



VECTOR INVERTER

-INSTRUCTION MANUAL-

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SSCNET COMMUNICATION OPTION

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**FR-V5NS**

Thank you for choosing the Mitsubishi vector inverter option unit.

This instruction manual gives handling information and precautions for use of this equipment. Incorrect handling might cause an unexpected fault. Before using the equipment, please read this manual carefully to use the equipment to its optimum.

Please forward this manual to the end user.

## This section is specifically about safety matters

Do not attempt to install, operate, maintain or inspect this product until you have read through this instruction manual and appended documents carefully and can use the equipment correctly. Do not use this product until you have a full knowledge of the equipment, safety information and instructions.


In this instruction manual, the safety instruction levels are classified into "WARNING" and "CAUTION".



Assumes that incorrect handling may cause hazardous conditions, resulting in death or severe injury.



Assumes that incorrect handling may cause hazardous conditions, resulting in medium or slight injury, or may cause physical damage only.

Note that the  CAUTION level may lead to a serious consequence according to conditions. Please follow the instructions of both levels because they are important to personnel safety.

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## SAFETY INSTRUCTIONS

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### 1. Electric Shock Prevention



## WARNING

- While power is on or when the inverter is running, do not open the front cover. You may get an electric shock.
- Do not run the inverter with the front cover removed. Otherwise, you may access the exposed high-voltage terminals and charging part and get an electric shock.
- Even if power is off, do not remove the front cover except for wiring or periodic inspection. You may access the charged inverter circuits and get an electric shock.
- Before starting wiring or inspection, check to make sure that the inverter power indicator lamp is off, wait for at least 10 minutes after the power supply has been switched off, and check that there are no residual voltage using a tester or the like. The capacitor is charged with high voltage for some time after power off and it is dangerous.

 **WARNING**

- Any person who is involved in the wiring or inspection of this equipment should be fully competent to do the work.
- Always install the option unit before wiring. Otherwise, you may get an electric shock or be injured.
- Handle this option unit with dry hands to prevent an electric shock.
- Do not subject the cables to scratches, excessive stress, heavy loads or pinching. Otherwise, you may get an electric shock.

## 2. Injury Prevention

 **CAUTION**

- While power is on or for some time after power-off, do not touch the inverter as it is hot and you may get burnt.

## 3. Additional Instructions

Also note the following points to prevent an accidental failure, injury, electric shock, etc.:

### (1) Transportation and mounting

 **CAUTION**

- Do not install or operate the option unit if it is damaged or has parts missing.
- Do not stand or rest heavy objects on the product.
- Check that the mounting orientation is correct.
- Prevent screws, metal fragments or other conductive bodies or oil or other flammable substance from entering the inverter.

### (2) Test operation and adjustment

 **CAUTION**

- Before starting operation, confirm and adjust the parameters. A failure to do so may cause some machines to make unexpected motions.

### (3) Usage

#### **WARNING**

- Do not modify the equipment.
- Do not perform parts removal which is not instructed in this manual. Doing so may lead to fault or damage of the inverter.

#### **CAUTION**

- When parameter clear or all parameter clear is performed, each parameter returns to the factory setting. Reset the required parameters before starting operation.
- For prevention of damage due to static electricity, touch nearby metal before touching this product to eliminate static electricity from your body.

### (4) Maintenance, inspection and parts replacement

#### **CAUTION**

- Do not test the equipment with a megger (measure insulation resistance).

### (5) Disposal

#### **CAUTION**

- Treat as industrial waste.

### (6) General instruction

All illustrations given in this manual may have been drawn with covers or safety guards removed to provide indepth description. Before starting operation of the product, always return the covers and guards into original positions as specified and operate the equipment in accordance with the manual.

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# 1. PRE-OPERATION INSTRUCTIONS

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## 1.1 Unpacking and Product Confirmation

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Take the option unit out of the package, check the unit name, and confirm that the product is as you ordered and intact.

This product is a plug-in option unit designed for exclusive use in the Mitsubishi FR-V500 series vector inverter. Before using it, check the type and SERIAL number of the inverter.

- This product may be used with the FR-V520-1.5k to 55k series manufactured in and after May 2002. Any of the models may be used with this unit if its SERIAL number indicated on the rating plate and package has "O25O O O O O O" or later version. For details on the SERIAL number, please contact your sales representative.

SERIAL is made up of 1 version symbol, 1 alphabet letter or numeric character indicating month, and 7 numeric characters indicating the year and control number as shown below. (Only the first three digits of the control number are printed on the package.)

<u>  O  </u>	<u>  2  </u>	<u>  O O O O O O</u>
Symbol	Year	Month Control number
SERIAL number		

## 1.2 Packing Confirmation

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Make sure that the package includes the following

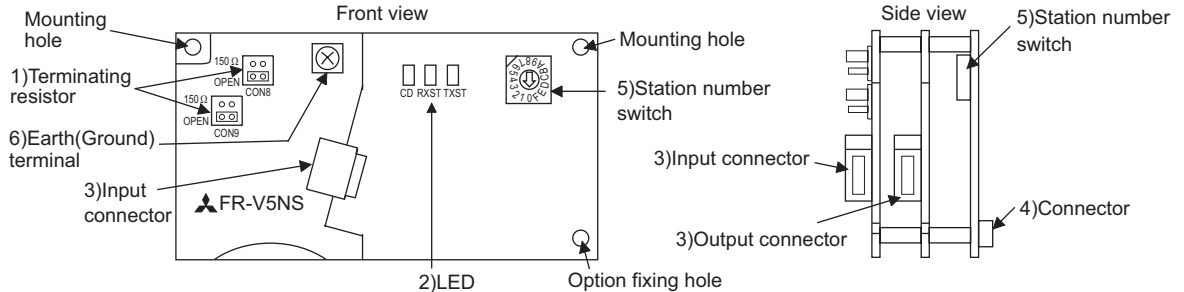
- Instruction manual ..... 1
- Mounting screws M3 × 10 ..... 2 (Refer to page 7.)
- Ferrite core ..... 2 (Refer to page 9.)

## 1.3 Caution

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- (1) Refer to the following manuals or software HELP for full information on the motion controller.
  - Q173CPU/Q172 CPU user's manual .....IB-0300040
  - Q173CPU/Q172 CPU motion controller (SV13/SV22) programming manual (real mode version) .....IB-0300043
- (2) Servo System Controller NETwork is abbreviated to SSCNET in this manual.

## 1.4 Structure



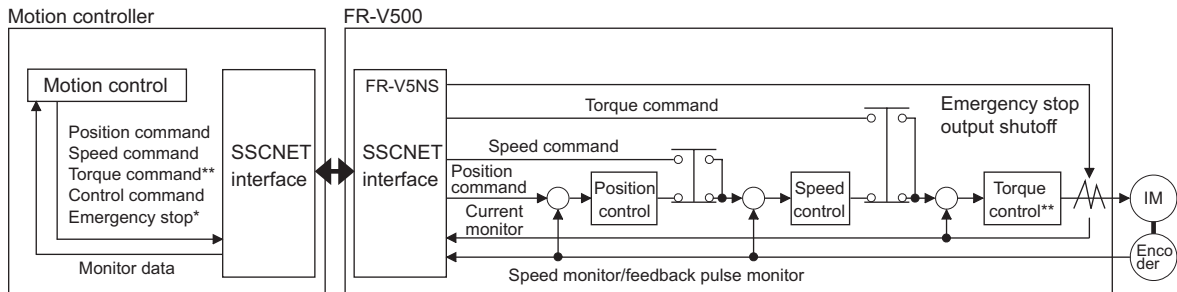
Name		Function	Refer to page
1)	Terminating resistor	Set terminating resistor present/absent using a jumper connector.	6
2)	LED	CD(carrier disconnection alarm)	Lit when the inverter and host computer have been physically disconnected.
		RXST (receiving)	Lit while receiving.
		TXST (transmitting)	Lit while transmitting.
3)	Communication connector	Input	Communication cable input connector for connecting SSCNET from the motion controller or other FR-V500 series (servo amplifier).
	Output	Communication cable output connector for connecting SSCNET to other FR-V500 series or the servo amplifier.	
4)	Connector	To be connected to the option unit connector of the inverter.	-
5)	Station number switch	Set the station number of the inverter when connected to the motion controller.	5
6)	Earth (Ground) terminal	To be connected to the ground terminal of the inverter.	12



### 1.5 Operation Overview

In communication with the Mitsubishi motion controller, the inverter operation (speed control or position control or torque control under vector control with encoder), monitoring, or parameter setting can be performed from a program on the motion controller.

SSCNET enables less wiring, improved reliability, improved synchronous control performance and motion controller-driven multi-axis batch control.



\* When the emergency stop signal is input, the inverter shuts off the output and the motor coasts.

\*\*Please contact your sales representative when performing torque control.

### CAUTION

**The inverter can perform vector control with encoder (speed control, position control, torque control) under the command from the motion controller. (Pr. 800 "control system selection" is made invalid.)**

## 2.INSTALLATION

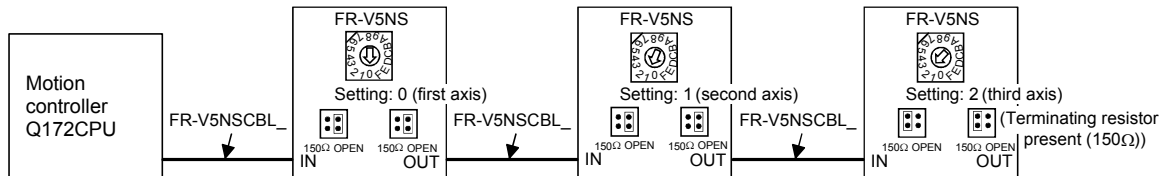
### 2.1 Pre-Installation Instructions

Make sure that the input power of the inverter is off.

#### CAUTION

 With input power on, do not install or remove the option unit. Otherwise, the inverter and option unit may be damaged.

### 2.2 Setting the Station Numbers and Terminating Resistor



#### REMARKS

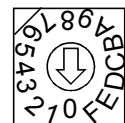
Refer to page 10 for the FR-V5NSCBL (SSCNET cable).

## 2.2.1 Setting the station numbers

Set the inverter station number before switching on the inverter and do not change the setting while power is on. SSCNET allows up to eight axes to be connected in one communication system.

### Station number switch

Move the arrow (↑) to the position corresponding to the station number you want to set.



Factory setting

Station Number	Description	Station Number	Description
0	First axis	8	Not used.
1	Second axis	9	Not used.
2	Third axis	A	Not used.
3	Fourth axis	B	Not used.
4	Fifth axis	C	Not used.
5	Sixth axis	D	Not used.
6	Seventh axis	E	Not used.
7	Eighth axis	F	Normal start. The inverter starts in the operation mode set in Pr. 79 "operation mode selection".

### REMARKS

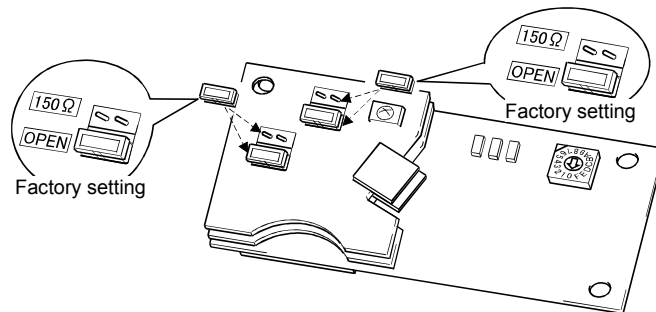
- If any of the station No. 8 to No. E is set to the inverter, it is placed in a communication initialization waiting status after power-on, but communication is not established. Do not use 8 to E.
- When the station No. F is set to the inverter, it starts in the external operation mode (when Pr. 79 = 0) and operates normally. It cannot perform SSCNET operation. Refer to the inverter manual for Pr. 79 "operation mode selection" for the station No. F.
- Set the station numbers consecutively in connection order. (You can also set the station numbers independently of the connection order.)

### CAUTION

1. If you change any station number while the inverter power is on, the setting is not made valid. The setting is made valid after power is switched on again or the RES signal is turned on.
2. You cannot set the same station number to two or more inverters on the same bus. (Such setting disables normal communication.)
3. Set the switch securely into the switch numeral position. Setting it in a middle position disables normal data communication.

## 2.2.2 Setting the terminating resistor

The terminating resistor setting jumper connectors are factory-set in the terminating resistor absent (OPEN) position. To make the terminating resistor present, change the positions of both jumper connectors on the FR-V5NS to the 150Ω positions. Only the terminating resistor of the inverter (servo amplifier) furthest from the motion controller should be made present (150Ω).

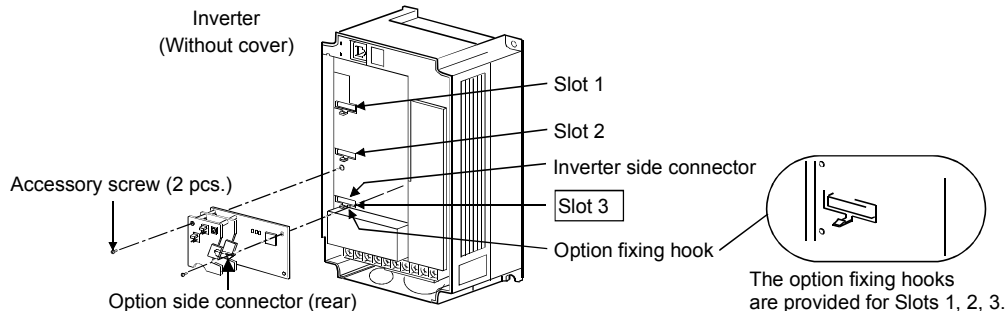


### CAUTION

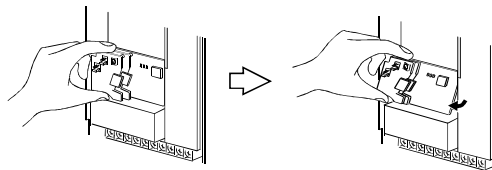
1. Do not change the jumper connector positions while power is on.
2. Jumper connectors must be fitted in either OPEN or 150Ω. If they are fitted in both positions at the same time, the option unit may be damaged.
3. For the handling of the servo amplifier terminating resistor, refer to the instruction manual of the servo amplifier.

## 2.3 Installation and Removal

- (1) Install the option unit to Slot 3. (If you install it to Slot 1 or 2, E.OP1 (E.OP2) is displayed and operation is not performed.)
- (2) Insert the option unit connector into the Slot 3 connector of the inverter securely. At this time, also insert the option fixing holes securely.  
Refer to the following diagram for the position of Slot 3. Push the option unit securely into the option fixing hook.
- (3) Fix the two right and left places of the option unit to the inverter securely with the accessory mounting screws. If the screw holes do not line-up, the connector may not have been inserted securely. Check for insecure insertion.



- (4) To remove the option unit, remove the two left and right screws, and then hold the option unit and pull its bottom toward you as shown in the figure. (The option unit is fixed by the hook of the inverter.)

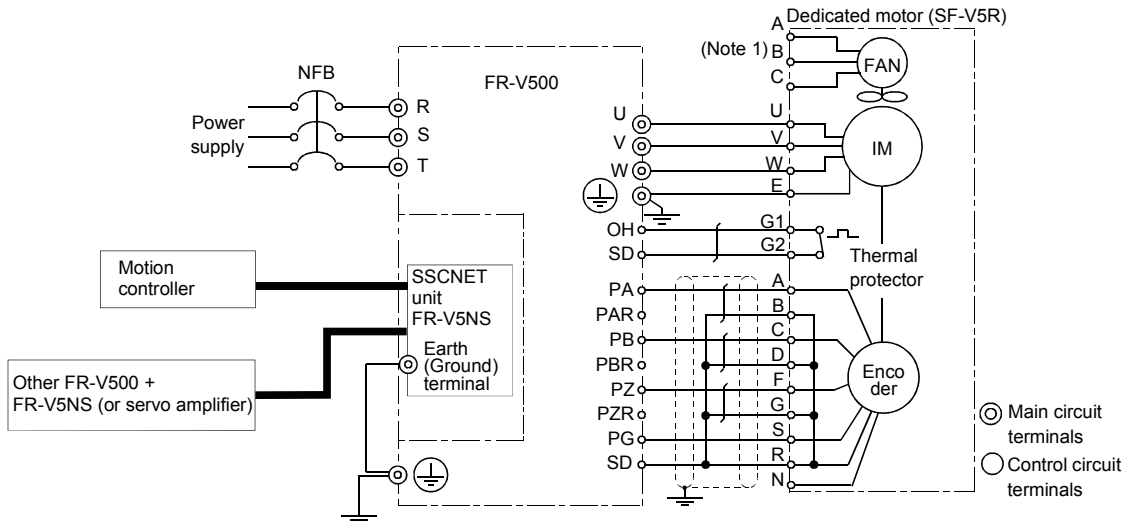


### CAUTION

You cannot use this option with any other communication options. Also, there are restrictions on some of the other option functions. (Refer to page 25.)

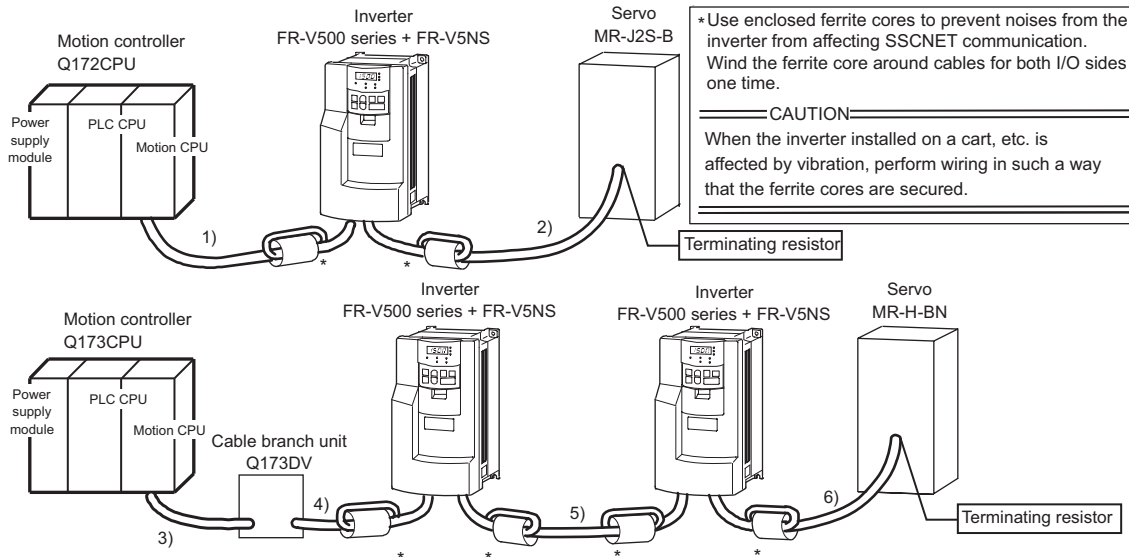
# 3. WIRING

## 3.1 Wiring Example



Note 1: The fan power supply of the 7.5kW or less dedicated motor is single-phase.

## 3.2 Connection Example



Motion controller CPU	Q173CPU or Q172CPU		
Inverter	FR-V500 series + FR-V5NS (SSCNET communication unit)		
Cables	1), 5)	FR-V5NSCBL_	For connection of Q172CPU and FR-V5NS, for connection of FR-V5NS and FR-V5NS
	2), 4)	Q172J2BCBL_M(-B)	For connection of Q172CPU/FR-V5NS and MR-J2-B/MR-J2S-B/MR-J2-03B5, for connection of Q173DV and FR-V5NS
	6)	Q172HBCBL_M(-B)	For connection of Q172CPU/FR-V5NS and MR-H-BN
	3)	Q173DVCBL_M	For connection of Q173CPU and Q173DV

### 3.3 SSCNET Cables and Ground Cable

Use our optional SSCNET connection cables.

(1) Cable type

Type *	Length [m]	Cable Type
Q172J2BCBL_M(-B)	0.5, 1, 5	UL20276 AWG#28 7 pair (cream)
Q172HBCBL_M(-B)		
FR-V5NSCBL_	0.5, 1, 5, 10, 20	UL20276 AWG#28 7 pair (ivory)
Q173DVCBL_M	0.5, 1	UL20276 AWG#28 13 pair (cream)

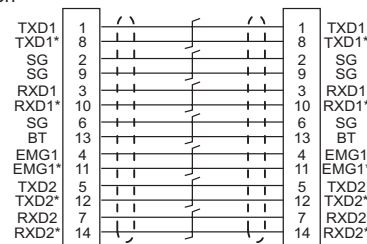
\* \_ in the type represents the cable length.

Symbol	005	01	05	10	20
Cable Length (m)	0.5	1	5	10	20

**REMARKS**

- If the necessary length is not found in the optional cables, fabricate it on the customer side. For SSCNET cables, use the twisted pair shielded cables indicated above or equivalent. The overall wiring length of the bus cables on the same bus is 30m.
- When fabricating SSCNET cable on the user side
  - Connector: HDR-E14MGI x 2(Honda tsushin kogyo Co., Ltd)
  - Wire: UL20276φ4.9 (Ivory AWG#28 x 7P)  
(Bando electric wire co., Ltd.)

• Connection diagram



**CAUTION**

- When fabricating a bus cable, make sure to connect cables to correct signals. Otherwise, over-run or burst may occur.



## ***WIRING***

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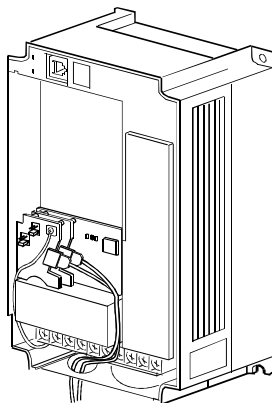
### (2) Earth (Ground) Cable

For wiring to the earth (ground) terminal of the FR-V5NS, use a crimping terminal with sleeve.

- Cable gauge: 2 mm<sup>2</sup>
- Crimping terminal: 2-3.5 (with sleeve)

### 3.4 Wiring Route

- Route the SSCNET cables using the space on the right side of the control circuit terminal.
- Connect the earth (ground) cable to the earth (ground) terminal of the inverter using the space on the left side of the control circuit terminal. (For the position of the earth (ground) terminal of the inverter, refer to the inverter manual.)



#### CAUTION



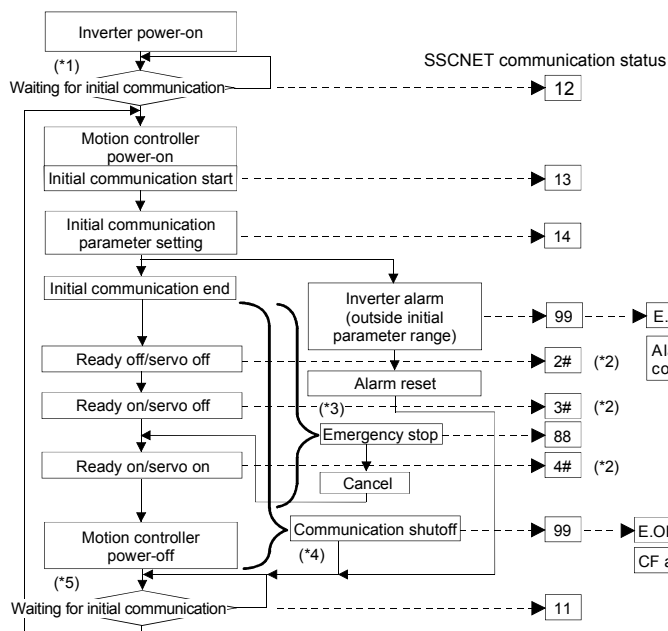
**When reinstalling the front cover of the inverter, route the cables in the wiring space securely so that the inverter control circuit terminal and option connection cables are not caught between the inverter and cover.**

## 4. SSCNET COMMUNICATION STATUS

When the inverter is fitted with the SSCNET communication unit (FR-V5NS) and has any of station No. 0 to No. 7, powering it on places it in the SSCNET communication initialization waiting status. In this status, the inverter is put in the SSCNET operation mode and cannot be switched to the external or PU operation mode. In addition, the Pr. 79 "operation mode selection" setting is disabled. How SSCNET communication is performed is shown below.

The status of communication with the motion controller can be monitored as a communication status.

To monitor it, set "39" (communication status) in Pr. 52 "DU/PU main display data selection". (Refer to page 17.)



Communication Status	Description
0	The V5NS is not fitted or the station number is F
11	After SSCNET communication had been established, the motion controller powered off.
12	Immediately after the inverter has been powered on, it is waiting for motion controller power-on and initial communication.
13	Initialization communication start
14	The initial parameters are being received during initialization.
2#	Ready off was received.
3#	Servo off was received.
4#	Servo on was received.
88	Emergency stop (inverter output shutoff)
99	Inverter trip

#. Axis number

\*1. The inverter is put in the SSCNET operation mode.

\*2. In the part #, the axis number appears. ("21" appears when the station number is 0.)

\*3. To reset the alarm, the alarm reset signal from the SSCNET or the RES terminal is valid.

\*4. When communication is interrupted, an inverter reset (CF alarm) or inverter alarm (E.OP3) occurs.

To select alarm output presence/absence and stop operation, use Pr. 499 "action selection at SSCNET communication interruption". (Refer to page 17.)

\*5. If the motion controller is powered off during inverter power input, the inverter is placed in the initialization waiting status.

## 5. INITIAL COMMUNICATION SETTING FROM MOTION CONTROLLER

The following parameters are set during initial communication with the motion controller.

For the setting method, refer to the manual of the motion controller (Refer to page 1 for the manual types.)

	No.	Name	Inverter Parameter No.
Basic parameters	1	Maximum speed	1
	2	Electronic thermal O/L relay	9
	3	Regenerative function selection	30
	4	Special regenerative brake duty	70
	5	Applied motor	71
	6	Motor capacity	80
	7	Number of motor poles	81
	8	Online auto tuning selection	95
	9	Torque restriction level	22
	10	Torque restriction level (regeneration)	812
	11	Torque restriction level (3rd quadrant)	813
	12	Torque restriction level (4th quadrant)	814
	13	Easy gain tuning response level setting	818
	14	Easy gain tuning selection	819
	15	Number of encoder pulses	851
	16	Encoder rotation direction	852
	17	Thermal protector input	876
Adjustment parameters	18	Position loop gain	422
	19	Position feed forward gain	423
	20	In-position width	426
	21	Error excessive level	427
	22	Speed control P gain 1	820
	23	Speed control integral time 1	821
	24	Model speed control gain	828

	No.	Name	Inverter Parameter No.	
Adjustment parameters	25	Notch filter frequency	862	
	26	Notch filter depth	863	
	27	Speed feed forward control/model adaptive speed control selection	877	
	28	Speed feed forward filter	878	
	29	Speed feed forward torque restriction	879	
	30	Load inertia ratio	880	
	31	Speed feed forward gain	881	
	Extended parameters	32	DA1 terminal function selection	54
		33	Speed monitoring reference	55
		34	Current monitoring reference	56
		35	DA2 terminal function selection	158
36		Overspeed detection level	374	
37		Torque characteristic selection	801	
38		Constant output region torque characteristic selection	803	
39		Torque monitoring reference	866	

### CAUTION

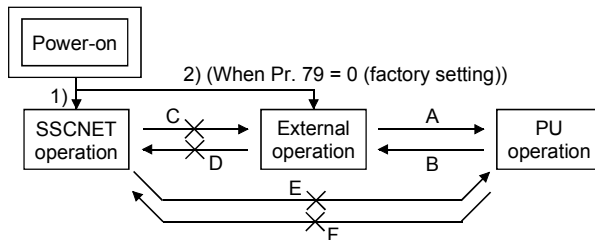
If any of the initial communication setting parameter values is outside the setting range, "E.9" is displayed at the time of initial communication.

### REMARKS

Refer to the inverter manual for details of the parameters.

## 6. INVERTER SETTINGS AND INDICATIONS

### 6.1 Operation Mode Switchover




#### (1) Starting operation mode

Symbol	Switchover Type	Switchover Method
1)	SSCNET operation mode	When the station number setting is any of 0 to 7 (first to eighth axes). (SSCNET operation is enabled at completion of initial communication.)
2)	External operation (Pr. 79 = 0 (factory setting))	When the FR-V5NS is not fitted or the station number setting is F.

#### (2) Operation mode switchover (When Pr. 79 = 0)

Symbol	Switchover Type	Switchover Method
A	External operation → PU operation	Operate the PU operation key on the PU.
B	PU operation → external operation	Operate the external operation key on the PU.
C	SSCNET operation → external operation	Switchover is disabled while power is on. After switching power off, remove the FR-V5NS or set the station number to F and switch power on.
D	External operation → SSCNET operation	Switchover is disabled while power is on. After switching power off, set the station number to any of 0 to 7 and switch power on with the FR-V5NS fitted.
E	SSCNET operation → PU operation	Switchover is disabled while power is on. After switching power off, remove the FR-V5NS or set the station number to F, switch power on, and then press the PU button to switch the operation mode.
F	PU operation → SSCNET operation	Switchover is disabled while power is on. After switching power off, set the station number to any of 0 to 7 and switch power on with the FR-V5NS fitted.

### CAUTION

1. In the SSCNET operation mode, the Pr. 79 "operation mode selection" setting is invalid.
2. Any station number changed with power on is invalid. The setting is made valid when power is switched on again or a reset is made with the RES terminal.
3. Even if SSCNET operation is being performed,  of the PU (FR-DU04-1/FR-PU04V) can be used to make a stop (when Pr. 75 = 14 (factory setting) to 17). At this time, the deceleration time is 0s. Refer to the inverter manual for Pr. 75 "PU stop selection".

### REMARKS

During SSCNET operation, "NET" is displayed on the FR-PU04V and the "EXT" LED is lit on the FR-DU04-1 to indicate the operation mode.

## 6.2 Initial Communication Waiting Status ("CF" alarm)

If SSCNET communication is disabled due to the fault of the communication cable and the power-off of the communication equipment (personal computer) or motion controller, etc., the output is shut off and the CF alarm is displayed on the FR-DU04-1 (or FR-PU04V).

Pr. 499 "action selection at SSCNET communication interruption" can be used to select the operation to be performed at occurrence of communication interruption.

### 6.2.1 Pr. 499 "action selection at SSCNET communication interruption"

You can select the operation to be performed at occurrence of communication interruption.

Pr. 499 Setting	Operation	
0 (Factory setting)	Output shutoff (coasting)	Reset the inverter. The inverter is placed in the initial communication waiting status (CF alarm) and can be recovered from the alarm when initial communication is restarted.
1	Output shutoff (coasting)	"E.OP3" is displayed. Resetting the inverter places it in the initial communication waiting status (CF alarm) and allows it to be recovered from the alarm when initial communication is restarted.

#### REMARKS

If communication data is in a CRC error etc., E.OP3 occurs regardless of the Pr. 499 setting.

### 6.2.2 Pr. 52 "DU/PU main display data selection"

You can select the SSCNET communication status to be displayed on the operation panel or parameter unit. To display it, set "39" in Pr. 52 and select the voltage monitor (third monitor). Refer to page 13 for the monitored data.

Pr.No	Function	Setting Range	Remarks
52	DU/PU main display data selection	0, 5 to 12, 17 to 20, 23, 24, 32 to 35, 38, 39	Set 39 to display the SSCNET communication status monitor.

#### REMARKS

For the set values of other than "39", refer to the inverter manual.

# 7. RESTRICTIONS ON THE FUNCTIONS

## 7.1 Inverter Parameter List

Function validity: There are restrictions on the inverter functions in the SSCNET communication operation mode. O indicates the valid parameter, and X the invalid parameter.

Inverter Parameter No.	Name	Function Validity
0	Torque boost (manual)	X
1	Maximum speed	O
2	Minimum speed	X
3	Base frequency	X
4	Multi-speed setting (high speed)	X
5	Multi-speed setting (middle speed)	X
6	Multi-speed setting (low speed)	X
7	Acceleration time	X
8	Deceleration time	X
9	Electronic thermal O/L relay	O
10	DC injection brake operation speed	X
11	DC injection brake operation time	X
12	DC injection brake voltage	X
13	Starting speed	X
15	Jog speed setting	X
16	Jog acceleration/deceleration time	X
17	MRS input selection	O
19	Base frequency voltage	X
20	Acceleration/deceleration reference speed	X

Inverter Parameter No.	Name	Function Validity
21	Acceleration/deceleration time increments	X
22	Torque restriction level	O
24	Multi-speed setting (speed 4)	X
25	Multi-speed setting (speed 5)	X
26	Multi-speed setting (speed 6)	X
27	Multi-speed setting (speed 7)	X
28	Multi-speed input compensation	X
29	Acceleration/deceleration pattern	X
30	Regenerative function selection	O
31	Speed jump 1A	X
32	Speed jump 1B	X
33	Speed jump 2A	X
34	Speed jump 2B	X
35	Speed jump 3A	X
36	Speed jump 3B	X
37	Speed display	O
41	Up-to-speed sensitivity	X
42	Speed detection	O
43	Speed detection for reverse rotation	O

Inverter Parameter No.	Name	Function Validity
44	Second acceleration/deceleration time	X
45	Second deceleration time	X
50	Second speed detection	O
52	DU/PU main display data selection	O
53	PU level display data selection	O
54	DA1 terminal function selection	O
55	Speed monitoring reference	O
56	Current monitoring reference	O
57	Restart coasting time	X
58	Restart cushion time	X
59	Remote setting function selection	X
60	Intelligent mode selection	X
65	Retry selection	X
67	Number of retries at alarm occurrence	X
68	Retry waiting time	X
69	Retry count display erasure	X
70	Special regenerative brake duty	O
71	Applied motor	O
72	PWM frequency selection	O



## RESTRICTIONS ON THE FUNCTIONS

Inverter Parameter No.	Name	Function Validity
73	Speed setting signal	X
75	Reset selection/disconnected PU detection/PU stop selection	○
77	Parameter write disable selection	○
78	Reverse rotation prevention selection	○
79	Operation mode selection	X
80	Motor capacity	○
81	Number of motor poles	○
82	Motor excitation current (no load current)	○
83	Rated motor voltage	○
84	Rated motor frequency	○
90	Motor constant R1	○
91	Motor constant R2	○
92	Motor constant L1	○
93	Motor constant L2	○
94	Motor constant X	○
95	Online auto tuning selection	○
96	Auto tuning setting/status	○
110	Third acceleration/deceleration time	X
111	Third deceleration time	X
116	Third speed detection	○
117	Station number	○
118	Communication speed	○

Inverter Parameter No.	Name	Function Validity
119	Stop bit length/data length	○
120	Parity check presence/absence	○
121	Number of communication retries	○
122	Communication check time interval	○
123	Waiting time setting	○
124	CR, LF presence/absence selection	○
128	PID action selection	X
129	PID proportional band	X
130	PID integral time	X
131	Upper limit	X
132	Lower limit	X
133	PID action set point for PU operation	X
134	PID differential time	X
140	Backlash acceleration stopping speed	X
141	Backlash acceleration stopping time	X
142	Backlash deceleration stopping speed	X
143	Backlash deceleration stopping time	X
144	Speed setting switchover	X
145	PU display language selection	○
150	Output current detection level	○

Inverter Parameter No.	Name	Function Validity
151	Output current detection time	○
152	Zero current detection level	○
153	Zero current detection time	○
156	Stall prevention operation selection	○
157	OL signal output timer	○
158	DA2 terminal function selection	○
160	Extended function selection	○
162	Automatic restart after instantaneous power failure selection	X
163	First cushion time for restart	X
164	First cushion voltage for restart	X
165	Restart current restriction level	X
171	Actual operation hour meter clear	○
180*	DI1 terminal function selection	○
181*	DI2 terminal function selection	○
182*	DI3 terminal function selection	○
183*	DI4 terminal function selection	○
187*	STR terminal function selection	○
190*	DO1 terminal function selection	○
191*	DO2 terminal function selection	○
192*	DO3 terminal function selection	○
195*	A,B,C terminal function selection	○
232	Multi-speed setting (speed 8)	X
233	Multi-speed setting (speed 9)	X

\*Some functions of the I/O signals set using these parameters are invalid. Refer to page 24.

## RESTRICTIONS ON THE FUNCTIONS

Inverter Parameter No.	Name	Function Validity
234	Multi-speed setting (speed 10)	X
235	Multi-speed setting (speed 11)	X
236	Multi-speed setting (speed 12)	X
237	Multi-speed setting (speed 13)	X
238	Multi-speed setting (speed 14)	X
239	Multi-speed setting (speed 15)	X
240	Soft-PWM setting	O
244	Cooling fan operation selection	O
250	Stop selection	X
251	Output phase failure protection selection	O
252	Override bias	X
253	Override gain	X
261	Power failure stop selection	X
262	Subtracted speed at deceleration start	X
263	Subtraction starting speed	X
264	Power-failure deceleration time 1	X
265	Power-failure deceleration time 2	X
266	Power-failure deceleration time switchover speed	X
278	Brake opening speed	X
279	Brake opening current	X
280	Brake opening current detection time	X

Inverter Parameter No.	Name	Function Validity
281	Brake operation time at start	X
282	Brake operation speed	X
283	Brake operation time at stop	X
284	Deceleration detection function selection	X
285	Overspeed detection speed	X
286	Droop gain	O
287	Droop filter constant	O
288	Droop function activation selection	O
306	Analog output signal selection	O
307	Setting for zero analog output	O
308	Setting for maximum analog output	O
309	Analog output signal voltage/current switchover	O
310	Analog meter voltage output selection	O
311	Setting for zero analog meter voltage output	O
312	Setting for maximum analog meter voltage output	O
313	Y0 output selection	O
314	Y1 output selection	O
315	Y2 output selection	O
316	Y3 output selection	O
317	Y4 output selection	O

Inverter Parameter No.	Name	Function Validity
318	Y5 output selection	O
319	Y6 output selection	O
320	RA1 output selection	O
321	RA2 output selection	O
322	RA3 output selection	O
330	RA output selection	O
331	Station number	X
332	Communication speed	X
333	Stop bit length	X
334	Parity check presence/absence	X
335	Number of communication retries	X
336	Communication check time interval	X
337	Waiting time setting	X
341	CR/LF presence/absence selection	X
342	E <sup>2</sup> PROM write selection	O
350	Stop position command selection	X
351	Orientation switchover speed	X
356	Internal stop position command	X
357	In-position zone	X
360	External position command selection	X
361	Position shift	X
362	Orientation position loop gain	X

\*Some functions of the I/O signals set using these parameters are invalid. Refer to page 24.

## RESTRICTIONS ON THE FUNCTIONS

Inverter Parameter No.	Name	Function Validity
374	Overspeed detection level	○
380	Acceleration S pattern 1	×
381	Deceleration S pattern 1	×
382	Acceleration S pattern 2	×
383	Deceleration S pattern 2	×
393	Orientation selection	×
396	Orientation speed gain (P term)	×
397	Orientation speed integral time	×
398	Orientation speed gain (D term)	×
399	Orientation deceleration ratio	×
400*	DI11 terminal function selection	○
401*	DI12 terminal function selection	○
402*	DI13 terminal function selection	○
403*	DI14 terminal function selection	○
404*	DI15 terminal function selection	○
405*	DI16 terminal function selection	○
406	High resolution analog input selection	×
407	Motor temperature detection filter	○
410*	D011 terminal function selection	○
411*	D012 terminal function selection	○
412*	D013 terminal function selection	○
413	Encoder pulse output division ratio	○
419	Position command right selection	×
420	Command pulse scaling factor numerator	×

Inverter Parameter No.	Name	Function Validity
421	Command pulse scaling factor denominator	×
422	Position loop gain	○
423	Position feed forward gain	○
424	Position command acceleration/ deceleration time constant	×
425	Position feed forward command filter	×
426	In-position width	○
427	Excessive level error	○
430	Pulse monitor selection	○
450	Second applied motor	×
451	Second motor control method selection	×
452	Second electronic thermal O/L relay	×
453	Second motor capacity	×
454	Number of second motor poles	×
464	Digital position control sudden-stop deceleration time	×
465	First position feed amount lower 4 digits	×
466	First position feed amount upper 4 digits	×
467	Second position feed amount lower 4 digits	×
468	Second position feed amount upper 4 digits	×

Inverter Parameter No.	Name	Function Validity
469	Third position feed amount lower 4 digits	×
470	Third position feed amount upper 4 digits	×
471	Fourth position feed amount lower 4 digits	×
472	Fourth position feed amount upper 4 digits	×
473	Fifth position feed amount lower 4 digits	×
474	Fifth position feed amount upper 4 digits	×
475	Sixth position feed amount lower 4 digits	×
476	Sixth position feed amount upper 4 digits	×
477	Seventh position feed amount lower 4 digits	×
478	Seventh position feed amount upper 4 digits	×
479	Eighth position feed amount lower 4 digits	×
480	Eighth position feed amount upper 4 digits	×
481	Ninth position feed amount lower 4 digits	×
482	Ninth position feed amount upper 4 digits	×

## RESTRICTIONS ON THE FUNCTIONS

Inverter Parameter No.	Name	Function Validity
483	Tenth position feed amount lower 4 digits	X
484	Tenth position feed amount upper 4 digits	X
485	Eleventh position feed amount lower 4 digits	X
486	Eleventh position feed amount upper 4 digits	X
487	Twelfth position feed amount lower 4 digits	X
488	Twelfth position feed amount upper 4 digits	X
489	Thirteenth position feed amount lower 4 digits	X
490	Thirteenth position feed amount upper 4 digits	X
491	Fourteenth position feed amount lower 4 digits	X
492	Fourteenth position feed amount upper 4 digits	X
493	Fifteenth position feed amount lower 4 digits	X
494	Fifteenth position feed amount upper 4 digits	X
495	Remote output selection	O
496	Remote output data 1	O
497	Remote output data 2	O
499	Action selection at SSCNET communication interruption	O

Inverter Parameter No.	Name	Function Validity
800	Control system selection	X
801	Torque characteristic selection	O
802	Pre-excitation selection	O
803	Constant output region torque characteristic selection	O
804	Torque command right selection	X
805	Torque command value (RAM)	X
806	Torque command value (RAM, E <sup>2</sup> PROM)	X
807	Speed restriction selection	X
808	Forward rotation speed restriction	X
809	Reverse rotation speed restriction	X
810	Torque restriction input method selection	X
812	Torque restriction level (regeneration)	O
813	Torque restriction level (3 quadrant)	O
814	Torque restriction level (4 quadrant)	O
815	Torque restriction level 2	X
816	Acceleration torque restriction	X
817	Deceleration torque restriction	X
818	Easy gain tuning response level setting	O
819	Easy gain tuning selection	O

Inverter Parameter No.	Name	Function Validity
820	Speed control P gain 1	O
821	Speed control integral time 1	O
822	Speed setting filter 1	X
823	Speed detection filter 1	O
824	Torque control P gain 1	O
825	Torque control integral time 1	O
826	Torque setting filter 1	X
827	Torque detection filter 1	O
828	Model speed control gain	O
830	Speed control P gain 2	X
831	Speed control integral time 2	X
832	Speed setting filter 2	X
833	Speed detection filter 2	X
834	Torque control P gain 2	X
835	Torque control integral time 2	X
836	Torque setting filter 2	X
837	Torque detection filter 2	X
840	Torque bias selection	X
841	Torque bias 1	X
842	Torque bias 2	X
843	Torque bias 3	X
844	Torque bias filter	X
845	Torque bias operation time	X
846	Torque bias balance compensation	X

## RESTRICTIONS ON THE FUNCTIONS

Inverter Parameter No.	Name	Function Validity
847	Fall-time torque bias No. 3 bias	X
848	Fall-time torque bias No. 3 gain	X
849	Analog input offset adjustment	X
851	Number of PLG pulses	O
852	PLG rotation direction	O
854	Excitation ratio	O
859	Torque current	O
862	Notch filter frequency	O
863	Notch filter depth	O
864	Torque detection	O
865	Low speed detection	O
866	Torque monitoring reference	O
867	DA1 output filter	O
868	No. 1 terminal function assignment	X
870	Speed deviation level	O
871	Speed deviation time	O
873	Speed restriction	X
874	OLT level setting	O
875	Fault definition	X
876	Thermal protector input	O
877	Speed feed forward/model adaptive speed control selection	O
878	Speed feed forward filter	O

Inverter Parameter No.	Name	Function Validity
879	Speed feed forward torque restriction	O
880	Load inertia ratio	O
881	Speed feed forward gain	O
890	Maintenance output setting time	O
891	Maintenance output timer	O
892	Maintenance output signal clear	O
900	DA1 terminal calibration	O
901	DA2 terminal calibration	O
902	Speed setting No.2 bias	X
903	Speed setting No.2 gain	X
904	Torque command No.3 bias	X
905	Torque command No.3 gain	X
917	No. 1 terminal bias (speed)	X
918	No. 1 terminal gain (speed)	X
919	No. 1 terminal bias (torque/magnetic flux)	X
920	No. 1 terminal gain (torque/magnetic flux)	X
990	PU buzzer control	O
991	PU contrast adjustment	O

## REMARKS

Whether the I/O terminal function in the SSCNET communication operation mode is valid or invalid is indicated by O or X.

Input Signal			Input Signal			Output Signal			Output Signal		
Signal name		Validity	Signal name		Validity	Signal name		Validity	Signal name		Validity
RL	Low-speed operation command (Pr. 59 = 0)	X	X14	PID control enable terminal	X	RUN	Inverter running	O	FAN	Fan fault output	O
	Remote setting (setting clear) (Pr. 59 = other than 0)	X	BRI	Brake sequence opening signal	X	SU	Up to speed	X	FIN	Heatsink overheat prealarm	O
RM	Mid-speed operation command (Pr. 59 = 0)	X	X16	PU operation/external operation switchover	X	IPF	Instantaneous power failure or undervoltage	O	ORA	Orientation in-position	X
	Remote setting (deceleration) (Pr. 59 = other than 0)	X	X20	S-pattern acceleration/ deceleration C switchover terminal	X	OL	Overload alarm	O	Y30	Output during forward rotation	O
RH	High-speed operation command (Pr. 59 = 0)	X	X22	Orientation command	X	FU, FB	Output speed detection	O	Y31	Output during reverse rotation	O
	Remote setting (acceleration) (Pr. 59 = other than 0)	X	LX	Pre-excitation/servo on	X	FU2, FB2	Second output speed detection	O	Y32	Regeneration status output	O
RT	Second function selection/ second motor switchover	X	MRS	Output stop	O	FU3, FB3	Third output speed detection	O	RY2	Operation ready 2	O
JOG	Jog operation selection	X	STOP	Start self-hold selection	X	RBP	Regenerative brake prealarm	O	LS	Low speed output	O
REX	15 speed selection (Combination with three speeds RL, RM, RH)	X	MC	Control mode switchover	X	THP	Electronic thermal overload protection prealarm	O	TU	Torque detection	O
X9	Third function selection	X	TL	Torque restriction selection	X				Y36	In-position	O
X10	FR-HC, FR-CV connection (Inverter operation enable signal)	O	X42	Torque bias selection 1	X	PU	PU operation mode	X	Y40	Trace status	O
X11	FR-HC connection (instantaneous power failure detection)	X	X43	Torque bias selection 2	X	RY	Inverter operation ready	O	RUN 2	Inverter running 2	O
X12	PU operation external interlock signal	X	X44	P control selection (P/PI control switchover)	X	Y12	Output current detection	O	REM	Remote output*	O
			X45	Servo on (position control)	X	Y13	Zero current detection	O	ER	Minor fault output 2	X
			STR	Reverse rotation command	X	FDN	PID lower limit	X	LF	Minor fault output	O
			STF	Forward rotation command	X	FUP	PID upper limit	X	ABC	Alarm output	O
			OH	External thermal relay	O	RL	PID forward/reverse rotation output	X	-	No function	O
			-	No function	O	BOF	Brake opening request	X			
			RES	Reset	O						
			1	Speed setting auxiliary input	X						
			2	Speed setting input	X						

\* The function using the PU connector is valid.

## 8. PRECAUTIONS

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- The inverter parameter values cannot be changed from the motion controller. Use the PU (FR-DU04-1/FR-PU04V) to change them. (Except the initial communication setting parameters)
- The usable encoder pulses are 1000 to 4096 pulses.
- Start and stop are SSCNET commands, and STR and STF are disabled. Among the external inputs (commands), only MRS, RES and OH are enabled.
- Before starting operation, always give the servo ON signal from the host controller to put the motor in the servo lock status, and then start operation.
- The running speed and rotation direction are as commanded from the motion controller.
- During SSCNET operation, the acceleration/deceleration of the inverter is automatically set to 0 s. When "0" is set in Pr.288 "droop function activation selection", droop control can not be performed. Set "1" or "2" in Pr.288. (For details, refer to the inverter manual.)
- The overcurrent and overvoltage alarms in the SSCNET operation mode are "E.OC3" and "E.OV3", respectively. (For details, refer to the inverter manual.)
- The restrictions on the I/O signals (refer to page 24) also apply to the case where any of the other options (FR-A5AY, FR-A5AR, FR-A5NR, FR-V5AX, FR-V5AY) is used with this option. (When the FR-A5NR is used with this option, RS-485 communication is disabled.)
- Offline auto tuning cannot be performed from the motion controller. Perform it from the PU before starting communication.

## 9. ALARM INDICATION DEFINITIONS AND CORRECTIVE ACTIONS

This section provides the definitions of the alarm indications and their corrective actions.

### (1) Faults

When any of the protective functions is activated, the inverter shuts off the output and outputs the corresponding alarm.

When the protective function is activated, find the cause, and then refer to the inverter manual and reset the inverter to resume operation.

<b>Operation panel indication</b>	<b>E.OP3</b>	<b>E.OP3</b>	<b>FR-PU04V</b>	<b>Option slot alarm 3</b>
<b>Name</b>	Option slot 3 alarm			
<b>Description</b>	<ul style="list-style-type: none"> <li>• If communication shutoff occurs at the Pr. 499 "action selection at SSCNET communication interruption" setting of "1", this alarm is displayed and the inverter output is stopped. If a communication line alarm occurs between the motion controller and plug-in option, the inverter output is stopped.</li> </ul>			
<b>Check point</b>	<ul style="list-style-type: none"> <li>• Check for communication shutoff.</li> <li>• Check that the plug-in option is connected to the connector securely.</li> <li>• Check the communication cable for wire break.</li> <li>• Check that the terminating resistor is set correctly.</li> <li>• Check that the option card is normal.</li> </ul>			
<b>Corrective action</b>	<ul style="list-style-type: none"> <li>• Recover communication from shutoff.</li> <li>• Check the option function settings, etc.</li> <li>• Connect the plug-in option securely.</li> </ul>			

<b>Operation panel indication</b>	<b>E. 3</b>	<b>E. 3</b>	<b>FR-PU04V</b>	<b>Fault 3</b>
<b>Name</b>	Option alarm			
<b>Description</b>	If poor contact etc. occurs at the connector between the inverter and communication option, the inverter output is stopped.			
<b>Check point</b>	Check that the communication option is plugged into the connector securely.			
<b>Corrective action</b>	<ul style="list-style-type: none"> <li>• Connect the communication option securely.</li> <li>• Contact your sales representative.</li> </ul>			



## ALARM INDICATION DEFINITIONS AND CORRECTIVE ACTIONS

<b>Operation panel indication</b>	<b>E. 9</b>	<b>E. 9</b>	<b>FR-PU04V</b>	<b>Fault 9</b>
<b>Name</b>	Initial communication alarm			
<b>Description</b>	If any of the values set in the initial communication parameters is outside the setting range at the time of initial communication of the motion controller and inverter (FR-V5NS), the alarm is displayed and initial communication is stopped.			
<b>Check point</b>	Check that the initial communication parameter values are set within the setting ranges.			
<b>Corrective action</b>	Refer to page 14 and check the initial communication parameter values.			

### (2) Alarm

When the protective function is activated, the output is not shut off.

<b>Operation panel indication</b>	<b>CF</b>	<b>CF</b>	<b>FR-PU04V</b>	<b>CF</b>
<b>Name</b>	Initial communication waiting status			
<b>Description</b>	If SSCNET communication is disabled due to the fault of the communication cable or the power-off of the communication equipment (personal computer) or motion controller, the output is shut off and the alarm is displayed. The operation to be performed at occurrence of communication shutoff can be selected using Pr. 499 "action selection at SSCNET communication interruption".			
<b>Check point</b>	<ul style="list-style-type: none"> <li>• Check the communication cable for a fault.</li> <li>• Check that the communication equipment (personal computer) and motion controller have not been powered off.</li> <li>• Check that the setting of Pr. 499 "action selection at SSCNET communication interruption" is correct.</li> </ul>			
<b>Corrective action</b>	<ul style="list-style-type: none"> <li>• Change the communication cable.</li> <li>• Power on the communication equipment (personal computer) and motion controller.</li> <li>• Check the Pr. 499 "action selection at SSCNET communication interruption" setting.</li> </ul>			

## REVISIONS

\*The manual number is given on the bottom left of the back cover.

Print Date	*Manual Number	Revision	
May, 2002	IB(NA)-0600106E-A	First edition	
Jul., 2003	IB(NA)-0600106E-B	<table border="1"><tr><td>Additions</td></tr></table> Torque control setting	Additions
Additions			
Feb., 2005	IB(NA)-0600106E-C	<table border="1"><tr><td>Additions</td></tr></table> Procedure for fabricating SSCNET cable	Additions
Additions			