX-SX PH16 template
- MICREX-SX PH08 template
- MICREX-SX SPB definition file
- MICREX-SX NW60C template
- MICREX-SX NW60 template
- MICREX-SX NW40C template
- MICREX-SX NW40 template
- MICREX-SX NW30 template
- MICREX-SX NW20 template
- Board controller definition file
- MICREX-SX NW32-42C definition file
- MICREX-SX NW16-42C definition file
- MICREX-SX NW08-41C definition file
- Training template•Page layout
- SX control utilities •POD link support

■ The compact setup type installs the following components.

- SX-Programmer Expert (D300win) program
- MICREX-SX definition file
- MICREX-SX PU256E template
- MICREX-SX PU048E template
- MICREX-SX PS245 template
- MICREX-SX PS117 template
- MICREX-SX PS74 template
- MICREX-SX PS74D template
- MICREX-SX PS32 template
- MICREX-SX PM256E template
- MICREX-SX PM256H template
- MICREX-SX PM48R template
- MICREX-SX PM48E template
- MICREX-SX PH16 template
- MICREX-SX PH08 template
- MICREX-SX SPB definition file
- MICREX-SX NW60C template
- MICREX-SX NW60 template
- MICREX-SX NW40C template
- MICREX-SX NW40 template
- MICREX-SX NW30 template
- MICREX-SX NW20 template
- Board controller definition file
- MICREX-SX NW32-42C template
- MICREX-SX NW16-42C template
- MICREX-SX NW08-41C template
- SX control utilities

■ For the custom setup type, you choose the components to install.
If you choose "Custom" on the "Setup type" screen and click [Next], the "Choose components" screen appears.

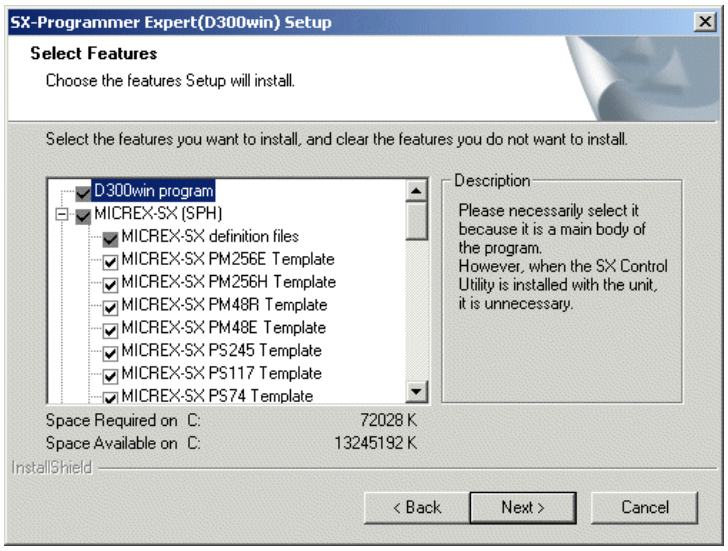


Fig. 1-3-9

◆ Choose the components to install and click [Next].

◆ The "Copy files" screen appears. Confirm the selection and click [Next].

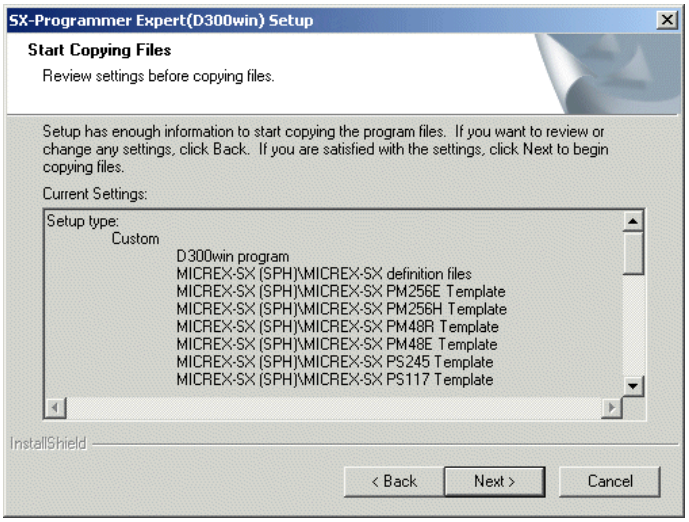


Fig. 1-3-10

◆ The setup process starts.

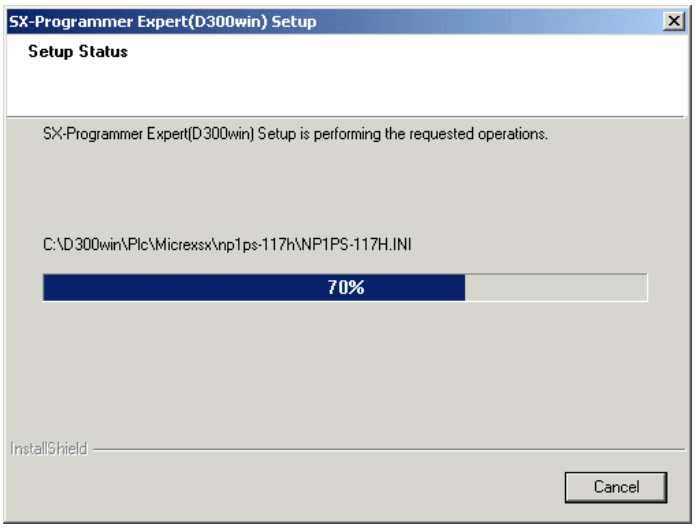


Fig. 1-3-11

Note) If you use a product CD of V3.4.2.0 or later and .NET Framework 2.0 does not exist on the target PC, .NET Framework 2.0 will be automatically installed.
Installation of .NET Framework 2.0 takes several minutes.
(Time required for installation depends on the performance of the PC.)

◆ You may encounter "A locked file was detected" message during installation. This appears when the installer tries to write to a file used by the Windows system. In this case, click [OK] as directed on the dialog box, and then click [Resume].

◆ When the setup process completes, a dialog box appears to ask you if you want to back up the projects created by the versions 1 and 2 of D300win. Click [Yes] if you want to back them up now. Click [No] if you want to back them up later, or you do not want backup.

Note) Refer to "Backup Utility" in "SX-Programmer Expert (D300win) Reference" for how to back up projects.

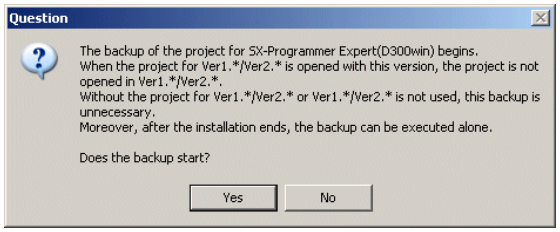


Fig. 1-3-12

◆ The warning dialog box shown below appears. It appears if the SX simulator is installed. This warning tells you that the TCP/IP protocol is required to use the SX simulator.

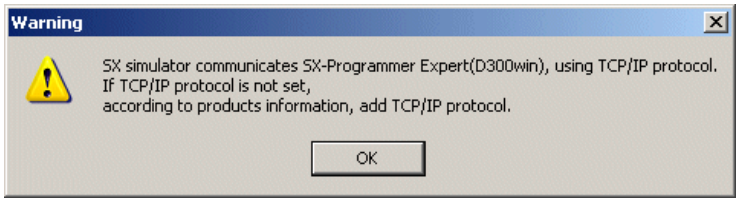


Fig. 1-3-13

◆ Clicking [OK] on the warning dialog box opens the following screen.
You need to restart the PC to launch D300win.
Choose "Yes, restart the computer now." and click [Finish] to restart the PC. This completes installation of D300win.

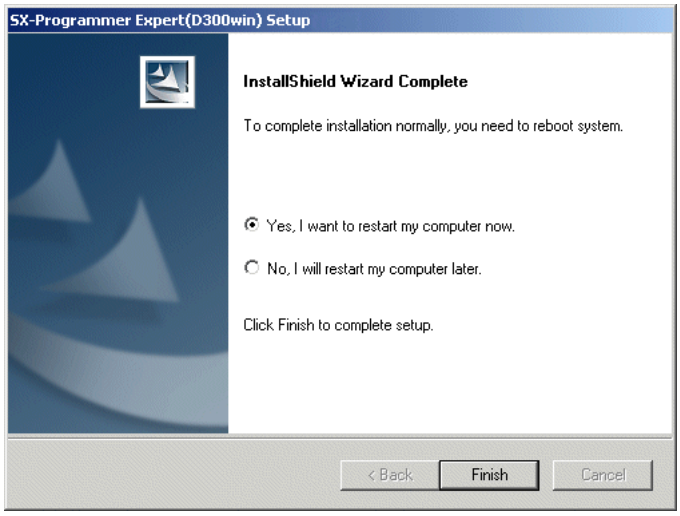


Fig. 1-3-14

1.3.1.2 Installing UPAC support function

Use an installation program to install.
The installation program executes the following process.
Adds the UPAC support function to SX-Programmer Expert (D300win).

1) Before installing

CAUTION

- Before installing the UPAC support function, you need to install D300win. Install D300win first if you have not installed D300win.
  Refer to "1.3.1.1 Installing the SX-Programmer Expert (D300win) software package" for how to install D300win.
  If SX-Programmer Expert (D300win) Ver3.6.X.X is not installed, the following dialog box appears and installation is cancelled.

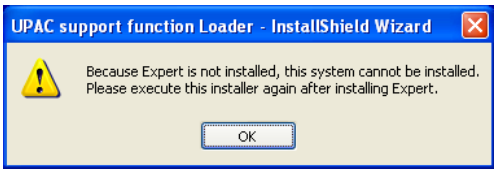


Fig. 1-3-15

If you have installed the UPAC support function, uninstall the UPAC support function for safety. Though you can overwrite to install without uninstalling, you will have such a problem as you cannot uninstall the UPAC support function completely. When you upgrade the version, we recommend that you uninstall first and then install again.

1) Installation
This process adds the UPAC support function to installed SX-Programmer Expert (D300win).
Follow the procedure below.

(1) Insert the CD-ROM containing the installation program (WPS-VG1-STR) into the CD-ROM drive of the PC.
(2) Double-click "upac_up3613" on the CD-ROM to display the disk1 folder.
(3) Double-click "setup.exe" in the disk1 folder to start installation of the UPAC support function.
(4) The following screen appears. Quit all the running applications and click [OK].

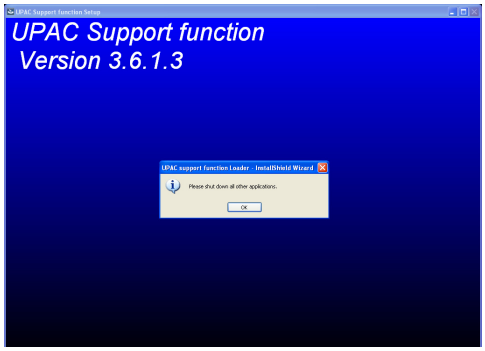


Fig. 1-3-16

(5) When the following screen appears, click [Next]. When the license agreement screen appears, read it and click [Next].

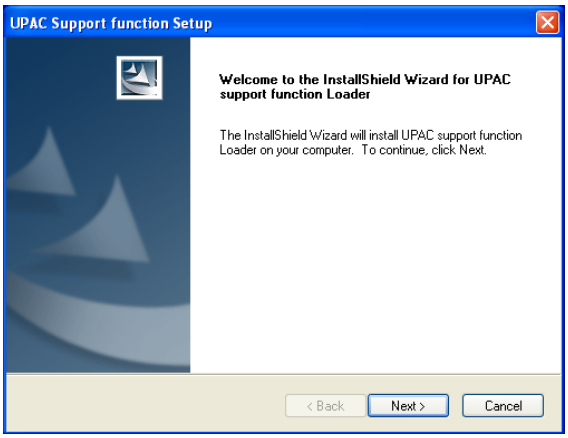


Fig. 1-3-17

(6) The function selection screen appwars. Choose the function s to install and click [Next].

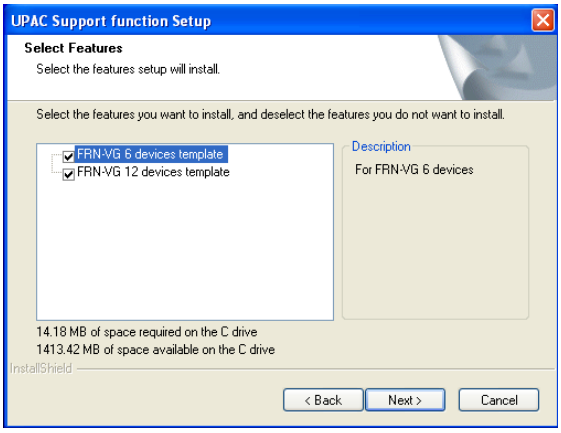


Fig. 1-3-18

(7) The folder where D300win is installed is automatically detected and used as the installation folder. Confirm and click [Next].

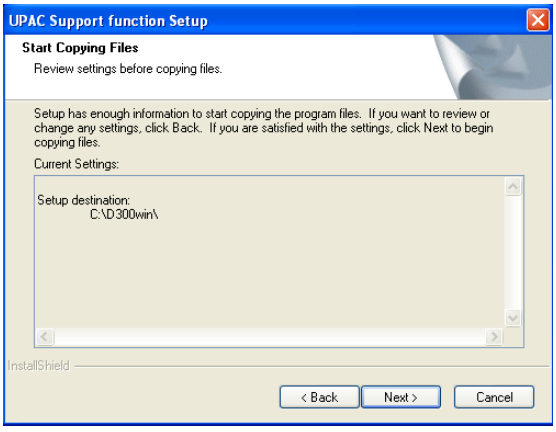


Fig. 1-3-19

(8) The necessary files are copied.

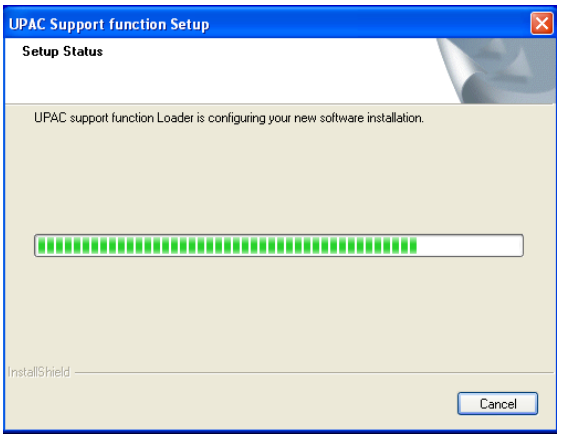


Fig. 1-3-20

(9) After the files are copied, installation completes.

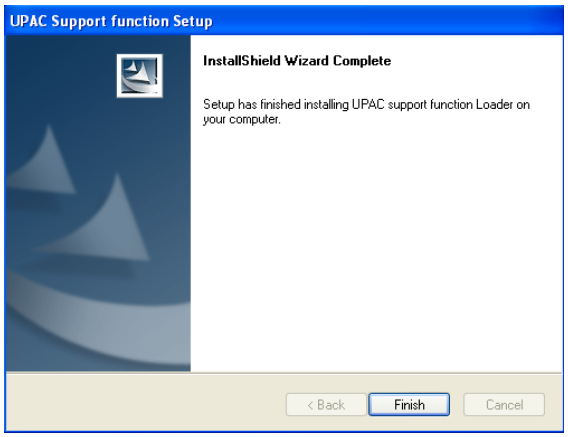


Fig. 1-3-21

1.3.2 Changing the SX-Programmer Expert (D300win) settings

Option programs can be added or deleted to/from the D300win system having been installed, or the program having been set up can be installed again.

◆ Open the Add/Remove Programs from the Control Panel, choose SX-Programmer Expert (D300win), and then click [Add/Remove].

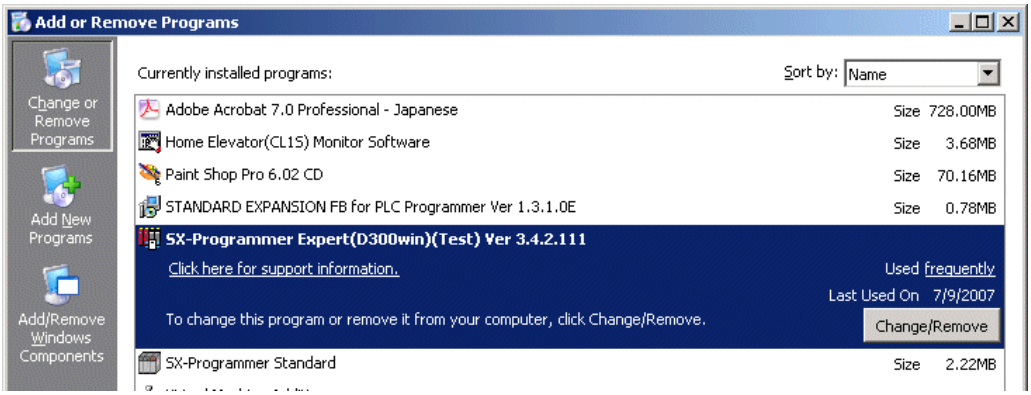


Fig. 1-3-22

◆ The following screen appears. Click [OK] to open the "Welcome" screen. Click [Change] and [Next].

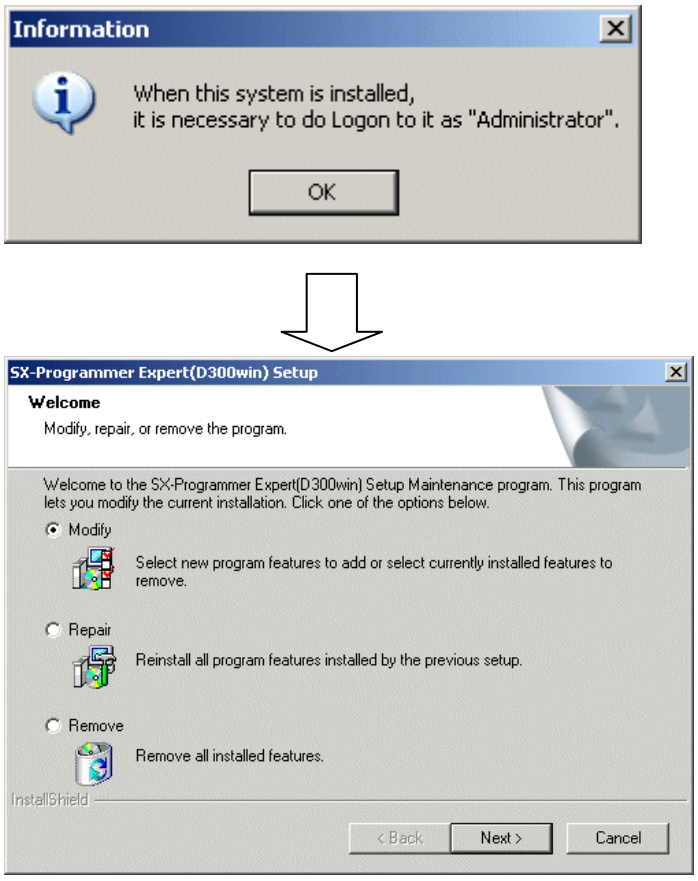


Fig. 1-3-23

◆ The "Choose components" screen appears. Select the check box for a component to add and deselect the check box for a component to remove, and then click [Next].

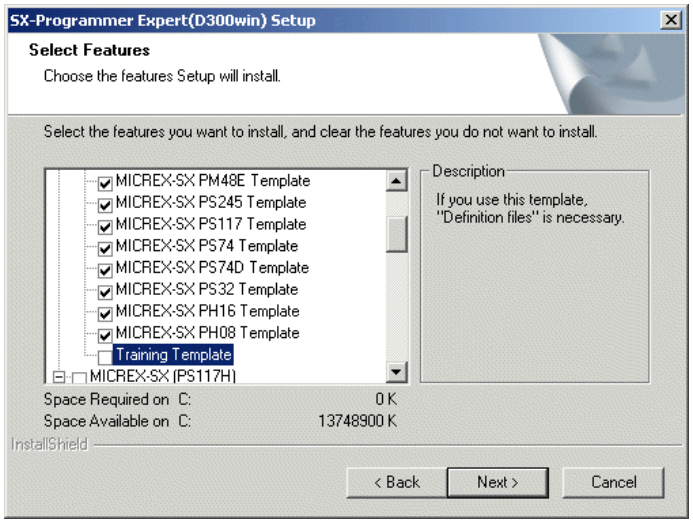


Fig. 1-3-24

◆ After setup is completed, the "Finish InstallShield" screen appears. Click the [Finish] button to restart the computer. This completes changing the D300win system settings.

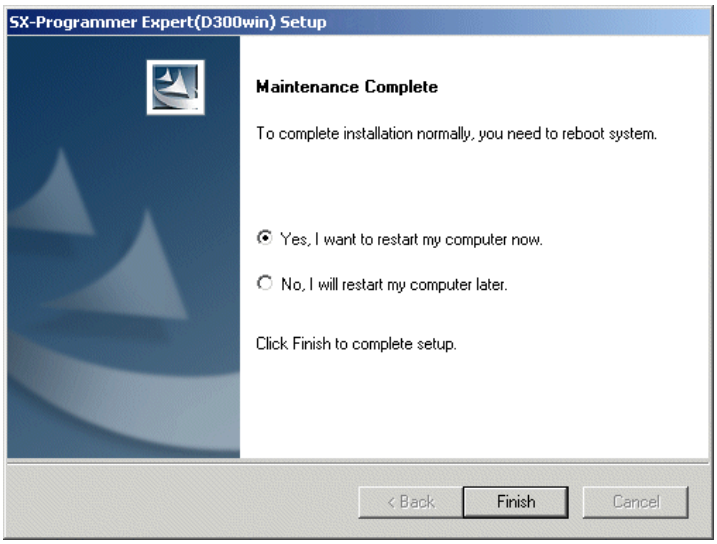


Fig. 1-3-25

1.3.3 Uninstallation

Uninstallation removes the SX-Programmer Expert (D300win) system files from the PC.

Follow the procedure below to uninstall the program.

Closing the Message Manager
↓
Uninstalling the UPAC support function
↓
Uninstalling SX-Programmer Expert (D300win)

1.3.3.1 Closing the Message Manager

If the message manager is running, close it before uninstllation. (The Message Manager launches when the PC is connected to UPAC or PLC for transferring programs or monitoring them.)

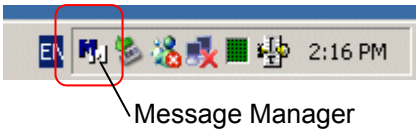


Fig. 1-3-26

◆ Right-click the Message Manager icon. Choose "Close Message Manager" from the context menu to open the confirmation dialog box.

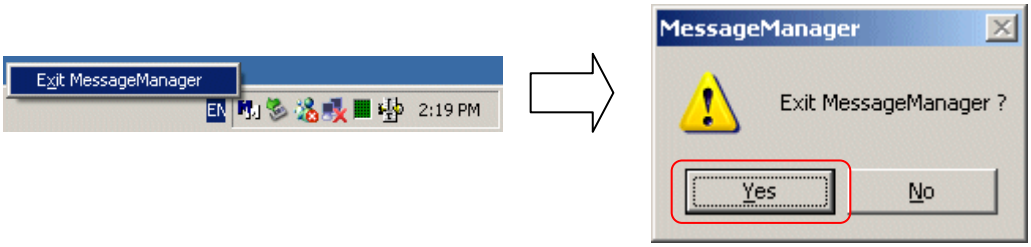


Fig. 1-3-27

◆ Click [Yes] to close the Message Manager.

1.3.3.2 Uninstalling the UPAC support function

◆ Uninstallation procedure

(1) Open the Add/Remove Programs from the Control Panel.
(2) Choose the UPAC support loader version 3.6.1.3 and click [Add/Remove].

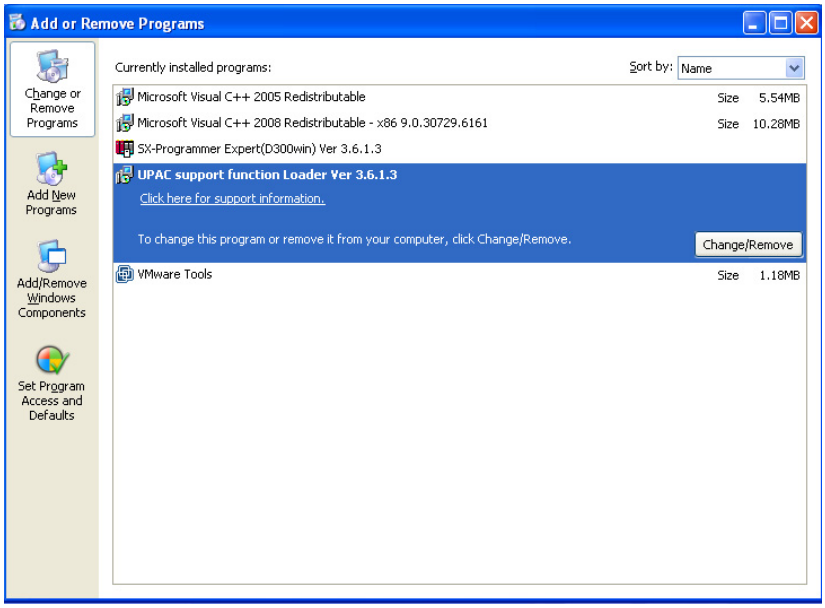


Fig. 1-3-28

(3) When the following dialog box opens, click [Yes].

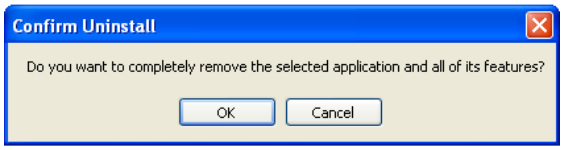


Fig. 1-3-29

(4) The files are deleted from the PC.

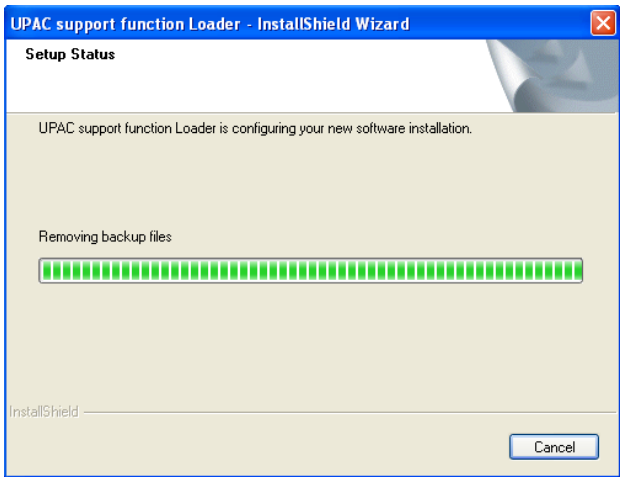


Fig. 1-3-30

(5) Uninstallation completes. Click [Finish] to close the dialog box.

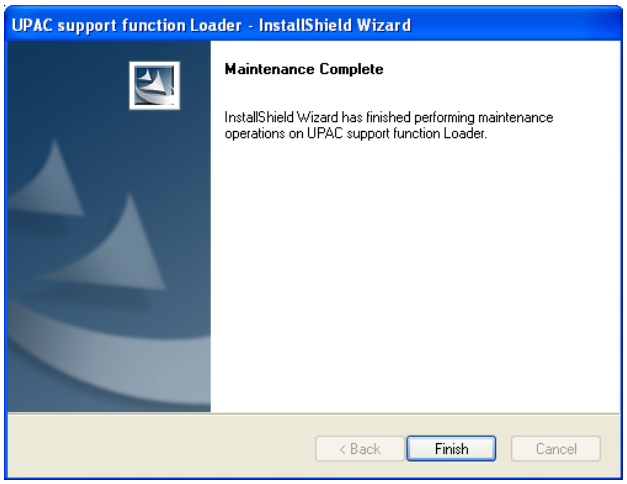


Fig. 1-3-31

1.3.3.3 Uninstalling SX-Programmer Expert (D300win)

◆ Open the Add/Remove Programs from the Control Panel and choose SX-Programmer Expert (D300win). Click [Add/Remove].

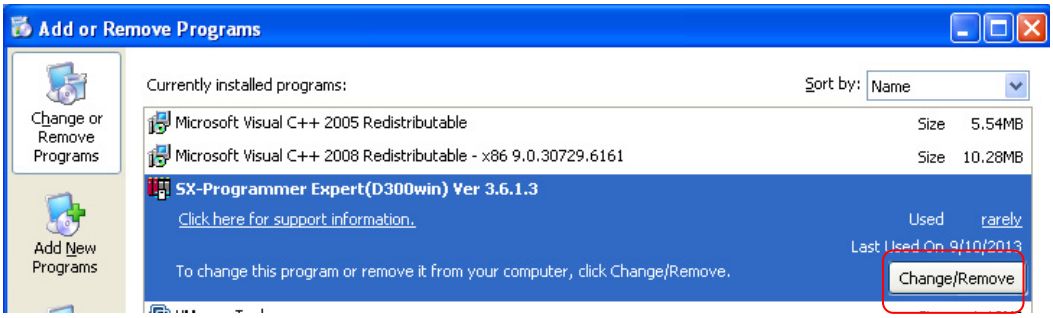


Fig. 1-3-32

◆ The following screen appears. Click [OK] to open the "Welcome" screen. Click [Remove] and [Next].

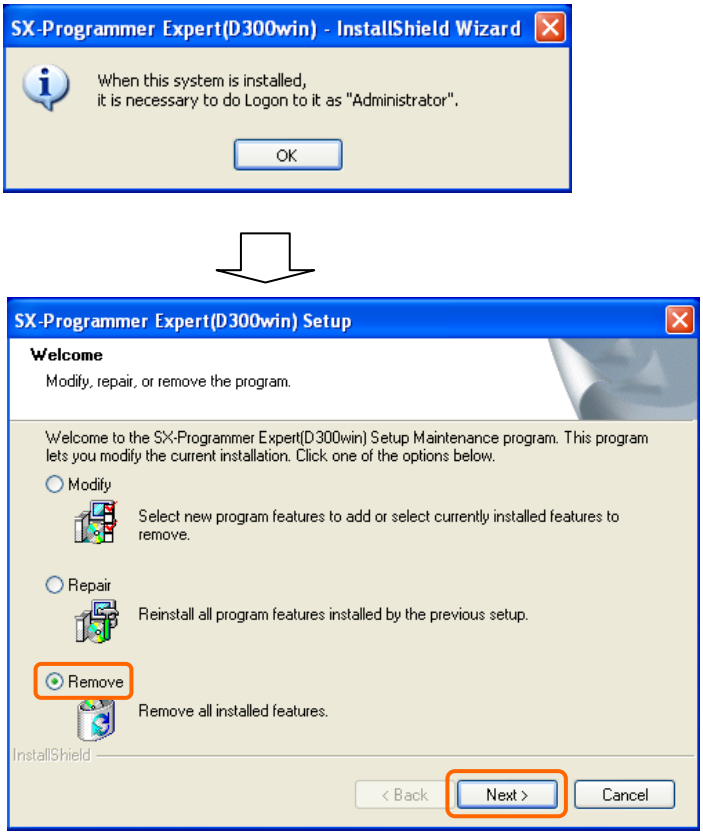


Fig. 1-3-33

◆ The "Confirm File Deletion" message box is displayed. Click [OK] to start deleting files.

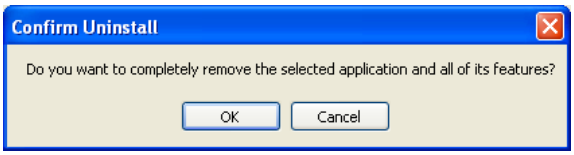


Fig. 1-3-34

* You may encounter "A locked file was detected" message during uninstallation. In this case, click [OK] as directed on the dialog box, and then click [Resume].

◆ When all the files have been deleted, the "Maintenance Completed" screen appears. Click [Finish] to complete changing the D300win system settings.

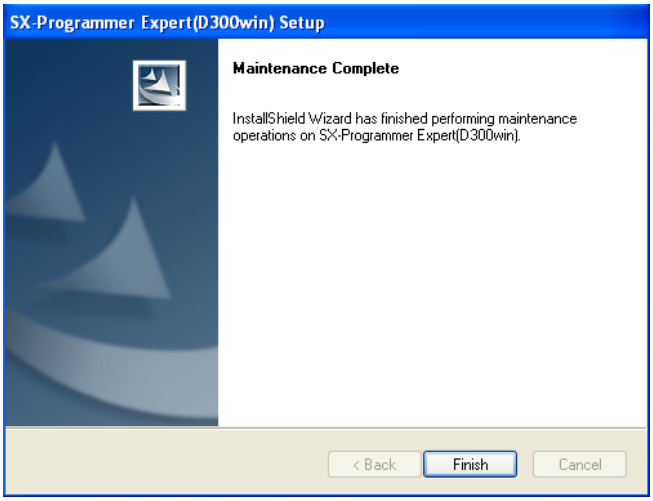


Fig. 1-3-35

1.3.4 Launching SX-Programmer Expert (D300win)

1.3.4.1 How to launch SX-Programmer Expert (D300win)

◆ From the SX-Programmer Expert (D300win) program group, run SX-Programmer Expert (D300win).

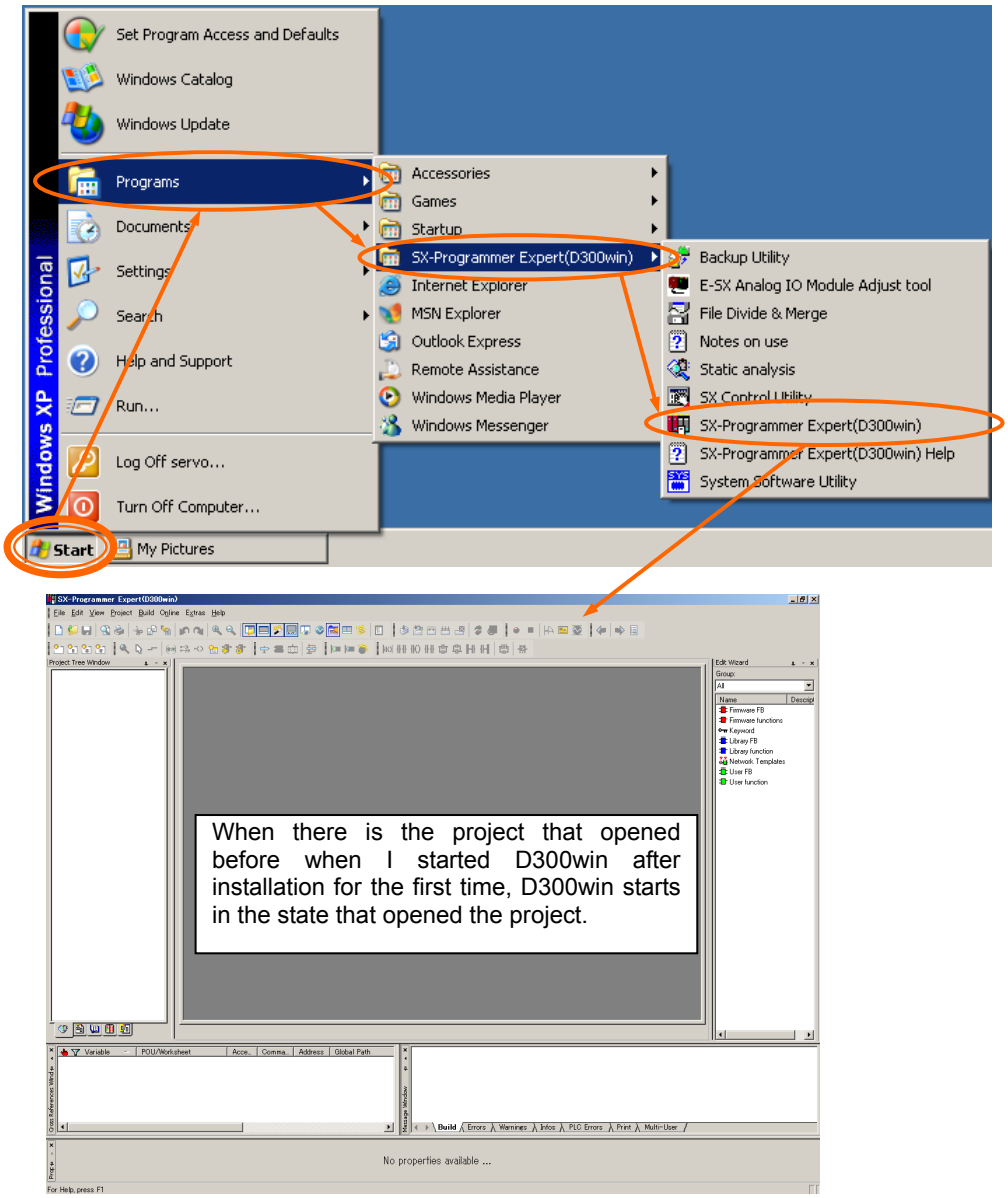
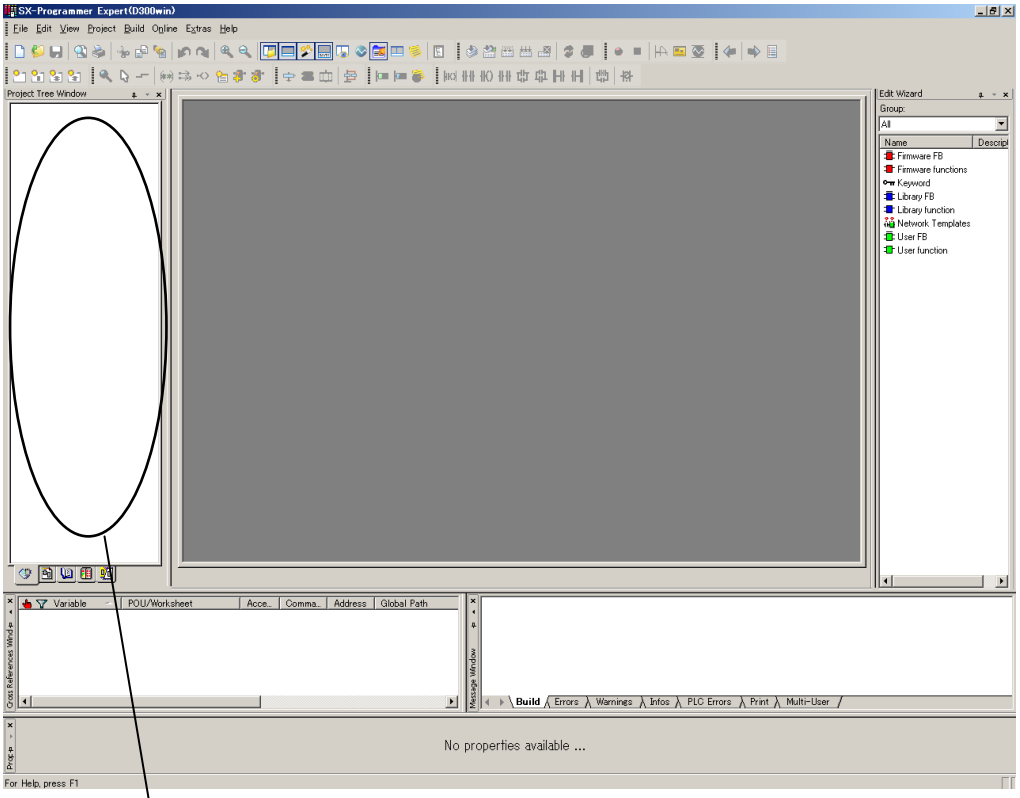


Fig. 1-3-36

SX-Programmer Expert (D300win) launches.

1.3.4.2 Creating a project and configuring basing settings

After D300win is started, the screen shown below is displayed.



It is a project called before (tree), or anything is displayed in a few state.

Fig. 1-3-37

■ Opening a UPAC project

The first step after you have started D300win is to produce a new UPAC project or to open an existing UPAC project. This section describes steps required to create a new UPAC project.

1) Creating new project using UPAC template

If you use this method to create a new project, D300win will copy the selected template to project as "Untitled". The template consists of POUs, worksheets, and configuration elements required for the PLC type. You can save the project "Untitled" with a name you want to use.

(1) Creating new project with mouse

Select the New Project menu item from the File submenu. The New Project dialog box appears.

(2) Creating new project with keyboard

Press ALT + F to open the File submenu and press N. The New Project dialog box appears.

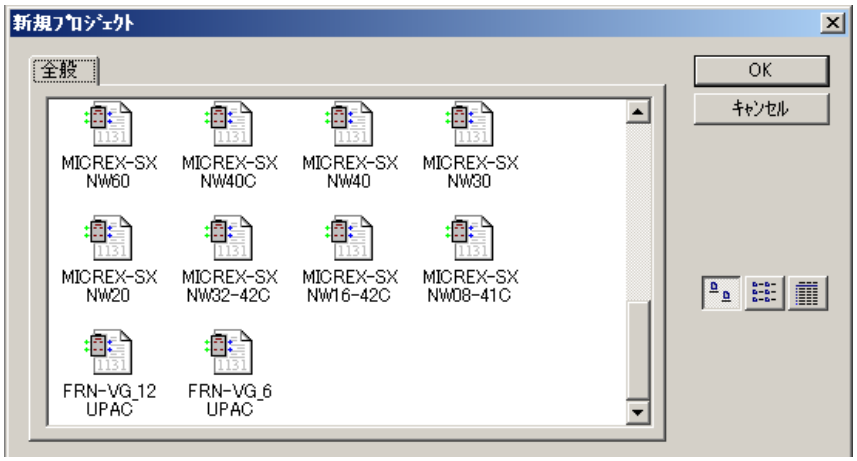


Fig. 1-3-38. New Project dialog box containing available project templates

(3) Using New Project dialog box

Left-click to select "FRENIC-VG_6 UPAC" or "VFRENIC-VG_12 UPAC" template.

(4) A new project named "Untitled" is created and the project tree shown to the right appears.

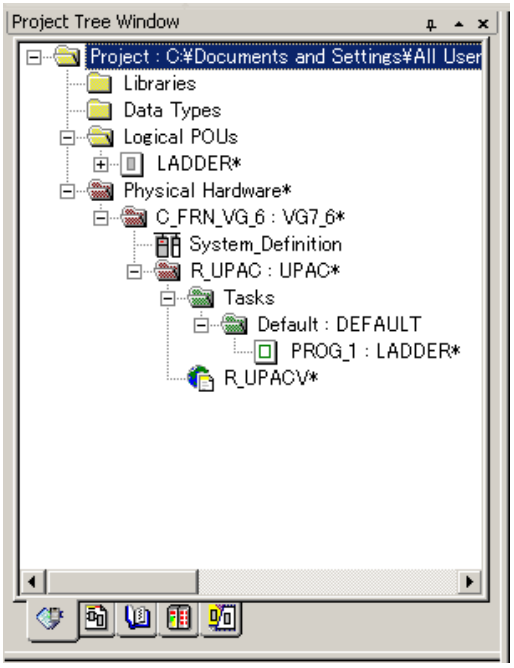


Fig. 1-3-39 Project "Untitled" including program "LADDER" and its worksheets

Library:

Register a project used as a library. No libraries are registered in the template of UPAC.

Data type:

Declare user-defined data types in addition to basic data types defined in IEC1131-3. No user-defined data types are registered in the template of UPAC.

Program configuration:

The project "Untitled" includes one POU - a program "LADDER" as default. There are three worksheets in POU.

- Description worksheet for POU document (optional), "LADDERT"
- Variable worksheet for declaring variables and FB instances, "LADDERV"
- Code body worksheet for defining code body, "LADDER"

You can change some of the properties of this program. The default language for the first program inserted automatically is LD and you cannot change it. If you need a program in other language, insert a new POU.

Physical Hardware:

This node defines the UPAC constitution. Use icons under the Physical Hardware node in the project tree in Fig. 1-3-39 to define the constitution.

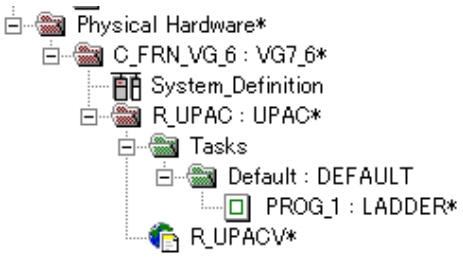


Fig. 1-3-40 Icons for Physical Hardware

- Configuration: A configuration corresponds to one programmable logic controller system such as a rack.
- System definition: Sets system components in detail.
- Resources: A resource, for example, corresponds to a CPU that you can insert to the rack.
- Tasks: Tasks determine the time scheduling of programs that are associated with the tasks.
- Global variable: Declares global variables common to multiple POUs.

  Global variables declare control variables and function variables used

by UPAC in advance.

Control variables: Global variables listed in IQ memory of FRENIC-VG.

Function variables: Global variables listed in MW memory of FRENIC-VG

Double-click the individual icons to display and set dialog boxes if you need. The following section describes items required for UPAC.

2) PC type and CPU type of UPAC

The dialog boxes displayed when you display or insert the properties of the individual icons contain fields for the PLC type and the CPU type when needed. Set as below according to the hardware you use.

Table 1-3-1 PLC type and CPU type of UPAC

Hardware used		PLC type	CPU Type
Number of inverters	Link type between inverters		
1 to 6 units	Optical link (OPC-VG1-S1)	FRENIC-VG_6	UPAC
1 to 12 units		FRENIC-VG_12	

■ Resource setting

Resource setting for UPAC is the same as the standard setting steps except for the following three points.

- You use the communication setting dialog box that appears when you click the [Communication setting] button in the Resource setting dialog box to set the communication between the personal computer and UPAC, and use the system definition to set the station number on RS485 of UPAC. See "System definition" in this manual for more information.
- UPAC operates based on the commands from FRENIC-VG regardless of the specified action when turned on.

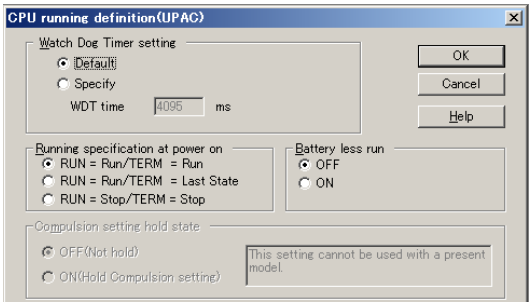


Fig. 1-3-41 CPU running definition dialog box

Use the Running specification at power on radio button in the CPU running definition dialog box to specify the action when you turn on. However, UPAC starts based on the command mode from FRENIC-VG regardless of your selection.

- One resource of UPAC can exist for one configuration.

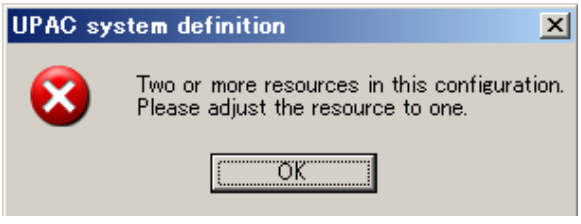


Fig. 1-3-42 Error message displayed when you open system definition with multiple resources

UPAC cannot handle multiple resources in one configuration. When you try to open the system definition in a project with multiple resources, you will get the following error message and cannot conduct the system definition.

Delete unnecessary resources to remove the error in the system definition.

■ Registering task and program

If you run a program, you should insert a task and associate the program with the task, or determine on which task you run the program. Though inserting a task and associating a program with the task is the same as that in the standard procedure, the setting range is different in UPAC. You can select 0 to 3 in the Priority field in the Task setting dialog box in the following figure, but UPAC can execute only 0 or 1 .

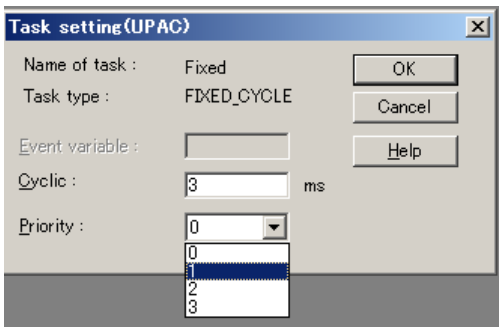


Fig. 1-3-43 Task setting dialog box

- When you try to open a system definition of a project including tasks with priority 2 or 3, you will get an error message in Fig. 1-3-44, and you will not be able to conduct the system definition.

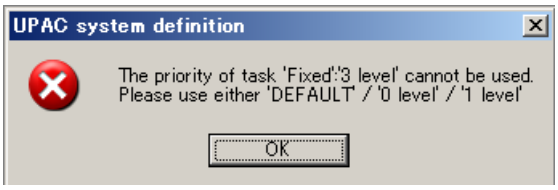


Fig. 1-3-44 Error message when you open system definition with invalid task settings

- To remove the system definition error, delete tasks that have priorities other than default, 0, or 1, or change the priorities.

■ System definition

1) Starting system definition

When you double-click the System_Definition icon in the project tree, the UPAC system definition screen appears.

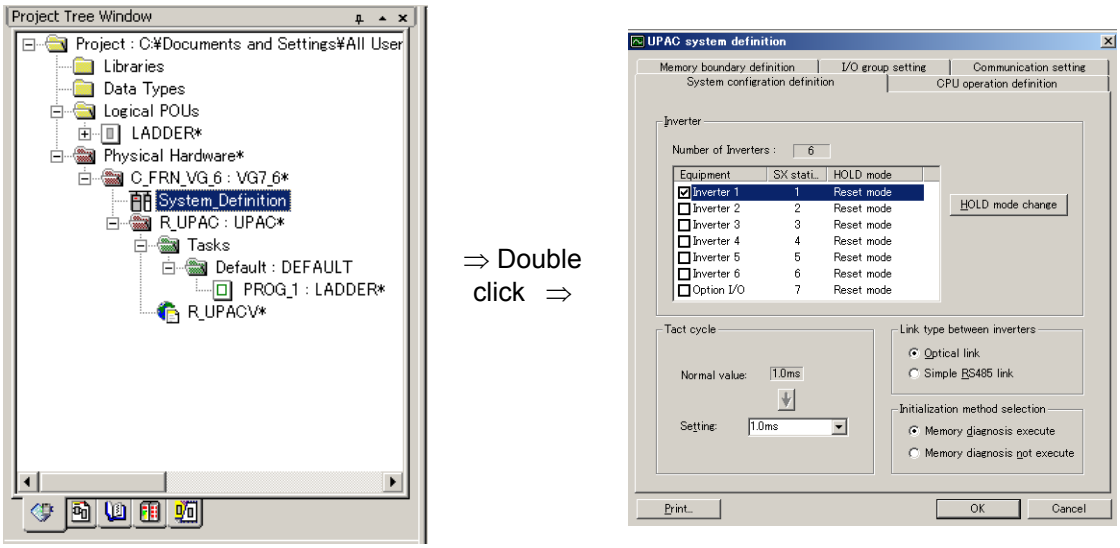


Fig. 1-3-45 How to start system definition

The UPAC system definition screen includes the following property sheet with five property pages classified by the setting item.

- System configuration definition
- CPU operation definition
- Memory boundary definition
- I/O group setting
- Communication setting

2) System configuration definition

The first property page of the UPAC system definition screen. You define the hardware constitution such as inverter to be used and type of inter-inverter link on this sheet.

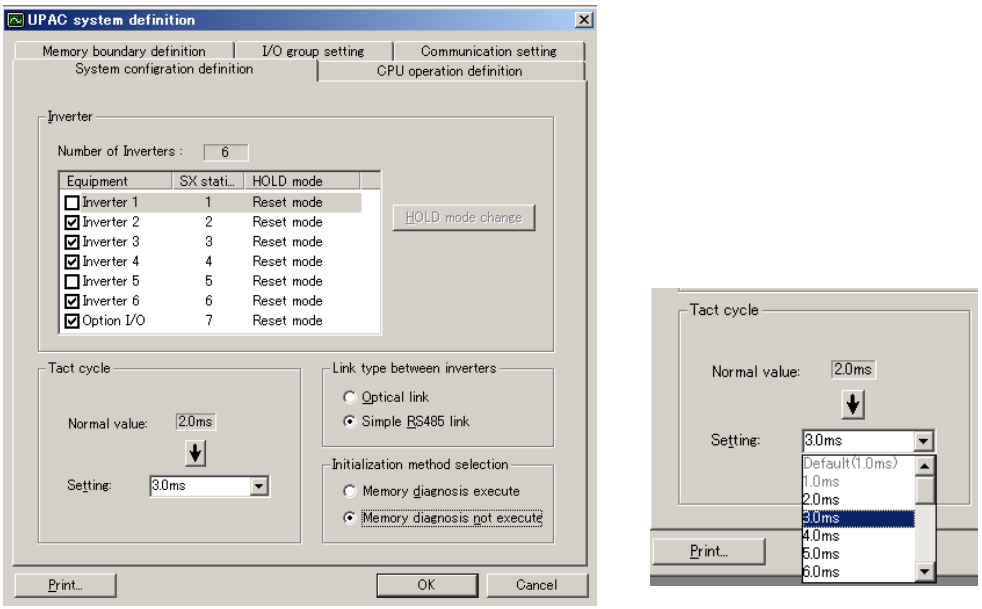


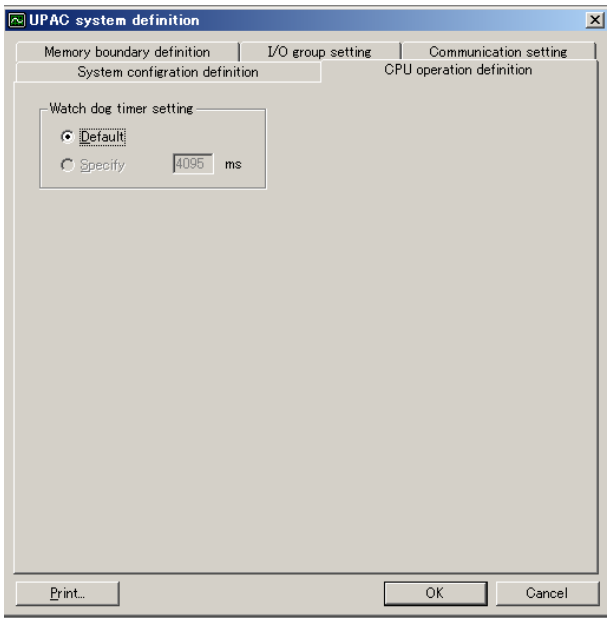
Fig. 1-3-46 System configuration definition screen

The operation method is described in the table below.

Table 1-3-2 Operation on System configuration definition screen

Item	Description
Number of inverters	Displays whether six-inverter system or twelve-inverter system.
Equipment	Mark the check box of a device you use (an inverter without check mark will be considered as "not installed") . You can not remove the last check mark.
SX station	Displays the SX station number of inverters.
[HOLD mode change] button (or double click inverter list)	Specifies the HOLD mode of the inverter selected in the list (HOLD mode/Reset mode). You cannot select this button if the selected inverter is not installed.
Tact cycle	The normal value displays standard value (1ms to 3 ms) automatically according to the number of inverters to be used. Click the [↓] button to copy the normal value to the setting. You can select the [↓] button only if the normal value and the setting are different. "Default (1.0ms), 1.0ms, 2.0ms, 3.0ms" are listed both for optical link and simplified RS485 in the setting combo box and select from them. Smaller values than the normal value are masked and are not available.
Link type between inverters	Select "Optical link".
Initialization method selection	Sets whether to execute the advanced memory diagnosis or not.

3) CPU operation definition

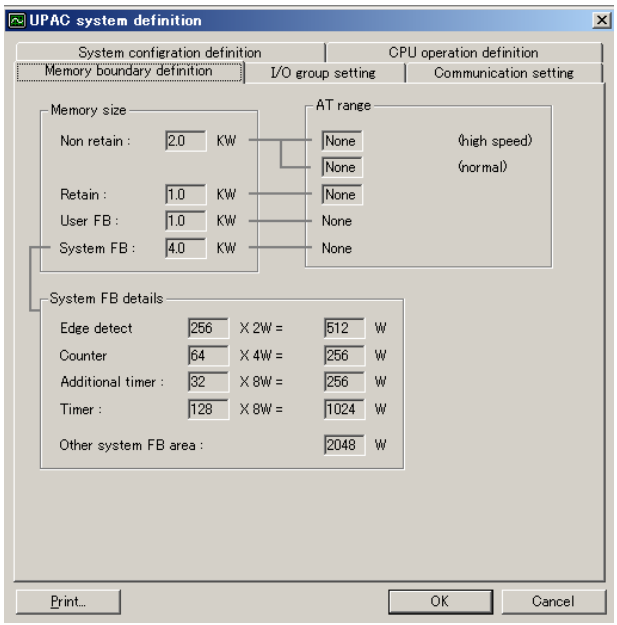


The second property page of the UPAC system definition screen.

The watch dog timer setting in the Resource setting dialog box is displayed as in the left figure.

Fig. 1-3-47 CPU operation definition screen

4) Memory boundary definition



The third property page of the UPAC system definition screen.

The memory boundary set in the Resource setting dialog box is displayed as in the left figure.

Fig. 1-3-48 Memory boundary definition screen

5) I/O group setting

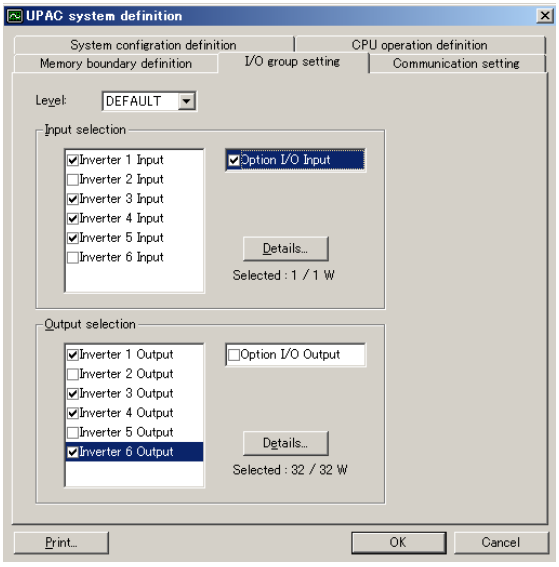


Fig. 1-3-49 I/O group setting screen

The fourth property page of the UPAC system definition screen.

Associate the task level of UPAC with the I/O data area of the inverter and define the refresh timing.

The operation method is described in the table below.

Table 1-3-3 Operation method in I/O group setting screen

Item	Description
Level	The priority of the task included in the resource is listed. If you select (the priority of) a task, current setting will be displayed.
Input selection	Select the input device used with UPAC. Selecting a check box selects all the input data from the selected device. Select an input device and click the [Detail] button to specify the input data for that device.
Output selection	Select the output device used with UPAC. Selecting a check box selects all the output data from the selected device. Select an output device and click the [Detail] button to specify the output data for that device.
Selected number	The numerator indicates the number of input or output data items for the selected device. The denominator indicates the total number of items for the selected device.
[Details] button (or double click an item)	Displays the input/output data selection screen for the selected device (Figure 1-3-50).

* All devices can be set without relations to installation of each device.

Detail operation method of selection check box

The check box is displayed or operated as described below.

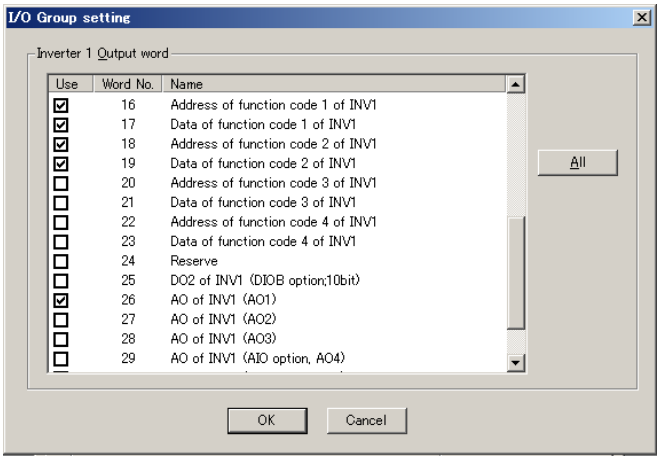
- If all items are used, they are displayed as ☑.
- If all items are used, they are displayed as gray☑.
- If all items are not used, they are displayed as ☐.
- Each time you click the check box, the state changes as follows.

☐→☑→☐→☑→☐→…

→☐→☑→☐→☑→…

→☐→☑→☐→☑→…

Detail setting method of each word



Press the [Details (D)] button or double-click on the item to display the detail setting screen.

Figure 1-3-50 Detail setting screen for each device

The operation method is described in the table below.

Table 1-3-4 Operation method of detail setting screen

Item	Description
[Use] check box	Set use or no use for each word.
Word No.	Shows word number beginning with 1.
Name	Shows the data name.
[All] button	Selects all the items at once for use or not use. If the majority of the selected buttons are used, clicking this button causes all items not to be used. If the majority of the selected buttons are not used, clicking this button causes all items not to used.

6) Communication setting

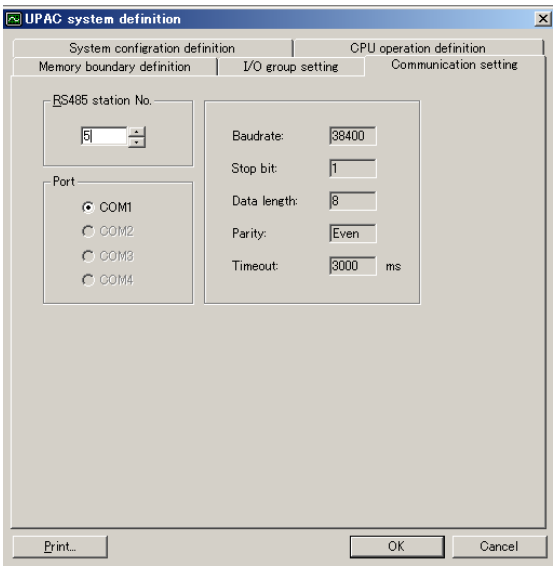


Fig. 1-3-51 Communication setting screen

The fifth property page of the UPAC system definition screen.

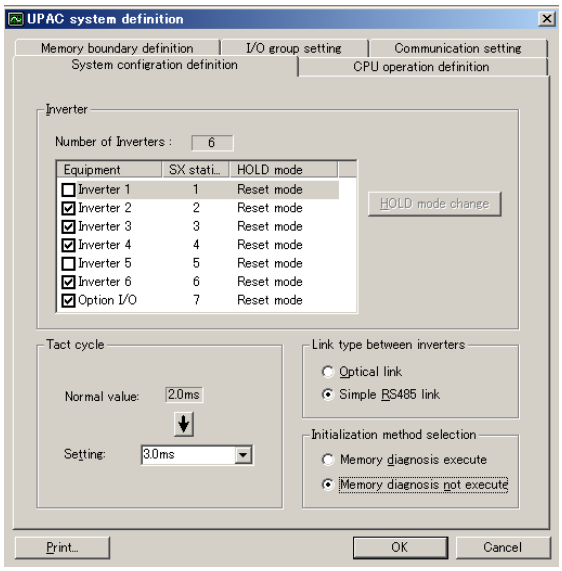
Sets the UPAC station number on RS485 in the range from 1 to 255. In addition to this, the setting in the Communication setting dialog box displayed when you click the [Communication setting] button in the Resource setting dialog box is displayed.

Make sure to conform to the set value of o40 "UPAC address" of FRENIC-VG.

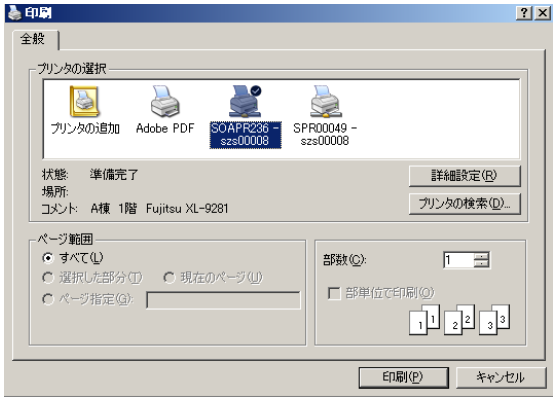
The factory setting of o40 is "100". If the change is not necessary, you can use the setting for RS485 station No. of "100" on the screen to connect.

At H34, set the same communication baud rate as the one shown on the left screen.

■ Printing UPAC system definition



You use the Properties of printer screen displayed when you click the [Print (P)] button on the property sheet to print the system definition of UPAC.



When you click [Print (P)], the following dialog box will appear.

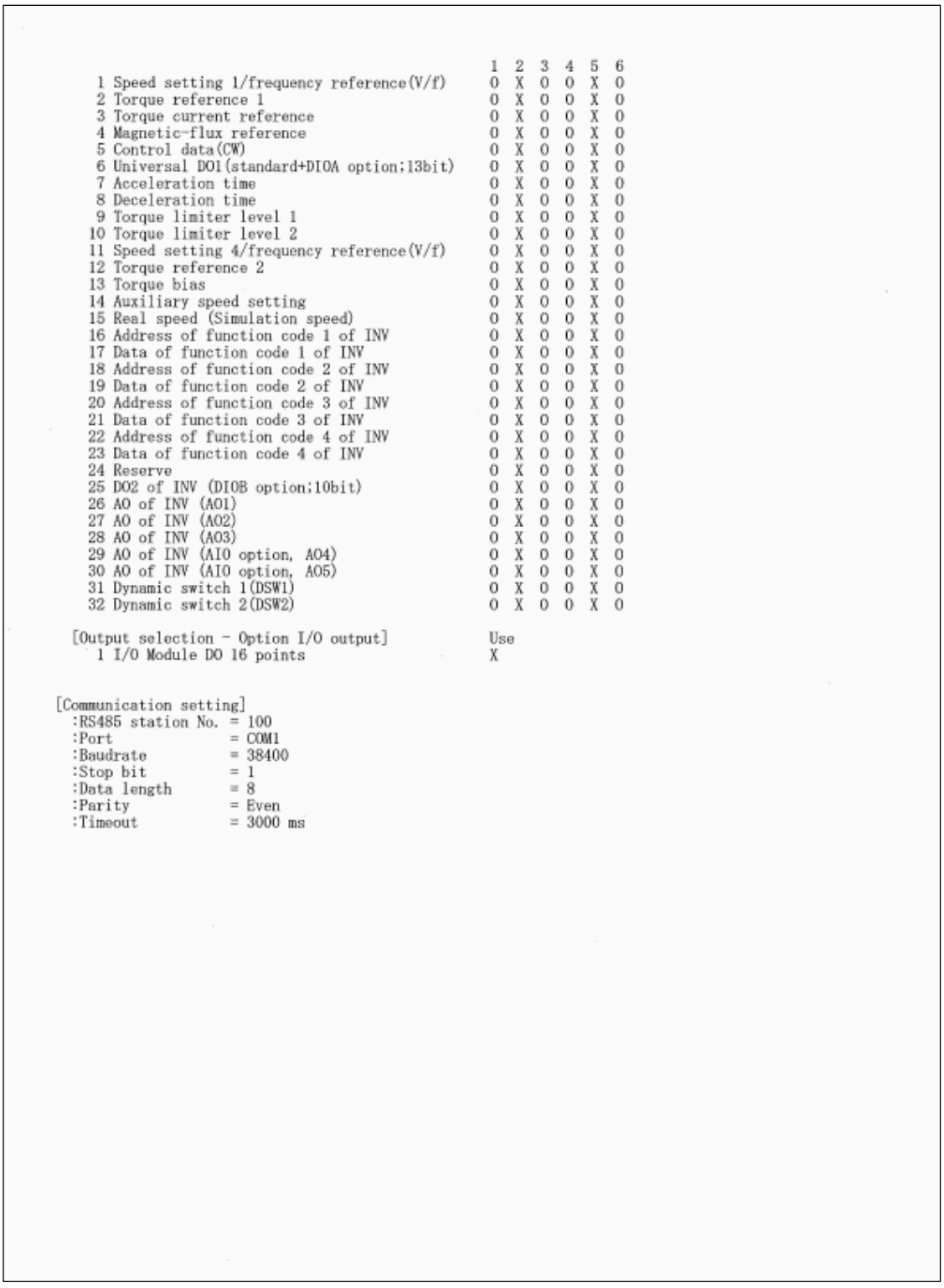
To print other items than the system definition, follow the standard procedure using the menu item Print or Print Project.

Fig. 1-3-52 Printing system definition

Printed example of system definition

A printed example for 12-unit system is listed below.

```
Project : UNTITLED  C:¥Documents and Settings¥All Users¥Application Data¥Fuji Electric¥SX-Programmer E>
Update  : 2013/09/09  12:50:18
Printed : 2013/09/09  14:26:17
------------------------------------------------------------------------

[System configuration]
  :Number of Inverters = 6

  [Equipment]     SX station No.   mode
      Inverter  1     1            RESET mode
    * Inverter  2     2            RESET mode
    * Inverter  3     3            RESET mode
    * Inverter  4     4            RESET mode
      Inverter  5     5            RESET mode
    * Inverter  6     6            RESET mode
    * Option I/O      7            RESET mode

  :Tact cycle                       = 3.0 ms
  :Link type between inverters      = Simple RS485 links
  :Initialization method selection = Memory diagnosis not execute


[CPU operation definition]
  :Watch dog timer setting = Default


[Memory boundary definition]            (AT Range)
  :Non retain memory =     2.0 KW       None            (High)
                                        None            (Normal)
  :Reatin memory     =     1.0 KW       None
  :User FB memory    =     1.0 KW       None
  :System FB memory  =     4.0 KW       None

  :System FB memory detail
      Edge detect    =     256 X 2 W =      512 W
      Counter        =      64 X 4 W =      256 W
      Addition timer =      32 X 8 W =      256 W
      Timer          =     128 X 8 W =     1024 W
      Other system FB area          =     2048 W

  :Reserve memory size per POU
      Use reserve memory = Selected POUs
      Non retain memory  = 10
      Retain memory      = 10
      User FB memory     = 10


[I/O group setting] - Default
  [Input selection  - Input signal]                 Use inverter
                                                    1  2  3  4  5  6
     1 Speed setting 4/frequency reference monitor  0  X  0  0  0  X
     2 Torque reference 2                           0  X  0  0  0  X
     3 Torque current reference (final)             0  X  0  0  0  X
     4 Magnetic-flux reference (final)              0  X  0  0  0  X
     5 Real speed(detected speed value)             0  X  0  0  0  X
     6 Control data(CW)(standard+DIOA;16bit)        0  X  0  0  0  X
     7 Operation status(SW)                         0  X  0  0  0  X
     8 Speed setting 1/frequency reference(V/f)     0  X  0  0  0  X
     9 Line speed input                             0  X  0  0  0  X
    10 pulse train position reference(PG(PR))       0  X  0  0  0  X
    11 Position detection (build-in or PG(PD))      0  X  0  0  0  X
    12 Position detection (Z phase input)(PG(PD))   0  X  0  0  0  X
    13 Position reference                           0  X  0  0  0  X
    14 DI of INV (DIOB option;16bit)                0  X  0  0  0  X
    15 Ai of INV (Ai1)                              0  X  0  0  0  X
    16 Ai of INV (Ai2)                              0  X  0  0  0  X
    17 Ai of INV (AIO option, Ai3)                  0  X  0  0  0  X
    18 Ai of INV (AIO option, Ai4)                  0  X  0  0  0  X

  [Input  selection - Option I/O input]             Use
     1 I/O Module DI 16 points                      0

  [Output selection - Output signal]                Use inverter
```



	1	2	3	4	5	6
1 Speed setting 1/frequency reference(V/f)	0	X	0	0	X	0
2 Torque reference 1	0	X	0	0	X	0
3 Torque current reference	0	X	0	0	X	0
4 Magnetic-flux reference	0	X	0	0	X	0
5 Control data(CW)	0	X	0	0	X	0
6 Universal DO1(standard+DIOA option;13bit)	0	X	0	0	X	0
7 Acceleration time	0	X	0	0	X	0
8 Deceleration time	0	X	0	0	X	0
9 Torque limiter level 1	0	X	0	0	X	0
10 Torque limiter level 2	0	X	0	0	X	0
11 Speed setting 4/frequency reference(V/f)	0	X	0	0	X	0
12 Torque reference 2	0	X	0	0	X	0
13 Torque bias	0	X	0	0	X	0
14 Auxiliary speed setting	0	X	0	0	X	0
15 Real speed (Simulation speed)	0	X	0	0	X	0
16 Address of function code 1 of INV	0	X	0	0	X	0
17 Data of function code 1 of INV	0	X	0	0	X	0
18 Address of function code 2 of INV	0	X	0	0	X	0
19 Data of function code 2 of INV	0	X	0	0	X	0
20 Address of function code 3 of INV	0	X	0	0	X	0
21 Data of function code 3 of INV	0	X	0	0	X	0
22 Address of function code 4 of INV	0	X	0	0	X	0
23 Data of function code 4 of INV	0	X	0	0	X	0
24 Reserve	0	X	0	0	X	0
25 DO2 of INV (DIOB option;10bit)	0	X	0	0	X	0
26 AO of INV (AO1)	0	X	0	0	X	0
27 AO of INV (AO2)	0	X	0	0	X	0
28 AO of INV (AO3)	0	X	0	0	X	0
29 AO of INV (AIO option, AO4)	0	X	0	0	X	0
30 AO of INV (AIO option, AO5)	0	X	0	0	X	0
31 Dynamic switch 1(DSW1)	0	X	0	0	X	0
32 Dynamic switch 2(DSW2)	0	X	0	0	X	0

[Output selection - Option I/O output]	Use
1 I/O Module DO 16 points	X

[Communication setting]
:RS485 station No. = 100
:Port = COM1
:Baudrate = 38400
:Stop bit = 1
:Data length = 8
:Parity = Even
:Timeout = 3000 ms

Fig. 1-3-53 Example of printed system definition

Chapter 2 Preparation and Basic Operation Examples

This chapter describes the basic operation with the test operation.

Contents

2.1 Examination of System

2.1.1 Application to Small to Medium Systems

⚠CAUTION

- UPAC has been developed for small to medium systems driving and controlling maximum about 10 inverters. It is not for large systems where several tens of inverters are generalized and controlled. When applying UPAC, carefully examine the specifications of UPAC and design a system while allowing an extra room in the specifications.

UPAC has been developed for small to medium systems (for from one to about ten inverters) controlling winding (dancer, tension), ratio (draw), position and synchronization and so on. A system having been controlled by an external PLC can be transformed into a rigid and high-speed entirely digital system, using the UPAC.

On the other hand, in a medium system, a distributed control system can be configured where driving control groups requiring high-speed control are generalized through the UPAC and the host PLC generalizes and controls each group with operation commands and initial value setup or the like.

When compared with large systems, the above-mentioned system may not satisfy all the requirements because of lack of a control distribution function for two or more UPACs, poor I/O point count, and poor trace memory. Deliberate system examination is necessary according to the size of the system. Refer to this section for approximate guidelines useful for the first examination of specifications.

1) Example of application to small system

The figure below shows an example of tension control using an SIU (optical link) option to link three FRENIC-VG inverters.

If I/O points are insufficient, an extension I/O option (DIO in the figure below) is used and the PG option (high-speed pulse counter) is applied for line speed detection. The built-in I/O is used to control I/O of general-purpose inverters.

Tension commands and line speed commands are given in a digital or analog quantity from the external PLC or computer. These small tension control systems can sufficiently be supported by one UPAC.

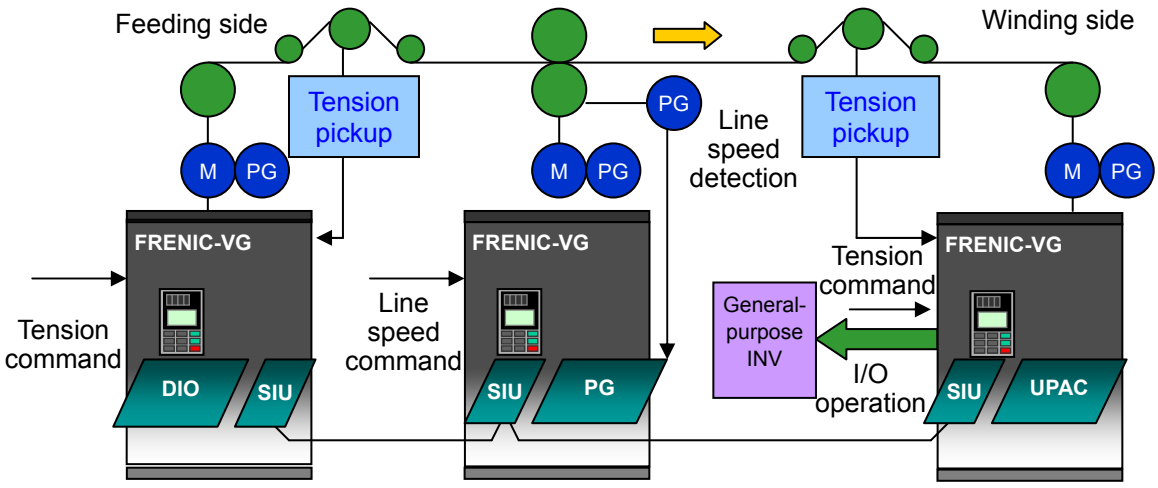


Fig. 2-1-1

2) Application to medium system

The figure below is an illustration where multiple FRENIC-VGs are linked via the SIU (optical link) option to form a small driving control group and PLC or a computer is installed in the host as a system controller to integrate and control other driving control groups.

A digital command from PLC is transferred to each inverter, while a command, from UPAC, driving and controlling FRENIC-VGs is transferred to each FRENIC-VG within the driving control group via the SIU (optical link) option.

At this time, the generalizing and controlling PLC or computer sends operation commands and initial settings to each driving control group while receiving monitor data from each group. UPAC functions as a master station in each control group and sends various commands for driving the motor via a high-speed optical link that is superior in noise immunity.

A distributed control system can be configured in this way where the host and subordinate units play clearly divided roles.

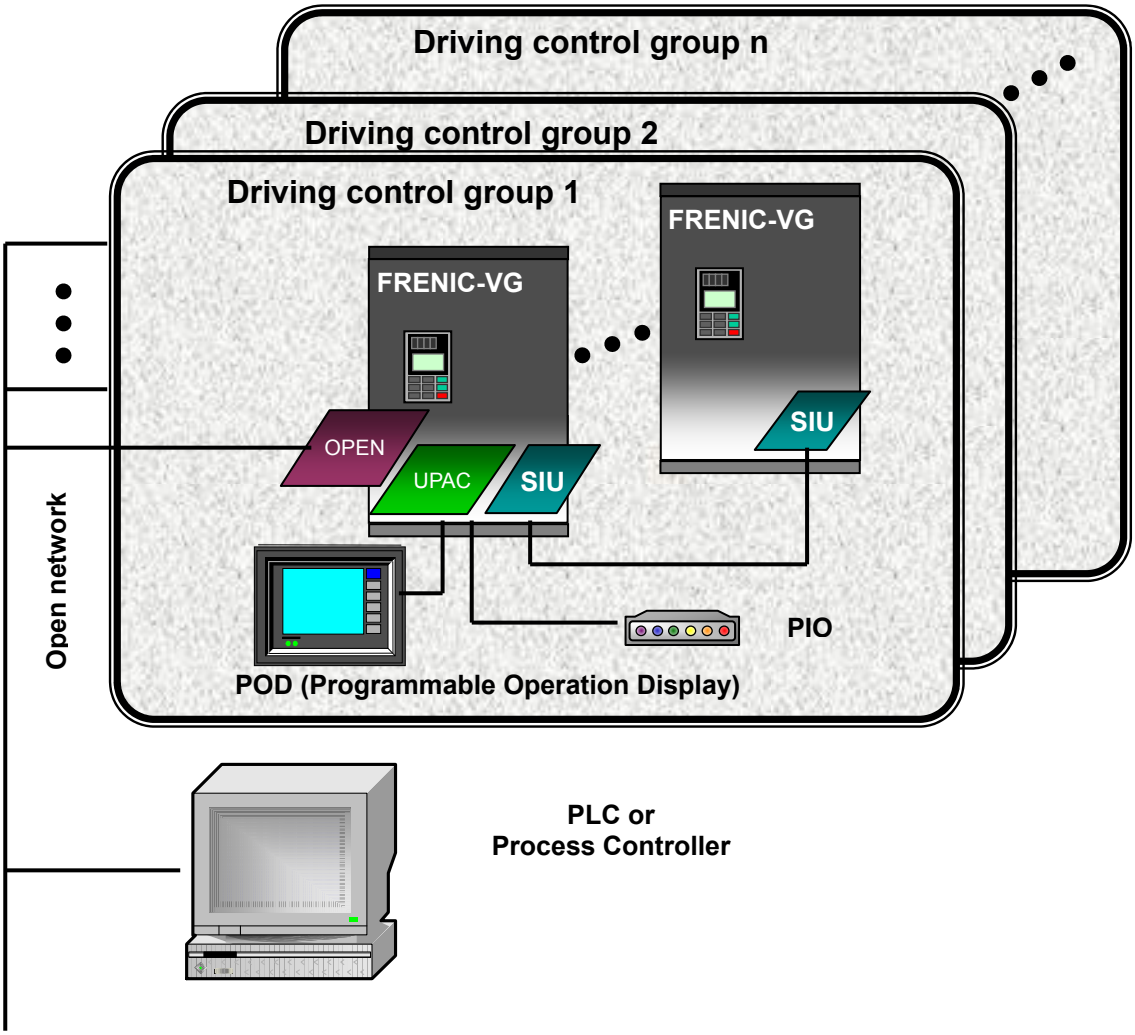


Fig. 2-1-2

2.1.2 Examination of Specification

⚠CAUTION

Be aware of the following limitations when examining the specifications.

- If the system (FRN_VG_6UPAC, FRN_VG_12UPAC) of the project is determined first, modification to the other system becomes impossible.
- Function codes cannot be read from slave FRENIC-VG (FRENIC-VG without UPAC) connected via the optical link.

2.1.2.1 System selection

After project creation is selected from D300win, the dialog box shown on the right is displayed. The UPAC system has the following system options from which you can select the desired one.

If the system is selected first, modification to the other system becomes impossible. Examine the system first before selecting.

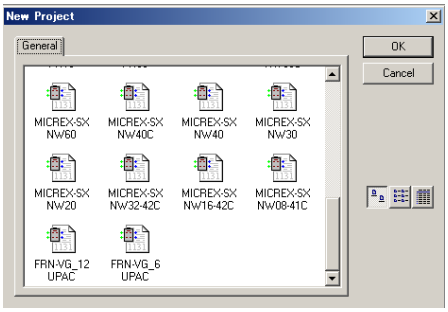


Fig. 2-1-3

Table 2-1-1

System	Selection
Broadcasting System consisting of 6 or fewer units	FRN_VG_6UPAC
Broadcasting System consisting of 1 to 12 units	FRN_VG_12UPAC

The satisfaction of the applicable system specification or controllability must be examined in advance according to the number of FRENIC-VG inverter units controlled by UPAC, controlling method, number of operated I/O points, refresh time and other particulars. A general guideline for examination is indicated here. Read the description of each part for details to avoid errors during first examination of specifications.

Table 2-1-2

		Broadcasting		Master slave		Remarks
		FRN_VG_6UPAC	FRN_VG_12UPAC	FRN_VG_6UPAC	FRN_VG_12UPAC	
Number of connected units		1 to 156		1 to 6	1 to 12	
Number of pieces of OPC-VG1-UPAC		1				Two or more UPACs cannot be installed inside the system.
Number of pieces of OPC-VG1-SIU		Number of units (number > 1)				Unnecessary for a system consisting of only one unit
I/Q memory		All 32W	All 14W	All 50W x 6 units	All 22W x 12 units	Memory for high-speed data exchange
	Number of memories	32W UPAC→VG : 32W (Slave: 18W) VG→UPAC : 18W (Slave: None)	14W UPAC→VG : 14W (Slave: 8W) VG→UPAC : 8W (Slave: None)	50W UPAC→VG : 32W (Slave: 18W) VG→UPAC : 18W (Slave: 18W)	22W UPAC→VG : 14W (Slave: 8) VG→UPAC : 8W (Slave: 8W)	In the master-slave link, data can be written or referenced for each slave.
	Type	Operation command, speed setting 1, 4, torque reference, torque current reference, magnetic flux reference, torque limiter 1, 2, acceleration / deceleration time, PG pulse count, position command, torque bias, auxiliary speed reference, function code 4W, standard and extended inputs and outputs, etc.				
	Writing time	Minimum 1ms Writing same data to slave		1 unit: Minimum 1 ms 2 units: Minimum 2 ms to 12 units: Minimum 22 ms Minimum time (ms) = (Number of units -1) X 2 * With 2 or more units, the reading period is twice the value		The refresh time between FRENIC-VG and UPAC is the value on the left according to the number of connected units even if the task operates for 1 ms.
	IO points (DI)	Standard 11 points + extended I/O	Standard 11 points	Standard 11 points + extended I/O	Standard 11 points	Extended I/O (OPC-VG1-DIOB, OPC-VG1-AIO) cannot be accessed in the 12-unit system.
	IO points (AI)	Standard 3 points + extended I/O	Standard 3 points	Standard 3 points + extended I/O	Standard 3 points	
	IO points (DO)	Standard 5 points + extended I/O	Standard 5 points	Standard 5 points + extended I/O	Standard 5 points	
	IO points (AO)	Standard 3 points + extended I/O	Standard 3 points	Standard 3 points + extended I/O	Standard 3 points	
	High-speed counter	Built-in PG OPC-VG1-PG(PGo)	Impossible	Built-in PG OPC-VG1-PG(PGo)	Impossible	The counter function (position, synchronization, and wiring control) is unavailable in the 12-unit system.
Function code						
	Access to master	Writing to or reading from all areas (F, E, C, P, H, A, o, L, U, M) 60 ms refresh M code is read only				Function to master only (FRENIC-VG equipped with UPAC)
	Access to slave	4W writing possible Reading impossible	Writing impossible Reading impossible	4W writing possible Reading impossible	Writing impossible Reading impossible	High-speed exchange using I/Q area of both master and slave

2.1.2.2 Designing the number of inputs and outputs

⚠CAUTION

Examine the following items in advance when designing the number of inputs and outputs.

- The number of I/O expansion cards installed in each FRENIC-VG unit is two. An optical link connected to the SIU card reduces the number of expansion cards by one.
- The synchronous motor drive (PMPG card necessary) and position control (PG card necessary) reduces the number of expansion cards by one, too.
- In the 12-unit system, the I/O expansion option cannot be operated (DIOA card can be operated).

The standard I/O and the I/O of the expansion card can be operated from the UPAC.

Two expansion cards can be installed. The number of inputs and outputs is restricted in this capacity.

One SIU (optical link) card reduces the number of installed cards by one, though all the inputs and outputs of the linked FRENIC-VG become expandable (+α). However, the I/O expansion option cannot be operated with a 12-unit system selected.

Table 2-1-3 Maximum number of inputs and outputs controlled with one unit of FRENIC-VG

	Standard	DIOA	DIOB	AIO	Combination of option (Total I/O points)					
					DIOA+DIOB	DIOA+AIO	DIOB+AIO	SIU+DIOA	SIU+DIOB	SIU+AIO
DI	9	4	16	-	29	13	25	13+α	25+α	9+α
DO	5	8	10	-	23	13	15	13+α	15+α	5+α
AI	3 (12 inputs)	-	-	2	3	3	5	3+α	3+α	5+α
AO	3	-	-	2	3	3	5	3+α	3+α	5+α

The maximum number of inputs and outputs controlled from the UPAC is shown in the table below for a system consisting of three units (α= 3).

	Combination of option (DIOB, AIO) (Total I/O points)			
	(3,0)	(2,1)	(1,2)	(0,3)
DI	75 (9*3+16*3)	59 (9*3+16*2)	43 (9*3+16*1)	27 (9*3+16*0)
DO	45 (5*3+10*3)	35 (5*3+10*2)	25 (5*3+10*1)	15 (5*3+10*0)
AI	9 (3*3+2*0)	11 (3*3+2*1)	13 (3*3+2*2)	15 (3*3+2*3)
AO	9 (3*3+2*0)	11 (3*3+2*1)	13 (3*3+2*2)	15 (3*3+2*3)

In the above table, the maximum number of inputs and outputs with one high-speed pulse counter (PG card) is as shown in the table below.

	Combination of option (DIOB, AIO) (Total I/O points)			
	(2,0)	(1,1)	(0,2)	
DI	59 (9*3+16*2)	43 (9*3+16*1)	27 (9*3+16*0)	
DO	35 (5*3+10*2)	25 (5*3+10*1)	15 (5*3+10*0)	
AI	9 (3*3+2*0)	11 (3*3+2*1)	13 (3*3+2*2)	
AO	9 (3*3+2*0)	11 (3*3+2*1)	13 (3*3+2*2)	
PG	1	1	1	

* Design the number of inputs and outputs with some spare points.

If the number of inputs and outputs is in shortage or there is no spare points, installation of an external PLC is recommended.

2.2 Individual Operation of UPAC

Basic operation and test operation in a system consisting of one unit of FRENIC-VG without optical option are described here.

2.2.1 Preparation

⚠CAUTION

After finishing installation, wiring and switch setting, check the following items before turning the inverter on.

- Check if wiring is correct.
- Check if wire dust, screws or the like is left.
- Check if the screws and terminals are tight.
- Check if some element wires at the crimp terminal are in contact with another terminal.

The following preparation, confirmation and setting are necessary.

(1) Turn on the main power supply (R/L1, S/L2, T/L3) or control power supply (R0, T0).
(2) The UPAC option is recognized.
(3) Set the function codes.

Refer to Chapter 3 "Preparation for Operation and Test Operation" for preparation for operation of the FRENIC-VG inverter.

1) Power-on

⚠CAUTION

- If the option is turned on for the first time, the ErA alarm may be displayed. If this happens, leave the power turned on for about 30 seconds, and turn the power off then on again.

(1) Recognition of UPAC option

Page 10 on the I/O check screen in the keypad appears as shown at right with the UPAC option installed.

D: If "VG1-UPAC" is not displayed, the inverter does not recognize the UPAC option. Check the installation state of the UPAC option in this case.

```
OPTION
D: VG1-UPAC
E: (5)
F: (6)
∧∨→PAGE      Switch
10
```

(2) Confirmation of ROM version

⚠CAUTION

- Some of options are not compatible with early ROM versions of FRENIC-VG. The operation does not function correctly with early versions. Be sure to check the ROM version shown in maintenance information of the keypad. If the version is uncertain, contact us.

Before installing the option, check the ROM version of the main body. If the option is already installed, check the ROM version of the main body in that state.

See the information displayed on the right of MAIN and MTR in the maintenance information of the keypad.

The screen shown on the right is page 5 in the maintenance information. Press the ∨ key at the keypad to go to page 5.

```
MAIN=H1××××
MTR =H2××××
KP  =K  ××××

∧∨→PAGE      Switch
5
```

Table 2-2-1

Model of option	ROM version	
	MAIN	MTR
OPC-VG1-UPAC	H10020 or more	H20020 or more

2.2.2 Settings on FRENIC-VG side

⚠CAUTION

- When “0” is set at o38 “UPAC start/stop” or a “stop (S)” command is issued form the control of D300win, data exchange does not occur between UPAC and FRENIC-VG.
- o38 cannot be controlled from the UPAC program.
- If the break point is set in the monitor screen of D300win and, in a broken state, “0” (stop) is set at o38, UPAC alarm “ErA” is caused. Do not operate o38 during break operation.
- Do not select zero clear at o39 “UPAC memory mode” for the FM and SFM areas.

2.2.2.1 Starting or stopping UPAC

Though the CPU of UPAC is always active without relations to the setting of the o38 function code (UPAC start/stop) and the control state of D300win, set “1” or “2” at o38 and give a “start (W)” command from the control of D300win to arrange the data exchange state between UPAC system and FRENIC-VG. This data exchange state is defined in the table below as “startup.”

The user must select and prepare the pieces of data exchanged between UPAC and FRENIC-VG in the System Definition (UPAC system definition) screen of D300win. The System Definition is described in details in section 2.2.3 “Settings on D300win side” and in Chapter 3.

Table 2-2-2 Starting and stopping condition of UPAC

Function code o38	D300win control	UPAC system	Outline of operation
0	“Stop (S)” command	Stop (data exchange)	Data exchange between UPAC and FRENIC-VG is stopped.
	“Start (W)” command		
1 Hot start	“Stop (S)” command		
	“Start (W)” command	Start (data exchange)	Data exchange between UPAC and FRENIC-VG is possible. Started with memory retention when UPAC starts.
2 Cold start	“Stop (S)” command	Stop (data exchange)	Data exchange between UPAC and FRENIC-VG is stopped.
	“Start (W)” command	Start (data exchange)	Data exchange between UPAC and FRENIC-VG is possible. Started with cleared memory when UPAC starts.

In a system using UPAC, make it a rule to set “1” or “2” at o38 and start or stop from the control of D300win.

This is important when UPAC is temporarily stopped for system definition downloading or reset command issuance. In such an instance, do not manipulate o38 but control the D300win control.

Because function code o38 controls UPAC directly, UPAC cannot operate o38.

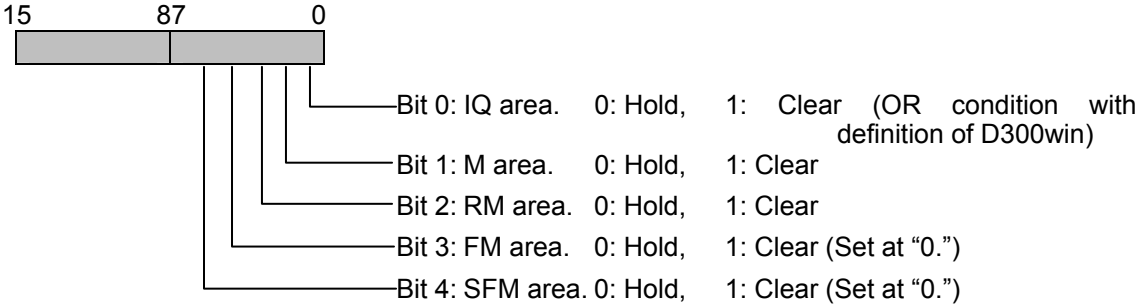
2.2.2.2 UPAC memory mode

You can select whether to clear the memory to zero or to hold at the state immediately before a stop, in the stopping state of UPAC. The memory area of UPAC includes the IQ, M, RM, FM and SFM areas. Clear/hold selection can be made for each memory area individually.

The o39 setting is reflected when UPAC is being stopped and the starting UPAC is stopped. The I area (FRENIC-VG->UPAC) of the IQ memory is updated immediately after it is cleared by FRENIC-VG, so that it cannot be cleared.

Leave the "hold" setting for the FM and SFM areas.

Definition of function code o39 "UPAC memory mode"



* The IQ area is the control data area for speed, torque and other data items exchanged at a high speed.
* Items related directly to the user in the M area is the function code area (F, E, C, P, H, A, o, L, U).
* The RM area is the retain memory area assigned by the user for applications.

The IQ memory is determined through combination with the coupled HOLD definition in System Definition-system configuration definition of D300win as shown in the figure.

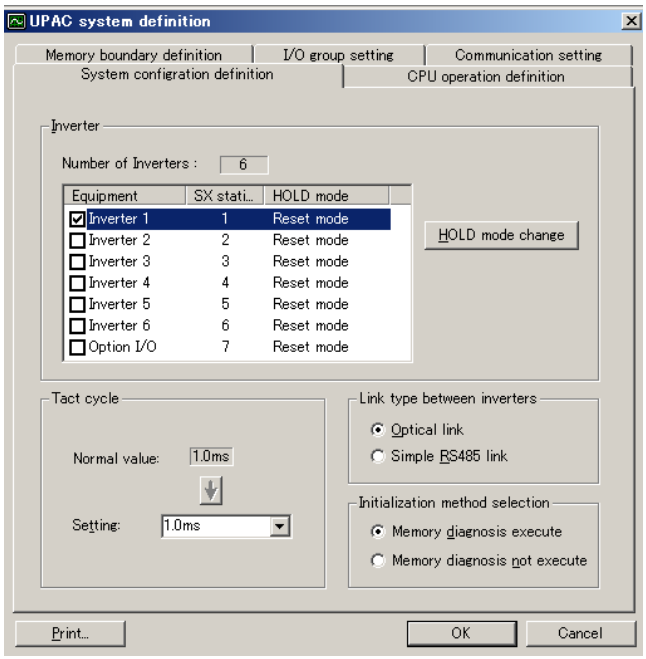


Fig. 2-2-1

1) IQ area

The IQ area is defined through combination between function code o39 "UPAC memory mode" and the coupled HOLD definition in System Definition.

Table 2-2-3 IQ memory clearing condition

IQ area bit of function code o39	System Definition	Description of memory	Outline of operation
0	HOLD mode	Hold	The IQ memory is held in the state before stoppage of UPAC.
	Reset mode	Clear	The IQ memory is cleared to zero upon stoppage of UPAC.
1	HOLD mode		
	Reset mode		

2) M, RM, FM and SFM areas

The M, RM, FM, and SFM areas are defined with function code o39 "UPAC memory mode."

Table 2-2-4 M, RM, FM and SFM memory clearing condition

Bit of M, RM, FM or SFM area of function code o39	Description of memory	Outline of operation
0	Hold	The corresponding memory is held at the state before stoppage of UPAC.
1	Clear	The corresponding memory is cleared to zero upon stoppage of UPAC.

2.2.3 Settings on D300win Side

Preparation has been made in section 2.2.2 to operate UPAC through the settings on the FRENIC-VG side.

To reflect the data calculated by UPAC to FRENIC-VG or to refer to the data on the FRENIC-VG side, definition must be given to the System Definition of UPAC (UPAC system definition) with D300win.

The concrete example for giving a "speed setting from UPAC to FRENIC-VG" is described below. Read the description carefully to fully understand it.

2.2.3.1 FRENIC-VG interface

Determine the destination of connection of the UPAC's speed setting to the FRENIC-VG control.

Suppose that you want to select speed setting 1 among speed setting 1 (before acceleration / deceleration calculation) and speed setting 4 (ASR input).

To register the definition to D300win, place a check mark√ at Speed setting 1 / frequency reference (V/f) in the output selection screen (screen shown on the right) in the I/O Group setting of the System Definition.

After clicking on OK, download the system definition when a speed command program (program is omitted) is compiled and downloaded, and give a reset command.

Upon this, the control on the FRENIC-VG side changes as shown in the figure below.

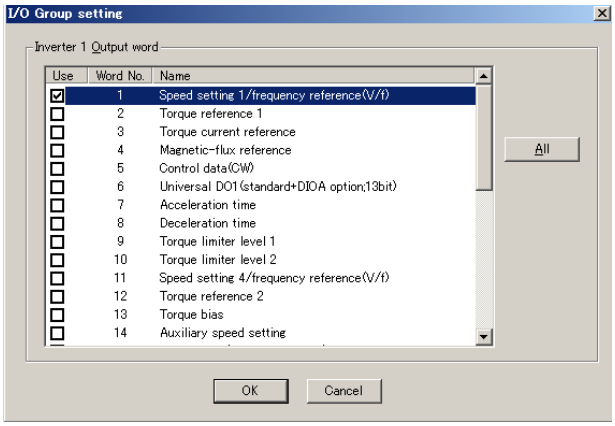


Fig. 2-2-2

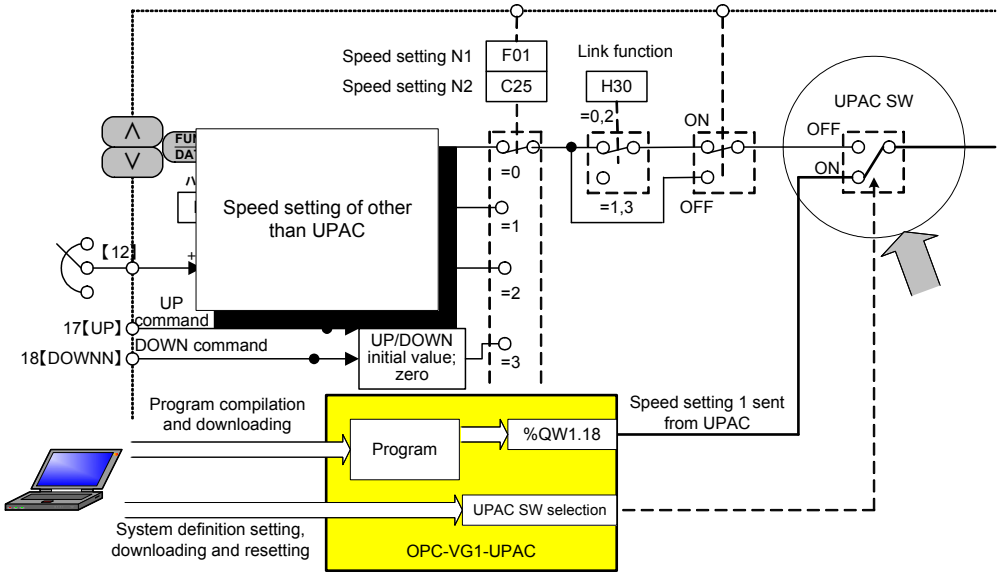


Fig. 2-2-3

2.2.3.2 I/O group setting

I/O group setting is on the fourth property sheet of the UPAC system definition screen. The setting method is described here.

Associate the task level of UPAC with the I/O data area of the inverter and define the refresh timing.

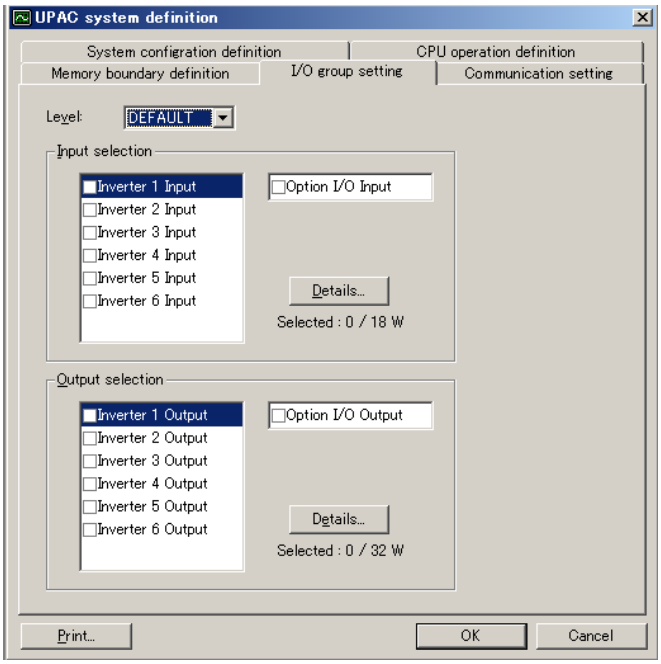


Fig. 2-2-4 I/O group setting screen

The operation method is described in the table below.

Table 2-2-5 Operation method in I/O group setting screen

Item	Description	Initial value
Level	The priority of the task included in the resource is listed. Select the desired task (priority) to display the current setting.	
Input selection	Select an input device to be used in UPAC. Place a check mark to select all input data on the devices selected. After selecting an input device, pressing the [Detail (D)] specifies input date of the device.	All OFF
Output selection	Select an output device to be used in UPAC. Place a check mark to select all output data on the devices selected. After selecting an output device, pressing the [Detail (D)] specifies output date of the device.	All OFF
Selected number	The number of pieces of data selected for input/output of a selected device appears on the numerator side. The number of pieces of decision branch data for a specified device appears on the denominator side.	
[Details (D)] button (or double click an item)	The input/output data selection screen of a selected device appears (Figure 2-2-5).	

* All devices can be set without relations to installation of each device.

Detail operation method of selection check box

The check box is displayed or operated as described below.

- A check mark is placed if the service state of all devices is ON.
- A check mark is placed in the gray check box if the service state of some devices is ON.
- No check mark is placed if the service state of all devices is OFF.
- When clicked on, the state of the check box changes as shown below.

→ → → → → …

→ → → → → → …

→ → → → → → …

Detail setting method of each word

Press the [Details (D)] button or double-click on the item to display the detail setting screen shown in thefigure below.

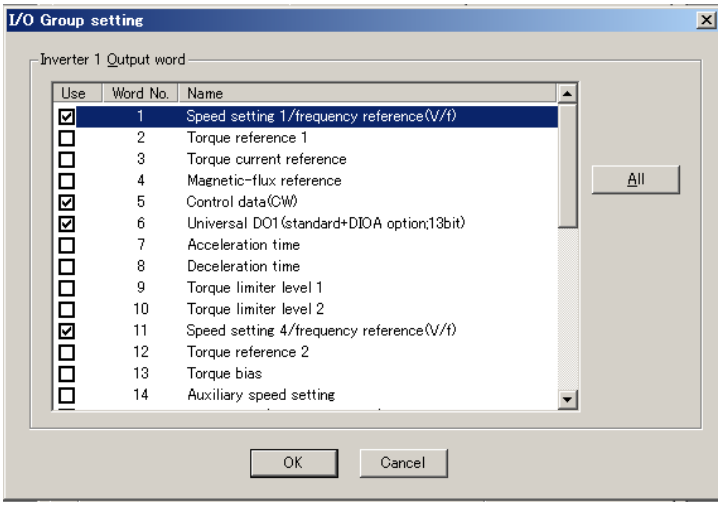


Fig. 2-2-5 Detail setting screen for each word

The operation method is described in the table below.

Table 2-2-6 Operation method of detail setting screen

Item	Description
[Use] check box	Set use or no use for each word.
Word No.	The word number starting at “1” is displayed.
Name	The data name is displayed.
[All] button	All points are turned on or off in a batch. If ON buttons are more than half, all words are turned off; if not, all words are turned on.

2.2.3.3 Precautions for I/O group setting

⚠CAUTION

- If output selection exceeds the predetermined number of words (6-unit system: 19W or more, 12-unit system: 9W or more) in the I/O group setting of the system definition of D300win, an illegal setting is judged and operation procedure alarm “Er6” is issued as a warning sign for safety.

In this section, cases in which an operation procedure alarm is developed are described. For the operation method of D300win or UPAC and VGFRENIC-VG interface setting, refer to the corresponding manual.

1) 6-unit system

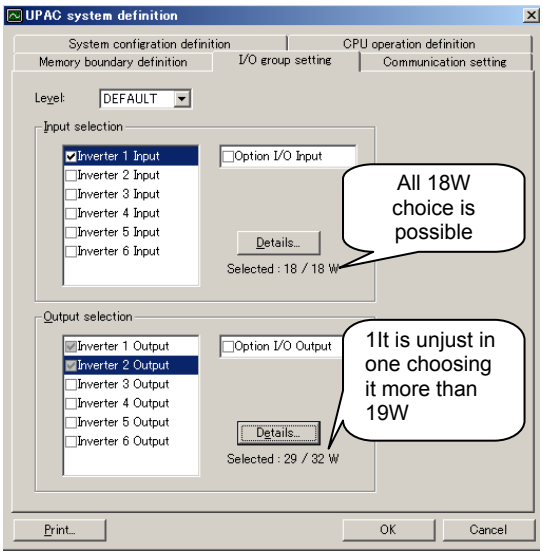


Fig. 2-2-6

In the 6-unit system, 19W or more outputs cannot be selected for the output selection in the I/O group setting of the system definition.

The data sent from UPAC to FRENIC-VG does not exceed 19W during regular operation. If 19W or more items are selected (check marks are placed), a setting error of the user is probable. In this state, FRENIC-VG may cause illegal actions, accompanying danger.

For this reason an operation procedure alarm is output to disable inverter operation.

In the case of input selection, UPAC can refer to all the information of FRENIC-VG connected via the optical link.

2) 12-unit system

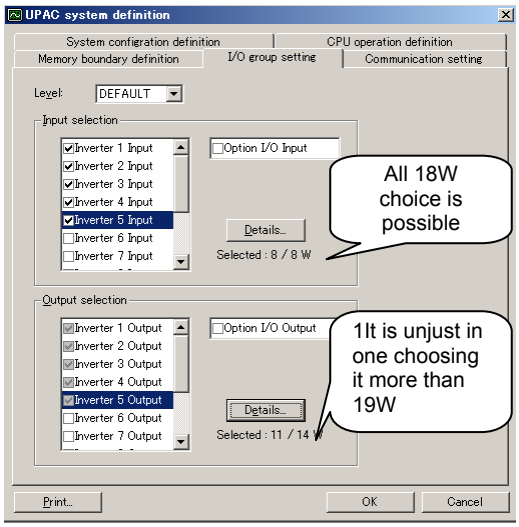


Fig. 2-2-7

In the 12-unit system, 9W or more outputs cannot be selected for the output selection in the I/O group setting of the system definition.

The data sent from UPAC to FRENIC-VG does not exceed 9W during regular operation. If 9W or more items are selected (check marks are placed), a setting error of the user is probable. In this state, FRENIC-VG may cause illegal actions, accompanying danger.

For this reason an operation procedure alarm is output to disable inverter operation.

In the case of input selection, UPAC can refer to all the information of FRENIC-VG connected via the optical link.

2.2.3.4 Downloading

⚠CAUTION

- Download programs and system definition from D300win during stoppage of the inverter. The data is not downloaded during operation of the inverter.
- Be sure to issue a reset command to allow data referencing and updating between FRENIC-VG and UPAC after downloading system definition from D300win. As well, wait for about 10 seconds after resetting before starting UPAC.

Refer to the MICREX-SX reference manual for details of downloading of programs and system definition.

In this section, conditions characteristic to UPAC are described.

1) Downloading and resetting conditions

The program and system definition can be downloaded or reset command for UPAC can be handled during stoppage of both the inverter and UPAC. Mere deactivation of operation commands is not judged to be stoppage of the inverter. Operation commands must be deactivated and the speed must be zero, and the inverter output must be shut off (with voltage output tuned off) before stoppage is judged.

To stop the UPAC, function code o38 may be set to "0" at the keypad; however, when considering operability, do not operate the keypad but give a stop (S) command from the control of D300win to stop. Stop the UPAC system after arranging the downloading and resetting conditions described in the table below.

Table 2-2-7 UPAC downloading and resetting condition

Function code o38	D300win control	UPAC system	FRENIC-VG	Downloading and resetting conditions
0	"Stop (S)" command	Stop (data exchange)	Output shutoff (stop)	Possible (△)
			Operating	Impossible *1
	"Start (W)" command		Output shutoff (stop)	Possible (△)
			Operating	Impossible *1
1	"Stop (S)" command		Output shutoff (stop)	Possible (recommended)
			Operating	Impossible *1
	"Start (W)" command	Start (data exchange)	Output shutoff (stop)	Impossible *2
			Operating	Impossible *1
2	"Stop (S)" command	Stop (data exchange)	Output shutoff (stop)	Possible (recommended)
			Operating	Impossible *1
	"Start (W)" command	Start (data exchange)	Output shutoff (stop)	Impossible *2
			Operating	Impossible *1

*1: Downloading and resetting are impossible during operation of FRENIC-VG. Stop FRENIC-VG temporarily.

*2: Downloading and resetting are impossible after UPAC has started. Issue a stop command from D300win temporarily.

2) Reset command

When a reset command is issued from D300win to UPAC, no response for confirmation of resetting may be displayed on the screen of the PC or it may be invisible even if displayed. UPAC takes about 10 seconds to process a reset command. Wait for 10 seconds after a reset command is issued before starting UPAC.

2.3 Operation of Multiple Units via Optical Option (OPC-VG1-SIU)

Basic operation and test operation of two or more units of FRENIC-VG linked with the optical option under control of UPAC are described.

Operation methods are based on description in section 2.2 Individual Operation of UPAC. Read section 2.2 first.

2.3.1 Preparation

⚠CAUTION

After finishing installation, wiring and switch setting, inspect the following items before turning the inverter on.

- Check if wiring is correct.
- Check if wire dust, screws or the like is left.
- Check if the screws and terminals are tight.
- Check if some element wires at the crimp terminal are in contact with another terminal.
- Check if SW1 and SW2 settings are correct.

The following preparation, confirmation and setting are necessary.

(1) Turn on the main power supply (R/L1, S/L2, T/L3) or control power supply (R0, T0).
(2) Confirm that the optical option is recognized and check the ROM version.
(3) Set the function codes.

Refer to Chapter 3 "Operation Preparation and Test Operation" in the User's Manual of the main body for operation preparation of the main body of FRENIC-VG.

1) Power-on

⚠CAUTION

- If operation is started without turning even one unit on in the UPAC system, an inverter-to-inverter link error "Erb" is caused. Because optical communication is not compatible with fail-soft operation, turn on all the units linked via optical cables.

Power-on sequence

The master and slave units may not be turned on simultaneously. As well, there is no definite power-on sequence. However, all the units linked via optical cables must be turned on before operation is started. If even one unit is not turned on in the system, optical communication does not function correctly.

As well, units do not issue warning display (alarm state output) until an operation command (FWD or REV) is issued.

Use the following two methods to check if the optical communication link is established.

If the master is turned off then on after the communication link is established, an alarm is caused.

(1) Check using LED on optical option

Check the blinking state of the green LED on the optical option to check the communication state. In this method, open the cover of the unit so that the printed circuit board of the optical option is visible.

Table 2-3-1 LED blink and communication state

No	LED blinking pattern	State of operation	State transition
1	Blink at 500 ms intervals	Correct operation	Optical communication is in correct operation state. When the option is turned on for the first time after purchase, the function code setting is not accurate and the No. 2 state is caused without correct operation.
2	Three blinks at 100 ms intervals then 500 ms OFF	Correct operation (Communication link not established)	Optical communication is not in correct operation state. • If the setting at switches SW1 or SW2 is wrong, turn the power off and correct the setting, and then turn the power on. • For setting errors of function codes, correct the settings and turn the power off then on again. • If there is a broken wire in the communication link, remove the cause of the broken wire.
3	Always ON (or OFF)	Option CPU error	An early ROM version of the main body of FRENIC-VG is probable. Contact us.

(2) UPAC application check

⚠CAUTION

- If the communication link is broken due to a broken wire or the like after the link is established when the power is turned on, the inverter-to-inverter link error “Erb” is caused at all units. If the communication link is broken before the power is turned on, the protective function is not effective during stoppage. When the operation command (FWD or REV) is issued, the inverter-to-inverter link error (Erb) is issued with a voltage output by the inverter to activate the protective function, but design the UPAC application to monitor the communication link to assure safety.

The communication state can be checked on the UPAC application side. Use this function for confirmation upon system startup or for assurance of reliability of the application during system stoppage.

Digital output

A digital output is issued in a UPAC + SIU system when the communication link between optical options is established.

Select one out of digital output terminals Y1 to Y5 and Y11 to Y18 (DIOA option) of the master inverter where UPAC is installed, and assign 45; [C-D07].

45; [C-D07] 1: Communication link established (Correct operation in UPAC + SIU)

0: Not established

Monitor the information of function code M14 “output terminal Y1 to Y18” at UPAC or connect the DO output at the terminal block (DIOA: connector) to an external device.

Setting example:

To assign the Y1 terminal for the check of communication link establishment, set 45;[C-D07] at function code E15 “Y1 function selection” at the keypad.

The communication link is established without relations to the o38 “UPAC start/stop” stetting or D300win control command if connection is correct.

2) Option recognition and ROM version confirmation

⚠CAUTION

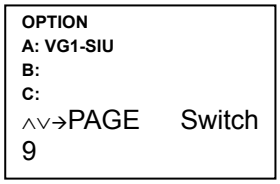
- Even if the optical option is physically installed, the communication link is not established if the connector is not inserted completely or there is poor continuity. Be sure to check on the I/O check screen of FRENIC-VG if “VG1-SIU” is recognized correctly.
- The optical option is not compatible with FRENIC-VG of early ROM versions. The communication link is not established with an early version. Be sure to check the ROM version shown in maintenance information of the keypad. If the version is uncertain, contact us.

(1) Recognition of optical option

If the optical option is installed and switch SW2 on the optical option is set at (ON, ON), the screen on page 9 of the I/O check screen at the keypad is displayed as shown at right. (In this case, SIU card is installed in port A.)

D: If "VG1-SIU" is not displayed, the inverter does not recognize the UPAC option.

In this case, check the installation state of the optical option and the state of SW2 again.



(2) ROM version confirmation

Check the ROM version of the main body of FRENIC-VG (no optical option or keypad).

See the information displayed on the right of MAIN and MTR in the maintenance information of the keypad.

The screen shown on the right is page 5 in the maintenance information. Press the ∨ key at the keypad to go to page 5.

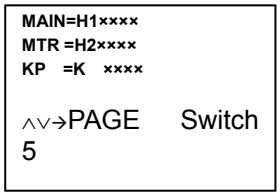


Table 2-3-2 ROM version

Maintenance information	Version to which optical option is effective
MAIN	H10040 or later
MTR	H20040 or later

2.3.2 Setting the Function Code

⚠WARNING

- Errors in the data of the function code may cause a dangerous state. To avoid this, check the data after setting or writing it.

Otherwise accidents may be caused.

⚠CAUTION

- Set “0” for o38 “UPAC start / stop” of the master unit or issue a “stop” command at the D300wincontrol to stop the UPAC + SIU system.
- Be sure to set o35 and o36 at all units. After the number of connected units and the connection order are determined, a unique setting is determined. If this setting is illegal, operation procedure alarm “Er6” or inverter-to-inverter link error “Erb” gives a warning.
- After changing o35 or o36, turn the power off then on again to reflect the new setting.

(1) Operation on o38

Set function code o38 on the master side (inverter with UPAC). o38 cannot be set on the slave side. The UPAC + SIU system does not function if o38 is set at “0.” If this happens, each inverter operates on the individual operation command and speed command.

The UPAC + SIU system does not function if o38 is set at “0.”

Master o38	UPAC+SIU link system	Outline of operation
0	Inactive	The communication link continues but various command data is not reflected at the inverters connected via the optical cable if there is no trouble in communication.
1,2	Active	The communication link is established and various commands and monitor data are reflected at the inverters connected via the optical cable if there is no trouble in communication.

(2) Address setting rule

- The o35 setting specifies between broadcasting and master-slave communication. The setting must be given at all units.
- Set the number of slave units at o36. Subtract one from the number of all units (to obtain the number of slave units). The setting must be given at all units.

Table 2-3-4 Special function code for optical option

No.	Parameter name		Setting range	Description of setting
	Name	Keypad indication		
o35	Optical option station address	Link address	0 to 255	Define the link address of the optical option for the UPAC link 0: Master address 1 to 11: Slave address 100: Master address (broadcasting) 101 to 255: Slave address (broadcasting)
o36	Number of slave stations of optical system	Link system slave station	1 to 155	Number of slave inverters connected via optical options with the one equipped with UPAC being the master.

(2)-1 How to set o35

No duplication is allowed for function code o35 among all units connected via the optical cables. After the number of connected units is determined and the master-slave connection sequence is determined, a unique number is determined. Set the serial number of the connection sequence of the optical cable (0 for master, 1 for the next slave, 2 for the next slave, ...).

Table 2-3-5 Setting of function code o35

Function code	Setting	Function	Remarks
o35	0	Master	Set for master-slave connection. The master-slave connection state indicates the state where UPAC writes or reads data to/from each slave inverter.
	1 to 11	Slave 1 to 11	
	100	Master	Set for broadcasting. The broadcasting mode is used to write the same data from UPAC to all inverters at a high speed. Writing to or reading from specific inverters is impossible.
	101 to 255	Slave 1 to 155	

Note: If a value larger than o36 is set at o35 (o35 > o36) or a value between 12 and 99 is set at o35, an operation procedure alarm is caused. If, though o35 ≤ o36, the same value is set at o35 for two or more inverters, the communication link is not established and an inverter-to-inverter link error is caused.

(2)-2 o36 setting method

The number of slave units connected via the optical cable must be set at function code o36. This is not the number including the master unit.

Table 2-3-6 Number of connected units and function code

Function code	Function	o36 setting	Remarks
o36	Number of slave stations of optical system	1	Setting for a system of two units (1 master + 1 slave)
		2	Setting for a system of three units (1 master + 2 slaves)
		-	
		10	Setting for a system of 11 units (1 master + 10 slaves)
		11	Setting for a system of 12 units (1 master + 11 slaves)
		1 to 155	Number of slave stations in broadcasting mode 1 to 155

Note: If the o36 value does not agree with the number of slave units, the communication link is not established. If operation is performed in this state, inverter-to-inverter link error "Erb" is issued to warn of a setting error.

(2)-3 Process after change

After changing o35 or o36 data, turn the power off then on again. The reset button at the terminal block (RST) or at the keypad is not effective.

Note: H31 is the address for identification in the data writing or reading process for the master unit (PLC, PC, etc.) connected with built-in RS485.

Table 2-3-7 RS485 address rule

No.	Parameter name		Setting range	Description of setting
	Name	Keypad indication		
H31	Station address	RS485 address	0 to 255	Station number for identification in a system connected to host device (POD, PC, etc.) via the built-in RS485. 0 (RTU), 99 (FGI): Broadcasting 1 to 255: Address

2.3.3 Connection

Description is made for the rule of connection setting in master-slave connection or broadcasting connection or accesses of a PC or the like to each inverter via the built-in RS485.

1) Master-slave connection

The figure on the right indicates connection of n units.

The division between the master and slave is given with SW1.

Table 2-3-8

SW1	SIU option definition
0	Master
1	Slave
2 to 9	Er6 or Erb is caused.

o35 gives definition of the link address.

Number of slave units: n - 1 (2 ≤ n ≤ 12), total n units

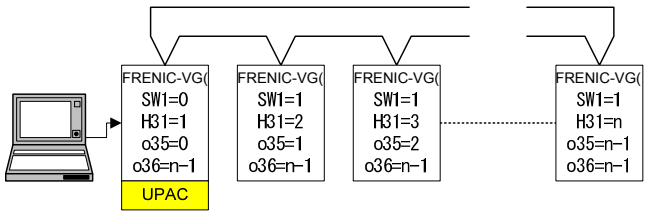


Fig. 2-3-1

Table 2-3-9

o35	o36	SIU option definition
0	n-1	Master
1	n-1	Slave 1
2	n-1	Slave 2
n-1	n-1	Slave n
≥ n		Er6 or Erb is caused.

2) Broadcasting connection

The figure on the right indicates connection of n units.

The division between the receiving and transmitting stations is given with SW1.

Table 2-3-10

SW1	SIU option definition
0	Transmitter
1	Receiver
2 to 9	Er6 or Erb is caused.

o35 gives definition of the link address.

Number of slave units: n - 1 (2 ≤ n ≤ 12), total n units

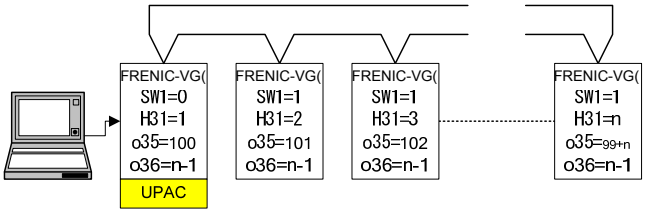


Fig. 2-3-2

Table 2-3-11

o35	o36	SIU option definition
100	n-1	Master
101	n-1	Slave 1
102	n-1	Slave 2
99+n	n-1	Slave n
≥ n		Er6 or Erb is caused.

2.4 Basic Operation Examples

In this section, a series of operations from concrete specification determination, preparation of programs, downloading to UPAC, to FRENIC-VG control by UPAC are described through simple examples for giving speed commands.

The most basic and important description is made here. Read through the description and fully understand.

Description assumes that you are already familiar with basic operations of D300win. For details of operation of D300win, refer to the D300win user's manual.

2.4.1 Determination of Specification

[Specification]

- Give FRENIC-VG the data set at function code UN0.01 as a speed command, to control the motor.

[Supplement]

FRENIC-VG can be operated with speed commands given at the keypad or data preset to multiple speeds. While this is the standard function, you cannot use the user area (UN0.01 to 64) of the function code to give speed commands. Though this is a simple example, the user can customize FRENIC-VG voluntarily using UPAC.

2.4.2 Creating a Program

Create a program according to the specification.

Start D300win and select File (F), New Project.

The New Project selection screen opens. Select FRN-VG_6 UPAC.

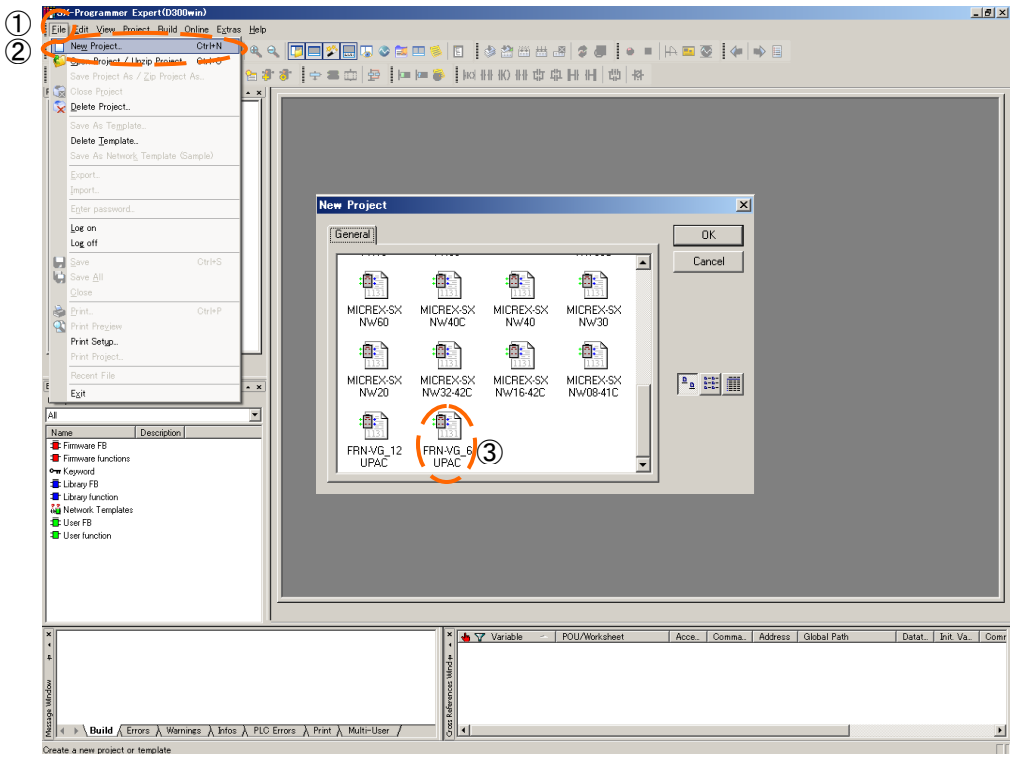


Fig. 2-4-1

A prototype project is created under project name “Untitled.”

Next, select File (F), Save/ Project As/Zip Project As (A) to give a file name and save.

Let the file name be “SPEED_CONTROL.” (Do not exceed 24 characters when entering the file name.)

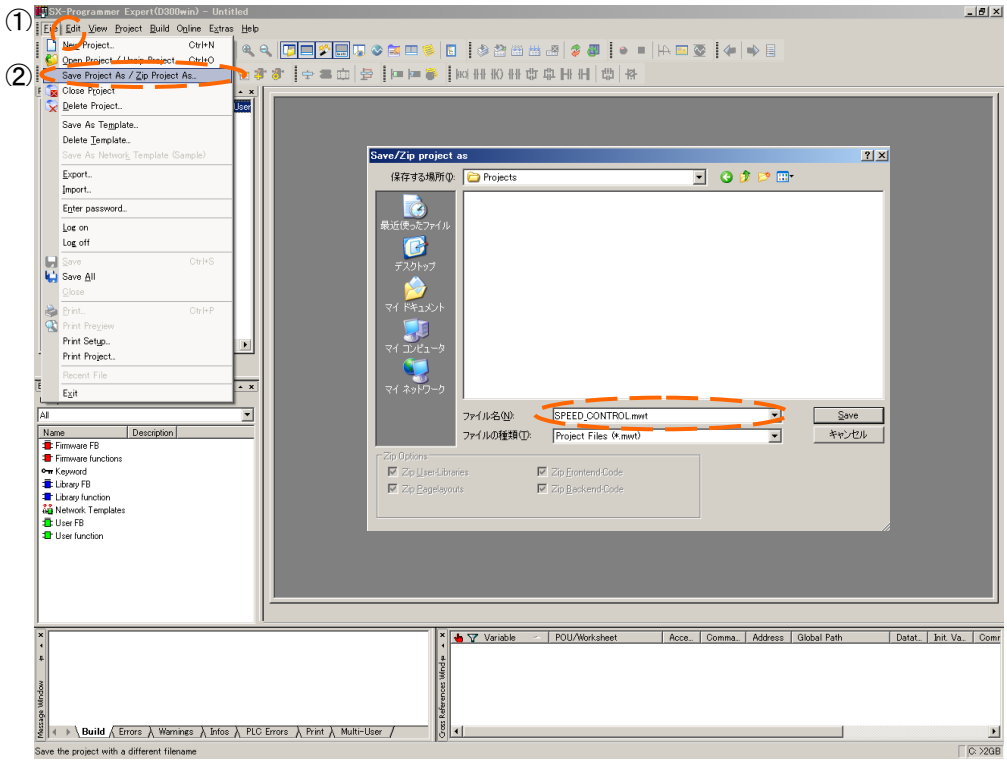


Fig. 2-4-2

Define the setting for referring to function code UN0.01.

(1) Double-click on LADDER*, the worksheet of LADDER, which is a default POU. A blank worksheet opens on the right side.

(2) Click the right mouse button on the worksheet. Select "Variable (V)" from the pull-down menu.

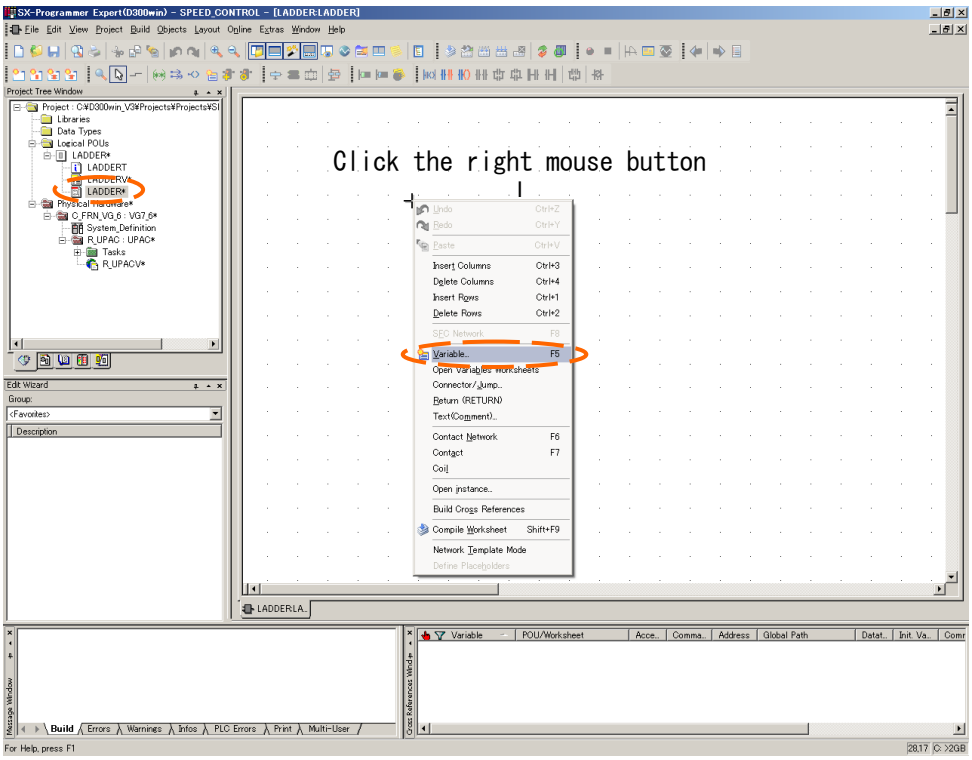
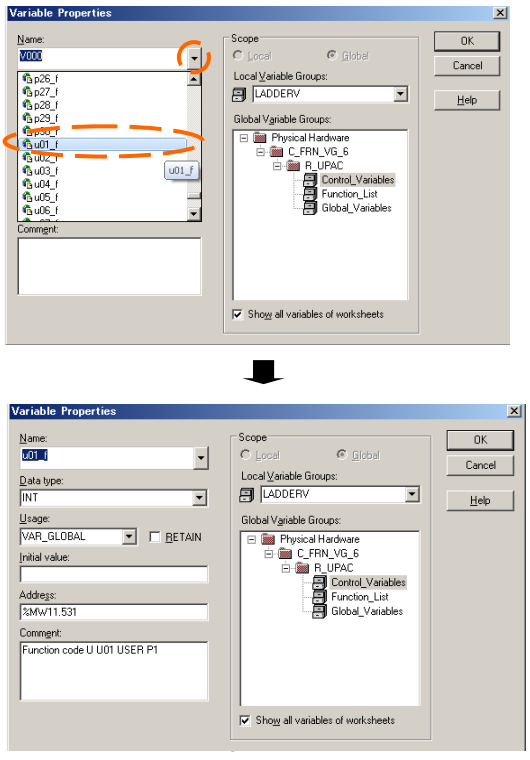


Fig. 2-4-3

(3) Select function code UN0.01 (u01_f) from the variable list.



Select [OK] in the previous page to give the variable of u01_f(UNO.01) to a worksheet as shown in the figure below.

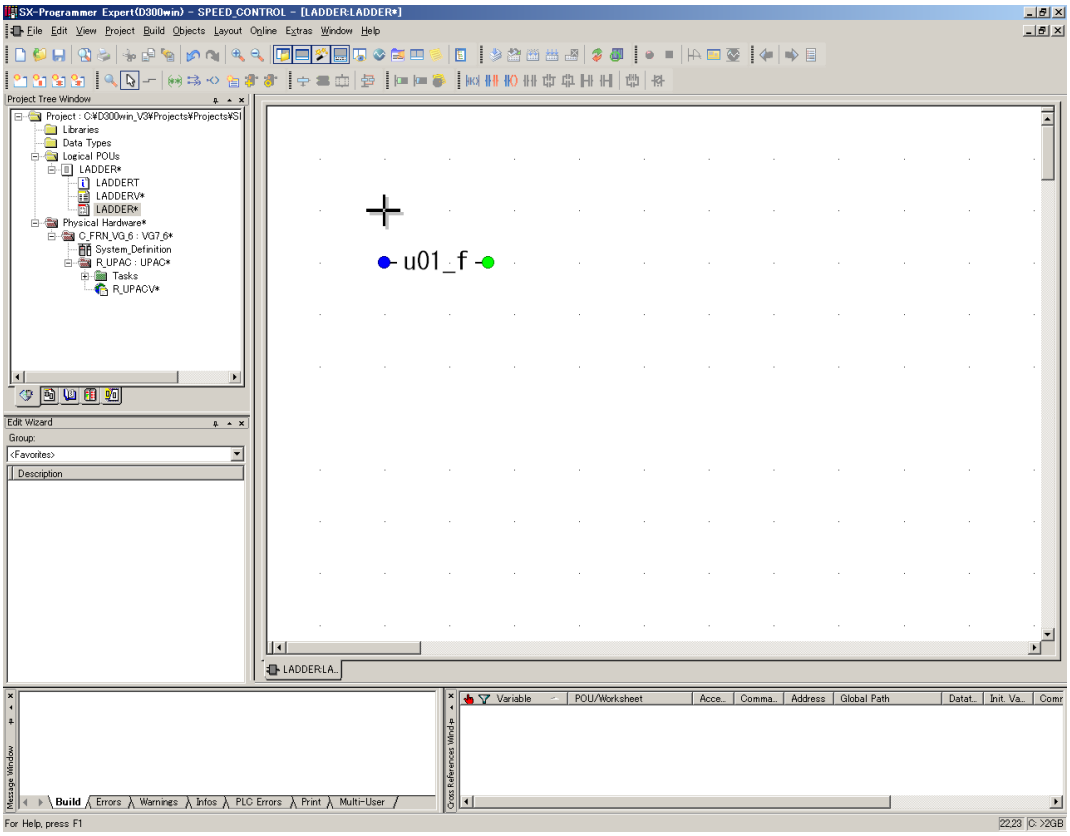


Fig. 2-4-5

Next, connect the speed command given to FRENIC-VG, in the variable of u01_f.

(4) Select control variable speed setting 1 (INV118_SPDREF1) from the variable list.

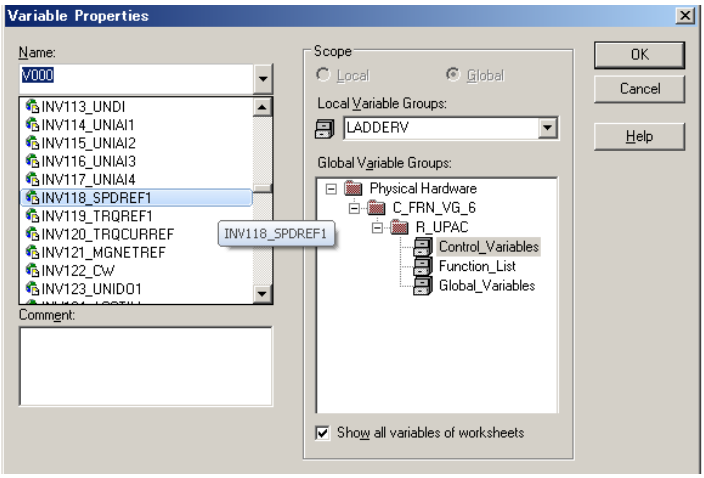


Fig. 2-4-6

The INV118_SPDREF1 variable appears on the worksheet. Select “u01_f” to connect.

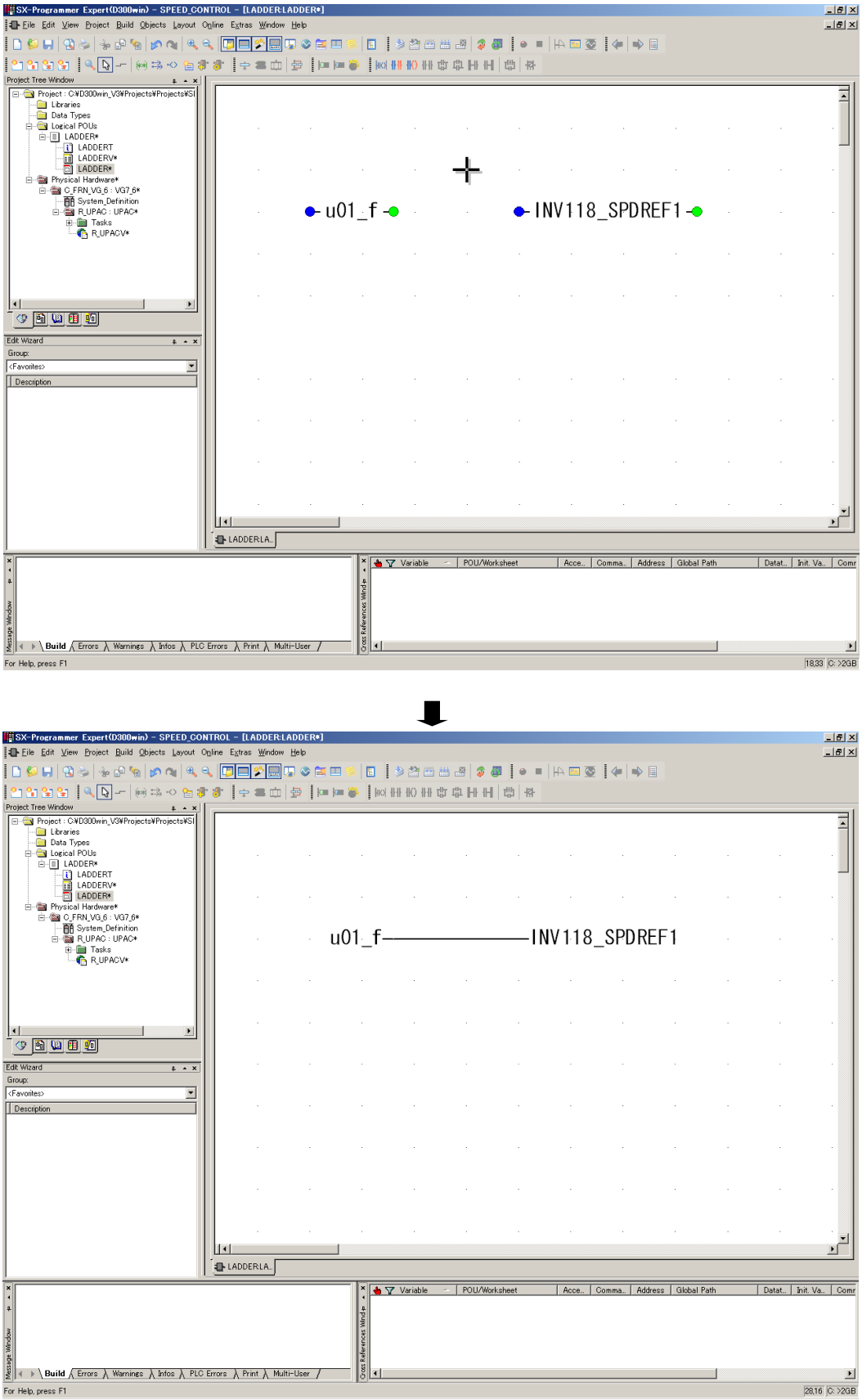


Fig. 2-4-7

Continue to compile the program in the Build (B) and Make (M) method. If there is no error in the program, “Error 0” is displayed as a result. If a warning has been issued, the program can be operated. (Confirmation of the intended range of the warning contents is recommended.)

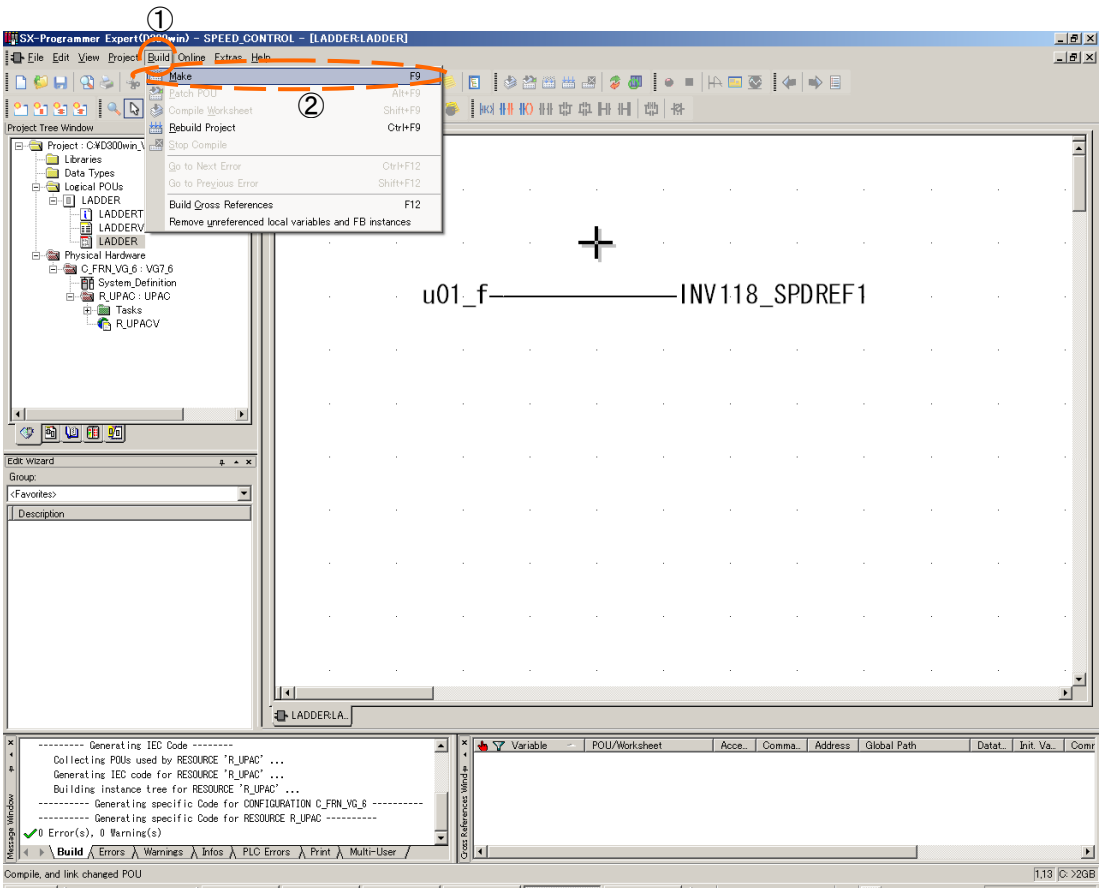


Fig. 2-4-8

Double-click on System_Definition in the tree structure of the project.

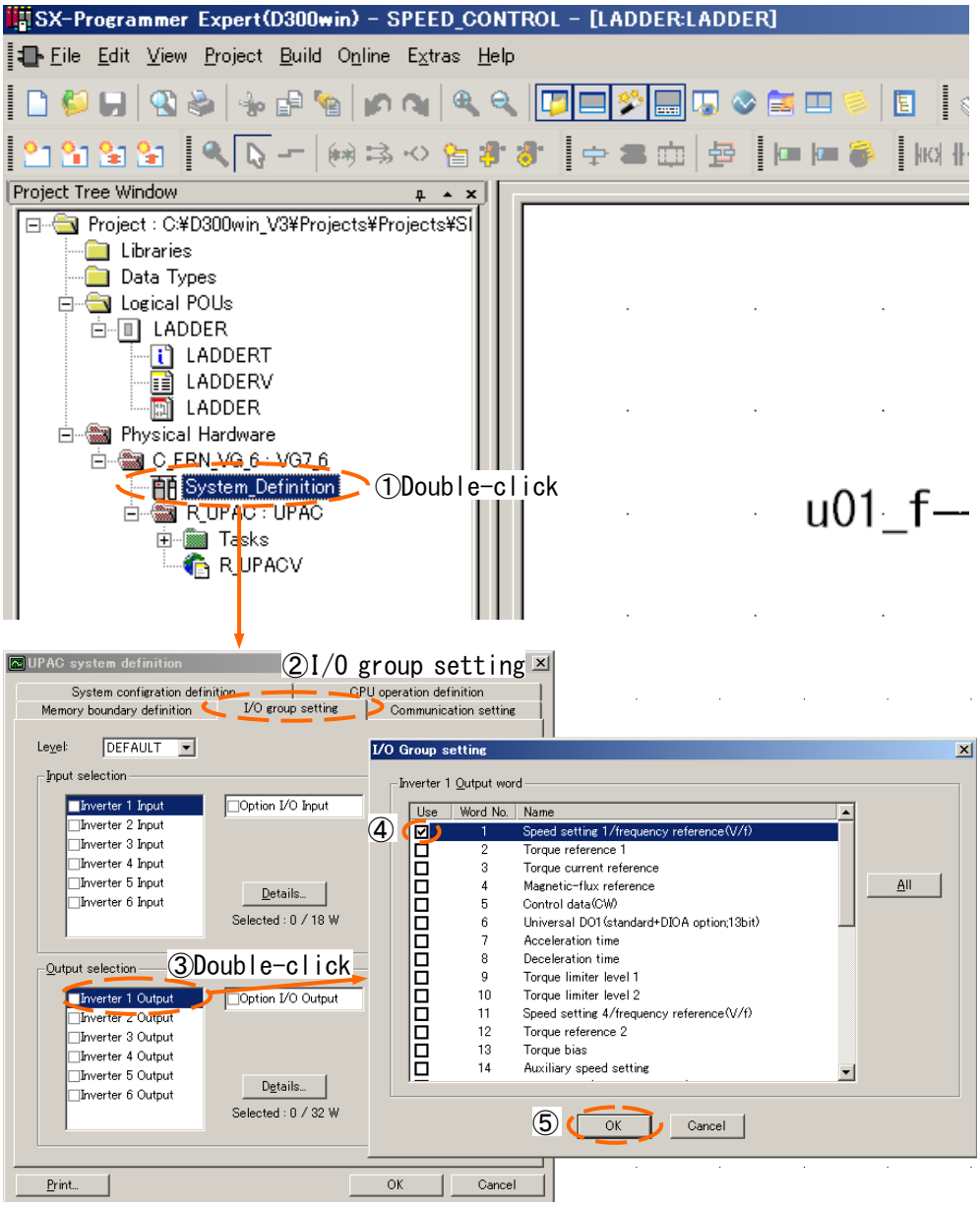


Fig. 2-4-9

Speed setting 1 / frequency reference (V/f) only is checked with the I/O Group setting in the I/O group setting. Do not use the [All (A)] button to place check marks for all data items.

2.4.3 Downloading

1) Connecting

When inserting the connector, pay attention to the direction.
The connector can be inserted only in the correct direction.

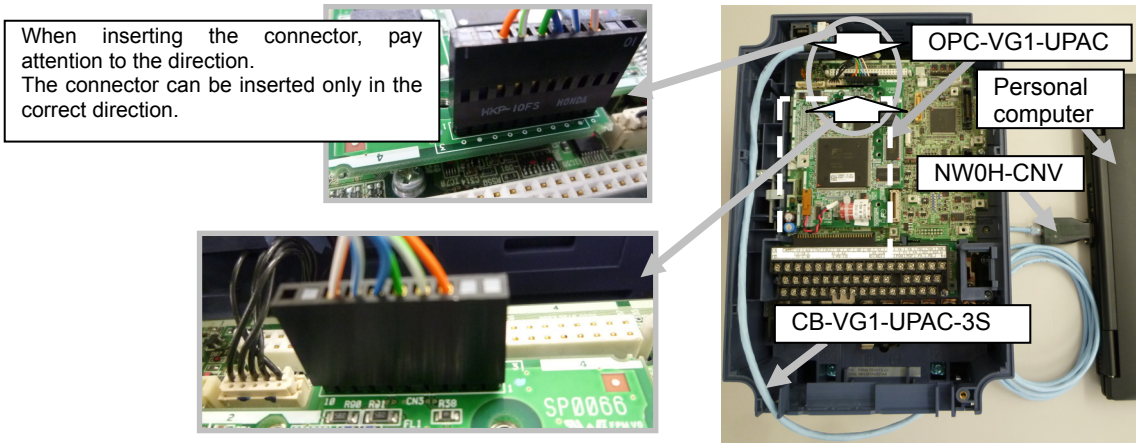


Fig. 2-4-10

Download the program and system definition created in section 2.4.2, to UPAC.
To download, connect the PC with OPC-VG1-UPAC via the CB-VG1-UPAC-3S connection cable. When connecting the connector of CB-VG1－UPAC－3S, insert it in the direction shown in the figure above.
Open the front cover of FRENIC-VG to expose and connect the control PCB as shown in the figure on the right. Refer to the section describing the installation method of the option, for how to open the front cover.

2) Checking the state of UPAC

After physically connecting the PC with OPC-VG1-UPAC via the CB-VG1-UPAC-3S cable, select Online (N), Resource Control (R) to display the control screen on the screen.

When the communication link is established, the "Run (Nonfatal failure)" state is displayed in the control screen on the right side of the figure shown below. If "Stop (Nonfatal failure)" is displayed, the o38 "UPAC start / stop" setting is "0." Change to "1" at the keypad.

When the communication link is not established, "PC is not connected" is displayed as a state in the control screen on the left side of the figure shown below.

⚠CAUTION

When a program created with SX-Programmer Expert(D300win) Version 2.x.x.x is opened
In some cases, the program may start in the state "PC is not connected." If this is the case, you can open the [Communication setting] screen of Section 1.3.4.2
and then click on OK to change to the Run state.

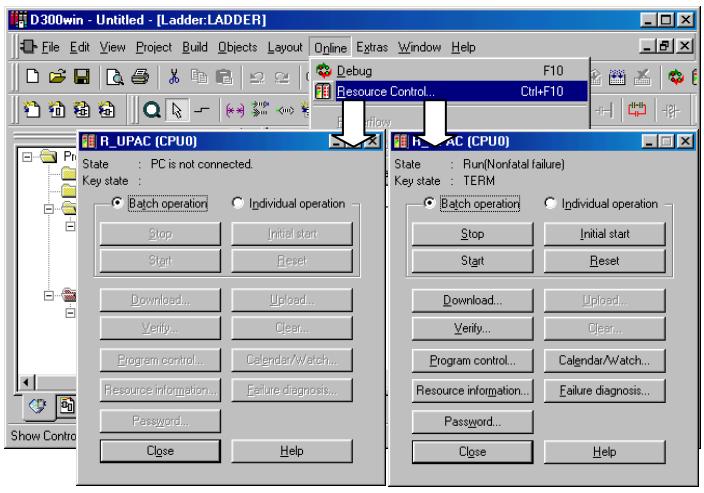


Fig. 2-4-11

3) Stopping UPAC

Click on the [Stop (S)] button of the control. A Stop dialog box appears. Select [Yes (Y)].

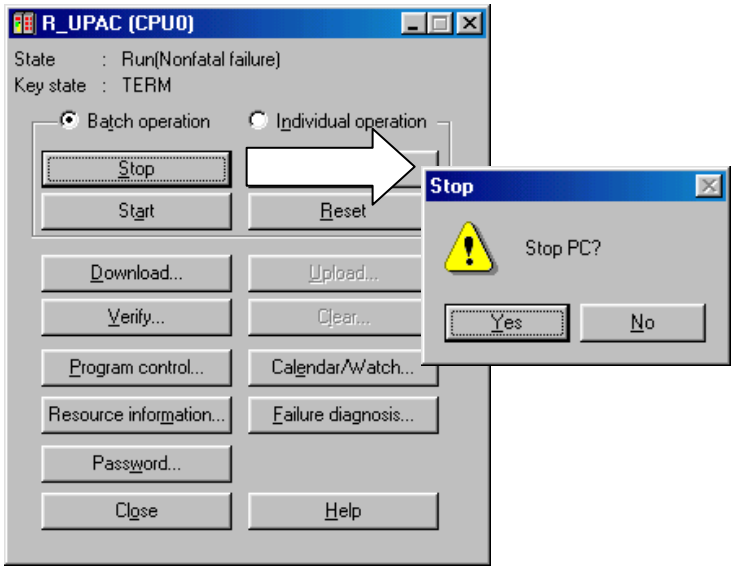


Fig. 2-4-12

4) Downloading

Check that the state of the control is "Stop" as shown in the figure below, and click on the [Download (D)] button.

If the state of the control is "Run," click on the [Stop (S)] button again to change to "Stop."

Next, in the "Download loader => CPU" screen, place a check mark in all of the Program, Clear retention memory (%M*.3) area, and System definition check boxes.

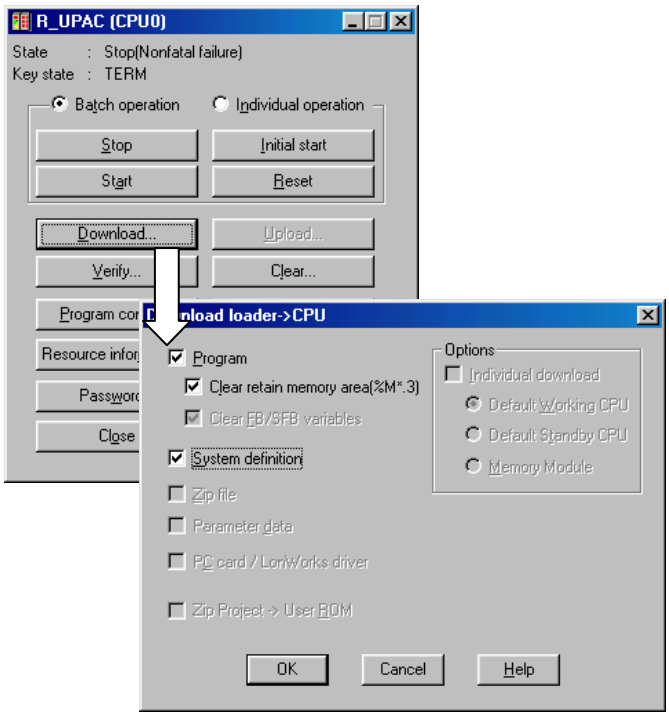


Fig. 2-4-13

When downloading, the "downloading project" bar graph is displayed at the bottom of the screen to show the progress of downloading. In the project in the example, the process finishes in about two to ten seconds.

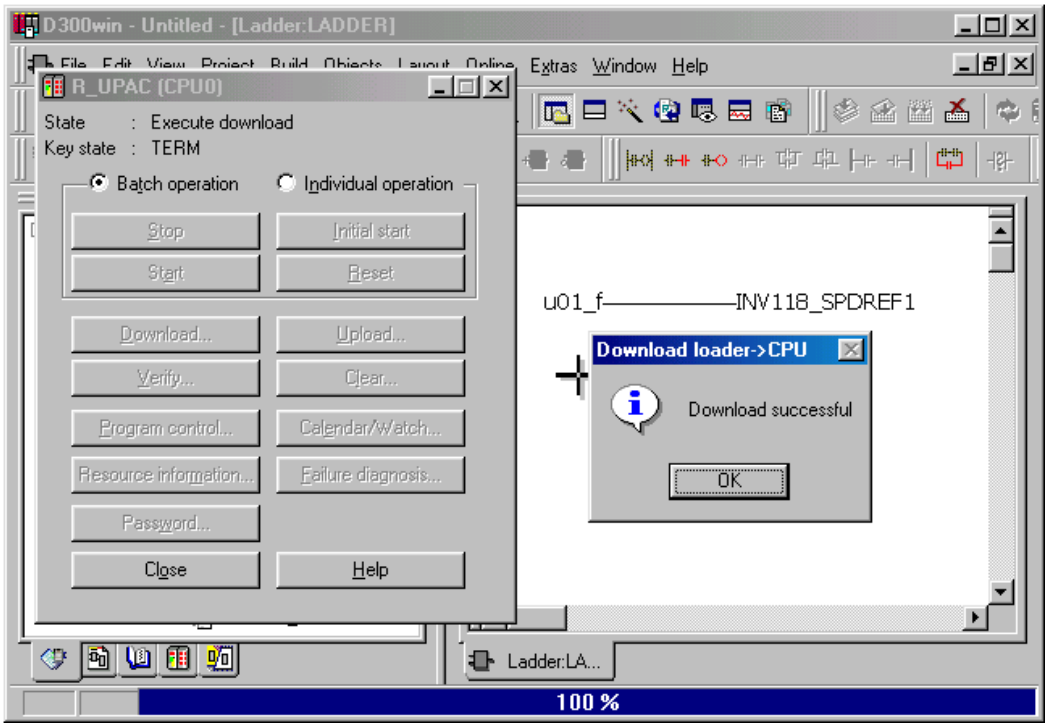


Fig. 2-4-14

5) Resetting

Click on the [Reset (R)] button in the control screen. A Reset dialog box appears. Select [Yes (Y)]. After Yes (Y) is clicked, the reset processing takes about ten seconds.

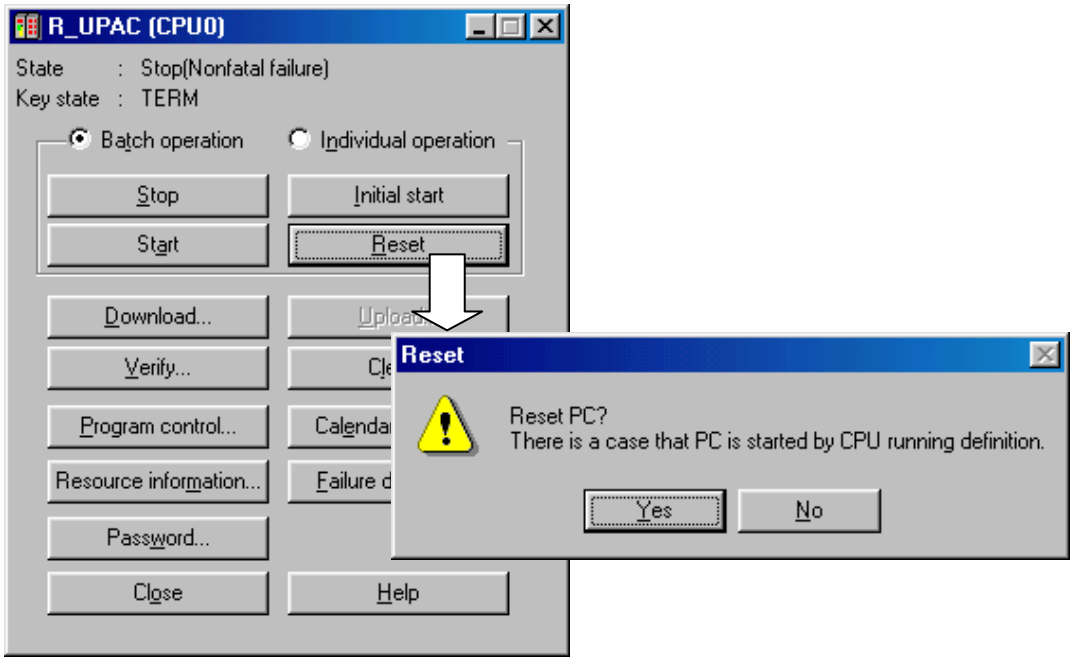


Fig. 2-4-15

6) Starting UPAC

Click on the [Start (W)] button in the control screen. A Start dialog box appears. Select [Yes (Y)]. Check that the state of the control screen changes to "Run."

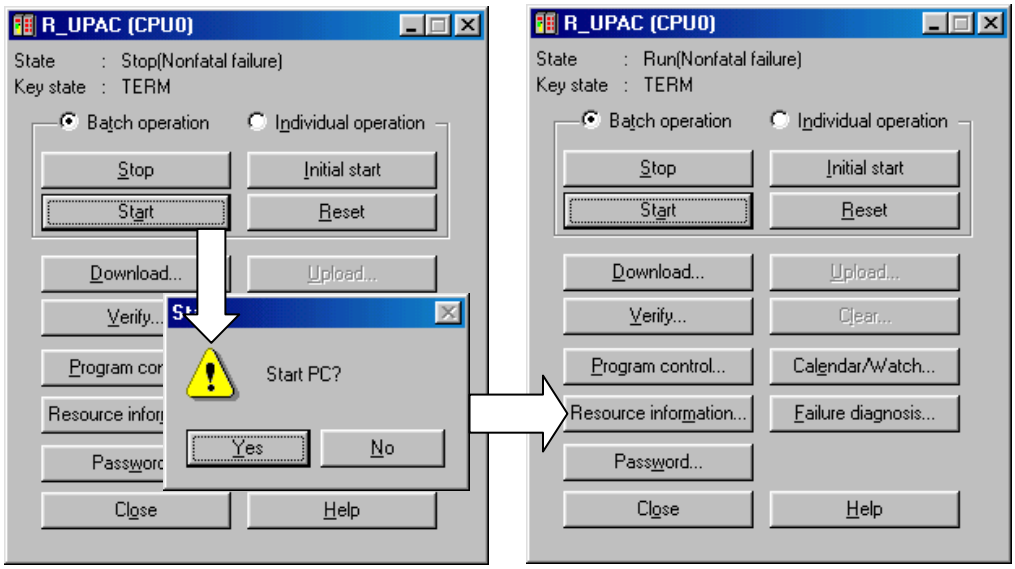


Fig. 2-4-16

2.4.4 Simulating and Monitoring

1) Preparation

Click on the [Close] button to exit from the control screen.

Next, select [Online (N)], [Debug (D)].

Check that "00000" is displayed below the variables (u01_f, INV118_SPDREF1) on the worksheet.

In this state, the state of the UPAC is monitored at the real time.

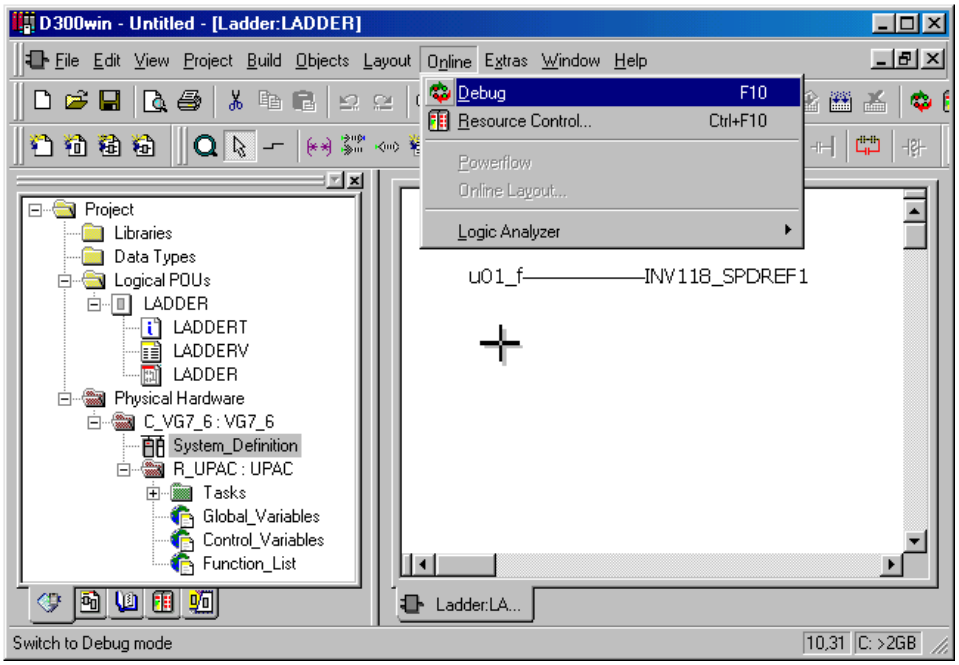


Fig. 2-4-17

2) Entering data from the keypad

Change function code UN0.01 from “0” to “1000” at the keypad.

Check that “00000” changes to “01000” on the D300win monitor screen.

From this, it is known that UPAC refers to the UN0.01 data on the FRENIC-VG side and writes the data in the speed interface of the IQ memory of UPAC.

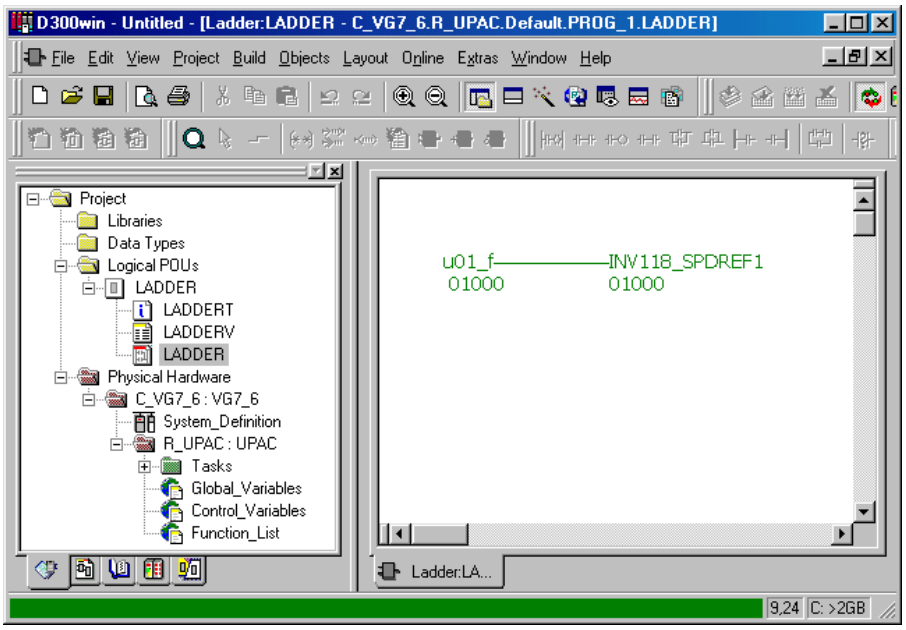


Fig. 2-4-18

Next, change settings as follows.

F01 “Speed setting N1” = “0”
F02 “Operation” = “0”
F03 “Max. speed “ = “1500”
P01 “M1 control method” = “2”: Simulation mode
H30 “Link operation” = “0”
Turn off all contact signals related to the speed change such as multi-step operation.

[Explanation of setting]

Turn off the relevant contacts such as F01, F02 and H30 to validate operation commands and speed commands entered at the keypad.

P01 makes simulation (speed control simulation) possible. This becomes inertia simulation for driving a rotating body having an inertia of function code H51 “M1 load inertia.” At this time, the inverter does not output a voltage, so that there is no need to connect a motor.

To drive an actual motor, refer to the FRENIC-VG User’s Manual for wiring and test operation of the motor.

3) Checking at the keypad

Whether the "1000" data is written from UPAC to FRENIC-VG as a speed setting or not can be checked at the 7-segment LED.

The speed data is converted into a scale where "20000" indicates the maximum speed (r/min).

Data 1000 x maximum speed (1500 r/min) / 20000 = **75 r/min**

The "75 r/min" speed setting is indicated with blinking **"75"** during stoppage of the inverter (with LCD monitor of the keypad displaying STOP).

In this state, correct operation of the UPAC function and data exchange between UPAC and FRENIC-VG has been verified. Press the FWD or REV key on the keypad to start simulation (simulation speed) at 75 r/min.

When "20000" is entered to UN0.01, the speed setting becomes:
20000 x maximum speed (1500 r/min) / 20000 = **1500 r/min**.

Chapter 3 FRENIC-VG Interface

This chapter describes the detailed setting for the operation and the control configuration in UPAC.

Contents

3.1 Memory Interface

3.1.1 Giving Basic Commands

3.1.1.1 Operation command

⚠CAUTION

- To operate from UPAC, short-circuit [FWD] and [REV] with [CM] at the terminal block. If only one terminal is short-circuited, the motor rotates when o38 “UPAC start/stop” is set at “0: Stop.” Be sure to short-circuit across [FWD] and [CM] and across [REV] and [CM].

(1) 6-unit system (broadcasting)

Table 3-1-1

Address	No	Name	FS/BS	Type	Direction	Remarks
%QW□.22	5	Control data (CW) (standard + DIOA 16-bit)	Type: 32	WORD	UPAC→FRENIC-VG	

□: 1 to 6 (INV1 to INV6)

(2) 12-unit system (broadcasting)

Table 3-1-2

Address	No	Name	FS/BS	Type	Direction	Remarks
%QW□.10	5	Control data (CW) (standard + DIOA 16-bit)	Type: 32	WORD	UPAC→FRENIC-VG	

□: 1 to 12 (INV1 to INV12)

There are two methods to issue an operation command ([FWD], [REV]): (1) operation at other than UPAC and (2) operation at UPAC. The features of the operation command concerning UPAC are operation under AND condition between external command and UPAC command and that the operation command becomes invalid if the command of both [FWD] and [REV] are ON.

1) How to use

The operation command is issued basically at the terminal block, keypad or communication system. UPAC can issue or stop these external commands under the AND logic condition shown in the figure below. This is the operation of UPAC.

When control data is disabled in UPAC System_Definition (I/O group setting), operation can be made with external commands alone (other than those from UPAC) without relations to UPAC.

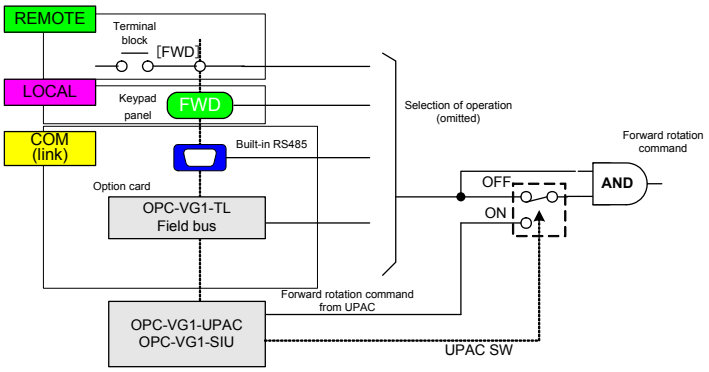
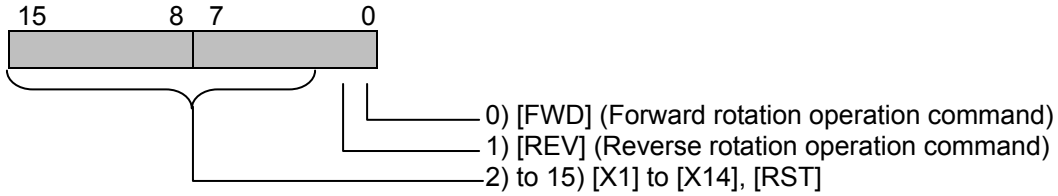


Fig. 3-1-1

The memory for giving forward or reverse rotation command from UPAC is two bits in the lower order of the control data (CW). “0” at the corresponding bit is OFF, while “1” is ON.

Control data (CW): operation command: type [32]



2) Operation from outside (other than UPAC)

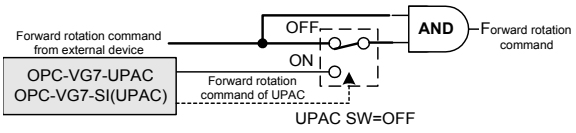
To operate without relations to UPAC according to operation commands from external device

Disable the control data (CW) in the I/O Group setting screen of output definition at System_Definition - I/O group setting of UPAC (Do not select the check box).

This operation makes operation of [FWD], [REV], [X1] through [X14] operation commands and control input commands of UPAC invalid.

In the figure on the right, the link from UPAC concerning the forward rotation command is canceled.

Because this causes word-level control including [FWD], [REV], and [X1] through [X14], there is the following precaution.



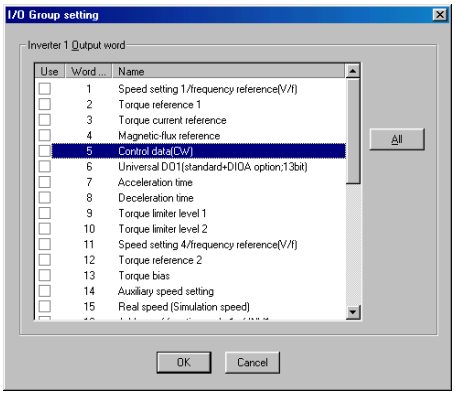


Fig. 3-1-2

Note: To invalidate [FWD] and [REV] operations of UPAC while validating control over [X1] through [X14], enable the control data (CW) (select the check box) and, according to the AND logic condition, OR the content of the corresponding memory with the following data and write the result to the control data (CW).
0000 0000 0000 0011 (binary)

3) Operation from UPAC

To issue operation commands from UPAC

Enable the control data (CW) (select the check box) in the I/O Group setting screen of output definition at System_Definition - I/O group setting of UPAC.

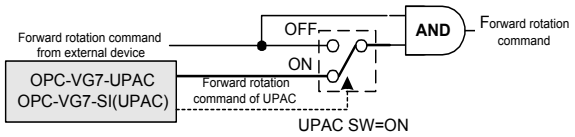
This makes operation of [FWD], [REV], and [X1] through [X14] operation commands and control input commands of UPAC valid.

In the figure on the right, the operation from UPAC concerning the forward rotation command is validated.

Because of operation from UPAC, external commands must be always turned on (short-circuited at terminal block).

If only one terminal is short-circuited at the terminal block when UPAC is stopped with “0” at o38 “UPAC start/stop,” the motor keeps operating. Make sure that both [FWD] and [REV] are short-circuited at the terminal block.

Simultaneous inputs result in output shutdown.



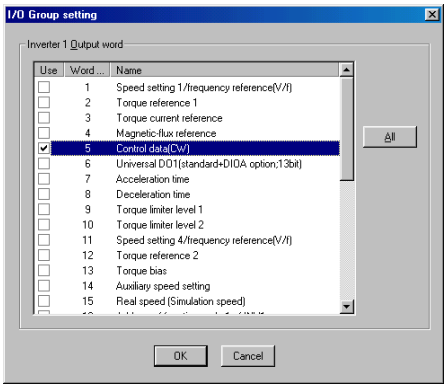


Fig. 3-1-3

3.1.1.2 Setting the speed

⚠CAUTION

- When an operation command is given and the speed is written to speed setting 4 first, the motor does not stop even if the operation command is turned off. Be sure to set the speed setting 4 data at “0” before turning off the operation command.

Otherwise injuries may be caused.

(1) 6-unit system (broadcasting)

Table 3-1-3

Address	No	Name	FS/BS	Type	Direction	Remarks
%QW□.18	1	Speed setting 1/frequency reference (during V/f)	20000/Nmax	INT	UPAC→FRENIC-VG	Before multi-step speed setting
%QW□.28	11	Speed setting 4/frequency reference (during V/f)	20000/Nmax	INT	UPAC→FRENIC-VG	Before ASR input

□: 1 to 6 (INV1 to INV6)

(2) 12-unit system (broadcasting)

Table 3-1-4

Address	No	Name	FS/BS	Type	Direction	Remarks
%QW□.8	1	Speed setting 1/frequency reference (during V/f)	20000/Nmax	INT	UPAC→FRENIC-VG	Before multi-step speed setting
%QW□.16	11	Speed setting 4/frequency reference (during V/f)	20000/Nmax	INT	UPAC→FRENIC-VG	Before ASR input

□: 1 to 12 (INV1 to INV12)

There are two methods for setting the speed: operation of speed setting 1 and operation of speed setting 4. Because speed setting 1 is inserted at the front stage of the control of FRENIC-VG, standard speed control systems of FRENIC-VG including acceleration/deceleration calculator, speed limit, and ASR input filter can be used. Because speed setting 4 is inserted immediately before ASR, it is useful for quick responses where speed outputs of position control are reflected on the FRENIC-VG side.

1) How to use

To reflect the speed setting calculated at UPAC on FRENIC-VG, enable (use) speed setting 1 or speed setting 4 in System_Definition, then download the system definition and reset to change the switches. In the figure below, speed setting 1 is changed.

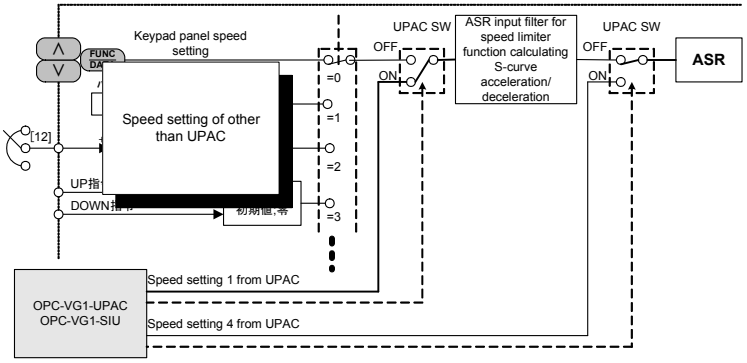


Fig. 3-1-4

Enable (select the check box for) the speed setting 1/frequency reference (during V/f) in the I/O Group setting screen of output definition at System_Definition - I/O group setting of the D300win screen.

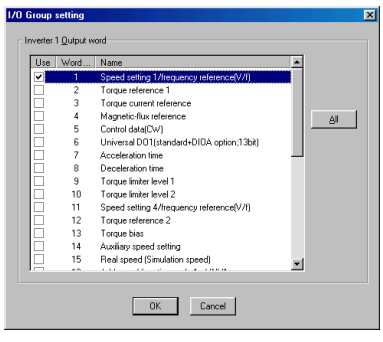


Fig. 3-1-5

The speed setting data is converted into a 20000 scale.

Data × maximum speed/20000

(Example) To write

“3000” for a maximum speed setting of 1500 r/min

3000 × 1500 / 20000 = 225 r/min

[Limitation]

When speed setting 4 is used, the acceleration/deceleration calculator does not function. Therefore function code M14 or acceleration (ACC) and deceleration (DEC) in the “operation state” information of IQ memory SW do not function correctly.

3.1.1.3 Auxiliary speed setting

⚠CAUTION

- The auxiliary speed setting cannot be used when function code F01 or C25 is set at “0,” “3,” “4” or “5.”

The auxiliary speed setting can be given at UPAC.

(1) 6-unit system (broadcasting)

Table 3-1-5

Address	No	Name	FS/BS	Type	Direction	Remarks
%QW□.31	14	Auxiliary speed setting	20000/Nmax	INT	UPAC→FRENIC-VG	

□: 1 to 6 (INV1 to INV6)

1) How to use

To reflect the auxiliary speed setting calculated at UPAC on FRENIC-VG, enable (use) auxiliary speed setting in System_Definition, then download the system definition and reset to change the switches. In the figure below, connection is switched to the auxiliary speed setting.

As shown in the block diagram, the auxiliary speed setting from UPAC is canceled if function code F01 or C25 (validated one) is set at “0,” “3,” “4” or “5.”

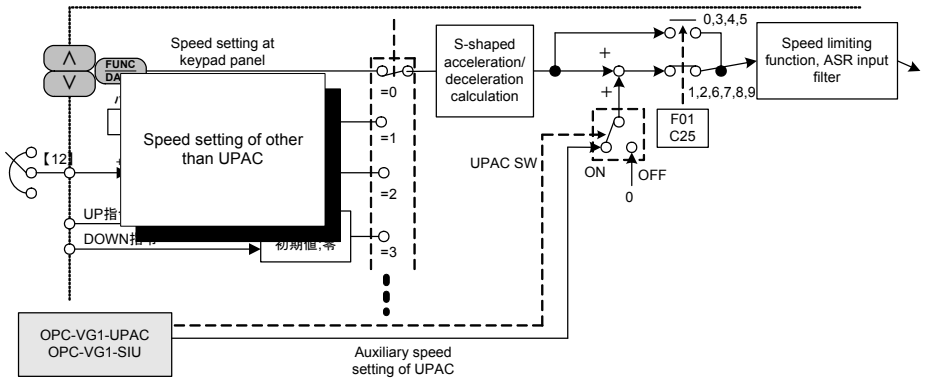


Fig. 3-1-6

Enable (select the check box for) the auxiliary speed setting in the I/O Group setting screen of output definition at System_Definition - I/O group setting of the D300win screen.

The auxiliary speed setting data is converted into a 20000 scale.

Data × maximum speed/20000

(Example) To write

“3000” for a maximum speed setting of 1500 r/min

3000 × 1500 / 20000 = 225 r/min

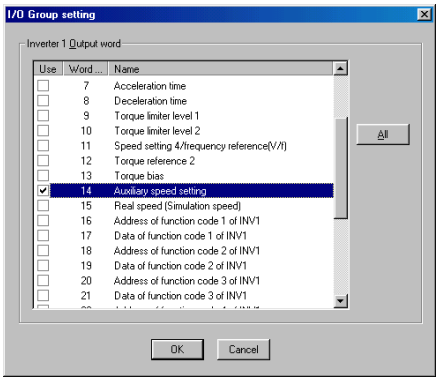


Fig. 3-1-7

3.1.1.4 Torque reference

⚠CAUTION

- After the operation command is turned on and a torque reference is given, the motor does not turn off even if the operation command is turned off. To stop after giving a torque reference, turn the operation command off and turn on coast-to-stop [BX].

Otherwise injuries may be caused.

(1) 6-unit system (broadcasting)

Table 3-1-6

Address	No	Name	FS/BS	Type	Direction	Remarks
%QW□.19	2	Torque reference 1	10000/100%	INT	UPAC→FRENIC-VG	Before torque limit
%QW□.29	12	Torque reference 2	10000/100%	INT	UPAC→FRENIC-VG	After torque limit

□: 1 to 6 (INV1 to INV6)

(2) 12-unit system (broadcasting)

Table 3-1-7

Address	No	Name	FS/BS	Type	Direction	Remarks
%QW□.19	2	Torque reference 1	10000/100%	INT	UPAC→FRENIC-VG	Before torque limit

□: 1 to 12 (INV1 to INV12)

There are two methods for the torque reference: operation of torque reference 1 and operation of torque reference 2 (available only for a 6-unit system). Because torque reference 1 is inserted immediately after the ASR output of the FRENIC-VG control, torque bias and torque limit in the standard torque control systems of FRENIC-VG can be used. Torque reference 2 is inserted immediately before the torque current reference calculation.

1) How to use

To reflect the torque reference calculated at UPAC on FRENIC-VG, enable (use) torque reference 1, torque reference 2 (available only for a 6-unit system) in System_Definition, then download the system definition and reset to change the switches. In the figure below, torque reference 1 is switched.

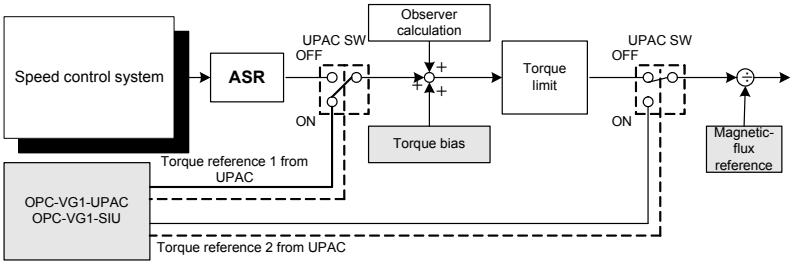


Fig. 3-1-8

Enable (select the check box for) the torque reference 1 in the I/O Group setting screen of output definition at System_Definition - I/O group setting of the D300win screen.

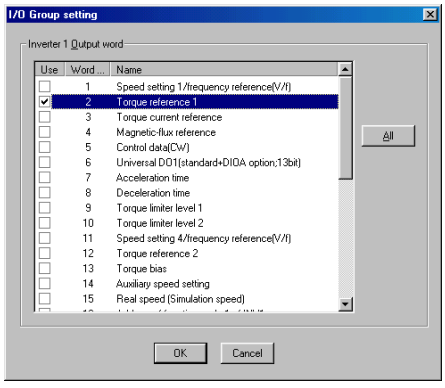


Fig. 3-1-9

The torque reference data is converted, assuming that "10000" is the 100% torque (with the rated torque being 100%).

Data/10000 = Torque %

(Example) To give a 60% torque reference, write "6000."

[Limitation]

Because the acceleration/deceleration calculator does not function when the torque reference is used, function code M14 or acceleration (ACC) and deceleration (DEC) in the SW "operation state" information of the IQ memory do not function correctly.

3.1.1.5 Torque limit

(1) 6-unit system (broadcasting)

Table 3-1-8

Address	No	Name	FS/BS	Type	Direction	Remarks
%QW□.26	9	Torque limiter level 1	10000/100%	INT	UPAC→FRENIC-VG	
%QW□.27	10	Torque limiter level 2	10000/100%	INT	UPAC→FRENIC-VG	

□: 1 to 6 (INV1 to INV6)

(2) 12-unit system (broadcasting)

Table 3-1-9

Address	No	Name	FS/BS	Type	Direction	Remarks
%QW□.14	9	Torque limiter level 1	10000/100%	INT	UPAC→FRENIC-VG	
%QW□.15	10	Torque limiter level 2	10000/100%	INT	UPAC→FRENIC-VG	

□: 1 to 12 (INV1 to INV12)

Operate torque limiter levels 1 and 2 according to the user specification (separation between driving and braking, same level between driving and braking, etc.). Refer to the FRENIC-VG User's Manual for how to use the torque limit.

1) How to use

To reflect the torque limit calculated at UPAC on FRENIC-VG, enable (use) torque limiter level 1, torque limiter level 2 in System_Definition, then download the system definition and reset to change the switches. In the figure below, torque limiter 1 is switched.

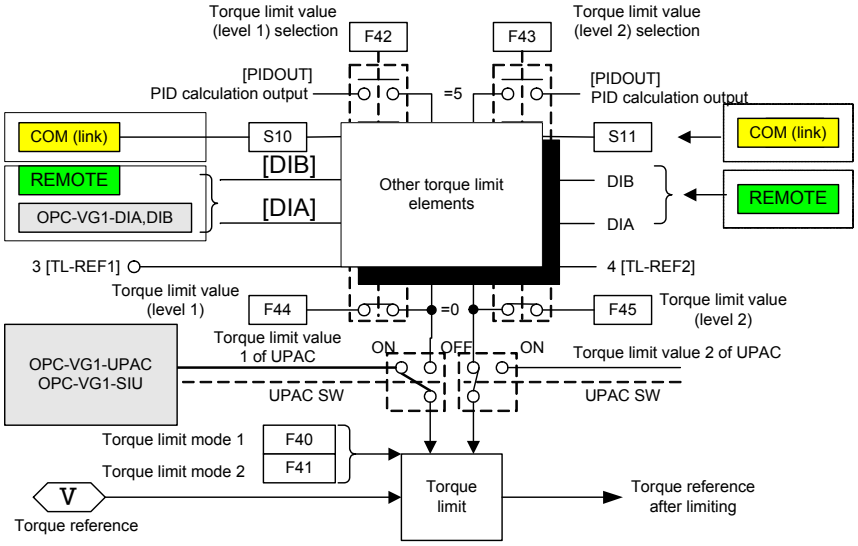


Fig. 3-1-10

Enable (select the check box for) the torque limiter level 1 in the I/O Group setting screen of output definition at System_Definition - I/O group setting of the D300win screen.

The torque limit data is converted, assuming that "10000" is the 100% torque (with the rated torque being 100%).

Data/10000 = Torque %

(Example) To give a 60% torque limit, write "6000."

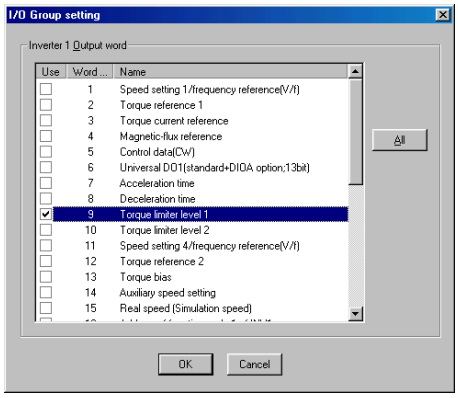


Fig. 3-1-11

3.1.1.6 Torque bias

⚠CAUTION

- After the operation command is turned on and a torque bias command is given, the motor does not turn off even if the operation command is turned off. To stop after giving a torque bias command, turn the operation command off and turn on coast-to-stop [BX].

Otherwise injuries may be caused.

The torque bias can be given at UPAC.

(1) 6-unit system (broadcasting)

Table 3-1-10

Address	No	Name	FS/BS	Type	Direction	Remarks
%QW□.30	13	Torque bias	10000/100%	INT	UPAC→FRENIC-VG	

□: 1 to 6 (INV1 to INV6)

The torque bias command is added immediately after the ASR output of FRENIC-VG control, thus observer function and torque limit in the standard torque control systems of FRENIC-VG can be used.

1) How to use

To reflect the torque bias command calculated at UPAC on FRENIC-VG, enable (use) torque bias in System_Definition, then download the system definition and reset to change the switches. In the figure below, the torque bias command is switched from other torque bias.

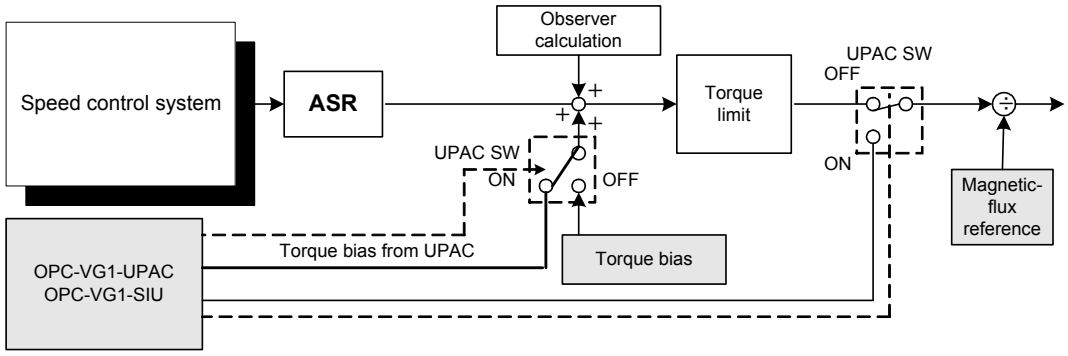


Fig. 3-1-12

Enable (select the check box for) the torque bias in the I/O Group setting screen of output definition at System_Definition - I/O group setting of the D300win screen.

The torque bias data is converted, assuming that “10000” is the 100% torque (with the rated torque being 100%).

Data/10000 = Torque %

(Example) To give a 60% torque bias, write “6000.”

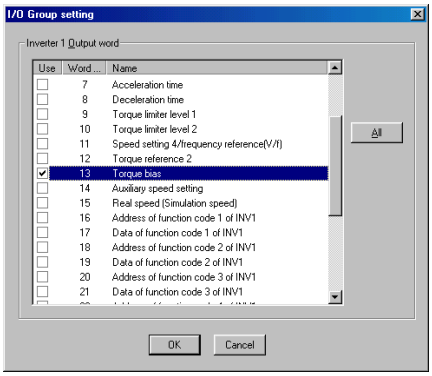


Fig. 3-1-13

3.1.2 Referencing or Updating Function Codes

⚠CAUTION

- There are some write-protected function codes in UPAC.
  Write-protected codes: P02, H01, H02, H03, H68, H71, o35 - o40, S01 - S12
- The data is written from UPAC to RAM (where the data evaporated when the power is turned off).
  Because the data evaporates when the power is turned off, change the default value at the keypad.

There are two methods for the referencing and writing of function codes: referencing and writing at 60 ms refreshment intervals and high-speed (tact cycle) writing. Use the former one for the data to be referred to or changed when the power is turned on, and use the latter for the data changed dynamically in interlock with the control.

3.1.2.1 Referencing and updating at 60 ms refreshment intervals

Use the data for calculation at UPAC based on referenced function code (F, E, C, ..., U) data or for modification of function codes in the power-up sequence.

Refer to the type in the function code list for scale conversion of the data. For example, “data type 5” of function code F44 “Torque limit (level 1)” indicates a signed value with two decimal places. Therefore “1000” indicates 10.00.

The data updated at the keypad of FRENIC-VG or via the communication system (RS485, T-link, etc.) is reflected on UPAC within 60 ms. Similarly, on the other hand, the data changed on the UPAC side is recognized by RENIC-VG within 60 ms.

No setting is required for the system definition to refer to or update function code data. Write in the worksheet of the program to finish the work.

1) How to use

When function code F03 “M1 max. speed” is referred to from UPAC, variables are defined on the worksheet. When a global variable worksheet is opened as shown in the figure below, a list is shown in the ct “f03_f” from the list.

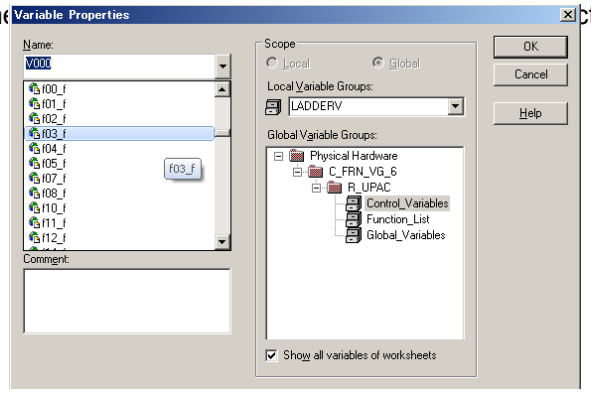


Fig. 3-1-14

Click on OK to open the Automatic Variables Declaration dialog box. In the dialog box, the address and variable definition of function code F03 are “%MW11.3” and “UINT.”

The user can select from the list the address and variable definition of F03 without entering them.

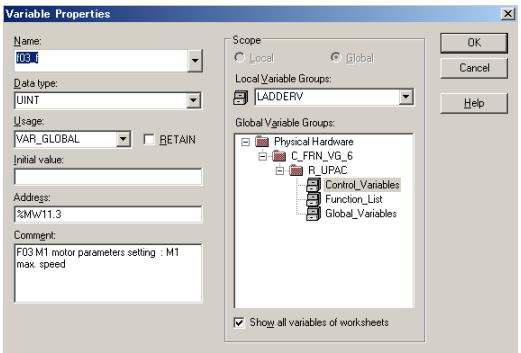


Fig. 3-1-15

3.1.2.2 High-speed data updating

(1) 6-unit system (broadcasting)

Table 3-1-11

Address	No	Name	FS/BS	Type	Direction	Remarks
%QW☐.33	16	Address of function code 1 of INV ☐	Judge from data type of each function code.	WORD	UPAC→FRENIC-VG	
%QW☐.34	17	Data of function code 1 of INV ☐		INT	UPAC→FRENIC-VG	
%QW☐.35	18	Address of function code 2 of INV ☐		WORD	UPAC→FRENIC-VG	
%QW☐.36	19	Data of function code 2 of INV ☐		INT	UPAC→FRENIC-VG	
%QW☐.37	20	Address of function code 3 of INV ☐		WORD	UPAC→FRENIC-VG	
%QW☐.38	21	Data of function code 3 of INV ☐		INT	UPAC→FRENIC-VG	
%QW☐.39	22	Address of function code 4 of INV ☐		WORD	UPAC→FRENIC-VG	
%QW☐.40	23	Data of function code 4 of INV ☐		INT	UPAC→FRENIC-VG	

☐: 1 to 6 (INV1 to INV6)

Use to change a function code (F, E, C, ..., U) dynamically in interlock with the control. If the data is written by UPAC in a tact cycle, the data written from FRENIC-VG via the keypad or communication system (RS485, T-link, etc.) is overwritten by UPAC at the next period.

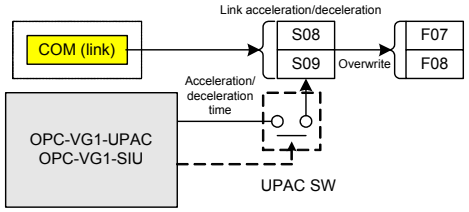


Fig. 3-1-16

Unavailable for 12-unit system.

After enabling torque limiter level 1, torque limiter level 2 in System_Definition, download the system definition and reset to enable the high-speed updating of function code data. Be careful that the usage of high-speed data updating is different from that of 60 ms refreshment.

1) How to use

Description is given here for the case to overwrite function code F61 “ASR1 P gain” from UPAC according to the controlling state as an example.

For example, suppose an application where the gain of speed control changes in a winding system according to the winding diameter (large winding diameter → large inertia → large gain, small winding diameter → small inertia → small gain).

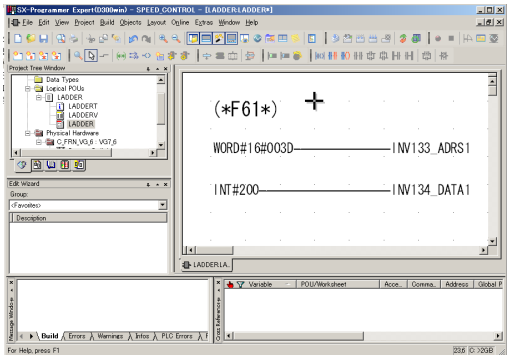
The figure on the right shows an example where “20.0” (data: 200) is written from UPAC to F61 data.

To reflect the change on FRENIC-VG, set the address (3Dh) of function code F61 and data (200d) on the worksheet.

Select the address from the communication address 485NO of the function code list.

To reflect the data, enable (use) Address of function code and Data of function code in System_Definition, download the system definition and reset.

Enable (select the check boxes for) the INV function code address and data in the I/O Group setting screen of output definition at System_Definition - I/O group setting of the D300win screen.



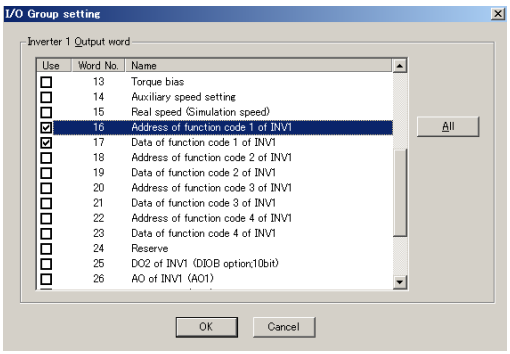


Fig. 3-1-17

3.1.2.3 Using user code

There are the following two methods for using the user code (UNO: function code U).

1) Using the user code as a parameter for writing the control and sequence program from UPAC

   Assign a control parameter to UNO to adjust UNO using the keypad or other standard equipment of FRENIC-VG when you have no PC to be used for maintenance.

2) Placing a PLC for generalization and control outside FRENIC-VG

   Use UNO as a buffer for data exchange between the PLC and UPAC.

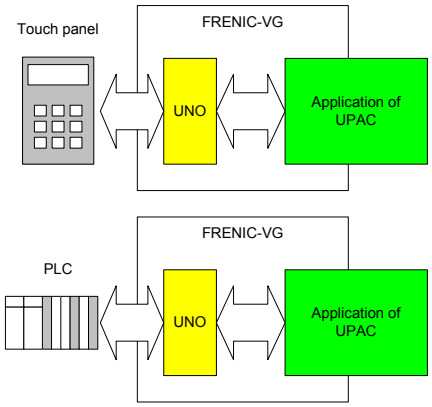


Fig. 3-1-18

The user code is the 64 pieces of word of data (UNO. 01 to 64) shown in the table below.

Table 3-1-12

No.	485NO		Name of parameter		Setting range	Remarks
	485NO	Link NO	Name	Keypad indication		
UNO.01	B01h	DBh	USER P1	USER P1	-32768 to 32767	
UNO.02	B02h	DCh	USER P2	USER P2	-32768 to 32767	
UNO.03	B03h	DDh	USER P3	USER P3	-32768 to 32767	
UNO.04	B04h	DEh	USER P4	USER P4	-32768 to 32767	
UNO.05	B05h	DFh	USER P5	USER P5	-32768 to 32767	
UNO.06	B06h	E0h	USER P6	USER P6	-32768 to 32767	
UNO.07	B07h	E1h	USER P7	USER P7	-32768 to 32767	
UNO.08	B08h	E2h	USER P8	USER P8	-32768 to 32767	
UNO.09	B09h	E3h	USER P9	USER P9	-32768 to 32767	
UNO.10	B0Ah	E4h	USER P10	USER P10	-32768 to 32767	
UNO.11	B0Bh	-	USER P11	USER P11	-32768 to 32767	
to		-				
UNO.60	B3Ch	-	USER P60	USER P60	-32768 to 32767	
UNO.61	B3Dh	-	USER P61	USER P61	-32768 to 32767	
UNO.62	B3Eh	-	USER P62	USER P62	-32768 to 32767	
UNO.63	B3Fh	-	USER P63	USER P63	-32768 to 32767	
UNO.64	B40h	-	USER P64	USER P64	-32768 to 32767	

[Limitations on usage]

- The range of the data and name are fixed as shown above. UPAC cannot control the indication shown at the keypad.
- Only 10 words (UNO. 01 to 10 assigned to link NO) can be changed or referred to from the PLC.
- The UNO data is written to the RAM (evaporative memory) from UPAC. To retain memory even after the power is turned off, there are the following two methods.

  1) Write manually at the keypad.

  2) Select “Retain” (retention form) memory definition on the UPAC side.

  Note: H01 “All save” cannot be accessed from UPAC.

3.1.2.4 Operation of acceleration/deceleration time

(1) 6-unit system (broadcasting)

Table 3-1-13

Address	No	Name	FS/BS	Type	Direction	Remarks
%QW□.24	7	Acceleration time	1/0.1s	INT	FRENIC-VG→UPAC	
%QW□.25	8	Deceleration time	1/0.1s	INT	FRENIC-VG→UPAC	

□: 1 to 6 (INV1 to INV6)

(2) 12-unit system (broadcasting)

Table 3-1-14

Address	No	Name	FS/BS	Type	Direction	Remarks
%QW□.12	7	Acceleration time	1/0.1s	INT	FRENIC-VG→UPAC	
%QW□.13	8	Deceleration time	1/0.1s	INT	FRENIC-VG→UPAC	

□: 1 to 12 (INV1 to INV12)

There are two methods to operate the acceleration time and deceleration time from UPAC: accessing the I/Q memory and writing the function code.

Write the function code (F07, F08, ...) using function code variables (%M).
Access the IQ memory using the above address (%Q). The F07 and F08 data is overwritten as shown in the block diagram on the right. Therefore validate parameter 1 ([RT1], [RT2] = OFF, OFF) when using the IQ memory.
S08 and S09 written by the link system are overwritten with the data of UPAC.

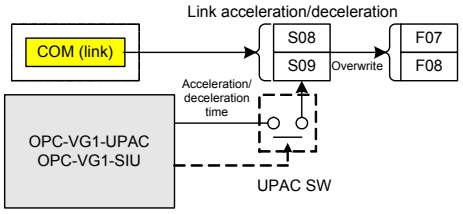


Fig. 3-1-19

3.1.3 Operating Inputs and Outputs

3.1.3.1 Referring to digital inputs

⚠CAUTION

- To use control inputs [X1] to [X9] and [X11] to [X14] (DIOA) only for monitoring from UPAC, set function codes E01 to E13 at “25” to assign each control input to universal DI [U-DI] so that activation and deactivation of the contact do not give effects on the control function of the main body.

(1) 6-unit system (not applicable to broadcasting)

Table 3-1-15

Address	No	Name	FS/BS	Type	Direction	Remarks
%IW□.5	6	Control data (CW) (standard + DIOA, 16-bit)	Type: 32	WORD	FRENIC-VG →UPAC	Define [U-DI] to allow UPAC to use the [DI] terminal for the control input.
%IW□.13	14	DI of INV□ (DIOB option, 16-bit)	Type: 26	WORD	FRENIC-VG →UPAC	Extended I/O exclusively for UPAC

□: 1 to 6 (INV1 to INV6)

(2) 12-unit system (not applicable to broadcasting)

Table 3-1-16

Address	No	Name	FS/BS	Type	Direction	Remarks
%IW□.3	6	Control data (CW) (standard + DIOA, 16-bit)	Type: 32	WORD	FRENIC-VG →UPAC	Define [U-DI] to allow UPAC to use the [DI] terminal for the control input.

□: 1 to 12 (INV1 to INV12)

The digital inputs referred to by UPAC are the standard DI ([X1] to [X9]), DIOA option ([X11] to [X14]) and DIOB option ([X21] to [X36]) (only for 6-unit system).

1) How to use

The control input can refer to terminal information ([X1] to [X9], [X11] to [X14], and [X21] to [X36]) and communication input information ([X1] to [X9], [RST], and [X11] to [X14]).

The communication input information needs the setting of function code H30 “link operation.” For details of the communication input, refer to Chapter 4 of the User’s Manual for the main body.

To refer to the data, enable (use) control data (CW), INV□DI in System_Definition , download the system definition, and reset.

Enable (select the check boxes for) the corresponding data items in the I/O Group setting screen of input definition at System_Definition - I/O group setting of D300win.

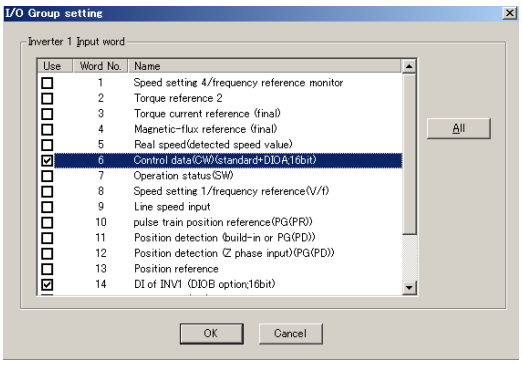


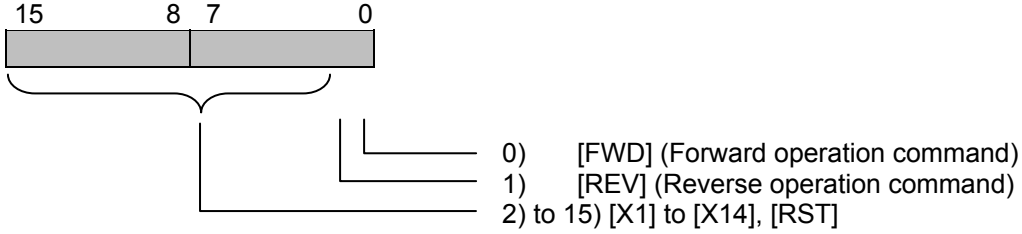
Fig. 3-1-20

Each control input must be assigned to universal DI if referencing only is the purpose when the ON/OFF state of [X1] to [X9] and [X11] to [X14] is referred to from UPAC. For example, [X1] is assigned to [SS0] in the factory shipment setting. When this signal is turned on, multi-step speed 1 becomes valid. To avoid this, set [U-DI] to refer to the state of [X1] without using the multi-step speed function.

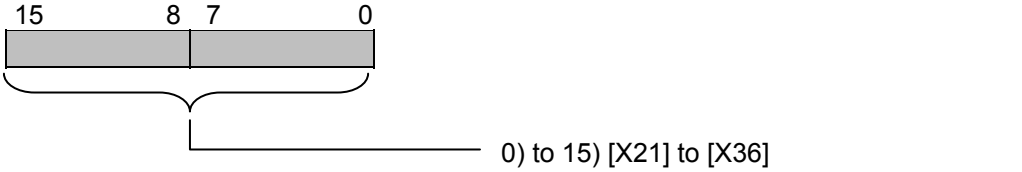
2) Decomposition of word data

The data of the control input is referred to in word information. The data format is as shown below.

(1) Control data (CW): operation command: type [32]



(2) DIOB option: type [26]



After acquiring, develop the word information into bits. An example in the IL language is shown below.

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
(*Acquire the standard DI input data.*)
      LD                INV105_CW
      ST                DI_INPUT
(*Develop to each input state.*)
      LD                DI_INPUT
      SHR_WORD          UINT#2
      WORD_TO_BOOL
      ST                X1_INPUT
      LD                DI_INPUT
      SHR_WORD          UINT#3
      WORD_TO_BOOL
      ST                X2_INPUT
```

	Variable	Data type	Usage	Comment	Address	Init	RETAIN	T...
	⊟ LADDERV							
	INV105_CW	WORD	VAR_EXT...	INV1 Control data(CW)(standard+DIOA;16bit)				
	DI_INPUT	BOOL	VAR					
	X1_INPUT	BOOL	VAR					
	X2_INPUT	BOOL	VAR					

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

An example in the FBD language is shown in the figure on the right.

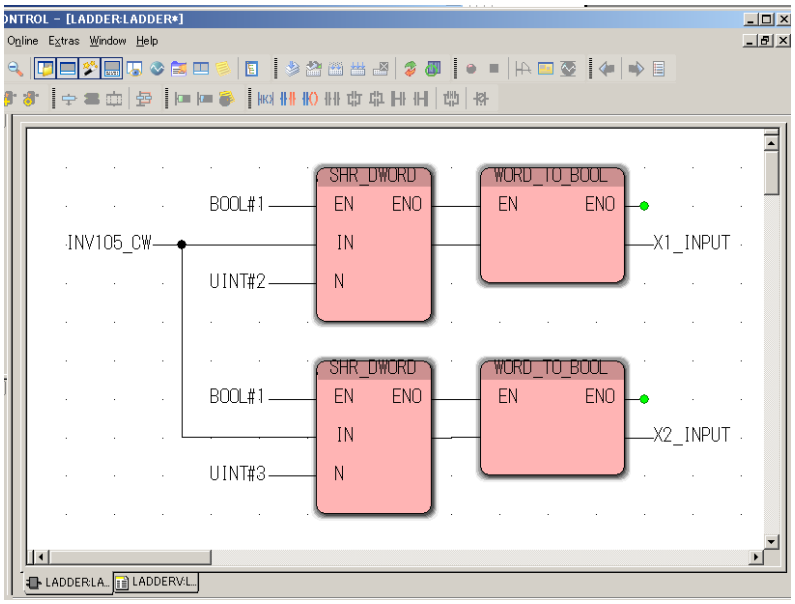


Fig. 3-1-21

3.1.3.2 Referring to analog inputs

⚠CAUTION

- To use analog inputs [Ai1], [Ai2], [Ai3], and [Ai4] (AIO option) only for monitoring from UPAC, set function codes E49 to E52 at "14" to assign each analog input to universal AI [U-AI] so that the analog inputs do not give effects on the control function of the main body.

(1) 6-unit system (not applicable to broadcasting)

Table 3-1-17

Address	No	Name	FS/BS	Type	Direction	Remarks
%IW☐.14	15	Ai of INV☐ (Ai1)	±4000h/±10V	INT	FRENIC-VG→UPAC	Define [U-AI] to allow UPAC to use the [AI] terminal for control inputs.
%IW☐.15	16	Ai of INV☐ (Ai2)	±4000h/±10V	INT	FRENIC-VG→UPAC	
%IW☐.16	17	Ai of INV☐ (AIO option, Ai3)	±4000h/±10V	INT	FRENIC-VG→UPAC	
%IW☐.17	18	Ai of INV☐ (AIO option, Ai4)	±4000h/±10V	INT	FRENIC-VG→UPAC	

☐: 1 to 6 (INV1 to INV6)

(2) 12-unit system (not applicable to broadcasting)

Table 3-1-18

Address	No	Name	FS/BS	Type	Direction	Remarks
%IW☐.6	15	Ai of INV☐ (Ai1)	±4000h/±10V	INT	FRENIC-VG→UPAC	Define [U-AI] to allow UPAC to use the [AI] terminal for control inputs.
%IW☐.7	16	Ai of INV☐ (Ai2)	±4000h/±10V	INT	FRENIC-VG→UPAC	

☐: 1 to 12 (INV1 to INV12)

The analog inputs referred to by UPAC are the standard AI ([Ai1] and [Ai2]) and AIO option ([Ai3] and [Ai4]) (only for 6-unit system).

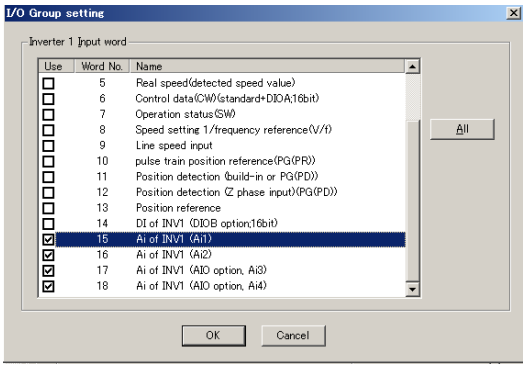
1) How to use

To refer to the data, enable (use) Ai of INV☐ in System_Definition , download the system definition, and reset.

Enable (select the check boxes for) the corresponding data items in the I/O Group setting screen of input definition at System_Definition - I/O group setting of D300win.

Each input must be assigned to universal AI [U-AI] when the state of [Ai1], [Ai2], [Ai3] and [Ai4] is referred to from UPAC.

Each analog input is assigned to [OFF] (input shutoff signal) in the factory shipment setting.



A ±10V analog input is converted into a ±4000h (±16384d) digital value and read into UPAC.

The standard function includes the gain, bias, filter, increment/decrement limiter, polarity inversion, and zero hold. For details, refer to Chapter 4 of the User's Manual for the main body.

The state of analog inputs can be checked using the I/O check at the keypad. If "15555" (type: INT) is displayed when an AI_DATA variable is monitored as shown in the figure on the right, the actual input is 9.49V (10V x 15555/16384) when the gain is "1" and the bias is "0.

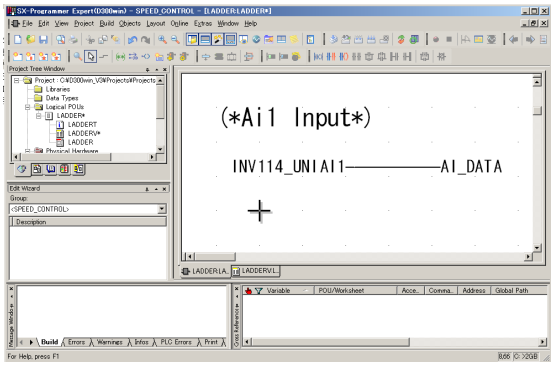


Fig. 3-1-22

3.1.3.3 Operation of digital output

⚠CAUTION

- To operate control outputs [Y1] to [Y5A] and [Y11] to [Y18] (DIOA) from UPAC, set function codes E15 to E27 at “25” to assign each output to the universal DO [U-DO] so that the control state of FRENIC-VG (running, speed agreement, etc.) do not give effects on the output signals.

(1) 6-unit system (broadcasting)

Table 3-1-19

Address	No	Name	FS/BS	Type	Direction	Remarks
%QW□.23	6	DO1 of INV□ (standard + DIOA 13-bit)	Type: 33	WORD	UPAC→FR ENIC-VG	Define [U-DO].
%QW□.42	25	DO2 of INV□ (DIOB option, 10-bit)	Type: 37	WORD	UPAC→FR ENIC-VG	Extended I/O exclusively for UPAC

□: 1 to 6 (INV1 to INV6)

(2) 12-unit system (broadcasting)

Table 3-1-20

Address	No	Name	FS/BS	Type	Direction	Remarks
%QW□.11	6	DO1 of INV□ (standard + DIOA 13-bit)	Type: 33	WORD	UPAC→FR ENIC-VG	Define [U-DO].

□: 1 to 12 (INV1 to INV12)

The digital outputs that can be controlled by UPAC are the standard DO ([Y1] to [Y5A]), DIOA option ([Y11] to [Y18]), and DIOB option ([Y21] to [Y30]) (only for 6-unit system).

1) How to use

To manipulate the data, enable (use) DO1 of INV□, DO2 of INV□ in System_Definition
, download the system definition, and reset.
Enable (select the check box for) the corresponding data item in the I/O Group setting screen of output definition at System_Definition - I/O group setting of D300win.
To operate [Y1] to [Y5A] and [Y11] to [Y18] from UPAC, assign each control output to the universal DO so that the control state of the main body of FRENIC-VG is not reflected on the output (running, speed agreement, etc.).

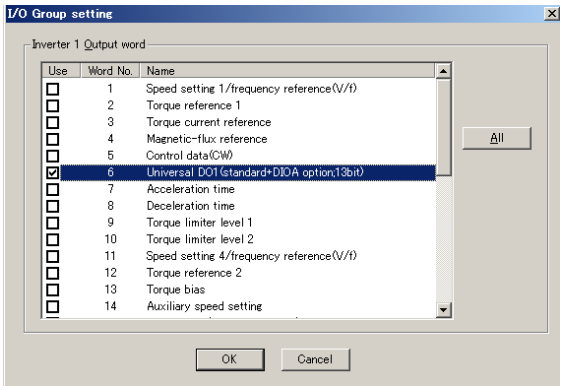


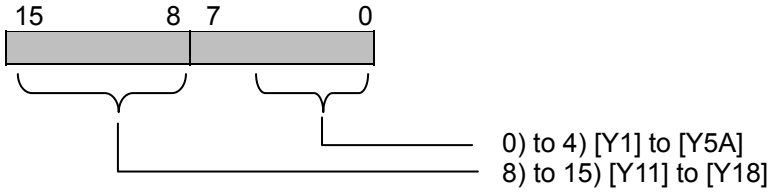
Fig. 3-1-23

For example, [Y1] is assigned to speed existence [N-EX] in the factory shipment value. When the motor rotates actually, [Y1] is turned on or off according to the speed. To operate [Y1] from UPAC only, assign the [U-DO] function to stop reflection of the state inside the control.

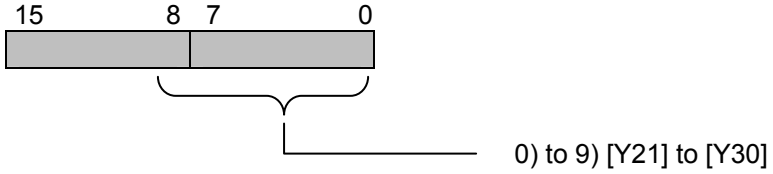
2) Composition into word data

The control output data is composed in a word data before it is reflected. The data format is as shown below.

(1) DO1 of INV☐ (standard + DIOA; 13-bit): type [33]



(2) DO2 of INV☐ (DIOB option; 10-bit): type [27]



Compose the bits into word data before reflecting. An example of composition in the IL language is shown below.

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
(*Acquire output information.*)
    LD              Y1_OUTPUT
    BOOL_TO_WORD
    SHL_WORD        UINT#0
    ST              DO_OUTPUT

    LD              Y2_OUTPUT
    BOOL_TO_WORD
    SHL_WORD        UINT#1
    OR              DO_OUTPUT
    ST              INV123_UNIDO1
```

	Variable	Data type	Usage	Comment	Address	Init	RETAIN	T...
	⊟ LADDER¥							
	INV123_UNIDO1	WORD	VAR_EXT...	INV1 DO1 of INV1(standard+DIOA;13bit)				
	DO_OUTPUT	WORD	VAR					
	Y1_OUTPUT	BOOL	VAR					
	Y2_OUTPUT	BOOL	VAR					

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

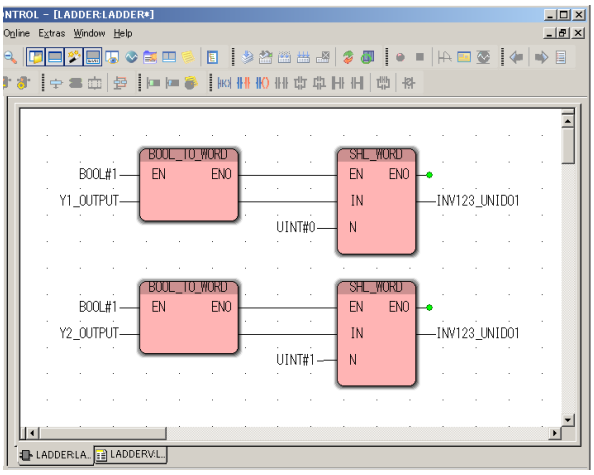


Fig. 3-1-24

3.1.3.4 Operation of analog output

⚠CAUTION

- To control analog outputs [A01] to [A03], [A04] and [A05] (AIO option) from UPAC, set function codes E69 to E73 at “30” to assign the analog outputs to the universal AO [U-AO] so that the control function of the main body does not give effects.

(1) 6-unit system (broadcasting)

Table 3-1-21

Address	No	Name	FS/BS	Type	Direction	Remarks
%QW☐.43	26	AO of INV☐ (AO1)	±4000h/±10V	INT	UPAC→FRENIC-VG	Define [U-AO] to allow UPAC to control the [AO] terminal.
%QW☐.44	27	AO of INV☐ (AO2)	±4000h/±10V	INT	UPAC→FRENIC-VG	
%QW☐.45	28	AO of INV☐ (AO3)	±4000h/±10V	INT	UPAC→FRENIC-VG	
%QW☐.46	29	AO of INV☐ (AIO option, AO4)	±4000h/±10V	INT	UPAC→FRENIC-VG	
%QW☐.47	30	AO of INV☐ (AIO option, AO5)	±4000h/±10V	INT	UPAC→FRENIC-VG	

☐: 1 to 6 (INV1 to INV6)

(2) 12-unit system (broadcasting)

Table 3-1-22

Address	No	Name	FS/BS	Type	Direction	Remarks
%QW☐.17	26	AO of INV☐ (AO1)	±4000h/±10V	INT	UPAC→FRENIC-VG	Define [U-AO] to allow UPAC to control the [AO] terminal.
%QW☐.18	27	AO of INV☐ (AO2)	±4000h/±10V	INT	UPAC→FRENIC-VG	
%QW☐.19	28	AO of INV☐ (AO3)	±4000h/±10V	INT	UPAC→FRENIC-VG	

☐: 1 to 12 (INV1 to INV12)

The analog outputs controlled by UPAC are the standard AO ([AO1], [AO2] and [AO3]) and AIO option ([AO4] and [AO5]) (only for 6-unit system).

1) How to use

To refer to the data, enable (use) AO of INV☐ in System_Definition , download the system definition, and reset.

Enable (select the check box for) the corresponding data item in the I/O Group setting screen of output definition at System_Definition - I/O group setting of D300win.

To operate the state of [AO1], [AO2], [AO3], [AO4] and [AO5] from UPAC, assign each output to the universal AO [U-AO].

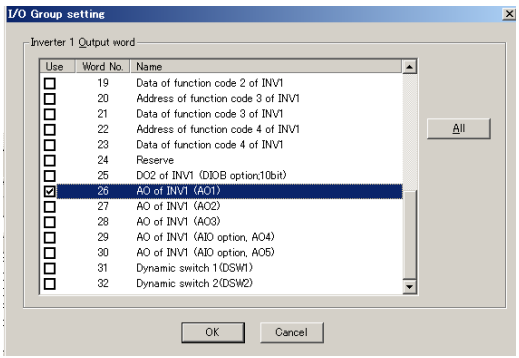
Each analog output is assigned to various purposes such as the torque current command in the factory shipment. To shut off these functions, assignment of [U-AO] is necessary.

A ±4000h (±16384d) digital amount is calculated and converted by UPAC into a ±10V analog output.

The gain, bias and filter functions can be used as standard features. Refer to Chapter 4 for details.

Use the I/O check at the keypad to monitor the analog output.

If “15555” (type: INT) is displayed when an AO_DATA variable is monitored as shown in the figure on the right, the actual output is 9.49V (10V x 15555/16384) when the gain is “1” and the bias is “0.”



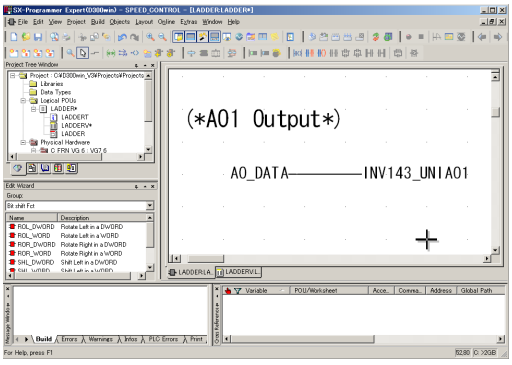


Fig. 3-1-25

3.1.4 Monitoring Data

UPAC can refer to the speed, torque data, and operation state (running, accelerating, etc.). There are two sampling methods: high-speed sampling using the IQ area, and 60 ms sampling using the M code area. The IQ area method allows you to refer to all the data of FRENIC-VG connected via the optical link. Using the M code area, you can refer to the data of only the FRENIC-VG (INV1) equipped with UPAC.

3.1.4.1 Speed command monitor (high speed)

(1) 6-unit system (not applicable to broadcasting)

Table 3-1-23

Address	No	Name	FS/BS	Type	Direction	Remarks
%IW□.0	1	Speed setting 4/frequency reference monitor	20000/Nmax	INT	FRENIC-VG →UPAC	Before ASR input
%IW□.7	8	Speed setting 1/frequency reference (during V/f)	20000/Nmax	INT	FRENIC-VG →UPAC	Before multi-step speed setting

□: 1 to 6 (INV1 to INV6)

(2) 12-unit system (not applicable to broadcasting)

Table 3-1-24

Address	No	Name	FS/BS	Type	Direction	Remarks
%IW□.0	1	Speed setting 4/frequency reference monitor	20000/Nmax	INT	FRENIC-VG→ UPAC	Before ASR input

□: 1 to 12 (INV1 to INV12)

The speed command monitor refers to the data of speed setting 1 (only for the 6-unit system) before multi-step speed calculation of FRENIC-VG control, and speed setting 4 refers to the data immediately before ASR input.

1) How to use

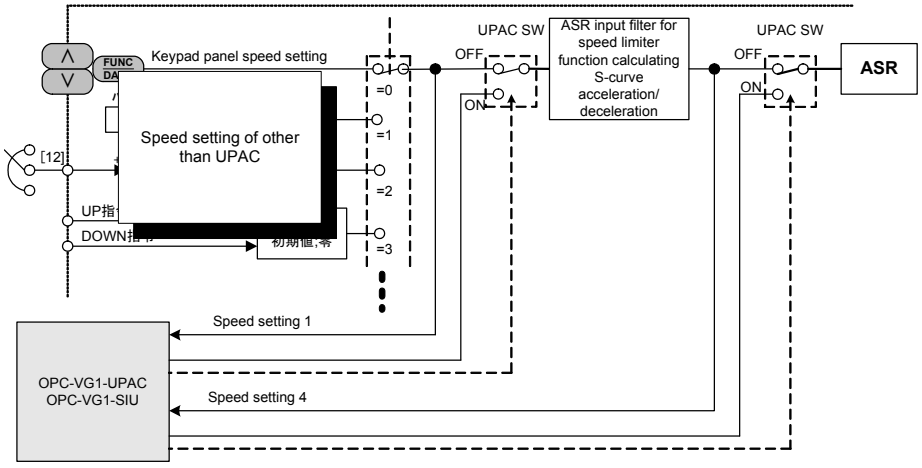


Fig. 3-1-26

Enable (select the check boxes for) Speed setting 4/frequency reference monitor, Speed setting 1/frequency reference (V/f) in the I/O Group setting screen of input definition at System_Definition - I/O group setting of D300win. Next, download the system definition, and reset.

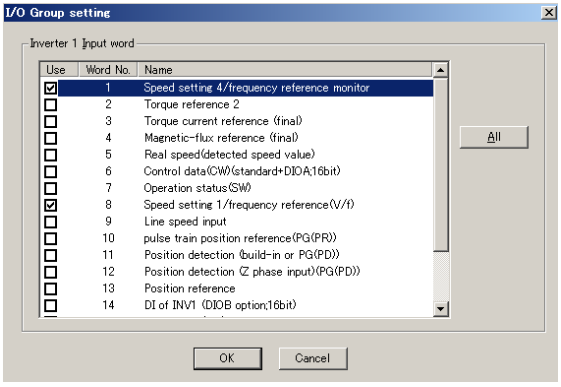


Fig. 3-1-27

The speed setting data is converted into the scale where “20000” indicates the maximum speed.

Data × maximum speed/20000

(Example) If “3000” is obtained when data is referred in a system where the maximum speed is set at 1500 r/min.
3000 × 1500 / 20000 = 225 r/min

3.1.4.2 Speed monitor (high speed)

(1) 6-unit system (not applicable to broadcasting)

Table 3-1-25

Address	No	Name	FS/BS	Type	Direction	Remarks
%IW□.4	5	Real speed	20000/Nmax	INT	FRENIC-VG →UPAC	Before filter

□: 1 to 6 (INV1 to INV6)

(2) 12-unit system (not applicable to broadcasting)

Table 3-1-26

Address	No	Name	FS/BS	Type	Direction	Remarks
%IW□.2	5	Real speed	20000/Nmax	INT	FRENIC-VG →UPAC	Before filter

□: 1 to 12 (INV1 to INV12)

In speed monitoring, the speed data (real speed) detected by the encoder, before filtering, is referred to. The value functions as an estimated speed for operation without sensors.

1) How to use

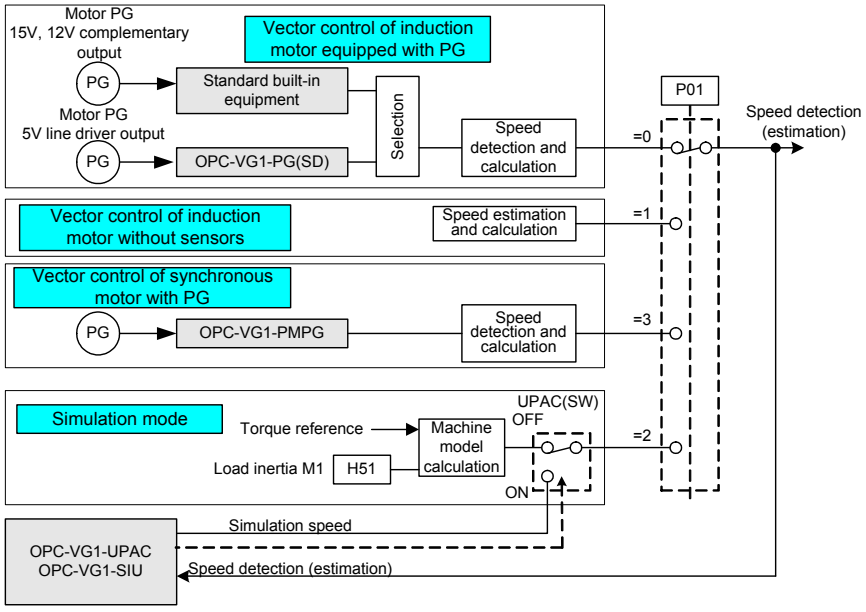


Fig. 3-1-28

Enable (select the check box for) the real speed (detected speed value) in the I/O Group setting screen of input definition at System_Definition - I/O group setting of D300win. Next, download the system definition and reset.

The speed setting data is converted into the scale where “20000” indicates the maximum speed.

Data × max. speed/20000

(Example) If “3000” is obtained in a system where the maximum speed setting is 1500 r/min

3000 × 1500 / 20000 = 225 r/min

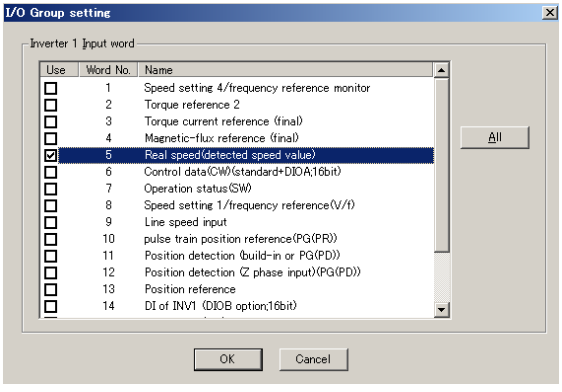


Fig. 3-1-29

3.1.4.3 Torque monitor (high speed)

(1) 6-unit system (not applicable to broadcasting)

Table 3-1-27

Address	No	Name	FS/BS	Type	Direction	Remarks
%IW□.1	2	Torque reference 2	10000/100%	INT	FRENIC-VG →UPAC	After torque limit
%IW□.2	3	Torque current reference	10000/100%	INT	FRENIC-VG →UPAC	

□: 1 to 6 (INV1 to INV6)

(2) 12-unit system (not applicable to broadcasting)

Table 3-1-28

Address	No	Name	FS/BS	Type	Direction	Remarks
%IW□.1	2	Torque reference 2	10000/100%	INT	FRENIC-VG →UPAC	After torque limit

□: 1 to 12 (INV1 to INV12)

There are two methods for torque monitoring: torque reference 2 after torque limit, and torque current reference (only for 6-unit system) where torque reference 2 is divided by the magnetic-flux reference.

1) How to use

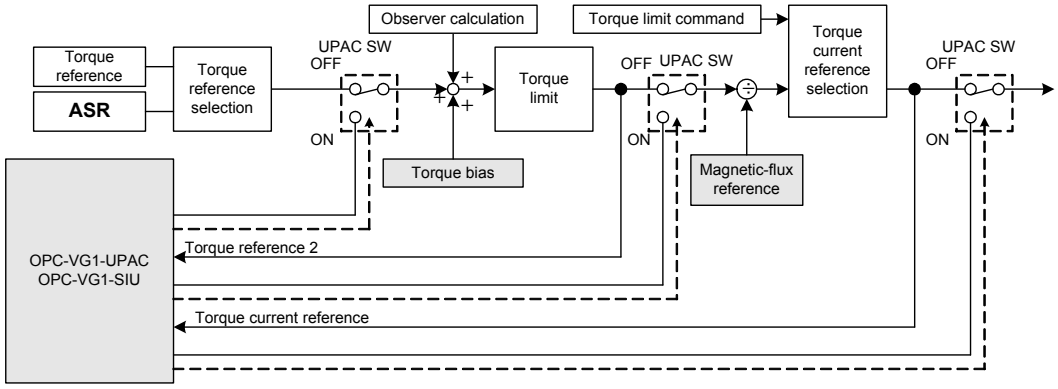


Fig. 3-1-30

Enable (select the check box for) either torque reference 2 or torque current reference or both of them in the I/O Group setting screen of input definition at System_Definition - I/O group setting of D300win. Next, download the system definition and reset.

The torque reference 2 data and torque current reference data are converted into a value where “10000” indicates the 100% torque (with the rated torque being 100%).

Data/10000 = Torque %

(Example) If “6000” is read, “60%” is judged.

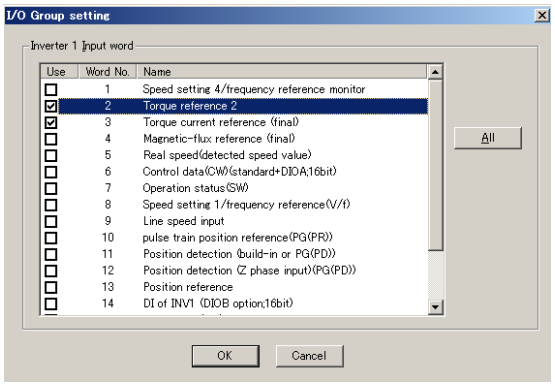


Fig. 3-1-31

3.1.4.4 Status monitor (high speed)

(1) 6-unit system (not applicable to broadcasting)

Table 3-1-29

Address	No	Name	FS/BS	Type	Direction	Remarks
%IW□.5	6	Control data (CW) (standard + DIOA, 16-bit)	Type: 32	WORD	FRENIC-VG→UPAC	
%IW□.6	7	Operation status (SW)	Type: 21	WORD	FRENIC-VG→UPAC	

□: 1 to 6 (INV1 to INV6)

(2) 12-unit system (not applicable to broadcasting)

Table 3-1-30

Address	No	Name	FS/BS	Type	Direction	Remarks
%IW□.3	6	Control data (CW) (standard + DIOA, 16-bit)	Type: 32	WORD	FRENIC-VG→UPAC	
%IW□.4	7	Operation status (SW)	Type: 21	WORD	FRENIC-VG→UPAC	

□: 1 to 12 (INV1 to INV12)

The high-speed status monitor consists of control data ([FWD], [REV], [X1] to [X9], and [X11] to [X14]) and operation status.

1) How to use

To refer to the data, enable (use) Control data (CW) and Operation status (SW) in the I/O Group setting screen of input definition at System_Definition - I/O group setting of D300win, download the system definition and reset.

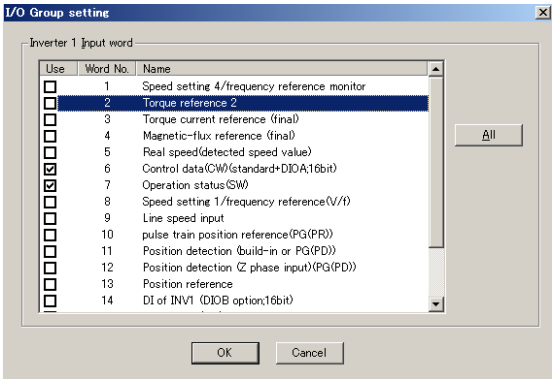
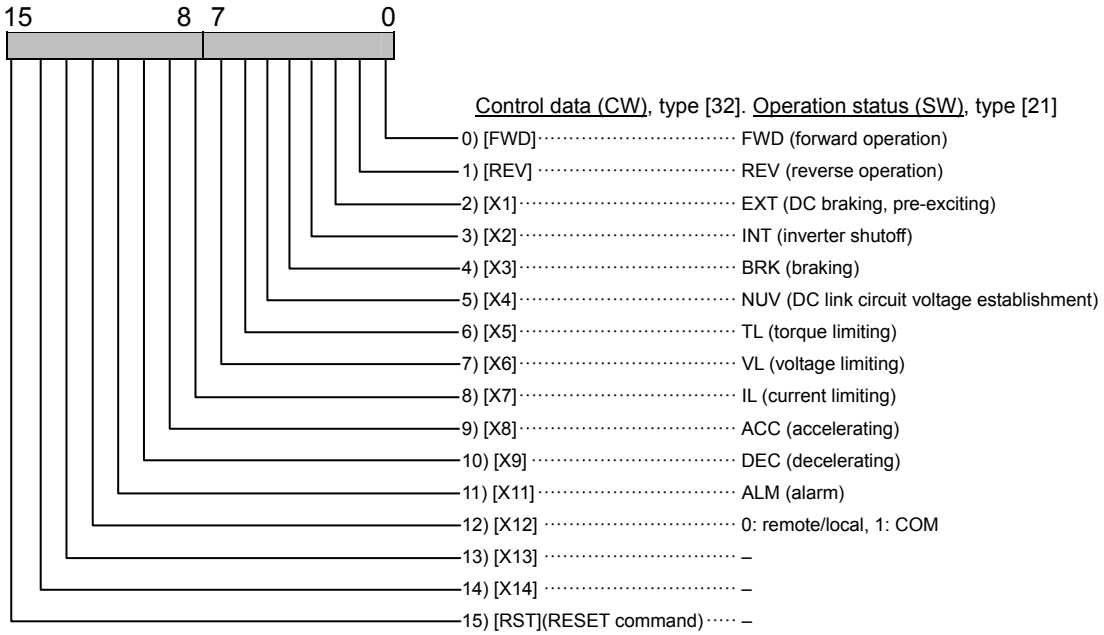


Fig. 3-1-32

The control input and operation status data are referred to in word information. The data format is as shown below.

Control data (CW), operation status



3.1.4.5 Status monitor (60 ms sampling)

The M area of the function code can be monitored at a refresh rate of 60 ms.

The figure on the right shows a program referring to the motor output and cumulative operation hours in the M code area.

The M code can be selected from the function list of the global variables similarly to other function codes.

For details of the data, refer to the function code list.

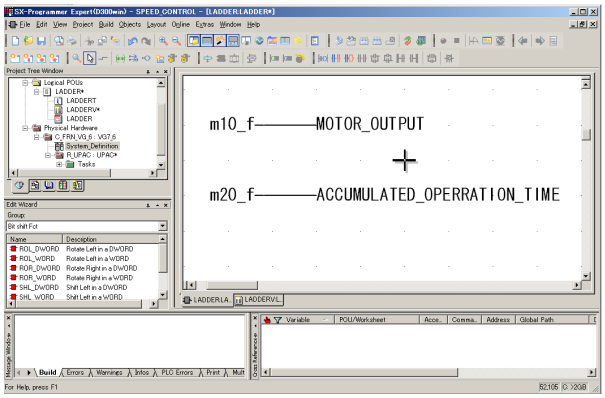


Fig. 3-1-33

Table 3-1-31 Monitor code list

(Refer to the function code list for details.)

Fcode	60 ms updating/referencing data			High-speed updating address	Name	Data range	Type	Written by UPAC
	Variable name	Type	Address					
M01	m01_f	INT	%MW11.611	Impossible	Speed setting 4 (ASR input)	-24000 to 24000	31	Impossible
M02	m02_f	UINT	%MW11.612	Impossible	Torque reference	0.01%/1d	7	Impossible
M03	m03_f	UINT	%MW11.613	Impossible	Torque current reference	0.01%/1d	7	Impossible
M04	m04_f	UINT	%MW11.614	Impossible	Magnetic flux reference	0.01%/1d	7	Impossible
M05	m05_f	UINT	%MW11.615	Impossible	Output frequency reference	0.1Hz/1d	2	Impossible
M06	m06_f	INT	%MW11.616	Impossible	Speed detection value	-24000 to 24000	31	Impossible
M07	m07_f	UINT	%MW11.617	Impossible	Calculated torque value	0.01%/1d	7	Impossible
M08	m08_f	UINT	%MW11.618	Impossible	Calculated torque current	0.01%/1d	7	Impossible
M09	m09_f	UINT	%MW11.619	Impossible	Output frequency	0.1Hz/1d	2	Impossible
M10	m10_f	UINT	%MW11.620	Impossible	Motor output	0.1kW/1d	2	Impossible
M11	m11_f	UINT	%MW11.621	Impossible	Effective output current	0.1A/1d	2	Impossible
to								
M56	m56_f	WORD	%MW11.666	Impossible	Option monitor 2	0000 to FFFF	9	Impossible
M57	m57_f	UINT	%MW11.667	Impossible	Option monitor 3	0 to 65535	0	Impossible
M58	m58_f	UINT	%MW11.668	Impossible	Option monitor 4	0 to 65535	0	Impossible
M59	m59_f	INT	%MW11.669	Impossible	Option monitor 5	-32768 to 32767	5	Impossible
M60	m60_f	INT	%MW11.670	Impossible	Option monitor 6	-32768 to 32767	5	Impossible

3.1.4.6 Displaying data at keypad

The data of UPAC can be displayed at the 7-segment LED (red 4-digit LED display) at real time using six points (option monitor 1 to 6).

Write the UPAC data you wish to display into op1 to op6 under Function_List of global variables.

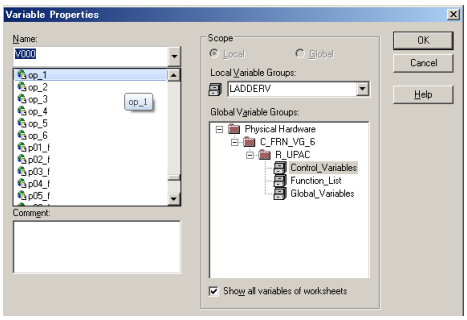


Fig. 3-1-34

As shown in the figure on the right, connect the speed data (user variable) with option monitor 5 on the worksheet to display the data. Select one of the option monitors 1 to 6 according to the data type.

For example, to display a signed decimal (DEC) for the speed data, select option monitor 5 or 6.

To display the status using bits, select option monitor 1 or 2 for a hexadecimal (HEX).

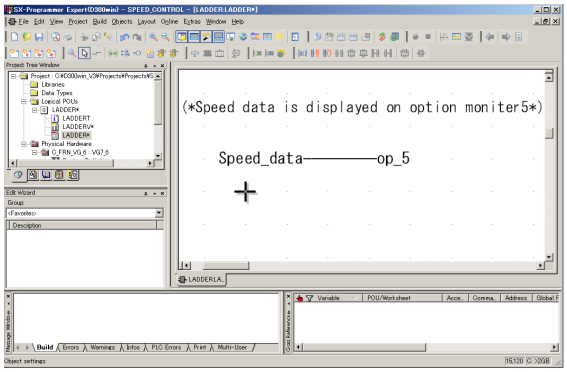


Fig. 3-1-35

⚠CAUTION

UPAC data cannot be displayed on option monitors 1 to 4 and 6 depending on the function setting of the main body. Refer to the following table for details.

Table 3-1-32 Displaying data type of monitor

Monitor	Display	Data range	Usage constraints (when the function below is enabled, UPAC data cannot be displayed)
Option monitor 1	HEX	0000 to FFFF	When the synchronized operation command (with [SYC] assigned to the X terminal) is enabled
Option monitor 2	HEX	0000 to FFFF	When the synchronized operation command (with [SYC] assigned to the X terminal) is enabled
Option monitor 3	DEC	0 to 65535	• Controlling a synchronous motor • When the fixed S-curve pattern setting L04 is 1 or 2
Option monitor 4	DEC	0 to 65535	When the fixed S-curve pattern setting L04 is 1 or 2
Option monitor 5	DEC	-32768 to 32767	No constraints
Option monitor 6	DEC	-32768 to 32767	When the load adaptive control function is enabled (H60 is set between 1 and 3)

3.1.5 Using Pulse Data

Table 3-1-33

Address	No	Name	FS/BS	Type	Direction	Remarks
%IW□.9	10	Pulse train position reference (PG (PR))	-32768 to 32767 /1 pulse	INT	FRENIC-VG →UPAC	
%IW□.10	11	Position detection (built-in or PG (PD))	-32768 to 32767 /1 pulse	INT	FRENIC-VG →UPAC	
%IW□.11	12	Position detection (Z-phase input) (PG (PD))	-32768 to 32767 /1 pulse	INT	FRENIC-VG →UPAC	
%IW□.12	13	S05: Position reference	-32768 to 32767 /1 pulse	INT	FRENIC-VG →UPAC	

□: 1 to 6 (INV1 to INV6)

3.1.5.1 Acquiring pulses

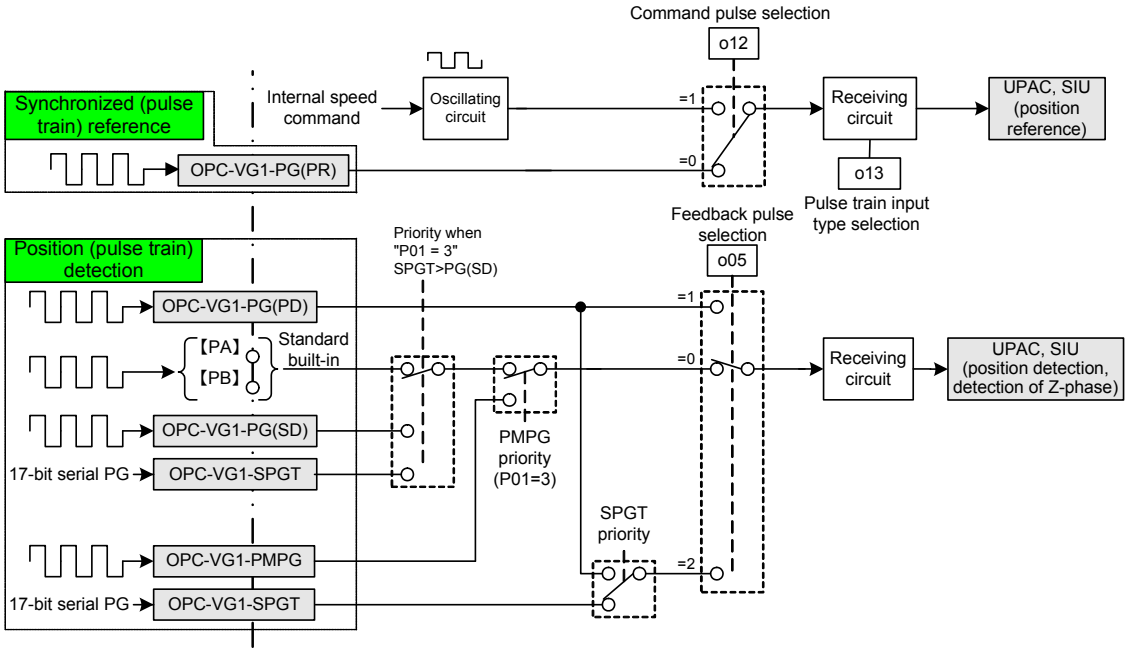


Fig. 3-1-36

Enable (use) pulse train position reference (PG (PR)) in the I/O Group setting screen of input definition at System_Definition - I/O group setting of D300win, download the system definition and reset.

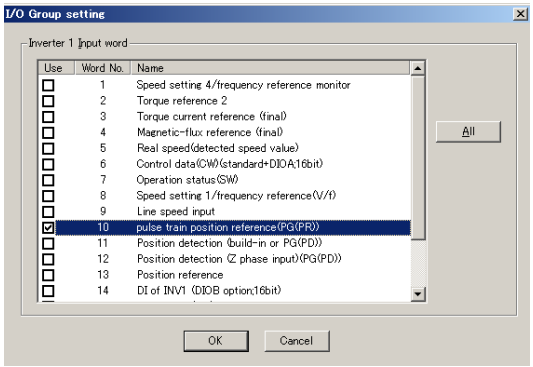


Fig. 3-1-37

3.1.5.2 Data acquisition method

1) For forward rotation of PG encoder

The PG pulse data increases during B-phase rotation (forward rotation). The difference between the sampling data of the previous and current cycles sampled at a t (ms) interval is added at every t (ms) time to obtain the pulse count.

Because the pulse count is obtained from four times the encoder input value, 4 multiplied by the number of encoder pulses divided by 1 revolution is the pulse count per encoder revolution.

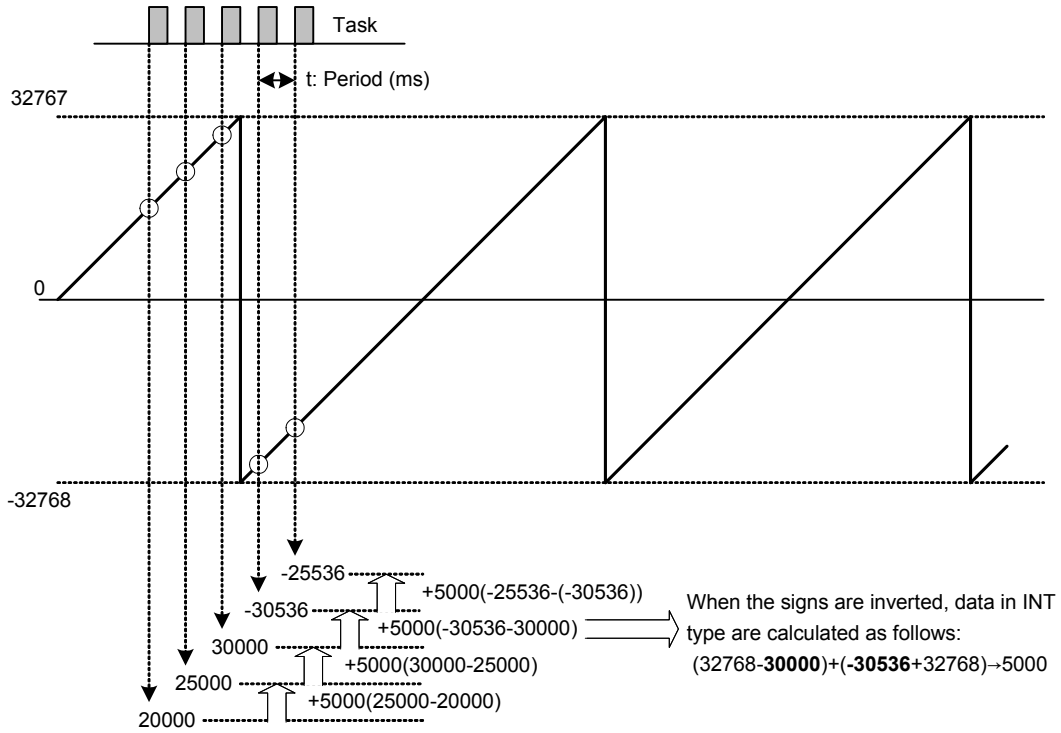


Fig. 3-1-38

Example of program for acquiring cumulative PG pulse count (PG_CNT) in IL language

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
        LD          INIT_FLAG
        JMPC        PULSE_GET
        LD          INV110_POSDET   (*Store the data built in the PG immediately after power is turned on.*)
        ST          PG_DATA
        LD          BOOL#1
        ST          INIT_FLAG
        JMP         MAIN_END
                                    (**This routine is repeated in the second and the following cycles after
PULSE_GET:                          the power is turned on.)
        LD          INV110_POSDET   (*Store the current value of data built-in the PG.*)
                                    (*Store the difference between the previous and current values of the
        SUB         PG_DATA         data built in the PG.*)
        INT_TO_DI
        NT                          (*Extend to 32 bits.*)
        ADD         PG_CNT          (*Add the difference data.*)
        ST          PG_CNT          (32-bit pulse count value)
        LD          INV110_POSDET   (*Store the previous value of the data built in the PG.*)
        ST          PG_DATA
MAIN_END:
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

[Concrete example with values]

Suppose that the motor equipped with a 1024 P/R encoder rotates once at 60 r/min. Then, each piece of memory data is counted as follows.

PG_CNT=00000000→00004096(32bit)

PG_DATA = 0004 or 0005 (during rotation), or 0000 when stopped

[Speed calculation example]

When the difference data (PG_DATA) sampled at 100 ms intervals is +5000 pulses, the speed of the rotor (motor, mechanical shaft, or line) to which the PG (1024 P/R) is connected, is calculated to be 732 r/min in the following equation.

$$\text{Speed of rotor (r/min)} = +5000(p) \times \frac{1}{4 \times 1024}(r/p) \times \frac{1000(ms/s)}{100(ms)}(1/s) \times 60(s/\text{min})$$
$$= 732.4(r/\text{min})$$

[Example of calculation of winding diameter]

Suppose to acquire data from the PG installed to the winding shaft. When the line speed is 100 m/min and the difference data (PG_DATA) sampled at 100 ms intervals is +5000 pulses, the winding diameter of the winding shaft to which the PG (1024 P/R) is connected, is calculated to be 21.7 mm in the following equation.

$$\text{Winding diameter (m)} = 100(m/\text{min}) \times \frac{1}{2\pi \times 732.4}(\text{min})$$
$$= 0.0217(m)$$

2) For reverse rotation of PG encoder

The PG pulse data decreases during A-phase rotation (reverse rotation). The difference between the sampling data of the previous and current cycles sampled at a t (ms) interval is added at every t (ms) time to obtain the pulse count. Because the pulse count is obtained from four times the encoder value, 4 multiplied by the number of encoder pulses divided by 1 revolution is the pulse count per encoder revolution.

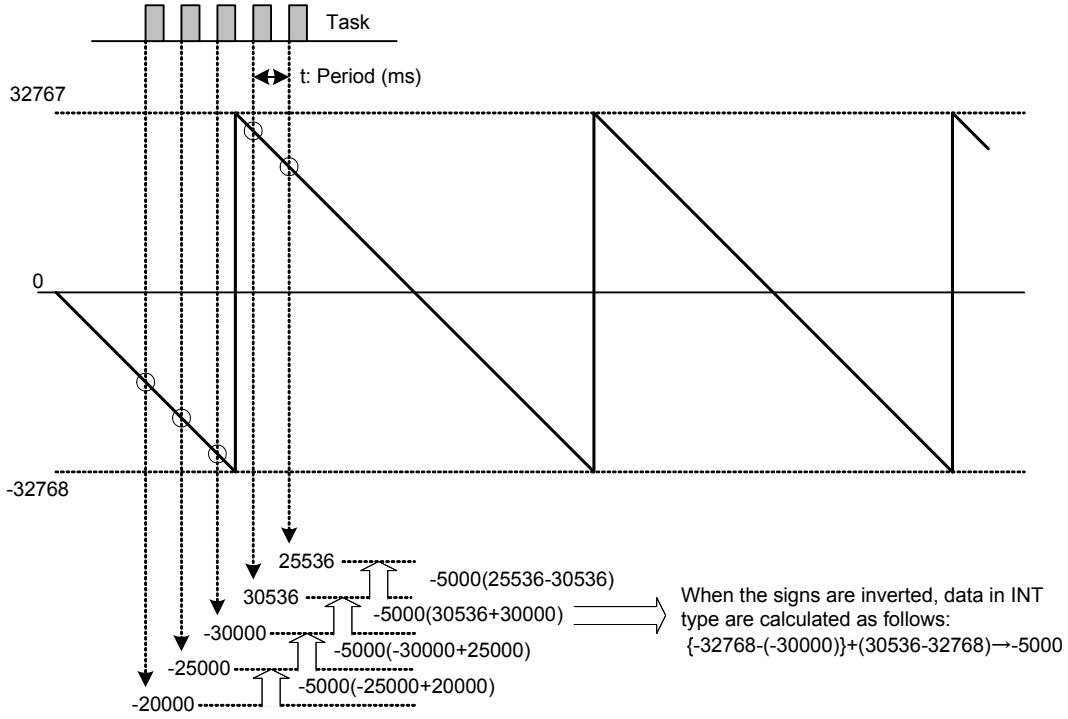


Fig. 3-1-39

3.1.5.3 Z-phase detection method

⚠CAUTION

- To detect the Z-phase for the first time after the power is turned on, the encoder shaft speed equipped with the Z-phase must be 60 r/min or faster. The later sequence is processed with software and therefore there is no problem if the speed is smaller than 60 r/min. Program a special sequence for Z-phase detection to be called only immediately after the power is turned on.

6-unit system (not applicable to broadcasting)

Table 3-1-34

Address	No	Name	FS/BS	Type	Direction	Remarks
%IW□.10	11	Position detection (built-in or PG (PD))	-32768 to 32767 /1 pulse	INT	FRENIC-VG→UPAC	
%IW□.11	12	Position detection (Z-phase input) (PG (PD))	-32768 to 32767 /1 pulse	INT	FRENIC-VG→UPAC	

Detection of the Z-phase reference position is effective for models equipped with the OPC-VG1-PG (PD) option.
For details of the PG option, refer to the description of operation in the FRENIC-VG User's Manual.

The PG pulse acquisition method is similar to that described in section 3.1.5.2 “PG pulse acquisition method.” When the results of differentiation of the above two memories in the task are PG_CNT and PG_CNT_Z, the PG_CNT_Z data is reset to zero upon detection of hardware Z-phase as shown in the figure on the right. Thus, Z-phase detection is judged when PG_CNT and PG_CNT_Z disagree each other.

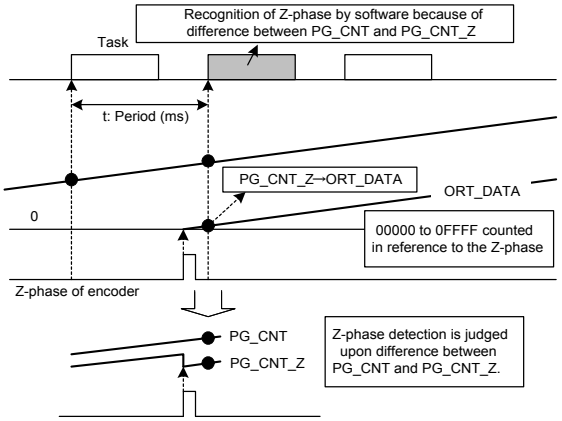


Fig. 3-1-40

Example of Z-phase detection program in IL language

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
    LD              INV110_POSDET   (*No. 11 position detection data*)
    SUB             POS_DATA
    ST              PG_CNT          (*Acquisition of count at execution task period through differentiation*)
    LD              INV111_POS_Z    (*Position detection data with No. 12 Z-phase detection function*)
    SUB             POS_ZDATA
    ST              PG_CNT_Z        (*Acquisition of count at execution task period through differentiation*)
    ADD             ORT_DATA        (*Absolute reference position data in 0000 to 0FFF range*)
    INT_TO_WORD
                                    (*With 1024 P/R encoder, multiplication by four, that is, 4096 (0FFF)
    AND             WORD#16#0FFF    counts*)
    WORD_TO_INT                     (*AND 0FFF for automatic Z-phase detection in software*)
    ST              ORT_DATA        (*Absolute reference position data in 0000 to 0FFF range*)
    LD              INV110_POSDET   (*Store the previous value.*)
    ST              PG_CNT
    LD              INV111_POS_Z    (*Store the previous value.*)
    ST              PG_CNT_Z
    LD              PG_CNT
    EQ              PG_CNT_Z        (*Judge Z-phase detection.*)
                                    (*Z-phase detection is judged because PG_CNT is not equal to
    JMPC            NOT_ZPHASE      PG_CNT_Z.*)
    LD              PG_CNT_Z
    ST              ORT_DATA
    LD              BOOL#1
    ST              ZPHASE_DETECT   (*”1” upon detection of Z-phase. Remains “1” until the power is turned off.*)
NOT_ZPHASE:
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

3.1.6 Dynamic Control Switching

⚠CAUTION

- The dynamic switch must be set for dynamic control switching. Dynamic control switching is effective when the corresponding bit of the dynamic switch is “0” (OFF), while dynamic control switching is ineffective when the bit is “1” (ON).

(1) 6-unit system (broadcasting)

Table 3-1-35

Address	No	Name	FS/BS	Type	Direction	Remarks
%QD□.48	31	Dynamic switch (DSW1)	Refer to the data format.	DWORD	FRENIC-VG→UPAC	Dynamic switching
	32	Dynamic switch (DSW2)				

□: 1 to 6 (INV1 to INV6)

(2) 12-unit system (broadcasting)

Table 3-1-36

Address	No	Name	FS/BS	Type	Direction	Remarks
%QD□.20	31	Dynamic switch (DSW1)	Refer to the data format.	DWORD	FRENIC-VG→UPAC	Dynamic switching
	32	Dynamic switch (DSW2)				

□: 1 to 12 (INV1 to INV12)

3.1.6.1 Definition

Use the dynamic switch to change the setting of control variables (UPAC → FRENIC-VG) during inverter operation after UPAC has started.

The function can be set individually for the control variables of each of the broadcasting, 6-unit and 12-unit systems.

As shown in the table below, the system definition is downloaded after both UPAC and FRENIC-VG are stopped.

On the other hand, dynamic switching changes data when UPAC is in operation.

Table 3-1-37

UPAC	FRENIC-VG	System definition downloading	Dynamic switching
Stopped (data exchange)	Output shutdown (stopped)	Possible	Impossible
	Output (running)	Impossible	
Starting (data exchange)	Output shutdown (stopped)		Possible
	Output (running)		

Enable (use) the dynamic switches (both DSW1 and DSW2; 32bits in total) in the I/O Group setting screen of output definition at System_Definition - I/O group setting of D300win, download the system definition and reset.

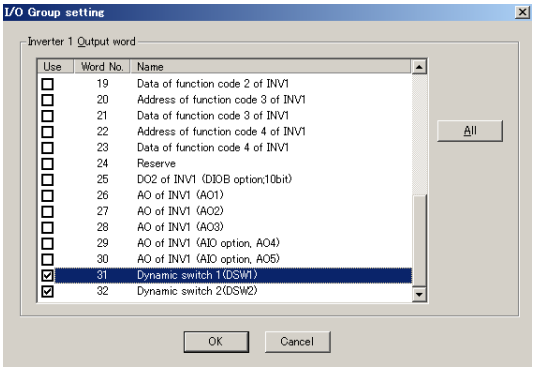


Fig. 3-1-41

3.1.6.2 Program example

An example of speed control and torque control switching is explained.

The upper half of the figure below shows a block diagram of speed-controlled operation where the speed command data calculated by UPAC is written in “speed setting 1” of the UPAC-to-FRENIC-VG interface memory to turn off the torque command UPAC SW.

The lower half of the figure below shows a block diagram of torque-controlled operation where the torque command data calculated by UPAC is written in “torque reference 1” of the UPAC-to-FRENIC-VG interface memory to turn on the torque command UPAC SW.

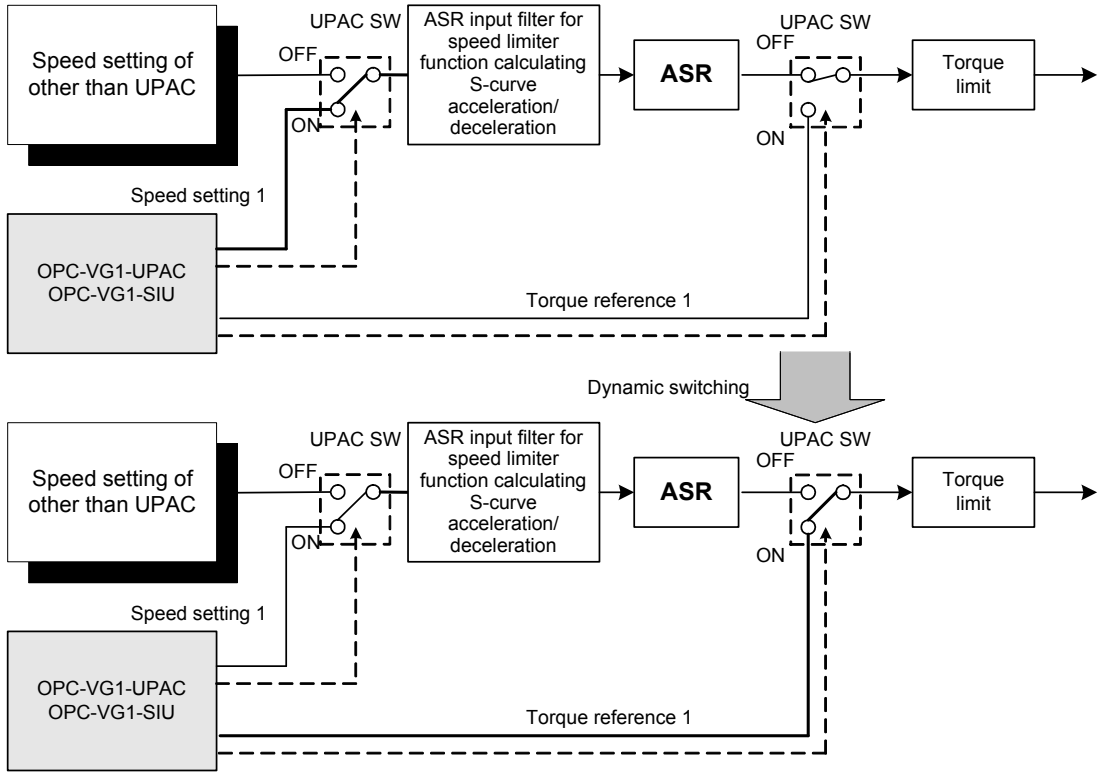


Fig. 3-1-42

An example of speed setting 1 and torque reference 1 switching program of the above control in the IL language is shown below.

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
(*Dynamic switching process*)
        LD          SPEED_SW            (*Control flag: 0: torque reference, 1: speed setting*)
        JMPC        SPEED_CONT
        LD          DWORD#16#00000000   (*No. 02: torque reference 1 is made valid.*)
        ST          INV148_DSW
        LD          TORQUE_DATA         (*Memory of torque reference data*)
        ST          INV119_TRQREF1      (*Torque reference 1 → FRENIC-VG*)
        JMP         DYNAMIC_END
SPEED_CONT:
        LD          DWORD#16#00000002   (*No. 2: torque reference 1 is canceled.*)
        ST          INV148_DSW
        LD          SPEED_DATA          (*Memory of speed setting data*)
        ST          INV118_SPDREF1      (*Speed setting 1 → FRENIC-VG*)
DYNAMIC_END:
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

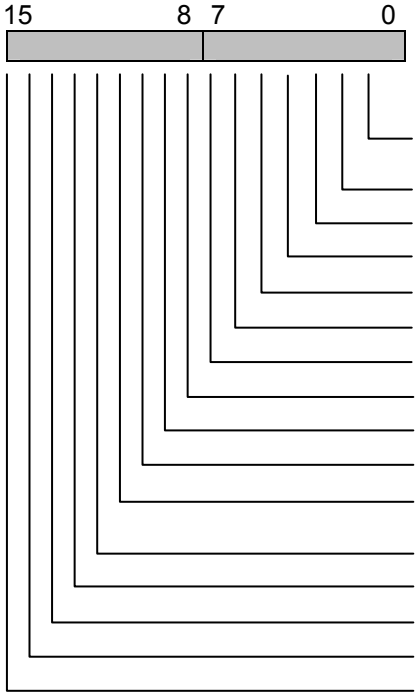
Note: In this example, output data of the acceleration/deceleration calculator may remain when the torque command is switched to speed control. The HLR zero clear function is recommended to reset the output data of the acceleration/deceleration calculator to zero.

3.1.6.3 Data format

When the corresponding bit of the data in the following data format is “0,” the function is valid and, when the bit is “1,” the function is invalid.

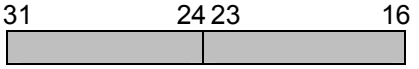
Note that the definition of data format differs from that of dynamic switching by a SX bus interface card (OPC-VG1-SX) in the UPAC compatible format.

(1) Lower 16 bits of 32 bits (DSW1)



	6-unit system	12-unit system
0)	No. 1 Speed setting 1/frequency reference	No. 1 Speed setting 1/frequency reference
1)	No. 2 Torque reference 1	No. 2 Torque reference 1
2)	No. 3 Torque current reference	-
3)	No. 4 Magnetic-flux reference	-
4)	No. 5 Control data	No. 5 Control data
5)	No. 6 Universal DO1	No. 6 Universal DO1
6)	No. 7 Acceleration time	No. 7 Acceleration time
7)	No. 8 Deceleration time	No. 8 Deceleration time
8)	No. 9 Torque limiter level 1	No. 9 Torque limiter level 1
9)	No. 10 Torque limiter level 2	No. 10 Torque limiter level 2
10)	No. 11 Speed setting 4/ frequency reference	No. 11 Speed setting 4/ frequency reference
11)	No. 12 Torque reference 2	-
12)	No. 13 Torque bias	-
13)	No. 14 Auxiliary speed setting	-
14)	No. 15 Actual speed (simulation)	-
15)	No. 16 Address function code 1 of-INV1	

(2) Upper 16 bits of 32 bits (DSW2)



	6-unit system	12-unit system
0)	No. 17 Data of function code 1 of INV1	-
1)	No. 18 Address of function code 2 of INV1	-
2)	No. 19 Data of function code 2 of INV1	-
3)	No. 20 Address of function code 3 of INV1	-
4)	No. 21 Data of function code 3 of INV1	-
5)	No. 22 Address of function code 4 of INV1	-
6)	No. 23 Data of function code 4 of INV1	-
7)	No. 24 -	-
8)	No. 25 DO2 of INV□	-
9)	No. 26 AO of INV1 (AO1)	No. 26 AO of INV1 (AO1)
10)	No. 27 AO of INV1 (AO2)	No. 27 AO of INV1 (AO2)
11)	No. 28 AO of INV1 (AO3)	No. 28 AO of INV1 (AO3)
12)	No. 29 AO of INV1 (AO4)	-
13)	No. 30 AO of INV1 (AO5)	-
14)	No. 31 -	-
15)	No. 32 -	-

3.1.7 Speed Simulation

⚠WARNING

- Before starting simulation, disconnect secondary cables (U, V, W) between the inverter and the motor or leave them disconnected.

Otherwise accidents may occur.

⚠CAUTION

- When performing simulation, select “2: simulation” for function code P01 “M1 control method.”

(1) 6-unit system (broadcasting)

Table 3-1-38

Address	No	Name	FS/BS	Type	Direction	Remarks
%QW□.32	15	Real speed (simulation speed)	20000/Nmax	INT	UPAC→FRENIC-VG	

□: 1 to 6 (INV1 to INV6)

UPAC can be used to make speed simulation. This is useful for examination of control using the FRENIC-VG control board and simple checkup of control functions. However, data between FRENIC-VG and UPAC is exchanged in a tact cycle. Thus, note that simulation cannot be used for verification of functions that require faster control than the tact cycle.

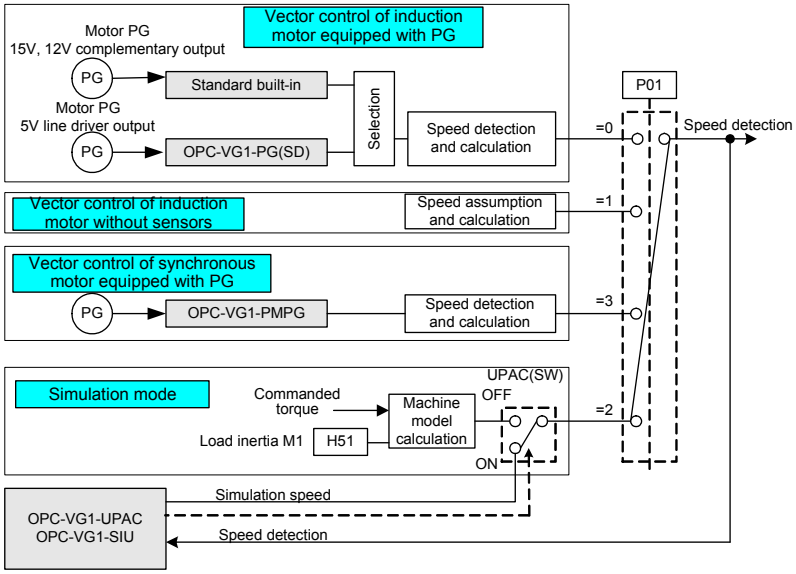


Fig. 3-1-43

1) How to use

Enable (use) Real speed (Simulation speed) in the I/O Group setting screen of output definition at System_Definition - I/O group setting of D300win, download the system definition and reset. Set P01 at “2.” The speed setting data is converted into a scale where the maximum speed is 20000.

Data × maximum speed/20000

(Example) When “3000” is written at the maximum speed setting of 1500 r/min;
3000 × 1500/20000 = 225 r/min

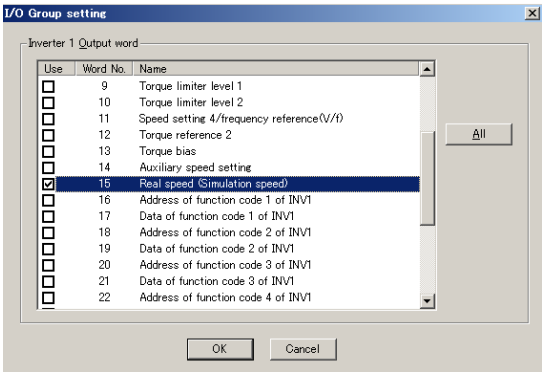


Fig. 3-1-44

3.1.7.1 Program example

A program example of two-inertia systems is shown.

The control block diagram including the interface with FRENIC-VG and UPAC is shown in the figure below.

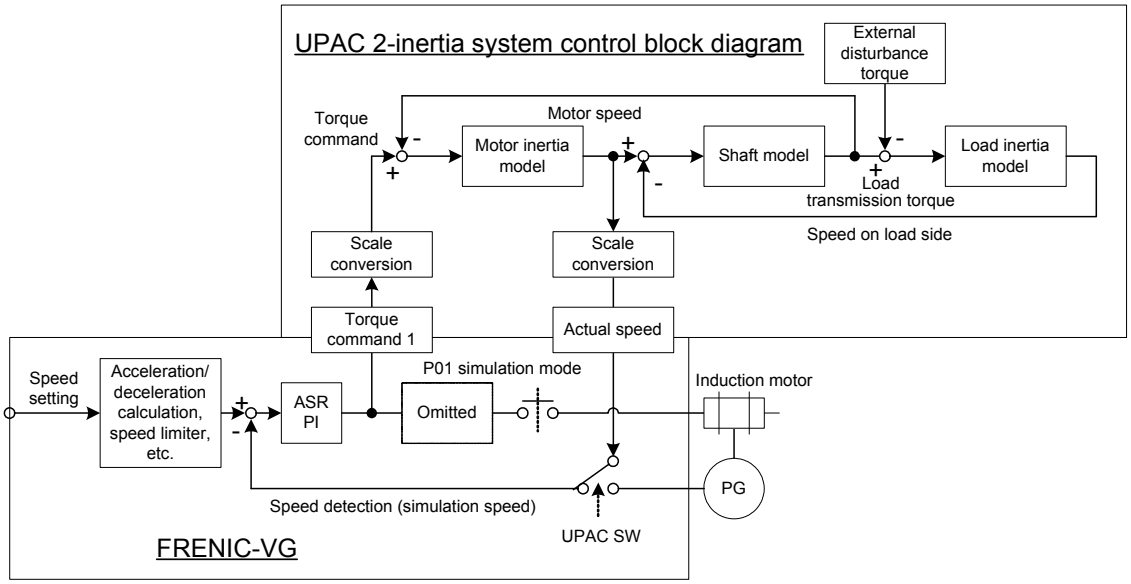


Fig. 3-1-45

1) Explanation

(1) On FRENIC-VG side

The FRENIC-VG inverter drives the induction motor and performs speed feedback by means of the motor PG for vector control with PG, thereby conducting automatic PI control. Set function code P01 “M1 control method”at “2” to disconnect the secondary cables (U, V, W) and select the simulation mode. Next, validate the actual speed (simulation speed) in the system definition. After these operations, the switch changes the flow as shown in the control block diagram. Give the speed setting from the keypad or the like and transfer torque command 1, an ASR output of FRENIC-VG, as a driving torque of two-inertia model of UPAC.

(2) On UPAC side

- Scale conversion
  The scale (10000/100%) and unit (100% → N·m unit of rated torque) of the torque command are converted.
  The scale (20000/Nmax) and unit (r/min → rad/s) of the simulation speed are converted.
- Inertia model (motor and load)

$$\omega(\text{rad/s}) = \frac{1}{J(kg \cdot m^2)} \int \tau(N \cdot m) dt$$

ω: Speed (rad/s), J: Inertia ($kg{\cdot}m^2$), τ: Torque ($N{\cdot}m$)

- Shaft model
  Model including the rigidity (N·m/rad) of the shaft and backlash and other dead zone.
- External disturbance torque
  An impact load, fixed load, viscosity load working as a function of the load speed, can be given.

3.2 Application Creation Examples

In this section, examples of applications of pattern operation and synchronous control using pulse train transmission and winding control using PI dancer position control are shown. Use these examples for reference of application creation using UPAC.

3.2.1 Pattern Operation Example

3.2.1.1 Specification

The specification is determined as shown in the block diagram below.

1) Description of specification

- UPAC sends speed commands to FRENIC-VG while automatically switching the speed set at function codes UN0.01 and 02.
- To change the data unit set at the function code to r/min, convert the scale of the data on the UPAC side.
- A fixed switching interval is used.
- Select speed setting 1 for the speed setting of UPAC to make acceleration/deceleration calculator of FRENIC-VG valid.

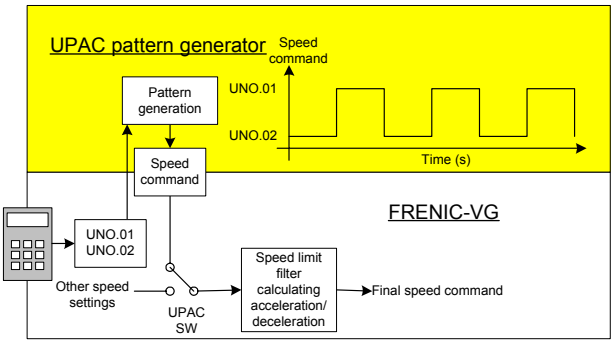


Fig. 3-2-1

3.2.1.2 System definition

In the system definition, select the check box for the following data item.

Table 3-2-1

Input/output memory	Data	Application
Output (1W/32W)	Speed setting 1/frequency reference (during V/f)	Speed command issued by UPAC

3.2.1.3 Task configuration and program

The task period is fixed at 1 ms.

A program example in the FBD language is shown in the figure on the right.

Description of program

PWM function block
- Setting of activation of WIDTH and OUT for 10s in 20s interval

Selection function block
- IN1 output upon “1” input (G) and IN0 output upon “0”

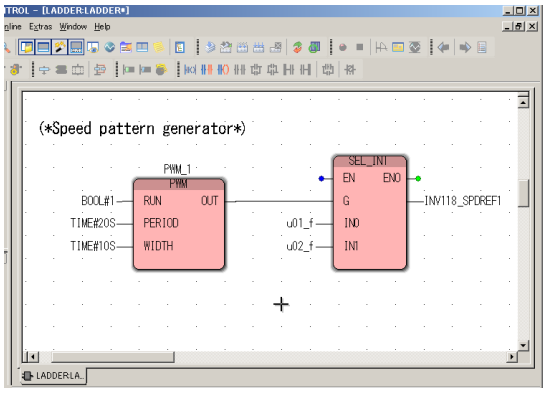


Fig. 3-2-2

Definition of variables

Variable	Data type	Usage	Comment	Address	Init	RETAIN	T..
LADDER¥							
INV118_SPDREF1	INT	VAR_EX...	INV1 Speed setting 1/frequency referenc...				
u01_f	INT	VAR_EX...	Function code U U01 USER P1				
u02_f	INT	VAR_EX...	U02 USER P2				
PWM_1	PWM	VAR					

3.2.2 Position Control Example Using Pulse Train

An example of position control program in the IL language using a pulse train reference is introduced.

3.2.2.1 Specification

The specification is determined as shown in the control block diagram below.

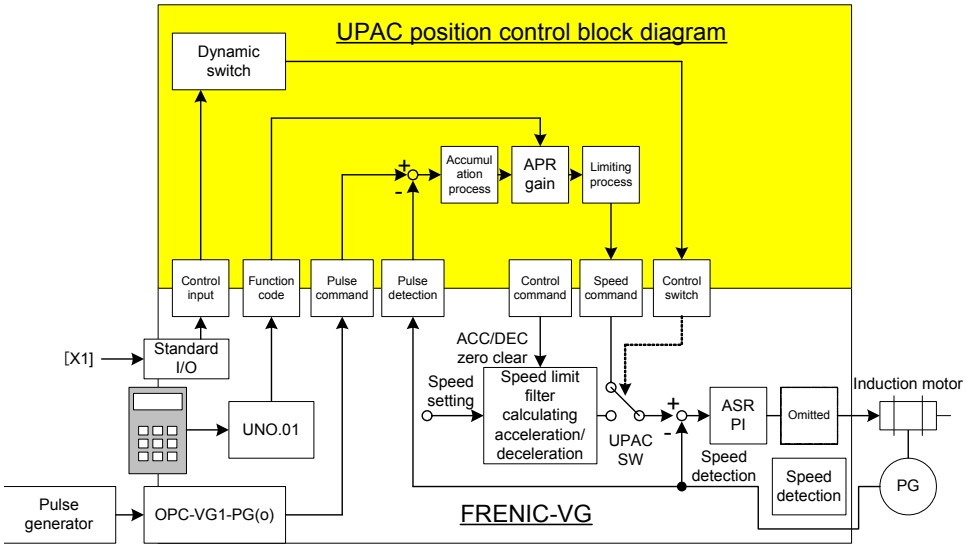


Fig. 3-2-3

1) Description of specification
   - The pulse train reference issued by the pulse generator is received at the OPC-VG1-PG (o) option and sent to UPAC as a pulse reference. (Variable: pulse train position reference PG (PR))
   - The feedback data of the encoder installed to the induction motor is sent to UPAC as detected pulses. (Variable: position detection (built-in)
   - The cumulative count multiplied by APR (position control) gain is handed over to FRENIC-VG as a speed command so that the cumulative deviation between the pulse reference and detected pulses becomes zero. (Variable: speed setting 4/frequency reference (during V/f)
     (Note: The stationary deviation does not become zero with APR gain only. It becomes zero during stoppage.)
   - FRENIC-VG dynamically switches between validation and cancellation (validation of internal speed setting) of the speed command sent from UPAC, using the [X1] input.
   - When the speed setting of UPAC is effective, the internal data of the internal acceleration/ deceleration calculator is reset to zero. (Variable: control data)
   - The APR gain is assigned to UN0.01 so that it can be changed or referred to from the keypad.
   - The definition of the APR gain for “1.0” (“10” in UN0.01 is assumed to be “1.0”) is assumed to be one speed unit (with “20000” speed units being the maximum speed) for a deviation of one pulse (with a deviation of 1000 pulses, 1000 speed units). When the maximum speed is 1500 r/min, the speed command is: 1500 × 1000/20000 = 75 r/min.

3.2.2.2 System definition

In the system definition, enable the following data items.

Table 3-2-2

Input/output memory	Data	Application
Input (3W/18W)	Control data (CW) (standard + DIOA option, 16-bit)	Monitoring of [X1] input state
	Pulse train position reference (PG (PR))	Acquisition of pulse train position reference
	Position detection (built-in or PG (PD))	Acquisition of pulse train position detection
Output (4W/32W)	Control data (CW)	Issuance of ACC/DEC zero clear command
	Speed setting 4/frequency reference (during V/f)	Speed command from UPAC
	Dynamic switch (DSW1)	Dynamic switch between speed command from UPAC and internal speed command
	Dynamic switch (DSW2)	

3.2.2.3 Task configuration and program

Select a constant-period task of about 1 ms to 4 ms, considering the position control response and acquisition and response of the control terminal [X1]. A program example in the IL language is shown below.

```
Program
(*START*)
   LD       INV105_CW          (*Control data: [X1] input state acquisition*)
   SHR_WORD UINT#2             (*Move [X1] bit to the least significant position.*)
   WORD_TO_BOOL
   ST       SYC                (*Reflect [X1] input status to SYC.*)
(*Synchronous control routine*)
   LD       SYC
  JMPCN     SPEED_OP           (*Synchronization when [x1] is ON, clearing process when OFF*)
(*Store first data.*)
   LD       SYC_FLG            (*Store first data immediately after the power is turned on.*)
   JMPC     PULSE_START
   LD       BOOL#1
   ST       SYC_FLG
   LD       INV109_PLSPOSREF   (*Store previous PG_PR command data.*)
   ST       PR_DATA
   LD       INV110_POSDET      (*Store previous PG_ built-in data.*)
   ST       PG_DATA
   JMP      MAIN_END
PULSE_START:
(*Latch position command data.*)
   LD       INV109_PLSPOSREF    (*PG_PR command data*)
   SUB      PR_DATA
   INT_TO_DINT                  (*Extension to 32 bits*)
   ADD      PR_CNT
   ST       PR_CNT
   LD       INV109_PLSPOSREF   (*Store previous PG_PR command data.*)
   ST       PR_DATA
(*Latch position detection data.*)
   LD       INV110_POSDET       (*PG_ built-in data*)
   SUB      PG_DATA
   INT_TO_DINT                  (*Extension to 32 bits*)
   ADD      PG_CNT
   ST       PG_CNT
   LD       INV110_POSDET       (*Store previous PG_ built-in data.*)
   ST       PG_DATA
(*Position deviation calculation*)
   LD       PR_CNT
   SUB      PG_CNT
   ST       DEV_CNT     (*Position deviation = command data - detection data*)
(*APR output calculation*)
   LD       u01_f              (*Assign position control gain to UNO.01.*)
   INT_TO_REAL                 (*Convert to 32-bit floating point for preparation.*)
   ST       APR_REAL
   LD       DEV_CNT
   DINT_TO_REAL                (*Convert to 32-bit floating point for preparation.*)
   MUL      APR_REAL
   MUL      REAL#0.1           (*Multiply APR gain scale by 0.1.*)
   ST       APR_OUT_REAL
   LD       REAL#-20000.0      (*Limit to -20000 to 20000 range.*)
   LIMIT_REAL APR_OUT_REAL     , REAL#20000.0
   REAL_TO_INT
   ST       APR_OUT_SPEED      (*APR output*)
(*Dynamic switching*)
   LD       DWORD#16#00000000  (*Validate No. 11 speed setting 4.*)
   ST       INV148_DSW
   LD       WORD#16#0803       (*ACC/DEC zero clear function: [X11] = ON*)
   ST       INV122_CW
   LD       APR_OUT_SPEED
   ST       INV128_SPDREF4     (*Send speed data to VG7S.*)
   JMP      MAIN_END
SPEED_OP:                     (*Speed control operation routine.*)
(*Dynamic switching*)
   LD       DWORD#16#00000400  (*Cancel No. 11 speed setting 4.*)
   ST       INV148_DSW
   LD       WORD#16#0003       (*ACC/DEC zero clear function: [X11] = OFF*)
   ST       INV122_CW
(*Memory clearing process*)
   LD       DINT#0
   ST       PR_CNT             (*Command data count clear*)
   ST       PG_CNT             (*Detection data count clear*)
   ST       DEV_CNT
   LD       REAL#0.0
   ST       APR_OUT_REAL
   LD       INT#0
   ST       APR_OUT_SPEED
   ST       PR_DATA
   ST       PG_DATA
   LD       BOOL#0
   ST       SYC_FLG
MAIN_END:
   LD       UINT#15            (*Assign ACC/DEC zero clear function.*)
   ST        e10_f             (*Assign above function to [X11].*)
```

	Variable	Data type	Usage	Comment	Address	Init	RETAIN	T..
	⊟ LADDERY							
	INV105_CW	WORD	VAR_EXTERNAL	INV1 Control data(CW)(standard+DIOA;16bit)				
	INV109_PLSPOSREF	INT	VAR_EXTERNAL	INV1 Pulse train position reference(PG(...				
	INV110_POSDET	INT	VAR_EXTERNAL	INV1 Position detection (build-in or PG...				
	INV122_CW	WORD	VAR_EXTERNAL	INV1 Control data(CW)				
	INV128_SPDREF4	INT	VAR_EXTERNAL	INV1 Speed setting 4/frequency referenc...				
	INV148_DSW	DWORD	VAR_EXTERNAL	INV1 Dynamic switch(DSW)				
	e10_f	UINT	VAR_EXTERNAL	E10 X11 function selection				
	u10_f	INT	VAR_EXTERNAL	U10 USER P10				
	SYC	BOOL	VAR_EXTERNAL					
	SYC_FLG	BOOL	VAR_EXTERNAL					
	PR_CNT	DINT	VAR_EXTERNAL					
	PG_CNT	DINT	VAR_EXTERNAL					
	DEV_CNT	DINT	VAR_EXTERNAL					
	PR_DATA	INT	VAR_EXTERNAL					
	PG_DATA	INT	VAR_EXTERNAL					
	APR_REAL	REAL	VAR_EXTERNAL					
	APR_OUT_REAL	REAL	VAR_EXTERNAL					
	APR_OUT_SPEED	INT	VAR_EXTERNAL					

3.2.3 Example of Dancer Control

3.2.3.1 Specification

The specification is determined as shown in the control block diagram below.

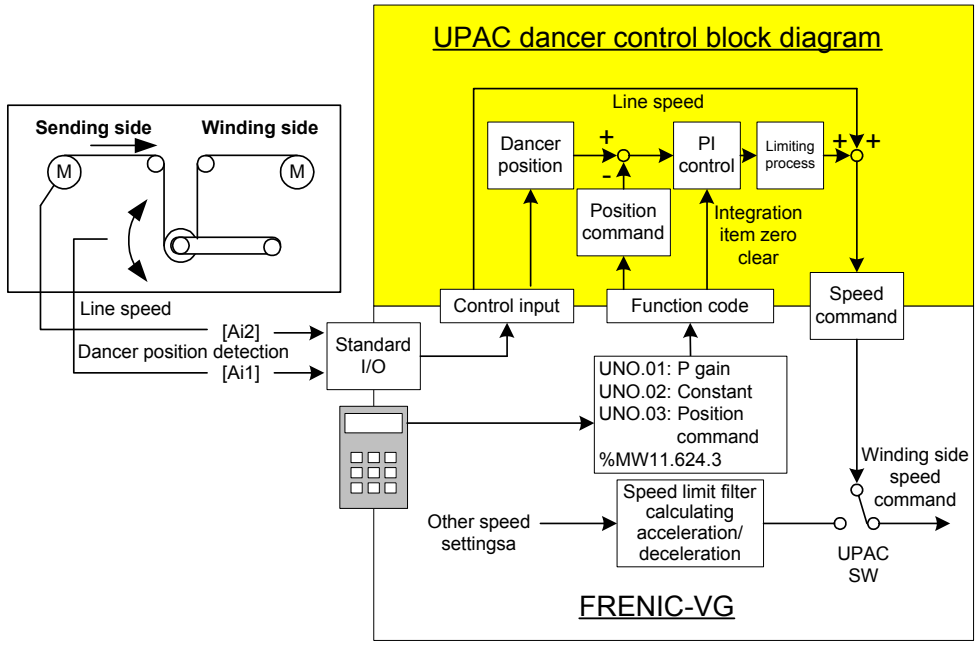


Fig. 3-2-4

1) Description of specification

- The analog line speed of the sender is input to [Ai2] of the driving FRENIC-VG of the sender and transferred to UPAC. At this time, the function selection of AI2 is set at universal Ai.
- The analog position of the dancer is detected and input to [Ai1] of the driving FRENIC-VG of the sender and transferred to UPAC. At this time, the function selection of AI1 is set at universal Ai.
- UPAC takes PI control based on the dancer position command (UNO.03) so that the difference with the dancer position becomes zero, where the PI output is added to the line speed for a speed setting output to FRENIC-VG. (Variable: speed setting 4/frequency reference (during V/f))
- The PI constant of the PI controller is assigned to function codes UNO.01 and 02 of the keypad.
- The operation state of the inverter is checked at a constant period of 60 ms, using the INT signal (bit 3 of function code M14, inverter shutoff: %MW11.624.3), and the output of the integration term is reset to zero during inverter shutoff (with INT signal being turned on).

3.2.3.2 System definition

A check mark is placed in the following data items of the system definition.

Table 3-2-3

Input/output memory	Data	Application
Input (2W/18W)	INV1 Ai(Ai1)	Analog dancer position detection
	INV1 Ai(Ai2)	Analog line speed command
Output (1W/32W)	Speed setting 4/frequency reference (during V/f)	Speed command from UPAC

3.2.3.3 Task configuration and program

Because high speed response is unnecessary, a 10 ms to 100 ms constant-period is enough for the task period.

A program example in the FBD language is shown below.

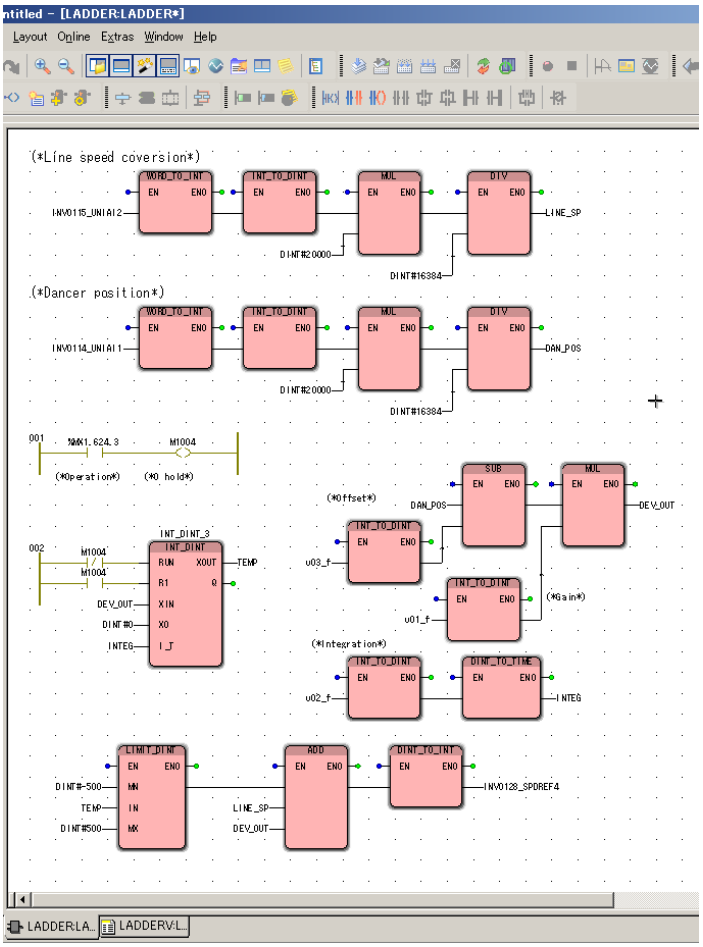


Fig. 3-2-5

Description of program

Analog input scale conversion
- Analog input at ±4000h/±10V
- Convert this into ±20000d/±10V of the speed unit.

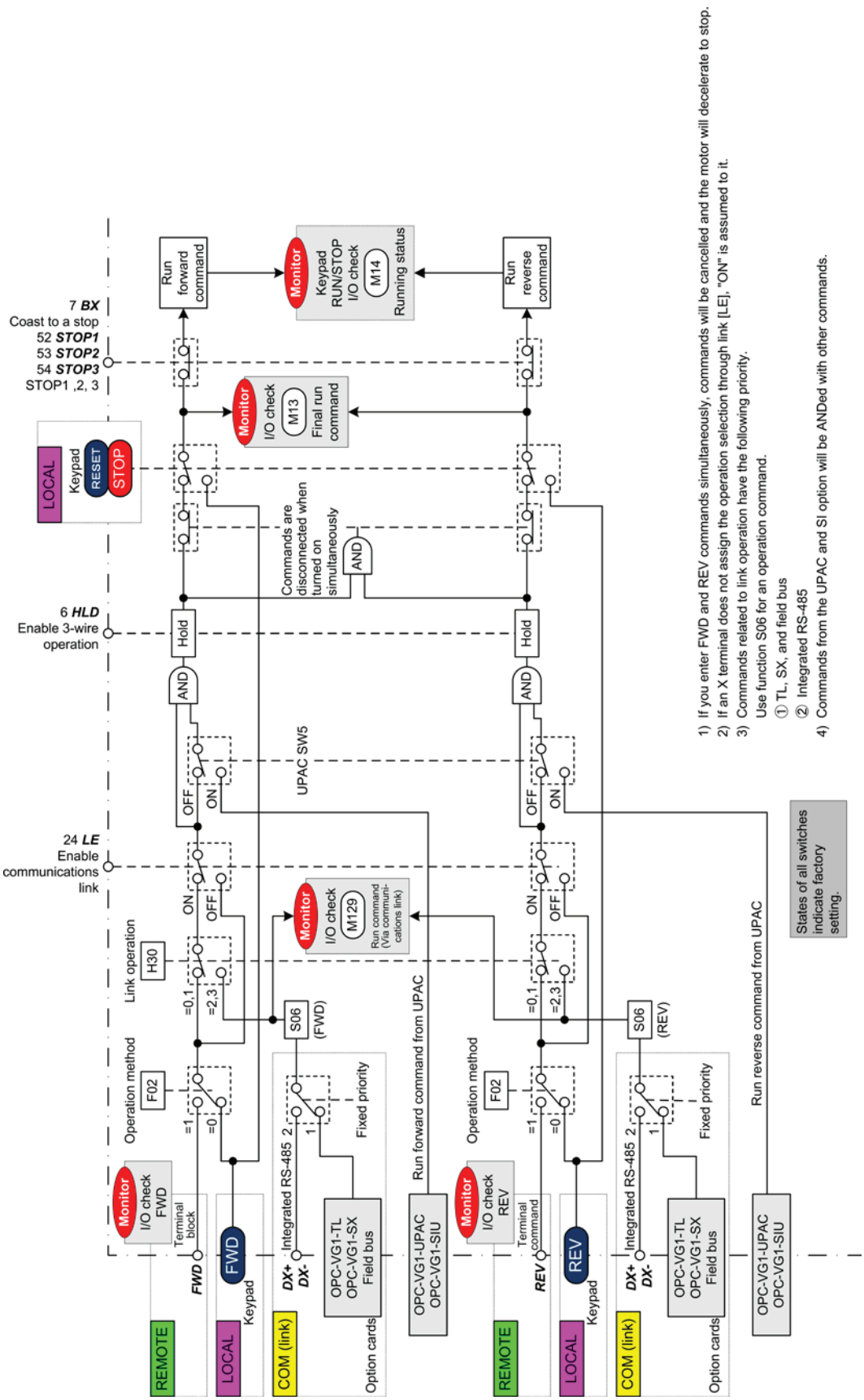
Integrator
- INT = OFF during operation, therefore
  → "1" upon RUN input, "0" upon R1 input
- INT = ON during stoppage, therefore
  → "0" upon RUN input, "1" upon R1 input, and zero output at integrator
- Pass the output of the integrator via "TEMP" to the limiter (LIMIT_DINT)
  → Fixed limit at ±500

Addition
- Add the line speed (LINE_SP), integrator output and P gain output (DEV_OUT) to compose a speed command (INV128_SPDREF4) for VG7S.

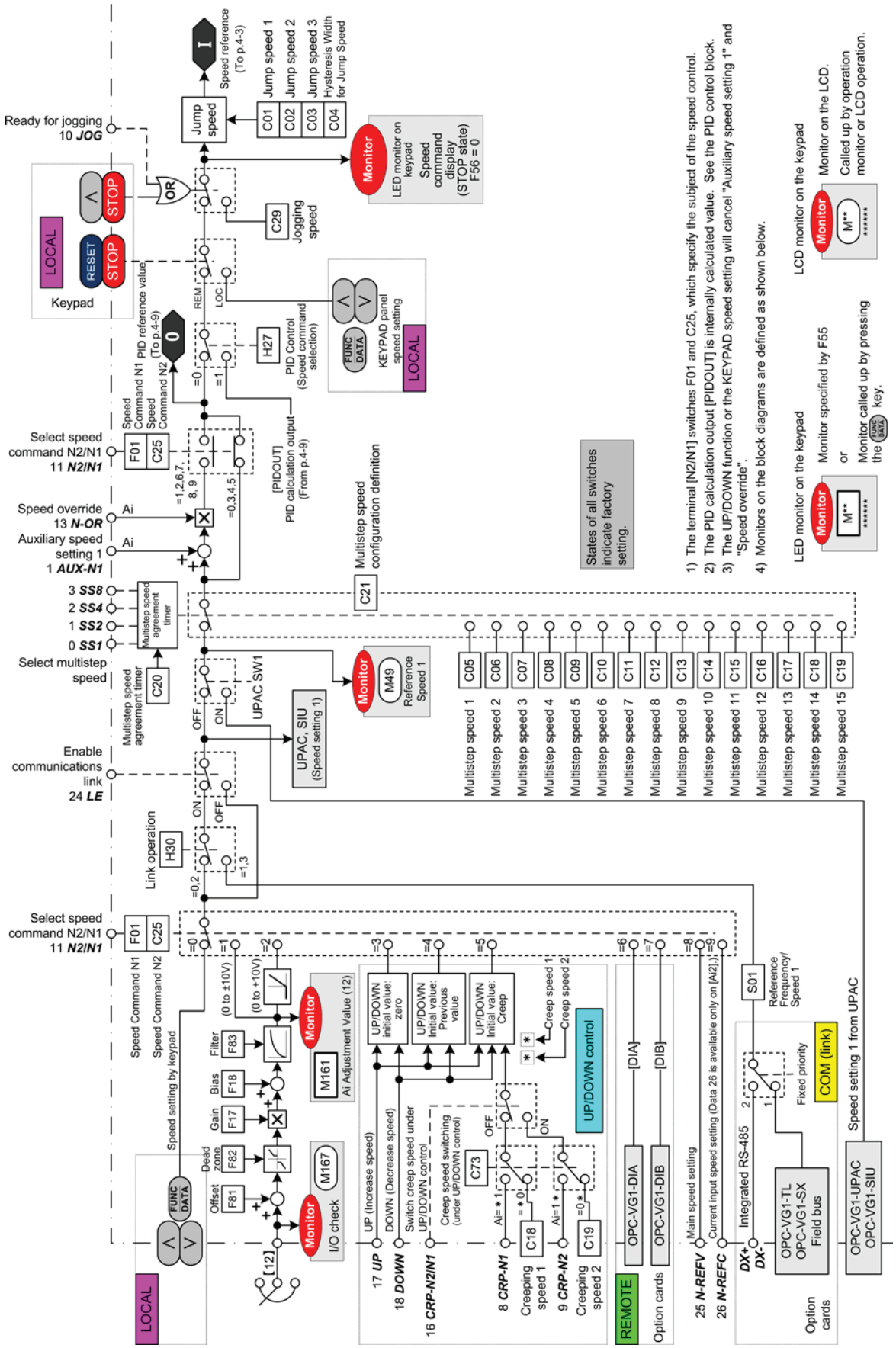
Variable	Data type	Usage	Comment	Address	Init	RETAIN	T...
LADDERV							
INV0128_SPDREF4	INT	VAR_EXT...	INV1 Speed setting 4/frequency referenc...				
INV0114_UNIAI1	INT	VAR_EXT...	INV1 Ai of INV1(Ai1)				
INV0115_UNIAI2	INT	VAR_EXT...	INV1 Ai of INV1(Ai2)				
u01_f	INT	VAR_EXT...	Function code U U01 USER P1				
u02_f	INT	VAR_EXT...	U02 USER P2				
u03_f	INT	VAR_EXT...	U03 USER P3				
LINE_SP	DINT	VAR_EXT...					
DAN_POS	DINT	VAR_EXT...					
DEV_OUT	DINT	VAR_EXT...					
INTEG	TIME	VAR_EXT...					
M1004	BOOL	VAR_EXT...					
INT_DINT_3	INT_DINT	VAR					
TEMP	DINT	VAR					

3.3 FRENIC-VG Control Block Diagrams

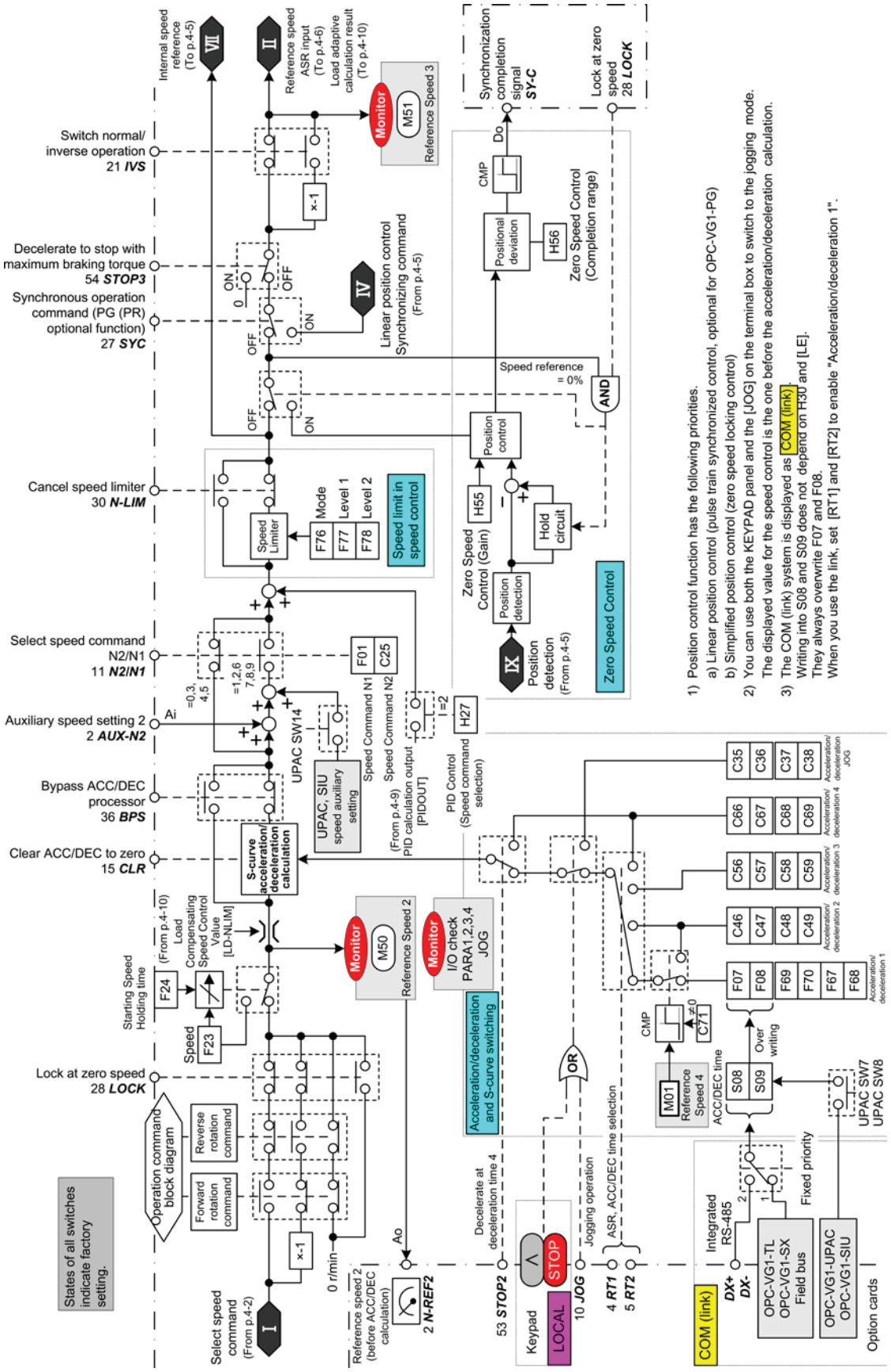
3.3.1 Operation Command



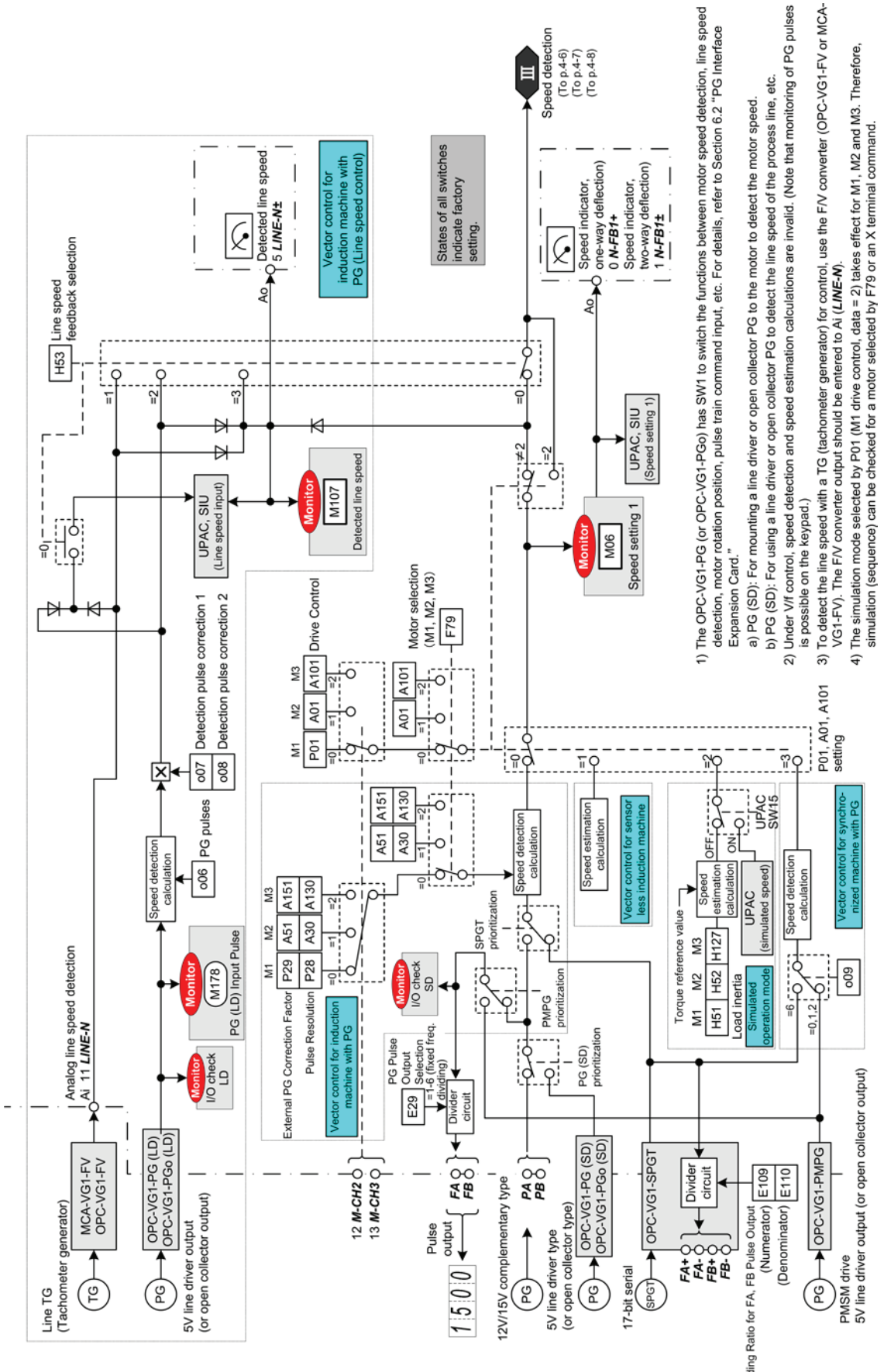
3.3.2 Speed Command Selection Section



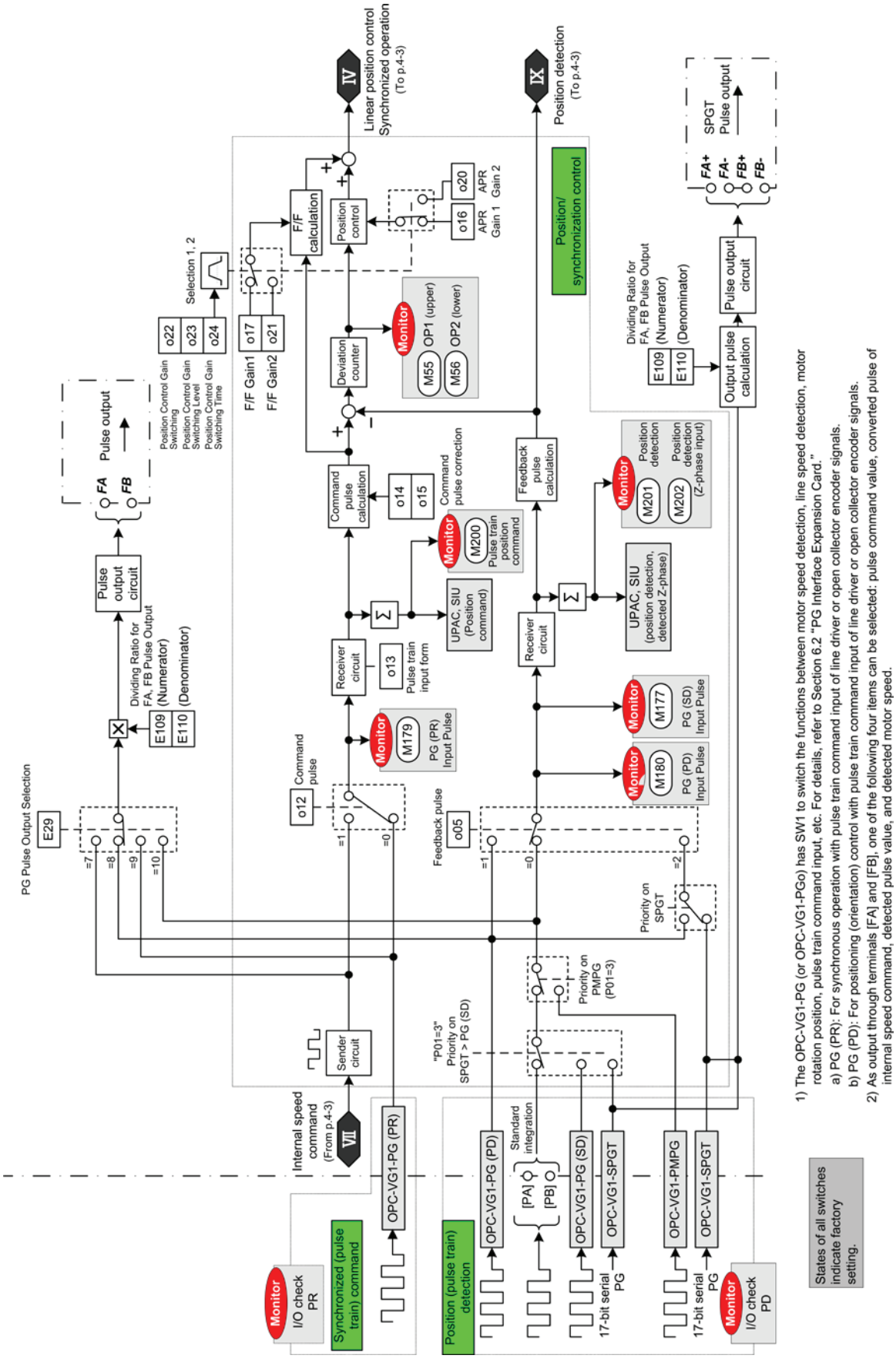
3.3.3 Acceleration/Deceleration Calculation, Speed Limiting, and Position Control Input Section



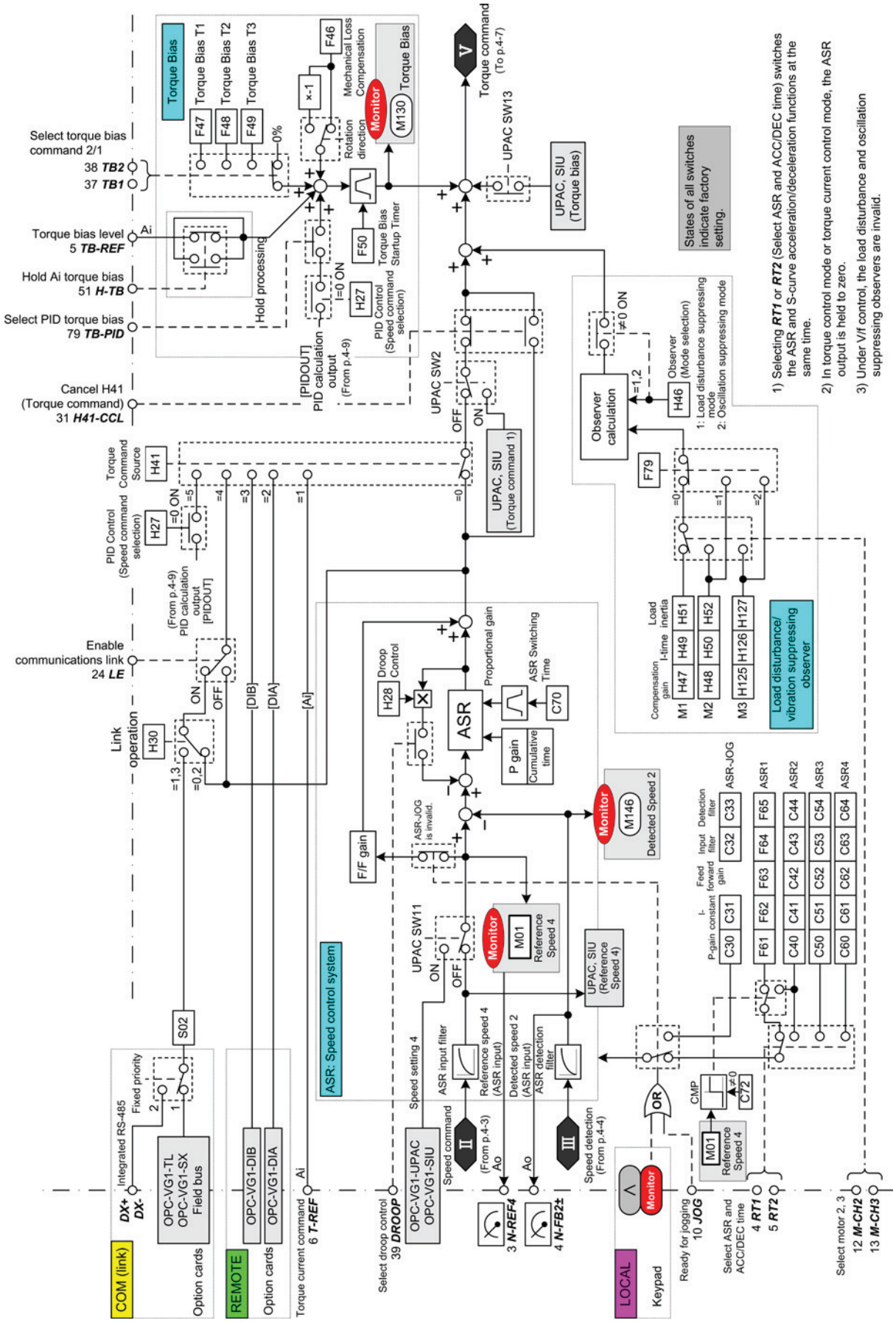
3.3.4 Motor Speed/Line Speed Detection



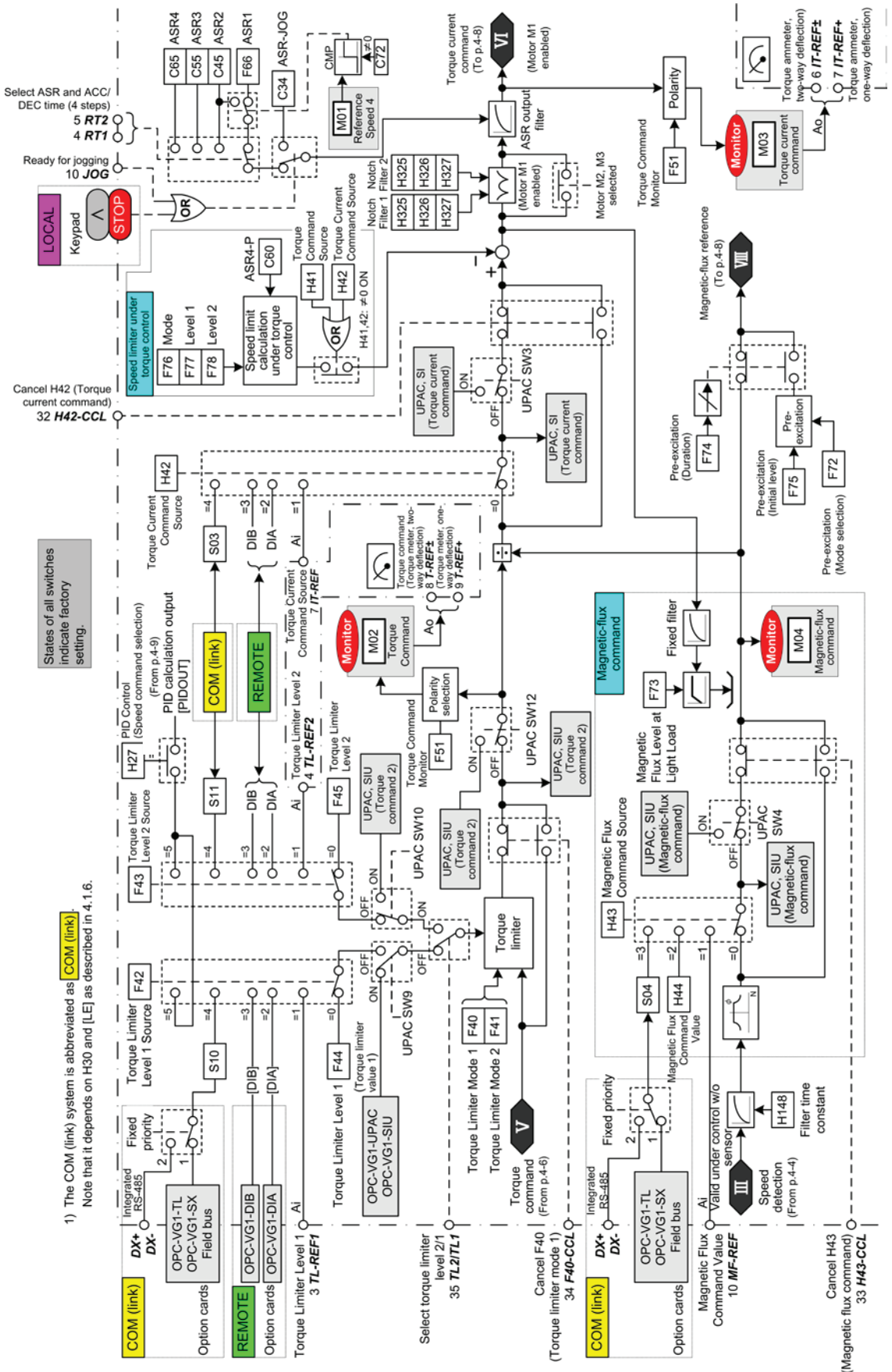
3.3.5 Pulse Train Reference Section and Position Detection Section



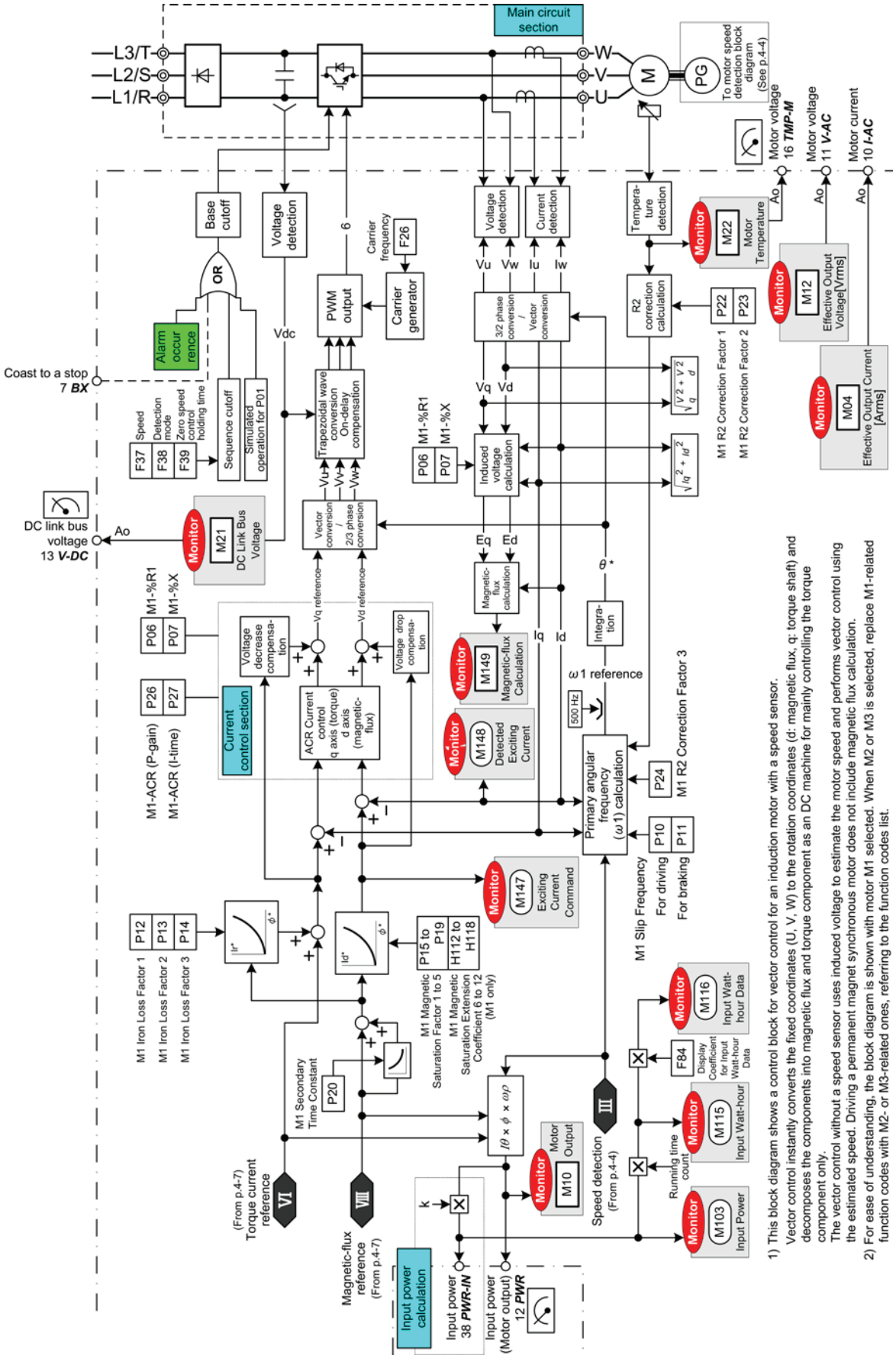
3.3.6 Speed Control and Torque Reference Section



3.3.7 Torque Limit, Torque Current Reference, and Magnetic-flux Reference Section



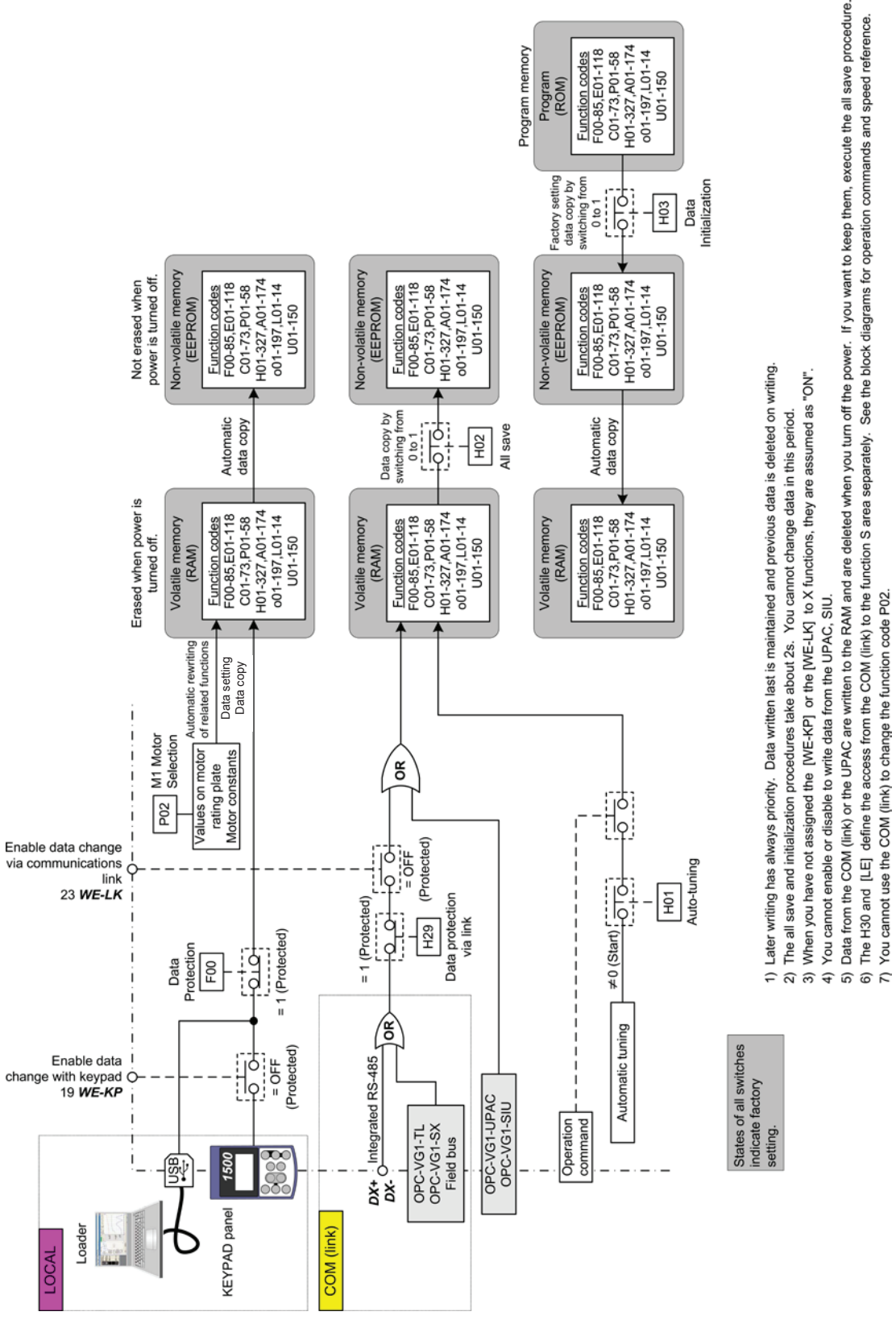
3.3.8 Current Control and Vector Control Section



1) This block diagram shows a control block for vector control for an induction motor with a speed sensor.
Vector control instantly converts the fixed coordinates (U, V, W) to the rotation coordinates (d: magnetic flux, q: torque shaft) and decomposes the components into magnetic flux and torque component as an DC machine for mainly controlling the torque component only.
The vector control without a speed sensor uses induced voltage to estimate the motor speed and performs vector control using the estimated speed. Driving a permanent magnet synchronous motor does not include magnetic flux calculation.

2) For ease of understanding, the block diagram is shown with motor M1 selected. When M2 or M3 is selected, replace M1-related function codes with M2- or M3-related ones, referring to the function codes list.

3.3.9 Enabling to Write/Saving Function Codes



1) Later writing has always priority. Data written last is maintained and previous data is deleted on writing.
2) The all save and initialization procedures take about 2s. You cannot change data in this period.
3) When you have not assigned the [WE-KP] or the [WE-LK] to X functions, they are assumed as "ON".
4) You cannot enable or disable to write data from the UPAC, SIU.
5) Data from the COM (link) or the UPAC are written to the RAM and are deleted when you turn off the power. If you want to keep them, execute the all save procedure.
6) The H30 and [LE] define the access from the COM (link) to the function S area separately. See the block diagrams for operation commands and speed reference.
7) You cannot use the COM (link) to change the function code P02.

Chapter 4 Package Software

This chapter introduces the package software for UPAC.

Contents

4.1 WPS-VG1-DAN

Available soon

WPS-VG1-DAN is packaged software for controlling the dancer of the winding system.
(Windows Personal Computer Software Package-Dancer control system on FRENIC-VG)

The features of the package are:

- Speed control through detection of position of dancer roll
- Calculation of winding diameter based on line speed command and winding (feeding) motor speed
- Switching of dancer roll position control gain, speed control gain and I constant according to variation of wound coil
- Common control system for winding and feeding (compatible with reverse mill)
- Tension taper output function
- Applicable to wire drawing machine

To detect the dancer position with a synchro transmitter with the dancer control function used, the MCA/OPC-VG1-SN option is necessary in addition to the UPAC option. For the hardware specification, installation method and other details of the option, refer to the FRENIC-VG User's Manual.

This packaged software is included in the CD-ROM of WPS-VG1-PCL (loader software) and provided free of charge. You may download the software from our website. To configure a system using this package, agreement with the following description is necessary.

[Terms of Agreement]

You are requested to agree to the following items.

If you do not agree to them, do not use WPS-VG1-DAN packaged software.

For inquiries about the agreement items, contact our sales person.

---

(1) When an analog interface is used to establish a dancer system, sufficient measures shall be taken in accordance with the description of the FRENIC-VG User's Manual to suppress noise.

(2) Function codes UNO. 01 through 63 used for dancer control are set at "0" before shipment from our factory. The user must change the setting of necessary parameters voluntarily according to the purpose.

(3) The battery included in the UPAC is needed to back up the data. The lifetime of the battery is five years (at 25°C). The battery life is reduced during operation at higher temperatures. When the battery life is reached, UPAC alarm "ErA" is displayed. If this alarm is displayed, change the battery soon. For the battery replacement method, refer to the corresponding part of this manual.

(4) If noise or vibration occurs due to resonance in the mechanical system or play in the gear, the mechanical system must be examined and adjusted. If the noise is not reduced after adjustment of the mechanical system, electrical countermeasures must be taken, so that the standard functions of FRFENIC-VG, gain and integration time of dancer control, filter and other parameters are used for adjustment. Please note that we will not meet requests to add special control applications to UPAC or to the main body of FRFENIC-VG.

(5) You are not allowed by the copyright law to duplicate, rent, or resell the entire or a part of the program.

(6) There are no limitations to voluntary addition, change, or deletion by the customer for program development based on this dancer control program. We will provide technical support and consultation on developing programs.

(7) We will assume no responsibility for the direct or indirect material loss or damage caused by the WPS-VG1-DAN program itself or change, addition or deletion to the program.

I agree the terms above (Your signature here)

4.1.1 System Consideration

4.1.1.1 Specifications

Table 4-1-1

Item		Specification of dancer control
Model of option card		OPC-VG1-UPAC * To use synchro transmitter: MCA/OPC-VG1-SN
Package Software		Dancer control package. Version 110□□ (displayed at function code UNO. 64)
Dancer control method		PID control of dancer roll position: APR (Auto Position Regulator)
Winding diameter calculation function		Automatic switch of P gain of APR and P/I of ASR according to winding diameter
Tension taper output		Analog output [A01]
Analog	Input signal	[12]: Line speed input, -10 V to 0 V to 10 V [Ai 1]: Dancer roll position input signal, -10 V to 0 V to 10 V [Ai 2]: Selection from the following signals, -10 V to 0 V to 10 V (Analog taper gain, analog initial diameter, analog line speed gain)
	Output signal	[AO 1]: Taper output, -10 V to 0 V to 10 V [AO 2]: Dancer roll position detection, -10 V to 0 V to 10 V [AO 3]: Winding diameter ratio, -10 V to 0 V to 10 V
Digital	Input signal	[X1]: Individual motor operation [X2]: APR-I zero hold [X3]: APR output zero hold [X4]: Winding diameter calculation hold [X5]: Initial diameter reset [X6]: Winding/feeding switch
	Output signal	Dancer roll position detection (Select [Y1] to [Y5] and assign the [U-DO] function.) Detection level defined with function code U55
Keypad monitor function		The following data items can be referred to in real time at the LED monitor of the keypad. Option monitor 3: Calculated winding diameter Option monitor 4: Line speed input Option monitor 5: Dancer roll position input Option monitor 6: Offset

4.1.1.2 Using the synchro transmitter

The synchro transmitter detects the dancer position in a system using the Fuji Electric's MCA/OPC-VG1-SN synchronous interface option. The analog output (S4, with common S2) of the synchro transmitter is connected to the standard analog input terminal ([Ai 1], with common [M]) of FRENIC-VG.

1) How to install the synchro transmitter
   (1) Install the synchro transmitter so that the output becomes larger when the target control position is in the speed boosting direction. When voltage output S4 is positive, the speed increases and maximum correction is made (at +10 V).
   (2) To change the polarity, exchange SY1 and SY2 terminals.
   (3) During installation of the synchro transmitter to the machine, adjust the angle so that the output from the synchro transmitter becomes 0 V at the center of the maximum movable span of the movable shaft of the synchro transmitter.
   (4) Adjust VR2 so that voltage output at S4 is 10 VDC at the maximum position in the maximum speed boosting direction, check that the voltage output at S4 is -10 VDC (±0.5 V) in the maximum deceleration direction.
   (5) The speed boosting direction varies according to the installation position of the synchro transmitter (in reference to the main body of the inverter). Refer to the figure below. (For forward winding control, refer to Fig. a; for reversing control, refer to Fig. b.)

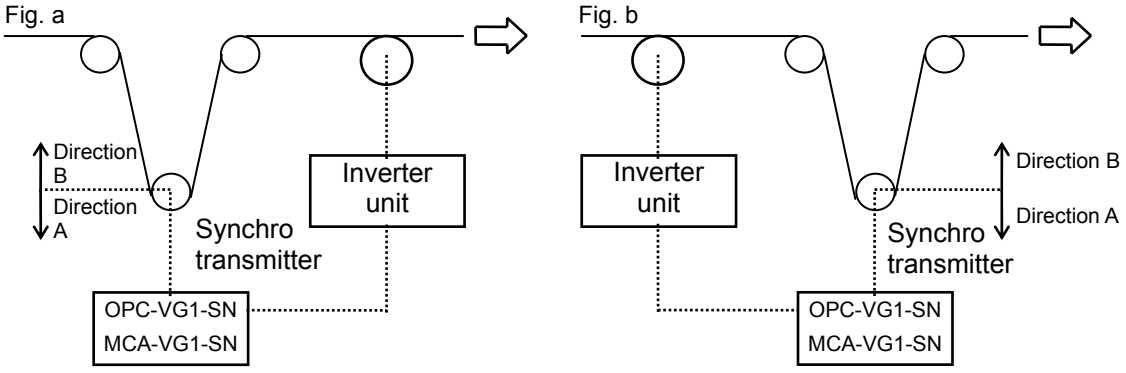


Fig. 4-1-1

2) Internal block diagram of MCA/OPC-VG1-SN

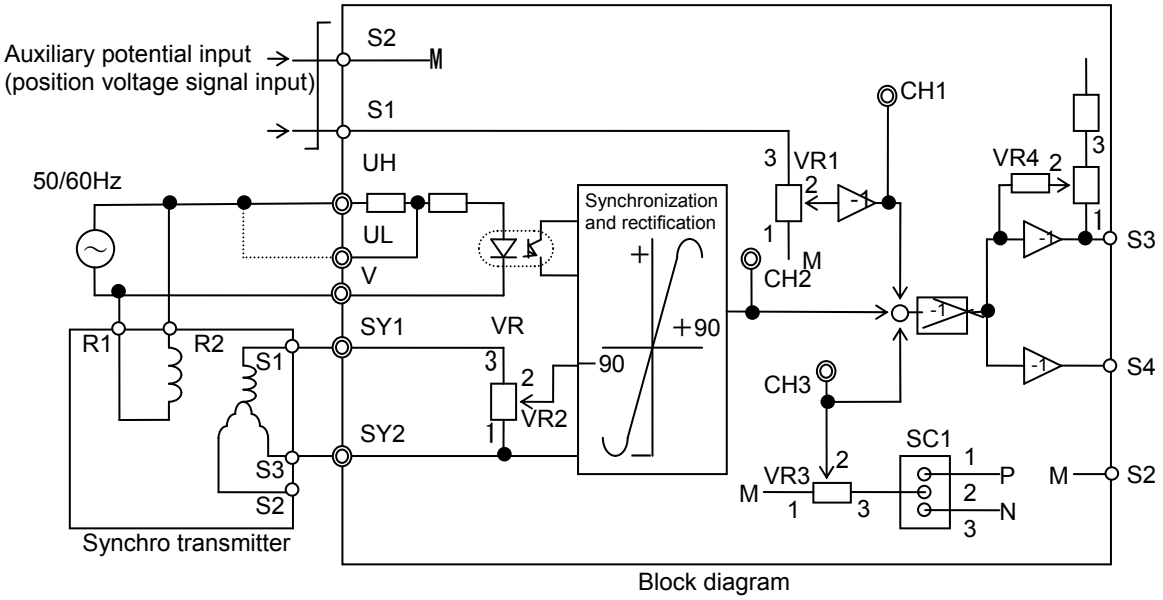


Fig. 4-1-2

4.1.2 Control Block Diagrams

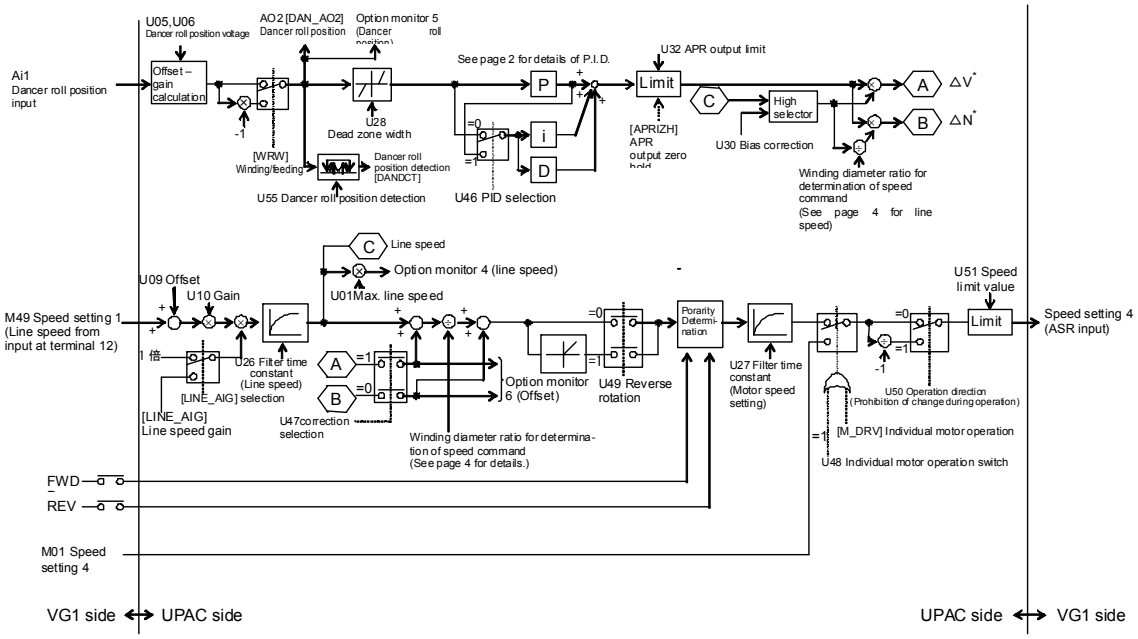


Fig. 4-1-3 Block diagram of UPAC dancer roll control software (1/4)

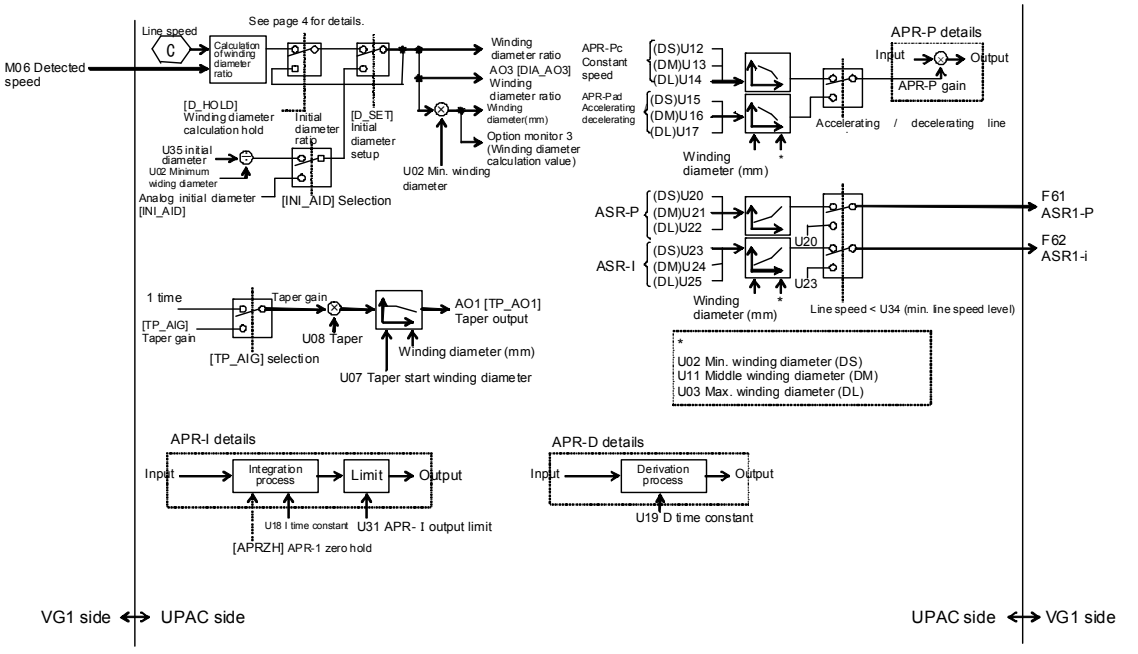


Fig. 4-1-3 Block diagram of UPAC dancer roll control software (2/4)

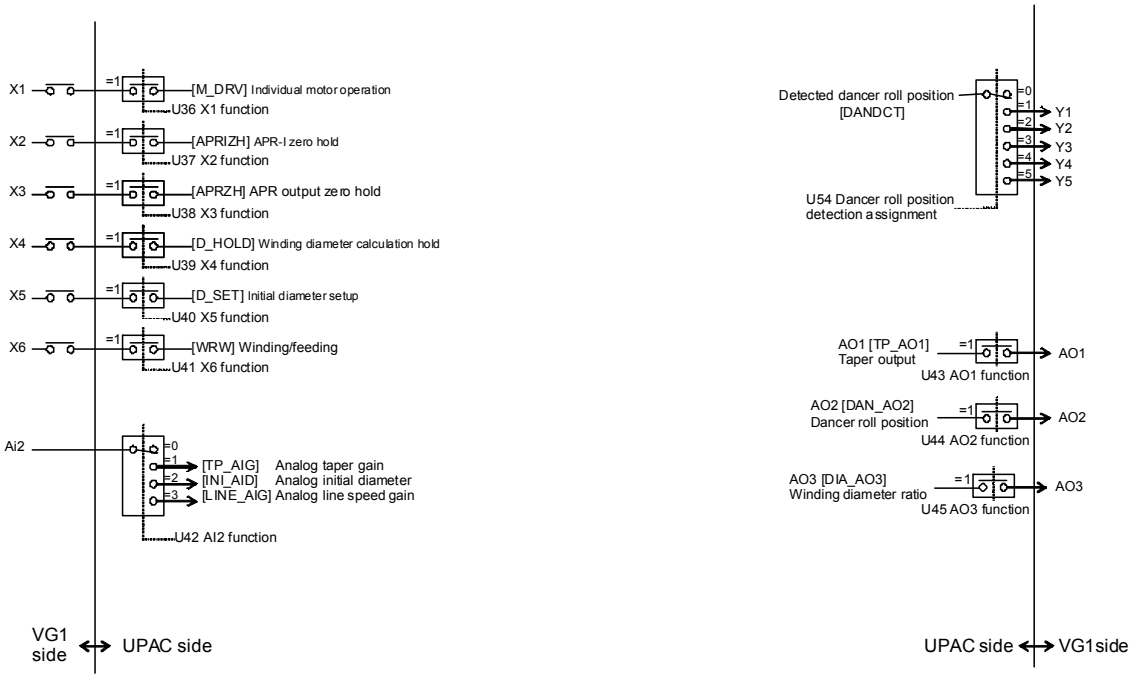


Fig. 4-1-3 Block diagram of UPAC dancer roll control software (3/4)

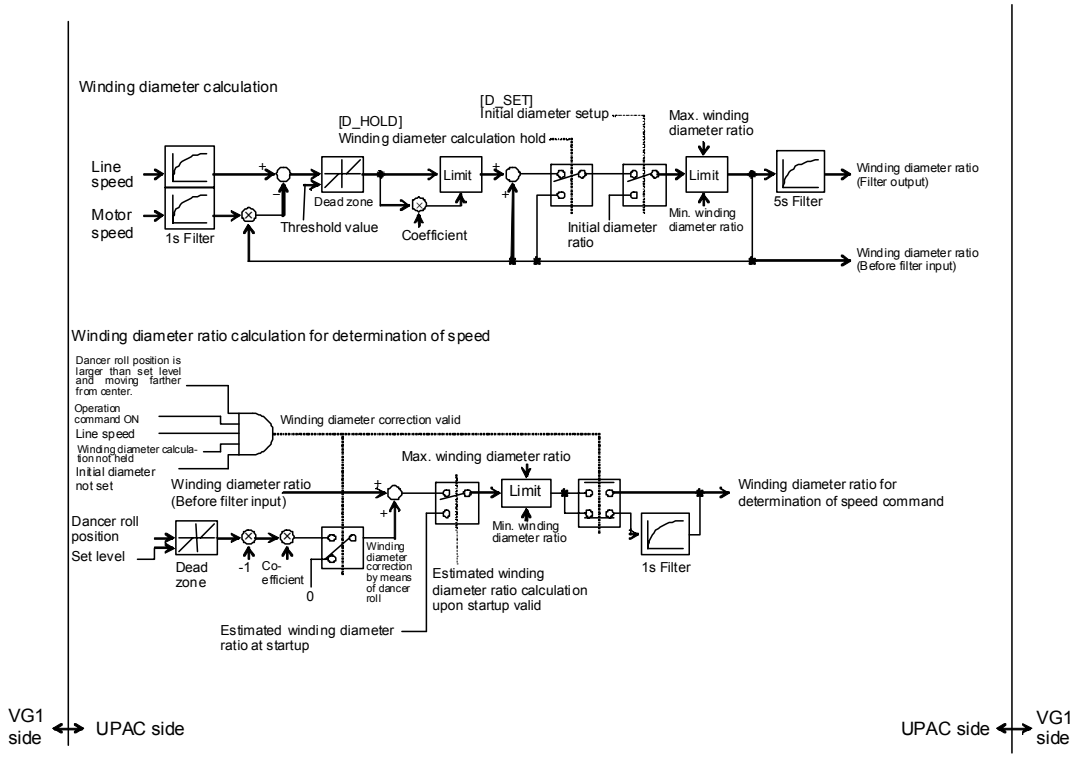


Fig. 4-1-3 Block diagram of UPAC dancer roll control software (4/4)

4.1.3 Function Code

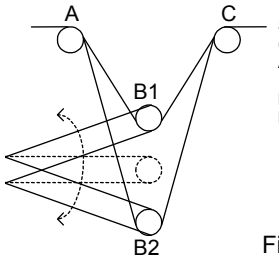
4.1.3.1 User function list

Table 4-1-2

Category	Function code	Name	LCD display (Japanese)		Effective setting range (Note 1)		Unit	Min. unit	Initial value	Change during operation	Remarks	See
Compulsory setting	U01	Max. line speed	U01	USER P1	1 to 1000	1 - 1000(m/min)	(m/min)	1	150/150(m/min)	○	Specify without fail.	4-9
	U02	Min. winding diameter (DS)	U02	USER P2	0 to 2000	0 to 2000(mm)	(mm)	1	90/90(mm)	○	Specify the winding diameter that causes the maximum motor speed.	4-9
	U03	Max. winding diameter (DL)	U03	USER P3	0 to 2000	0 to 2000(mm)	(mm)	1	1270/1270(mm)	○		4-9
	U04	Material length (Note 2)	U04	USER P4	0 to 1000	0 to 1000(mm)	(mm)	1	400/400(mm)	○	Specify without fail for estimation of the winding diameter.	4-9
	U05	Dancer roll position voltage winding: loose limit/Feeding: tight limit	U05	USER P5	-10000 to 10000	-10000 to 10000(mV) (Note 3)	(mV)	1	0/0(mV)	○	Specify the voltage across AI1 and M at the loose (winding) and tight (feeding) limits of the dancer roll position in mV.	4-9
	U06	Dancer roll position voltage winding: tight limit/Feeding: loose limit	U06	USER P6	-10000 to 10000	-10000 to 10000(mV) (Note 3)	(mV)	1	0/0(mV)	○	Specify the voltage across AI1 and M at the tight (winding) and loose (feeding) limits of the dancer roll position in mV.	4-9
	U07	Taper start winding diameter	U07	USER P7	0 to 2000	0 to 2000(mm)	(mm)	1	700/700(mm)	○	Specify "1" for U43 and "30" for E69 when taper output is used, and assign taper output to AO1.	4-9
	U08	Taper variable	U08	USER P8	0 to 100	0 to 100(%)	(%)	1	30/30(%)	○		4-9
	U09	Line speed offset	U09	USER P9	-1000 to 1000	-1000 to 1000	(mV)	1	0/0(mV)	○		4-10
	U10	Line speed gain	U10	USER P10	0 to 10000	0.000 to 10.000	(times)	1	1000/1.000(times)	○	Specify to obtain 0-to-±10 V line speed voltage across 12 and 11 if it is not 0 to ±10 V.	4-10
Adjustment element	U11	Middle winding diameter (DM)	U11	USER P11	0 to 2000	0 to 2000(mm)	(mm)	1	880/880(mm)	○		4-10
	U12	APR-Pc (DS)	U12	USER P12	0 to 10000	0.000/10.000(times)	(times)	1	100/0.100(times)	○	Gain at minimum winding diameter (DS) and constant line speed	4-10
	U13	APR-Pc (DM)	U13	USER P13	0 to 10000	0.000/10.000(times)	(times)	1	0/0.000(times)	○	Apply the same value as APR-Pc (DS) at gain setting "0" with a middle winding diameter (DM) and constant line speed.	4-10
	U14	APR-Pc (DL)	U14	USER P14	0 to 10000	0.000/10.000(times)	(times)	1	0/0.000(times)	○	Apply the same value as APR-Pc (DS) at gain setting "0" with a maximum winding diameter (DL) and constant line speed.	4-10
	U15	APR-Pad (DS)	U15	USER P15	0 to 10000	0.000/10.000(times)	(times)	1	200/0.200(times)	○	Gain at minimum winding diameter (DS) and accelerating line speed	4-10
	U16	APR-Pad (DM)	U16	USER P16	0 to 10000	0.000/10.000(times)	(times)	1	0/0.000(times)	○	Apply the same value as APR-Pad (DS) at gain setting "0" with a middle winding diameter (DM) and constant line speed.	4-10
	U17	APR-Pad (DL)	U17	USER P17	0 to 10000	0.000/10.000(times)	(times)	1	0/0.000(times)	○	Apply the same value as APR-Pad (DS) at gain setting "0" with a maximum winding diameter (DL) and constant line speed.	4-10
	U18	APR-I	U18	USER P18	0 to 10000	0.00 to 100.00(s)	(s)	1	1000/10.00(s)	○	Integration with setting "0" invalid	4-11
	U19	APR-D	U19	USER P19	0 to 1000	0.00 to 10.00(s)	(s)	1	0/0.00(s)	○	Derivation with setting "0" invalid	4-11
	U20	ASR-P (DS)	U20	USER P20	1 to 2000	0.1 to 200.0	–	1	200/20.0(times)	○	ASR-P with minimum winding diameter (DS) during stall operation in individual motor operation mode	4-12
	U21	ASR-P (DM)	U21	USER P21	1 to 2000	0.1 to 200.0	–	1	300/30.0(times)	○	ASR-P at middle winding diameter (DM)	4-12
	U22	ASR-P (DL)	U22	USER P21	1 to 2000	0.1 to 200.0	–	1	500/50.0(times)	○	ASR-P at maximum winding diameter (DL)	4-12
	U23	ASR -I (DS)	U23	USER P23	10 to 1000	0.010 to 1.000(s)	(s)	1	40/0.040(s)	○	ASR-P with minimum winding diameter (DS) during stall operation in individual motor operation mode	4-12
	U24	ASR -I (DM)	U24	USER P24	10 to 1000	0.010 to 1.000(s)	(s)	1	80/0.080(s)	○	ASR-I at middle winding diameter (DM)	4-12
	U25	ASR-I (DL)	U25	USER P25	10 to 1000	0.010 to 1.000(s)	(s)	1	80/0.080(s)	○	ASR-I at maximum winding diameter (DL)	4-12
Fine adjustment element	U26	Line speed filter	U26	USER P26	0 to 5000	0.000 to 5.000(s)	(s)	1	40/0.040(s)	○		4-13
	U27	Motor speed command filter	U27	USER P27	0 to 5000	0.000 to 5.000(s)	(s)	1	5/0.005(s)	○		4-13
	U28	Dead zone for dancer roll position input	U28	USER P28	0 to 1000	0.0 to 100.0(%)	(%)	1	0/0.0(%)	○		4-13
	U29	APR invalidation dancer roll level	U29	USER P29	0 to 50	0 to 50(%)	(%)	1	5/5(%)	○	When | dancer roll | < U29 and line speed < U34, APR is held at zero.	4-14
	U30	Bias correction	U30	USER P30	0 to 1000	0.0 to 100.0(%)	(%)	1	200/20.0(%)	○		4-14
	U31	APR-I output limit	U31	USER P31	0 to 200	0 to 200(%)	(%)	1	100/100(%)	○		4-11
	U32	APR output limit	U32	USER P32	0 to 200	0 to 200(%)	(%)	1	100/100(%)	○		4-11
	U33	Dancer roll level for application of ASR-P, I (DL)	U33	USER P33	10 to 100	10 to 100(%)	(%)	1	50/50	○	When | dancer roll position | ≥ U33, U22 is applied to ASR-P and U25 is applied to ASR-I.	4-12
	U34	Lowest line speed	U34	USER P34	1 to 100	1 - 100(m/min)	(m/min)	1	5/5(m/min)	○		4-12

Note 1: Though the setting range of U01 through U64 is from -32768 to 32767, enter the settings in the above effective setting ranges.

Note 2: Concerning U04 Material length



Specify the following distance to U04.
(Distance from A to B2 to C) - (distance from A to B1 to C)

B1: Position of dancer roll at tight limit
B2: Position of dancer roll at loose limit

Fig. 4-1-4

Note 3: Concerning U05 and U06 Dancer Roll position voltage

The U05 and U06 settings vary according to application to feeding and winding cases.

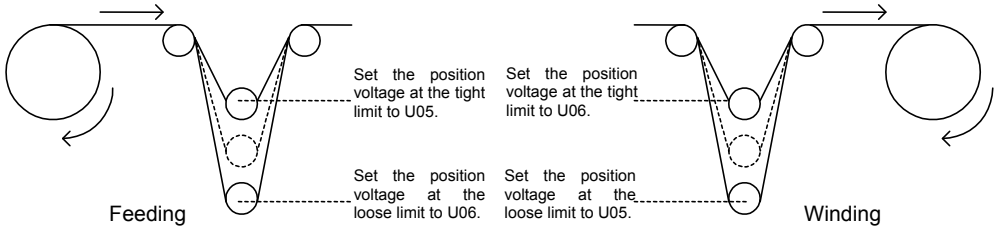


Fig. 4-1-5

Table 4-1-3

Category	Function code	Name	LCD display (Japanese)	Effective setting range (Note 1)	Unit	Min. unit	Initial value	Change during operation	Remarks	See
I/O and related items	U35	Initial diameter (DINI)	USER P35	0 to 2000 / 0 to 2000(mm)	(mm)	1	700/700(mm)	○	(1) If U35 is not zero, this setting becomes the winding diameter at startup. If U35 is zero, the above change in the winding diameter is canceled. (2) If U40 is "1" and [D-SET] is assigned to X5, the setting is written to the calculated winding diameter when X5 [D-SET] is turned on.	4-15
	U36	X1 function selection	**U36** USER P36	0:No assignment [X1-NOP] 1:Individual motor operation [M_DRV]	-	1	0	(Note 2)	Specify "25" [U-DI] at E01.	4-16
	U37	X2 function selection	**U37** USER P37	0:No assignment [X2-NOP] 1:APR-I zero hold [APRIZH]	-	1	0	(Note 2)	Specify "25" [U-DI] at E02.	4-17
	U38	X3 function selection	**U38** USER P38	0:No assignment [X3-NOP] 1:APR output zero hold [APRZH]	-	1	0	(Note 2)	Specify "25" [U-DI] at E03.	4-17
	U39	X4 function selection	**U39** USER P39	0:No assignment [X4-NOP] 1:Winding diameter calculation hold [D_HOLD]	-	1	0	(Note 2)	Specify "25" [U-DI] at E04.	4-17
	U40	X5 function selection	**U40** USER P40	0:No assignment [X5-NOP] 1:Set the initial diameter. [D_SET]	-	1	0	(Note 2)	Specify "25" [U-DI] at E05.	4-15
	U41	X6 function selection	**U41** USER P41	0:No assignment [X6-NOP] 1:Winding/feeding switching [WRW]	-	1	0	(Note 2)	Specify "25" [U-DI] at E06.	4-17
	U42	Ai2 function selection	**U42** USER P42	0:No assignment [AI2-NOP] 1:Taper variable gain: 10 VDC/100% [TP_AIG] 2:Initial diameter ratio: 10 VDC/winding diameter ratio 20 times [INI_AID] 3:Line speed gain: 10 VDC/4 folds [LINE_AIG]	—	1	1 (Taper variable gain)	(Note 2)	Specify "14" [U-AI] at E50 when setting "1" to "3" at U42.	4-9
	U43	AO1 function selection	**U43** USER P43	0:No assignment [AO1-NOP] 1:Taper output: 100%/10 VDC [TP_AO1]	-	1	1 (Taper output)	(Note 2)	Specify "30" [U-AO] at E69.	4-9
	U44	AO2 function selection	**U44** USER P44	0:No assignment [AO2-NOP] 1:Dancer roll position: ±100%/±10 V DC [DAN_AO2]	-	1	0	(Note 2)	Specify "30" [U-AO] at E70.	4-18
	U45	AO3 function selection	**U45** USER P45	0:No assignment [AO3-NOP] 1:Winding diameter ratio output: Winding diameter ratio 20 times/10 VDC [DIA_AO3]	-	1	0	(Note 2)	Specify "30" [U-AO] at E71.	4-18
Control method, etc.	U46	Correction method (PID)	**U46** USER P46	0:P+I+D 1:P+P・I+P・D	—	1	1 (P+P•I+P•D)	○		4-11
	U47	Correction method (offset)	**U47** USER P47	0:Offset for motor speed command 1:Offset for line speed	—	1	1 (Line speed)	○		4-14
	U48	Individual motor operation	**U48** USER P48	0:Dancer roll control 1:Individual motor operation	—	1	0	○	Specify "1" at U48, "0" at F01, and "0" at F02 during adjustment of the maximum speed of the winding motor.	4-16
	U49	Reverse rotation prevention	**U49** USER P49	0:Reverse rotation concerning the direction of the line is made effective. 1:Reverse rotation concerning the direction of the line is prohibited.	—	1	0	○		4-19
	U50	Operation direction switch	**U50** USER P50	0:Forward motor rotation upon FWD command, reverse motor rotation upon REV command 1:Reverse motor rotation upon FWD command, forward motor rotation upon REV command	—	1	0	(Note 2)		4-19
	U51	Speed limit	**U51** USER P51	0 to 110 / 0 to 110(%)	(%)	1	100/100(%)	○		4-19
	U52	Minimum winding diameter ratio	**U52** USER P52	10 to 100 / 10 to 100(%): "100 (%)" indicates the exact winding diameter.	(%)	1	100/100(%)	○		4-19
	U53	Initial value write judgment	**U53** USER P53	0,100: "100" upon completion of writing of initial value	—	1	—		Do not change.	-
Dancer position search	U54	Dancer roll position detection signal assignment [DANDCT]	**U54** USER P54	0:Do not assign [DANDCT] to Y1 through Y5. 1:Assign [DANDCT] to Y1. 2:Assign [DANDCT] to Y2. 3:Assign [DANDCT] to Y3. 4:Assign [DANDCT] to Y4. 5:Assign [DANDCT] to Y5.	-	1	0	(Note 2)	Specify "25" [U-DO] at E15 Specify "25" [U-DO] at E16 Specify "25" [U-DO] at E17. Specify "25" [U-DO] at E18. Specify "25" [U-DO] at E19.	4-20
	U55	Dancer roll position detection level	**U55** USER P55	0 to 100 / 0 to 100(%)	(%)	1	100/100(%)	○	When the dancer roll position is within this setting, [DANDCT] turns on.	4-20
	U56		**U56** USER P56							-
	U57		**U57** USER P57							-
	U58		**U58** USER P58							-
	U59		**U59** USER P59							-
	U60		**U60** USER P60							-
	U61		**U61** USER P61							-
	U62		**U62** USER P62							-
	U63		**U63** USER P63							-
	U64	Version information	**U64** USER P64		1	1	110□□			-

Note 1: Though the setting range of U01 through U63 is from -32768 to 32767, enter the settings in the above effective setting ranges.

Note 2: Change the setting during stoppage.

4.1.3.2 Other function codes

Table 4-1-4

Function code	Name	LCD display (Japanese)		Effective setting range		Unit	Min. unit	Initial value	Change during operation	Remarks	See
F01	Speed setting N1	**F01**	Speed setting N1	0 to 7	0: Speed setting entered at the keypad is valid. 2: Setting input at terminal 12 [0 to +10 V] is valid.	-	1	0	X	During regular operation: During maximum speed of winding motor: Specify "1" at U48, "0" at F01, and "0" at F02. Specify "0" at U48, "2" at F01, and "1" at F02.	-
F02	Operation method	**F02**	Operation	0 to 1	0: Operation command entered at the keypad is effective. 1: Operation command entered from the FWD or REV terminal is effective.	-	1	0	X		-
F03	M1 maximum speed	**F03**	M1 max. speed	50 to 24000		r/m	1	1500	X	Specify the motor speed that can achieve the "maximum line speed" (U01) with the "minimum winding diameter" (U02).	-
F61	ASR1-P (gain)	**F61**	USER P6	0.1 to 200.0	UPAC overwrites data.	(times)	0.1	10.0	○	Write a value suitable for the winding diameter from UPAC.	-
F62	ASR 1-I (integration constant)	**F62**	ASR1-I	0.010 to 1.000	UPAC overwrites data.	(s)	0.001	0.200	○		
E01	X1 function selection	**E01**	X1 function	0 to 63		-	1	0	X	When U36 is "1," specify "25" [U-DI].	4-16
E02	X2 function selection	**E02**	X2 function	0 to 63		-	1	1	X	When U37 is "1," specify "25" [U-DI].	4-17
E03	X3 function selection	**E03**	X3 function	0 to 63		-	1	2	X	When U38 is "1," specify "25" [U-DI].	4-17
E04	X4 function selection	**E04**	X4 function	0 to 63		-	1	3	X	When U39 is "1," specify "25" [U-DI].	4-17
E05	X5 function selection	**E05**	X5 function	0 to 63		-	1	4	X	When U40 is "1," specify "25" [U-DI].	4-15
E06	X6 function selection	**E06**	X6 function	0 to 63		-	1	5	X	When U41 is "1," specify "25" [U-DI].	4-17
E09	X9 function selection	**E09**	X9 function	0 to 63	***Specify "9" [THR] (external alarm).***	-	1	9	X	Assign to the external alarm input.	-
E14	X terminal function normally open/closed	**E14**	X normal setting	0000 to 01FF	***Specify the part of 9 (X9) on CL side.***	-	1	0000	X	The X9 (external alarm) terminal becomes a normally closed terminal.	-
E15	Y1 function selection	**E15**	Y1 function	0 to 47		-	1	1	X	When U54 is "1," specify "25" [U-DO].	4-20
E16	Y2 function selection	**E16**	Y2 function	0 to 47		-	1	2	X	When U54 is "2," specify "25" [U-DO].	4-20
E17	Y3 function selection	**E17**	Y3 function	0 to 47		-	1	3	X	When U54 is "3," specify "25" [U-DO].	4-20
E18	Y4 function selection	**E18**	Y4 function	0 to 47		-	1	4	X	When U54 is "4," specify "25" [U-DO].	4-20
E19	Y5 function selection	**E19**	Y5 function	0 to 47		-	1	14	X	When U54 is "5," specify "25" [U-DO].	4-20
E49	Ai1 function selection	**E49**	Ai 1 function	0 to 18	***Specify "14" [U-AI].***	-	1	0	X	Assign for dancer roll position input.	-
E50	Ai2 function selection	**E50**	Ai 2 function	0 to 18		-	1	0	X	When U42 is not "0," specify "14" [U-AI].	4-9
E69	AO1 function selection	**E69**	AO1 function	0 to 31		-	1	1	○	When U43 is "1," specify "30" [U-AO].	4-9
E70	AO2 function selection	**E70**	AO2 function	0 to 31		-	1	6	○	When U44 is "1," specify "30" [U-AO].	4-18
E71	AO3 function selection	**E71**	AO3 function	0 to 31		-	1	3	○	When U45 is "1," specify "30" [U-AO].	4-18
H02	All save function	**H02**	All save	0,1	***Download the UPAC software, specify "1" at o38, and save the initial data.***	-	1	0	X	After specifying "1" at o38, STOP + ∧ to specify "1" to save all initial U code data.	-
o38	UPAC start/stop	**o38**	UPAC operation	0 to 2	***Specify "1" at o38.***	-	1	0	X	Specify "1" at o38.	-
o40	UPAC Address	**o40**	UPAC address	100 to 255		-	1	100	X	Specify the same "communication setting: RS485 station number" in the UPAC system definition as o40.	-

4.1.3.3 Description of each function code

U01	Max. line speed	Setting: 0 to 1,000/0 to 1,000(m/min)

◆ Used for indication of the [line speed] in option monitor 4 and for calculation of estimated winding diameter ratio at startup.

U02	Min. winding diameter (DS)	Setting: 0 to 2,000/0 to 2,000(mm)

◆ Used for calculation of the [calculated winding diameter] in option monitor 3. Specify the minimum winding diameter that can be installed to the winding shaft.

◆ The relationship among [M1 max. speed] (F03), [max. line speed] (U01), and [min. winding diameter] (U02) is as shown below.

F03 [M1. max. speed] = U01 [max. line speed]/π/speed reduction ratio (< 1)/U02 [min. winding diameter]

U03	Max. winding diameter (DL)	Setting: 0 to 1,000/0 to 1,000(mm)

◆ Setting point for the upper limit of the calculated winding diameter and the taper variable of taper output.

U04	Material length	Setting: 0 to 1,000/0 to 1,000(mm)

◆ Used for calculation of the estimated winding ratio at startup.
The winding diameter ratio is estimated from this setting, variation in the dancer roll position input to the Ai1 terminal, and the number of pulses of the motor PG.

◆ If this setting is "0," calculation of the estimated winding diameter ratio during startup is not made.

U05	Dancer roll position voltage Winding: loose limit/feeding: tight limit	Setting: -10,000 to 10,000/ -10,000 to 10,000(mV)
U06	Dancer roll position voltage Winding: tight limit/feeding: loose limit	Setting: -10,000 to 10,000/ -10,000 to 10,000(mV)

◆ Specify the input voltage at Ai1 when the dancer roll is at the loose or tight limit.
When the input voltage at Ai1 is at this setting, the dancer roll position is supposed to be the ±100% position.

◆ When the middle voltage between the loose and tight limits is input, the center position of the dancer roll is supposed.

◆ The setting parameter varies according to the attaching position of the dancer roll between the winding machine and feeding machine.

Machine	Voltage at loose limit	Voltage at tight limit
Winding machine	U05	U06
Feeding machine	U06	U05

U07	Taper start winding diameter	Setting: 0 to 2,000/0 to 2,000(mm)
U08	Taper variable	Setting: 0 to 100/0 to 100 (%)
U42	Ai2 function selection	Setting: 0 to 3
U43	AO1 function selection	Setting: 0 and 1
E50	Ai2 function selection	Setting: 0 to 18
E69	AO1 function selection	Setting: 0 to 31

With this function, a taper characteristic voltage suitable for the winding diameter is output.

◆ To use this function, U43 must be "1" and E69 must be "30," and taper output [TP_AO1] must be assigned to AO1.

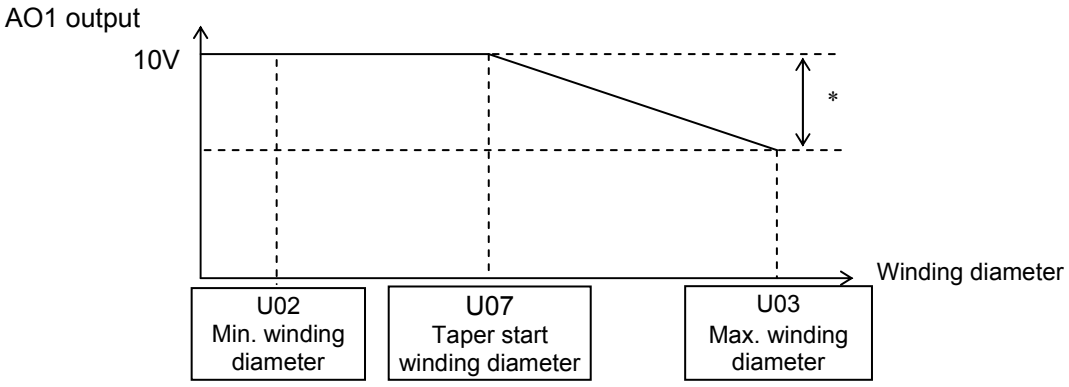


Fig. 4-1-6

(1) When U43 is "1" and E50 is "14," the input at Ai2 becomes the gain concerning the [taper variable] (U08).
Taper variable = U08 [taper variable] x input at Ai1 (V)/10 (V)

(2) Other than above (1)
Taper variable = U08 [taper variable]

* The output voltage at AO1 is smaller as the taper variable is larger.

U09	Line speed offset	Setting: -1,000 to 1,000/-1,000 to 1,000
U10	Line speed gain	Setting: 0 to 10,000/0 to 10.000 (Multiplication)

◆ Use this function to correct the line speed (input across 12 and 11) to the 10 (V) line speed specification.

Example: When 0.5 (V) is obtained at the "0" line speed and 7.5 (V) is obtained at the maximum line speed
U09 [line speed offset] = -500: Correction of 0.5 (V)
U10 [line speed gain] = 10/(7.5 - 0.5) x 1,000 = 1,429 (1,429 times)

U11	Middle winding diameter (DM)	Setting: 0 to 2,000/0 to 2,000(m/min)
U12	APR-Pc(DS)	Setting: 0 to 10,000/0.000 to 10.000 (Multiplication)
U13	APR-Pc(DM)	Setting: 0 to 10,000/0.000 to 10.000 (Multiplication)
U14	APR-Pc(DL)	Setting: 0 to 10,000/0.000 to 10.000 (Multiplication)
U15	APR-Pad(DS)	Setting: 0 to 10,000/0.000 to 10.000 (Multiplication)
U16	APR- Pad (DM)	Setting: 0 to 10,000/0.000 to 10.000 (Multiplication)
U17	APR- Pad (DL)	Setting: 0 to 10,000/0.000 to 10.000 (Multiplication)

◆ Concerning APR-P
With the APR (Auto Position Regulator)-P term, the deviation of the dancer roll position input multiplied by the setting is output.

◆ The gain (Pc) at the constant line speed and the gain (Pad) during acceleration and deceleration can be individually specified.

◆ Values at the three points (minimum winding diameter (DS), middle winding diameter (DM), and maximum winding diameter (DL) can be specified.
When the settings (U13, U14, U16 and U17) at the middle winding diameter (DM) and the maximum winding diameter (DL) are specified at "0," the settings (U12 and U15) for the minimum winding diameter (DS) is applied to the maximum winding diameter. (Flat characteristic)

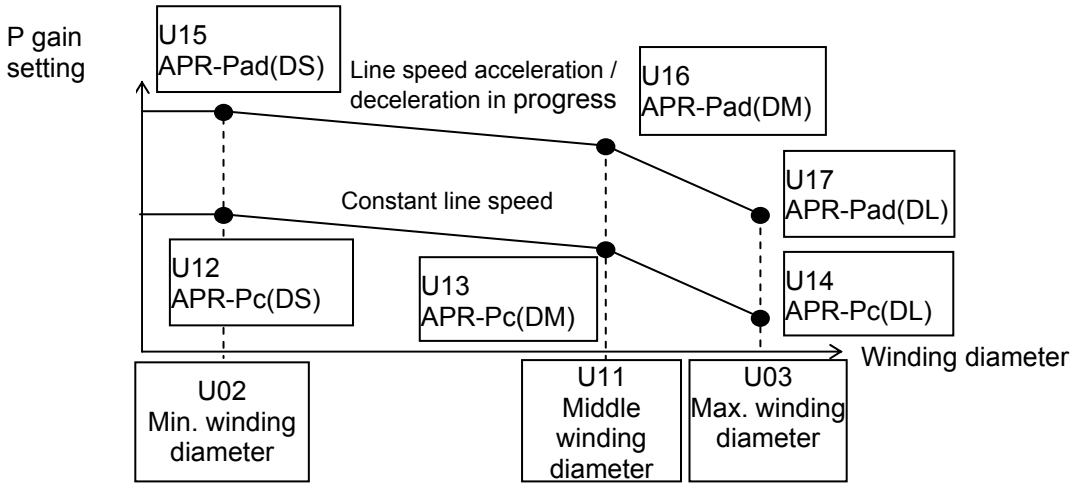
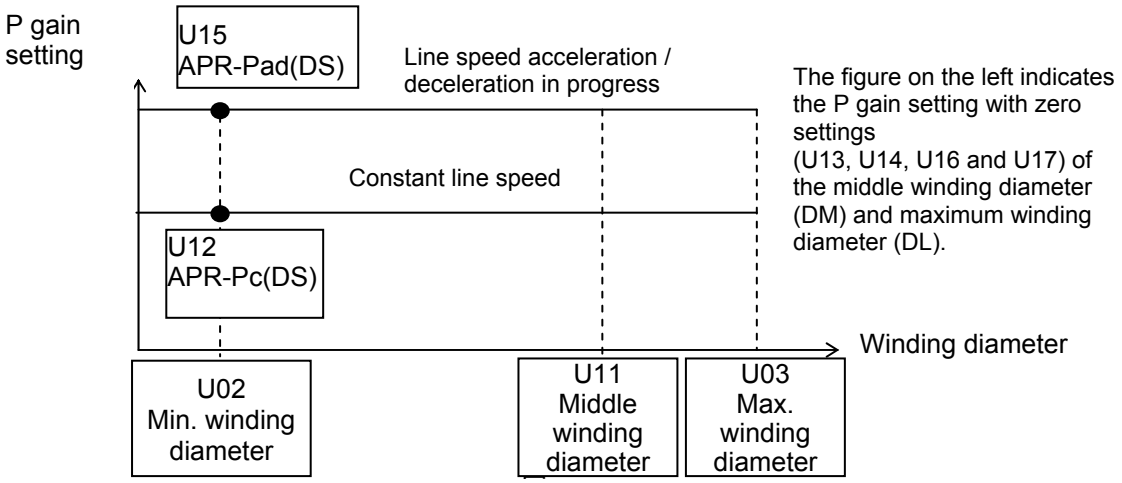


Fig. 4-1-7



The figure on the left indicates the P gain setting with zero settings (U13, U14, U16 and U17) of the middle winding diameter (DM) and maximum winding diameter (DL).

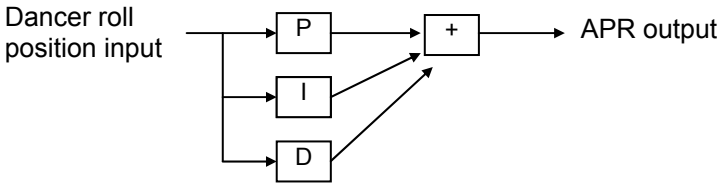
Fig. 4-1-8

U18	APR-I	Setting: 0 to 1,000/0.00 to 10.00(s)
U19	APR-D	Setting: 0 to 1,000/0.00 to 10.00(s)
U31	APR-I output limit	Setting: 0 to 200/0 to 200(%)
U32	APR output limit	Setting: 0 to 200/0 to 200(%)
U46	Correction method (PID)	Setting: 0 and 1

◆ Integration (APR-I) or differentiation (APR-D) is made for the deviation in the input of the dancer roll position.
The functions of U18 and U19 are canceled if the setting is zero.

◆ Use the U46 setting to change the integration and differentiation inputs.

U46 = 0: Suppose that the APR-I and APR-D inputs are dancer roll input positions.



U46 = 1: Suppose APR-I and APR-D inputs are APR-P outputs.

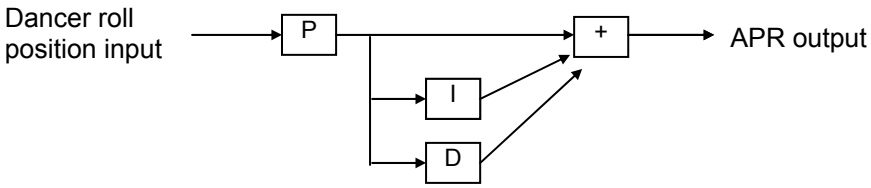


Fig. 4-1-9

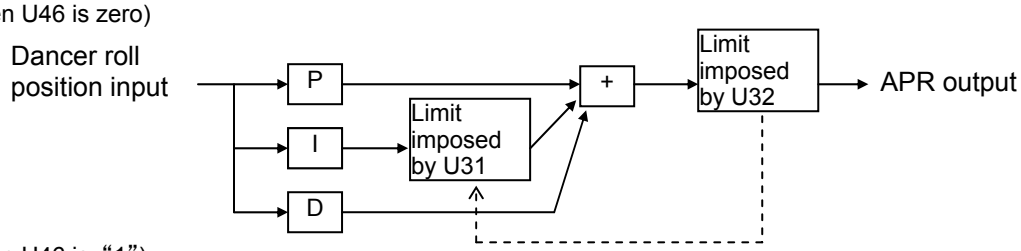
◆ Limitation in ASR output

U31 sets a limit in the APR-I output, and U32 sets a limit in the APR output (with additional P, I, D value).

The percent value of the limit indicates the level of the dancer roll position input.

If U32 (APR output limit) < U31 (APR-I output limit), the APR-I output is limited to the U32 (APR output limit) value.

(When U46 is zero)



(When U46 is "1")

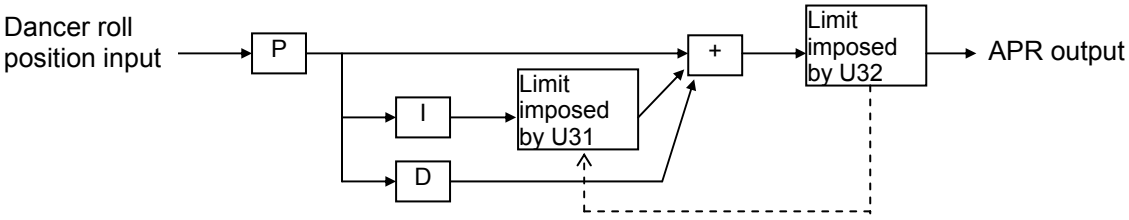


Fig. 4-1-10

U20	ASR-P(DS)	Setting: 1 to 2,000/0.1 to 200.0 (Multiplication)
U21	ASR -P(DM)	Setting: 1 to 2,000/0.1 to 200.0 (Multiplication)
U22	ASR -P(DL)	Setting: 1 to 2,000/0.1 to 200.0 (Multiplication)
U23	ASR -I(DS)	Setting: 10 to 1,000/0.010 to 1.000(s)
U24	ASR -I(DM)	Setting: 10 to 1,000/0.010 to 1.000(s)
U25	ASR -I(DL)	Setting: 10 to 1,000/0.010 to 1.000(s)
U33	Dancer roll level for application of APR-P, I (DL)	Setting: 10 to 100/10 to 100(%)
U34	Lowest line speed	Setting: 1 to 100/1 to 100(m/min)

Concerning ASR-P and -I

◆ As the winding diameter increases, the inertia (machine constant) of the machine becomes larger. Therefore ASR-P and -I must be set at ones suitable for the winding diameter.

◆ ASR-P and -I are prepared for each of the minimum winding diameter (DS), middle winding diameter (DM) and maximum winding diameter (DL).

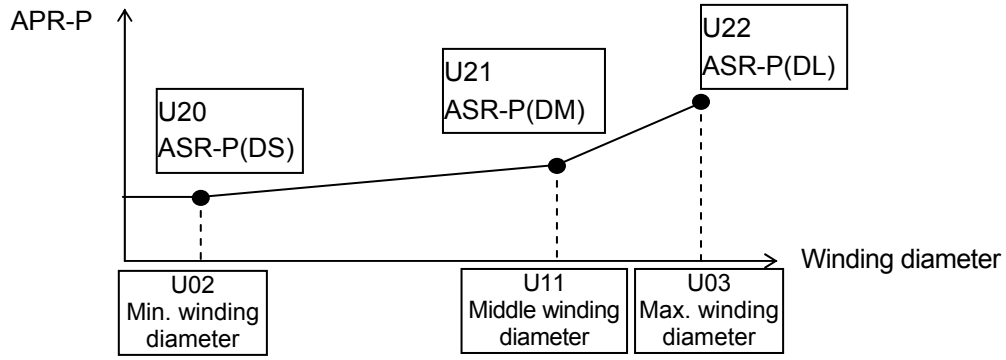


Fig. 4-1-11

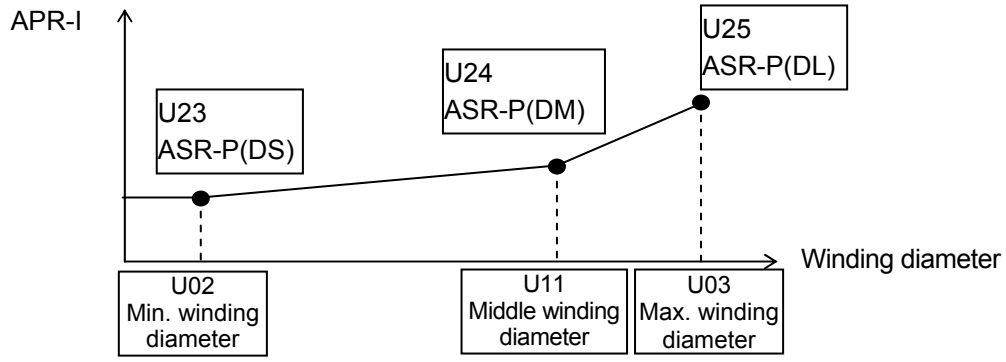


Fig. 4-1-12

◆ Concerning ASR-P and -I during line stoppage

ASR-P and -I at a line speed smaller than the [lowest line speed] (U34) are adjusted to U20 (ASR-P) and U23 (ASR-I) equivalent to the minimum winding diameter (DS) without relations to the current winding diameter. (This is to prevent the winding shaft from moving slightly during stoppage of the line.)

◆ Adjustment of ASR-P and -I according to position of dancer roll [Application when the current winding diameter ≥ middle winding diameter (DM)]

The dancer roll must be returned to the center quickly if it is far from the center. If the winding diameter is large, the mechanical inertia is large, too, so that ASR-P must be increased.

If the current winding diameter is equal to or larger than the middle winding diameter (DM) and the danger roll position is equal to or larger than U33 [dancer roll level for application of ASR-P and -I (DL)], ASR-P and -I are made U22 (ASR-P) and U25 (ASR-I) for the maximum winding diameter (DL).

If the above-mentioned "line stoppage" and "danger roll position" conditions overlap (for example, if the dancer roll position is larger than U33 after controlled stop at a large winding diameter), the "dancer roll" condition is given priority and ASR-P and -I for the maximum winding diameter (DL) are applied.

U26	Line speed filter	Setting: 0 to 5,000/0.000 to 5.000(s)
U27	Motor speed command filter	Setting: 0 to 5,000/0.000 to 5.000(s)

◆ The [line speed filter] (U26) is a filter applied to the line speed that is input across 12 and 11.

Use this filter if there is fluctuation in the line speed signal issued by the sender.

◆ The [motor speed command filter] (U27) is a filter applied to the motor speed command calculated with UPAC.

Use it when hunting is observed in the motor.

U28	Dead zone for dancer roll position input	Setting: 0 to 1,000/0.0 to 100.0(%)

◆ Use the setting if there is variation in the dancer roll position input (across Ai1 and M) around the center to prevent the dancer roll from becoming stable.

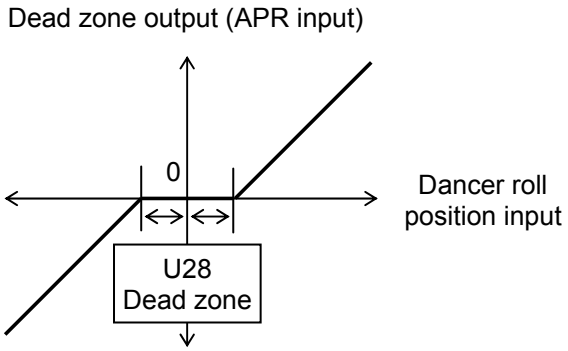


Fig. 4-1-13

U29	APR invalidation dancer roll level	Setting: 0 to 50/0 to 50(%)
U34	Lowest line speed	Setting: 1 to 100/1 to 100(m/min)

◆ If there is slight fluctuation in the dancer roll position during stoppage of the line, integration or other correction measures may function, causing slight motion of the motor.

To avoid such phenomenon, the APR output is held at zero if the dancer roll position is smaller than [APR invalidation dancer roll level] (U29) to prevent the motor from slight motions.

◆ The line stoppage judgment is made in comparison between the line speed input (across 12 and 11) and [lowest line speed] (U34). Line stoppage is judged if the line speed is smaller than U34.

U30	Bias correction	Setting: 0 to 1,000/0.0 to 100.0(%)
U47	Correction method (offset selection)	Setting: 0 and 1

The APR output is multiplied by the line speed to produce the offset. A sufficient offset cannot be obtained if the line speed is zero (line stoppage) or it is low. Therefore a "high selector" (priority is given on the higher one) setting is prepared for the line speed multiplied by the APR, so that a sufficient offset can be obtained even if the line speed is low.

◆ Concerning correction method

Selection between the offset (⊿V*) as to the line speed and motor speed command (⊿N*) can be made for the offset of the dancer roll. The "offset" displayed at [option monitor 6] changes between the line speed and motor speed according to the setting at the [correction method (offset selection)] (U47).

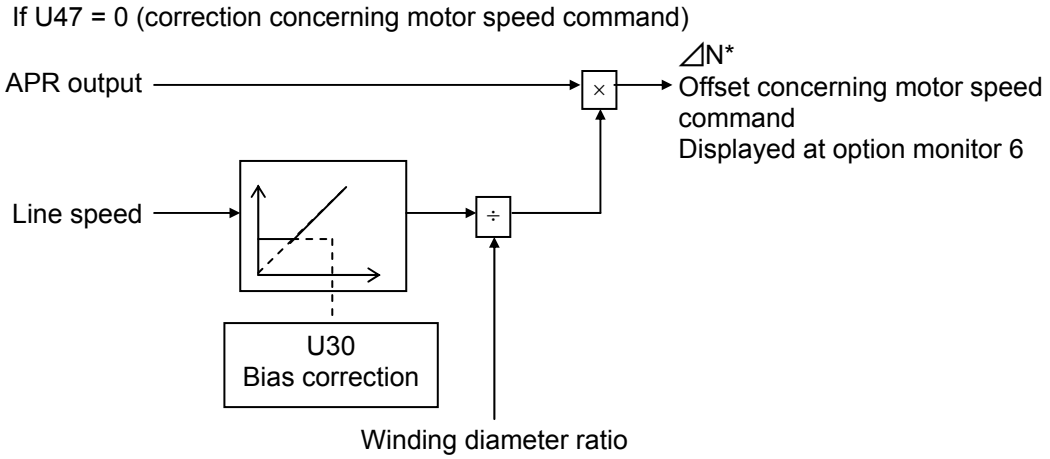


Fig. 4-1-14

If U47 = 0 (correction concerning motor speed

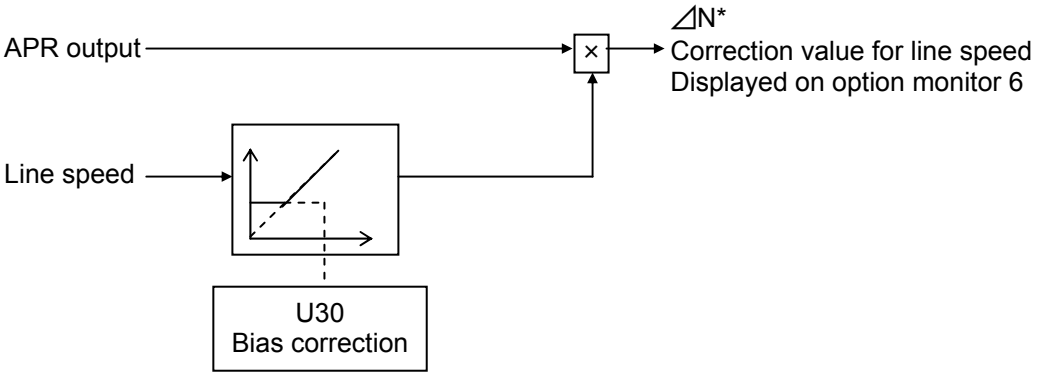


Fig. 4-1-15

U35	Initial diameter	Setting: 0 to 2,000/0 to 2,000(mm)
U40	X5 function selection	Setting: 0 and 1
E05	X5 function selection	Setting: 0 to 63

◆ Calculated winding diameter at startup based on initial diameter

If [initial diameter] (U35) is not zero

When an operation command (FWD, REV) is issued, the calculated winding diameter immediately becomes the winding diameter specified at U35.

When the operation command is stopped, a new winding diameter is judged and operation starts at the initial diameter.

The winding diameter at startup can be adjusted to a middle diameter with these settings for stable motor speed command at startup. (If the previous winding diameter is almost the minimum winding diameter and the actual winding diameter is around the maximum winding diameter, the motor speed command increases substantially, causing large shock.)

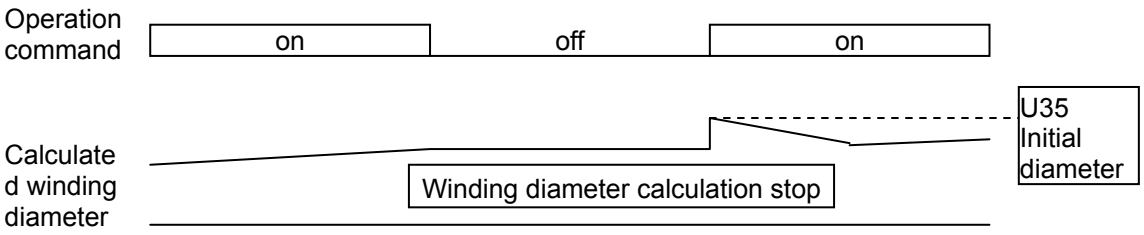


Fig. 4-1-16

If U35 [initial diameter] setting = 0

If the[initial diameter] (U35) setting is zero, the calculated winding diameter remains the previous value and operation starts even when the operation command (FWD, REV) is issued.

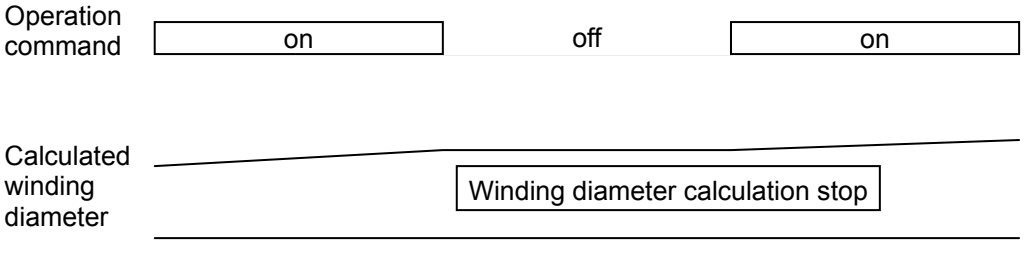


Fig. 4-1-17

◆ Initial value setting through contact input

When the new winding diameter is already known, assign [initial diameter set] to contact input X5 to set the winding diameter (initial diameter: U35) to the calculated winding diameter while this signal is issued.

Setting for assigning initial diameter set [D_SET] to X5

U40=1
E05=25[U-DI]

* Note: Use a temporary command for the X5 signal assigned to the initial diameter setting. If the signal remains turned on, the calculated winding diameter is fixed at the [initial diameter] (U35).

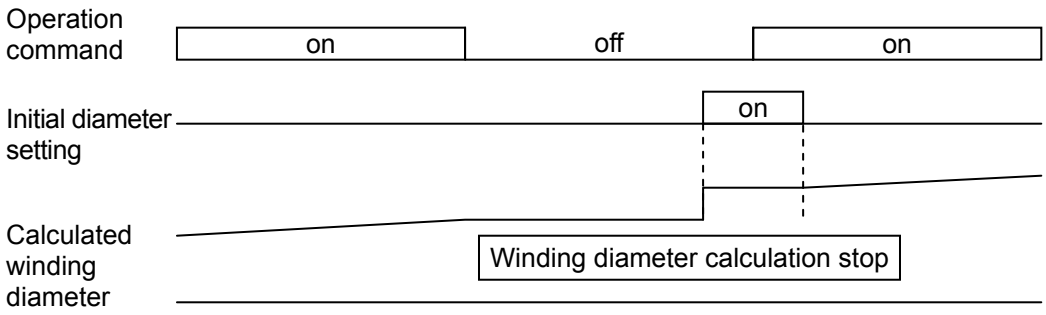


Fig. 4-1-18

U36	X1 function selection	Setting: 0 and 1
U48	Individual motor operation switching	Setting: 0 and 1
E01	X1 function selection	Setting: 0 to 63

◆ Dancer roll control and individual motor operation switching

Individual motor operation indicates an operation method without dancer roll control or winding diameter calculation, where only speed commands are given.

The switching method between dancer roll control operation and individual motor operation includes two variations: contact input X1 and parameter.

◆ Contact input switching

Assign the individual motor operation [M_DRV] to X1 in the following setting.

After assignment, the individual motor operation mode continues while X1 [M_DRV] remains turned on.

U36=1
E01=25[U-DI]

◆ Parameter switching

Specify "1" at [individual motor operation switch] (U48) to start the individual motor operation mode.

(Specify "0" at [individual motor operation switch] (U48) to start the dancer roll control operation mode.)

* The individual motor operation mode starts when X1 [M_DRV] is turned on or U48 is "1."

U37	X2 function selection	Setting: 0 and 1
E02	X2 function selection	Setting: 0 to 63

◆ APR-I output zero hold

Assign APR-I zero hold [APRIZH] to X2 in the following settings.

After assignment, the APR-I output is held at zero while X2 [APRIZH] is turned on.

U37=1
E02=25[U-DI]

U38	X3 function selection	Setting: 0 and 1
E03	X3 function selection	Setting: 0 to 63

◆ APR output zero hold

Assign APR zero hold [APRIZH] to X3 in the following settings.

After assignment is made, the APR-I output is held at zero while X3 [APRZH] is turned on.

U38=1
E03=25[U-DI]

The APR-I integration value, too, is held at zero when X3 [APRZH] is turned on.

U39	X4 function selection	Setting: 0 and 1
E04	X4 function selection	Setting: 0 to 63

◆ Winding diameter calculation hold

Assign winding diameter calculation hold [D_HOLD] to X4 in the following settings.

After assignment, the previous value of the calculated winding diameter is held while X4 [D_HOLD] is turned on.

U39=1
E04=25[U-DI]

U41	X6 function selection	Setting: 0 and 1
E06	X6 function selection	Setting: 0 to 63

◆ Winding/feeding switching

Use the setting in a system where a feeding roll, idler, and winding roll are included and there are two line directions, to switch the line direction.

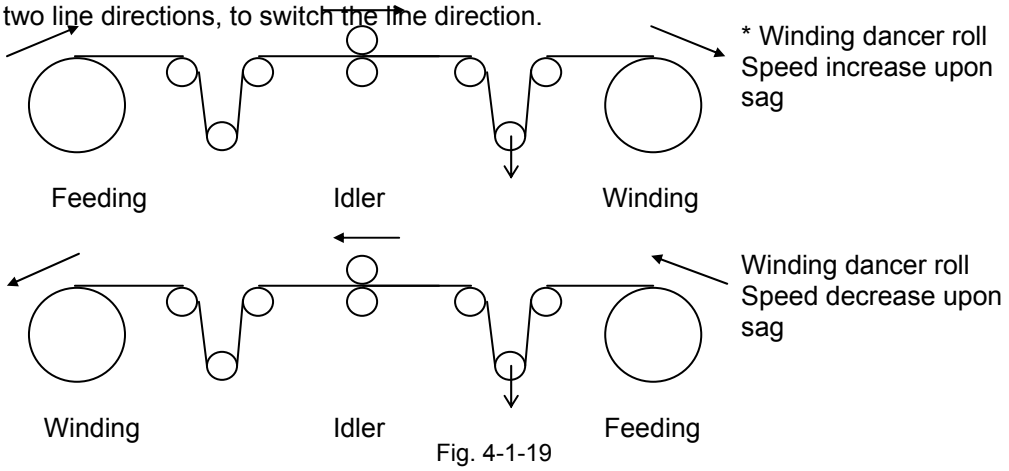


Fig. 4-1-19

As described at the * mark, after the line direction changes and the winding roll and the feeding roll are exchanged in role, the correction polarity of the dancer roll becomes reverse, therefore X6 [WRW] must be used to switch the polarity of the dancer roll position input. Specify both rolls (winding and feeding rolls on the left and right of the above figure) as a winding roll when specifying the dancer roll position input at U05 and U06.

U41=1
E06=25[U-DI]

U42	Ai2 function selection	Setting: 0 to 3
E50	Ai2 function selection	Setting: 0 to 18

◆ Select assignment of Ai2.

To specify 1 to 3 at U42 to assign Ai2 for dancer roll control, E50 [Ai2 terminal function] must be specified at "14" [U-Ai].

U42 = 0: No assignment
U42 = 1: Taper variable gain [TP_AIG]
U42 = 2: Initial diameter ratio [INI_AID]

When the above settings are given, an input at Ai2 determines the initial diameter instead of the initial diameter specified at U35.

Effective when X5 [D_SET] is turned on, 20 times winding diameter ratio upon +10 VDC input.

U42 = 3: Line speed gain [LINE_AIG]

Specify the gain for the line speed input across 12 and 11, using the input at Ai2. The setting is multiplied by four upon +10 VDC.

U44	AO2 function selection	Setting: 0 and 1
E70	AO2 function selection	Setting: 0 to 31

◆ Dancer roll position output

The current dancer roll position is output at AO2. These settings are used for indication of the dancer roll position at an instrument.

The output is +10 VDC for dancer a roll position of 100%.

Assign the dancer roll position [DAN_AO2] to AO2 in the following settings.

U44=1
E70=30[U-AO]

U45	AO3 function selection	Setting: 0 and 1
E71	AO3 function selection	Setting: 0 to 31

◆ Winding diameter ratio output

The calculated current winding diameter ratio is output at AO3. The output is +10 VDC when the winding diameter ratio is 20 times.

Assign the winding diameter ratio output [DIA_AO3] to AO3 in the following settings.

U45=1
E71=30[U-AO]

U49	Reverse rotation prevention function	Setting: 0 and 1

◆ Select the correction method for a tight dancer roll during stoppage of the line.

U49 = 0: Reverse rotation in the line direction is valid

When the dancer roll is at position A in a tight state as shown in the figure below, the winding motor is reversed in the line direction to return the dancer roll to the center.

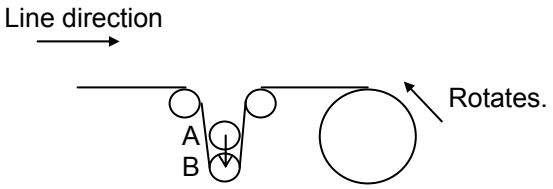


Fig. 4-1-20

U49 = 1: Prohibit reverse rotation in line direction.

If the dancer roll is at position A in a tight state as shown in the figure below, rotation of the winding motor is limited. Use this function to limit the rotation in the loosening direction, such as for metallic materials.

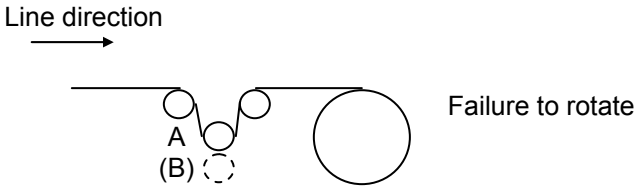


Fig. 4-1-21

U50	Operation direction switching	Setting: 0 and 1

◆ Use the setting to reverse the motor with an FWD command.

U50 = 0: FWD command for forward motor rotation, REV command for reverse motor rotation

U50 = 1: FWD command for reverse motor rotation, REV command for forward motor rotation

* Change the parameter during stoppage.

U51	Speed limit	Setting: 0 to 110/0 to 110(%)
U52	Minimum winding diameter ratio	Setting: 10 to 100/10 to 100(%)

◆ Speed limit

The limit applies to the motor speed command added with the dancer roll speed offset.

◆ Minimum winding diameter ratio

The minimum winding diameter, which is specified at the [minimum winding diameter] (U02) during regular operation, can be specified in % of the U02 setting, with "1" being the minimum winding diameter ratio.

The value specified in this parameter is the lowest limit of the minimum calculated winding diameter.

U54	Dancer roll position detection signal assignment Setting: 0 to 5
U55	Dancer roll position detection level Setting: 0 to 100/0 to 100(%)
E15	Y1 function selection Setting: 0 to 47
E16	Y2 function selection Setting: 0 to 47
E17	Y3 function selection Setting: 0 to 47
E18	Y4 function selection Setting: 0 to 47
E19	Y5 function selection Setting: 0 to 47

◆ The dancer roll position is detected and output in an on/off DO output signal [DANDCT].

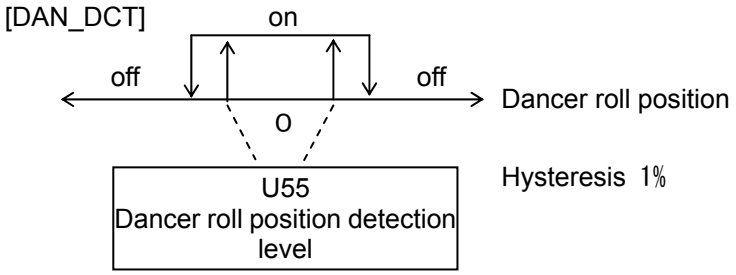


Fig. 4-1-22

Specify the parameter (E15 to E19) settings of the assigned DO output at "25" [U-DO] and set U54 as shown below.

U54 = 0: No assignment to Y1 to Y5
U54 = 1: Assign to Y1
U54 = 2: Assign to Y2
U54 = 3: Assign to Y3
U54 = 4: Assign to Y4
U54 = 5: Assign to Y5

4.1.3.4 Option monitor

Table 4-1-5

Function code	Name	LCD display (Japanese)	Data displaying range	Unit	Min. unit	Remarks
OP1						
OP2						
OP3	Calculated winding diameter	Option monitor 3	0 to 2000 0 to 2000(mm)	(mm)	1	
OP4	Line speed	Option monitor 4	0 to 1000 0 to 1000(m/min)	(m/min)	1	
OP5	Dancer roll position	Option monitor 5	-200 to 200 -200 to 200(%)	(%)	1	When a voltage specified at U05 or U06 is input, ±100 (%) is displayed.
OP6	Offset	Option monitor 6	-100 to 100 -100 to 100(%)	(%)	1	The maximum line speed or maximum motor speed is assumed to be 100%.

4.2 WPS-VG1-POS

WPS-VG1-POS is packaged software for controlling the orientation position.
(Windows Personal Computer Software Package-Position control system on FRENIC-VG)

The features of the package are:

- The encoder resolution can be selected from seven options of 128, 256, 512, 1024, 2048, 4096, and 8192 according to the requirement of the stopping accuracy of the machine shaft.
- Four stopping position commands can be preset inside, among which the target one is selected with a contact.
- The stopping position command can be given externally from our MICREX series PLC, 16-point digital input, RS485 communication via POD or the like, or CC Link. The stopping position latch function can be used to stop at multiple points.
- Because the orientation function is implemented by the UPAC option, all the standard functions of the FRENIC-VG inverter can be used without limitations.

To realize the orientation function, the OPC-VG1-PG option is necessary in addition to the UPAC option. For the hardware specification, installation method and other details of the option, refer to the FRENIC-VG User's Manual.

This packaged software is included in the CD-ROM of WPS-VG1-PCL (loader software) and provided free of charge. You may download the software from our website. To configure a system using this package, agreement with the following description is necessary.

[Terms of Agreement]
You are requested to agree to the following items.
If you do not agree to them, do not use WPS-VG1-POS packaged software.
For inquiries about the agreement items, contact our sales person.

---

(1) Function codes UNO. 01 through 63 used for orientation control are set at "0" before shipment from our factory. The user must change the setting of necessary parameters voluntarily according to the purpose.

(2) The battery included in the UPAC is needed to back up the data. The lifetime of the battery is five years (at 25°C). The battery life is reduced during operation at higher temperatures. When the battery life is reached, UPAC alarm "ErA" is displayed. If this alarm is displayed, change the battery soon. For the battery replacement method, refer to the corresponding part of this manual.

(3) If noise or vibration occurs due to resonance in the mechanical system or play in the gear, the mechanical system must be examined and adjusted. If the noise is not reduced after adjustment of the mechanical system, electrical countermeasures must be taken, so that the standard functions of FRFENIC-VG, gain and integration time of dancer control, filter and other parameters are used for adjustment. Please note that we will not meet requests to add special control applications to UPAC or to the main body of FRFENIC-VG.

(4) You are not allowed by the copyright law to duplicate, rent, or resell the entire or a part of the program.

(5) There are no limitations to voluntary addition, change, or deletion by the customer for program development based on this dancer control program. We will provide technical support and consultation on developing programs.

(6) We will assume no responsibility for the direct or indirect material loss or damage caused by the WPS-VG1-POS program itself or change, addition or deletion to the program.

I agree the terms above (Your signature here)

4.2.1 System Consideration

4.2.1.1 Specifications

Table 4-2-1

Item		Orientation specification
Model of option card		OPC-VG1-UPAC OPC-VG1-PG(PD)
Package Software		Orientation package. Version 13□□□ □□□ refers to 009 or higher numbers (displayed at function code UNO. 01, 64)
Stopping position		Stopping position setting = external stopping position setting + internal stopping position setting For example, with 30° internal and 10° external commands, 40°.
	External stopping position setting	Any of the following interface can be used to set. (1) OPC-VG1-TL(T-Link I/F card) + Fuji's MICREX (2) OPC-VG1-DIO (DIOB) card (3) Standard RS485 (4) OPC-VG1-DIO (CC-Link card) * (1), (3) and (4): Function code S05 "Orientation position command" is used to write.
	Internal stopping position setting (When the external stopping position setting is used, this setting may be a value for offset adjustment.)	Four points can be specified using the UNO function code. General-purpose input terminals are combined to switch among them. When using this function, assign the [U-DI] function to [X6] and [X7]. [X6], [X7] = OFF, OFF UNO. 20 stopping position setting 1 valid [X6], [X7] = ON, OFF UNO. 21 stopping position setting 2 valid [X6], [X7] = OFF, ON UNO. 22 stopping position setting 3 valid [X6], [X7] = ON, ON UNO. 23 stopping position setting 4 valid
Control command		Use any of the following setting. Use function code UNO. 04 to select among them. However, there are limitations when using a 4096 or 8192 p/r pulse encoder. (See section 5-2-4.) (1) OPC-VG1-TL(T-Link I/F card) + Fuji's MICREX (function code: UNO. 04=2) (2) OPC-VG1-DIO (DIOB) card (function code: UNO. 04=1) (3) Standard RS485 (function code: UNO. 04=2) (4) OPC-VG1-DIO (CC-Link card) (5) Standard terminal function ([X1], [X2] and [X3]) (function code: UNO. 04=0) [U-DI] must be assigned. * (1), (3) and (4): Function code S05 "Orientation position command" is used to write.
	Orientation command	Issue this signal during FWD or REV operation to lock at the target stopping position. Cancel the signal for operation under regular speed control.
	Low speed direction command	Define the direction of rotation for orientation from a stopping state.
	Position change command	Function for latching the external stopping position command. The command is latched upon the rising edge.
Repeatability		Varies according to the encoder resolution installed to the machine shaft. Be sure to specify function code UNO. 09 according to the resolution of the installed encoder. ±0.703° (function code: UNO. 09 = -3, for 128 P/R pulse encoder on machine shaft) ±0.352° (function code: UNO. 09 = -2, for 256 P/R pulse encoder on machine shaft) ±0.176° (function code: UNO. 09 = -1, for 512 P/R pulse encoder on machine shaft) ±0.088° (function code: UNO. 09 = 0, for 1024 P/R pulse encoder on machine shaft) ±0.044° (function code: UNO. 09 = 1, for 2048 P/R pulse encoder on machine shaft) ±0.022° (function code: UNO. 09 = 2, for 4096 P/R pulse encoder on machine shaft) ±0.011° (function code: UNO. 09 = 3, for 8192 P/R pulse encoder on machine shaft) * Note: The positioning accuracy is for rotation in a uniform direction. The stopping accuracy deteriorates in a system with forward and reverse rotation.
Pulse encoder specification		Pulse encoder specification: RS422A, line driver specification (SN75113, 26LS31) A,$\overline{A}$ signal: B,$\overline{B}$ signal: Z,$\overline{Z}$ signal: 1P/R ¯ The underlined part indicates the reverse signal. The Z-phase is necessary for judgment of the reference stopping position. Be sure to select the Z-phase. Pulse number: 128, 256, 512, 1024, 2048, 4096, or 8192P/R
Resistive torque		Possible up to the maximum value of the motor (PI control) * The displacement increases temporarily in response to instantaneous load torque. * Adjust the resistance torque using the speed control gain, integration time and orientation gain.
Mechanical conditions		Max. allowable input to PG card: 500 kHz Speed steps: 4: [RT1] and [RT2] are used. [RT1], [RT2] = OFF, OFF Gain setting 1 is validated. [RT1], [RT2] = ON, OFF Gain setting 2 is validated. [RT1], [RT2] = OFF, ON Gain setting 3 is validated. [RT1], [RT2] = ON, ON Gain setting 4 is validated.
Orientation specification		Random access stopping direction selection, speed boosting to stop in the shortest path, stopping without speed boosting and other functions can be selected.
Control state output function		Orientation signal and orientation completion signal are output. To use this function, assign the [U-DO] function to [Y1] and [Y2]. [Y1] Orientation completion signal output [Y2] Orientation signal output Off-delay and on-delay operations of the above output signals are possible. The orientation completion width can be set.
Monitor function		The following data items can be referred to in real time on the LED monitor at the keypad panel. Option monitor 3: Stopping position command Option monitor 4: Z-phase reference shaft position (current position) Option monitor 5: Position deviation (current position - stopping position command)

4.2.1.2 Definition of operation

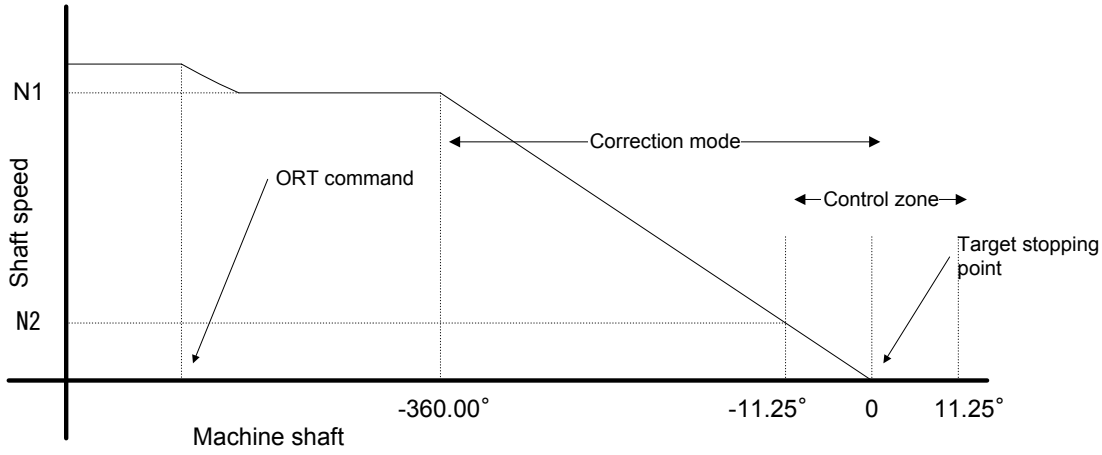


Fig. 4-2-1

Table 4-2-2

Item	Description
N1: Slow speed 1	Motor speed set at slow speed 1 (UNO. 10 to 13)
N2: Slow speed 2	ORT gain (UNO 14 to 17) x 2/10 rotation speed
Correction mode	After the ORT command is input, the speed command is corrected from N1 according to the position feedback signal issued from the shaft encoder.
Control zone	Range of ±11.25° to target stopping point

There are two patterns in the operation: stopping at the target position during operation at a speed, and rotation to the target position in a stopping state at zero speed. Be sure to combine with the FWD or REV operation command. The direction of rotation of ORT from operation depends on the FWD or REV command. ORT from the stopping state is in the random access direction toward the target position or slow speed direction command.

1) ORT from running state

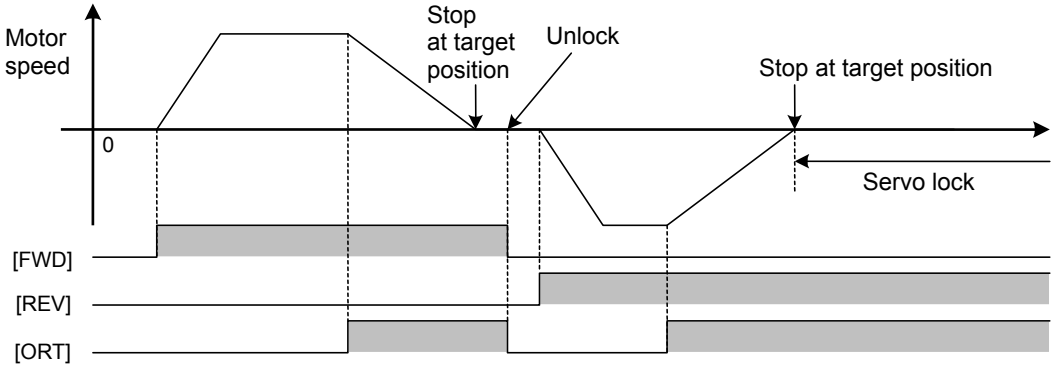


Fig. 4-2-2

2) ORT from stopping state

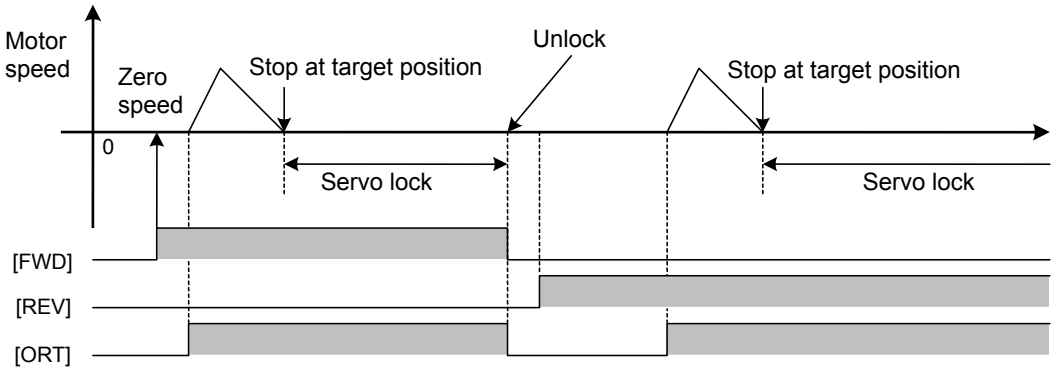
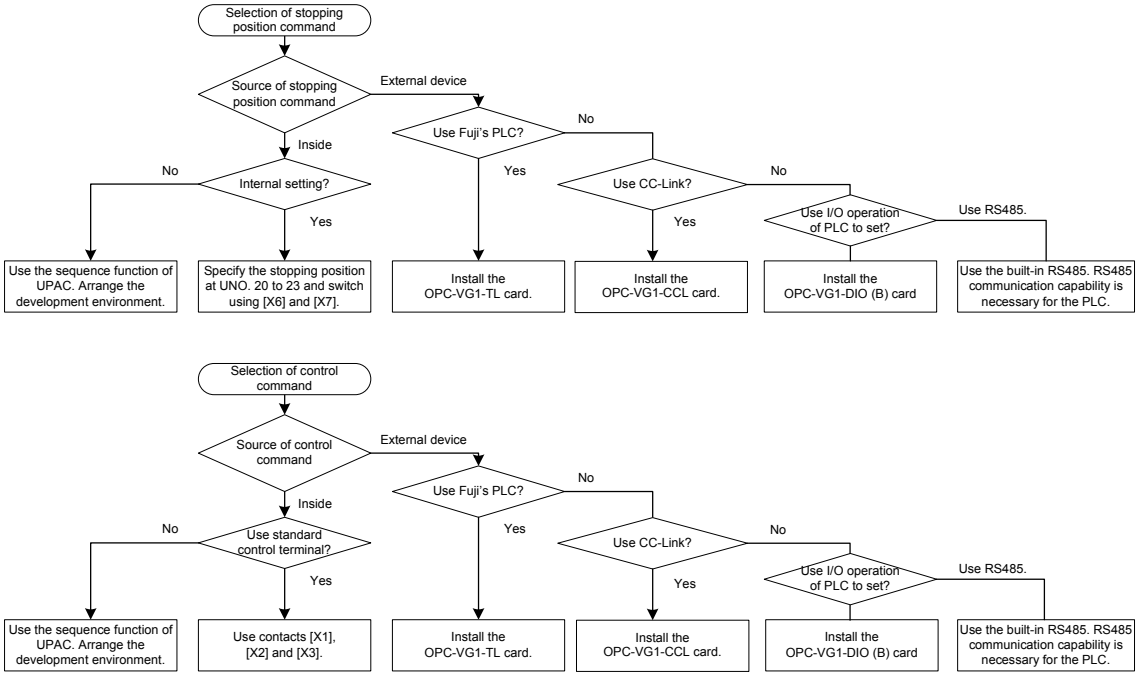


Fig. 4-2-3

4.2.1.3 Master device

The interface on the FRENIC-VG side must be selected according to the master device for issuing stopping position and controlling commands (such as orientation command). Refer to the following flow chart for examination.



* Similar setting can be made with the Field Bus option.
* You can use PLC, PC, POD (Programmable Operation Display) or other host devices with RS485.

4.2.1.4 Encoder feedback

Various feedback form can be employed according to the system. Select one of the following four methods.

1) Standard (special) motor

Use this method to detect the speed with the PG built in the standard VG motor and detect the position with the PE installed to the spindle. Relevant function code settings are as follows:

Table 4-2-3

Function Code	Name	Setting:
PNO. 28	M1-PG pulse count selection	Motor PG count
PNO. 29	M1 external PG correction coefficient	Not used
UNO. 09	Pulse encoder selection	Spindle PE count
UNO. 24	Speed detection selection	0: Built-in PG

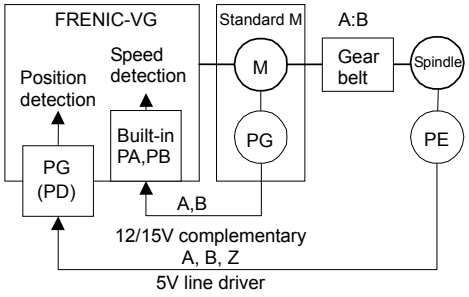


Fig. 4-2-4

2) General-purpose motor (from manufacturers other than Fuji)

Use this method to detect the speed and position with the PE installed to a general-purpose motor (made by other than Fuji). Relevant function code settings are as follows:

Table 4-2-4

Function Code	Name	Setting:
PNO. 28	M1-PG pulse count selection	Number of installed PEs
PNO. 29	M1 external PG correction coefficient	Not used
UNO. 09	Pulse encoder selection	Number of installed PEs
UNO. 24	Speed detection selection	1: PG (PD)

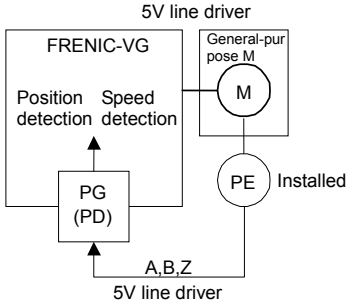


Fig. 4-2-5

3) Speed and position control with spindle PE

Use this method to use a general-purpose motor to control the speed and position with the PE installed at the spindle. If the gear ratio is not 1:1 or the gear ratio changes with the gear changed, PNO. 28 and PNO. 29 settings are required. Refer to the User's Manual for details. Relevant function code settings are as follows:

Table 4-2-5

Function Code	Name	Setting:
PNO. 28	M1-PG pulse count selection	Number of installed PEs
PNO. 29	M1 external PG correction coefficient	Setting based on A : B
UNO. 09	Pulse encoder selection	Spindle PE count
UNO. 24	Speed detection selection	1: PG (PD)

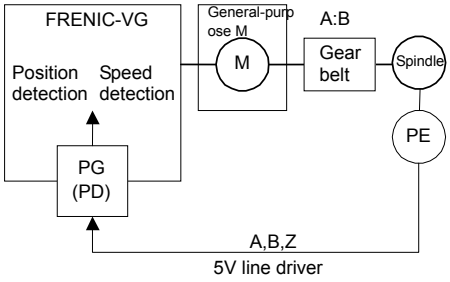


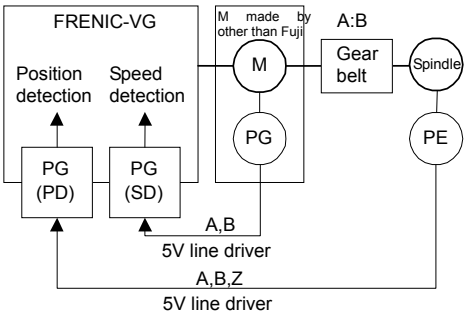
Fig. 4-2-6

4) Motor with 5 V line driver PG

Use this method for a servomotor or a motor with a 5 V line driver PG made by other than Fuji. Use the PG (SD) card to detect the speed, and use the PG (PD) card to detect the position. Relevant function code settings are as follows:

Table 4-2-6

Function Code	Name	Setting:
PNO. 28	M1-PG pulse count selection	Motor PG count
PNO. 29	M1 external PG correction coefficient	Not used
UNO. 09	Pulse encoder selection	Spindle PE count
UNO. 24	Speed detection selection	0: PG (PD)



Note) • If "0" is specified for UNO. 24 "Speed detection selection," the built-in PG and PG (SD) become valid. When PG (SD) is installed, PG (SD) is given priority. When PG (SD) is not installed, the built-in PG is valid.
• To drive a synchronous motor, specify "3" to P01 to detect the speed using a PMPG card. Because the PMPG card is not effective for position control, use form (4) on the previous page and replace PG (SD) with PMPG.
• "SD" and "PD" in the parentheses after "PG" indicate the switch installed on the printed circuit board. "SD" indicates peed detection and
"PD" position detection.
• "PG" stands for Pulse Generator and "PE" Pulse Encoder. Though the two terms mean the same device, the one built in the motor is called "PG" and the one installed at the spindle is called "PE" according to the purpose.

4.2.1.5 Stopping accuracy

⚠CAUTION

The stopping accuracy depends on the resolution of the datum encoder.

- In a system where both forward and reverse rotation occurs during orientation from a running state or random access is selected for orientation from a stopping state, the stopping accuracy deteriorates.

The stopping accuracy to the target position depends on the installed encoder resolution as described in "specifications." In addition, in a system where forward and reverse rotation occurs during orientation, the stopping accuracy will deteriorate by the pulse width of the Z-phase.

The stopping accuracy deteriorates in the following conditions.

1. Both **forward rotation and reverse rotation** occur for the orientation command from a running state.
2. The **random path** access method is selected for the orientation method from a stopping state.

That is, if only the forward or reverse rotation is selected or a single direction is selected for orientation from a stopping state, the stopping accuracy described in "specifications" is assured.

1) Explanation

The position count of FRENIC-VG is reset to zero at the rising edge of the Z-phase (reference position) as shown in the figure on the right.

Because there are two edges (rising and falling) for each of the A and B phases and the phase difference between phases is 90°, there are four edges in each period with the A and B phases.

Each edge is counted at the hardware counter built in FRENIC-VG, resulting in 4096 counts for a 1024 P/R encoder (because of multiplication by four).

Suppose that the pulse width of the encoder in the Z-phase is seven edges (example shown on the right). The absolute position adjusted in reference to the ◆ mark during forward rotation deviates by seven edges, that is, seven counts during reverse rotation.

Seven counts for a 1024 p/r encoder are equivalent to 0.6°. An allowable deviation of 0.6° in the stopping accuracy of the spindle machine must be checked in advance.

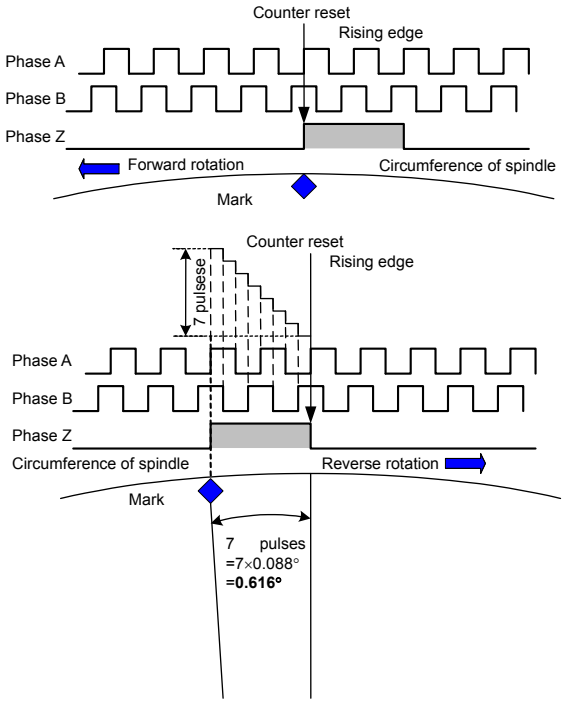


Fig. 4-2-8

2) Countermeasure

In a system where forward and reverse rotation is necessary and the random path access method from a stopping state is selected, contact the manufacturer of the encoder for the pulse width in the Z-phase of the encoder and choose one having as short a pulse width as possible. Check the number of edges of the pulse width of the Z-phase to calculate the stopping accuracy.

4.2.2 Basic connection diagram

Examples are shown for rotation position determination using the encoder installed to the machine shaft. Our option detects the pulse including the Z-phase, therefore select "PD." The Z-phase is used for detection of the absolute position of the machine. The stopping position and orientation command can be given via T-Lin, DIO (B) card, built-in RS485, CC Link or the like.

To drive a synchronous motor, use the separate PMPG card.

Switch setting on option

Function	SW1-1	SW2-2
PD	**OFF**	**OFF**
LD	ON	OFF
PR	OFF	ON
SD	ON	ON

(1) Connection example using T-Link

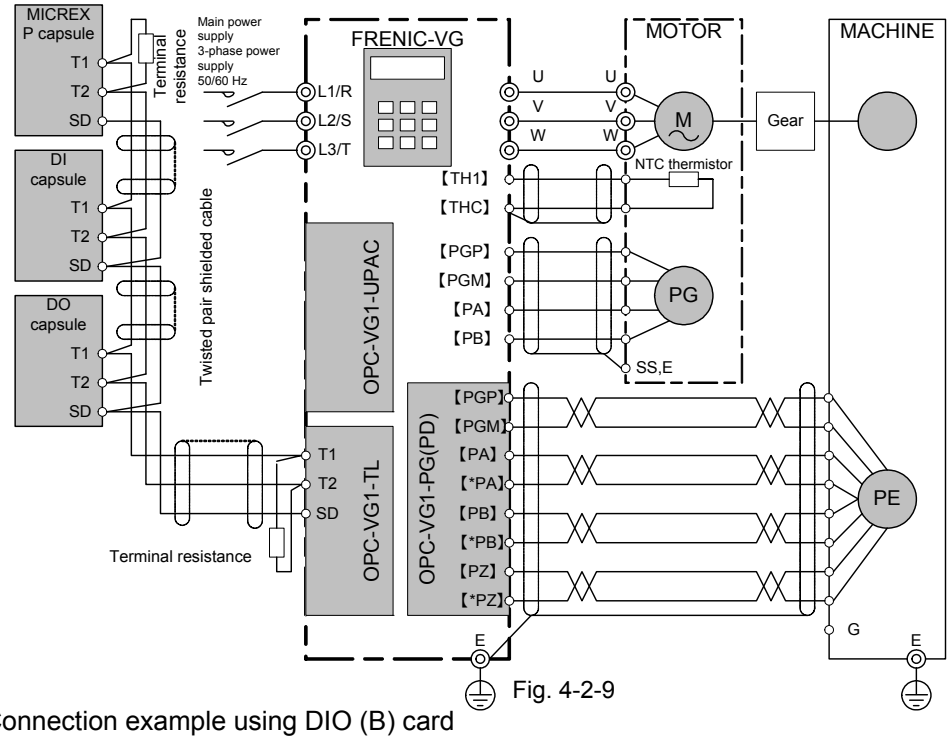


Fig. 4-2-9

(2) Connection example using DIO (B) card

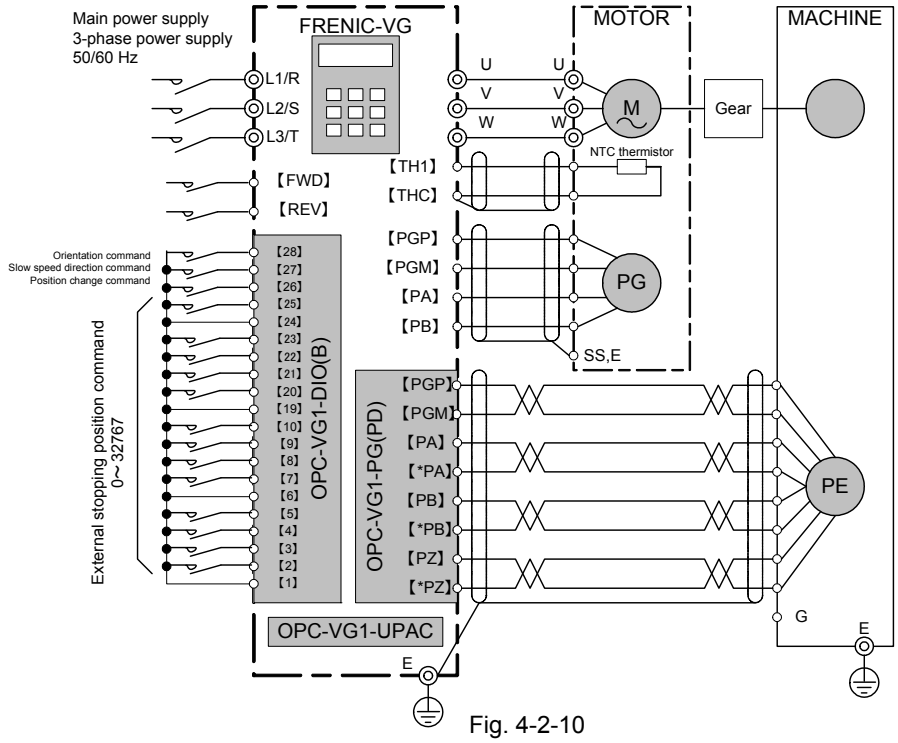


Fig. 4-2-10

(3) Connection example using RS485 communication (POD)

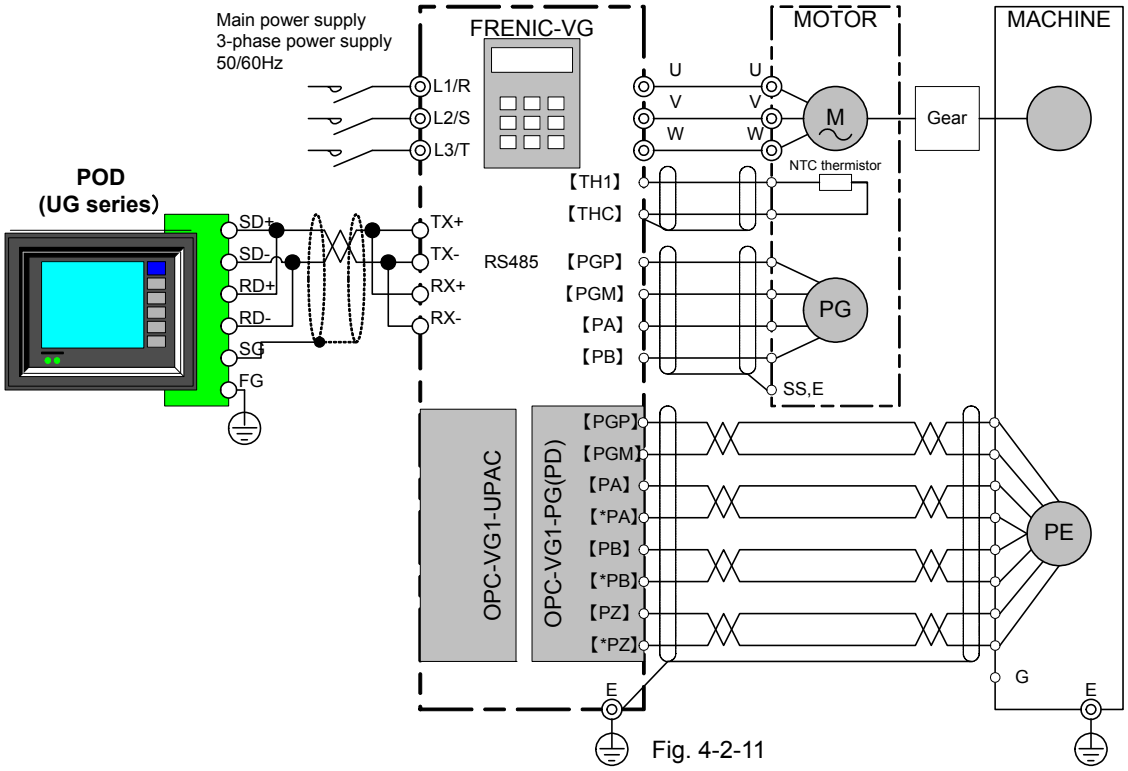


Fig. 4-2-11

(4) Connection example using standard I/O terminal

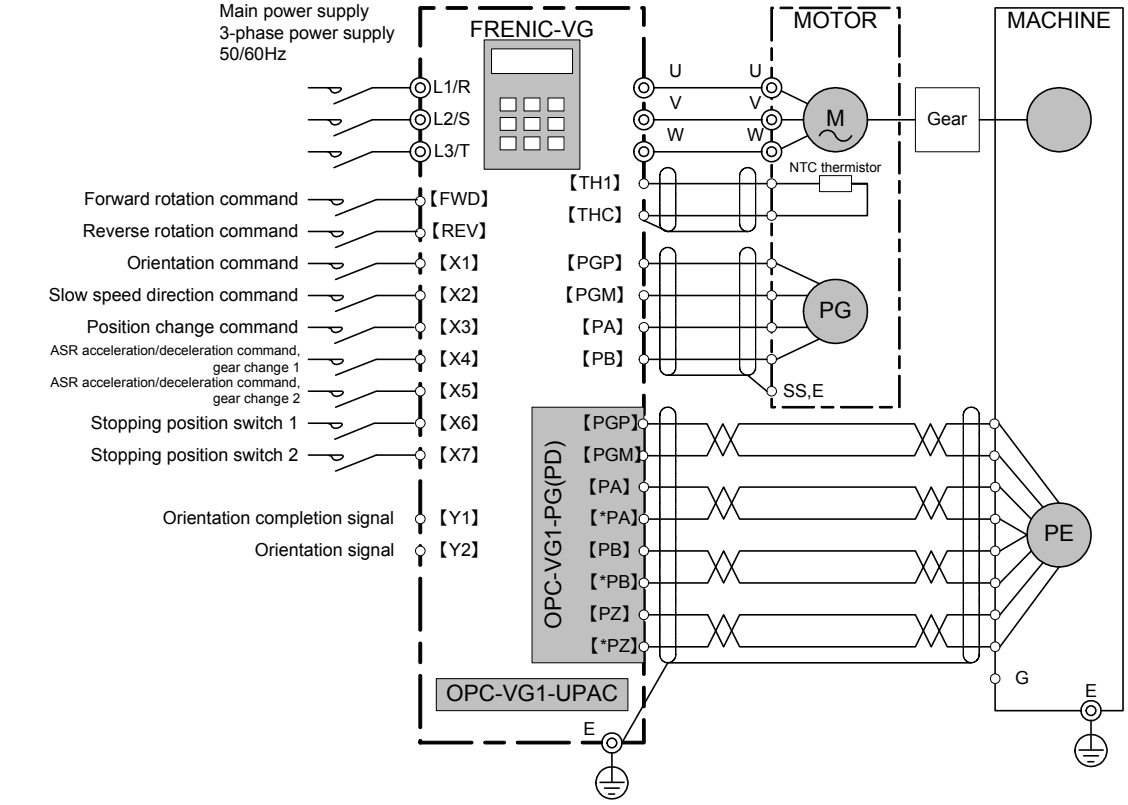


Fig. 4-2-12

4.2.3 Control Block Diagrams

The control block diagram of the UPAC orientation option is shown below.

1) Meaning of term

ASR: Speed adjuster

ORT: Position adjuster ... Adjuster that functions when the spindle is in the control zone

Automatic subtraction pattern calculation ... Calculation of subtraction pattern of spindle that functions in the correction mode when the shaft is outside the control zone

Control zone judgment ... Orientation is switched depending on judgment of the spindle in the control zone (±11.25°).

The orientation function is not included in the standard function. It can be realized using the UPAC option, PG (PD) card, and orientation package software.

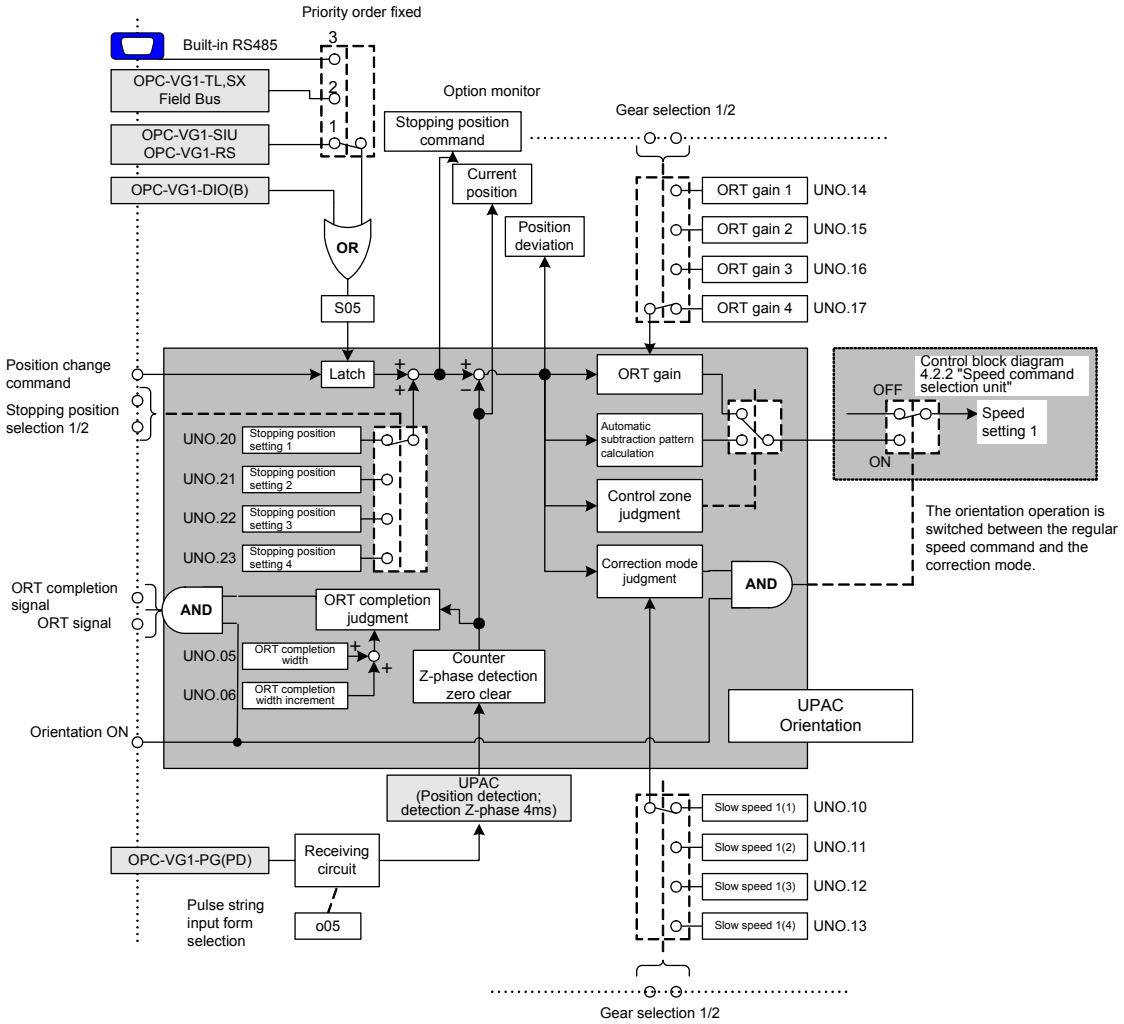


Fig. 4-2-13

4.2.4 Function Code

Table 4-2-7

Function code	Name	LCD display (Japanese)		Effective setting range	Unit	Min. unit	Initial value	Change during operation	Remarks
U01	ORT version information	**U01**	USER P1		-	1	1300□	X	Read-only data. Shows version of UPAC package software.
U02	ORT rotation direction from stopping	**U02**	USER P2	0,1	-	1	0	X	0: Direction for shorter to target position. 1: Direction for following external slow speed direction. Set to stop after shorter rotation or to follow slow speed direction to conduct orientation when stopping.
U03	ORT stop mode selection	**U03**	USER P3	0,1	-	1	0	X	0: Stop in shortest time. (may accelerate) 1: Stop without accelerating from current speed Set to accelerate over the second slow speed or not in orientation operation.
U04	Control input selection	**U04**	USER P4	0, 1, 2	-	1	0	X	0: Internal terminal valid (X1 to X3) 1: DIOB card input valid 2: S05 (communication system, e.g., T-Link or RS485) valid
U05	ORT completion range	**U05**	USER P5	0 to 511	Pulse	1	0	○	0 to 511 pulses Provides ORT completion signal (ON) when enters a range specified by pulses set by parameter to the position for ORT stopping.
U06	Completion width after ORT stopping	**U06**	USER P6	0 to 511	Pulse	1	0	○	0 to 511 pulses The orientation completion width is replaced with this setting after stoppage within the orientation completion width.
U07	ORT completion signal ON timer	**U07**	USER P7	0 to 1000	S	1	0	○	0 to 1000 (0.00 to 10.00s) Setting for timer after ORT completion to turning on ORT completion signal.
U08	ORT completion signal OFF timer	**U08**	USER P8	0 to 1000	S	1	0	○	0 to 1000 (0.00 to 10.00s) Setting for timer after ORT completion release to turning off ORT completion signal.
U09	Pulse encoder selection	**U09**	USER P9	-3 to 3	-	1	0	X	-3: 128P/R encoder -2: 256P/R encoder -1: 512P/R encoder 0: 1024P/R encoder 1: 2048P/R encoder 2: 4096P/R encoder 3: 8192P/R encoder
U10	Slow speed 1 (1)	**U10**	USER P10	0 to 1000	r/min	1	0	X	Set value for first slow speed (N1) during ORT Four steps are available for setting. Speed steps: 4: [RT1] and [RT2] are used.
U11	Slow speed 1 (2)	**U11**	USER P11						
U12	Slow speed 1 (3)	**U12**	USER P12						
U13	Slow speed 1 (4)	**U13**	USER P13						
U14	ORT gain (1)	**U14**	USER P14	0 to 1000	Times	1	0	○	0 to 1000 (0.0 to 100.0 times) Position loop gain Setting for position adjuster proportional gain during ORT. Speed steps: 4: [RT1] and [RT2] are used. Always assign [RT1] and [RT2] to X4 to X5 respectively.
U15	ORT gain (2)	**U15**	USER P15						
U16	ORT gain (3)	**U16**	USER P16						
U17	ORT gain (4)	**U17**	USER P17						
U18	Not used	**U18**	USER P18		-	1	0		Not used
U19	Not used	**U19**	USER P19		-	1	0		
U20	Stop position setting 1	**U20**	USER P20	0 to 32768	-	1	0	X	Set the number of pulses of installed encoder x 4. Set to 1024x4x100°/360°=1138 for stop position command of 100° in forward direction when you use 1024p/r encoder. Subtract one rotation when you set while exceeding four times. Set the travel distance in shaft forward direction. Use terminal input (switching stop position 1, 2) for changing four-point stop position. *** Data switching is not accepted during ORT. Turn on the position change command or temporarily turn off the ORT ON signal.**
U21	Stop position setting 2	**U21**	USER P21						
U22	Stop position setting 3	**U22**	USER P21						
U23	Stop position setting 4	**U23**	USER P23						
U24	Speed detection selection	**U24**	USER P24	0,1	-	1	0	X	0: Integrated PG (PA, PB), PG (SD) card valid (SD prioritized) P01="3": PMPG card valid for synchronous motor driving PG (PD) card valid
U25	ORT speed just after power on	**U25**	USER P25	0 to 1000	r/min	1	0	○	Speed limit function for orientation command from stop state just after power on.
U64	ORT version information	**U64**	USER P64		-	1	1300□	X	Read-only data. Shows version of UPAC package software.

(1) About setting range

Though setting range from keypad is –32768 to 32767, the UPAC limits the set values to the above data range. For example, when you set ORT gain to –20, the UPAC limits it to 0, and when you set ORT gain to 2000, the UPAC limits it to 1000.

(2) About changing setting

• Though function codes unchanged during operation (marked × in the table) are not protected against input from the keypad, input are not reflected during operation

(3) It takes about 60 ms to update data.

4.2.5 Preparing for Operation

Follow the guidance described below to prepare the orientation and test the operation.

4.2.5.1 Setting Function Codes

(1) Checking Basic Operation

Check if normal operation is achieved with the speed control. The speed control means that your motor rotates as you instruct when you enter the speed command from the analog input and the keypad. See "FRENIC-VG User's Manual" for more information.

(2) Make sure that the options, OPC-VG1-UPAC and OPC-VG1-PG, are implemented. Also, make sure that the OPC-VG1-PG option is set to PD. You can use the I/O check on the keypad for these checking.

(3) Orientation Package

Make sure the orientation package software for the UPAC has been downloaded. Use the keypad to check, and make sure the function code UNO. 01 show version number ("13□□□"; □□□ refers to 009 or higher numbers). Here, □ indicates INDEX.

(4) Control Input Selection (UNO. 04)

Select the standard integrated terminals X1 to X3, the DIO (B) card or the TL card for entering the orientation command, the slow speed orientation command, and the position change command. Use the standard integrated terminals X1 to X3, which are "0", for test operation. For X1 to X3, set the function codes E01 to E03 to "25": U-DI respectively.

(5) Pulse Encoder Selection (UNO. 09)

Set the pulse number of an encoder, which is connected to a machine shaft or a motor shaft for position control, to function code UNO. 09.

(6) Selecting Speed Detection

Determine whether to use the encoder input terminals PA, PB, or PG (SD), which is integrated as standard, or to use the PG (PD) card to detect speed. When driving a synchronous motor, set the PMPG card to "0" for speed control. When using an encoder attached to a shaft separated from your motor through gears, also set the function codes P28 "M1-PG pulse number" and P29 "M1 external PG compensation coefficient". See "FRENIC-VG User's Manual" for more information.

(7) Selecting Feedback Pulse

Set the function code o05 "Feedback pulse selection" to "1". You can detect pulses of the spindle encoder.

(8) Setting Position

The stop position setting 1 (UNO. 20) is valid as default. The factory setting is "0". This means a distance equivalent to 0 pulse from Z phase reference position of your encoder. Maintain 0 during test operation, and check if it stops at the 0 reference position.

You can use the option monitor 4, "Z phase reference spindle position display" of the keypad to check the 0 reference position.

(9) Setting Slow Speed 1

For the orientation command while the motor is rotating, set the target speed to which the motor decelerates following the deceleration time setting. Set **"200" (r/min)** to the function code: UNO. 10 "Slow speed 1 (1)" during test operation. UNO. 10 is valid as default.

(10) Setting ORT gain

Set **"50"** (5.0 times) to the function code UNO. 14 "ORT gain (1)" during test operation. UNO. 14 is valid as default.

(11) Setting Orientation from Stopping Just after Power On

Set 100 r/min (UNO. 25). This is the speed limiting feature for orientation from stopping just after power on. You cannot conduct the orientation without changing the default of 0 r/min.

4.2.5.2 Test Operation and Adjustment

After you finish checking and setting as described in 4.2.5.1, use the FWD or REV terminal to start operation and operate the motor under the speed control. At this time, you can specify zero speed command.

In this operation, if you set X1 "Orientation ON" to ON, the inverter switches to the position control mode, stops at the position, and enters the servo lock state. When you set X1 to OFF, the inverter switches to the speed control.

After test operation, use the slow speed 1, the ORT gain, and ASR adjusting (such as gain, I constant, filter) to adjust a behavior just before stopping according to your machine. When you want an earlier stop time, though you should set the slow speed 1 and gain larger, and set the deceleration time smaller, set the slow speed 1 and the gain smaller when the hunting is large just before stopping.

Calculate the number of pulses in the FWD (CCW) direction to a machine shaft from the Z phase reference position when you set a position. You can rotate the machine shaft for adjusting while checking the option monitor 4 "Z phase reference spindle position display" when the operation stops.

Use the orientation complete signal and the orienting signal for providing an answer back to an external instrumentation. When the completion signal chatters, use the completion range setting and ON delay timer.

When the motor stops (zero speed), if you provide an orientation command, a setting to stop in a direction for shorter rotation or to stop only in one direction is available as UNO. 02 "ORT rotation direction from stopping". Use the UNO. 03 "ORT stop mode selection" to select whether to stop in the shortest time or to stop while limiting the speed.

4.2.5.3 Determining Stopping Position

Understand the relation between an object to be stopped at a target position and an installation of an encoder for detecting the position.

Setting example:

1) Setting with Calculation

When you use an encoder of 1024 p/r, 4096 pulses, which are the result of multiplication by four, are generated per rotation. Use this count as 360° to set the stop position.

In the right figure, the relationship between an object to be positioned and encoder matches the Z phase in horizontal direction. When you want stop at a position 71.7° from this reference position: 4096x71.7°/360°=816 pulse count is set to the stop position command.

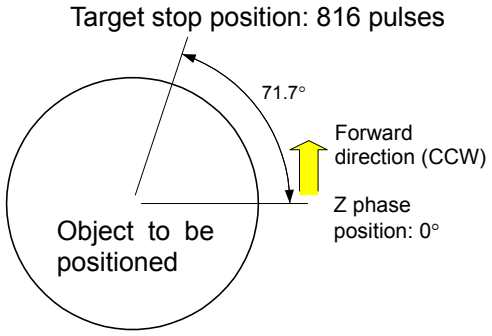


Fig. 4-2-14

2) Setting Manually

When you move the object to the position of 71.7°, the option monitor 4 (Z phase reference spindle position) shows "816" on the keypad. This value is set to the stop position command.

4.2.6 Control command

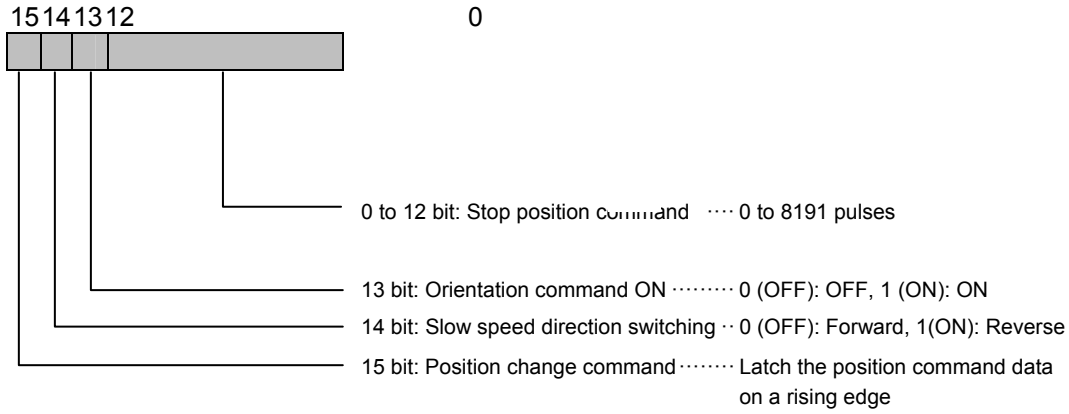
The definition for control command varies according to how many encoders you use.

1) Using S05

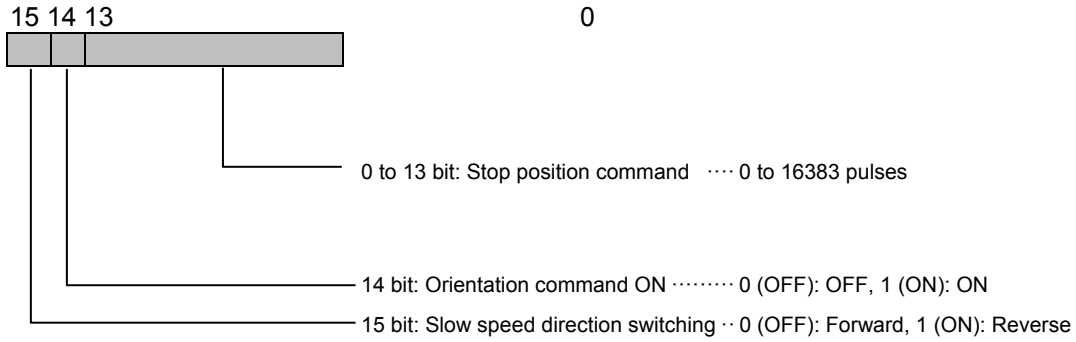
Use S05 when you use an external device (MICREX or PC) to provide the orientation command over T-link or RS485.

The function code corresponds to S05 "Orientation position command".

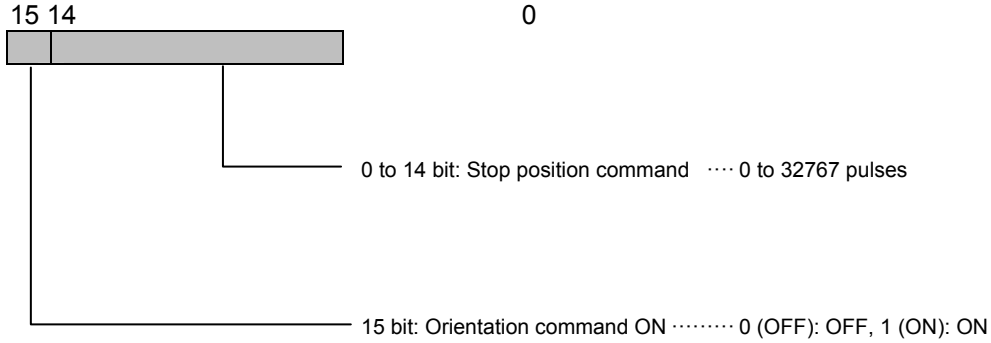
(1) For Encoder of 128 p/r to 2048 p/r



(2) For 4096 p/r encoder

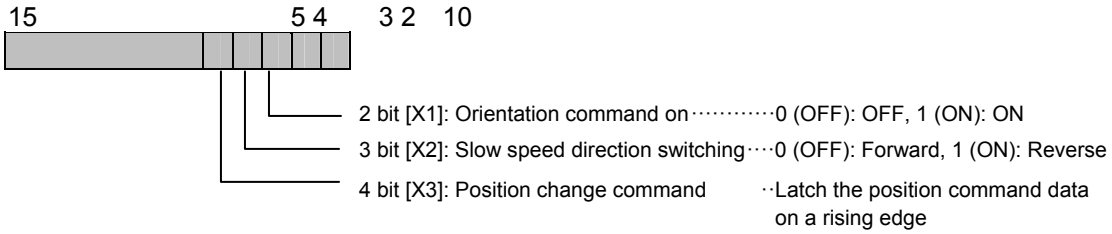


(3) For 8192 p/r encoder



2) Using General Input

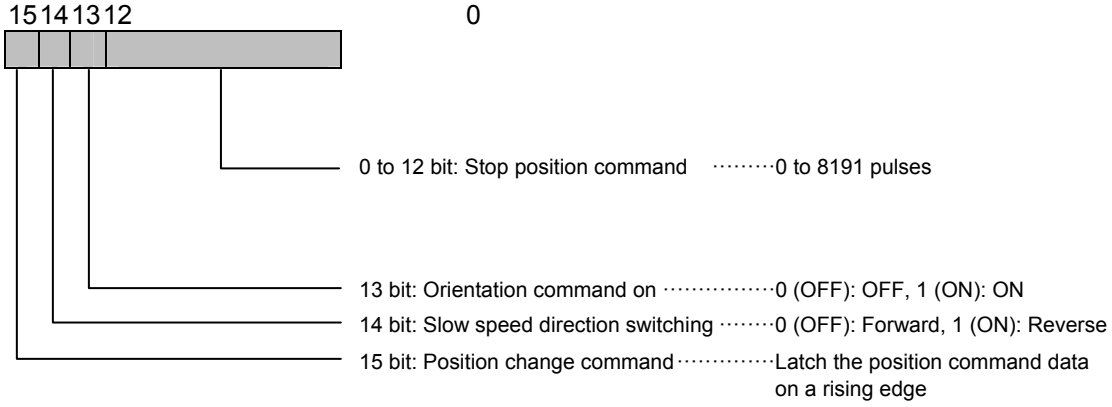
Use general input when you use the general control terminals [X1] to [X3] to provide a control command. You can use the function code S06 "Operation command 1" to use [X1], [X2], and [X3] as S05 "Orientation position command" when the access is over the communication system (MICREX or PC). When you enter control commands in both S05 and S06, they are "ORed"



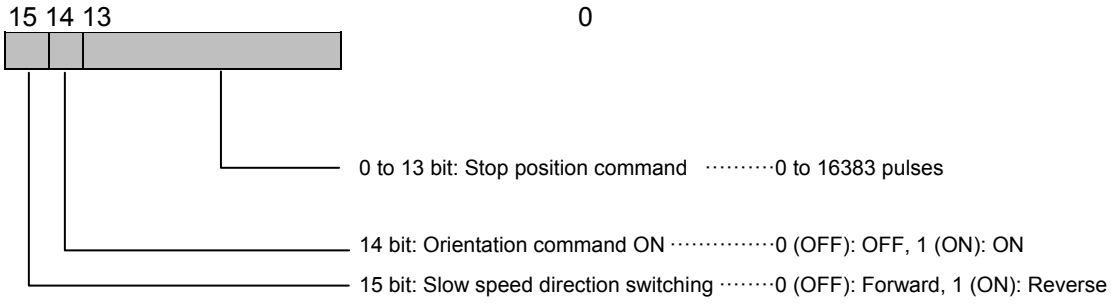
3) Using DIO Card

You can use the 16-bit input of the DIOB when the OPC-VG1-DIO card is installed.

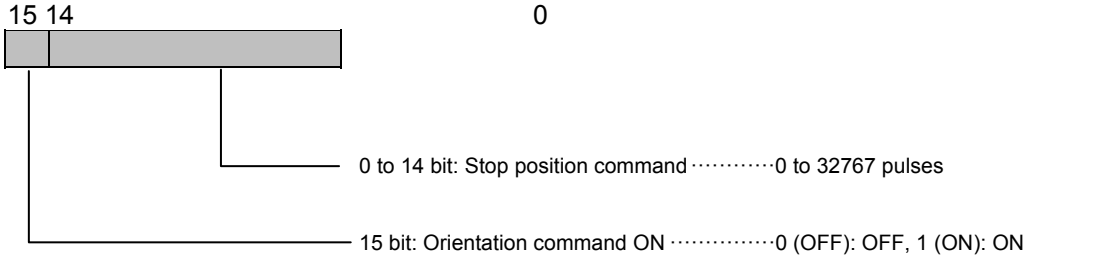
(1) For Encoder of 128 p/r to 2048 p/r



(2) For 4096 p/r encoder



(3) For 8192 p/r encoder



4.2.7 ORT Stop Operation

4.2.7.1 Power ON sequence

The reference position (Z phase) of your encoder should be recognized when you turn on the power. Recognizing the reference position allows stopping at your target position. Select either of the following two methods:

1) Using Initial Operation of FRENIC-VG

   Just after you turn on power, when you set the operation command (either FWD or REV) and the ORT ON (X1) to ON, your motor runs at the initial speed, and stops at your target position after detecting a reference position (Z). The initial speed is fixed to the direction of the low speed direction command and is limited by UNO. 25 "ORT speed just after turning ON" (r/min). Set the UNO. 25 to 100 r/min or more. When you set to a low speed, the motor does not detect the reference position and may continue running.

2) Running for Several Rotations

   Operate your inverter with the speed control at a certain speed (100 r/min or more) on turning on power without detecting a reference position (Z phase), and let your inverter to detect the reference position after running your motor for several rotations. You use your sequence.

4.2.7.2 Soft stop while running

When you want the ORT operation while your motor is running at a speed higher than a set speed for the first slow speed (N1), you use the standard deceleration time to set whether the soft deceleration is used as a deceleration operation to N1 or not.

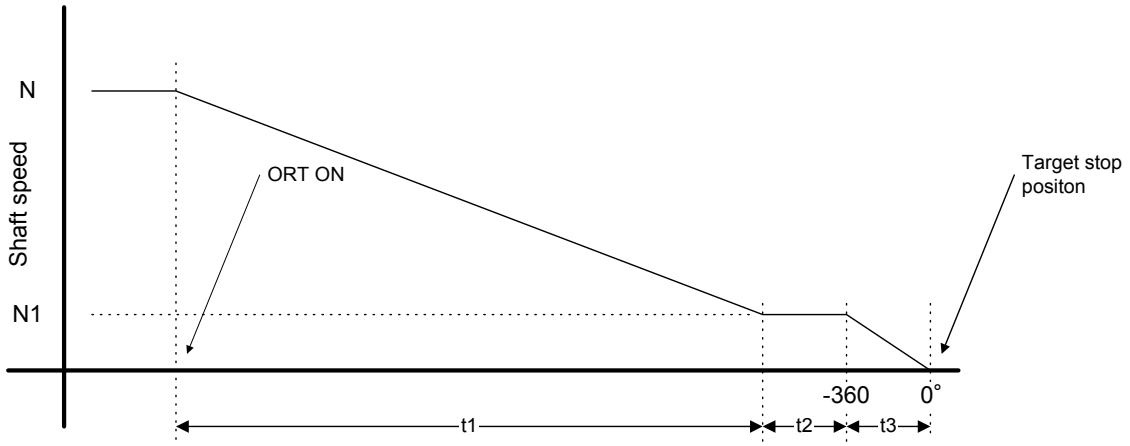


Fig. 4-2-15

Table 4-2-8

Time	Definition
t1	Deceleration time to the first slow speed. Depends of the set value for the deceleration time of the parameter.
t2	First slow speed maintaining time (up to 360 degrees)
t3	ORT deceleration time (depends of N1 and ORT gain)

4.2.7.3 ORT while running

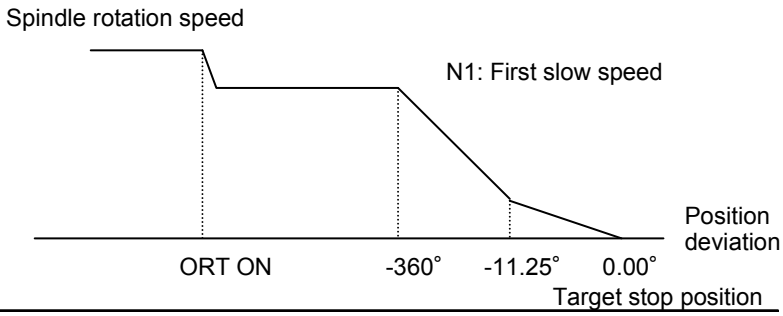
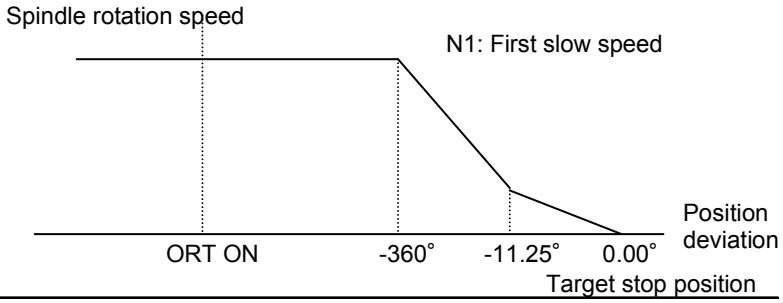
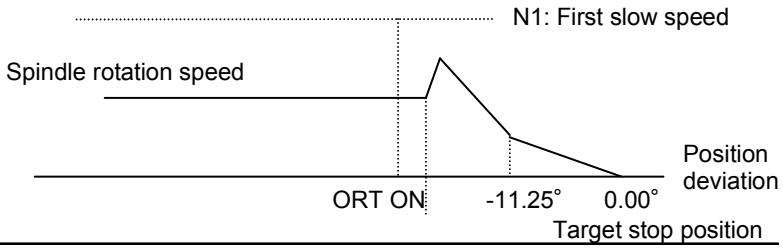
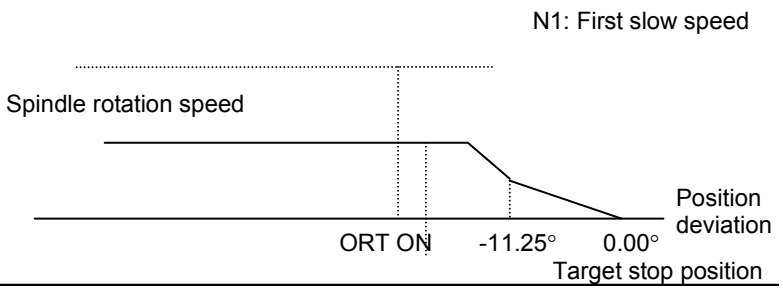
U03	ORT Stop mode selection	Setting: 0 and 1

◆ Define the operation while stopping. Set to accelerate over the second slow speed or not in orientation operation.

0: Stop in shortest time. (may accelerate)

1: Stop without accelerating from current speed

Table 4-2-9

State	UNO. 03	Description of operation	Operation wave form
Rotation speed >N1	Any		
Rotation speed=N1	Any		
Rotation speed<N1	Setting: 0	Mode for stopping in shortest time (may accelerate)	
	Setting: 1	Mode for stopping without accelerating from current speed	

4.2.7.4 Orientation from a stopping state

U02	Direction of orientation from stopping state Setting: 0 and 1
U03	ORT Stop mode selection Setting: 0 and 1

◆ U02: Select the orientation method from a stopping state between random path selection and slow speed direction.

0: Direction for shorter to target position.

1: Direction for following external slow speed direction.

◆ U03: Set to accelerate over the second slow speed or not in orientation operation.

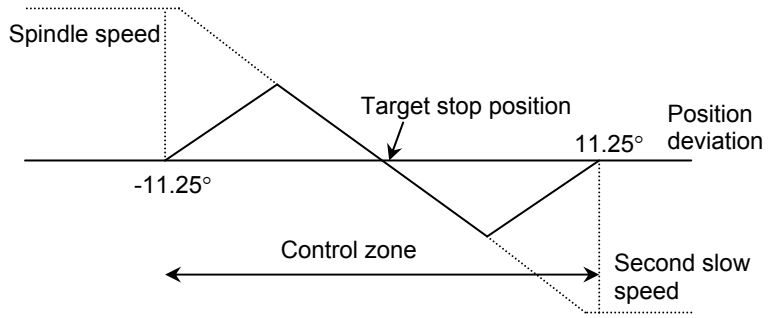
0: Stop in shortest time. (may accelerate)

1: Stop without accelerating from N2 slow speed

* If "1" is specified at UNO. 02 without slow speed direction switch, the motor always stops in the direction of forward rotation.

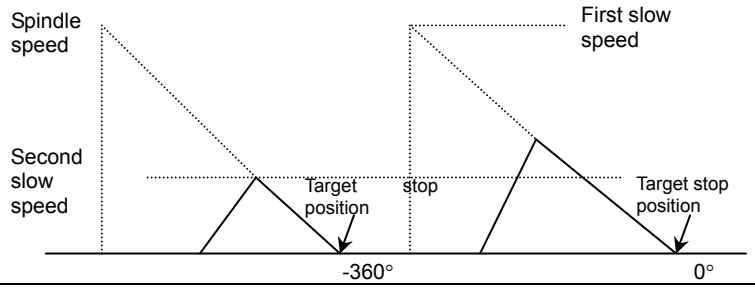
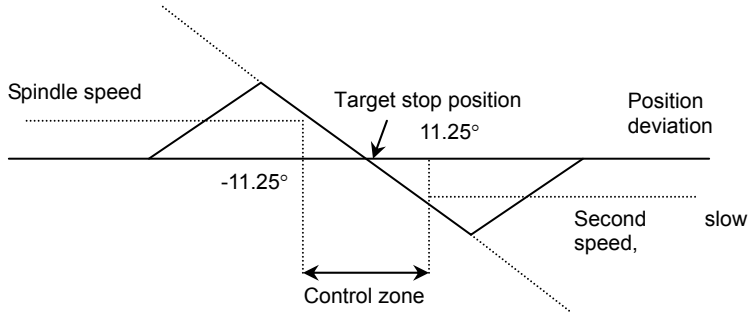
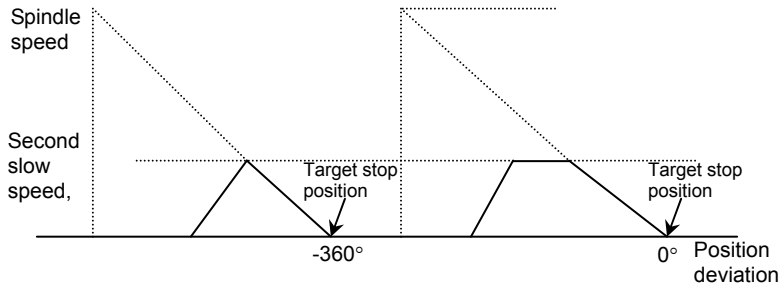
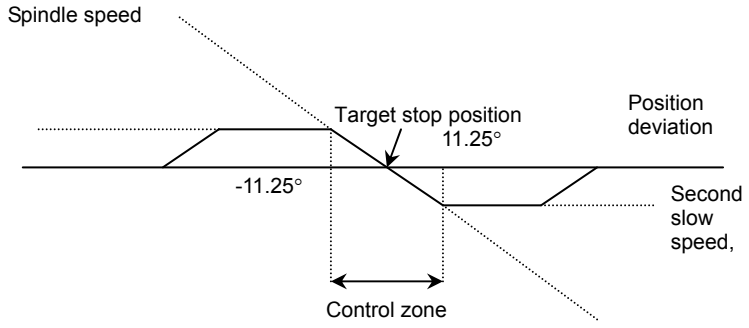
Stopping from control zone

Table 4-2-10

State	UNO. 02 UNO. 03	Description of operation	Operation wave form
Orientation command from outside the control zone	Any	Immediate transition into correction mode	

Stopping from outside the control zone

Table 4-2-11

State	UNO. 02 UNO. 03	Description of operation	Operation wave form
Orientation command from outside the control zone	UNO. 02=1 UNO. 03=0	Stopping in the shortest time by following the external slow speed direction command	
	UNO. 02=0 UNO. 03=0	Rotating to the target position through the nearest path and stopping in the shortest time	
	UNO. 02=1 UNO. 03=1	Stopping within the second slow speed by following the external slow speed direction command	
	UNO. 02=0 UNO. 03=1	Rotating through the nearest path to the target position and stopping within the second slow speed	

4.2.8 Input/Output Specification

4.2.8.1 Input signal

1) Control input
   To use control inputs (orientation command, slow speed direction command, and position change command) at general-purpose input terminals, assign the [X1], [X2] or [X3] terminal to universal DI.
2) Gear selection
   Use [RT1] and [RT2] of standard functions to switch.
3) Stopping position selection
   Assign [X6] and [X7] to universal DI to use the terminals for stopping position selection.

Table 4-2-12

Terminal	Name of command	Assignment	Description
[X1]	Orientation command (ORT ON)	Universal DI [U-DI]	Orientation signal ON (1): Orientation OFF (0): No orientation Normal operation
[X2]	Low speed direction command		Signal for designating the direction of rotation to reach the target stopping position during orientation from a stopping state. ON (1): Reverse rotation OFF (0): Forward rotation
[X3]	Position change command		Signal for latching data after a change in the external stop position command Rising edge (hold for at least 10 ms): Read external position command
[X4]	Gear selection 1	Selection between acceleration/deceleration and ASR [RT1]	[X4], [X5] = OFF, OFF Acceleration/deceleration, ASR, ORT gain, slow speed 1 valid [X4], [X5] = ON, OFF Acceleration/deceleration, ASR, ORT gain, slow speed 2 valid
[X5]	Gear selection 2	Selection between acceleration/deceleration and ASR [RT2]	[X4], [X5] = OFF, ON Acceleration/deceleration, ASR, ORT gain, slow speed 3 valid [X4], [X5] = ON, ON Acceleration/deceleration, ASR, ORT gain, slow speed 4 valid
[X6]	Stopping position selection 1	Universal DI [U-DI]	[X6], [X7] = OFF, OFF UNO. 20 stopping position setting 1 valid [X6], [X7] = ON, OFF UNO. 21 stopping position setting 2 valid [X6], [X7] = OFF, ON UNO. 22 stopping position setting 3 valid [X6], [X7] = ON, ON UNO. 23 stopping position setting 4 valid
[X7]	Stopping position selection 2		
[X8]	Any		
[X9]			

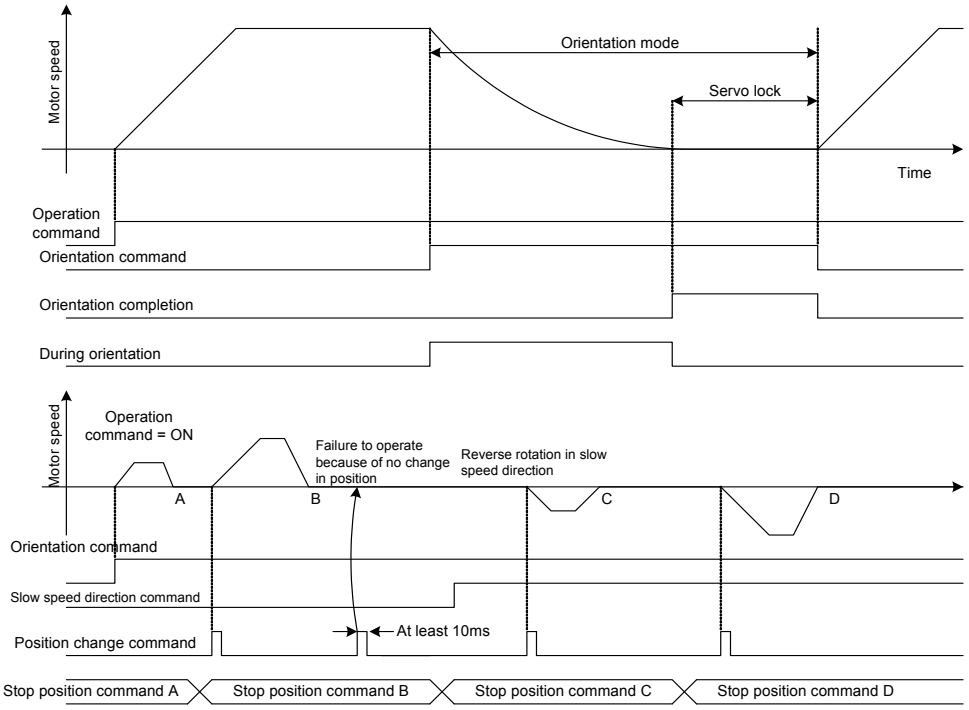


Fig. 4-2-16

4.2.8.2 Output signal

The orientation completion signal and orientation signal can be output.

The off-delay and on-delay timers for these outputs can be specified.

These settings do not give effects on the positioning accuracy.

Table 4-2-13

Terminal	Name of signal	Assignment	Description
[Y1]	Orientation completion signal	Universal DO [U-DO]	ON when the ORT command is ON within the orientation completion width
[Y2]	Orientation signal		ON when the ORT command is ON in excess of the orientation completion width

Note) The above signal will turn ON under the following conditions.
1) The operation command is OFF
2) The BX signal (Coast-to-stop command) is ON
3) The alarm is generated.

Specify the completion signal using the completion width setting function code.

Table 4-2-14

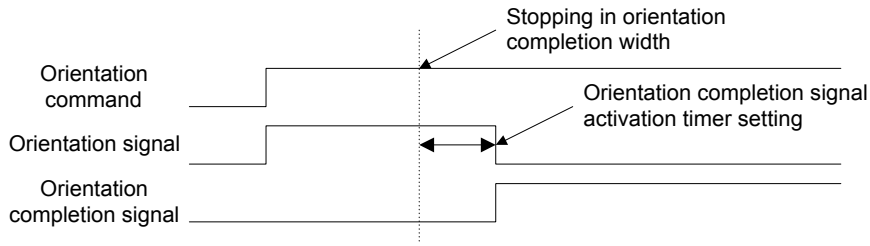
No.	Name of parameter,		Setting range	Description of setting
	Name	Indication on keypad		
UNO. 05	ORT completion range	USER P05	0 to 511	0 to 511 pulses Provides ORT completion signal (ON) when enters a range specified by pulses set by parameter to the position for ORT stopping.
UNO. 06	Completion width after ORT stopping	USER P06	0 to 511	0 to 511 pulses The ORT completion width is replaced with this setting after stoppage within the ORT completion width.

4.2.8.3 Output delay operation

Table 4-2-15

No.	Name of parameter,		Setting range	Description of setting
	Name	Indication on keypad		
UNO. 07	ORT completion signal ON timer	USER P07	0 to 1000	0 to 1000 (0.00 to 10.00s) Setting for timer after ORT completion to turning on ORT completion signal.
UNO. 08	ORT completion signal OFF timer	USER P08	0 to 1000	0 to 1000 (0.00 to 10.00s) Setting for timer after ORT completion cancellation to turning off ORT completion signal.

ORT (1) During regular operation



(2) If the orientation signal is turned off

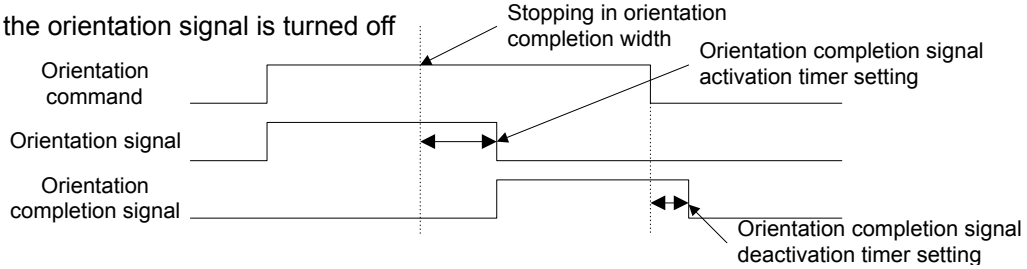


Fig. 4-2-17

4.2.8.4 Option monitor

Three types of data can be referred to from the keypad panel installed on the inverter.

Table 4-2-16

Option monitor	Description of indication	Data range	Description
Option monitor 3	Stopping position command	Positive value 0 to 32767	0 to 32767 Valid data of the stopping position setting (internal + external) is displayed. For the conversion method of the displayed data, refer to 4.2.5.3.
Option monitor 4	Datum shaft position in Z-phase (current position)	Positive value 0 to 32767	0 to 32767 The position in the forward direction (counter-clockwise rotation) from the Z-phase datum is displayed. The angle of rotation of the shaft in reference to the direction of rotation is displayed in pulses. For the conversion method of the displayed data, refer to 4.2.5.3.
Option monitor 5	Position deviation (current position - stop position command)	Positive value -500 to 500 pulses	-500 to 500 The deviation variable is displayed in the positive or negative value. Positive: If there is deviation in the forward direction, reverse rotation reduces the deviation to zero. Negative: If there is deviation in the reverse direction, forward rotation reduces the deviation to zero. ("0" is displayed for values exceeding +/-500.)

4.2.8.5 Gear selection

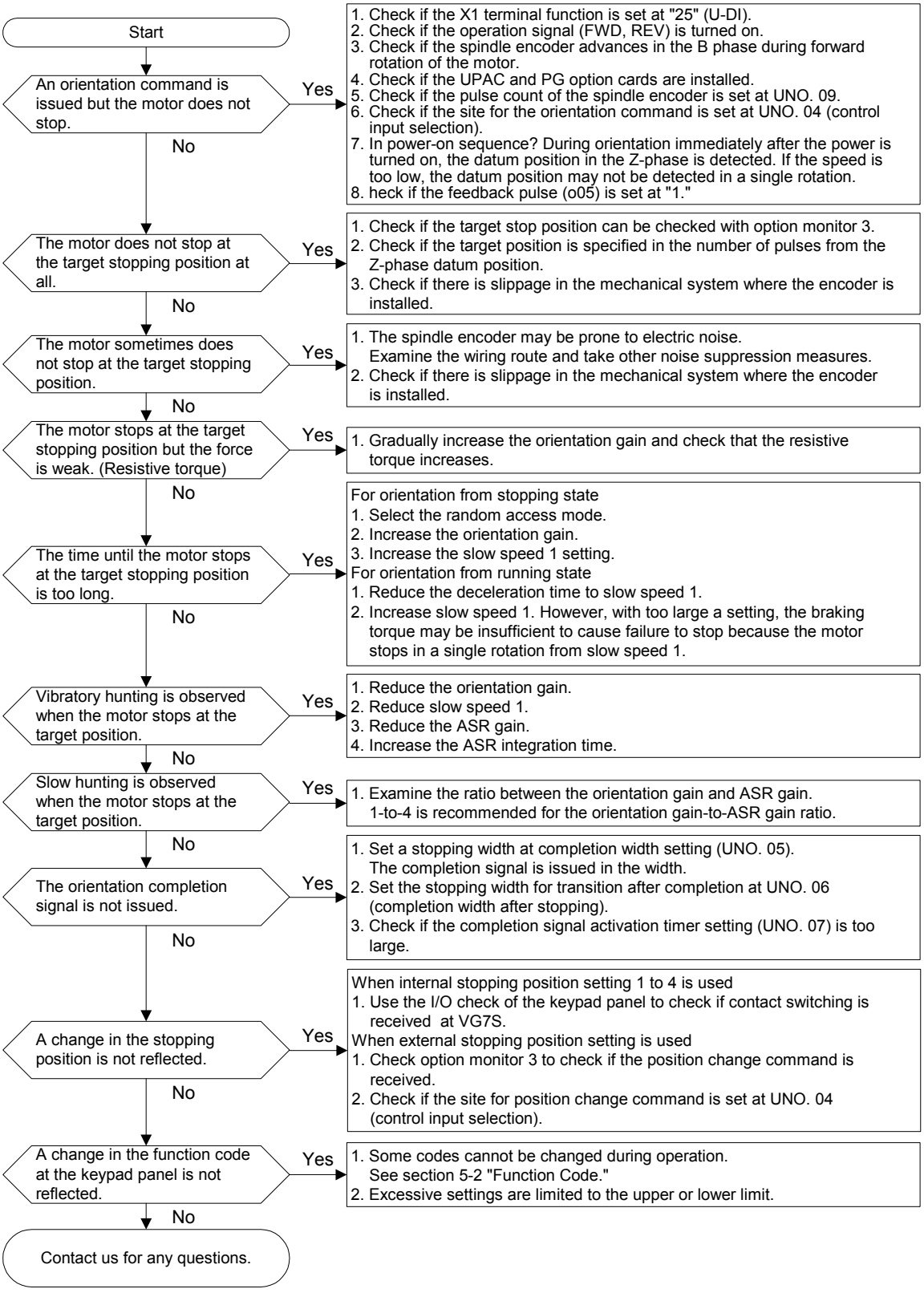
If a speed reduction means is installed between the motor and the shaft, the first slow speed, speed control adjustment (gain, integration constant, etc.), position control gain (orientation gain), and S-curve acceleration/deceleration time can be switched in four steps according to the gear ratio, using digital inputs [RT1] and [RT2].

Table 4-2-17

Digital input		Effective functions				
[RT2]	[RT1]	Slow speed 1	Speed control	Position control	Acceleration/deceleration time	S-curve setting
OFF	OFF	Slow speed 1 (1)	ASR1-P (gain) ASR1-I (integration constant) ASR1-FF (gain) ASR1 input filter ASR1 detection filter ASR1 output filter	Orientation gain 1	Acceleration time 1 Deceleration time 1	S-curve acceleration on starting side 1 S-curve acceleration on arrival side 1 S-curve deceleration on starting side 1 S-curve deceleration arrival side 1
OFF	ON	Slow speed 1 (2)	ASR2-P (gain) ASR2-I (integration constant) ASR2-FF (gain) ASR2 input filter ASR2 detection filter ASR2 output filter	Orientation gain 2	Acceleration time 2 Deceleration time 2	S-curve on starting side 2 S-curve on arrival side 2
ON	OFF	Slow speed 1 (3)	ASR2-P (gain) ASR2-I (integration constant) ASR2-FF (gain) ASR2 input filter ASR2 detection filter ASR2 output filter	Orientation gain 3	Acceleration time 3 Deceleration time 3	S-curve on starting side 3 S-curve on arrival side 3
ON	ON	Slow speed 1 (4)	ASR2-P (gain) ASR2-I (integration constant) ASR2-FF (gain) ASR2 input filter ASR2 detection filter ASR2 output filter	Orientation gain 4	Acceleration time 4 Deceleration time 4	S-curve on starting side 4 S-curve on arrival side 4

The function for damping the shock during switching (C70: ASR switching time) can be used.

4.2.9 Troubleshooting



4.3 WPS-VG1-TEN Available soon

WPS-VG1-TEN is package software for tension control designed for a winding system.
(Windows Personal Computer Software Package-Tension control system on FRENIC-VG)

The features of the package are:

- Constant tension torque control with tension pickup detection
- Wound diameter calculation using a line speed command and winding motor speed
-Tension taper calculation
- Automatic sampling for mechanical torque by automatically measuring mechanical loss
- Interface for a POD or a PLC for setting tension, taper and various conditions. (Note that you need an additional option card for interface)

This package software is provided for free on the CD-ROM for WPS-VG1-PCL (loader software). You may download the software from our website. To configure a system using this package, agreement with the following description is necessary.

[Terms of Agreement]

You are requested to agree to the following items.

Otherwise you should not use the WPS-VG1-TEN package software. If you need information on the agreement, please contact our sales representative.

(1) When you use the analog interface to build your system, you should consult the "FRENIC-VG User's Manual" and apply sufficient measures for preventing noise.

(2) All function codes U01 to 63 for tension control are set to '0' on delivery. The user must change the setting of necessary parameters voluntarily according to the purpose.

(3) The battery included in the UPAC is used to back up the data. The lifetime of the battery is five years (at 25°C). When the atmospheric temperature for the power supply you use is high, the lifetime of the battery becomes shorter than five years. When the battery life is reached, UPAC alarm "ErA" is displayed. If this alarm is displayed, change the battery soon. Please refer to the appropriate section described on the UPAC in the "FRENIC-VG User's Manual" for replacing the battery.

(4) If noise or vibration occurs due to resonance in the mechanical system or play in the gear, the mechanical system must be examined and adjusted. When you cannot adjust the machine system to restrain them, you should employ electrical measures, and you should adjust the standard functions of the FRENIC-VG, the gain and integration time of the PID controller, and the parameters for the filter while you separate the inverter from the floor. Please note that we cannot provide measures for adding dedicated control applications for the control of your UPAC or FRENIC-VG.

(5) You are not allowed by the copyright law to duplicate, rent, or resell the entire or a part of the program.

(6) There is no limitation/restriction on adding, altering, or deleting the specification to develop your own program based on this tension control program. We will provide technical support and consultation on developing programs.

(7) Fuji is not responsible for direct or indirect damage caused by the program itself of WPS-VG1-TEN or alteration, addition, or deletion made to the program by a customer.

I agree the terms above (Your signature here)

4.3.1 System Consideration

4.3.1.1 Specifications

Table 4-3-1

Item		Tension Control Specification	
Model of option card		You need the OPC-VG1-UPAC and an additional card for interface.	
Package Software		Tension control package. Version number "1200□" (Use function code UNo. 64 for display.)	
Control type		Constant tension PID control with a tension pick up: ATR (Auto Tension Regulator)	
Analog	Input signal	[Ai1]: Tension detection signal 0 V to 10 V [Ai2]: Line speed input 0 V to 10 V	
	Output signal	[Ao1]: -10 V to 0 V to 10 V [Ao2]: -10 V to 0 V to 10 V [Ao3]: -10 V to 0 V to 10 V	When defined as U-Ao, you can monitor the following output. 1. Tension setting [N] 2. ATR correction [N] 3. Wound diameter [mm] 4. Torque corresponding to tension command [%] 5. Acceleration/deceleration torque [%] 6. Mechanical loss torque [%]
Digital	Input signal	[X1]: Cancel torque command (CCL) [X2]: ON on operation command (U-Di) [X3]: OFF on stop command (U-Di) [X4]: ON on tension ON command (U-Di) [X5]: OFF on emergency stop (U-Di) [X6]: Alarm reset (U-Di) [X7]: Mechanical loss measuring command (U-Di) [X8]: Reset wound diameter (U-Di) [X9]: Coast-to-stop (U-Di)	
	Output signal	[Y1]: ON on abnormal tension (U-Di) [Y2]: Completion of mechanical loss measuring (U-Di) [Y5]: ON on inverter error (U-Di)	
Others (POD and T link Set with keypad)		[U01]: Stall tension setting 0 - □[N]/0 - □ [U02]: Operation tension setting 0 - □[N]/0 - □ [U03]: Material thickness □ - □[mm]/ □ - □ 1000 [U04]: Material width □ - □[mm]/ □ - □ [U05]: Abnormal tension (Upper limit setting) 0 - 150[%]/0 - 150 [U06]: Abnormal tension (Lower limit setting) 0 - 150[%]/0 - 150 [U07]: Wound diameter (Initial value) 100 - 1500 [mm]/100 - 1500 [U08]: Material mass 500 to 2000 [kg/m^3]/500 to 2000 [U09]: Linear taper setting 0 - 150[%]/0 - 150 [U10]: Two-point taper setting 0 - 150[%]/0 - 150 [U11]: Two-point taper diameter setting 0 - 2000[mm]/0 - 2000	

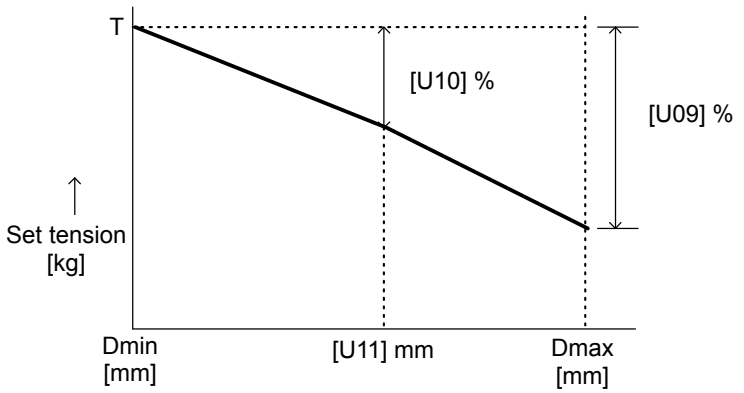


Fig. 4-3-1

• When you use the POD to set the data, connect the POD to the built-in RS485 port.

- When you use the PLC to set the data, use an option card (OPC-VG1-TL: T-Link I/F card or OPC-VG1-CCL: CC-Link I/F card).

4.3.2 Input/Output Standard Interface (single inverter is used)

1) Bit Signal from Control Panel to UPAC

		POD address
(1) Tension command (ON on ON)	%IX1.5.5 ⊸ ⊸X4	Hardware/T-link/POD 401799-5
(2) Operation command (ON on command)	%IX1.5.3 ⊸ ⊸X2	Hardware/T-link/POD 401799-3
(3) Stop command (OFF on stop)	%IX1.5.4 ⊸ ⊸X3	Hardware/T-link/POD 401799-4
(4) Emergency stop (OFF on emergency stop)	%IX1.5.6 ⊸ ⊸X5	Hardware only
(5) Alarm reset (ON on reset)	%IX1.5.7 ⊸ ⊸X6	Hardware/T-link/POD 401799-7
(6) Mechanical loss automatic measuring command (ON while command is active)	%IX1.5.8 ⊸ ⊸X7	Hardware/T-link/POD 401799-8
(7) Wound diameter reset (ON on reset)	%IX1.5.9 ⊸ ⊸X8	Hardware/T-link/POD 401799-9

2) Bit Signal from UPAC to Control Panel

(1) Inverter error (ON on error)	%QX1.23.4	Y5 Relay output	Hardware 401799-5
(2) Abnormal tension (ON on abnormality)	%QX1.23.0	Y1 Transistor output	Hardware 401799-0
(3) Completion of measuring mechanical loss (ON for two seconds after completion)	%QX1.23.1	Y2 Transistor output	Hardware 401799-1

3) Data Setting from POD and Control Panel to UPAC

(1) Line speed command	Ai2 0 VDC to ■ V/O-■m/min	
(2) Tension feedback signal input	Ai1 0 VDCO to 10 V/O-■N	
(3) Stall tension setting [N]	0 to ■N	USER P1POD 402818
(4) Operation tension setting [N]	0 to ■N	USER P2POD 402819
(5) Abnormal tension setting (Upper limit level) [N]	0 to ■N	USER P5POD 402822
(6) Abnormal tension setting (Lower limit level) [N]	0 to ■N	USER P6POD 402823
(7) Initial wound diameter setting [mm]	■ to ■mm	USER P7POD 402824
(8) Material width [mm]	■ to ■mm	USER P4POD 402821
(9) Material thickness [mm]	■ to ■mm (1000=1mm)	USER P3POD 402820
(10) Material specific gravity (density) [kg/m^3]	■ to ■kg/m^3	USER P8POD 402825
(11) Taper		
(1) Linear taper setting [%]	0 to ■%	USER P9POD 402826
(2) Two-point taper setting [%]	0 to ■%	USER P10POD 402827
(3) Two-point taper diameter setting [mm]	■ to ■mm	USER P11POD 402828

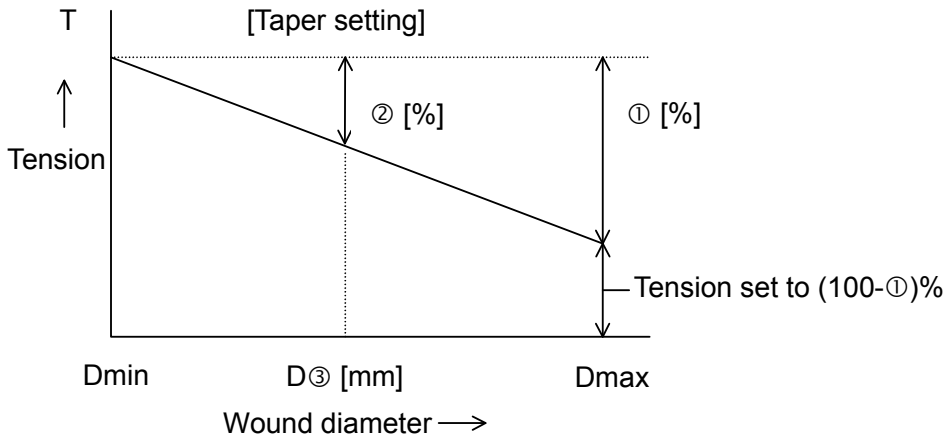


Fig. 4-3-2

(12) Load cell input	0 to ■N	USER P50POD 402867
(13) Speed monitor	0 to ■m/min (1000＝100m/min)	USER P49POD 402866

4) Example of Basic Connection

The following figure shows a connection example.

You can use the POD or the PLC to select different settings of tension. Note that there is a restriction for the setting from PLC. (You can use the link No. to set U01 to U10.)

• You need an option card (OPC-VG1-TL) to use the PLC.

You use either the POD or the PLC to constitute your system.

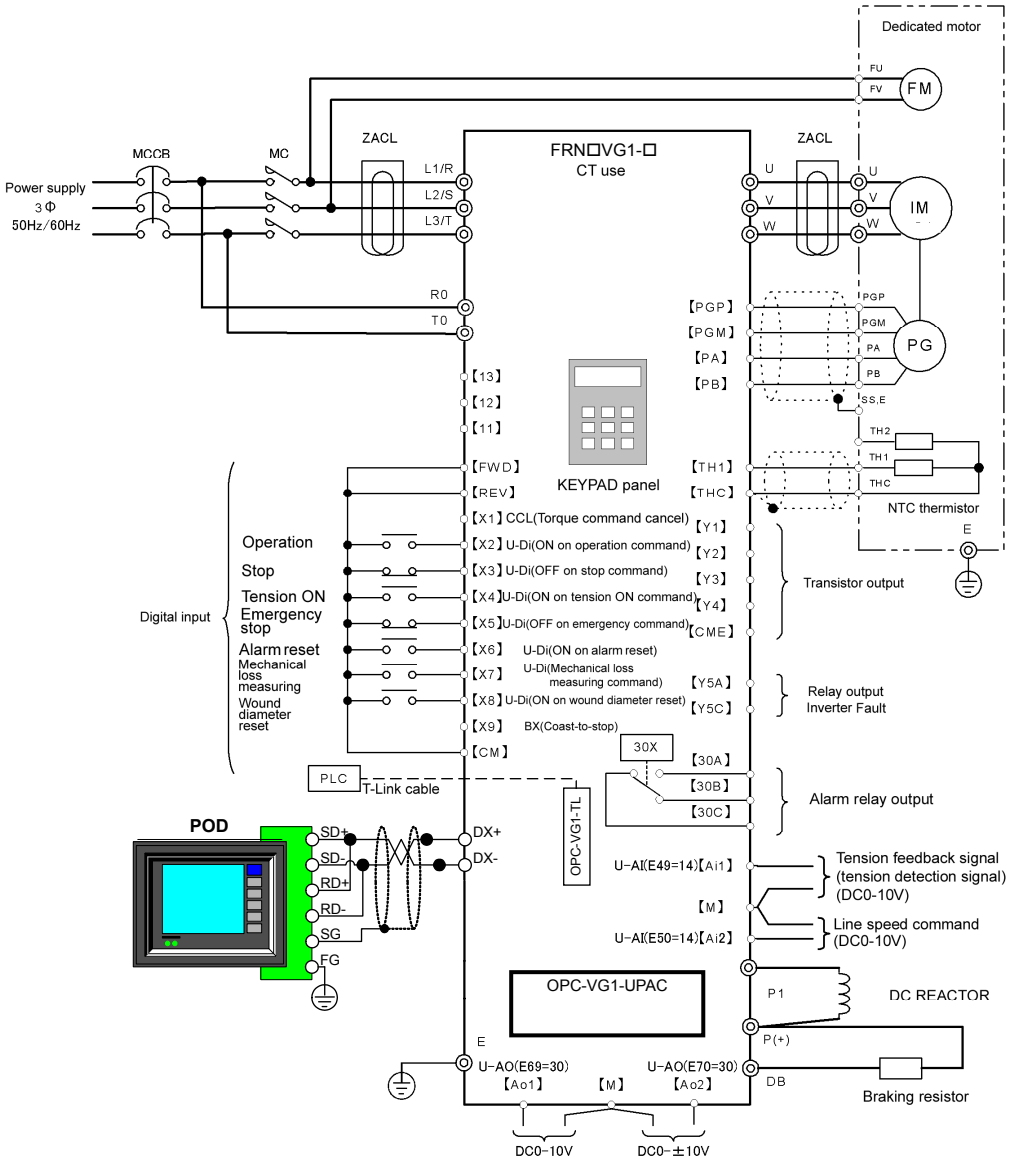


Fig. 4-3-3

4.3.3 How to Adjust

Follow the steps below for adjusting.

1) Mechanical Loss Automatic Measuring

You can use the mechanical loss automatic measuring command to measure torques necessary for loads at individual rotations of your motor, and store the data into the software. (Required time for the automatic measuring is about eight minutes.)

<Mechanical conditions>

• Operate while a paper tube is attached. (Raw material is not required.)

<Mechanical loss measuring>

• Operate at the maximum motor rotation speed determined by the maximum line speed, the minimum wound diameter and the speed reduction ratio.

• The rotation speed is automatically measured at 20 points while the speed is reduced stepwise.

• After the mechanical loss is measured, the motor accelerates to the maximum rotation speed again to automatically measure the acceleration torque. It is dangerous, and you should watch for eight minutes until the measuring is completed. Keep away from your winding machine.

2) Set/Check Fixed Constants

• Start the UPAC and check the constants. (o38: "1" or "2")

• To prevent a malfunction, reset the I/O definition for UPAC=>INV.

[Uncheck the check marks for the individual output in the I/O group setting in System_Definition. (Record the existing setting for later recovery.)]

(1) Dedicated Software for Winding Machines

The current software is configured for a winding machine.

(2) I/O Check

• Experimentally apply external DI's, and use the online monitor of the UPAC to check their state.

• Use the online monitor of the UPAC to check whether external analog inputs are received as correct values.

(3) Checking Individual Constants

Check if input values set by using the user parameters are received in the UPAC as correct values.

If you can experimentally provide the tension command value and the like, check the calculated torque value.

3) Adjusting Control Parameters

• Conduct individual adjusting with an actual operation while raw material is mounted.

• Set the I/O definition for UPAC=>INV.

[Uncheck the check marks for the individual output in the I/O group setting in System_Definition. (Record the existing setting for later recovery.)]

(1) Setting Individual Conditions

Set the subjects to adjusting: U01, U02, U03, U04, U05, U06, U07, U08, U09, U10, U11, U12, U13, U14, U15, U27, U28, U31, and U48.

Acceleration/deceleration time: F07 and F08 (Set the times to reach the speeds described above, and set the pitch of rising speed. Note that set the same values as the rising/falling of the line speed.)

(2) Tension Control (PID Parameters)

Base parameters for the tension control.

Subjects to adjusting: U20, U21, U25, U26, U29, U30, U44, and U56 to U61

Proportional term (P): U17 and U22

Integral term (I): U18 and U23

Differential term (D): U19 and U24

(1) Adjust tension control parameters during the stall operation.

(2) Adjust slack on start.

Adjust what corresponds to dynamic mechanical loss torque. Set U38, U39, U45, and U46.

(3) Adjust the tension control parameters at a constant speed.

(4) Adjust the acceleration/deceleration compensation torque.

Conduct a line operation after adjusting the stall tension, and adjust while increasing/decreasing the speed.

Set U33, U34 to U42, U45 to U48, U62, and U63.

4.3.4 Parameter Description

1) Functions for Setting Tension and Material Conditions

U01	**Stall tension setting**	**Set value: 0 to 980/0 to 980 [N] (without limiter)**

Sets the tension setting value while stalling. (Stall tension is present while the tension is ON and the operation command is OFF.)

U02	**Operation tension setting**	**Set value: 0 to 980/0 to 980 [N] (without limiter)**

Sets the tension set value while operating. (Operation tension is present while the tension is ON and the operation command is ON.)

U03	**Material thickness setting**	**Set value: 1 to 30000/0.001 to 30[mm] (without limiter)**
U04	**Material width setting**	**Set value: 100 to 1000/100 to 1000[mm] (without limiter)**

2) Functions Relevant to Setting Material Conditions

U05	**Abnormal tension (Upper limit setting)**	**Set value: 0 to 1960/0 to 1960 [N] (without limiter)**
U06	**Abnormal tension (Lower limit setting)**	**Set value: 0 to 1960/0 to 1960 [N] (without limiter)**

When these set values are exceeded, a signal for stopping the line operation is provided externally, and the winding machine stops.

U07	**Wound diameter (Initial value)**	**Set value: 100 to 1500/100 to 1500[mm] (without limiter)**

Sets the initial wound diameter of the winding machine.

U08	**Material mass**	**Set value: 500 to 2000/500 to 2000[kg/m^3] (without limiter)**

Enter a mass per 1 m^3 in [kg].
Sets for calculating the acceleration/deceleration torque. (Used for GD^2 conversion corresponding to the material)

3) Taper Setting

U09	**Linear taper setting**	**Set value: 0 to 150/0 to 150 [%] (without limiter)**

See the figure below.

U10	**Two-point taper setting**	**Set value: 0 to 150/0 to 150 [%] (without limiter)**

See the figure below.

U11	**Two-point taper diameter setting**	**Set value: 0 to 2000/0 to 2000[mm] (without limiter)**

See the figure below.

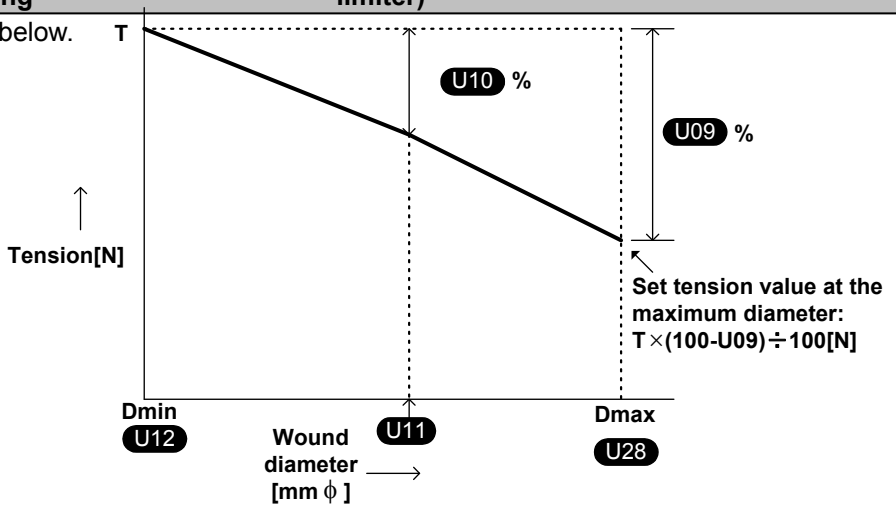


Fig. 4-3-4

4) Tension Conditions Setting

U12	**Coil diameter (minimum diameter)**	**Set value: 100 to 2000/100 to 2000[mm] (without limiter)**

Enter the minimum value for the coil diameter. (Enter the bobbin diameter.)

U13	**Range setting for maximum value for tension detection value**	**Set value: 0 to 14700/0 to 1470 [N] (without limiter)**

Enter the maximum tension for scale conversion for the tension detection value.

Use N for entry.

U14	**Speed reduction ratio**	**Set value: 0 to 10000/0 to 100.00 (without limiter)**

Enter $\frac{\text{Motor rotation speed}}{\text{Machine shaft rotation speed}} \times 100.$

U15	**Range setting for maximum tension set value**	**Set value: 0 to 9800/0 to 980 [N] (without limiter)**

Enter the maximum tension set value for scale conversion for the tension set value.

Use N for entry. (Enter □kgx9.8.)

5) Functions Relevant to Detecting Tension

These are terms set for the feed back control for a difference between the instructed tension and the detected tension.

A proportional operation (P), an integral operation (I), and a differential operation (D) of the ATR as a control type for eliminating a difference between a measured value and a reference value are used for a highly precise tension feed back control.

U16	**PID control type selection**	**Set value: Fixed to 000**

Fixed to the PID control type described in the figure below.

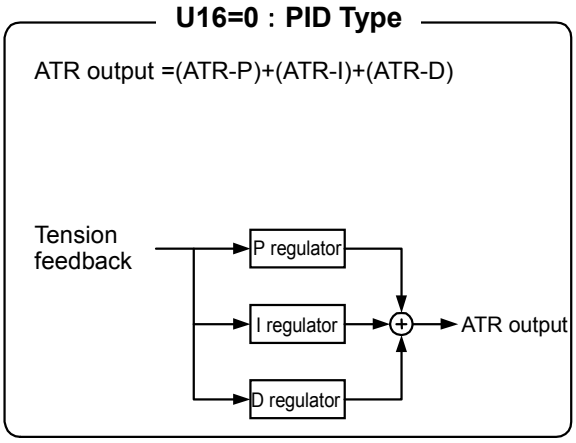


Fig. 4-3-5

6) Functions Relevant to Feedback Control

U17	**P gain for ATR (during constant speed)**	**Set value: 0 to 10000/0 to 10.000 [times] (without limiter)**

Sets P gain while the line speed is constant.

U18	**I time for ATR (during constant speed)**	**Set value: 0 to 10000/0 to 100.00 [sec] (without limiter)**

Sets I time while the line speed is constant.

U19	**D time for ATR (during constant speed)**	**Set value: 0 to 10000/0 to 10.000 [sec] (without limiter)**

Sets D time while the line speed is constant.

U20	**Upper limit value for ATR (while constant speed)**	**Set value: -300 to 300/-300 to 300[%] (without limiter)**

It will be the upper limit value for correction value of the ATR while the line speed is constant.

U21	**Lower limit value for ATR (while constant speed)**	**Set value: -300 to 300/-300 to 300[%] (without limiter)**

It will be the lower limit value for correction value of the ATR while the line speed is constant.

U22	**P gain for ATR(while accelerating/decelerating line)**	**Set value: 0 to 10000/0 to 10.000 [times] (without limiter)**

Sets P gain while accelerating/decelerating the line.

U23	**I time for ATR(while accelerating/decelerating line)**	**Set value: 0 to 10000/0 to 100.00 [sec] (without limiter)**

Sets I time while accelerating/decelerating the line.

U24	**D time for ATR(while accelerating/decelerating line)**	**Set value: 0 to 10000/0 to 10.000 [sec] (without limiter)**

Sets D time while accelerating/decelerating the line.

U25	**Upper limit value for ATR(while accelerating/decelerating line)**	**Set value: -300 to 300/-300 to 300[%] (without limiter)**

It will be the upper limit value for correction value of the ATR while accelerating/decelerating the line.

U26	**Lower limit value for ATR(while accelerating/decelerating line)**	**Set value: -300 to 300/-300 to 300[%] (without limiter)**

It will be the lower limit value for correction value of the ATR while accelerating/decelerating the line.

U27	**Maximum value setting for line speed**	**Set value: 0 to 20000/0 to 2000 [m/min] (without limiter)**

Enter the maximum speed for scale conversion for the line speed.

U28	**Maximum diameter setting**	**Set value: 100 to 2000/100 to 2000[mm] (without limiter)**

Enter the maximum diameter for scale conversion for the wound diameter.

U29	**Limit (upper limit) for ATR while stalling**	**Set value: -300 to 300/-300 to 300[%] (without limiter)**

Sets the upper limit value for the correction value by the ATR while stalling.

Increase this setting when you want to increase the correction value by the ATR while stalling.

U30	**Limit (lower limit) for ATR while stalling**	**Set value: -300 to 300/-300 to 300[%] (without limiter)**

Sets the upper limit value for the correction value by the ATR while stalling.

Increase this setting when you want to increase the correction value by the ATR while stalling.

U31	**Minimum rotation speed**	**Set value: 15 to 1500/15 to 1500 [r/min] (without limiter)**

Enter the minimum rotation speed of a winding motor when the wound diameter is the maximum at the maximum line speed for calculating the wound diameter.

$$\frac{V\max[m/\min]}{D\max[m]\times\pi}\times \text{Speed reduction ratio} = \text{calculate and enter minimum rotation speed of motor}$$

$$\left(\text{Speed reduction ratio} = \frac{\text{Motor rotation speed}}{\text{Machine shaft rotation speed}}\right)$$

7) ATR Control Timing Adjusting

U44	**Speed for turning off ATR**	**Set value: 0 to 100/0 to 1 [m]**

Sets the line speed for turning off the ATR correction. Sets to 0 when you want it active until complete stop.

U56	**Delay timer setting for ATR OFF**	**Set value: 0 to 5000/0 to 5 [sec]**

Sets the time until the ATR control is turned off after the condition for turning off the ATR is met.

U57	**Delay timer setting for detecting speed of out of material**	**Set value: 0 to 5000/0 to 5 [sec]**

Sets the time for the timer for confirming that the machine is out of material.

U58	**Delay timer setting for enabling ATR PI**	**Set value: 0 to 5000/0 to 5 [sec]**

Sets the time to start the ATR control after conditions for enabling the ATR are met.

U59	**Detecting speed of out of material**	**Set value: 0 to 2000/0 to 2000 [r/min]**

Rotation speed calculated from the wound diameter + α is used as a reference for detecting the speed.

Sets the +α value here.

U60	**Torque command limit**	**Set value: 0 to 15000/0 to 150 [%]**

Usually enter a value so as to fix this torque command limit to 150%.

U61	**ATR dead zone width**	**Set value: 0 to 100/0 to 100 [N]**

Enter the width of a dead zone for the ATR control input.

8) Functions Relevant to Acceleration/Deceleration Compensation Torque

U33	**Acceleration/deceleration detection level (dead zone)**	**Set value: 0 to 1000**

Sets the deviation amount of change in order to determine the constant speed/acceleration. (The deviation amount is affected by changes in the speed command value. Sets so as to avoid a detection error at a constant speed.) The value is compared with the previous value at a 1-msec calculation interval.

U34	**Deceleration detection level (dead zone)**	**Set value: 0 to -1000**

Sets the deviation amount of change in order to determine the deceleration. (The deviation amount is affected by changes in the speed command value. Sets so as to avoid a detection error at a constant speed.) The value is compared with the previous value at a 1-msec calculation interval.

U35	**Torque command limit**	**Set value: 0 to 1000/0 to 1000 [msec]**

Sets a time for a filter through which the last output of the torque command passes. (Standard: 5 msec)

U36	**GD^2 corresponding to reel [kgm^2]**	**Set value: 1 to 32767/0.01 to 327.67 [kgm^2]**

Calculates GD^2 corresponding to a reel converted into the motor shaft.

U37	**Speed setting correction**	**Set value: 0 to 200/0 to 200 [%]**

Sets this correction value slightly smaller than 100 when a material is slightly slipping with respect to the line speed set value.

U38	**Active time of dynamic mechanical loss (while operating)**	**Set value: 0 to 5000/0 to 5 [sec]**

Use this setting when you cannot adjust by using the acceleration/deceleration torque compensation.
Sets the time when the toque compensation corresponding to the dynamic mechanical loss is applied when starting the operation. Sets 0 to disable.
Adjust this time when the tension decreases when starting the operation.

U39	**Active time of dynamic mechanical loss (while stalling)**	**Set value: 0 to 5000/0 to 5 [sec]**

Use this setting when you cannot adjust to a set tension by using the stall operation.
Adjust this time when the tension decreases during the stall operation. Sets 0 to disable.
Use this setting after the wound diameter is reset to an initial value.

U40	**Deceleration dv/dt on emergency stop**	**Set value: 0 to -100/0 to -100[m/min/sec]**

Used for calculating the deceleration compensation torque on an emergency stop.
[Example] dv/dt for stopping from 500 m/min in five seconds is –500/5=–100.

U41	**Acceleration/deceleration torque correction corresponding to material**	**Set value: 0 to 150/0 to 150 [%]**

Corrects an excess/deficiency of an acceleration/deceleration torque due to a material. Usually sets to 100%.

U42	**Acceleration/deceleration torque correction corresponding to reel**	**Set value: 0 to 150/0 to 150 [%]**

Corrects an excess/deficiency of an acceleration/deceleration torque due to reel (mechanical system). Usually sets to 100%.

U45	**Torque setting corresponding to dynamic mechanical loss(while operating)**	**Set value: 0 to 3000/0 to 30 [%]**

Enter a mechanical loss torque on staring the operation.

U46	**Torque setting corresponding to dynamic mechanical loss(while operating)**	**Set value: 0 to 3000/0 to 30 [%]**

Enter a mechanical loss torque when starting stall.

U58	**Tension feedback filter setting**	**Set value: 0 to 5000/0 to 5 [sec]**

Sets the filter time for the input of the detected tension. The standard setting is 5 msec.

U62	**dv/dt during acceleration**	**Set value: 0 to 100/0 to 100[m/min/sec]**

Used for calculating a compensation torque during acceleration.
[Example] dv/dt for accelerating to 500 m/min in twenty seconds is 500/20=25.

U63	**dv/dt during deceleration**	**Set value: 0 to -100/0 to -100[m/min/sec]**

Usually used for calculating a compensation torque during deceleration.
[Example] dv/dt for decelerating from 500 m/min in ten seconds is –500/10=–50.

9) [Ao1 to Ao5] Monitor Output Selection

U51 **[Ao1] Output item selection for output monitor Set value: 1 to 6**

1: Final value for tension command [N] (10 V for the maximum tension setting)
2: Final value corresponding to the ATR correction [N] (10 V for the maximum tension setting)
3: Current value of wound diameter [mm] (10 V for the maximum diameter)
Torque corresponding to tension command [%] (10 V for 150%)
5: Torque for compensating acceleration/deceleration [%] (10 V for 150%)
6: Torque for compensating mechanical loss [%] (10 V for 150%)

U52 **[Ao2] Output item selection for output monitor Set value: 1 to 6**

1: Final value for tension command [N] (10 V for the maximum tension setting)
2: Final value corresponding to the ATR correction [N] (10 V for the maximum tension setting)
3: Current value of wound diameter [mm] (10 V for the maximum diameter)
Torque corresponding to tension command [%] (10 V for 150%)
5: Torque for compensating acceleration/deceleration [%] (10 V for 150%)
6: Torque for compensating mechanical loss [%] (10 V for 150%)

U53 **[Ao3] Output item selection for output monitor Set value: 1 to 6**

1: Final value for tension command [N] (10 V for the maximum tension setting)
2: Final value corresponding to the ATR correction [N] (10 V for the maximum tension setting)
3: Current value of wound diameter [mm] (10 V for the maximum diameter)
4: Torque corresponding to tension command[%] (10 V for 150%)
5: Torque for compensating acceleration/deceleration [%] (10 V for 150%)
6: Torque for compensating mechanical loss [%] (10 V for 150%)

U54 **[Ao4] Output item selection for output monitor Set value: 1 to 6**

1: Final value for tension command [N] (10 V for the maximum tension setting)
2: Final value corresponding to the ATR correction [N] (10 V for the maximum tension setting)
3: Current value of wound diameter [mm] (10 V for the maximum diameter)
4: Torque corresponding to tension command[%] (10 V for 150%)
5: Torque for compensating acceleration/deceleration [%] (10 V for 150%)
6: Torque for compensating mechanical loss [%] (10 V for 150%)

U55 **[Ao5] Output item selection for output monitor Set value: 1 to 6**

1: Total corresponding to torque command [%] (10 V for 150%)
2: Final value corresponding to the ATR correction [N] (10 V for the maximum tension setting)
3: Current value of wound diameter [mm] (10 V for the maximum diameter)
4: Torque corresponding to tension command[%] (10 V for 150%)
5: Torque for compensating acceleration/deceleration [%] (10 V for 150%)
6: Torque for compensating mechanical loss [%] (10 V for 150%)

* When you use [Ao4] and [Ao5], you need an AI0 option (OPC-VG1-AI0).

4.3.5 Table for Setting Relevant Parameters

1) U Code Parameters (Subject to setting/adjusting for UPAC tension control)

Table 4-3-2

Category	Function code	Name	LCD display (Japanese)		Valid setting range (Note 1)		Unit	Min. unit	Initial value	Change during operation	Remarks	See
	U01	Stall tension setting	**U01**	USER P1	0 to 980	0 to 980(N)	(N)	1	POD.PLC	○		4-49
	U02	Operation tension setting	**U02**	USER P2	0 to 980	0 to 980(N)	(N)	1	POD.PLC	○		4-49
	U03	Material thickness	**U03**	USER P3	1 to 30000	0.001 to 30(mm)	(mm)	0.01	POD.PLC	○		4-49
	U04	Material width	**U04**	USER P4	100 to 2000	100 to 2000(mm)	(mm)	1	POD.PLC	○		4-49
	U05	Tension upper limit (error level)	**U05**	USER P5	0 to 1960	0 to 1960(N)	(N)	1	POD.PLC	○		4-49
	U06	Lower limit (error level)	**U06**	USER P6	0 to 980	0 to 980(N)	(N)	1	POD.PLC	○		4-49
	U07	Wound diameter (Initial value)	**U07**	USER P7	100 to 2000	100 to 2000(mm)	(mm)	1	POD.PLC	○		4-49
	U08	Material mass	**U08**	USER P8	500 to 2000	500 - 2000(kg/m^2)	(kg/m^2)	1	POD.PLC	○		4-49
	U09	Linear taper setting	**U09**	USER P9	0 to 150	0 to 150(%)	(%)	1	POD.PLC	○		4-49
	U10	Two-point taper setting	**U10**	USER P10	0 to 150	0 to 150(%)	(%)	1	POD.PLC	○		4-49
	U11	Two-point taper diameter setting	**U11**	USER P11	0 to 2000	0 to 2000(mm)	(mm)	1		○		4-49
	U12	Coil diameter (minimum diameter)	**U12**	USER P12	100 to 2000	100 to 2000(mm)	(mm)	1	100	○		4-50
	U13	Maximum tension F B range120kgf	**U13**	USER P13	0 to 14700	0 to 1470(N)	(N)	1		○		4-50
	U14	Speed reduction ratio (motor/machine x 100)	**U14**	USER P14	0 to 10000	0 to 100.00		0.01		○		4-50
	U15	Maximum tension setting range	**U15**	USER P15	0 to 14700	0 to 1470(N)	(N)	1		○		4-50
	U16	(Unused)	**U16**	USER P16					000			4-50
	U17	ATR_CON: P gain	**U17**	USER P17	0 to 10000	0 to 10.000(times)	(times)	0.001	6000	○		4-51
	U18	ATR_CON: I time	**U18**	USER P18	0 to 10000	0 to 100.00(sec)	(sec)	0.01	400	○		4-51
	U19	ATR_CON: D time	**U19**	USER P19	0 to 10000	0 to 10.000(sec)	(sec)	0.01	1	○		4-51
	U20	ATR_CON: Limit (upper)	**U20**	USER P20	-300 to 300	-300 to 300(%)	(%)	1	100	○		4-51
	U21	ATR_CON: Limit (lower)	**U21**	USER P21	-300 to 300	-300 to 300(%)	(%)	1	-100	○		4-51
	U22	ATR_CON (accelerating/decelerating line):P gain ATR_No .1: P gain	**U22**	USER P22	0 to 10000	0 to 10.000(times)	(times)	0.001	6000	○		4-51
	U23	ATR_CON (accelerating/decelerating line): I time ATR_No .1: I time	**U23**	USER P23	0 to 10000	0 to 100.00(sec)	(sec)	0.01	400	○		4-51
	U24	ATR_CON (accelerating/decelerating line): D time ATR_No .1: D time	**U24**	USER P24	0 to 10000	0 to 10.000(sec)	(sec)	0.01	1	○		4-51
	U25	ATR_No.1: Limit (upper)	**U25**	USER P25	-300 to 300	-300 to 300(%)	(%)	1	0	○		4-51
	U26	ATR_No .1: Limit (lower)	**U26**	USER P26	-300 to 300	-300 to 300(%)	(%)	1	0	○		4-51
	U27	Line speed	**U27**	USER P27	0 to 20000	0 to 2000(mm)	(m/min)	1		○		4-51
	U28	Maximum diameter	**U28**	USER P28	10 to 2000	100 to 2000(mm)	(mm)	1		○		4-51
	U29	Limit (upper) for ATR while stalling	**U29**	USER P29	0 to 500	0 to 500(%)	(%)	1	300	○		4-51
	U30	Limit (lower) for ATR while stalling	**U30**	USER P30	0 to 500	0 to 500(%)	(%)	1	-100	○		4-52
	U31	Minimum rotation speed	**U31**	USER P31	15 to 1500	15 to 1500(r/min)	(r/min)	1		○		4-52
	U32	(Unused)	**U32**	USER P32					0			-
	U33	Acceleration detection level	**U33**	USER P33	0 to 1000			1	20	○		4-52
	U34	Deceleration detection level	**U34**	USER P34	0 to -1000			1	-20	○		4-52
	U35	Torque command limit	**U35**	USER P35	0 to 1000	0 to 1000(ms)	(ms)	1	5	○		4-52
	U36	GD^2 corresponding to reel [kgm^2]	**U36**	USER P36	0 to 32767	0 to 327.67(kgm^2)	(kgm^2)	0.01		○		4-53
	U37	Speed setting correction	**U37**	USER P37	0 to 200	0 to 200(%)	(%)	1	100	○		4-53
	U38	Active time of dynamic mechanical loss (while operating)	**U38**	USER P38	0 to 5000	0 to 5(sec)	(sec)	0.001	0	○		4-53
	U39	Active time of dynamic mechanical loss (while stalling)	**U39**	USER P39	0 to 5000	0 to 5(sec)	(sec)	0.001	2000	○		4-53
	U40	Deceleration dv/dt on emergency stop	**U40**	USER P40		0 to 5.0 (m/min/sec) (Enter a negative value)	(m/min/sec)	-1	-2	○		4-53
	U41	Acceleration/deceleration torque correction corresponding to material	**U41**	USER P41	0 to 150	0 to 150(%)	(%)	1	100	○		4-53
	U42	Acceleration/deceleration torque correction corresponding to reel	**U42**	USER P42	0 to 150	0 to 150(%)	(%)	1	100	○		4-53
	U43	(Unused)	**U43**	USER P43								-
	U44	Speed for turning off ATR	**U44**	USER P44	0 to 100	0 to 1(mm)	(m/min)	1	125	○		4-52
	U45	Torque corresponding to dynamic mechanical loss (while operating)	**U45**	USER P45	0 to 1500	0 to 15(%)	(%)	1	0	○		4-53
	U46	Torque corresponding to dynamic mechanical loss (while stalling)	**U46**	USER P46	0 to 1500	0 to 15(%)	(%)	1	15	○		4-53
	U47	(Unused)	**U47**	USER P47								-
	U48	Tension feedback filter setting	**U48**	USER P48	0 to 5000	0 to 5(sec)	(sec)	0.001	5	○		4-53
	U49	Line speed monitor (To POD)	**U49**	USER P49	0 to 20000	0 to 2000(mm)	(m/min)	-	Monitor	○	Monitor only. Output as m/min x 10.	-
	U50	Load cell output (To POD)	**U50**	USER P50	0 to 1960	0 to 1960(N)	(N)	-	Monitor	○	Monitor only. Output as N.	-
	U51	Ao1 Monitor output selection	**U51**	USER P51	0 to 6			-	0	○		4-54
	U52	Ao2 Monitor output selection	**U52**	USER P52	0 to 6			-	3	○		4-54
	U53	Ao3 Monitor output selection	**U53**	USER P53	0 to 6			-	2	○		4-54
	U54	Ao4 Monitor output selection	**U54**	USER P54	0 to 6			-	5	○		4-54
	U55	Ao5 Monitor output selection	**U55**	USER P55	0 to 6			-	1	○		4-54
	U56	ATR Pi OFF delay timer	**U56**	USER P56		0 to 5,000(ms)	(ms)	1	200	○		4-52
	U57	Delay timer for detecting speed for out of pipe	**U57**	USER P57		0 to 5,000(ms)	(ms)	1	0	○		4-52
	U58	ATR Pi enabling delay timer	**U58**	USER P58		0 to 5,000(ms)	(ms)	1	0	○		4-52
	U59	Speed limiter + N(Detecting speed of out of material)	**U59**	USER P59		0 to 200(r/min)	(r/min)	1	100	○		4-52
	U60	+ torque command limit	**U60**	USER P60	0 to 15000	0 to 150(%)	(%)	1	15000	○		4-52
	U61	ATR dead zone width	**U61**	USER P61		0/20(N)	(N)	1		○		4-52
	U62	dv/dt during acceleration	**U62**	USER P62		0 to 100(m/min/sec)	(m/min/sec)	1	1	○		4-53
	U63	dv/dt during deceleration	**U63**	USER P63		0 to -100 (m/min/sec) (Enter a negative value)	(m/min/sec)	-1	-1	○		4-53
	U64	Version information	**U64**	USER P64	Reference only				1200 □			-

Note 1) Though setting in a range from -32768 to 32767 is possible for U01 to U64, set in the valid setting ranges described in the table above.

2) Other Relevant Parameters

Table 4-3-3

Function code	Name	LCD display (Japanese)		Effective setting range	Unit	Min. unit	Initial value	Change during operation	Remarks	See
F01	Speed setting N1	F01	SPD CMD 1	0 to 7	-	1	0	X		-
F02	Operation method	F02	OPR METHOD	0.1	-	1	0	X		-
F03	M1 maximum speed	F03	M1-Nmax	50 to 24000	(r/min)	1	1500	X		-
F07	Acceleration time 1	F07	ACC TIME1	0.01 to 99.99 100.0 to 999.9 1000 to 3600	(sec)	0.01 0.1 1	5	○		-
F08	Deceleration time 1	F08	DEC TIME1	0.01 to 99.99 100.0 to 999.9 1000 to 3600	(sec)	0.01 0.1 1	5	○		-
F17	Gain(for speed setting signal 12)	F17	Setting gain	0.00 to 200	(%)	0.1	100	○		-
F18	Bias (for speed setting signal 12)	F18	Bias speed	-24000 to 24000		1	0	○		-
F40	Torque limiter mode 1	F40	TLIM MODE1	0 to 3	-	1	0	X		-
E01	X1 function selection	E01	X1 FUNC	0 to 63	-	1	0	X	ON on canceling torque command	-
E02	X2 function selection	E02	X2 FUNC	0 to 63	-	1	1	X	ON on operation command	-
E03	X3 function selection	E03	X3 FUNC	0 to 63	-	1	2	X	OFF for stop command	-
E04	X4 function selection	E04	X4 FUNC	0 to 63	-	1	3	X	ON on tension ON command	-
E05	X5 function selection	E05	X5 FUNC	0 to 63	-	1	4	X	OFF on emergency stop	-
E06	X6 function selection	E06	X6 FUNC	0 to 63	-	1	5	X	Alarm reset (ON on reset)	-
E07	X7 function selection	E07	X7 FUNC	0 to 63	-	1	7	X	Mechanical loss automatic measuring	-
E08	X8 function selection	E08	X8 FUNC	0 to 63	-	1	8	X	Reset wound diameter	-
E09	X9 function selection	E09	X9 FUNC	0 to 63	-	1	9	X	Coast-to-stop command	-
E14	X function normally open/normally closed	E14	X NORMAL	0000 to 01FF	-	1	0	X		-
E15	Y1 function selection	E15	Y1 FUNC	0 to 47	-	1	1	X	Abnormal tension	-
E16	Y2 function selection	E16	Y2 FUNC	0 to 47	-	1	2	X	Completion of mechanical loss measuring	-
E17	Y3 function selection	E17	Y3 FUNC	0 to 47	-	1	3	X	Speed is present	-
E18	Y4 function selection	E18	Y4 FUNC	0 to 47	-	1	4	X	Speed detection 1 (unused)	-
E19	Y5 function selection	E19	Y5 FUNC	0 to 47	-	1	14	X	Inverter error	-
E49	Ai1 function selection	E49	Ai1 FUNC	0 to 18	-	1	0	X	Detected tension input 0 – 10V/ 0 - N	-
E50	Ai2 function selection	E50	Ai2 FUNC	0 to 18	-	1	0	X	Line speed command 0 – 10 V/ 0 – m/min	-
E51	Ai3 function selection	E51	Ai3 FUNC	0 to 18	-	1	0	X	Not used	-
E52	Ai4 function selection	E52	Ai4 FUNC	0 to 18	-	1	0	X	Not used	-
E53	Ai1 gain setting	E53	GAIN Ai1	-10,000 to 10,000	(times)	0.001	1	○		-
E54	Ai2 gain setting	E54	GAIN Ai2	-10,000 to 10,000	(times)	0.001	1	○		-
E55	Ai3 gain setting	E55	GAIN Ai3	-10,000 to 10,000	(times)	0.001	1	○		-
E56	Ai4 gain setting	E56	GAIN Ai4	-10,000 to 10,000	(times)	0.001	1	○		-
E57	Ai1 bias setting	E57	BIAS Ai1	-100.0 to 100.0	(%)	0.1	0	○		-
E58	Ai2 bias setting	E58	BIAS Ai2	-100.0 to 100.0	(%)	0.1	0	○		-
E59	Ai3 bias setting	E59	BIAS Ai3	-100.0 to 100.0	(%)	0.1	0	○		-
E60	Ai4 bias setting	E60	BIAS Ai4	-100.0 to 100.0	(%)	0.1	0	○		-
E61	Ai1 filter setting	E61	FILTER Ai1	0.00 to 0.50	(s)	0.001	0.01	○		-
E62	Ai2 filter setting	E62	FILTER Ai2	0.00 to 0.50	(s)	0.001	0.01	○		-
E63	Ai3 filter setting	E63	FILTER Ai3	0.00 to 0.50	(s)	0.001	0.01	○		-
E64	Ai4 filter setting	E64	FILTER Ai4	0.00 to 0.50	(s)	0.001	0.01	○		-
E69	Ao1 function selection	E69	AO1 FUNC	0 to 31	-	1	1	○		-
E70	Ao2 function selection	E70	AO2 FUNC	0 to 31	-	1	6	○		-
E71	Ao3 function selection	E71	AO3 FUNC	0 to 31	-	1	3	○		-
E72	Ao4 function selection	E72	AO4 FUNC	0 to 31	-	1	0	○	Not used	-
E73	Ao5 function selection	E73	AO5 FUNC	0 to 31	-	1	0	○	Not used	-
P12	M1 iron loss coefficient 1	P12	M1-LOSS1			0.01		○		-
P13	M1 iron loss coefficient 2	P13	M1-LOSS2			0.01		○		-
P14	M1 iron loss coefficient 3	P14	M1-LOSS3			0.01		○		-
H02	All save function	H02	ALL SAVE	0.1	-	1	0			-
o06	Digital line speed detection definition (PG pulse number)	o06	LS-PG DEF	100 to 60000	(p/r)	1	1024	○		-
o07	Digital line speed detection definition (Detected pulse correction)	o07	LS-PG CP1	0 to 9999		1	1000	○		-
o08	Digital line speed detection definition (Detected pulse correction 1)	o08	LS-PG CP2	0 to 9999		1	1000	○		-
o38	UPAC start/stop	o38	UPAC ACT	0, 1, 2		1	0	X		-
o39	UPAC memory mode	o39	UPAC MEMOR	0000 to 001F		1	0	X		-
o40	UPAC Address	o40	UPAC ADRES	100 to 255		1	100	X		-

4.3.6 Calculation Control Block Diagrams

1) Mechanical Loss Automatic Measuring Control Block

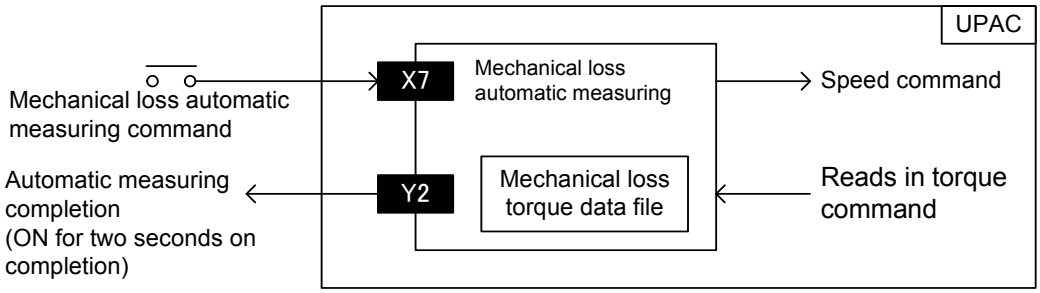


Fig. 4-3-6

- Use the completion command Y2 and set a hard sequence to turn OFF the mechanical loss automatic measuring command X7.
- To cancel automatic measurement midway, turn off the mechanical loss automatic measuring command X7.

2) Wound Diameter Calculation Control Block

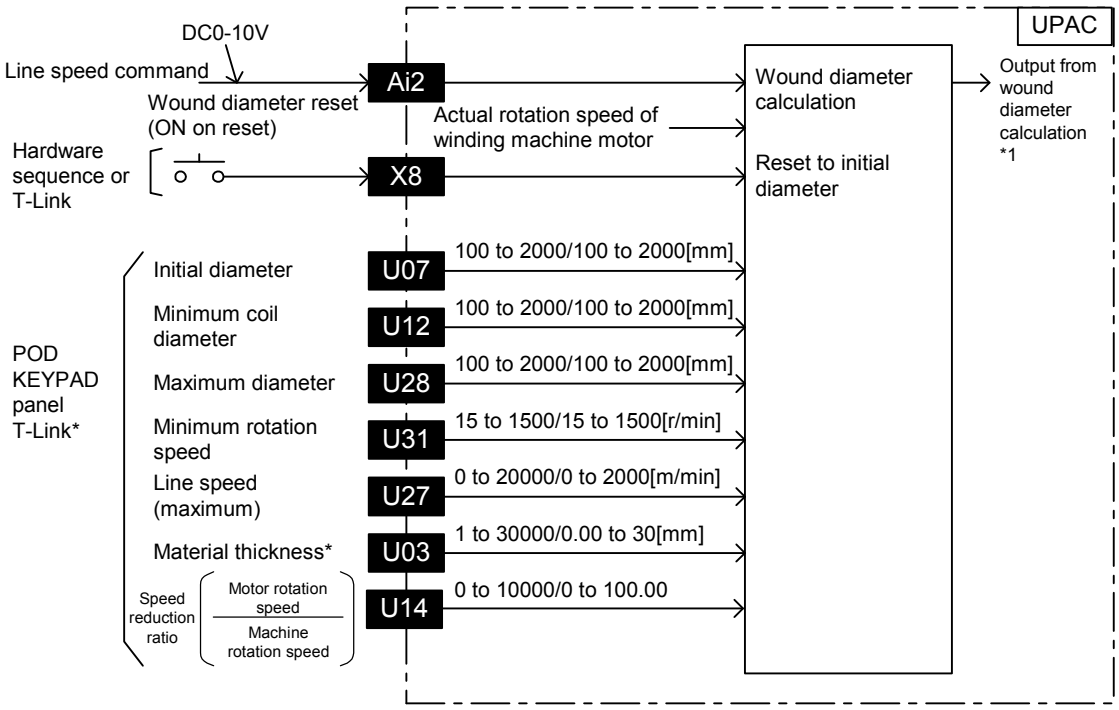


Fig. 4-3-7

Items marked by * can be set from the PLC after you add the T-Link I/F card.

3) Tension Set Value Block

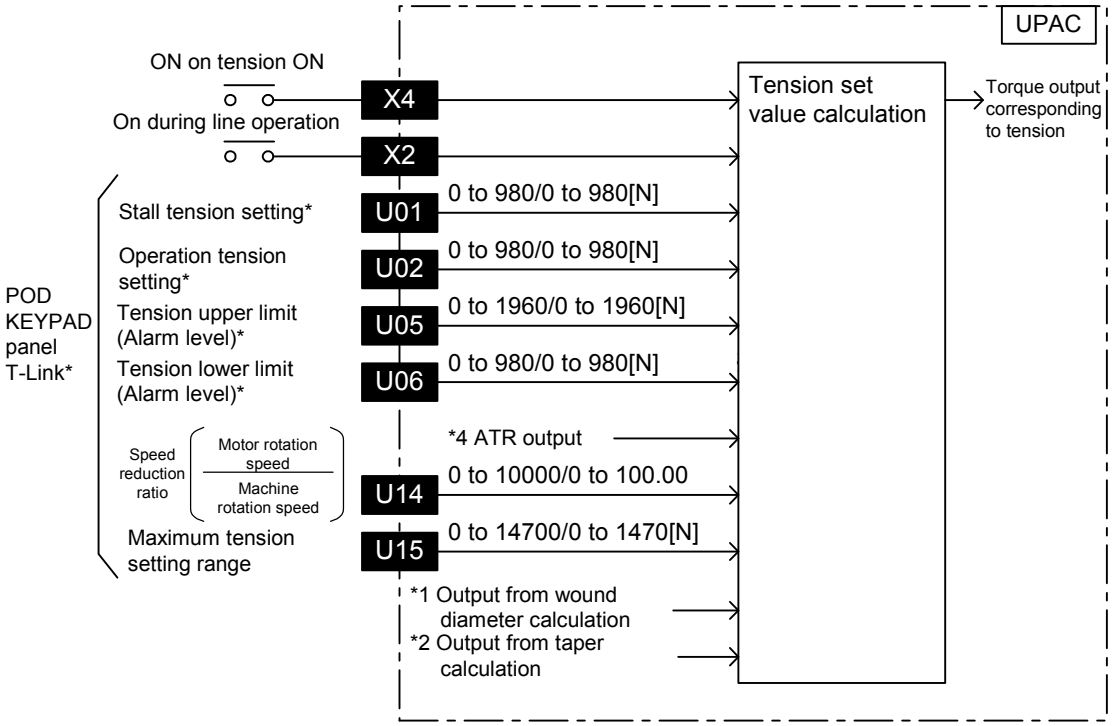


Fig. 4-3-8

Items marked by * can be set from the PLC after you add the T-Link I/F card.

4) Taper Calculation Block

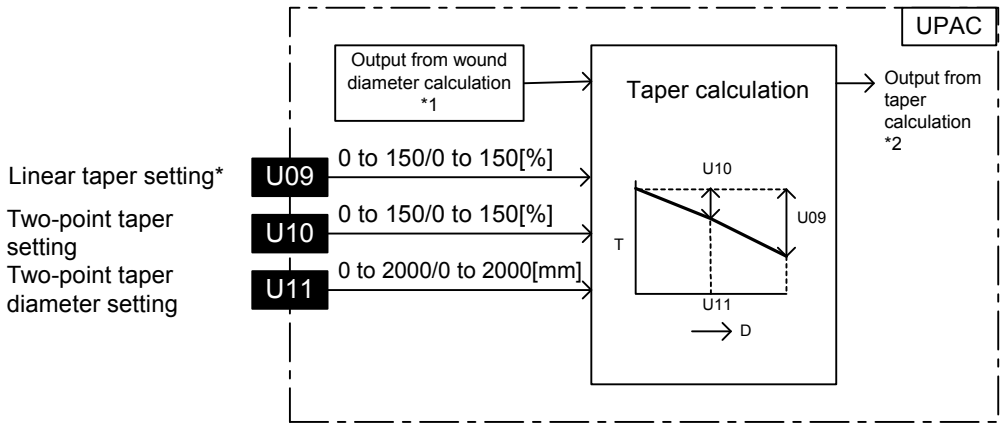


Fig. 4-3-9

Items marked by * can be set from the PLC after you add the T-Link I/F card.

5) ATR (Tension Feedback) Control

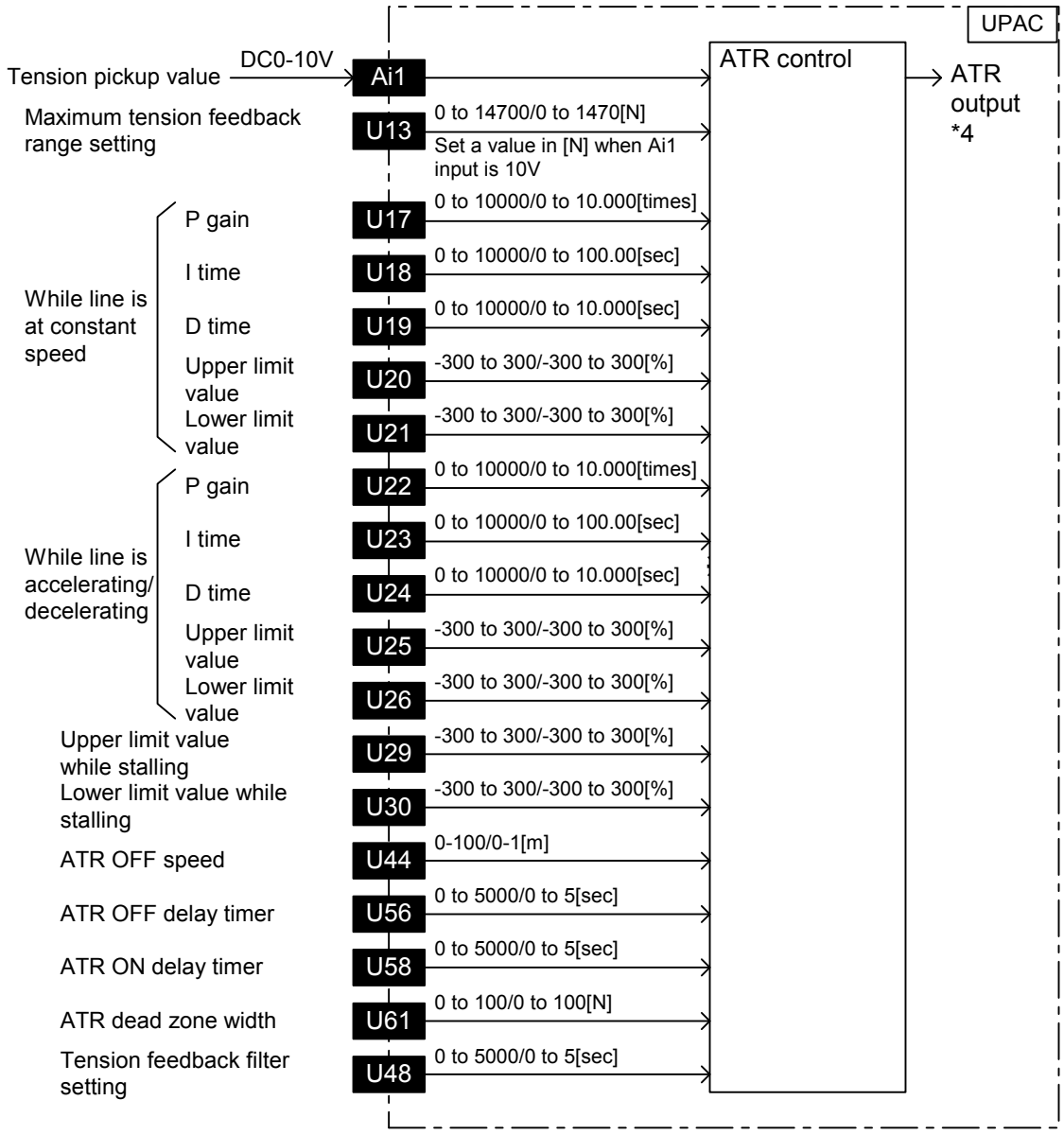


Fig. 4-3-10

6) Acceleration/Deceleration Compensation Torque Calculation Block

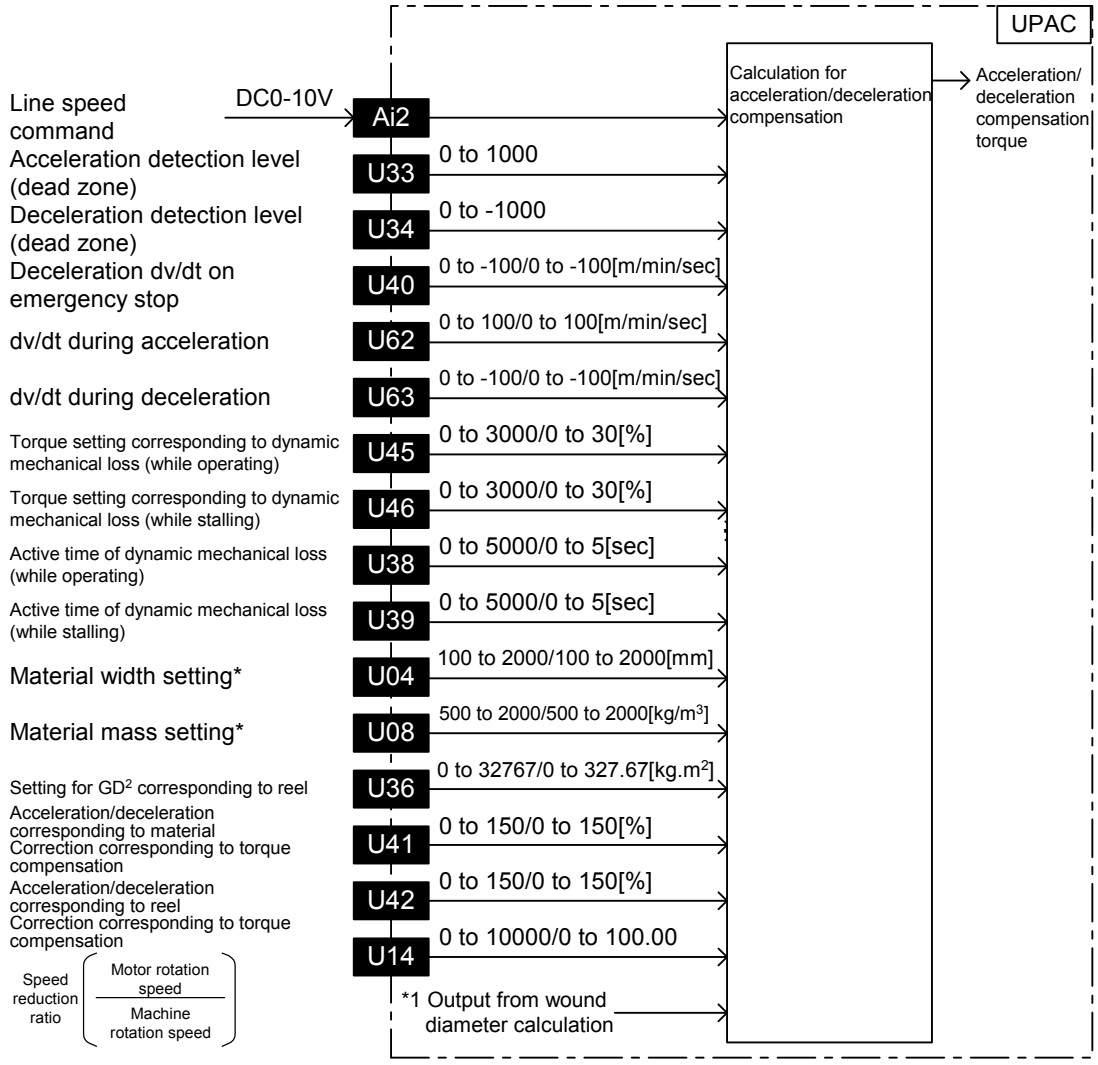


Fig. 4-3-11

Items marked by * can be set from the PLC after you add the T-Link I/F card.

7) Mechanical Loss Compensation Torque Calculation Block

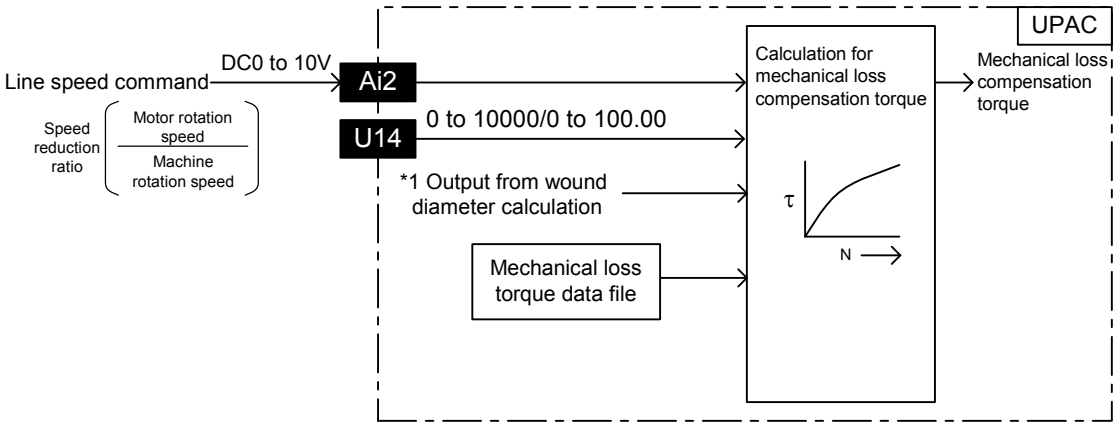


Fig. 4-3-12

Chapter 5 UPAC Programming Specification

This chapter describes the UPAC programming specifications and the connection with VG unit.

Contents

5.1 Performance Specification

Table 5-1-1

Item			Specification
Type			OPC-VG1-UPAC
Execution control type			Stored program Cyclic scan type (default task), fixed cycle task, event task
Input/output control type			Task synchronized refresh
CPU			32 bit OS processor, 32 bit execution processor
Memory type			Program memory, data memory, temporary
Programming language			IL language (Instruction List) ST language (Structured Text) LD language (Ladder Diagram) FBD language (Function Block Diagram) SFC element (Sequential Function Chart) conforming to IEC 61131-3
Instruction word length			Variable length (depending on language)
Instruction execution time		Sequence instruction	20ns or more/instruction
		Data instruction	40ns or more/instruction
Program memory capacity			32768 steps
Maximum program capacity in one POU			8192 steps
Memory	Input/output memory (I/Q)		302 words
	Standard memory (M)		2048 words (default value)
	Retain memory (M)		1024 words (default value)
	Instance memory for user FB (M)		1024 words (default value)
	Instance memory for system FB (M)		4096 words (default value) Timer : 128 points (default value) (8 words/point) Accumulation timer : 32 points (default value) (8 words/point) Counter : 64 points (default value) (4 words/point) Edge detection : 256 points (default value) (2 words/point) Others : 2048 words(default value)
	System memory (M)		512 words
Temporary area			8192 words
Available data type Note)			BOOL, INT, DINT, UINT, UDINT, REAL, TIME, DATE, TOD, DT, STRING, WORD, DWORD
Data type nesting			One stage (array of arrays, structure of arrays, array of structures)
Number of members in structure data type			200
Number of elements in array data type			16 bit data type: 4096, 32 bit data type:
Task number			Default task (cyclic scan): 1 Fixed cycle task : } Event task : Up to two in total }
Program instance (POU number/resource)			256 Note that maximum registration number for one task is 128.
Number of POUs on one project			1000 (including POUs in library)

Note: Depends on instruction to be used.

Item		Specification
User function block number		256 pc
Nesting of user function block		127 stages
User function number		256 pc
User function nesting		127 stages
FB instance		620/POU (up to 620 FBs can be created on one POU)
Variable	Global variable	8000
	Local variable	8000
Number of terminals for user FB		VAR_INPUT : Up to 128 VAR_OUTPUT : Up to 128 } 128 in total
Library	Number for registration	16 (per project)
	Nesting	8 stages
Diagnosis function		Self-diagnosis (memory check, ROM sum check), module failure monitor
Security function		Password
Calendar function		No calendar function available
Memory backup by battery		Backup range: Data memory Battery: Lithium primary battery Backup period:Five years (25C), Contents of backup memory will be lost during battery replacement.
Flash ROM (integrated into UPAC)		Application programs, system definition, ZIP files are stored in flash memory integrated into CPU.

Reference

Keyword	Bit number	Data range	Keyword	Bit number	Data range
BOOL	1	0 or 1	REAL	32	$-2^{128}<N\leq-2^{-126}$, 0, $2^{-126}\leq N<2^{128}$
INT	16	-32,768 to 32,767	TIME	32	0ms to 4,294,967,295ms
DINT	32	-2,147,483,648 to 2,147,483,647	DATE	32	0:00:00 to 23:59:59
UINT	16	0 to 65535	WORD	16	0x0000 to 0xFFFF
UDINT	32	0 to 4,294,967,295	DWORD	32	0x00000000 to 0xFFFFFFFF

5.2 Memory

5.2.1 Memory Map

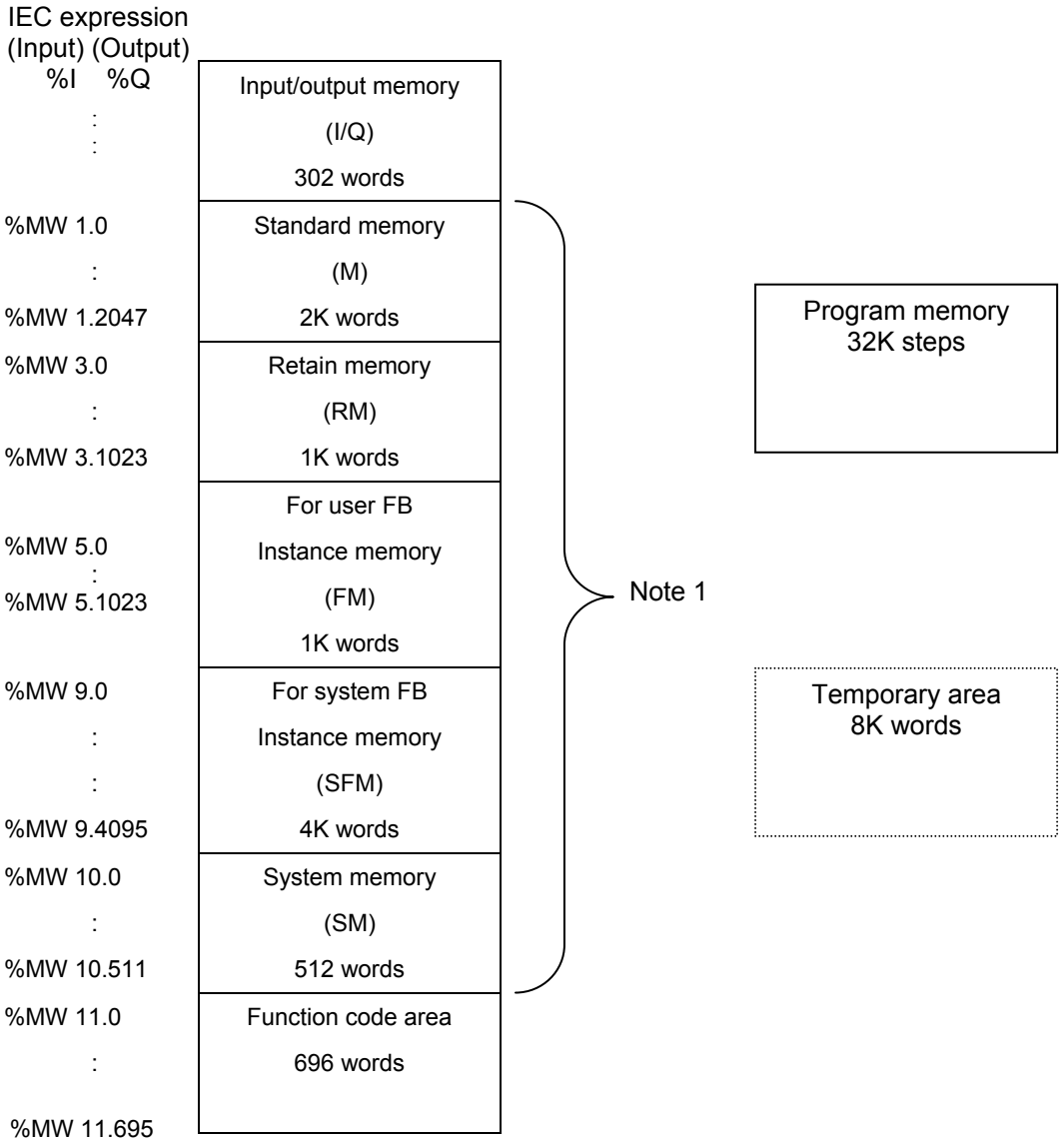


Figure 5-2-1

Note 1: 2K words at the beginning of the standard memory are for high-speed access (high-speed memory area). You can increase the size of the standard memory by reducing the size of other areas such as the size of retain memory and instance memory. However, you cannot increase the high-speed memory area.

5.2.1.1 Input/output memory (I/Q)

This area is for exchange data between UPAC and VG7S and is used for providing data from VG7S to UPAC and supplying arithmatic operation result of a program for VG7S.

See the list in "5)-32 Assigning address" for data.

Key point

(1) Input and output are represented %I and %Q (prefix) respectively. When you assign address, you add "size" and "address" information to them in variable declaration. See "5.2.2 Input/output address assignment" and "MICREX-SX Series USER'S MANUAL–INSTRUCTIONS, 1-4-4 Variable declaration" for more detail.

(2) Input and output cannot exist in the same word.

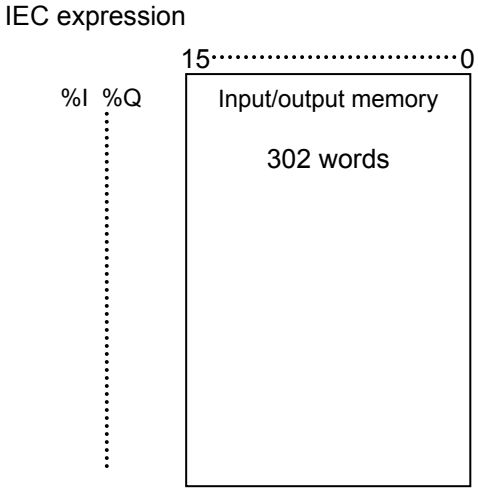


Figure 5-2-2

5.2.1.2 Standard memory area

This area is for auxiliary relays used in UPAC.

Key point

(1) Direct addressing is represented as "%M 1…" (is X, W, or D). Since variable declaration assigns memory to an application program in general programming, you do not have to bother the address. See "MICREX-SX Series USER'S MANUAL–INSTRUCTIONS, 1-4 Variables" for more information.

(2) Cleared to 0 at the start of UPAC operation.

(3) 2K words from the beginning of the standard memory are high-speed memory where one accesse is processed in 20ns.

(4) The size of the standard memory can be changed in cooperation with other memory areas. However, you cannot change the size of the high-speed memory. The size is fixed to 2K words. Use "CPU Memory size definition" in "Resource setting" dialog box to change the size.

(5) You cannot access across the boundary between the high-speed memory and the other standard memory. For example, you cannot arrange an array or a structure across this boundary.

IEC expression

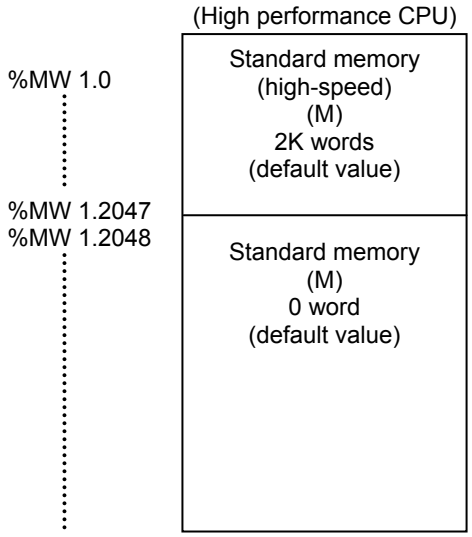


Figure 5-2-3

5.2.1.3 Retain memory

This area is for auxiliary relays used in UPAC.

Key point

(1) Direct addressing is represented as "%M 1…" (is X, W, or D). Since variable declaration assigns memory to an application program in general programming, you do not have to bother the address. See "MICREX-SX Series USER'S MANUAL–INSTRUCTIONS, 1-4 Variables" for more information.

(2) The following table shows the actions on start of cold operation and start of warm operation. Note)

	Start of cold operation	Start of warm operation
Retain memory	Clears to 0	Retains previous values
Retain memory with initial value	Writes initial values specified	Retains previous values

(3) You can select to clear this area or not when you download a project.
The action on operation start is cold operation when you select to "clear" and is warm operation when you select "not to clear"

(4) The size of the retain memory can be changed in cooperation with other memory areas. Use "CPU Memory size definition" in "Resource setting" dialog box to change the size.

IEC expression

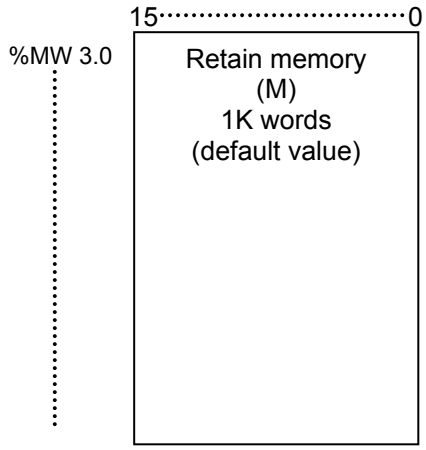


Figure 5-2-4

Note: Cold operation is initiated when "Initial start" from D300win or cold operation request (VG7S function code o38="2") from VG7S is issued. Warm operation is initiated when "Start" from D300win or warm operation request (VG7S function code o38="1") is issued.

5.2.1.4 Instance memory for user FB (M)

This area is a unique instance memory for individual user FBs of different types used in UPAC.

Key point

(3) The size of the instance memory area for system FB can be changed in cooperation with other memory areas.

. Use "CPU Memory size definition" in "Resource setting" dialog box to change the size.

IEC expression

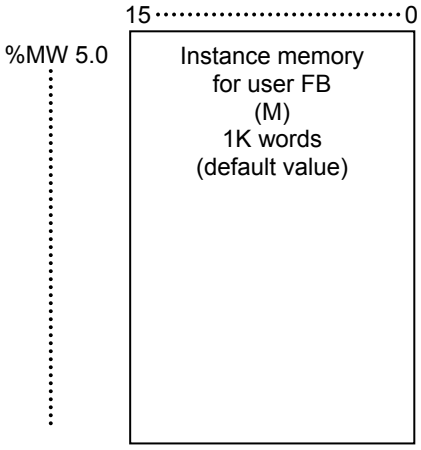


Figure 5-2-5

5.2.1.5 Instance memory for system FB (M)

This area is a unique instance memory for individual system FBs of different types such as timer, counter, differentiation instruction used in UPAC.

Key point

(1) Prescribed initialization is conducted for PC operation (previous value is retained or cleared to 0). Note that an area where previous values are retained is cleared to 0 when a project is downloaded.

Example) The current values for the counter and the accumulation timer and the previous values for the edge detection are retained to the previous values, and the current values for the timer is cleared to 0.

(2) Eight words per point of timer, four words per point of counter, and two words per point of edge detection instruction are used.

(3) The size of the instance memory area for system FB can be changed in cooperation with other memory areas. Use "CPU Memory size definition" in "Resource setting" dialog box to change the size.

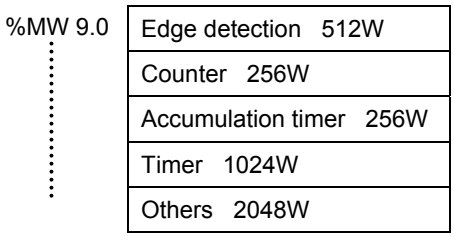
(4) The following table shows the default number of points for the timer, the accumulation timer, the counter, the edge detection. You can increase/decrease the numbers as needed.

Timer	Accumulation timer	Counter	Edge detection	Others
128 points	32 points	64 points	256 points	2048 points

Observe the following condition when you set the point number for the timer, the accumulation timer, counter, edge detection or others.

(Timer point number) 8 words + (Counter point number) 4 words + (Edge detection point number) 2 words + others
Set size for instance memory area for system FB

IEC expression



Note: Numbers of words in the left memory map are the default values.

Figure 5-2-6

5.2.1.6 System memory (M)

The system memory is an area where flags for informing operation status or abnormal states of UPAC are assigned and its usage is prescribed.

1) System memory list

%MW 10.0	Resource operation status
%MW 10.1	Not used
%MW 10.2	Resource major fault factor
%MW 10.3	Not used
%MW 10.4	Resource minor fault factor
%MW 10.5	Not used
%MW 10.6	CPU error factor
%MW 10.7	Not used
%MW 10.8	Memory error factor
%MW 10.9	Not used
%MW 10.10 %MW 10.11	**VG7S interface error factor**
%MW 10.12	Application abnormality factor (major fault)
%MW 10.13	Application abnormality factor (minor fault)
%MW 10.14 to %MW 10.16	User major fault factor 0 to 47
%MW 10.17	Not used
%MW 10.18 to %MW 10.20	User minor fault factor 0 to 47
%MW 10.21	Not used
%MW 10.22 to %MW 10.29	System definition error factor
%MW 10.30 to %MW 10.37	Not used
%MW 10.38 %MW 10.39	Application program error factor
%MW 10.40 %MW 10.41	Not used
%MW 10.42 %MW 10.43	Annunciator relay
%MW 10.44 to %MW 10.48	Not used
%MW 10.49	Resource operation information
%MW 10.50	Resource constitution information
%MW 10.51	Resource error information
%MW 10.52 to %MW 10.67	Configuration constitution information
%MW 10.68 to %MW 10.83	Configuration error information
%MW 10.84 to %MW 10.511	Not used

Resource… One CPU system consisting of one CPU module and multiple I/O modules. In the case of UPAC, this consists of one UPAC and one or more FRENIC-VG units.

Figure 5-2-7

Values in unused area and unused bit are uncertain and you should not use them.

2) Resource operation status %MW 10.0 (Read-only)

Displays the operation status and the operation mode of the resource (UPAC).

Table 5-2-1

Address	Name	Explanation
%MX 10.0.0	Inverter running [RUN]	"1" during UPAC operation.
%MX 10.0.1	Inverter stopping	"1" when CPU is stopping.
%MX 10.0.2	Major fault	"1" when major fault is present in resource.
%MX 10.0.3	Minor fault	"1" when minor fault is present in resource.
%MX 10.0.4	Not used	
%MX 10.0.5	Not used	
%MX 10.0.6	Not used	
%MX 10.0.7	Not used	
%MX 10.0.8	Not used	
%MX 10.0.9	Not used	
%MX 10.0.10	Not used	
%MX 10.0.11	Battery-less operation mode	"1" when battery-less operation.
%MX 10.0.12	Not used	
%MX 10.0.13	Not used	
%MX 10.0.14	Not used	
%MX 10.0.15	Not used	

Battery-less operation mode

The entire memory is initialized (set to initial values or cleared to 0) when the system is turned on. Connection to the battery and the voltage are not checked. Setting is conducted with the system definition.

3) Resource major fault factors %MW 10.2 (Read-only)

Fault factors causing a resource (UPAC) to stop.

Table 5-2-2

Address	Name	Explanation
%MX 10.2.0	CPU error	"1" when major fault is present in UPAC.
%MX 10.2.1	Power abnormality	"1" when power is disconnected.
%MX 10.2.2	Memory error	"1" for error in memory in UPAC.
%MX 10.2.3	FRENIC-VG interface fault	"1" when error is presents in interface with FRENIC-VG.
%MX 10.2.4	Application abnormality	"1" when abnormality is present in application program or system definition.
%MX 10.2.5	Not used	
%MX 10.2.6	Not used	
%MX 10.2.7 to %MX 10.2.12	Not used	
%MX 10.2.13	Not used	
%MX 10.2.14	Not used	
%MX 10.2.15	User major fault	"1" when any bit of user major fault flag (%MX 10.14.0 to %MX 10.16.15) is set to ON in application program.

4) Resource minor fault factors %MW 10.4 (Read-only)

Fault factors in the presence of which resource continues operation.

Table 5-2-3

Address	Name	Explanation
%MX 10.4.0	Not used	
%MX 10.4.1	Not used	
%MX 10.4.2	Memory error	"1" for error in memory in UPAC.
%MX 10.4.3	Not used	
%MX 10.4.4	Application abnormality	"1" when abnormality is present in application program or system definition.
%MX 10.4.5	Not used	
%MX 10.4.6	Not used	
%MX 10.4.7 to %MX 10.4.12	Not used	
%MX 10.4.13	Not used	
%MX 10.4.14	Battery abnormality	"1" when voltage of data backup battery drops or no battery is present.
%MX 10.4.15	User minor fault	"1" when any bit of user minor fault flag (%MX 10.18.0 to %MX 10.20.15) is set to ON in application program.

5) CPU error factors %MW 10.6 (Read-only)

Table 5-2-4

Address	Name	Explanation
%MX 10.6.0	Operation processor abnormality	Hardware abnormality of operation LSI in UPAC
%MX 10.6.1	OS processor abnormality	Hardware abnormality of OS control LSI in UPAC
%MX 10.6.2 to %MX 10.6.15	Not used	

6) Memory error factors %MW 10.8, %MW 10.9 (Read-only)

Table 5-2-5

Address	Name	Explanation	Fault level
%MX 10.8.0	System ROM error	"1" for error in system ROM in UPAC.	Major fault
%MX 10.8.1	System RAM error	"1" for error in system RAM in UPAC.	Major fault
%MX 10.8.2	Application ROM error	"1" for error in ROM for application program storage in UPAC.	Major fault
%MX 10.8.3	Application RAM error	"1" for error in RAM for application program storage in UPAC.	Major fault
%MX 10.8.4 to %MX 10.8.14	Not used		
%MX 10.8.15	Memory backup error	"1" when data to be retained during power failure are not retained.	Major fault
%MX 10.9.0 to %MX 10.9.14	Not used		
%MX 10.9.15	Memory backup error	"1" when data to be retained during power failure are not retained.	Major fault

Operation after memory error

When a major fault happens due to the memory error listed above, the following start (power OFF to ON) will be an initial start and the retained memory will be cleared to 0. The failure from %MX 10.8.0 to 3 can be caused by a hardware failure and a major fault due to memory error will possibly happen again after you turn on.

7) SX bus abnormality factors %MW 10.10, %MW 10.11

Table 5-2-6

Address	Name	Explanation	Fault level
%MX 10.10.0	Not used		
%MX 10.10.1	Not used		
%MX 10.10.2	Not used		
%MX 10.10.3 to %MX 10.10.12	Not used		
%MX 10.10.13	Not used		
%MX 10.10.14	Not used		
%MX 10.10.15	I/O refresh congestion	"1" when VG7S does not update input/output data for 128ms or more.	Major fault
%MX 10.11.0 to %MX 10.11.13	Not used		
%MX 10.11.14	Not used		
%MX 10.11.15	Not used		

8) Application abnormality sources %MW 10.12, %MW 10.13(Read-only)

Table 5-2-7

Address	Name	Explanation	Fault level
%MX 10.12.0	System definition abnormality	"1" for abnormality in system definition.	Major fault
%MX 10.12.1	Application program abnormality	"1" for abnormality in application program.	Major fault
%MX 10.12.2 to %MX 10.12.15	Not used		
%MX 10.13.0	Not used		
%MX 10.13.1	Application program abnormality	"1" for abnormality in application program.	Minor fault
%MX 10.13.2 to %MX 10.13.15	Not used		

9) User major faults %MW 10.14 to %MW 10.16

Table 5-2-8

Address	Name	Explanation
%MX10.14.0	User major fault factor 0	UPAC will stop due to a major fault when an application program sets any bit to ON.
to	to	
%MX10.14.15	User major fault factor 15	
%MX10.15.0	User major fault factor 16	
to	to	
%MX10.15.15	User major fault factor 31	
%MX10.16.0	User major fault factor 32	
to	to	
%MX10.16.15	User major fault factor 47	

10) User minor faults %MW 10.18 to %MW 10.20

Table 5-2-9

Address	Name	Explanation
%MX10.18.0	User major fault factor 0	UPAC will present a minor fault when an application program sets any bit to ON. However, the operation continues.
to	to	
%MX10.18.15	User major fault factor 15	
%MX10.19.0	User major fault factor 16	
to	to	
%MX10.19.15	User major fault factor 31	
%MX10.20.0	User major fault factor 32	
to	to	
%MX10.20.15	User major fault factor 47	

11) System definition abnormality factors %MW 10.22 to %MW 10.29 (Read-only)

Table 5-2-10

Address	Name	Explanation	Fault level
%MX 10.22.0	Not used		
%MX 10.22.1	Not used		
%MX 10.22.2	Not used		
%MX 10.22.3	Not used		
%MX 10.22.4 to %MX 10.22.9	Not used		
%MX 10.22.10	CPU action definition abnormality	"1" for abnormality in CPU action definition.	Major fault
%MX 10.22.11	CPU memory boundary definition abnormality	"1" when memory used in application program exceeds memory range.	Major fault
%MX 10.22.12 to %MX 10.22.15	Not used		
%MX 10.23.0	For CPU I/O group definition abnormality default task	"1" when input module is set to output selection.	Major fault
%MX 10.23.1	For CPU I/O group definition abnormality default task		
%MX 10.23.2	For CPU I/O group definition abnormality default task		
%MX 10.23.3	Not used		
%MX 10.23.4	Not used		
%MX 10.23.5	Not used		
%MX 10.23.6	Not used		
%MX 10.23.7	Not used		
%MX 10.23.8	Not used		
%MX 10.23.9	Not used		
%MX 10.23.10	Not used		
%MX 10.23.11	Not used		
%MX 10.23.12	Not used		
%MX 10.23.13	Not used		
%MX 10.23.14	Not used		
%MX 10.23.15	Not used		
%MX 10.24.0	Not used		
%MX 10.24.1	Not used		
%MX 10.25.0	Not used		
%MX 10.25.1	Not used		
%MX 10.25.2	Not used		
%MX 10.25.3	Not used		
%MX 10.25.4	Not used		
%MX 10.25.5	Not used		
%MX 10.25.6	Not used		
%MX 10.25.7	Not used		
%MX 10.25.8 to %MX 10.25.15	Not used		
%MX 10.26.0	Not used		
%MX 10.26.1	Not used		
%MX 10.26.2 to %MX 10.29.15	Not used		

Note: The system definition abnormality factors include errors that are blocked by D300win to rarely occur in standard operation.

12) Application program abnormality factors %MW 10.38, %MW 10.39

Table 5-2-11

Address	Name	Explanation	Fault level
%MX 10.38.0	Application WDT abnormality	"1" when execution time of default task exceeds watch dog timer value.	Major fault
%MX 10.38.1	Application execution abnormality	"1" when error such as temporary size over occurs during user program execution.	Major fault
%MX 10.38.2 to %MX 10.38.10	Not used		
%MX 10.38.11	FB instance setting abnormality	"1" when specified memory address does not exist.	Major fault
%MX 10.38.12	Initial value setting abnormality	"1" when set initial value exceeds memory area range.	Major fault
%MX 10.38.13	SFM boundary definition setting abnormality	"1" when capacity exceeding maximum capacity of instance memory for system FB is set.	Major fault
%MX 10.38.14	POU instruction abnormality	"1" for abnormality in POU.	Major fault
%MX 10.38.15	Task registration abnormality	"1" for abnormality in task registration.	Major fault
%MX 10.39.0	0 level task skip	"1" when task execution is skipped. You can set to OFF in application program.	Minor fault
%MX 10.39.1	1 level task skip		
%MX 10.39.2	Not used		
%MX 10.39.3	Not used		
%MX 10.39.4	0 level task congestion	"1" when specified constant cycle is not observed due to program execution congestion. You can set to OFF in application program.	Minor fault
%MX 10.39.5	1 level task congestion		
%MX 10.39.6	Not used		
%MX 10.39.7	Not used		
%MX 10.39.8 to %MX 10.39.14	Not used		
%MX 10.39.15	Not used		

13) Annunciator relay %MW 10.42, %MW 10.43

Table 5-2-12

Address	Name	Explanation
%MX 10.42.0	Initial flag	"1" when initial start (cold operation start). Use application program to set to "0" if needed.
%MX 10.42.1	Power disconnection flag	"1" when power was disconnected during preceding operation.
%MX 10.42.2 to %MX 10.42.14	Not used	
%MX 10.42.15	Not used	
%MX 10.43.0	0 level start flag	"0" during first execution of 1 level task.
%MX 10.43.1	1 level start flag	"1" during first execution of 1 level task.
%MX 10.43.2	Not used	
%MX 10.43.3	Not used	
%MX 10.43.4 to %MX 10.43.14	Not used	
%MX 10.43.15	Default task start flag	"1" during first execution of default task.

14) Resource operation information %MW 10.49

Table 5-2-13

Address	Name	Explanation
%MX 10.49.0	UPAC operating	"1" during UPAC operation.
%MX 10.49.1	Not used	
%MX 10.49.2	Not used	
%MX 10.49.3	Not used	
%MX 10.49.4	Not used	
%MX 10.49.5	Not used	
%MX 10.49.6	Not used	
%MX 10.49.7	Not used	
%MX 10.49.8 to %MX 10.49.15	Not used	

15) Resource configuration information %MW 10.50

User program uses configuration information and abnormality information to recognize the resource (UPAC) status.

Table 5-2-14

Resource configuration information	Resource abnormality error	Resource status
OFF	OFF	None
ON	OFF	Normal (operating or stopping)
ON	ON	Minor fault (operating or stopping)
OFF	ON	Major fault (stopping)

Table 5-2-15

Address	Name	Explanation
%MX 10.49.0	UPAC operating	"1" when resource operation status is normal or minor fault.
%MX 10.49.1	Not used	
%MX 10.49.2	Not used	
%MX 10.49.3	Not used	
%MX 10.49.4	Not used	
%MX 10.49.5	Not used	
%MX 10.49.6	Not used	
%MX 10.49.7	Not used	
%MX 10.49.8 to %MX 10.49.15	Not used	

16) Resource abnormality information %MW 10.51

Table 5-2-16

Address	Name	Explanation
%MX 10.51.0	UPAC abnormality	"1" when resource operation status is major fault or minor fault.
%MX 10.51.1	Not used	
%MX 10.51.2	Not used	
%MX 10.51.3	Not used	
%MX 10.51.4	Not used	
%MX 10.51.5	Not used	
%MX 10.51.6	Not used	
%MX 10.51.7	Not used	
%MX 10.51.8 to %MX 10.51.15	Not used	

5.2.2 Input/output Address Assignment

5.2.2.1 Address assignment rules

Input/output addresses are assigned following the rules below in UPAC.

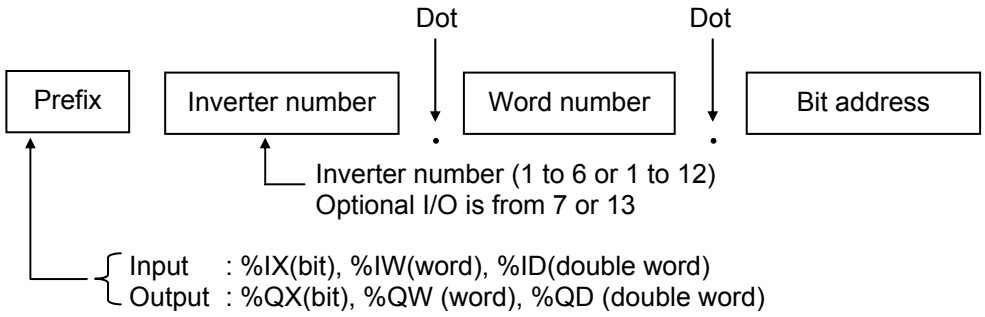


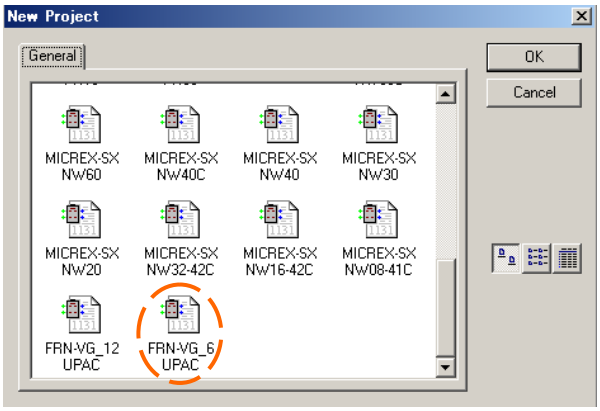
Figure 5-2-8

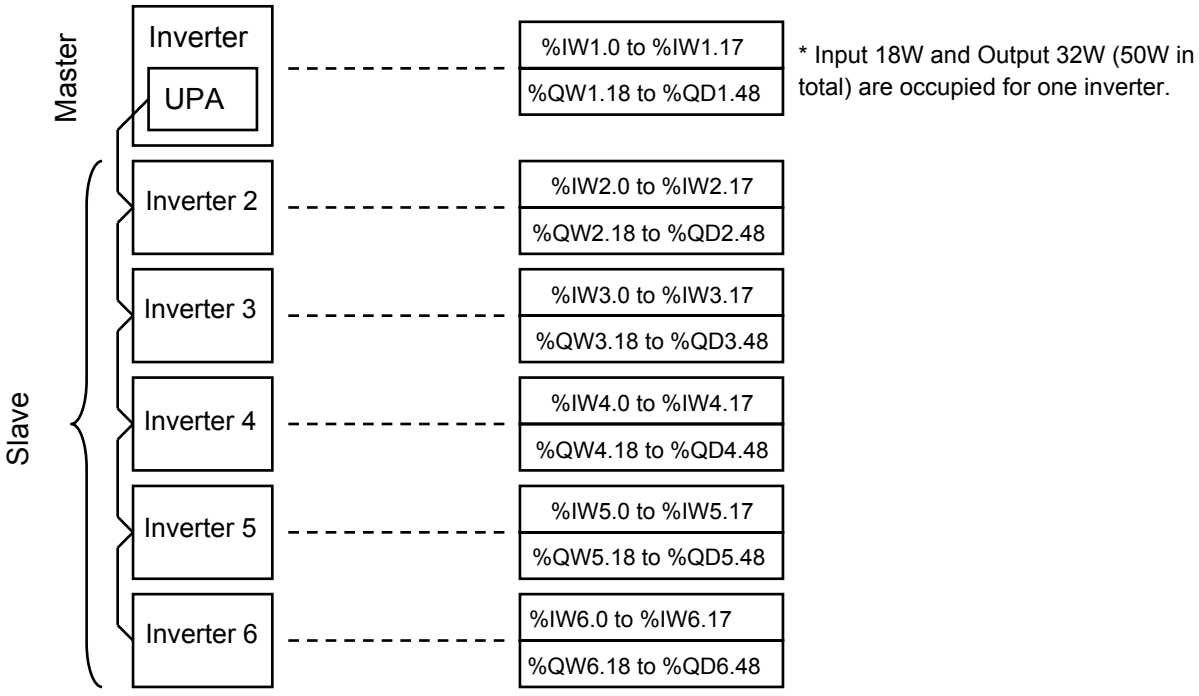
5.2.2.2 Assigning input/output address to application program

Input/output addresses have been assigned in the global variable worksheet for UPAC and you do notneed to assign again.

5.2.2.3 Assigning address

1) Project configuration with up to six FRN-VG_6 UPAC's





* Input 18W and Output 32W (50W in total) are occupied for one inverter.

Figure 5-2-9

Control variables/IQ area (50W input/output)

These control variables (global variables assigned to Control Variables) are available when you select VG7 six-unit system In order to make respective data in the IQ area valid, it is necessary to set then "To be used" in System_Definition. Respective data in the IQ area can be used in programming by one of the three methods below. Choose any convenient method, because their program executing functions are equivalent.

(1) Select from the Control Variables list of Global Variables.
(2) Create a variable with its address assigned.
(3) Directly specify (write) the address.

The IQ area (50-W I/O) is between UPAC and FRENIC-VG, and is refreshed as UPAC→FRENIC-VG:(No. of units -1)×2ms(1 ms if 1 unit),FRENIC-VG→UPAC:(No. of units -1)×4ms(1 ms if 1 unit)in the master slave connection method. UPAC→FRENIC-VG is refreshed in 1 ms in the broadcast connection method.

Table 5-2-17

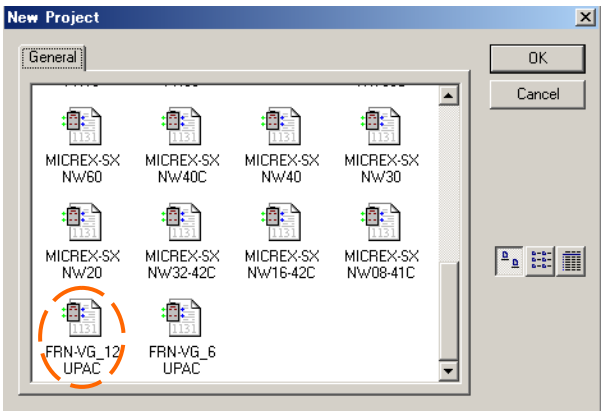
Address	Area	Name	Max. value / basic unit	Type	Direction	Remark See control block diagram for more information
%IW□0	Dedicated area	Speed setting 4/frequency reference monitor	20000/Nmax	INT	FRENIC-VG→UPAC	Before ASR/ before V/fcalculation
%IW□1		Torque reference 2	10000/100%	INT		After torque limit
%IW□2		Torque current reference (final)	10000/100%	INT		Just before torque currentreference filter
%IW□3		Magnetic-flux reference (final)	10000/100%	INT		
%IW□4		Detected speed (speed detection)	20000/Nmax	INT		
%IW□5		Control data (CW) (standard + DIOA 16-bit)	Data distinction: 32	WORD		
%IW□6		Operation status (SW)	Data distinction: 21	WORD		
%IW□7		Speed setting 1/frequency command (during V/f)	20000/Nmax	INT		Before multistep speedreference
%IW□8		Line speed input	20000/Nmax	INT		
%IW□9	Position control	Pulse train position reference (PG (PR))	1/1	INT		10 and 11 are used for pulsetrain synchronized control.11, 12, and 13 are used fororientation control.
%IW□10		Position detection (built-in or PG (PD))	1/1	INT		
%IW□11		Position detection (Z phase input) (PG (PD))	1/1	INT		
%IW□12		Position reference	1/1	INT		
%IW□13	Universal area	DI(DIOB option: 16bit)	Data distinction: 26	WORD		
%IW□14		Ai(Ai1)	±4000h/±10V	INT		UPAC uses INV and Aiterminals for control input. Ai used by UPAC is defined asuniversal.
%IW□15		Ai(Ai2)	±4000h/±10V	INT		
%IW□16		Ai((AIO option, Ai3))	±4000h/±10V	INT		
%IW□17		Ai((AIO option, Ai4))	±4000h/±10V	INT		
%QW□18	Dedicated area	Speed setting 1/frequency command (during V/f)	20000/Nmax	INT	UPAC→FRENIC-VG	Before multistep speedreference
%QW□19		Torque reference 1	10000/100%	INT		Before torque limit
%QW□20		Torque current reference	10000/100%	INT		Just before torque currentreference filter
%QW□21		Magnetic-flux reference	10000/100%	INT		
%QW□22		Control data (CW)	Data distinction: 32	WORD		
%QW□23		DO1(Standard+DIOA;13bit)	Data distinction: 33	WORD		Universal DO definition required
%QW□24		Acceleration time	1/0.1s	INT		Overwritten on F07
%QW□25		Deceleration time	1/0.1s	INT		Overwritten on F08
%QW□26		Torque limiter level 1	10000/100%	INT		
%QW□27		Torque limiter level 2	10000/100%	INT		
%QW□28		Speed setting 4/frequency command (during V/f)	20000/Nmax	INT		Before ASR/ before V/fcalculation
%QW□29		Torque reference 2	10000/100%	INT		After torque limit
%QW□30		Torque bias	10000/100%	INT		Before torque limit
%QW□31		Auxiliary speed setting	20000/Nmax	INT		
%QW□32		Real speed (simulation speed)	20000/Nmax	INT		Speed output from motor model
%QW□33	High speed function code exchange	Function code 1 address	Depends on data distinction of individual function code.	WORD		While usual function code data sending is in a cycle of 60 ms, function codes assigned to this area can be sent in the IQ refresh cycle.
%QW□34		Function code 1 data		INT		
%QW□35		Function code 2 address		WORD		
%QW□36		Function code 2 data		INT		
%QW□37		Function code 3 address		WORD		
%QW□38		Function code 3 data		INT		
%QW□39		Function code 4 address		WORD		
%QW□40		Function code 4 data		INT		
%QW□41		Reserved	Data distinction: 27	WORD		
%QW□42	Universal area	DI(DIOB option: 16bit)	±4000h/±10V	INT		UPAC operates AO/DO of FRENIC-VG. AO/DO used by FRENIC-VG aredefined as universal. Note that universal definition isnot required for DIOB.
%QW□43		A0(AO1)		INT		
%QW□44		A0(AO2)		INT		
%QW□45		A0(AO3)		INT		
%QW□46		DO2 (AIO option, A04)		INT		
%QW□47		DO2(AIO option, A05)		INT		
%QD□48	SW	Dynamic switch (DSW)		DWORD		Change data reflected on INV6dynamically.

□ indicates the inverter number (1 to 6), and specifies the address of each inverter.

In addition, INV1 can exchange function codes (F, E, C, P, H, A, o, L, U, and M) at about 60ms constant cycle.

INV 2 to 6 requires a high-speed optical link card (OPC-VG1-SIU）.

2) Project configuration with up to six FRN-VG_6 UPAC's



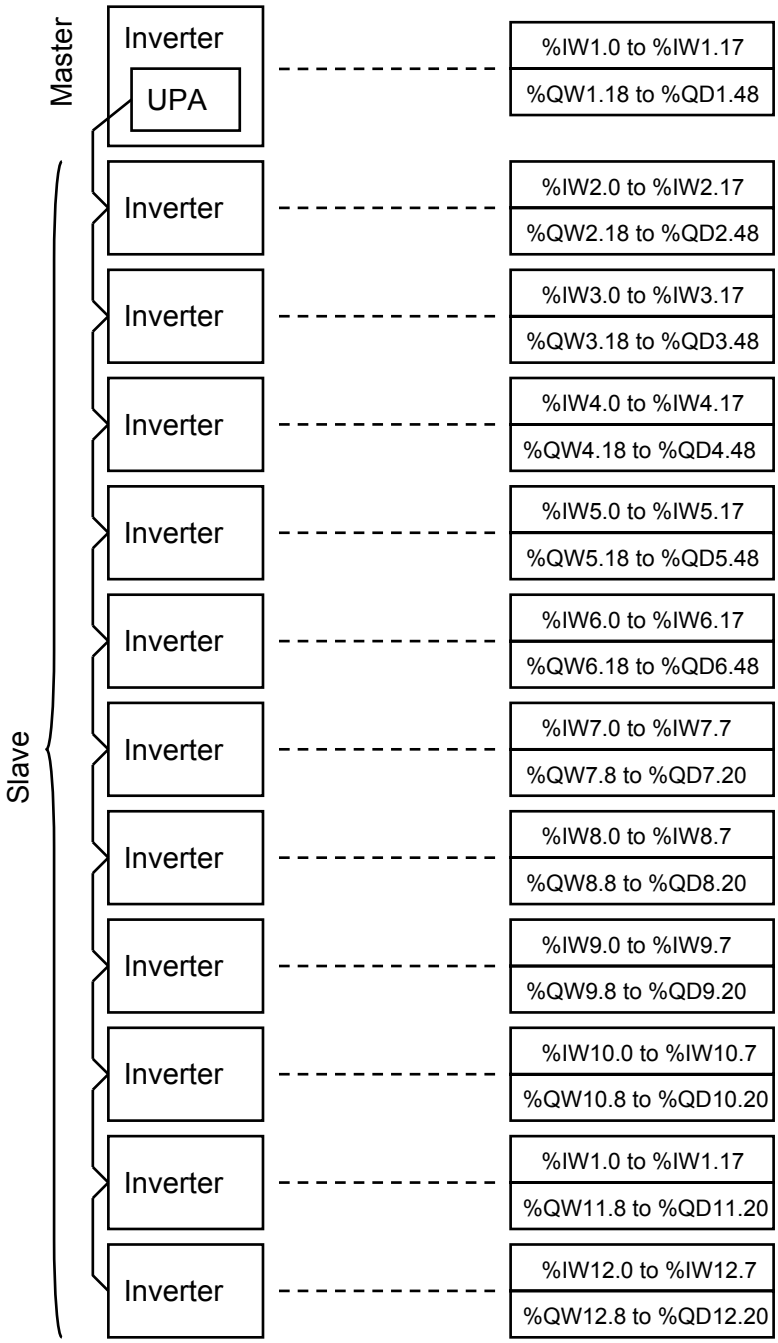


Figure 5-2-10

* Input 8W and Output 14W (22W in total) are occupied for one inverter.

Control variables/IQ area (22W input/output)

These control variables (global variables assigned to Control Variables) are available when you select FRENIC-VG 12-unit system

In order to make respective data in the IQ area valid, it is necessary to set then "To be used" in System_Definition.

Respective data in the IQ area can be used in programming by one of the three methods below. Choose any convenient method, because their program executing functions are equivalent.

(1) Select from the Control Variables list of Global Variables.

(2) Create a variable with its address assigned.

(3) Directly specify (write) the address.

The IQ area (50-W I/O) is between UPAC and FRENIC-VG, and is refreshed as UPAC→FRENIC-VG:(No. of units -1)×2ms(1 ms if 1 unit),FRENIC-VG→UPAC:(No. of units -1)×4ms(1 ms if 1 unit)in the master slave connection method. UPAC→FRENIC-VG is refreshed in 1 ms in the broadcast connection method.

Table 5-2-18

Address	Area	Name	Max. value / basic unit	Type	Direction	Remark See control block diagram for more information
%IW□0	Dedicated area	Speed setting 4/frequency reference monitor	20000/Nmax	INT	FRENIC-VG→UPAC	Before ASR/ before V/fcalculation
%IW□1		Torque reference 2	10000/100%	INT		After torque limit
%IW□2		Detected speed (speed detection)	20000/Nmax	INT		
%IW□3		Control data (CW) (standard + DIOA 16-bit)	Data distinction: 32	WORD		
%IW□4		Operation status (SW)	Data distinction: 21	WORD		
%IW□5		Line speed input	20000/Nmax	INT		
%IW□6	Universal area	A0(AO1)	±4000h/±10V	INT		UPAC uses Aiterminals for control input. Ai used by UPAC is defined asuniversal.
%IW□7		A0(AO2)	±4000h/±10V	INT		
%QW□8	Dedicated area	Speed setting 1/frequency command (during V/f)	20000/Nmax	INT	UPAC→FRENIC-VG	Before multistep speedreference
%QW□9		Torque reference 1	10000/100%	INT		Before torque limit
%QW□10		Control data (CW)	Data distinction: 32	WORD		
%QW□11		Universal D01 (Standard+DIOA;13bit)	Data distinction: 33	WORD		Universal DO definition required
%QW□12		Acceleration time	1/0.1s	INT		Overwritten on F07
%QW□13		Deceleration time	1/0.1s	INT		Overwritten on F08
%QW□14		Torque limiter level 1	10000/100%	INT		
%QW□15		Torque limiter level 2	10000/100%	INT		
%QW□16		Speed setting 4/frequency command (during V/f)	20000/Nmax	INT		Before ASR/ before V/fcalculation
%QW□17	Universal area	A0(AO1)	±4000h/±10V	INT		UPAC operates AO/DO of FRENIC-VG. AO/DO used by FRENIC-VG aredefined as universal.
%QW□18		A0(AO2)		INT		
%QW□19		A0(AO3)		INT		
%QD□20	SW	Dynamic switch (DSW)		DWORD		Change data reflected on INV6dynamically.

□ indicates the inverter number (1 to 12), and specifies the address of each inverter.

In addition, INV1 can exchange function codes (F, E, C, P, H, A, o, L, U, and M) at about 60ms constant cycle.

INV 2 to 12 requires a high-speed optical link card (OPC-VG1-SIU).

3) Dynamic software switch (DWS)

This function switches the reflection of control variables when UPAC is on and the inverter is in operation. You can individually set for 30W (six-unit system) data or 12W (twelve-unit system) data.

The following section describes the bit assignment of the DSW (software switch). In this section, No. refers to No. in control variable/I/O area data list.

This indicates the No value of the table.

If a UPAC application does not set these data, data will be 0 and enabled as defined below. If you want to switch data to be disabled, set 1 to corresponding bit.

Setting bit data 0: Enabled

1 (Disable)

(1) For six-unit system

Table 5-2-19

MSB LSB

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
No.16	No.15	No.14	No.13	No.12	No.11	No.10	No.9	No.8	No.7	No.6	No.5	No.4	No.3	No.2	No.1

MSB LSB

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
-	-	No.30	No.29	No.28	No.27	No.26	No.25	No.24	No.23	No.22	No.21	No.20	No.19	No.18	No.17

(2) For twelve-unit system

Table 5-2-20

MSB LSB

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	-	-	-	-	No.11	No.10	No.9	No.8	No.7	No.6	No.5	-	-	No.2	No.1

MSB LSB

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
-	-	-	-	No.28	No.27	No.26	-	-	-	-	-	-	-	-	-

5.2.3 Function Code Area Address Assignment

The accessing method for function codes (F, E, C, P, H, A, o, L, U and M) includes two variations: those that can be referred to or updated at 60 ms intervals, and those updated or referred to at minimum 1 ms intervals. For actual use and limitations, refer to section 3.1.2 “Referencing and Updating Function Codes” and use the better one for each application.

5.2.3.1 Addresses updated or referenced at 60 ms intervals

All function codes (F, E, C, P, H, A, o, L, U and M) of master FRENIC-VG (where UPAC is installed) can bereferred to. Some codes are write-protected. (Refer to “Written by UPAC” in the list on the following pages.)

The function code variable, address, and the type of the variable are registered in the Function List in the project tree of D300win preliminarily as shown in the figure below.

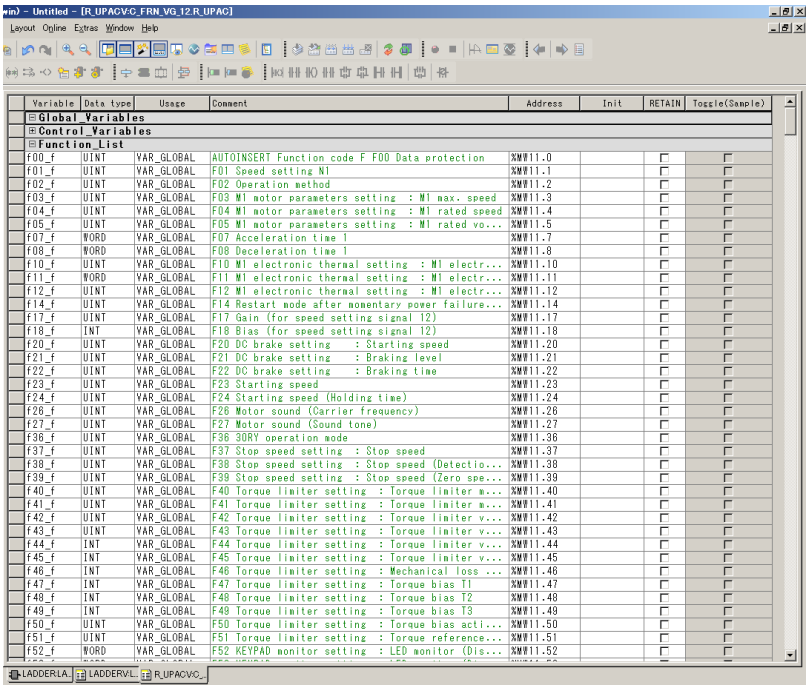


Figure 5-2-11

The user uses this information to refer to or change function codes.

The user can open a variable dialog on the worksheet, and select select a function code from the variable list, in order to write a program without paying attention to addresses (%MW□.□).

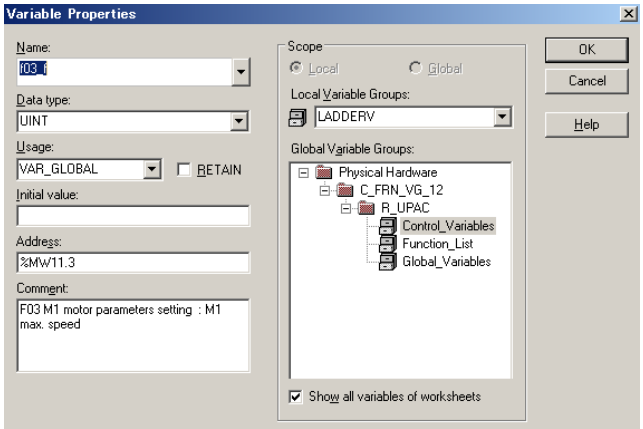


Figure 5-2-12

5.2.3.2 Addresses updated at high speed

To update the function code data at minimum 1 ms intervals, directly access the “high speed updating address” found in section 5.2.3.3 “Function code list.” With this method, parameters can be accessed at high speeds which is used to access control data, using the input/output memory (IQ). For details of the accessing method, refer to section 3.1.2.2 “High-speed data updating.” Be careful that the data cannot be referred to with this method.

5.2.3.3 Function code list

Table 5-2-21 Description of list

Fcode	Identification code of function code
60 ms updating and referencing data	Name and type of variable, and address assignment of function code that can be referred to or updated at a constant period of 60 ms from UPAC into FRENIC-VG where UPAC is installed
Addresses updated at high speed	Assigned address of function code of VG7S where UPAC is installed, and two or more units of VG7S linked via optical link, for updating at a minimum period of 1 ms. The type of the called data is always integer (INT). The address is the same as the RS485 communication NO.
Name	Function code name
Setting range	Indicates the setting range and definition of the data.
Default setting	Data set by our company at shipping from the factory
Type	Definition of the scale of the data and meaning
Written by UPAC	“No” is specified for write-protected function codes that cannot be changed from UPAC.

Table 5-2-22 F: Fundamental Functions

F code	60 ms updating and referencing data			High-speed Updating address	Name	Setting range	Default setting	Type	Written by UPAC
	Variable name	Type	Address						
F00	f00_f	UINT	%MW11.0	0000h	Data protection	0 to 1 0: The data can be changed 1: Data Protection This is a function to protect data against writing from thekeypad panel. The data is protected against writing from the link(TLINK, RS485, etc.) using H29 "Data protection vialink.	0	40	Yes
F01	f01_f	UINT	%MW11.1	0001h	Speed setting N1	0 to 9 0: Keypad (△/▽) key 1: Analog 12 input (0～±10V) 2: Analog 12 input (0～+10V) 3: UP/DOWN control (initial value: 4: UP/DOWN(initial value: previous value) 5: UP/DOWN(initial value: Creep speed 1,2) 6: DIA card input 7: DIB card input 8: Ai(N-REFV) input 9: Ai2(N-REFC) input Define the setting method of speed reference	0	41	Yes
F02	f02_f	UINT	%MW11.2	0002h	Operation method	0 to 1 0: Key operation (FWD, REV, STOP key) (LOCAL mode) 1: External signal (FWD, REV terminal) (REMOTE mode) The operation method is set.	0	42	Yes
F03	f03_f	UINT	%MW11.3	0003h	M1 motor parameter setting - M1 maximum speed	50 to 30000 r/min	1500	0	Yes
F04	f04_f	UINT	%MW11.4	0004h	- M1 rated speed	50 to 30000 r/min	By capacity	0	Yes
F05	f05_f	UINT	%MW11.5	0005h	- M1 rated voltage	80 to 999 V	By capacity	0	Yes
F07	f07_f	WORD	%MW11.7	0007h	Acceleration time 1	0.01 to 99.99 s 100.0 to 999.9 s 1000 to 3600 s	5.00	13	Yes
F08	f08_f	WORD	%MW11.8	0008h	Deceleration time 1	0.01 to 99.99 s 100.0 to 999.9 s 1000 to 3600 s	5.00	13	Yes
F10	f10_f	UINT	%MW11.10	000Ah	M1 electronic thermal overload relay setting -M1 electronic thermal overload relay(function selection)	0 to 2 0: Inactive (with special motor for VG) 1: Enable (for general-purpose motor: to be used for self-cooling fan) 2: Enable (for inverter motor: to be used for separately-driven fan)	0	85	Yes

You can change the setting of the shaded setting code during operation. Stop operation to change the setting of the other functions.

F code	60 ms updating and referencing data			High-speed Updating address	Name	Setting range	Default setting	Type	Written by UPAC
	Variable name	Type	Address						
F11	f11_f	WORD	%MW11.11	000Bh	- M1 electronic thermal overload relay(operation level)	0.01 to 99.99A 100.0 to 999.9A 1000 to 2000A	By capacity	13	Yes
F12	f12_f	UINT	%MW11.12	000Ch	- M1 electronic thermal overload relay(thermal time constant)	0.5 to 75.0 min	By capacity	2	Yes
F14	f14_f	UINT	%MW11.14	000Eh	Restart Mode after Momentary Power Failure (Mode selection)	0 to 5 0: Inactive (No restart; immediate alarm *lu*) 1: Inactive (No restart; alarm upon power recovery *lu*) 2: Inactive (No restart; alarm after controlled stop lu) 3: Active (Restart; continuation of operation) 4: Active (Restart; operation at speed on power failure) 5: Active (Restart; operation at starting speed)	0	0	Yes
F17	f17_f	UINT	%MW11.17	0011h	Gain (Speed setting signal 12)	0.0 to 200.0% Rate to speed set value (analog input) can be set at the control terminal [12]. Limited at ±110% of the maximum speed	100.0	2	Yes
F18	f18_f	INT	%MW11.18	0012h	Bias (Speed setting signal 12)	-30000 to 30000 r/min Bias speed can be added to speed set value (analog input) at the control terminal [12]. Limited at ±110% of the maximum speed	0	5	Yes
F20	f20_f	UINT	%MW11.20	0014h	DC braking setting - Starting speed	0 to 3600 r/min	0	0	Yes
F21	f21_f	UINT	%MW11.21	0015h	- Operation level	0 to 100%	0	16	Yes
F22	f22_f	UINT	%MW11.22	0016h	- Braking time	0.0 to 30.0 s 0.0: Inactive 0.1 to 30.0 s: Active	0.0	2	Yes
F23	f23_f	UINT	%MW11.23	0017h	Starting speed	0.0 to 150.0 r/min The frequency is limited so as not to fall below 0.1 Hz (sensorless or under V/f control). In order to guarantee torque at starting, start speed can be set.	0.0	2	Yes
F24	f24_f	UINT	%MW11.24	0018h	Starting speed (holding time)	0.00 to 10.00 s	0.00	3	Yes
F26	f26_f	UINT	%MW11.26	001Ah	Motor sound(carrier frequency)	2 to 15 kHz 2: 2kHz 3: 3kHz 4: 4kHz 5: 5kHz 6: 6kHz 7: 7kHz 8,9: 8kHz 10,11: 10kHz 12,13,14: 12kHz 15: 15kHz Adjustment leads to reduced motor noise, avoidance of resonance with the mechanical system, reduced leaked current in the output circuit wiring, reduced inverger-generated noise, etc.	55kW or less 8 75kW or more 7	10	Yes
F36	f36_f	UINT	%MW11.36	0024h	30RY operation mode	0 to 1 0: Excitation upon alarm 1: Excitation during regular operation	0	43	Yes
F37	f37_f	UINT	%MW11.37	0025h	Stopping speed setting - Stopping speed	0.0 to 150.0 r/min The frequency is limited so as not to fall below 0.1 Hz (sensorless or under V/f control).	10.0	2	Yes
F38	f38_f	UINT	%MW11.38	0026h	- Stopping speed (detection method)	0 to 1 0: Detected speed 1: Commanded speed The command value only is valid under vector control without speed sensor or under V/f control.	0	90	Yes
F39	f39_f	UINT	%MW11.39	0027h	- Stopping speed (zero speed holding time)	0.00 to 10.00 s Used to count the timing for applying mechanical brake.	0.50	3	Yes
F40	f40_f	UINT	%MW11.40	0028h	Toque limit setting - Torque limit mode 1	0 to 3 0: Torque limit invalid 1: Torque limit 2: Output power limit 3: Torque current limit	0	44	Yes
F41	f41_f	UINT	%MW11.41	0029h	- Torque limit mode 2	0 to 3 0: Same limiting level (level 1) for 4 quadrants 1: Driving (Level 1). Braking (Level 2) 2: Upper limit (Level 1), Lower limit (Level 2) 3: Same limiting level (Level 1 and Level 2 switched) for 4 quadrants Level 1 and Level 2 are data at the setting source defined by F42 and 43.	0	45	Yes
F42	f42_f	UINT	%MW11.42	002Ah	- Torque limit (level 1) selection	0 to 5 0: Function code (F44) 1: Ai[TL-REF1] 2: DIA card 3: DIB card 4: Link valid 5: PID output	0	46	Yes
F43	f43_f	UINT	%MW11.43	002Bh	- Torque limit (level 2) selection	0 to 5 0: Function code (F45) 1: Ai[TL-REF2] 2: DIA card 3: DIB card 4: Link valid 5: PID output	0	47	Yes
F44	f44_f	INT	%MW11.44	002Ch	- Torque limit (level 1)	-300 to 300%	150	5	Yes
F45	f45_f	INT	%MW11.45	002Dh	- Torque limit (level 2)	-300 to 300%	10	5	Yes
F46	f46_f	INT	%MW11.46	002Eh	- Mechanical loss compensation	-300.00 to 300.00%	0.00	7	Yes

You can change the setting of the shaded setting code during operation. Stop operation to change the setting of the other functions.

F code	60 ms updating and referencing data			High-speed Updating address	Name	Setting range	Default setting	Type	Written by UPAC
	Variable name	Type	Address						
F47	f47_f	INT	%MW11.47	002Fh	- Torque bias T1	-300.00 to 300.00% Use DI to switch among torque bias T1, T2 and T3.	0.00	7	Yes
F48	f48_f	INT	%MW11.48	0030h	- Torque bias T2	-300.00 to 300.00%	0.00	7	Yes
F49	f49_f	INT	%MW11.49	0031h	- Torque bias T3	-300.00 to 300.00%	0.00	7	Yes
F50	f50_f	UINT	%MW11.50	0032h	- Torque bias starting timer	0.00 to 1.00 s Set the time to reach 300%.	0.00	3	Yes
F51	f51_f	UINT	%MW11.51	0033h	- Torque command monitor (polarity selection)	0 to 1 0: Torque polarity 1: A positive value for driving, and a negative value for braking. Polarity for torque-related data output (AO monitor, keypad LED monitor, keypad LCD monitor) can be set.	0	48	Yes
F52	f52_f	WORD	%MW11.52	0034h	Keypad panel LED, LCD monitor setting - LED monitor (display coefficient A)	-999.00 to 999.00 Set the conversion coefficient for determining the load shaft speed and line speed displayed on the keypad LED. Displayed value = motor speed x (0.01 to 200.00) The setting is effective only in the 0.01 to 200.00 range and values out of the allowable range are restricted.	1.00	12	Yes
F53	f53_f	WORD	%MW11.53	0035h	- LED monitor (display coefficient B)	-999.00 to 999.00 Coefficient A: Max. value Coefficient B: Min. value Set the conversion coefficient for determining the displayed command value feedback variable output value (process variable) of the PID adjuster, using display coefficients A and B. Displayed value: (command value or feedback value) x (display coefficient A - B) + B	1.00	12	Yes
F54	f54_f	UINT	%MW11.54	0036h	- LED monitor (display filter)	0.0 to 5.0 s	0.2	2	Yes
F55	f55_f	UINT	%MW11.55	0037h	- LED monitor (display selection)	00 to 32 00: Speed detection 1, speed reference (r/min) (Motor stopping indication is switched by F56) 01: Speed setting 4 (ASR input) (r/min) 02: Commanded output frequency (including slip) (Hz) 03: Torque current reference (%) 04: Torque command value (%) 05: Calculated torque value (%) 06: Power consumption (motor output) (F60 switches the unit.) (kW, HP) 07: Detected output current (A) 08: Detected output voltage (V) 09: Detected DC link circuit voltage (V) 10: Commanded magnetic flux (%) 11: Calculated magnetic flux (%) 12: Motor temperature (deg. C) ("--" is displayed when NTC thermistor is not used.) 13: Detected or commanded value (r/min) of load shaft rotation speed (F56 switches the display during motor stoppage.) 14: Line speed detected value, commanded value (m/min) (F56 switches the display during motor stoppage.) 15: Ai adjustment value (12) (%) 16: Ai adjustment value (Ai 1) (%) 17: Ai adjustment value (Ai 2) (%) 18: Ai adjustment value (Ai 3) (%) 19: Ai adjustment value (Ai 4) (%) The following data may not be displayed depending on mode or option. 20: PID command (%) 21: PID feedback amount (%) 22: PID output (%) 23: Option monitor 1 (HEX) 24: Option monitor 2 (HEX) 25: Option monitor 3 (DEC) 26: Option monitor 4 (DEC) 27: Option monitor 5 (DEC) 28: Option monitor 6 (DEC) 29: - 30: Load factor (%) 31: Input power (F60 switches the unit. (kW/HP) 32: Input watt-hour (×100kWh)	0	49	Yes

You can change the setting of the shaded setting code during operation. Stop operation to change the setting of the other functions.

F code	60 ms updating and referencing data			High-speed Updating address	Name	Setting range	Default setting	Type	Written by UPAC
	Variable name	Type	Address						
F56	f56_f	UINT	%MW11.56	0038h	- LED monitor (Display at stop mode)	0 to 1 0: Command value 1: Actual value Indication during motor stoppage is switched. The corresponding data items are speed (0), load shaft rotation speed (13) and line speed (14).	0	50	Yes
F57	f57_f	UINT	%MW11.57	0039h	- LCD monitor (Display selection)	0 to 1 0: Operation guide screen(Operation state, direction of rotation) 1: Bar graph indication of operating data (speed detection 1, current, torque command value) Operating mode screen is switched on the keypad.	0	51	Yes
F58	f58_f	UINT	%MW11.58	003Ah	- LCD monitor (Language selection)	0 to 7 0: Japanese 1: English 2: German (service will become available shortly) 3: French (service will become available shortly) 4: Spanish (service will become available shortly) 5: Italian (service will become available shortly) 6: Chinese 7: Korean	0	52	Yes
F59	f59_f	UINT	%MW11.59	003Bh	- LCD monitor (Contrast adjustment)	0 (pale) to 10 (dark)	5	0	Yes
F60	f60_f	UINT	%MW11.60	003Ch	Output unit (HP/kW) setting	0 to 1 0: kW 1: HP Switches indication unit for inverter output (power consumption) on the keypad LED monitor and LCD monitor, and selection list (kW-HP) on P02 "Motor Selection (M1)".	0	53	Yes
F61	f61_f	UINT	%MW11.61	003Dh	ASR 1 setting - ASR 1-P (Gain)	0.1 to 500.0 (Multiplication)	10.0	2	Yes
F62	f62_f	UINT	%MW11.62	003Eh	- ASR 1-I (Integration constant)	0.000 to 10.000 s P control when set to 0.000	0.200	4	Yes
F63	f63_f	UINT	%MW11.63	003Fh	- ASR 1-FF (Gain)	0.000 to 9.999 s	0.000	4	Yes
F64	f64_f	UINT	%MW11.64	0040h	- ASR 1 input filter	0.000 to 5.000 s	0.040	4	Yes
F65	f65_f	UINT	%MW11.65	0041h	- ASR 1 detection filter	0.000 to 0.100 s d02 specifies a time constant determining the first order delay of the speed detection filter.	0.005	4	Yes
F66	f66_f	UINT	%MW11.66	0042h	- ASR 1 output filter	0.000 to 0.100 s d02 specifies a time constant determining the first order delay of the speed detection filter.	0.002	4	Yes
F67	f67_f	UINT	%MW11.67	0043h	- S-curve (Acceleration start side 1)	0 to 50%	0	0	Yes
F68	f68_f	UINT	%MW11.68	0044h	- S-curve (Acceleration end side 1)	0 to 50%	0	0	Yes
F69	f69_f	UINT	%MW11.69	0045h	- S-curve (Deceleration start side 1)	0 to 50%	0	0	Yes
F70	f70_f	UINT	%MW11.70	0046h	- S-curve (Deceleration end side 1)	0 to 50%	0	0	Yes
F73	f73_f	UINT	%MW11.73	0049h	Magnetic flux level setting - Magnetic flux level at light load	10 to 100%	100	16	Yes
F74	f74_f	UINT	%MW11.74	004Ah	- Pre-exciting time	0.0 to 10.0 s When the operation command (FWD, REV) turns ON, it automatically enters pre-exciting state for the time set by this function code.	0.0	2	Yes
F75	f75_f	UINT	%MW11.75	004Bh	- Pre-excitation initial level	100 to 400%	100	0	Yes
F76	f76_f	UINT	%MW11.76	004Ch	Speed limit setting - Speed limit (Mode selection)	0 to 3 0: Limit level 1 for forward rotation and limit level 2 forreverse rotation 1: Limit level 1 for both forward and reverse rotation 2: Limit level 1 for upper limit and limit level 2 for lower limit 3: Limit level 1 for forward rotation and limit level 2 forreverse rotation Add the [12] input as a bias.	0	91	Yes
F77	f77_f	INT	%MW11.77	004Dh	- Speed limit level 1	-110.0 to 110.0%	100.0	6	Yes
F78	f78_f	INT	%MW11.78	004Eh	- Speed limit level 2	-110.0 to 110.0%	100.0	6	Yes
F79	f79_f	UINT	%MW11.79	004Fh	Motor selection (M1, M2, M3)	0 to 2 0: M1 selection However, the contact switching by X function is given priority. 1: M2 selection (X function invalid) 2: M3 selection (X function invalid) Select motor to be used from M1, M2 and M3.	0	54	Yes
F80	f80_f	UINT	%MW11.80	0050h	Current rating switching	0 to 3 0,2: HD(Overload current 150%-1min/200%-3sec) 1: LD(Overload current 120%-1min) 3: MD(Overload current 150%-1min) Switches between the three-fold rating (HD, LD, MD) of the inverter.	0	56	Yes

You can change the setting of the shaded setting code during operation. Stop operation to change the setting of the other functions.

Table 5-2-23 E: Extension Terminal Functions

E code	60 ms updating and referencing data			High-speed Updating address	Name	Setting range	Default setting	Type	Written by UPAC
	Variable name	Type	Address						
E01	e01_f	UINT	%MW11.97	0101h	X terminal function - X1 terminal function	00 to 79 00,01,02,03: Multistep speed selection(1 to 15 steps) [00: SS1, 01: SS2, 02: SS4, 03: SS8] 04,05: ASR, acceleration / deceleration selection(4 steps) [04:RT1, 5:RT2] 06: 3 wire operation stop command [HLD] 07: Coast-to-stop command [BX] 08: Alarm reset [RST] 09: External alarm [THR] 10: Jogging operation [JOG] 11: Speed setting N2 / speed setting N1 [N2 / N1] 12: Motor M2 selection [M-CH2] 13: Motor M3 selection [M-CH3] 14: DC brake command [DCBRK] 15: ACC/DEC zero clear command [CLR] 16: Creep speed switching in UP/DOWN control [CRP-N2 /N1] 17: UP command in UP/DOWN control [UP] 18: DOWN command in UP/DOWN control [DOWN] 19: Write enable for keypad (data can be changed) [WE-KP] 20: Cancel PID control [KP/PID] 21: Inverse mode changeover [IVS] 22: Interlock (52-2) [IL] 23: Write enable through link [WE-LK] 24: Enable communications link via RS-485 or fieldbus [LE] 25: Universal DI [U-DI] 26: Pickup start mode [STM] 27: Synchronized operation command(PG (PR) option) [SYC] 28: Zero speed locking command [LOCK] 29: Pre-exciting command [EXITE] 30: Speed reference value limiter cancel [N-LIM] 31: H41 Cancel [torque command] [H41-CCL] 32: H42 Cancel [torque current command] [H42-CCL] 33: H43 [magnetic flux command] cancel [H43-CCL] 34: F40[Torque limiting mode 1] cancel [F40-CCL] 35: Torque limit (level 1 / 2 selection) [TL2/TL1] 36: Bypass [BPS] 37,38: Torque bias command 1 / 2 [37:TB1,38:TB2] 39: Droop selection [DROOP] 40: Ai1 zero hold [ZH-AI1] 41: Ai2 zero hold [ZH-AI2] 42: Ai3 zero hold (AIO option) [ZH-AI3] 43: Ai4 zero hold (AIO option) [ZH-AI4] 44: Ai 1 polarity inversion [REV-AI1] 45: Ai 2 polarity inversion [REV-AI2] 46: Ai 3 polarity inversion (AIO option) [REV-AI3] 47: Ai 4 polarity inversion (AIO option) [REV-AI4] 48: PID output inversion selection [PID-INV] 49: Cancel PG alarm [PG-CCL] 50: Undervoltage cancel [LU-CCL] 51: Ai torque bias hold [H-TB] 52: STOP 1(The motor decelerates and stops in normal deceleration time.) [STOP1] 53: STOP 2(The motor decelerates and stops in “deceleration time 4.”) [STOP2] 54: STOP3 [STOP3] 55: DIA data latch (DIA option) [DIA] 56: DIB data latch (DIA option) [DIB] 57: Multi-winding motor cancel [MT-CCL] 58-67: Custom Di1-Di10 [C-DI1～C-DI10] 69: PID clear [PID-CCL] 70: PID FF dection valid [PID-FF] 72,73: Toggle signal 1/2 [72:TGL1 ,73:TGL2] 74: External mock alarm [FTB] 75: NTC thermistor alarm cancel [NTC-CCL] 76: Life alarm cancel [LF-CCL] 78: PID Feedback switch signal [PID-1/2] 79: PID torque bias selection [TB-PID]	0	57	Yes
E02	e02_f	UINT	%MW11.98	0102h	- X2 terminal function	0 to 79 (Refer to X1 terminal function.)	1	57	Yes
E03	e03_f	UINT	%MW11.99	0103h	- X3 terminal function	0 to 79 (Refer to X1 terminal function.)	2	57	Yes
E04	e04_f	UINT	%MW11.100	0104h	- X4 terminal function	0 to 79 (Refer to X1 terminal function.)	3	57	Yes
E05	e05_f	UINT	%MW11.101	0105h	- X5 terminal function	0 to 79 (Refer to X1 terminal function.)	4	57	Yes
E06	e06_f	UINT	%MW11.102	0106h	- X6 terminal function	0 to 79 (Refer to X1 terminal function.)	5	57	Yes
E07	e07_f	UINT	%MW11.103	0107h	- X7 terminal function	0 to 79 (Refer to X1 terminal function.)	7	57	Yes
E08	e08_f	UINT	%MW11.104	0108h	- X8 terminal function	0 to 79 (Refer to X1 terminal function.)	8	57	Yes
E09	e09_f	UINT	%MW11.105	0109h	- X9 terminal function	0 to 79 (Refer to X1 terminal function.)	9	57	Yes
E10	e10_f	UINT	%MW11.106	010Ah	- X11 terminal function	0 to 79 (Refer to X1 terminal function.)	25	57	Yes
E11	e11_f	UINT	%MW11.107	010Bh	- X12 terminal function	0 to 79 (Refer to X1 terminal function.)	25	57	Yes

You can change the setting of the shaded setting code during operation. Stop operation to change the setting of the other functions.

E code	60 ms updating and referencing data			High-speed Updating address	Name	Setting range	Default setting	Type	Written by UPAC
	Variable name	Type	Address						
E12	e12_f	UINT	%MW11.108	010Ch	- X13 terminal function	0 to 79 (Refer to X1 terminal function.)	25	57	Yes
E13	e13_f	UINT	%MW11.109	010Dh	- X14 terminal function	0 to 79 (Refer to X1 terminal function.)	25	57	Yes
E14	e14_f	WORD	%MW11.110	010Eh	X terminal function normally open/closed	0000 to 01FF 0: Normally open 1: Normally closed Open/closed setting is possible for X1 to X9 function terminals.	0000	35	Yes
E15	e15_f	UINT	%MW11.111	010Fh	Y terminal function - Y1 terminal function	00 to 84 00: Inverter running [RUN] 01: Speed existence [N-EX] 02: Speed agreement [N-AG1] 03: Speed arrival [N-AR] 04: Speed detection 1 [N-DT1] 05: Speed detection 2 [N-DT2] 06: Speed detection 3 [N-DT1] 07: Undervoltage detection signal [LU] 08: Torque polarity detection (braking/driving) [B/D] 09: Torque Limiting [TL] 10: Torque detection 1 [T-DT1] 11: Torque detection 2 [T-DT12] 12: Keypad operation enabled [KP] 13: Inverter stopping [STOP] 14: Operation ready [RDY] 15: Magnetic flux detection signal [MF-DT] 16: Motor M2 selection status [SW-M2] 17: Motor M3 selection status [SW-M3] 18: Brake release signal [BRK] 19: Alarm indication [AL1] 20: Alarm indication [AL2] 21: Alarm indication [AL4] 22: Alarm indication [AL8] 23: Cooling fan operation [FAN] 24: Auto-resetting [TRY] 25: Universal DO [U-DO] 26: Heat sink overheat early warning [INV-OH] 27: Synchronization completion [SY-C] 28: Life alarm [LIFE] 29: Accelerating [U-ACC] 30: Decelerating [U-DEC] 31: Inverter overload early warning [INV-OL] 32: Motor overheat early warning [M-OH] 33: Motor overload early warning [M-OL] 34: DB overload early warning [DB-OL] 35: Link transmission error [LK-ERR] 36: Load adaptive control being limited [ANL] 37: Load adaptive control being calculated [ANC] 38: Analog torque bias hold [TBH] 39 to 48: Custom Do1-Do10 [C-DO1 to C-DO10] 51: Multi-winding communication establishing [MTS] 52: Multi-winding motor cancel response [MEC-AB] 53: Multi-winding master selection [MSS] 54: Multi-winding self fault [AL-SF] 55: Communication error stopping [LES] 56: Alarm output (for any alarm) [ALM] 57: Light alarm [L-ALM] 58: Maintenance information [MNT] 59: Braking transistor broken [DBAL] 60: DC fan locked signal [DCFL] 61: Speed agreement 2 [N-AG2] 62: Speed agreement 3 [N-AG3] 63: Axis flow fan operation stop signal [MFAN] 66: Droop selection response [DSAB] 67: Torque command / torque current command cancel response [TCL-C] 68: Torque limiting mode 1 cancel response [F40-AB] 71: 73 input command [PRT-73] 72: Y terminal test output ON [Y-ON] 73: Y terminal test output OFF [Y-OFF] 75: Clock battery lifetime [BATT] 80: EN terminal detection circuit fault [DECF] 81: EN terminal OFF [ENOFF] 82: Safety function running [SF-RUN] 84: STO diagnosis in progress [SF-TST]	1	58	Yes
E16	e16_f	UINT	%MW11.112	0110h	- Y2 terminal function	0 to 84 (Refer to X1 terminal function.)	2	58	Yes
E17	e17_f	UINT	%MW11.113	0111h	- Y3 terminal function	0 to 84 (Refer to X1 terminal function.)	3	58	Yes
E18	e18_f	UINT	%MW11.114	0112h	- Y4 terminal function	0 to 84 (Refer to X1 terminal function.)	4	58	Yes
E19	e19_f	UINT	%MW11.115	0113h	- Y5 terminal function	0 to 84 (Refer to X1 terminal function.)	14	58	Yes
E20	e20_f	UINT	%MW11.116	0114h	- Y11 terminal function	0 to 84 (Refer to X1 terminal function.)	26	58	Yes
E21	e21_f	UINT	%MW11.117	0115h	- Y12 terminal function	0 to 84 (Refer to X1 terminal function.)	26	58	Yes
E22	e22_f	UINT	%MW11.118	0116h	- Y13 terminal function	0 to 84 (Refer to X1 terminal function.)	26	58	Yes
E23	e23_f	UINT	%MW11.119	0117h	- Y14 terminal function	0 to 84 (Refer to X1 terminal function.)	26	58	Yes
E24	e24_f	UINT	%MW11.120	0118h	- Y15 terminal function	0 to 84 (Refer to X1 terminal function.)	26	58	Yes
E25	e25_f	UINT	%MW11.121	0119h	- Y16 terminal function	0 to 84 (Refer to X1 terminal function.)	26	58	Yes
E26	e26_f	UINT	%MW11.122	011Ah	- Y17 terminal function	0 to 84 (Refer to X1 terminal function.)	26	58	Yes
E27	e27_f	UINT	%MW11.123	011Bh	- Y18 terminal function	0 to 84 (Refer to X1 terminal function.)	26	58	Yes
E28	e28_f	WORD	%MW11.124	011Ch	Y terminal function normally open/closed	0000 to 001F 0: Normally open 1: Normally closed Set the normal state of Y1 through Y5.	0000	36	Yes

You can change the setting of the shaded setting code during operation. Stop operation to change the setting of the other functions.

E code	60 ms updating and referencing data			High-speed Updating address	Name	Setting range	Default setting	Type	Written by UPAC
	Variable name	Type	Address						
E29	e29_f	UINT	%MW11.125	011Dh	PG pulse output selection	0 to 10 0: No division 1: 1/2 2: 1/4 3: 1/8 4: 1/16 5: 1/32 6: 1/64 0 to 6: Inputs to built-in PG are divided and output. 7: Internal speed command: Pulse generation mode 8: PG(PD): Pulse detection input oscillation mode 9: PG(PR): Pulse command input oscillation mode 10: Built-in PG・PG(SD): Speed detection pulse input oscillation mode 7 to 10: Input pulses are arbitrarily divided and output. (AB90°phase difference)	0	92	Yes
E30	e30_f	UINT	%MW11.126	011Eh	Protective function setting - Motor overheat protection (temp.)	50 to 200□	150	0	Yes
E31	e31_f	UINT	%MW11.127	011Fh	- Motor overheat early warning (temp.)	50 to 200□	75	0	Yes
E32	e32_f	UINT	%MW11.128	0120h	- M1 to M3 PTC operation level	0.00 to 5.00 V If "PTC thermistor" is selected to be used in thermistor selection, operation starts when input voltage on PTC terminal reaches or exceeds the set voltage (operation level).	1.60	3	Yes
E33	e33_f	UINT	%MW11.129	0121h	- Inverter overload early warning	25 to 100%	90	0	Yes
E34	e34_f	UINT	%MW11.130	0122h	- Motor overload early warning	25 to 100%	90	0	Yes
E35	e35_f	UINT	%MW11.131	0123h	- DB overload protection	0 to 100% Set %ED for the braking resistor to inverter capacity. The braking resistor overheating alarm (*dbh*) is enabled when set to 0.	0	0	Yes
E36	e36_f	UINT	%MW11.132	0124h	- DB overload early warning	0 to 100%	80	0	Yes
E37	e37_f	UINT	%MW11.133	0125h	- DB thermal time constant	0 to 1000 s	300	0	Yes
E38	e38_f	WORD	%MW11.134	0126h	Speed detection setting - Speed detection method	000 to 111 Detection method for 0x[E39][E40][E41] 0: Speed detection 1: Speed setting The command value only is valid during V/f control.	000	9	Yes
E39	e39_f	UINT	%MW11.135	0127h	- Speed detection level 1	0 to 30000 r/min Detection signal is output when the speed detection level 1, set in Speed Detection 1 [N-FB1±] (or Speed Setting 4 [N-REF4]) is reached or exceeded.	1500	0	Yes
E40	e40_f	INT	%MW11.136	0128h	- Speed detection level 2	-30000 to 30000 r/min	1500	5	Yes
E41	e41_f	INT	%MW11.137	0129h	- Speed detection level 3	-30000 to 30000 r/min	1500	5	Yes
E42	e42_f	UINT	%MW11.138	012Ah	- Speed arrival (hysteresis)	1.0 to 20.0% When speed detection enters the detection range of both + polarity and - polarity from speed detection 2, detection signal is output.	3.0	2	Yes
E43	e43_f	UINT	%MW11.139	012Bh	- Speed agreement (hysteresis)	1.0 to 20.0% When speed detection enters the detection range of both + polarity and - polarity from speed detection 4, detection signal is output.	3.0	2	Yes
E44	e44_f	UINT	%MW11.140	012Ch	- Speed agreement (off-delay timer)	0.000 to 5.000 s	0.100	4	Yes
E45	e45_f	UINT	%MW11.141	012Dh	- Speed disagreement alarm Used / Not used	00 to 21 Units digit: Speed disagreement alarm (*er9*) 0: Not used 1: Used Tens digit: Lin phase lack detection (*lin*) 0: Standard level 1: Reserved for particular manufacturers 2: Disable	00	9	Yes
E46	e46_f	UINT	%MW11.142	012Eh	Torque / magnetic flux detection level setting - Torque detection level 1	0 to 300% Calculated value during V/f control When the torque command value reaches or exceeds set value, detection signal is output.	30	16	Yes
E47	e47_f	UINT	%MW11.143	012Fh	- Torque detection level 2	0 to 300%	30	16	Yes
E48	e48_f	UINT	%MW11.144	0130h	- Magnetic flux detection level	10 to 100% When the magnetic flux calculated value reaches or exceeds set value, detection signal is output.	100	16	Yes

You can change the setting of the shaded setting code during operation. Stop operation to change the setting of the other functions.

E code	60 ms updating and referencing data			High-speed Updating address	Name	Setting range	Default setting	Type	Written by UPAC
	Variable name	Type	Address						
E49	e49_f	UINT	%MW11.145	0131h	Ai terminal function - Ai1 terminal function	00 to 27 00: Input signal shutoff [OFF] 01: Auxiliary speed setting 1 [AUX-N1] 10V/Nmax 02: Auxiliary speed setting 2 [AUX-N2] 10V/Nmax 03: Torque limiter level 1 [TL-REF1] ±10V/±150% 04: Torque limiter level 2 [TL-REF2] ±10V/±150% 05: Torque bias [TB-REF] ±10V/±150% 06: Torque command [T-REF] 10V/150% 07: Torque current command [IT-REF] 10V/150% 08: Creep speed 1 in UP/DOWN control [CRP-N1] 10V/Nmax 09: Creep speed 1 in UP/DOWN control [CRP-N1] 10V/Nmax 10: Magnetic flux command [MF-REF] 10V/100% 11: Line speed detection [LINE-N] 10V/Nmax 12: Motor temperature [M-TMP] 10V/200C 13: Speed override [N-OR] ±10V/±50% 14: Universal Ai [U-AI]±10V/±4000(h) 15: PID feedback amount 1 [PID-FB1]±10V/±20000(d) 16: PID reference value [PID-REF]10V/20000(d) 17: PID correction gain [PID-G] 10V/4000(h) 18 to 24: Custom Ai 1 to 7 [C-AI1 to C-AI7] 25: Speed main setting [N-REFV] ±10V/±Nmax 26: Current input speed setting(DC4-20mA)[N-REFC] ±10V/±Nmax (26: Current input speed setting is only available for Ai2.) 27: PID feedback 2 [PID-FB2]±10V/±20000(d)	0	59	Yes
E50	e50_f	UINT	%MW11.146	0132h	- Ai2 terminal function	0 to 27 (Refer to Ai1 terminal function.)	0	59	Yes
E51	e51_f	UINT	%MW11.147	0133h	- Ai3 terminal function	0 to 27 (Refer to Ai1 terminal function.) (26: Current input speed setting is only available for Ai2.)	0	59	Yes
E52	e52_f	UINT	%MW11.148	0134h	- Ai4 terminal function	0 to 27 (Refer to Ai1 terminal function.) (26: Current input speed setting is only available for Ai2.)	0	59	Yes
E53	e53_f	INT	%MW11.149	0135h	Ai gain setting - Ai1 gain setting	-10.000 to 10.000 (Multiplication)	1.000	8	Yes
E54	e54_f	INT	%MW11.150	0136h	- Ai2 gain setting	-10.000 to 10.000 (Multiplication)	1.000	8	Yes
E55	e55_f	INT	%MW11.151	0137h	- Ai3 gain setting	-10.000 to 10.000 times (Displayed for models with AIO option.)	1.000	8	Yes
E56	e56_f	INT	%MW11.152	0138h	- Ai4 gain setting	-10.000 to 10.000 times (Displayed for models with AIO option.)	1.000	8	Yes
E57	e57_f	INT	%MW11.153	0139h	Ai bias setting - Ai1 bias setting	-100.0 to 100.0%	0.0	6	Yes
E58	e58_f	INT	%MW11.154	013Ah	- Ai2 bias setting	-100.0 to 100.0%	0.0	6	Yes
E59	e59_f	INT	%MW11.155	013Bh	- Ai3 bias setting	-100.0 to 100.0% (Displayed for models with AIO option.)	0.0	6	Yes
E60	e60_f	INT	%MW11.156	013Ch	- Ai4 bias setting	-100.0 to 100.0% (Displayed for models with AIO option.)	0.0	6	Yes
E61	e61_f	UINT	%MW11.157	013Dh	Ai filter setting - Ai1 filter setting	0.000 to 0.500 s	0.010	4	Yes
E62	e62_f	UINT	%MW11.158	013Eh	- Ai2 filter setting	0.000 to 0.500 s	0.010	4	Yes
E63	e63_f	UINT	%MW11.159	013Fh	- Ai3 filter setting	0.000 to 0.500 s	0.010	4	Yes
E64	e64_f	UINT	%MW11.160	0140h	- Ai4 filter setting	0.000 to 0.500 s	0.010	4	Yes
E65	e65_f	UINT	%MW11.161	0141h	Increment / decrement limiter (Ai) setting - Increment / decrement limiter (Ai1)	0.00 to 60.00 s Sets time for change of inverter's internal data from 0V data to 10V data, when voltage 0 to 10 V is input to analog input terminal.	0.00	3	Yes
E66	e66_f	UINT	%MW11.162	0142h	- Increment / decrement limiter (Ai2)	0.00 to 60.00 s	0.00	3	Yes
E67	e67_f	UINT	%MW11.163	0143h	- Increment / decrement limiter (Ai3)	0.00 to 60.00 s	0.00	3	Yes
E68	e68_f	UINT	%MW11.164	0144h	- Increment / decrement limiter (Ai4)	0.00 to 60.00 s	0.00	3	Yes

You can change the setting of the shaded setting code during operation. Stop operation to change the setting of the other functions.

E code	60 ms updating and referencing data			High-speed Updating address	Name	Setting range	Default setting	Type	Written by UPAC
	Variable name	Type	Address						
E69	e69_f	UINT	%MW11.165	0145h	AO terminal function setting - AO1 terminal function	00 to 40 00: Detected speed 1(speedometer, swing on single side) [N-FB1+] Nmax10V 01: Detected speed 1(speedometer, swing on both sides) [N-FB1] Nmax10V 02: Speed setting 2(before acceleration / deceleration calculation) [N-REF2] Nmax10V 03: Speed setting 4 (ASR input) [N-REF4] Nmax10V 04: Detected speed 2 (ASR input) [N-FB2] Nmax10V 05: Line speed detection [LINE-N±]±Nmax/±10V 06: Torque current command (torque ammeter, swing on both sides) [IT-REF±]±150%/±10V 07: Torque current command (torque ammeter, swing on single side) [IT-REF+] ±150%/10V 08: Torque command(torque meter, swing on both sides) [T-REF] 150%10V 09: Torque command(torque meter, swing on single side) [T-REF] 150%10V 10: Motor current [I-AC] 200%10V 11: Motor voltage [V-AC] 200%10V 12: Power consumption (motor output) [PWR] 200%/10V 13: DC link circuit voltage [V-DC] 800V/10V 14: +10V output test [P10], output equivalent to +10V 15: -10V output test [N10], output equivalent to -10V 16: Motor temperature [TMP-M] ±200□/±10V 30: Universal AO [U-AO] 31-37: Custom Ao1-Ao7 [C-AO1～C-AO7] 38: Input power [PWR-IN] 200%/10V 39: Magnet polar location signal [SMP] TOP/5V 40: PID output value [PID-OUT] ±200%/±10V	1	60	Yes
E70	e70_f	UINT	%MW11.166	0146h	- AO2 terminal function	0 to 40 (Refer to AO1 terminal function.)	6	60	Yes
E71	e71_f	UINT	%MW11.167	0147h	- AO3 terminal function	0 to 40 (Refer to AO1 terminal function.)	3	60	Yes
E72	e72_f	UINT	%MW11.16	0148h	- AO4 terminal function	0 to 40 (Refer to AO1 terminal function.)	0	60	Yes
E73	e73_f	UINT	8%MW11.169	0149h	- AO5 terminal function	0 to 40 (Refer to AO1 terminal function.)	0	60	Yes
E74	e74_f	INT	%MW11.170	014Ah	AO gain setting - AO1 gain setting	-100.00 to 100.00 (Multiplication)	1.00	7	Yes
E75	e75_f	INT	%MW11.171	014Bh	- AO2 gain setting	-100.00 to 100.00 (Multiplication)	1.00	7	Yes
E76	e76_f	INT	%MW11.172	014Ch	- AO3 gain setting	-100.00 to 100.00 (Multiplication)	1.00	7	Yes
E77	e77_f	INT	%MW11.173	014Dh	- AO4 gain setting	-100.00 to 100.00 times (Displayed for models with AIO option.)	1.00	7	Yes
E78	e78_f	INT	%MW11.174	014Eh	- AO5 gain setting	-100.00 to 100.00 times (Displayed for models with AIO option.)	1.00	7	Yes
E79	e79_f	INT	%MW11.175	014Fh	AO bias setting - AO1 bias setting	-100.0 to 100.0%	0.0	6	Yes
E80	e80_f	INT	%MW11.176	0150h	- AO2 bias setting	-100.0 to 100.0%	0.0	6	Yes
E81	e81_f	INT	%MW11.177	0151h	- AO3 bias setting	-100.0 to 100.0%	0.0	6	Yes
E82	e82_f	INT	%MW11.178	0152h	- AO4 bias setting	-100.0 to 100.0% (Displayed for models with AIO option.)	0.0	6	Yes
E83	e83_f	INT	%MW11.179	0153h	- AO5 bias setting	-100.0 to 100.0% (Displayed for models with AIO option.)	0.0	6	Yes
E84	e84_f	UINT	%MW11.180	0154h	AO1-5 filter setting	0.000 to 0.500 s	0.010	4	Yes

You can change the setting of the shaded setting code during operation. Stop operation to change the setting of the other functions.

Table 5-2-24 C: Control Functions of Frequency

C code	60 ms updating and referencing data			High-speed Updating address	Name	Setting range	Default setting	Type	Written by UPAC
	Variable name	Type	Address						
C01	c01_f	UINT	%MW11.193	0201h	Jump speed setting - Jump speed 1	0 to 30000 r/min Have the set speed jump so that the load's mechanical resonance point will not overlap with the motor speed. Three jump points may be set.	0	0	Yes
C02	c02_f	UINT	%MW11.194	0202h	- Jump speed 2	0 to 30000 r/min	0	0	Yes
C03	c03_f	UINT	%MW11.195	0203h	- Jump speed 3	0 to 30000 r/min	0	0	Yes
C04	c04_f	UINT	%MW11.196	0204h	- Jump width	0 to 1000 r/min	0	0	Yes
C05	c05_f	UINT	%MW11.197	0205h	Multistep speed setting - Multistep speed 1	0 to 30000 r/min / 0.00 to 100.00% / 0.0 to 999.9 m/min (Switched according to C21.) Turning terminal commands SS1, SS2, SS4 and SS8 ON/OFF selectively switches the reference frequency of the inverter in 15 steps.	0/0.00/0.0	0	Yes
C06	c06_f	UINT	%MW11.198	0206h	- Multistep speed 2	0 to 30000 r/min / 0.00 to 100.00% / 0.0 to 999.9 m/min (Switched according to C21.)	0/0.00/0.0	0	Yes
C07	c07_f	UINT	%MW11.199	0207h	- Multistep speed 3	0 to 30000 r/min / 0.00 to 100.00% / 0.0 to 999.9 m/min (Switched according to C21.)	0/0.00/0.0	0	Yes
C08	c08_f	UINT	%MW11.200	0208h	- Multistep speed 4	0 to 30000 r/min / 0.00 to 100.00% / 0.0 to 999.9 m/min (Switched according to C21.)	0/0.00/0.0	0	Yes
C09	c09_f	UINT	%MW11.201	0209h	- Multistep speed 5	0 to 30000 r/min / 0.00 to 100.00% / 0.0 to 999.9 m/min (Switched according to C21.)	0/0.00/0.0	0	Yes
C10	c10_f	UINT	%MW11.202	020Ah	- Multistep speed 6	0 to 30000 r/min / 0.00 to 100.00% / 0.0 to 999.9 m/min (Switched according to C21.)	0/0.00/0.0	0	Yes
C11	c11_f	UINT	%MW11.203	020Bh	- Multistep speed 7	0 to 30000 r/min / 0.00 to 100.00% / 0.0 to 999.9 m/min (Switched according to C21.)	0/0.00/0.0	0	Yes

You can change the setting of the shaded setting code during operation. Stop operation to change the setting of the other functions.

C code	60 ms updating and referencing data			High-speed Updating address	Name	Setting range	Default setting	Type	Written by UPAC
	Variable name	Type	Address						
C12	c12_f	UINT	%MW11.204	020Ch	- Multistep speed 8	0 to 30000 r/min / 0.00 to 100.00% / 0.0 to 999.9 m/min (Switched according to C21.)	0/0.00/ 0.0	0	Yes
C13	c13_f	UINT	%MW11.205	020Dh	- Multistep speed 9	0 to 30000 r/min / 0.00 to 100.00% / 0.0 to 999.9 m/min (Switched according to C21.)	0/0.00/ 0.0	0	Yes
C14	c14_f	UINT	%MW11.206	020Eh	- Multistep speed 10	0 to 30000 r/min / 0.00 to 100.00% / 0.0 to 999.9 m/min (Switched according to C21.)	0/0.00/ 0.0	0	Yes
C15	c15_f	UINT	%MW11.207	020Fh	- Multistep speed 11	0 to 30000 r/min / 0.00 to 100.00% / 0.0 to 999.9 m/min (Switched according to C21.)	0/0.00/ 0.0	0	Yes
C16	c16_f	UINT	%MW11.208	0210h	- Multistep speed 12	0 to 30000 r/min / 0.00 to 100.00% / 0.0 to 999.9 m/min (Switched according to C21.)	0/0.00/ 0.0	0	Yes
C17	c17_f	UINT	%MW11.209	0211h	- Multistep speed 13	0 to 30000 r/min / 0.00 to 100.00% / 0.0 to 999.9 m/min (Switched according to C21.)	0/0.00/ 0.0	0	Yes
C18	c18_f	UINT	%MW11.210	0212h	- Multistep speed 14/ Creep speed 1	0 to 30000 r/min / 0.00 to 100.00% / 0.0 to 999.9 m/min (Switched according to C21.) C18 and C19 also serves as creep speed function while UP/DOWN function is used.	0/0.00/ 0.0	0	Yes
C19	c19_f	UINT	%MW11.211	0213h	- Multistep speed 15/ Creep speed 2	0 to 30000 r/min / 0.00 to 100.00% / 0.0 to 999.9 m/min (Switched according to C21.)	0/0.00/ 0.0	0	Yes
C20	c20_f	UINT	%MW11.212	0214h	- Multistep speed command agreement timer	0.000 to 0.100 s When [SS1], [SS2], [SS4] and [SS8] have remained in the same state for the time set by this timer, the speed set value is switched.	0.000	4	Yes
C21	c21_f	UINT	%MW11.213	0215h	- Definition of multistep speed setting	0 to 2 0: 0 to 30000 r/min 1: 0.00 to 100.00% 2: 0.0 to 999.9 m/min Unit for setting multistep for C05 to C19 is defined. When “1” is selected, the setting is the ratio to the maximum speed (F03, A06, A106) of the selected motor.	0	93	Yes
C25	c25_f	UINT	%MW11.217	0219h	Speed setting N2	0 to 9 0: Keypad (△/▽) key 1: Analog 12 input (0～±10V) 2: Analog 12 input (0～+10V) 3: UP/DOWN control (initial value: 4: UP/DOWN(initial value: previous value) 5: UP/DOWN(initial value: Creep speed 1,2) 6: DIA card input 7: DIB card input 8: Ai(N-REFV) input 9: Ai2(N-REFC) input When X terminal function [N2/N1] goes ON, the speed command set by this function code becomes valid.	0	41	Yes
C29	c29_f	UINT	%MW11.221	021Dh	Jogging speed	0 to 30000 r/min Set speed for motor jogging.	50	0	Yes
C30	c30_f	UINT	%MW11.222	021Eh	ASR-JOG setting - ASR-P (gain) JOG	0.1 to 500.0 (Multiplication)	10.0	2	Yes
C31	c31_f	UINT	%MW11.223	021Fh	- ASR-I (integration constant) JOG	0.000 to 10.000 s P control when set to 0.000	0.200	4	Yes
C32	c32_f	UINT	%MW11.224	0220h	- ASR-JOG input filter	0.000 to 5.000 s	0.040	4	Yes
C33	c33_f	UINT	%MW11.225	0221h	- ASR-JOG detection filter	0.000 to 0.100 s	0.005	4	Yes
C34	c34_f	UINT	%MW11.226	0222h	- ASR-JOG output filter	0.000 to 0.100 s	0.002	4	Yes
C35	c35_f	WORD	%MW11.227	0223h	- Acceleration time JOG	0.01 to 99.99 s 100.0 to 999.9 s 1000 to 3600 s	5.00	13	Yes
C36	c36_f	WORD	%MW11.228	0224h	- Deceleration time JOG	0.01 to 99.99 s 100.0 to 999.9 s 1000 to 3600 s	5.00	13	Yes
C37	c37_f	UINT	%MW11.229	0225h	- S-curve starting side JOG	0 to 50%	0	0	Yes
C38	c38_f	UINT	%MW11.230	0226h	- S-curve end side JOG	0 to 50%	0	0	Yes
C40	c40_f	UINT	%MW11.232	0228h	ASR 2 setting - ASR 2-P gain	0.1 to 500.0 (Multiplication)	10.0	2	Yes
C41	c41_f	UINT	%MW11.233	0229h	- ASR 2-I (integration constant)	0.000 to 10.000 s P control when set to 0.000	0.200	4	Yes
C42	c42_f	UINT	%MW11.234	022Ah	- ASR 2-FF (gain)	0.000 to 9.999 s	0.000	4	Yes
C43	c43_f	UINT	%MW11.235	022Bh	- ASR 2 input filter	0.000 to 5.000 s	0.040	4	Yes
C44	c44_f	UINT	%MW11.236	022Ch	- ASR 2 detection filter	0.000 to 0.100 s	0.005	4	Yes
C45	c45_f	UINT	%MW11.237	022Dh	- ASR 2 output filter	0.000 to 0.100 s	0.002	4	Yes
C46	c46_f	WORD	%MW11.238	022Eh	- Acceleration time 2	0.01 to 99.99 s 100.0 to 999.9 s 1000 to 3600 s	5.00	13	Yes
C47	c47_f	WORD	%MW11.239	022Fh	- Deceleration time 2	0.01 to 99.99 s 100.0 to 999.9 s 1000 to 3600 s	5.00	13	Yes
C48	c48_f	UINT	%MW11.240	0230h	- S-curve starting side 2	0 to 50%	0	0	Yes
C49	c49_f	UINT	%MW11.241	0231h	- S-curve end side 2	0 to 50%	0	0	Yes
C50	c50_f	UINT	%MW11.242	0232h	ASR 3 setting - ASR 3-P gain	0.1 to 500.0 (Multiplication)	10.0	2	Yes
C51	c51_f	UINT	%MW11.243	0233h	- ASR 3-I (integration constant)	0.000 to 10.000 s P control when set to 0.000	0.200	4	Yes
C52	c52_f	UINT	%MW11.244	0234h	- ASR 3-FF (gain)	0.000 to 9.999 s	0.000	4	Yes
C53	c53_f	UINT	%MW11.245	0235h	- ASR 3 input filter	0.000 to 5.000 s	0.040	4	Yes

You can change the setting of the shaded setting code during operation. Stop operation to change the setting of the other functions.

C code	60 ms updating and referencing data			High-speed Updating address	Name	Setting range	Default setting	Type	Written by UPAC
	Variable name	Type	Address						
C54	c54_f	UINT	%MW11.246	0236h	- ASR 3 detection filter	0.000 to 0.100 s	0.005	4	Yes
C55	c55_f	UINT	%MW11.247	0237h	- ASR 3 output filter	0.000 to 0.100 s	0.002	4	Yes
C56	c56_f	WORD	%MW11.248	0238h	- Acceleration time 3	0.01 to 99.99 s 100.0 to 999.9 s 1000 to 3600 s	5.00	13	Yes
C57	c57_f	WORD	%MW11.249	0239h	- Deceleration time 3	0.01 to 99.99 s 100.0 to 999.9 s 1000 to 3600 s	5.00	13	Yes
C58	c58_f	UINT	%MW11.250	023Ah	- S-curve starting side 3	0 to 50%	0	0	Yes
C59	c59_f	UINT	%MW11.251	023Bh	- S-curve end side 3	0 to 50%	0	0	Yes
C60	c60_f	UINT	%MW11.252	023Ch	ASR 4 setting - ASR 4-P gain	0.1 to 500.0 (Multiplication)	10.0	2	Yes
C61	c61_f	UINT	%MW11.253	023Dh	- ASR 4-I (integration constant)	0.000 to 10.000 s P control when set to 0.000	0.200	4	Yes
C62	c62_f	UINT	%MW11.254	023Eh	- ASR 4-FF (gain)	0.000 to 9.999 s	0.000	4	Yes
C63	c63_f	UINT	%MW11.255	023Fh	- ASR 4 input filter	0.000 to 5.000 s	0.040	4	Yes
C64	c64_f	UINT	%MW11.256	0240h	- ASR 4 detection filter	0.000 to 0.100 s	0.005	4	Yes
C65	c65_f	UINT	%MW11.257	0241h	- ASR 4 output filter	0.000 to 0.100 s	0.002	4	Yes
C66	c66_f	WORD	%MW11.258	0242h	- Acceleration time 4	0.01 to 99.99 s 100.0 to 999.9 s 1000 to 3600 s	5.00	13	Yes
C67	c67_f	WORD	%MW11.259	0243h	- Deceleration time 4	0.01 to 99.99 s 100.0 to 999.9 s 1000 to 3600 s	5.00	13	Yes
C68	c68_f	UINT	%MW11.260	0244h	- S-curve starting side 4	0 to 50%	0	0	Yes
C69	c69_f	UINT	%MW11.261	0245h	- S-curve end side 4	0 to 50%	0	0	Yes
C70	c70_f	UINT	%MW11.262	0246h	ASR switching time	0.00 to 2.55 s	1.00	3	Yes
C71	c71_f	UINT	%MW11.263	0247h	Acceleration / deceleration time switching speed	0.00 to 100.00%	0.00	3	Yes
C72	c72_f	UINT	%MW11.264	0248h	ASR switching speed	0.00 to 100.00%	0.00	3	Yes
C73	c73_f	WORD	%MW11.265	0249h	Creep speed selection (during UP/DOWN)	00 to 11 (Creep speed 1)(Creep speed 2) 0: Code (C18, C19) 1: Ai (CRP1, CRP2)	00	9	Yes

You can change the setting of the shaded setting code during operation. Stop operation to change the setting of the other functions.

Table 5-2-25 P: Motor Parameters

P code	60 ms updating and referencing data			High-speed Updating address	Name	Setting range	Default setting	Type	Written by UPAC
	Variable name	Type	Address						
P01	p01_f	UINT	%MW11.289	0301h	M1 control method	0 to 5 0: Vector control (induction motor) 1: Vector control without sensor (induction motor) 2: Mock operation mode 3: Vector control (induction motor) 4: - 5: V/f control (induction motor)	0	55	Yes
P02	p02_f	UINT	%MW11.290	0302h	M1 motor parameter setting - M1 motor selection	00 to 50 When F60 = 0, 1, the indicated table (kW, HP) is changed. 00 to 35: Motor setting dedicated to FRENIC-VG Automatically sets data for the relevant motor to F04,F05,P03～P27. F04, F05, and P03 through P27 are write protected. 36: P-OTHER (keypad panel indication: P-OTR) F04, F05 and P03 through P27 do not change. F04, F05, and P03 through P27 are write protected. 37: OTHER F04, F05 and P03 through P27 do not change. F04, F05 and P03 through P27 are not write-protected. 38 to 50: Dedicated setting for FRENIC-VG(8 type) Automatically sets data for the relevant motor to F04,F05,P03～P27. F04, F05, and P03 through P27 are write protected. Handling of set value and motor is of 4.2.3.2 type [82]: Refer to M1 Motor Selection.	By capacity	82	No
P03	p03_f	UINT	%MW11.291	0303h	- M1 rated capacity	Inverter capacity 400 kW or less When F60 = 0, 0.00 to 500.00kW When F60 = 1,0.00 to 600.00HP Inverter capacity 500kW or more When F60 = 0, 0.00 to 1200kW When F60 = 1, 0.00 to 1600HP In the case of multi-winding motor, set motor capacity for single winding.	By capacity	3	Yes
P04	p04_f	WORD	%MW11.292	0304h	- M1 rated current	0.01 to 99.99A 100.0 to 999.9A 1000 to 2000A	By capacity	13	Yes
P05	p05_f	UINT	%MW11.293	0305h	- M1 poles	2 to 100 poles	4	1	Yes
P06	p06_f	UINT	%MW11.294	0306h	－M1-%R1	0.00 to 30.00%	By capacity	3	Yes
P07	p07_f	UINT	%MW11.295	0307h	- M1-%X	0.00 to 200.00%	By capacity	3	Yes
P08	p08_f	WORD	%MW11.296	0308h	- M1 exciting current	0.01 to 99.99A 100.0 to 999.9A 1000 to 2000A	By capacity	13	Yes

You can change the setting of the shaded setting code during operation. Stop operation to change the setting of the other functions.

P code	60 ms updating and referencing data			High-speed Updating address	Name	Setting range	Default setting	Type	Written by UPAC
	Variable name	Type	Address						
P09	p09_f	WORD	%MW11.297	0309h	- M1 torque current	0.01 to 99.99A 100.0 to 999.9A 1000 to 2000A	By capacity	13	Yes
P10	p10_f	UINT	%MW11.298	030Ah	- M1 slip (driving)	0.001 to 10.000 Hz	By capacity	4	Yes
P11	p11_f	UINT	%MW11.299	030Bh	- M1 slip (braking)	0.001 to 10.000 Hz	By capacity	4	Yes
P12	p12_f	UINT	%MW11.300	030Ch	- M1 iron loss coefficient 1	0.00 to 10.00%	By capacity	3	Yes
P13	p13_f	UINT	%MW11.301	030Dh	- M1 iron loss coefficient 2	0.00 to 10.00%	By capacity	3	Yes
P14	p14_f	UINT	%MW11.302	030Eh	- M1 iron loss coefficient 3	0.00 to 10.00%	By capacity	3	Yes
P15	p15_f	UINT	%MW11.303	030Fh	- M1 magnetic saturation coefficient 1	0.0 to 100.0% Adjustment coefficient for exciting current with magnetic flux command at 93.75%	By capacity	2	Yes
P16	p16_f	UINT	%MW11.304	0310h	- M1 magnetic saturation coefficient 2	0.0 to 100.0% Adjustment coefficient for exciting current with magnetic flux command at 87.5%	By capacity	2	Yes
P17	p17_f	UINT	%MW11.305	0311h	- M1 magnetic saturation coefficient 3	0.0 to 100.0% Adjustment coefficient for exciting current with magnetic flux command at 75%	By capacity	2	Yes
P18	p18_f	UINT	%MW11.306	0312h	- M1 magnetic saturation coefficient 4	0.0 to 100.0% Adjustment coefficient for exciting current with magnetic flux command at 62.5%	By capacity	2	Yes
P19	p19_f	UINT	%MW11.307	0313h	- M1 magnetic saturation coefficient 5	0.0 to 100.0% Adjustment coefficient for exciting current with magnetic flux command at 50%	By capacity	2	Yes
P20	p20_f	UINT	%MW11.308	0314h	- M12 secondary time constant	0.001 to 9.999 s	By capacity	4	Yes
P21	p21_f	UINT	%MW11.309	0315h	- M1 induction voltage coefficient	0 to 999 V	By capacity	0	Yes
P22	p22_f	UINT	%MW11.310	0316h	- M1 - R2 correction coefficient 1	0.500 to 5.000	By capacity	4	Yes
P23	p23_f	UINT	%MW11.311	0317h	- M1 - R2 correction coefficient 2	0.500 to 5.000	By capacity	4	Yes
P24	p24_f	UINT	%MW11.312	0318h	- M1 - R2 correction coefficient 3	0.010 to 5.000	By capacity	4	Yes
P25	p25_f	UINT	%MW11.313	0319h	- M1 exciting current correction coefficient	0.000 to 5.000	By capacity	4	Yes
P26	p26_f	UINT	%MW11.314	031Ah	- M1 - ACR-P (gain)	0.1 to 20.0	1.0	2	Yes
P27	p27_f	UINT	%MW11.315	031Bh	- M1 - ACR-I (integration time)	0.1 to 100.0 ms	1.0	2	Yes
P28	p28_f	UINT	%MW11.316	031Ch	M1-PG pulses	100 to 60000	1024	0	Yes
P29	p29_f	WORD	%MW11.317	031Dh	M1 external PG correction coefficient	0000 to 4FFF	4000	9	Yes
P30	p30_f	UINT	%MW11.318	031Eh	M1 thermistor selection	0 to 3 0: Without thermistor 1: Select NTC thermistor 2: Select PTC thermistor 3: Ai[M-TMP] Set the protection level of the motor protection function using E30 through E32.	1	84	Yes

You can change the setting of the shaded setting code during operation. Stop operation to change the setting of the other functions.

Table 5-2-26 H: High Performance Functions

H code	60 ms updating and referencing data			High-speed Updating address	Name	Setting range	Default setting	Type	Written by UPAC
	Variable name	Type	Address						
H01	h01_f	UINT	%MW11.321	0401h	Tuning operation selection	0 to 4 0: Inactive 1: ASR auto-tuning (will become available shortly) 2: Motor constant auto-tuning R1,Lσ 3: Motor stop auto-tuning 4: Motor rotation auto-tuning The setting is automatically reset to zero after the data is written. To retain the data, validate H02 (all save function).	0	61	No
H02	h02_f	UINT	%MW11.322	0402h	All save function	0 to 1 When auto-tuning is executed by H01, or when data is overwritten via linked system (T link, field bus, RS-485, etc.), data is deleted once the inverter is powered off. To retain data, activate this function. The setting is automatically reset to zero after the data is written.	0	11	No
H03	h03_f	UINT	%MW11.323	0403h	Data initialization	0 to 1 The data changed by the customer is initialized to the default factory setting. The initialized code includes all the F, E, C, H, o, L and U codes excluding the motor parameters (P and A), F04, F05, and F10 through F12, and F58. The setting is automatically reset to zero after the data is written.	0	11	No
H04	h04_f	UINT	%MW11.324	0404h	Retry (times)	0 to 10 0: Inactive 1 to 10 times The retry operation signal can be output to the output terminal.。	0	0	Yes
H05	h05_f	UINT	%MW11.325	0405h	Retry (interval)	0.01 to 20.00 s	5.00	3	Yes
H06	h06_f	UINT	%MW11.326	0406h	Cooling fan ON/OFF control	0 to 1 0: Inactive 1: Active The cooling fan operation signal can be output in interlock with this function. Selects whether to automatically detect temperature of cooling fin inside the inverter, and enable ON/OFF control of the cooling fan.	0	68	Yes

You can change the setting of the shaded setting code during operation. Stop operation to change the setting of the other functions.

H code	60 ms updating and referencing data			High-speed Updating address	Name	Setting range	Default setting	Type	Written by UPAC
	Variable name	Type	Address						
H08	h08_f	UINT	%MW11.328	0408h	Reverse phase sequence lock	0 to 1 0: Invalid 1: Effective	0	68	Yes
H09	h09_f	UINT	%MW11.329	0409h	Starting characteristic (rotating motor pick-up)	0 to 2 0: Inactive 1: Active (only when restarting after momentary power failure) 2: Active Detects motor speed at start, and outputs the same speed as the motor speed.	2	0	Yes
H10	h10_f	UINT	%MW11.330	040Ah	Automatic energy-saving operation	0 to 1 0: Invalid 1: Effective	0	68	Yes
H11	h11_f	UINT	%MW11.331	040Bh	Automatic operation OFF function	0 to 4 0: The motor decelerates and stops when OFF between FWD-CM and REV-CM. 1: Operation OFF at speeds lower than F37 stoppingspeed even if connection across FWD-CM and REV-CM is ON. 2: Coast to stop when OFF between FWD-CM and REV-CM. 3: ASR decelerates and stops under torque control when OFF between FWD-CM,REV-CM. 4: Coast to stop under torque control when OFF between FWD-CM and REV-CM.	0	0	Yes
H13	h13_f	UINT	%MW11.333	040Dh	Start after momentary power failure - Delay	0.1 to 5.0 s	0.5	2	Yes
H14	h14_f	UINT	%MW11.334	040Eh	- Speed fall rate	1 to 3600 r/min	500	0	Yes
H15	h15_f	UINT	%MW11.335	040Fh	- Holding voltage on continuous operation	3 phase 200V: 200 to 300V 3 phase 400V: 400 to 600V This is related to when set value 2 (Trip after decelerate-to-stop) or 3 (continuation of operation) is selected for restart after momentary power failure (F14: mode selection).	235/ 470	0	Yes
H16	h16_f	UINT	%MW11.336	0410h	- Operation command self- hold setting	0 to 1 0: Designation at H17 1: Maximum time (The inverter judges momentary power failure and holds the operation command while the control power is established in the inverter or until the main circuit DC voltage becomes almost zero.)	1	94	Yes
H17	h17_f	UINT	%MW11.337	0411h	- Operation command self- holding time	0.0 to 30.0 s	30.0	2	Yes
H19	h19_f	UINT	%MW11.339	0413h	Active drive	0 to 1 0: Invalid 1: Effective Under vector control, output torque is automatically limitted, and overload or other trips are avoided.	0	68	Yes
H20	h20_f	UINT	%MW11.340	0414h	PID control setting - Function select	0 to 3 0: Inactive 1: Active 2: Inverse action 1 3: Inverse action 2	0	69	Yes
H21	h21_f	UINT	%MW11.341	0415h	- Command select	0 to 1 0: Keypad or input 12 1: Analog input [PID-REF]	0	70	Yes
H22	h22_f	UINT	%MW11.342	0416h	- P gain	0.000 to 10.000 (Multiplication)	1.000	4	Yes
H23	h23_f	UINT	%MW11.343	0417h	- I gain	0.00 to 100.00 s	1.00	3	Yes
H24	h24_f	UINT	%MW11.344	0418h	- D gain	0.000 to 10.000 s	0.000	4	Yes
H25	h25_f	INT	%MW11.345	0419h	- Upper limit	-300 to 300%	100	5	Yes
H26	h26_f	INT	%MW11.346	041Ah	- Lower limit	-300 to 300%	-100	5	Yes
H27	h27_f	UINT	%MW11.347	041Bh	- Speed command select	0 to 2 0: Invalid 1: PID selection 2: Auxiliary speed selection	0	95	Yes
H28	h28_f	UINT	%MW11.348	041Ch	Droop control	0.0 to 25.0%	0.0	2	Yes
H29	h29_f	UINT	%MW11.349	041Dh	Link function - Data protection via link	0 to 1 0: Code can be written from the link. 1: Protected against Code writing from the link. This function is to prevent code overwriting from the link (T link, RS-485, etc.) The link area is divided into two areas: regular code area (mentioned above) and command data area (S area). The S area is defined with H30.	0	40	Yes
H30	h30_f	UINT	%MW11.350	041Eh	- Link operation	0 to 3 Monitor, command data, operation control (FWD, REV) 0: ○ × × 1: ○ ○ × 2: ○ × ○ 3: ○ ○ ○	0	72	Yes
H31	h31_f	UINT	%MW11.351	041Fh	RS485 setting - Station address	0 to 255 Broadcast: (0: RTU),(99: Fuji) address: 1 to 255 Specifies the station address for the RS-485.	1	0	Yes
H32	h32_f	UINT	%MW11.352	0420h	- Function select upon error	0 to 3 0: Forced stop (*er*5) 1: Operation for H33 time, and alarm (*er*5) 2: Operation for H33 time, and stop if continuation of communication alarm is judged (*er*5). 3: Continuation of operation	3	73	Yes

You can change the setting of the shaded setting code during operation. Stop operation to change the setting of the other functions.

H code	60 ms updating and referencing data			High-speed Updating address	Name	Setting range	Default setting	Type	Written by UPAC
	Variable name	Type	Address						
H33	h33_f	UINT	%MW11.353	0421h	- Timer	0.01 to 20.00 s	2.00	3	Yes
H34	h34_f	UINT	%MW11.354	0422h	- Transmission speed	0 to 4 0: 38400bps 1: 19200bps 2: 9600bps 3: 4800bps 4: 2400bps	0	74	Yes
H35	h35_f	UINT	%MW11.355	0423h	- Data length	0 to 1 0: 8bit 1: 7bit	0	75	Yes
H36	h36_f	UINT	%MW11.356	0424h	- Parity bit	0 to 2 0: None 1: Even parity 2: Odd parity	1	76	Yes
H37	h37_f	UINT	%MW11.357	0425h	- Stop bits	0 to 1 0: 2bit 1: 1bit	1	77	Yes
H38	h38_f	UINT	%MW11.358	0426h	- No response error detection time	0.0 to 60.0 s 0.0: Broken wire detection invalid 0.1 to 60.0: Broken wire detection valid	60.0	2	Yes
H39	h39_f	UINT	%MW11.359	0427h	- Response interval	0.00 to 1.00 s	0.01	3	Yes
H40	h40_f	UINT	%MW11.360	0428h	- Protocol	0 to 2 0: Fuji general-purpose inverter protocol 1: FRENIC Loader protocol (SX protocol) 2: Modbus RTU protocol When PC loader dedicated to FRENIC-VG is used, set "1: SX protocol".	1	78	Yes
H41	h41_f	UINT	%MW11.361	0429h	Torque and magnetic flux control setting - Torque command selection	0 to 5 0: Internal ASR 1: Ai (T-REF) 2: DIA card valid 3: DIB card valid 4: Link valid 5: PID	0	64	Yes
H42	h42_f	UINT	%MW11.362	042Ah	- Torque current command selection	0 to 4 0: Internal ASR 1: Ai (IT-REF) 2: DIA card valid 3: DIB card valid 4: Link valid	0	65	Yes
H43	h43_f	UINT	%MW11.363	042Bh	- Magnetic flux command selection	0 to 3 0: Internal calculation 1: Ai (MF-REF) 2: Function code H44 valid 3: Link valid	0	66	Yes
H44	h44_f	UINT	%MW11.364	042Ch	- Magnetic flux reference value	10 to 100%	100	16	Yes
H46	h46_f	UINT	%MW11.366	042Eh	Observer setting - Observer type selection	0 to 2 0: Observer inactive 1: Load disturbance observer 2: Vibration suppression observer	0	79	Yes
H47	h47_f	UINT	%MW11.367	042Fh	- M1 compensation gain	0.00 to 1.00 (Multiplication)	0.00	3	Yes
H48	h48_f	UINT	%MW11.368	0430h	- M2 compensation gain	0.00 to 1.00 (Multiplication)	0.00	3	Yes
H49	h49_f	UINT	%MW11.369	0431h	- M1 integration time	0.005 to 1.000 s	0.100	4	Yes
H50	h50_f	UINT	%MW11.370	0432h	- M2 integration time	0.005 to 1.000 s	0.100	4	Yes
H51	h51_f	UINT	%MW11.371	0433h	- M1 load inertia	0.001 to 50.000 kg·m2 Setting multiplication can be selected by H228.	By capacity	4	Yes
H52	h52_f	UINT	%MW11.372	0434h	- M2 load inertia	0.001 to 50.000 kg·m2 Setting multiplication can be selected by H228.	0.001	4	Yes
H53	h53_f	UINT	%MW11.373	0435h	Line speed feedback selection	0 to 3 0: Line speed invalid (built-in PG valid) With UPAC, select between Ai input or PG(LD) high, 1: Analog line speed detection (AI-LINE) 2: Digital line speed detection (PG(LD)) 3: High selector (select high levels for motor speed and line speed)	0	67	Yes
H55	h55_f	UINT		0437h	Zero speed control setting - Zero speed control (gain)	0 to 100 (Multiplication) For details, see [LOCK] in "X function selection" for function codes E01 to E13.	5	0	Yes
H56	h56_f	UINT	%MW11.375 %MW11.376	0438h	Zero speed control (completion width)	0 to 100 pulses	100	0	Yes
H57	h57_f	UINT	%MW11.377	0439h	Suppression function setting - Over voltage suppression function	0 to 1 0: Inactive 1: Active	0	68	Yes

You can change the setting of the shaded setting code during operation. Stop operation to change the setting of the other functions.

H code	60 ms updating and referencing data			High-speed Updating address	Name	Setting range	Default setting	Type	Written by UPAC
	Variable name	Type	Address						
H58	h58_f	UINT	%MW11.378	043Ah	- Over current suppression function	0 to 1 0: Inactive 1: Active	0	68	Yes
H60	h60_f	UINT	%MW11.380	043Ch	Load adaptive control function setting - Load adaptive control function definition 1	0 to 3 0: Invalid 1: Type 1 2: Type 2 3: Type 3	0	80	Yes
H61	h61_f	UINT	%MW11.381	043Dh	- Load adaptive control function definition 2	0 to 1 0: Wind up upon forward rotation of motor 1: Wind down upon forward rotation of motor	0	81	Yes
H62	h62_f	UINT	%MW11.382	043Eh	- Winding speed	0.0 to 999.9 m/min	0.0	2	Yes
H63	h63_f	UINT	%MW11.383	043Fh	- Counterweight	0.00 to 600.00 t	0.00	3	Yes
H64	h64_f	UINT	%MW11.384	0440h	- Safety coefficient	0.50 to 1.20	1.00	3	Yes
H65	h65_f	UINT	%MW11.385	0441h	- Mechanical efficiency	0.500 to 1.000	0.500	4	Yes
H66	h66_f	UINT	%MW11.386	0442h	- Rated load	0.00 to 600.00 t	0.00	3	Yes
H68	h68_f	UINT	%MW11.388	0444h	Alarm data delete	0 to 1 The setting is automatically reset to zero after the data is written. Internally retained alarm history, alarm causes, and alarm information are all deleted.	0	11	No
H70	h70_f	UINT	%MW11.390	0446h	Adjustment for manufacturer - For manufacturer 1	0 to 9999 For manufacturer (Do not specify.)	0	0	Yes
H71	h71_f	UINT	%MW11.391	0447h	- For manufacturer 2	0 to 10 For manufacturer (Do not specify.)	0	62	Yes

You can change the setting of the shaded setting code during operation. Stop operation to change the setting of the other functions.

Table 5-2-27 A: Alternative Motor Parameters

A code	60 ms updating and referencing data			High-speed Updating address	Name	Setting range	Default setting	Type	Written by UPAC
	Variable name	Type	Address						
A01	a01_f	UINT	%MW11.401	0501h	M2 motor parameter setting - M2 control method	0 to 5 0: Vector control (induction motor) 1: Vector control without sensor (induction motor) 2: - 3: Vector control (induction motor) 4: - 5: V/f control (induction motor)	0	55	Yes
A02	a02_f	UINT	%MW11.402	0502h	- M2 rated capacity	Inverter capacity 400 kW or less When F60 = 0, 0.00 to 500.00kW When F60 = 1,0.00 to 600.00HP Inverter capacity 500kW or more When F60 = 0, 0.00 to 1200kW When F60 = 1, 0.00 to 1600HP In the case of multi-winding motor, set motor capacity for single winding.	0.00	3	Yes
A03	a03_f	WORD	%MW11.403	0503h	- M2 rated current	0.01 to 99.99A 100.0 to 999.9A 1000 to 2000A	0.01	13	Yes
A04	a04_f	UINT	%MW11.404	0504h	- M2 rated voltage	80 to 999 V	80	0	Yes
A05	a05_f	UINT	%MW11.405	0505h	- M2 rated speed	50 to 30000 r/min	1500	0	Yes
A06	a06_f	UINT	%MW11.406	0506h	- M2 maximum speed	50 to 30000 r/min	1500	0	Yes
A07	a07_f	UINT	%MW11.407	0507h	- M2 poles	2 to 100 poles	4	1	Yes
A08	a08_f	UINT	%MW11.408	0508h	- M2-%R1	0.00 to 30.00%	0.00	3	Yes
A09	a09_f	UINT	%MW11.409	0509h	- M2-%X	0.00 to 200.00%	0.00	3	Yes
A10	a10_f	WORD	%MW11.410	050Ah	- M2 exciting current	0.01 to 99.99A 100.0 to 999.9A 1000 to 2000A	0.01	13	Yes
A11	a11_f	WORD	%MW11.411	050Bh	- M2 torque current	0.01 to 99.99A 100.0 to 999.9A 1000 to 2000A	0.01	13	Yes
A12	a12_f	UINT	%MW11.412	050Ch	- M2 slip (driving)	0.001 to 10.000 Hz	0.001	4	Yes
A13	a13_f	UINT	%MW11.413	050Dh	- M2 slip (braking)	0.001 to 10.000 Hz	0.001	4	Yes
A14	a14_f	UINT	%MW11.414	050Eh	- M2 iron loss coefficient 1	0.00 to 10.00%	0.00	3	Yes
A15	a15_f	UINT	%MW11.415	050Fh	- M2 iron loss coefficient 2	0.00 to 10.00%	0.00	3	Yes
A16	a16_f	UINT	%MW11.416	0510h	- M2 iron loss coefficient 3	0.00 to 10.00%	0.00	3	Yes
A17	a17_f	UINT	%MW11.417	0511h	- M2 magnetic saturation coefficient 1	0.0 to 100.0%	93.8	2	Yes
A18	a18_f	UINT	%MW11.418	0512h	- M2 magnetic saturation coefficient 2	0.0 to 100.0%	87.5	2	Yes

You can change the setting of the shaded setting code during operation. Stop operation to change the setting of the other functions.

A code	60 ms updating and referencing data			High-speed Updating address	Name	Setting range	Default setting	Type	Written by UPAC
	Variable name	Type	Address						
A19	a19_f	UINT	%MW11.419	0513h	- M2 magnetic saturation coefficient 3	0.0 to 100.0%	75.0	2	Yes
A20	a20_f	UINT	%MW11.420	0514h	- M2 magnetic saturation coefficient 4	0.0 to 100.0%	62.5	2	Yes
A21	a21_f	UINT	%MW11.421	0515h	- M2 magnetic saturation coefficient 5	0.0 to 100.0%	50.0	2	Yes
A22	a22_f	UINT	%MW11.422	0516h	- M2 secondary time constant	0.001 to 9.999 s	0.001	4	Yes
A23	a23_f	UINT	%MW11.423	0517h	- M2 induction voltage coefficient	0 to 999 V	0	0	Yes
A24	a24_f	UINT	%MW11.424	0518h	- M2-R2 correction coefficient	0.000 to 5.000	1.000	4	Yes
A25	a25_f	UINT	%MW11.425	0519h	- M2-R2 correction coefficient	0.000 to 5.000	1.000	4	Yes
A26	a26_f	UINT	%MW11.426	051Ah	- M2-R2 correction coefficient	0.010 to 5.000	1.000	4	Yes
A27	a27_f	UINT	%MW11.427	051Bh	- M2 exciting current correction coefficient	0.000 to 5.000	0.000	4	Yes
A28	a28_f	UINT	%MW11.428	051Ch	- M2-ACR-P (gain)	0.1 to 20.0	1.0	2	Yes
A29	a29_f	UINT	%MW11.429	051Dh	- M2-ACR-I (integration time)	0.1 to 100.0 ms	1.0	2	Yes
A30	a30_f	UINT	%MW11.430	051Eh	M2-PG pulses	100 to 60000	1024	0	Yes
A31	a31_f	UINT	%MW11.431	051Fh	M2 thermistor selection	0 to 3 0: Without thermistor 1: Select NTC thermistor 2: Select PTC thermistor 3: Ai[M-TMP] Set the protection level of the motor protection function using E30 through E32.	1	84	Yes
A32	a32_f	UINT	%MW11.432	0520h	M2 electronic thermal overload relay setting - M2 electronic thermal overload relay (function selection)	0 to 2 0: Inactive (with special motor for VG) 1: Enable (for general-purpose motor: to be used for self-cooling fan) 2: Enable (for inverter motor: to be used for separately-driven fan)	0	85	Yes
A33	a33_f	WORD	%MW11.433	0521h	- M2 electronic thermal overload relay (operation level)	0.01 to 99.99A 100.0 to 999.9A 1000 to 2000A	0.01	13	Yes
A34	a34_f	UINT	%MW11.434	0522h	- M2 electronic thermal overload relay (thermal time constant)	0.5 to 75.0 min	0.5	2	Yes
A102	a35_f	UINT	%MW11.435	2402h	- M3 rated capacity	Inverter capacity 400 kW or less When F60 = 0, 0.00 to 500.00kW When F60 = 1,0.00 to 600.00HP Inverter capacity 500kW or more When F60 = 0, 0.00 to 1200kW When F60 = 1, 0.00 to 1600HP In the case of multi-winding motor, set motor capacity for single winding.	0.00	3	Yes
A103	a36_f	WORD	%MW11.436	2403h	- M3 rated current	0.01 to 99.99A 100.0 to 999.9A 1000 to 2000A	0.01	13	Yes
A104	a37_f	UINT	%MW11.437	2404h	- M3 rated voltage	80 to 999 V	80	0	Yes
A153	a38_f	UINT	%MW11.438	2435h	－M3 maximum output voltage	80 to 999 V	80	0	Yes
A105	a39_f	UINT	%MW11.439	2405h	- M3 rated speed	50 to 30000 r/min	1500	0	Yes
A106	a40_f	UINT	%MW11.440	2406h	- M3 maximum speed	50 to 30000 r/min	1500	0	Yes
A107	a41_f	UINT	%MW11.441	2407h	- M3 poles	2 to 100 poles	4	1	Yes
A108	a42_f	UINT	%MW11.442	2408h	- M3-%R1	0.00 to 30.00%	0.00	3	Yes
A109	a43_f	UINT	%MW11.443	2409h	- M3-%X	0.00 to 200.00%	0.00	3	Yes
A110	a44_f	WORD	%MW11.444	240Ah	- M3 exciting current	0.01 to 99.99A 100.0 to 999.9A 1000 to 2000A	0.01	13	Yes
A154	a45_f	INT	%MW11.445	2436h	- M3 slip compensation variable	-20.000 to 5.000 Hz	0.000	8	Yes
A155	a46_f	UINT	%MW11.446	2437h	M3 torque boost	0.0 to 20.0 This function is unique to V/f control. The following options are available. 0.0: Auto torque boost (for fixed torque properties load) 0.1 to 0.9: For square torque properties load 1.0 to 1.9: For proportional torque properties load 2.0 to 20.0: For fixed torque properties load	0.0	2	Yes
A131	a47_f	UINT	%MW11.447	241Fh	M3 thermistor selection	0 to 3 0: Without thermistor 1: Select NTC thermistor 2: Select PTC thermistor 3: Ai[M-TMP] Set the protection level of the motor protection function using E30 through E32.	1	84	Yes
A132	a48_f	UINT	%MW11.448	2420h	M3 electronic thermal overload relay setting - M3 electronic thermal overload relay (function selection)	0 to 2 0: Inactive (with special motor for VG) 1: Enable (for general-purpose motor: to be used for self-cooling fan) 2: Enable (for inverter motor: to be used for separately-driven fan)	0	85	Yes
A133	a49_f	WORD	%MW11.449	2421h	- M3 electronic thermal overload relay (operation level)	0.01 to 99.99A 100.0 to 999.9A 1000 to 2000A	0.01	13	Yes
A134	a50_f	UINT	%MW11.450	2422h	- M3 electronic thermal overload relay (thermal time constant)	0.5 to 75.0 min	0.5	2	Yes

You can change the setting of the shaded setting code during operation. Stop operation to change the setting of the other functions.

Note)

When you switch over from the VG7 series, function codes A35 to 50 in VG7 series are changed to A102 to 134 and A53 to 155 in the VG1 series. Also note that high-speed updating addresses also differ.

Table 5-2-28 O: Optional Functions

o code	60 ms updating and referencing data			High-speed Updating address	Name	Setting range	Default setting	Type	Written by UPAC
	Variable name	Type	Address						
o01	o01_f	UINT	%MW11.465	0601h	- DIA function selection	0 to 1 0: binary 1: BCD	0	86	Yes
o02	o02_f	UINT	%MW11.466	0602h	- DIB function selection	0 to 1 0: binary 1: BCD	0	86	Yes
o03	o03_f	UINT	%MW11.467	0603h	- DIA BCD input setting	99 to 7999	1000	0	Yes
o04	o04_f	UINT	%MW11.468	0604h	- DIB BCD input setting	99 to 7999	1000	0	Yes
o05	o05_f	UINT	%MW11.469	0605h	PG (PD) option setting - Feedback pulse selection	0 to 2 0: PG built in main body 1: PG(PD) options 2: SPGT options	0	96	Yes
o06	o06_f	UINT	%MW11.470	0606h	PG (LD) option setting Digital line speed detection Definitions (no. of encoder pulses)	100 to 60000 P/R	1024	0	Yes
o07	o07_f	UINT	%MW11.471	0607h	Digital line speed detection Definitions (Detection pulse correction 1)	1 to 9999	1000	0	Yes
o08	o08_f	UINT	%MW11.472	0608h	Digital line speed detection Definitions (Detection pulse correction 2)	1 to 9999	1000	0	Yes
o09	o09_f	UINT	%MW11.473	0609h	M1 ABS signal input definition	0 to 16 Set in accordance with the encoder specification. Define operational interface to detect the magnetic pole locaion. 1bit（terminal ; F0）Z phase interface (will become available shortly) 3bit（terminal ; F0,F1,F2）U,V,W phase interface 4bit（terminal ; F0,F1,F2,F3）gray code interface SPGT 17bit seven interface	0	0	Yes
o10	o10_f	WORD	%MW11.474	060Ah	- Magnetic pole position offset	0.0 to 359.9 (0°～359.9°CCW direction) Specify the reference position of encoder and the offset amount to the actual motor magnetic pole position.	0.0	9	Yes
o11	o11_f	UINT	%MW11.475	060Bh	- Salient pole ratio (%Xq/%Xd)	1.000 to 5.000 Set the synchronous motor salient pole ratio. Set value ＝ Lq／Ld When SPM motor is to be driven, set to 1,000.	1.000	4	Yes
o12	o12_f	UINT	%MW11.476	060Ch	PG (PR) pulse string option setting - Command pulse selection	0 to 1 0: PG(PR) options 1: Internal speed command	0	97	Yes
o13	o13_f	UINT	%MW11.477	060Dh	- Pulse string input form selection	0 to 2 0: Phase difference 90 between A and B phases 1: A phase: Command pulse, B phase: Command sign 2: A phase: Forward rotation pulse, B phase: Reverse rotation pulse	0	98	Yes
o14	o14_f	UINT	%MW11.478	060Eh	- Command pulse correction	1 to 9999	1000	0	Yes
o15	o15_f	UINT	%MW11.479	060Fh	- Command pulse correction	1 to 9999	1000	0	Yes
o16	o16_f	UINT	%MW11.480	0610h	- APR gain	0.1 to 999.9 (Multiplication)	1.0	2	Yes
o17	o17_f	UINT	%MW11.481	0611h	- F/F gain	0.0 to 1.5 (Multiplication)	0.0	2	Yes
o18	o18_f	UINT	%MW11.482	0612h	- Excessive deviation tolerance	0 to 65535 pulses	65535	0	Yes
o19	o19_f	UINT	%MW11.483	0613h	- Deviation zero width	0 to 1000 pulses	20	0	Yes
o30	o30_f	UINT	%MW11.494	061Eh	Link option setting - Action upon transmission error	0 to 3 0: immediate trip (*er4*) 1: Trip after operation has been continued for the specified operation time (*er4*) 2: Trip after communication error has continued for the specified operation time or longer (*er4*) 3: Continuation of operation Set action when Link communication error occurs. Set value 0 to 3 for CC-Link varies from the action above.	0	73	Yes
o31	o31_f	UINT	%MW11.495	061Fh	- Operation time upon transmission error	0.01 to 20.00 s Set time before communication error is issued after link communication error occurs.	0.10	3	Yes
o32	o32_f	UINT	%MW11.496	0620h	- Transmission format	0 to 4 0:Transmission format1 1 : Transmission format2 2:Transmission format3 3 : Transmission format4 4:Transmission format5	0	87	Yes
o33	o33_f	UINT	%MW11.497	0621h	Multi-system control method	0 to 5 0: Invalid 1: Multi-winding system 2: Multi-system 1 (direct para system) 3: Multi-system 2 4,5: Spare 1,2 Select whether to use a high-speed serial communication-enabled terminal block as a multi-winding system or multi-system. If set to invalid, single-unit operation becomes possible. Also see "Multi-system cancel" section in "X function selection" for E01 to E13.	0	68	Yes
o34	o34_f	UINT	%MW11.498	0622h	Multi-system No. of slave units	1 to 5 When multi-system is enabled, set the number of slave units excluding master unit.	1	0	Yes

You can change the setting of the shaded setting code during operation. Stop operation to change the setting of the other functions.

o code	60 ms updating and referencing data			High-speed Updating address	Name	Setting range	Default setting	Type	Written by UPAC
	Variable name	Type	Address						
o35	o35_f	UINT	%MW11.499	0623h	SIO option setting - SIU link station address	0 to 255 Define the link station address for SIU option used in UPAC link. 0: Master address 1 to 11: Slave address 100: Master address (broadcasting) 101 to 255: Slave address (broadcasting)	0	0	No
o36	o36_f	UINT	%MW11.500	0624h	- SIU link system slave stations	1 to 155 Number of slave stations linked with SIU option in a system of multiple inverters with UPAC inverter being the master	1	0	No
o38	o38_f	UINT	%MW11.502	0626h	- UPAC start / stop	0 to 2 0: UPAC stop 1: UPAC start 2: UPAC start (initial start) Controls starting and stopping of UPAC.	0	68	No
o39	o39_f	WORD	%MW11.503	0627h	- UPAC memory mode	00 to 1F Set the corresponding area for changing UPAC duringstoppage. 0 : Hold1 : Zero clear Bit 1 : IQ area Bit 2 : M area Bit 3 : RM area Bit 4 : FM area Bit 5 : SFM area	0	9	No
o40	o40_f	UINT	%MW11.504	0628h	UPAC Address	100 to 255 Station address of UPAC for communication over RS485 in a system where PC accesses (refers to or downloads) UPAC application.	100	0	No

You can change the setting of the shaded setting code during operation. Stop operation to change the setting of the other functions.

Table 5-2-29 L: Lift Functions

L code	60 ms updating and referencing data			High-speed Updating address	Name	Setting range	Default setting	Type	Written by UPAC
	Variable name	Type	Address						
L01	l01_f	UINT	%MW11.511	0901h	Password data 1	0 to 9999 By setting eight digits of password data in total for L01 and L02, changes and checks of function code data can be limited. By setting either L01 or L02 to data other than 0, limitation by password becomes valid.	0	0	Yes
L02	l02_f	UINT	%MW11.512	0902h	Password data 2	0 to 9999	0	0	Yes
L03	l03_f	UINT	%MW11.513	0903h	Rated lift speed	0.0 to 999.9 m/min	100.0	2	Yes
L04	l04_f	UINT	%MW11.514	0904h	S-curve setting - Fixed S-curve pattern	0 to 2 0: Not used Regular acceleration and deceleration, S-curve (15 steps, S-curve 5) 1: Type 1 VG3, VG5 method. Acceleration / deceleration can be controlled via terminal 12 when all of SS1, SS2 and SS4 are OFF. 2: Type 2 VG7,FRENIC-VG method. Zero speed when all of SS1, SS2 and SS4 are OFF. Select application modes for S-curve setting and for multi-step speed setting.	0	80	Yes
L05	l05_f	UINT	%MW11.515	0905h	- S-curve setting 1	0 to 50%	0	0	Yes
L06	l06_f	UINT	%MW11.516	0906h	- S-curve setting 2	0 to 50%	0	0	Yes
L07	l07_f	UINT	%MW11.517	0907h	- S-curve setting 3	0 to 50%	0	0	Yes
L08	l08_f	UINT	%MW11.518	0908h	- S-curve setting 4	0 to 50%	0	0	Yes
L09	l09_f	UINT	%MW11.519	0909h	- S-curve setting 5	0 to 50%	0	0	Yes
L10	l10_f	UINT	%MW11.520	090Ah	- S-curve setting 6	0 to 50%	0	0	Yes
L11	l11_f	UINT	%MW11.521	090Bh	- S-curve setting 7	0 to 50%	0	0	Yes
L12	l12_f	UINT	%MW11.522	090Ch	- S-curve setting 8	0 to 50%	0	0	Yes
L13	l13_f	UINT	%MW11.523	090Dh	- S-curve setting 9	0 to 50%	0	0	Yes
L14	l14_f	UINT	%MW11.524	090Eh	- S-curve setting 10	0 to 50%	0	0	Yes

You can change the setting of the shaded setting code during operation. Stop operation to change the setting of the other functions.

Table 5-2-30 U: User Functions

U code	60 ms updating and referencing data			High-speed Updating address	Name	Setting range	Default setting	Type	Written by UPAC
	Variable name	Type	Address						
U01	u01_f	INT	%MW11.531	0B01h	USER P1	-32768 to 32767	0	5	Yes
U02	u02_f	INT	%MW11.532	0B02h	USER P2	-32768 to 32767	0	5	Yes
U03	u03_f	INT	%MW11.533	0B03h	USER P3	-32768 to 32767	0	5	Yes
U04	u04_f	INT	%MW11.534	0B04h	USER P4	-32768 to 32767	0	5	Yes
U05	u05_f	INT	%MW11.535	0B05h	USER P5	-32768 to 32767	0	5	Yes
U06	u06_f	INT	%MW11.536	0B06h	USER P6	-32768 to 32767	0	5	Yes
U07	u07_f	INT	%MW11.537	0B07h	USER P7	-32768 to 32767	0	5	Yes
U08	u08_f	INT	%MW11.538	0B08h	USER P8	-32768 to 32767	0	5	Yes
U09	u09_f	INT	%MW11.539	0B09h	USER P9	-32768 to 32767	0	5	Yes
U10	u10_f	INT	%MW11.540	0B0Ah	USER P10	-32768 to 32767	0	5	Yes
U11	u11_f	INT	%MW11.541	0B0Bh	USER P11	-32768 to 32767	0	5	Yes
U12	u12_f	INT	%MW11.542	0B0Ch	USER P12	-32768 to 32767	0	5	Yes
U13	u13_f	INT	%MW11.543	0B0Dh	USER P13	-32768 to 32767	0	5	Yes
U14	u14_f	INT	%MW11.544	0B0Eh	USER P14	-32768 to 32767	0	5	Yes
U15	u15_f	INT	%MW11.545	0B0Fh	USER P15	-32768 to 32767	0	5	Yes
U16	u16_f	INT	%MW11.546	0B10h	USER P16	-32768 to 32767	0	5	Yes
U17	u17_f	INT	%MW11.547	0B11h	USER P17	-32768 to 32767	0	5	Yes
U18	u18_f	INT	%MW11.548	0B12h	USER P18	-32768 to 32767	0	5	Yes
U19	u19_f	INT	%MW11.549	0B13h	USER P19	-32768 to 32767	0	5	Yes
U20	u20_f	INT	%MW11.550	0B14h	USER P20	-32768 to 32767	0	5	Yes
U21	u21_f	INT	%MW11.551	0B15h	USER P21	-32768 to 32767	0	5	Yes
U22	u22_f	INT	%MW11.552	0B16h	USER P22	-32768 to 32767	0	5	Yes
U23	u23_f	INT	%MW11.553	0B17h	USER P23	-32768 to 32767	0	5	Yes
U24	u24_f	INT	%MW11.554	0B18h	USER P24	-32768 to 32767	0	5	Yes
U25	u25_f	INT	%MW11.555	0B19h	USER P25	-32768 to 32767	0	5	Yes
U26	u26_f	INT	%MW11.556	0B1Ah	USER P26	-32768 to 32767	0	5	Yes
U27	u27_f	INT	%MW11.557	0B1Bh	USER P27	-32768 to 32767	0	5	Yes
U28	u28_f	INT	%MW11.558	0B1Ch	USER P28	-32768 to 32767	0	5	Yes
U29	u29_f	INT	%MW11.559	0B1Dh	USER P29	-32768 to 32767	0	5	Yes
U30	u30_f	INT	%MW11.560	0B1Eh	USER P30	-32768 to 32767	0	5	Yes
U31	u31_f	INT	%MW11.561	0B1Fh	USER P31	-32768 to 32767	0	5	Yes
U32	u32_f	INT	%MW11.562	0B20h	USER P32	-32768 to 32767	0	5	Yes
U33	u33_f	INT	%MW11.563	0B21h	USER P33	-32768 to 32767	0	5	Yes
U34	u34_f	INT	%MW11.564	0B22h	USER P34	-32768 to 32767	0	5	Yes
U35	u35_f	INT	%MW11.565	0B23h	USER P35	-32768 to 32767	0	5	Yes
U36	u36_f	INT	%MW11.566	0B24h	USER P36	-32768 to 32767	0	5	Yes
U37	u37_f	INT	%MW11.567	0B25h	USER P37	-32768 to 32767	0	5	Yes
U38	u38_f	INT	%MW11.568	0B26h	USER P38	-32768 to 32767	0	5	Yes
U39	u39_f	INT	%MW11.569	0B27h	USER P39	-32768 to 32767	0	5	Yes
U40	u40_f	INT	%MW11.570	0B28h	USER P40	-32768 to 32767	0	5	Yes
U41	u41_f	INT	%MW11.571	0B29h	USER P41	-32768 to 32767	0	5	Yes
U42	u42_f	INT	%MW11.572	0B2Ah	USER P42	-32768 to 32767	0	5	Yes
U43	u43_f	INT	%MW11.573	0B2Bh	USER P43	-32768 to 32767	0	5	Yes
U44	u44_f	INT	%MW11.574	0B2Ch	USER P44	-32768 to 32767	0	5	Yes
U45	u45_f	INT	%MW11.575	0B2Dh	USER P45	-32768 to 32767	0	5	Yes
U46	u46_f	INT	%MW11.576	0B2Eh	USER P46	-32768 to 32767	0	5	Yes
U47	u47_f	INT	%MW11.577	0B2Fh	USER P47	-32768 to 32767	0	5	Yes
U48	u48_f	INT	%MW11.578	0B30h	USER P48	-32768 to 32767	0	5	Yes
U49	u49_f	INT	%MW11.579	0B31h	USER P49	-32768 to 32767	0	5	Yes
U50	u50_f	INT	%MW11.580	0B32h	USER P50	-32768 to 32767	0	5	Yes
U51	u51_f	INT	%MW11.581	0B33h	USER P51	-32768 to 32767	0	5	Yes
U52	u52_f	INT	%MW11.582	0B34h	USER P52	-32768 to 32767	0	5	Yes
U53	u53_f	INT	%MW11.583	0B35h	USER P53	-32768 to 32767	0	5	Yes
U54	u54_f	INT	%MW11.584	0B36h	USER P54	-32768 to 32767	0	5	Yes
U55	u55_f	INT	%MW11.585	0B37h	USER P55	-32768 to 32767	0	5	Yes
U56	u56_f	INT	%MW11.586	0B38h	USER P56	-32768 to 32767	0	5	Yes
U57	u57_f	INT	%MW11.587	0B39h	USER P57	-32768 to 32767	0	5	Yes
U58	u58_f	INT	%MW11.588	0B3Ah	USER P58	-32768 to 32767	0	5	Yes
U59	u59_f	INT	%MW11.589	0B3Bh	USER P59	-32768 to 32767	0	5	Yes
U60	u60_f	INT	%MW11.590	0B3Ch	USER P60	-32768 to 32767	0	5	Yes
U61	u61_f	INT	%MW11.591	0B3Dh	USER P61/U-Ai1	-32768 to 32767	0	5	Yes
U62	u62_f	INT	%MW11.592	0B3Eh	USER P62/U-Ai2	-32768 to 32767	0	5	Yes
U63	u63_f	INT	%MW11.593	0B3Fh	USER P63/U-Ai3	-32768 to 32767	0	5	Yes
U64	u64_f	INT	%MW11.594	0B40h	USER P64/U-Ai4	-32768 to 32767	0	5	Yes

You can change the setting of the shaded setting code during operation. Stop operation to change the setting of the other functions.

Table 5-2-31 M: Monitor Functions

M code	60 ms updating and referencing data			High-speed Updating address	Name	Setting range	Default setting	Type	Written by UPAC
	Variable name	Type	Address						
M01	m01_f	INT	%MW11.611	No	Speed setting 4 (ASR input)	-32000 to 32000 : (data)*Nmax/20000 r/min	-	31	No
M02	m02_f	INT	%MW11.612	No	Torque command	0.01% / 1d	-	7	No
M03	m03_f	INT	%MW11.613	No	Torque current command	0.01% / 1d	-	7	No
M04	m04_f	INT	%MW11.614	No	Magnetic flux command	0.01% / 1d	-	7	No
M05	m05_f	UINT	%MW11.615	No	Output frequency command	0.1Hz / 1d	-	2	No
M06	m06_f	INT	%MW11.616	No	Detected speed	-32000 to 32000 : (data)*Nmax/20000 r/min	-	31	No
M07	m07_f	INT	%MW11.617	No	Calculated torque	0.01% / 1d	-	7	No
M08	m08_f	INT	%MW11.618	No	Calculated torque current	0.01% / 1d	-	7	No
M09	m09_f	UINT	%MW11.619	No	Output frequency	0.1Hz / 1d	-	2	No
M10	m10_f	UINT	%MW11.620	No	Motor output	0.1kW / 1d	-	2	No
M11	m11_f	UINT	%MW11.621	No	Effective output current	0.1A / 1d	-	2	No
M12	m12_f	UINT	%MW11.622	No	Effective output voltage	0.1V / 1d	-	2	No
M13	m13_f	WORD	%MW11.623	No	Operation command (final command)	0000 to FFFF	-	32	No
M14	m14_f	WORD	%MW11.624	No	Operation status	0000 to FFFF	-	21	No
M15	m15_f	WORD	%MW11.625	No	Output terminal Y1 to Y18	0000 to FFFF	-	33	No
M16	m16_f	WORD	%MW11.626	No	Latest alarm	0000 to 552F	-	14	No
M17	m17_f	WORD	%MW11.627	No	Previous alarm	0000 to 552F	-	15	No
M18	m18_f	WORD	%MW11.628	No	Alarm before previous one	0000 to 552F	-	15	No
M19	m19_f	WORD	%MW11.629	No	Alarm before two previous ones	0000 to 552F	-	15	No
M20	m20_f	UINT	%MW11.630	No	Cumulative operation time	0 to 65535 h	-	0	No
M21	m21_f	UINT	%MW11.631	No	DC link circuit voltage	1V / 1d	-	0	No
M22	m22_f	INT	%MW11.632	No	Motor temperature	1□/1d	-	5	No
M23	m23_f	WORD	%MW11.633	No	Model code	0000 to FFFF 200V type: 1313h 400V type: 1314h	-	29	No
M24	m24_f	UINT	%MW11.634	No	Capacity code	0 to 34	-	28	No
M25	m25_f	WORD	%MW11.635	No	Inverter ROM (Main control) version	0000 to FFFF	-	9	No
M26	m26_f	UINT	%MW11.636	No	Transmission error code	0000 to FFFF	-	34	No
M27	m27_f	INT	%MW11.637	No	Speed setting on alarm	-32000 to 32000 : (data)*Nmax/20000 r/min	-	31	No
M28	m28_f	INT	%MW11.638	No	Torque command on alarm	0.01% / 1d	-	7	No
M29	m29_f	INT	%MW11.639	No	Torque current command on alarm	0.01% / 1d	-	7	No
M30	m30_f	UINT	%MW11.640	No	Magnetic flux command on alarm	0.01% / 1d	-	3	No
M31	m31_f	UINT	%MW11.641	No	Output frequency command on alarm	0.1Hz / 1d	-	2	No
M32	m32_f	INT	%MW11.642	No	Detected speed on alarm	-32000 to 32000 : (data)*Nmax/20000 r/min	-	31	No
M33	m33_f	INT	%MW11.643	No	Calculated torque on alarm	0.01% / 1d	-	7	No
M34	m34_f	INT	%MW11.644	No	Calculated torque current on alarm	0.01% / 1d	-	7	No
M35	m35_f	UINT	%MW11.645	No	Output frequency on alarm	0.1Hz / 1d	-	2	No
M36	m36_f	UINT	%MW11.646	No	Motor output on alarm	0.1kW / 1d	-	2	No
M37	m37_f	UINT	%MW11.647	No	Effective output current on alarm	0.1A / 1d	-	2	No
M38	m38_f	UINT	%MW11.648	No	Effective output voltage on alarm	0.1V / 1d	-	2	No
M39	m39_f	WORD	%MW11.649	No	Operation command on alarm	0000 to FFFF	-	32	No
M40	m40_f	WORD	%MW11.650	No	Operation status on alarm	0000 to FFFF	-	21	No
M41	m41_f	WORD	%MW11.651	No	Output terminal on alarm	0000 to FFFF	-	33	No
M42	m42_f	UINT	%MW11.652	No	Cumulative operation hours on alarm	0 to 65535 h	-	0	No
M43	m43_f	UINT	%MW11.653	No	DC link circuit voltage on alarm	1V / 1d	-	0	No
M44	m44_f	INT	%MW11.654	No	Inverter internal temperature on alarm	1□/1d	-	5	No
M45	m45_f	INT	%MW11.655	No	Heat sink temperature on alarm	1□/1d	-	5	No
M46	m46_f	UINT	%MW11.656	No	Main circuit capacitor life	0 to 100%	-	0	No
M47	m47_f	UINT	%MW11.657	No	PCB capacitor life	0 to 65535 [10h]	-	0	No
M48	m48_f	UINT	%MW11.658	No	Cooling fan life	0 to 65535 [10h]	-	0	No
M49	m49_f	INT	%MW11.659	No	Speed setting 1 (Before multi-step speed command)	-32000 to 32000 : (data)*Nmax/20000 r/min	-	31	No
M50	m50_f	INT	%MW11.660	No	Speed setting 2 (Before ACC/DEC calculation)	-32000 to 32000 : (data)*Nmax/20000 r/min	-	31	No
M51	m51_f	INT	%MW11.661	No	Speed setting 3 (after speed control)	-32000 to 32000 : (data)*Nmax/20000 r/min	-	31	No
M52	m52_f	WORD	%MW11.662	No	Control output 1	0000 to FFFF	-	125	No
M53	m53_f	WORD	%MW11.663	No	Control output 2	0000 to FFFF	-	126	No
M54	m54_f	WORD	%MW11.664	No	Control output 3	0000 to FFFF	-	127	No
M55	m55_f	WORD	%MW11.665	No	Option monitor 1	0000 to FFFF	-	9	No
M56	m56_f	WORD	%MW11.666	No	Option monitor 2	0000 to FFFF	-	9	No
M57	m57_f	UINT	%MW11.667	No	Option monitor 3	0 to 65535	-	0	No
M58	m58_f	UINT	%MW11.668	No	Option monitor 4	0 to 65535	-	0	No
M59	m59_f	INT	%MW11.669	No	Option monitor 5	-32768 to 32767	-	5	No
M60	m60_f	INT	%MW11.670	No	Option monitor 6	-32768 to 32767	-	5	No

You can change the setting of the shaded setting code during operation. Stop operation to change the setting of the other functions.

5.2.3.4 Data format list

Data format list

This format is for access to function code from the link, and is common to FRENIC-VG.

Data type 0 to 13

In principle, all data exchange is executed using 0 to 13 codes.

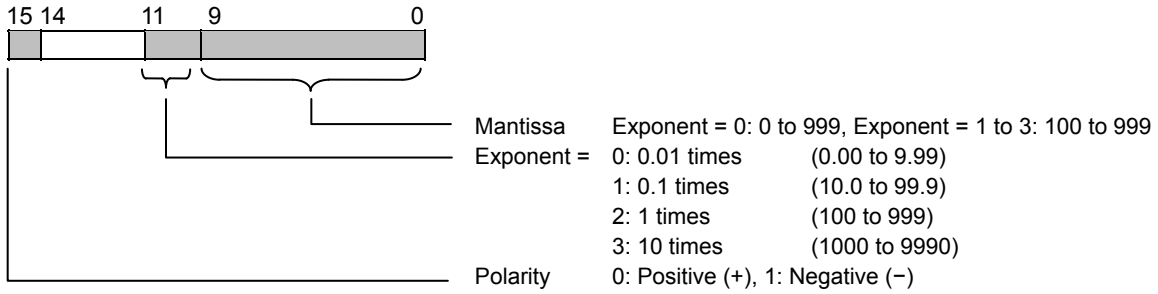
Table 5-2-32

Type	Description	Display/setting	Resolution	Remark
0	Integer	0, 1, 2, 3,.....	1	
1	Integer	0, 2, 4, 6,.....	2	Number of motor poles only
2	Fixed point	0.0, 0.1, 0.2,.....	0.1	
3		0.00, 0.01, 0.02,.....	0.01	
4		0.001, 0.002, 0.003,.....	0.001	
5	Integer (signed)	-2, -1, 0, 1, 2,.....	1	
6	Fixed point (signed)	-0.1, 0.0, 0.1,.....	0.1	
7		-0.01, 0.00, 0.01,.....	0.01	
8		-0.001, 0.000, 0.001,.....	0.001	
9	HEX	1A8E	1h	Initial cursor position is left end. Cursor does not move automatically. When setting range is from 00 to 11, you should specify individual digits toset only 00, 01, 10, or 11.
10	Special data 3	0.75,1,2,...14,15		Carrier frequency setting
11	Operation data		1	The setting is automatically reset to zero after the data is written.

Data type 12 to 145

The following data have special formats.

Type [12]: Time, current, power, PID process values

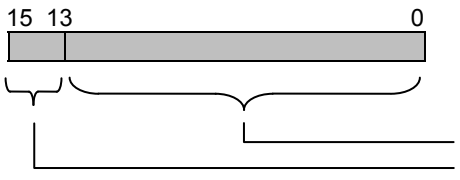


Exponent = 0: 0 to 999, Exponent = 1 to 3: 100 to 999

0: 0.01 times (0.00 to 9.99)
1: 0.1 times (10.0 to 99.9)
2: 1 times (100 to 999)
3: 10 times (1000 to 9990)

Polarity 0: Positive (+), 1: Negative (−)

Type [13]: Current and others



Exponent = 0: 0 to 9999, Exponent = 1, 2 to 3: 1000 to 9999

0: 0.01 times (0.00 to 99.99)
1: 0.1 times (100.0 to 999.9)
2: 1 times (1000 to 9999)
3: 10 times (10000 to 99990)

Type [14]: Cause of alarm

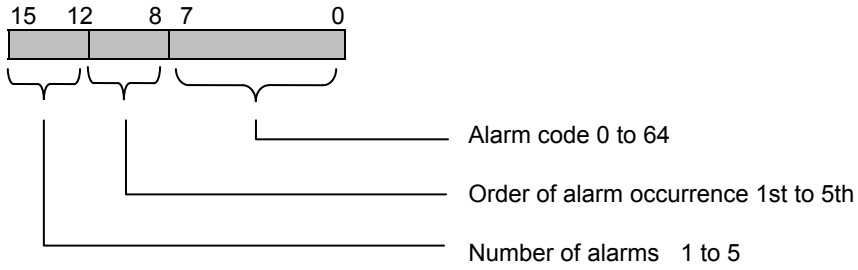
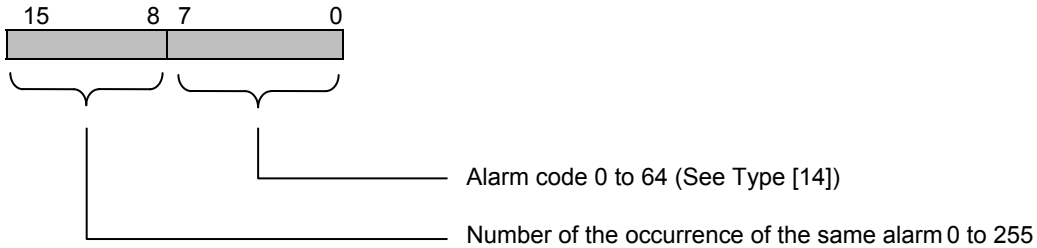


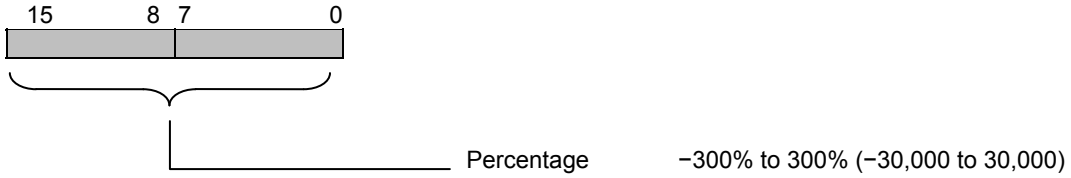
Table 5-2-33 Alarm codes

Code	Display	Description	Code	Display	Description	Code	Display	Description
0	- - -	No alarm	22	OH2	External failure	44	A-C	Error code C for specified users
1	- - -	No alarm	23	OH3	Inverter internal overheat	45	A-d	Error code D for specified users
2	dbH	Braking resistor overheat	24	OH4	Motor overheat	46	A-E	Error code E for specified users
3	dCF	DC fuse break	25	OL 1	Motor 1 overload (M1)	47	A-F	Error code F for specified users
4	d0	Excessive positioning deviation	26	OL2	Motor 2 overload (M2)	48	dbA	Braking transistor broken
5	EF	Ground fault	27	OL3	Motor 3 overload (M3)	49	ECF	Safety circuit error
6	Er 1	Memory error	28	OLU	Inverter overload	50	Er-H	Hardware error
7	Er2	Keypad communication error	29	OS	Excessive speed	51	Er-r	Mock alarm
8	Er3	CPU error	30	OU	Overvoltage	52	LOC	Starting jam
9	Er4	Network error	31	PbF	Charging circuit error	53	dFA	DC fan locked
10	Er5	RS-485 error	32	PG	PG wire breakage (including incorrect wiring)	54	Et 1	Serial encoder error
11	Er6	Operation step error	33	A- 1	Error code 1 for specified users	55	- - -	No alarm
12	Er 7	Output wiring error	34	A-2	Error code 2 for specified users	56	EC	Serial encoder Communication error
13	Er8	A/D converter error	35	A-3	Error code 3 for specified users	57	- - -	No alarm
14	Er9	Speed disagreement	36	A-4	Error code 4 for specified users	58	- - -	No alarm
15	ErA	UPAC error	37	A-5	Error code 5 for specified users	59	- - -	No alarm
16	Erb	Link between inverters communication error	38	A-6	Error code 6 for specified users	60	- - -	No alarm
17	L in	Power phase loss	39	A- 7	Error code 7 for specified users	61	OPL	Output phase loss
18	LU	Undervoltage	40	A-8	Error code 8 for specified users	62	S iF	Functional safety card error
19	nrb	NTC thermistor break	41	A-9	Error code 9 for specified users	63	Si-F	Functional safety card error
20	OC	Overcurrent	42	A-A	Error code A for specified users	64	- - -	No alarm
21	OH 1	Heat sink overheat	43	A-b	Error code B for specified users			

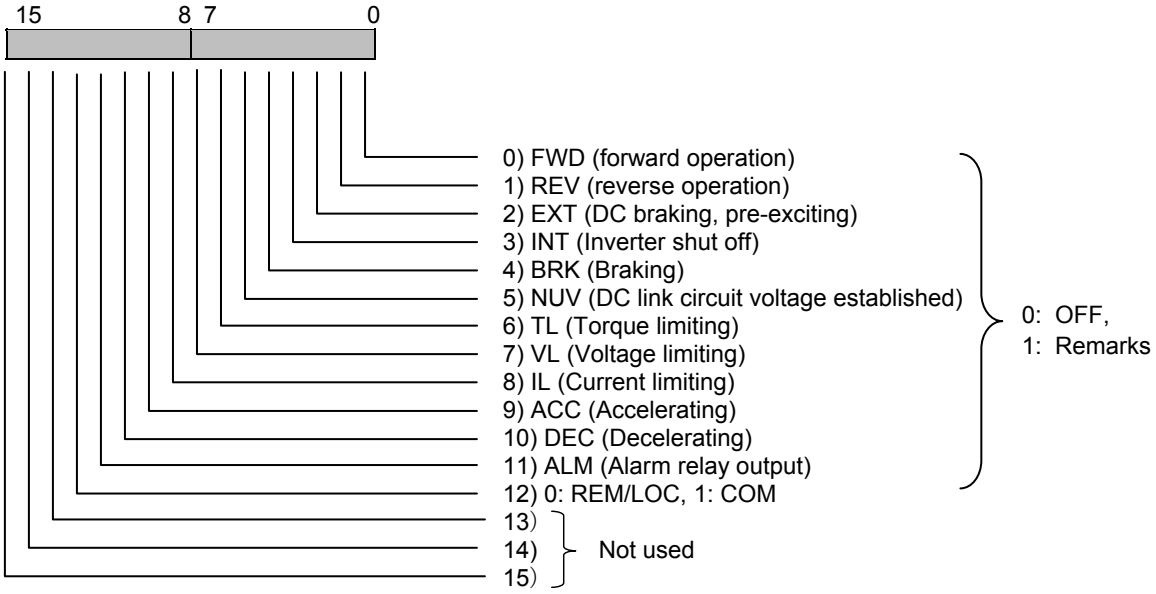
Type [15]: Alarm history



Type [16]: Percentage

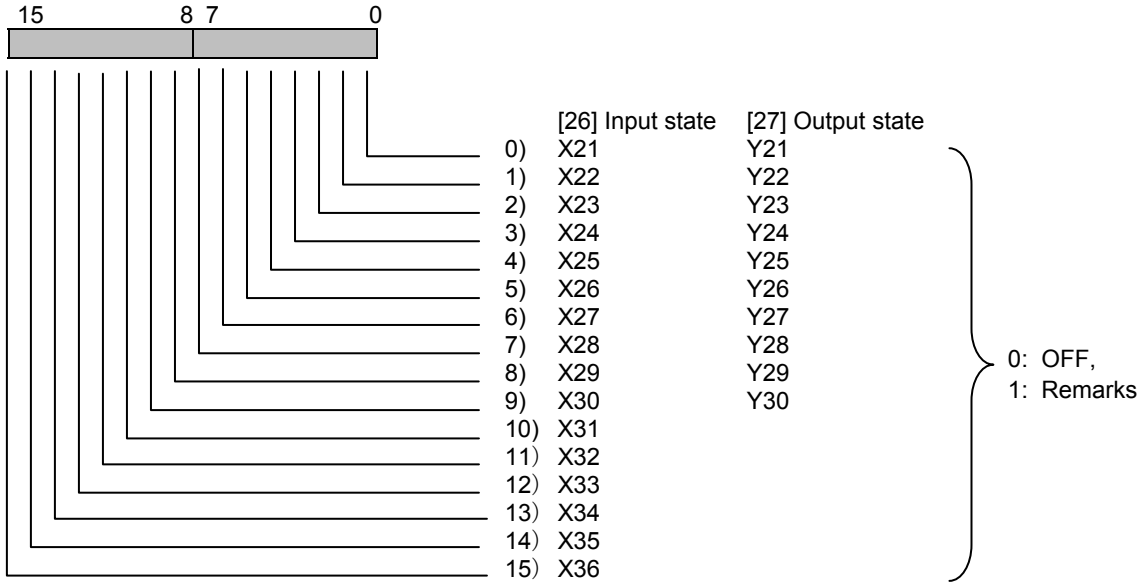


Type [21]: Operation status



Type [26]: DIOB option input state

Type [27]: DIOB option output state



Type [28]: Inverter capacity

Table 5-2-34

Code	Inverter capacity	Code	Inverter capacity	Code	Inverter capacity	Code	Inverter capacity	Code	Inverter capacity
0	0.05	8	5.5	16	45	24	220	32	630
1	0.1	9	7.5	17	55	25	250	33	710
2	0.2	10	11	18	75	26	280	34	800
3	0.4	11	15	19	90	27	315		
4	0.75	12	18.5	20	110	28	355		
5	1.5	13	22	21	132	29	400		
6	2.2	14	30	22	160	30	OTHER		
7	3.7	15	37	23	200	31	500		

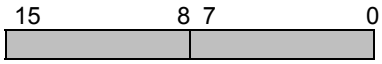
Type [29]: Inverter model (common to entire FUJI inverter system)

The number is fixed to 1313 or 1314 for the FRENIC-VG inverters

200V system: Fixed to 1313h

400V system: Fixed to 1314h

Type [31]: Speed



Data (0 to ±20,000) → (0 to ±12,000 × r/min) : (Data) × Nmax/20,000 conversion

(Example) When the maximum speed is Nmax=1,500r/min,

• If you want to direct a speed reference of 1,000r/min,

Specify a data of

$$\frac{1000}{1500} \times 20000 \rightarrow 13333$$

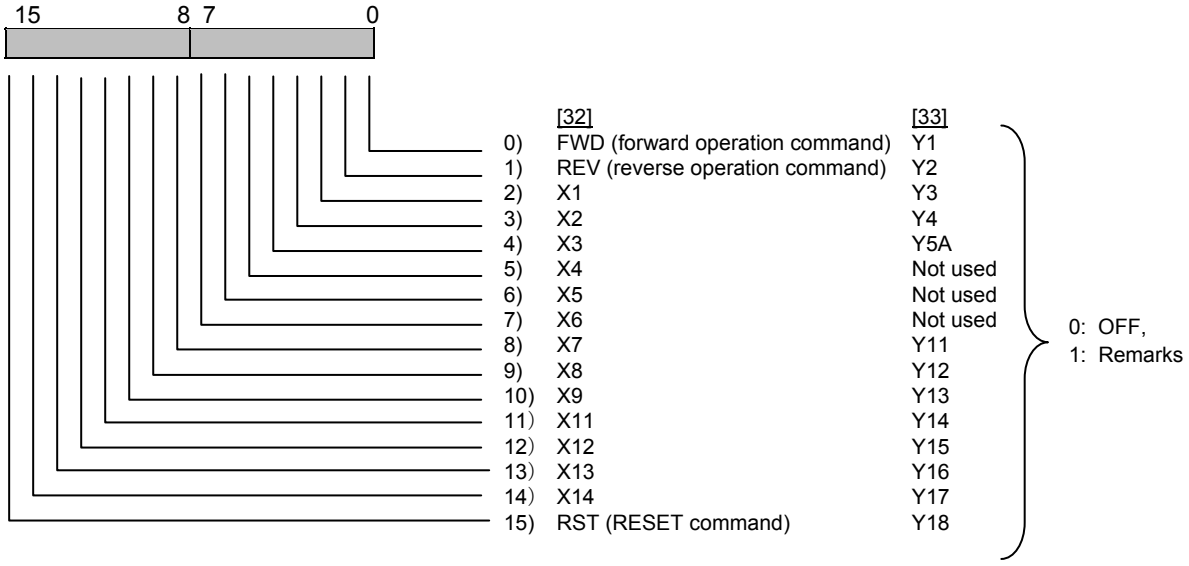
Note 1) If the read out data is 3,500,

You can determine the speed is

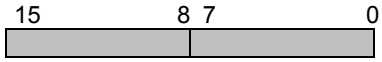
$$\frac{1500}{20000} \times 3{,}500 \rightarrow 262.5\text{r/min.}$$

Type [32]: Operation commands, [33]: Y1 to Y18

This type is the same as S06 and S07.



Type [34]: Communication error codes



Description of alarms in the communication through the link (RS485, T-Link, field bus). The following data is set to the monitor data M26 according to the communication status. The codes listed in the column "KEYPAD panel display" is displayed on the KEYPAD panel as a communication error

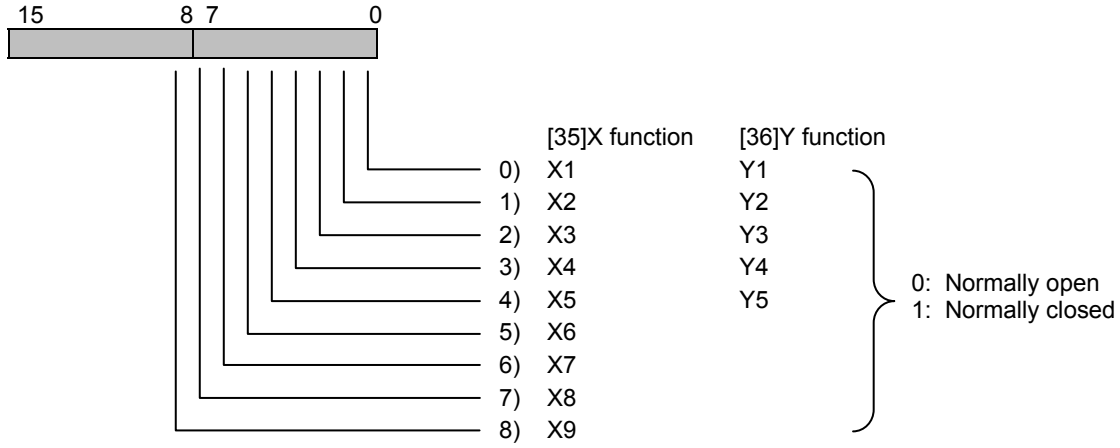
Table 5-2-35

M26 (HEX.)	Keypad panel display	Communication error name	Description	
0 (0H)	-	No communication error	1 Normal communication 2 A data is written to an unused address of the function code (writing to address out of the specified range is defined separately). 3 A data is read from an unused address. The data will be "0000". 4 Writing to the S area while link operation is disabled. The data will not be reflected and cause no error. 5 A data out of range is written to the S area. The data is written afteradjusted to the upper or the lower limit. 6 Access from another link or the KEYPAD panel occurs during datawriting (EEPROM other than the S area is accessed). 7 Writing to operation data (such as tuning or initialization) duringmultiple function codes are being written once through the link. The inverter decides that the procedure is canceled and continues the writing. 8 Writing to/reading from option function codes that are not displayedon the KEYPAD panel	
1 to 32	-	-	-	
33 to 70	-	Not used		
71 (47H)	04	Checksum error: CRC error	Software error	Checksum value or CRC value does notmatch.
72 (48H)	05	Parity error	Hardware error	Parity does not match.
73 (49H)	06	Others (such as overrun, framing)		Physical (reception) errors other than above.
74 (4AH)	01	Format error	Incorrect format. Characters requesting transmission are incorrect. Characters terminating transmission are not in the specified order.	
75 (4BH)	01	Command error	Codes other than the specified commands are transmitted.	
76 (4CH)	07	Link priority error	1 Writing to the S area through RS485 while a link option is installed. 2 Writing to the S area through a link with lower priority while multiple link options are installed.	
77 (4DH)	07	No right to write functioncode data	Not used	
78 (4EH)	02	Function code error	1 Access to a data out of the address range of the function codes (such as access to a data over F86). 2 Writing data over 16 words.	
79 (4FH)	07	Error on writing to writedisableddata	1 Write-disabled function codes (Read-only data or the M area). 2 Function codes write-disabled during operation. 3 Writing through the link to data out of the S area in "write-disabledthrough link" mode. Note that F00 or "Write enable for KEYPAD" cannot protect from writing through the link. 4 Function codes that cannot be written through the link (link function codes: H31 to H40) 5 Writing to M1 function code (P) area when motor parameters areprotected. 6 Writing through the link in the copy mode operation of the KEYPADpanel.	
80 (50H)	03	Data error	Written data is out of the setting range.	
81 (51H)	07	Error during writing	Another writing request comes from the same source while writingfunction code data (EEPROM other than the S area is accessed).	

Note: The alarm codes 1 to 32 constitute a code system specific to the FRENIC-VG different from the assignment for the general purpose inverters.
The communication error codes 71 to 81 are common to the different models. Note that some causes of alarm arespecific to models.
The KEYPAD panel does not display raw communication error codes but the values in the "KEYPAD panel display"column in the table above.
The KEYPAD panel displays "**" when it receives data that does not have a corresponding "KEYPAD panel display"in the table above.

Type [35]: X function normally open/closed

Type [36]: Y function normally open/closed



Type [40] to [99]

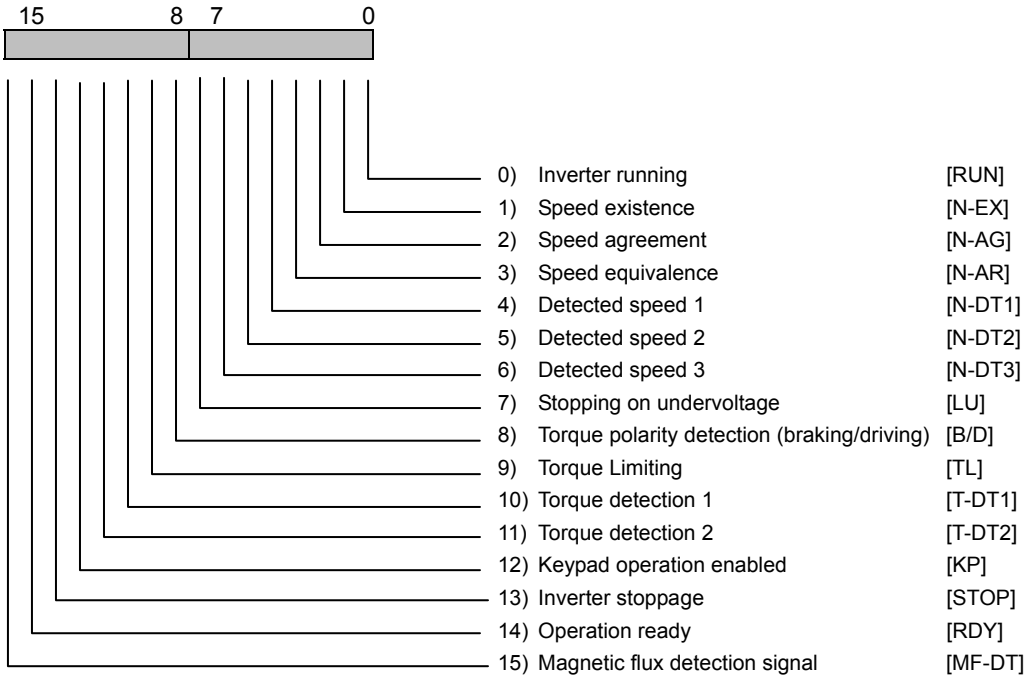
These types are reserved for the manufacturer. Users can considers these types as type [0] to use.

Type [82]: M1 Motor Selection

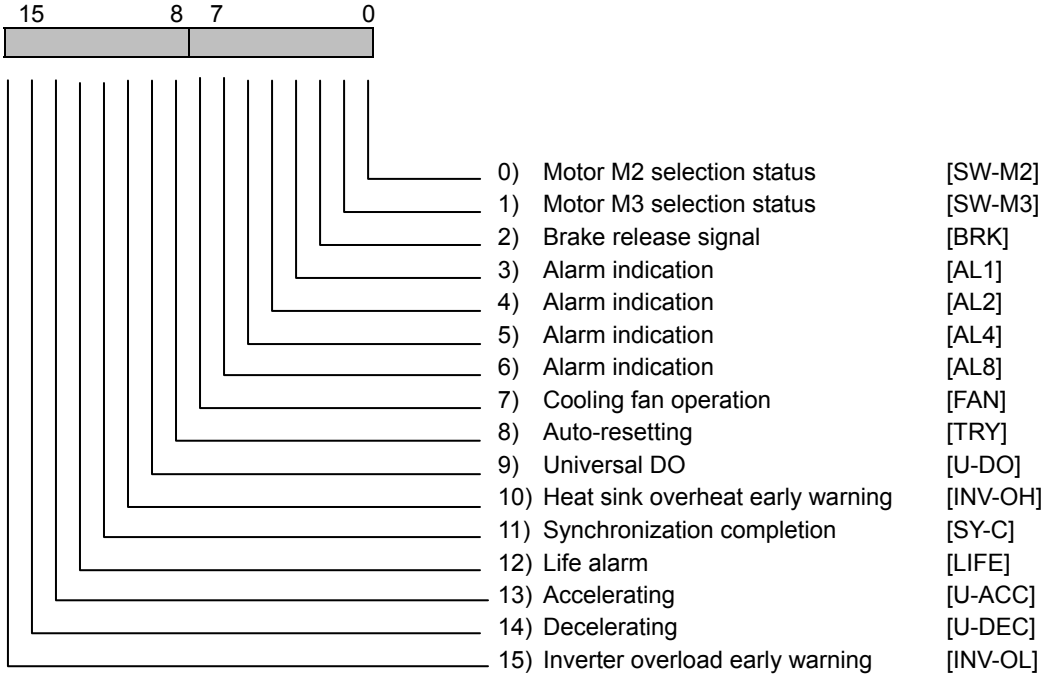
Table 5-2-36

Code	kW indication	HP indication	Code	kW indication	HP indication	Code	kW indication	HP indication
0	00 : 0.75-2	00 : 1-2	17	17 : 3.7-4	17 : 5-4	34	34 : 200-4	34 : 250-4
1	01 : 1.5-2	01 : 2-2	18	18 : 5.5-4	18 : 7.5-4	35	35 : 220-4	35 : 300-4
2	02 : 2.2-2	02 : 3-2	19	19 : 7.5-4	19 : 10-4	36	36 : P-OTR	36 : P-OTR
3	03 : 3.7-2	03 : 5-2	20	20 : 11-4	20 : 15-4	37	37 : OTHER	37 : OTHER
4	04 : 5.5-2	04 : 7.5-2	21	21 : 15-4	21 : 20-4	38	38 : 30-2A	38 : 40-2A
5	05 : 7.5-2	05 : 10-2	22	22 : 18.5-4	22 : 25-4	39	39 : 55-2A	39 : 75-2A
6	06 : 11-2	06 : 15-2	23	23 : 22-4	23 : 30-4	40	40 : 75-2A	40 : 100-2A
7	07 : 15-2	07 : 20-2	24	24 : 30-4	24 : 40-4	41	41 : 90-2A	41 : 125-2A
8	08 : 18.5-2	08 : 25-2	25	25 : 37-4	25 : 50-4	42	42 : 30-4A	42 : 40-4A
9	09 : 22-2	09 : 30-2	26	26 : 45-4Y	26 : 60-4Y	43	43 : 55-4A	43 : 75-4A
10	10 : 30-2	10 : 40-2	27	27 : 45-4S	27 : 60-4S	44	44 : 75-4A	44 : 100-4A
11	11 : 37-2	11 : 50-2	28	28 : 55-4	28 : 75-4	45	45 : 90-4A	45 : 125-4A
12	12 : 45-2Y	12 : 60-2Y	29	29 : 75-4	29 : 100-4	46	46 : 110-4A	46 : 150-4A
13	13 : 45-2S	13 : 60-2S	30	30 : 90-4	30 : 125-4	47	47 : 132-4A	47 : 175-4A
14	14 : 55-2	14 : 75-2	31	31 : 110-4	31 : 150-4	48	48 : 160-4A	48 : 200-4A
15	15 : 75-2	15 : 100-2	32	32 : 132-4	32 : 175-4	49	49 : 200-4A	49 : 250-4A
16	16 : 90-2	16 : 125-2	33	33 : 160-4	33 : 200-4	50	50 : 220-4A	50 : 300-4A

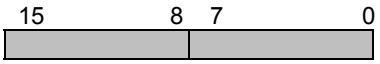
Type [125]: Control output 1



Type [126]: Control output 2



Type [127]: Control output 3



0)	Motor overheat early warning	[M-OH]
1)	Motor overload early warning	[M-OL]
2)	DB overload early warning	[DB-OL]
3)	Link transmission error	[LK-ERR]
4)	Load adaptive control being limited	[ANL]
5)	Load adaptive control being calculated	[ANC]
6)	Analog torque bias hold	[TBH]
7)	Custom-Do 1	[C-Do1]
8)	Custom-Do 2	[C-Do2]
9)	Custom-Do 3	[C-Do3]
10)	Custom-Do 4	[C-Do4]
11)	Custom-Do 5	[C-Do5]
12)	Custom-Do 6	[C-Do6]
13)	Custom-Do 7	[C-Do7]
14)	Custom-Do 8	[C-Do8]
15)	Custom-Do 9	[C-Do9]

5.2.4 Option Monitor Area Address Assignment

Data in UPAC can be displayed on the LED monitor of the KEYPAD panel of the inverter where theUPAC is installed whether FRN-VG six-unit system or FRN-VG twelve-unit system is selected.

Data are reflected at about 60ms fixed cycle.

When you use this feature, select a code from the Function List or specify the address (%MW area) in thetable to register a variable.

This area is used for writing from UPAC to INV1.

See the section for the KEYPAD panel operation for the option monitor indication on the KEYPAD panel.

OP1-OP6

Table 5-2-37

Code	Address	Type
OP1	%MW11.681	WORD
OP2	%MW11.682	WORD
OP3	%MW11.683	UINT
OP4	%MW11.684	UINT
OP5	%MW11.685	INT
OP6	%MW11.686	INT

5.2.5 User Application RAS Area Address Assignment

An application designed by user can monitor the state and activate the inverter protective action (alarmstate) whether FRN-VG six-unit system or FRN-VG twelve-unit system is selected.

Sixteen bits (16 types) are provided corresponding to cause of alarms. When any bit is set to ON, theinverter generates an "ErA" alarm and enters into the protective function activation state. You cannotcancel (reset) the ErA alarm unless you set all bits to OFF.

User RAS

Table 5-2-38

Address	Type
%MW11.690	WORD

Chapter 6 Maintenance and Inspection

This chapter describes the items of periodic inspection and the procedure of battery replacement.

Contents

6.1 General Inspection Points

The UPAC must be regularly inspected to enable it to operate to its maximum performance.

⚠CAUTION

・Confirm that the unit is used at the rated voltage specified in the FRENIC-VG INSTRUCTION MANUAL and USER'S MANUAL.

A fire or malfunction may occur.

・Confirm that the unit is used under the environmental conditions specified in the FRENIC-VG INSTRUCTION MANUAL and USER'S MANUAL.

・Do not use the unit in a hot or humid environment or an environment where it is subjected to dew, dust, corrosive gas, oil, organic solvent or serious vibration or impact.

A fire, electric shock or malfunction may occur.

・Confirm the unit to see if there are foreign substances inside, such as dirt, wire scraps, and iron chips, and proper measures are taken to prevent them.

A fire or malfunction may occur.

・Regularly confirm that the terminal screws and the setscrews are securely tightened.

A fire or malfunction may occur.

6.1.1 Inspection Intervals

The UPAC consists mainly of semiconductor elements and is a highly reliable product. However, the elements may deteriorate depending on the ambient environment, and it is, therefore, necessary to perform a regular inspection on the UPAC. The unit must be inspected once or twice a year, but it should be inspected at shorter intervals according to the ambient environment. If any of the inspection results does not meet the criterion, take appropriate corrective measures.

6.1.2 Inspection Items

Follow the items in the table below to inspect your facility.

Table 6-1-1

Inspection items		What to inspect	Criteria	How to inspect
UPAC operation state		Failure diagnosis display with D300win	Normal display. No major or minor fault.	Visual inspection
Ambient condition	Temperature	Within the specification (temperature inside the panel if installed in the panel)	-10 to +50ºC	Maximum and minimum thermometer
	Humidity	Condensation. Excessive color change or rust.	20% to 95%RH	Visual inspection/ hygrometer
	Vibration	Vibration	None	Tactile inspection
	Dust	Attached dust or foreign object	None	Visual inspection
Mounting state		Individual cards are fixed firmly	No loose cards	Visual inspection
		Screws of terminals for external wiring are not loose	No loose screws	Screwdriver
		Connector for connecting cable is inserted firmly	No loose or playing connectors	Visual inspection, screwdriver
		Disconnecting external wiring cable	No abnormal appearance	Visual inspection
Battery		Expiration date is reached (Note)	Expiration label display	Visual inspection, "2) Battery change"
Maintenance parts		Required number of parts exist. Stored properly.	Inspection record	
Program		No abnormality when referred. Source program is stored properly.	No abnormality	Program reference

Note: Voltage of battery decreases in storage due to self discharge. Change to new battery before expiration date is reached.

6.2 Replacing the Battery

⚠WARNING

・When an ErA alarm (UPAC alarm) is displayed on the FRENIC-VG and the minor failure of lower battery voltage is discovered by the D300win failure diagnosis, replace the battery immediately. Applications operating with backup memory do not undergo an ErA alarm (critical failure: memory backup error) when the control power of the inverter is turned on, even if the power voltage drops (backup failure during a power outage). However, once the power is turned off, an ErA alarm will be issued upon power-on and the retained data will be lost.

An accident may occur.

⚠CAUTION

Precautions for handling the battery

・Do not short both of the poles.

・Do not throw the battery into fire.

・Do not charge or dismantle the battery.

・Dispose of the battery according to the regulations stipulated by the competent local administrative agency.

Replace the battery with a new one when it reaches the effective period even if no battery failure message is displayed.

Replace the battery immediately with a new one when an "ErA (UPAC alarm" occurs on the FRENIC-VG and the minor failure of lower battery voltage is discovered by the D300win failure diagnosis.

Although the battery can be used for another one week or so after an ErA alarm (minor failure relating to the battery) is issued, replace it immediately.

Table 6-2-1

Replacement timing	The year and month are displayed on the battery (guarantee period). Note: The battery replacement timing is the year and month five years after manufacture.
Replacement battery model	OPK-BP
Nominal voltage	3.6V

6.2.1 Battery Replacement Procedure

⚠CAUTION

・Improper operations during battery mounting or removal may cause damage to the product.

・Before mounting or removing the battery, turn OFF the inverter input power and confirm that the charge lamp (CHARGE) is OFF. If the external control circuit is powered by a separate power supply, the power is applied to the inverter control terminals 30A, 30B, 30C, Y5A, and Y5C even if all of the inverter main circuit, control, and auxiliary power supplies are turned OFF (open).

・Turn OFF (open) the external power supply as well to prevent electric shocks.

⚠CAUTION

・**An ErA alarm (critical failure: memory backup error)** may occur when the power is first turned ON after battery replacement. If this happens, leave the power turned on for about 30 seconds, and turn the power off then on again.

Follow the procedure below to properly replace the battery:

1) Remove the front cover from the FRENIC-VG.

   See the supplied instruction manual before removing the front cover.

   As shown in the figure below, remove the front cover from the inverter. Note that the removing method is different between applicable inverter models (capacities).

2) How to handle the optional UPAC

   The battery can be replaced with the optional UPAC attached. However, it is advisable to remove the spacers before replacing the battery, as guided by the supplied instruction manual.

3) Replacing the battery

   (1) Disconnect the battery connector from the CN2, and cut the band securing the battery with nippers.

   (2) Replace the battery with a new one, and secure the battery with a new band as shown in the figure below. The contents of backup data (retain memory) will be lost if the battery is kept removed. It is advisable to save required data before turning OFF the power.

   (3) Connect the battery connector to the CN2.

   (4) Mount the optional UPAC and replace the FRENIC-VG front cover by reversing the above procedure, and turn ON the power.

   (5) A critical failure (memory backup error) may occur when the power is first turned ON after battery replacement. In this case, keep the power ON for approximately 30 seconds, then turn it OFF and ON again.

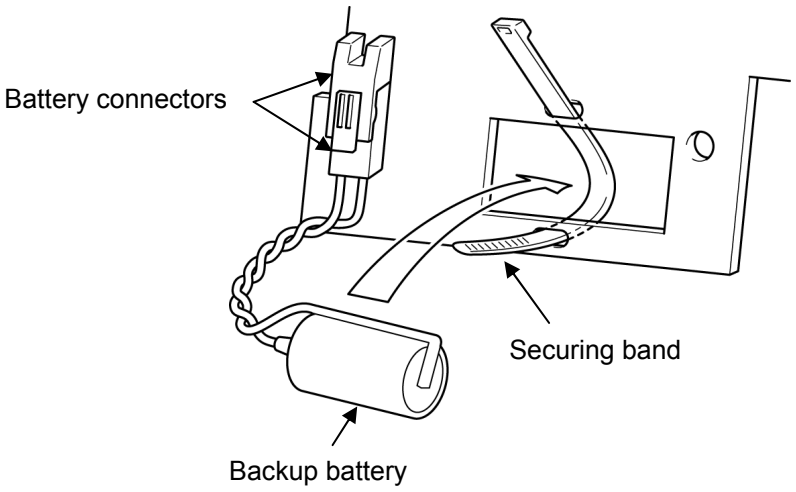


Fig. 6-2-1

High performance vector control inverter

FRENIC-VG

User's Manual (UPAC edition)

First Edition, June 2013
Second Edition, July 2013

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