MITSUBISHI ELECTRIC

INVERTER
Plug-in option
FR-A7NCA
INSTRUCTION MANUAL

CANopen *communication function*

700 series

Thank you for choosing this Mitsubishi Inverter plug-in option.
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".

⚠ WARNING	Assumes that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠ CAUTION	Assumes that incorrect handling may cause hazardous conditions, resulting in medium or slight injury, or may cause physical damage only.

Note that even 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.

SAFETY INSTRUCTIONS

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 or wiring cover removed. Otherwise, you may access the exposed high-voltage terminals and charging part and get an electric shock.
- 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 indication of the inverter operation panel 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.
- Any person who is involved in the wiring or inspection of this equipment should be fully competent to do the work.
- Always install the plug-in option before wiring. Otherwise, you may get an electric shock or be injured.
- Do not touch the plug-in option with wet hands. Otherwise you may get 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

- Apply only the voltage specified in the instruction manual to each terminal. Otherwise, burst, damage, etc. may occur.
- Ensure that the cables are connected to the correct terminals. Otherwise, burst, damage, etc. may occur.
- Always make sure that polarity is correct to prevent damage, etc. Otherwise, burst, damage may occur.
- 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 plug-in option 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 other conductive bodies such as screws and metal fragments or other flammable substance such as oil from entering the inverter.

2) Trial run

⚠ 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, reset the required parameters before starting operations. Each parameter returns to the initial value.
- 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 in-depth 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.

— CONTENTS —

1 PRE-OPERATION INSTRUCTIONS

1.1 Unpacking and Product Confirmation

Take the plug-in option 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 for the FR-A700 series inverter assembled in and after July 2006.
Check the SERIAL number printed on the rating plate or the Serial number sticker of the inverter or package and check that the first three digits of the SERIAL number is the number in the table next page.

● SERIAL number check

(1) For the FR-A740-00023 to 00620-EC

Refer to the inverter manual for the position of the rating plate.

Rating plate example

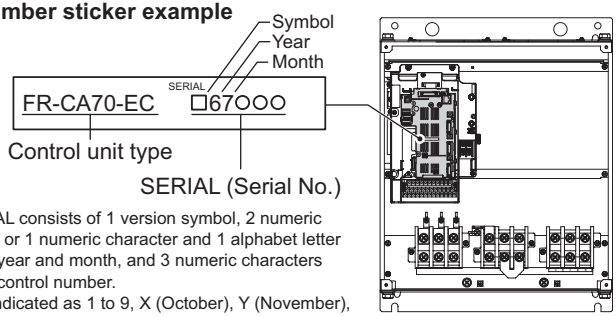
□	6	7	○○○○○○
Symbol	Year	Month	Control number
SERIAL (Serial No.)			

The SERIAL consists of 1 version symbol, 2 numeric characters or 1 numeric character and 1 alphabet letter indicating year and month, and 6 numeric characters indicating control number.
Month is indicated as 1 to 9, X (October), Y (November), and Z (December).

(2) For the FR-A740-00770 to 12120-EC

Check the SERIAL indicated on the Serial number sticker shown below.

Serial number sticker example



The SERIAL consists of 1 version symbol, 2 numeric characters or 1 numeric character and 1 alphabet letter indicating year and month, and 3 numeric characters indicating control number.
Month is indicated as 1 to 9, X (October), Y (November), and Z (December).

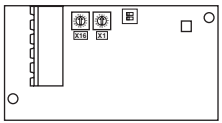
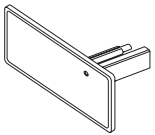
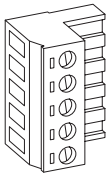
- To check the SERIAL, the front cover must be removed.
  For the removal of the front cover, refer to the inverter manual.

● Compatible SERIAL number list

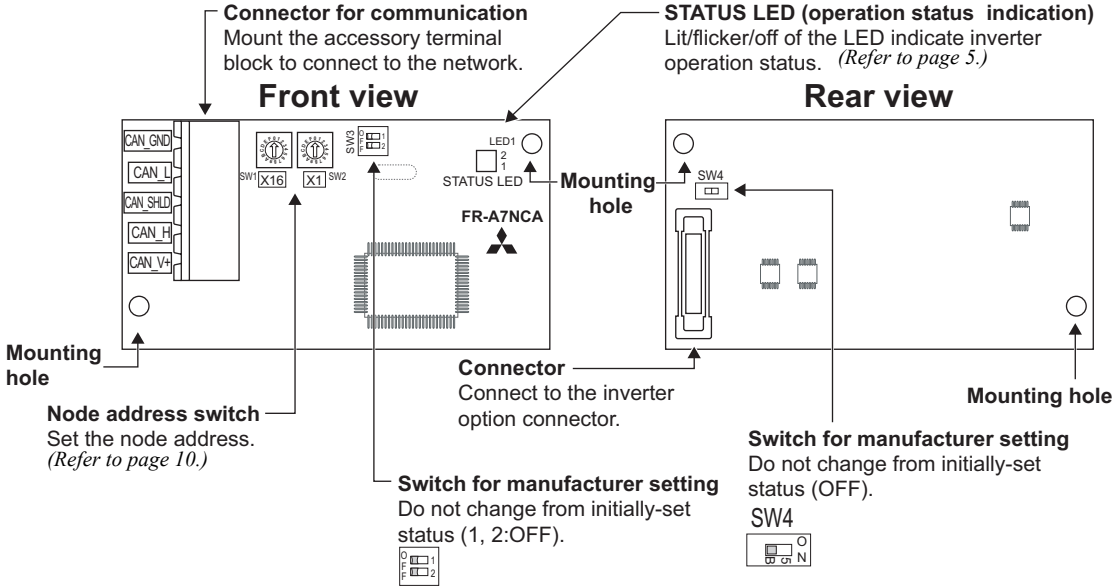
Type	SERIAL (the first three digits)
FR-A740-00023 to 00620-EC	E67 or later
FR-A740-00770 to 12120-EC	D67 or later

1.1.1 Packing confirmation

Check the enclosed items.

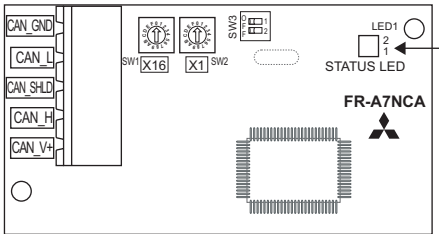
Plug-in option ..... 1 	Mounting screw (M3 × 6mm) ..... 2 *(Refer to page 8.)* 	Hex-head screw for option mounting (5.5mm) ..... 1 *(Refer to page 8.)* 
Communication option LED display cover ..... 1 *(Refer to page 7.)* 	Terminal block ..... 1 *(Refer to page 12.)* 	CANopen is a registered trademark of CiA (CAN in Automation).

1.1.2 Parts


Connector for communication
Mount the accessory terminal block to connect to the network.
STATUS LED (operation status indication)
Lit/flicker/off of the LED indicate inverter operation status. (Refer to page 5.)
Front view
Rear view
CAN_GND
CAN_L
CAN_SHLD
CAN_H
CAN_V+
SW1
X16
X1
SW2
SW3
LED1
STATUS LED
FR-A7NCA
SW4
Mounting hole
Mounting hole
Node address switch
Set the node address.
(Refer to page 10.)
Connector
Connect to the inverter option connector.
Mounting hole
Switch for manufacturer setting
Do not change from initially-set status (1, 2:OFF).
Switch for manufacturer setting
Do not change from initially-set status (OFF).
SW4
ON

1.2 STATUS LED (operation status indication)

STATUS LED indicates the operating status of the option unit according to the indication status of LED (RUN, ERR).



STATUS LED
Green: Indicates operating status
Red: Indicates error status

Indicates network status and error status of the device.

LED indication status		Status	Description
Off		Power OFF/Reset Hold Without error	Power of the device is OFF. Or reset held status. The inverter functions properly.
Green (RUN)	Single flash	"STOPPED"	The network status of the device is "Stopped"
	Blinking	"PRE-OPERATIONAL"	The network status of the device is "Pre-Operational"
	On	"OPERATIONAL"	The network status of the device is "Operational"
Red (ERR)	Single flash	Warning	A network error such as a communication frame error has occured and a warning was given from a CAN chip. (error passive status)
	Double flash	Error control event occurrence	Error control event has occurred. · Guard message send · Heartbeat message receive
	On	Bus off	Bus off state occured to the CAN chip.

* When checked through a lens for the LED display cover, Red and Green alternately displayed (Double flash of Red during Green is lit) is observed depending on the operating status. Red indicates error status and Green indicates operating status.

REMARKS

Refer to *page 60* for network status.

1.3 Specifications

(1) Communication specifications

Item	Description
Topology	Bus
Communication speed	10Kbps to 1Mbps
Transmission distance	25m(1M) to 2500m(10k) *
Number of node	127
Communication method	PeerToPeer, broad cast
EDS file	With

* A bridge or repeater is necessary when the transmission distance is 1000m or more.

(2) List of communication service (function)

Item	Description
NMT	Slave
Error Control	Node Guarding, Heartbeat (either can be selected at configuration)
Node ID setting	Switch, parameter
Number of PDO	RPDO × 3, TPDO × 3
PDO mode	Event Driven Timer Driven Sync Remote Request
PDO Linking	Possible
PDO Mapping	Impossible (Static)
Emergency message	With
Application layer	CiA DS301 V4.01
Profile	CiA DSP402 V2.0

2 INSTALLATION

2.1 Pre-Installation Instructions

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

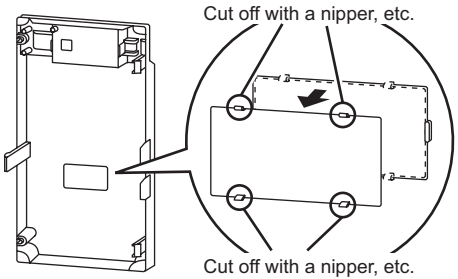
⚠ CAUTION

⚠ **With input power on, do not install or remove the plug-in option. Otherwise, the inverter and plug-in option may be damaged.**

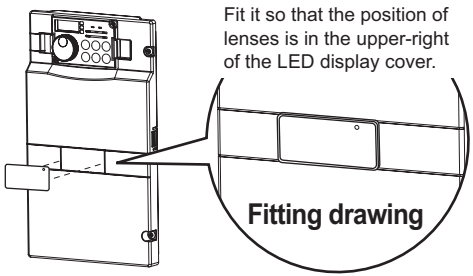
2.2 Installation of the Communication Option LED Display Cover

Mount the cover for displaying the operation status indication LED for the communication option on the inverter front cover.

1) Cut off hooks on the rear of the inverter front cover with nipper, etc. and open a window for fitting the LED display cover.



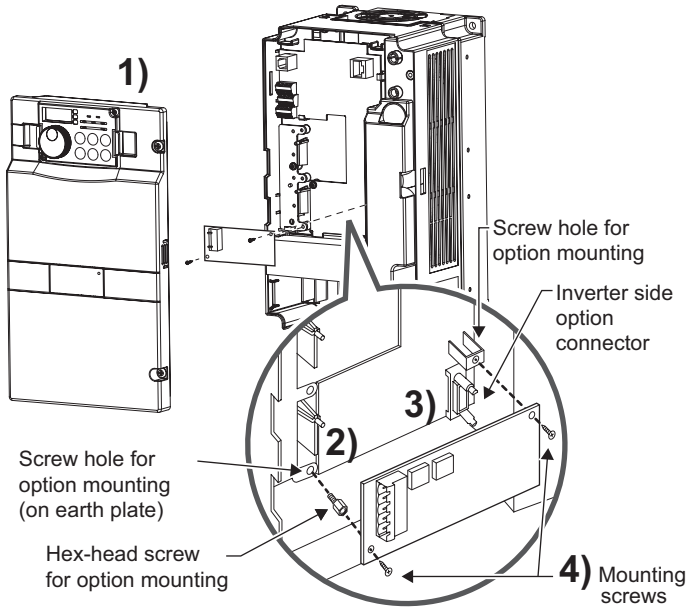
2) Fit the communication option LED display cover to the front of the inverter front cover and push it into until fixed with hooks.



⚠ CAUTION

⚠ **Take care not to hurt your hand and such with portions left by cutting hooks of the rear of the front cover.**

2.3 Installation Procedure



1) Remove the inverter front cover.

2) Mount the hex-head screw for option mounting into the inverter screw hole (on earth plate). (size 5.5mm, tightening torque 0.56N·m to 0.75N·m)

3) Securely fit the connector of the plug-in option to the inverter connector along the guides.

4) Securely fix the both right and left sides of the plug-in option to the inverter with the accessory mounting screws. If the screw holes do not line-up, the connector may not have been plugged snugly. Check for loose plugging.

REMARKS

After removing two screws on the right and left places, remove the plug-in option.

CAUTION

- **When using this option unit, mount it in the "option connector 3 (lowermost connector)" of the inverter.**

  If it is fitted in option connector 1 or 2, " E. 1 " or " E. 2 " (option alarm) is displayed and the inverter will not function. In addition, when the inverter can not recognize that the option is mounted due to improper installation, etc., " E. 3 " (option alarm) is displayed even if the option is fitted in the option connector 3.

Mounting Position	Error Display
Connector 1	E. 1
Connector 2	E. 2
Connector 3	E. 3

- **Take care not to drop a hex-head screw for option mounting or mounting screw during mounting and removal.**
- **Pull out the option straight to remove. Otherwise, the connector may be damaged by some applied force.**

2.4 Node Address Setting

(1) Setting with node address switch

Set the node address between "1 to 127(7Fh)" using node address switches on the FR-A7NCA *(refer to page 4)*.

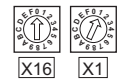
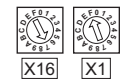
The setting is reflected when power turns on next or the inverter is reset.

Set the node address switch to node address (SW1 setting × 16 + SW2 setting).

Set *Pr.347 CANopen address* to "0 (initial value)".

Set the arrow (⇧) of the corresponding switches to the number to set a desired address.

● Setting example

Node address 1: Set the "⇧" of SW1 to "0" and the "⇧" of SW2 to "1".	
Node address 127: Set the "⇧" of SW1 to "7" and the "⇧" of SW2 to "F".	

CAUTION

1. **Set the node address switch to the switch number position correctly. If the switch is set between numbers, normal data communication can not be made.**
2. **When the node address switch is set to values other than "1 to 127", they are regarded as "127".**

Good example 

Bad example 

(2) Set with parameter *(Pr. 347)*

Use parameter *(Pr. 347)* of the inverter to set. Setting node address with parameter makes the node address switch setting invalid. The setting is reflected at the next power-on or inverter reset. *(Refer to page 15)*

3 WIRING

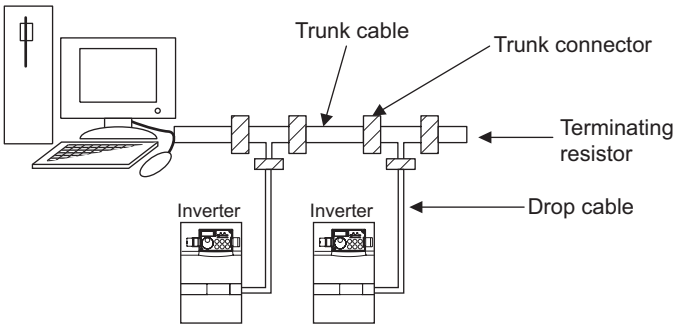
3.1 Connection to Network

(1) Be sure to check the following before connecting the inverter to the network.
- Check that the FR-A7NCA is snugly inserted into the inverter. *(Refer to page 7.)*
- Check that the correct node address is set. *(Refer to page 10.)*
- Check that a drop cable is firmly connected to the FR-A7NCA. *(Refer to page 12.)*

(2) Make sure that the terminating resistor is installed at each end (between CAN_H and CAN_L) of the trunk cable. These resistors must meet the following requirements.

Requirements of Terminating Resistors		
R (resistance value) = 124Ω	1% metal film	0.25 W

(3) Connect drop cables to the trank cable.

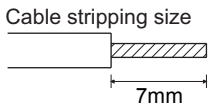


- If the trunk connector is a CANopen sanctioned pluggable or sealed connector, the connection to the active network can be made at any time whether the inverter is on or off. The option unit automatically detects when the connection is completed.
- If connecting to the network with free wires, power to the network and inverter should be shut off as a safety precaution in case two or more signal wires are accidentally shorted together.

3.2 Wiring

(1) Strip the insulation back about 40mm on the free wire end of the drop cable to expose the four colored signal wires and the silver shield wire.

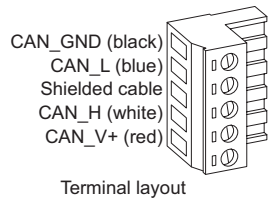
(2) Strip the insulation back of each signal cable to use. If the length of the sheath pealed is too long, a short circuit may occur among neighboring wires. If the length is too short, wires might come off.



Wire the stripped cable after twisting it to prevent it from becoming loose. In addition, do not solder it.
Use a bar type terminal as required.

(3) Loosen the terminal screw and insert the cable into the terminal according to the terminal arrignment.
Tighten each cable with fixing screws to the recommended tightening torque.

Screw Size	Tightening Torque	Cable Size	Screwdriver
M3	0.5N•m to 0.6N•m	0.3mm^2 to 0.75mm^2	Small ⊖flat-blade screwdriver (Tip thickness: 0.4mm/tip width: 2.5mm)

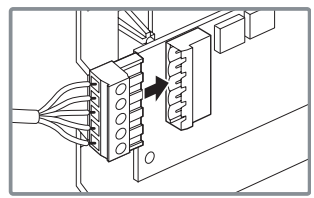


Terminal layout

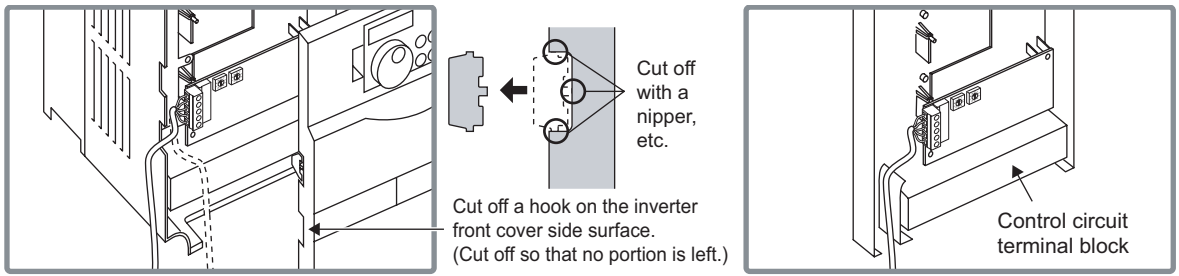
CAUTION

Undertightening can cause cable disconnection or malfunction. Overtightening can cause a short circuit or malfunction due to damage to the screw or unit.

(4) Connect the terminal block to the connector for communication of the communication option mounted on the inverter.



(5) For wiring of **FR-A740-00620-EC or less**, route wires between the control circuit terminal block and front cover. If cables can not be routed between the control circuit terminal block and front cover (approx 7mm), remove a hook of the front cover and use a space become available.
For wiring of **FR-A740-00770-EC or more**, use the space on the left side of the control circuit terminal block.



FR-A740-00620-EC or less **FR-A740-00770-EC or more**

REMARKS

- When the hook of the inverter front cover is cut off for wiring, the protective structure (JEM1030) changes to open type (IP00).

⚠ CAUTION

⚠ When performing wiring using the space between the inverter front cover and control circuit terminal block, take care not to subject the cable to stress.
⚠ After wiring, wire offcuts must not be left in the inverter. They may cause an error, failure or malfunction.

4 INVERTER SETTING

4.1 Parameter List

The following parameters are used for the communication option (FR-A7NCA)
Set the values according to need.

Parameter Number	Name	Setting Range	Minimum Setting Increments	Initial Value	Refer to Page
79	Operation mode selection	0 to 4, 6, 7	1	0	18
338	Communication operation command source	0, 1	1	0	21
339	Communication speed command source	0, 1, 2	1	0	21
340	Communication startup mode selection	0, 1, 2, 10, 12	1	0	18
342	Communication EEPROM write selection	0, 1	1	0	25
347 *	CANopen address	0 to 4095	1	0	15
348 *	CANopen baud rate	0 to 4095	1	4	16
349 *	Communication reset selection	0, 1	1	0	33
500 *	Communication error recognition waiting time	0 to 999.8s	0.1s	0	26
501 *	Communication error occurrence count display	0	1	0	27
502 *	Stop mode selection at communication error	0, 1, 2, 3	1	0	28
550	NET mode control source selection	0, 1, 9999	1	9999	21

* Parameters which can be displayed when the plug-in option (FR-A7NCA) is mounted.

4.2 Parameter for CANopen communication

CANopen communication can be set by the inverter parameter.
Parameter setting is made valid after inverter reset (turning the power off and turning the RES signal on).

4.2.1 CANopen address (Pr. 347)

Parameter Number	Name	Setting Range	Minimum Setting Increments	Initial Value
347	CANopen Address	0 to 4095	1	0

Node address can be set using *Pr.347*.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Address Key				Not Available*					Node Address						

* A value set is ignored.

Bit	Item	Initial Value	Setting Range	Definition
0 to 6	Node Address	0	0 to 127	Node Address of device is set between 1 to 127. Set "0" (initial value) to set node address with node address switch.
12 to 15	Address Key	0	0	Set "0" always. When a value other than "0"is set, the inverter operates as when "0" (initial value) is set in *Pr. 345*.

Pr.347 setting	Node Address Switch	Node Address
0	0	127
	1 to 127(7Fh)	Switch setting
	128(80h) or more	127
1 to 127	—	The *Pr.347* setting is valid regardless of the switch setting.

4.2.2 CANopen baud rate (Pr. 348)

Parameter Number	Name	Setting Range	Minimum Setting Increments	Initial Value
348	CANopen baud rate	0 to 4095	1	4

Baud rate of CANopen communication can be set using *Pr.348*.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Baud Rate Key				Not Available*								Baud Rate			

* A value set is ignored.

Bit	Item	Initial Value	Setting Range	Definition
0 to 3	Baud Rate	4	0	1Mbps
			1	800kbps
			2	500kbps
			3	250kbps
			4	125kbps (Initial value)
			5	Setting can not be made (operates as when an initial value is set)
			6	50kbps
			7	20kbps
			8	10kbps
			9 to 15	Setting can not be made (operates as when an initial value is set)
12 to 15	Baud Rate Key	0	0	Set "0" always. When a value other than "0"is set, the inverter operates as when "0" (initial value) is set in *Pr. 348*.

4.3 Operation Mode Setting

The inverter mounted with a communication option has three operation modes.

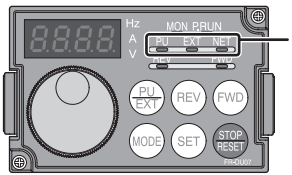
(1) PU operation [PU]..... Controls the inverter from the key of the operation panel (FR-DU07) mounted on the inverter.

(2) External operation [EXT] ... Controls the inverter by switching on/off external signals connected to the control circuit terminals of the inverter.
(The inverter is factory-set to this mode.)

(3) Network operation [NET] ... Controls the inverter with instructions from the network via the communication option.
(The operation signal and running frequency can be entered from the control circuit terminals depending on the *Pr. 338 Communication operation command source* and *Pr. 339 Communication speed command source* setting. *Refer to page 22*.)

4.3.1 Operation mode indication

FR-DU07



Operation mode indication
(The inverter operates according to the LED lit mode.)
PU: PU operation mode
EXT: External operation mode
NET: Network operation mode

4.3.2 Operation mode switching and communication startup mode (Pr. 79, Pr. 340)

(1) Operation mode switching conditions

Before switching the operation mode, check that:

1) The inverter is at a stop;
2) Both the STF and STR signals are off; and
3) The *Pr. 79 Operation mode selection* setting is correct.
   (Set with the operation panel of the inverter.)
   Refer to *the inverter manual (applied)* for details of *Pr. 79*.

(2) Operation mode selection at power on and at restoration from instantaneous power failure

The operation mode at power on and at restoration from instantaneous power failure can be selected.
Set a value other than "0" in *Pr. 340* to select the network operation mode.
After started in network operation mode, parameter write from the network is enabled.

REMARKS

1. Change of the *Pr. 340* setting is made valid when powering on or resetting the inverter.
2. *Pr. 340* can be changed with the operation panel independently of the operation mode.

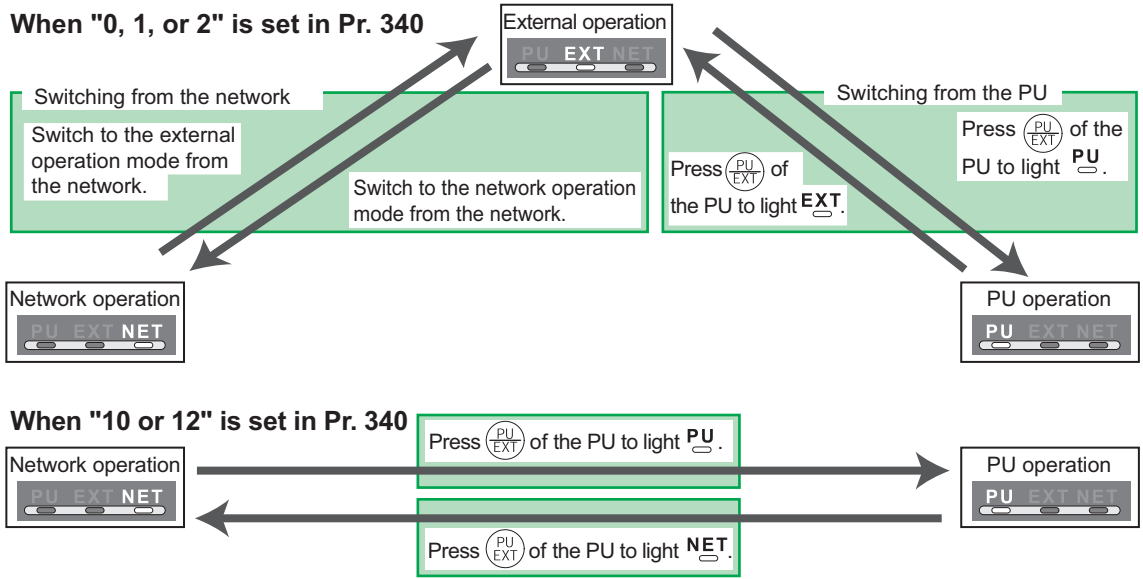
Pr. 340 Setting	*Pr. 79* Setting	Operation Mode at Power on or Power Restoration	Operation Mode Switchover
0 (initial value)	0 (initial value)	External operation mode	Switching among the external, PU, and NET operation mode is enabled *1
	1	PU operation mode	PU operation mode fixed
	2	External operation mode	Switching between the external and Net operation mode is enabled Switching to the PU operation mode is disallowed
	3, 4	External/PU combined operation mode	Operation mode switching is disallowed
	6	External operation mode	Switching among the external, PU, and NET operation mode is enabled while running.
	7	X12 (MRS) signal ON..... external operation mode	Switching among the external, PU, and NET operation mode is enabled *1
		X12 (MRS) signal OFF ... external operation mode	External operation mode fixed (Forcibly switched to external operation mode.)
1, 2 *2	0	NET operation mode	Same as when *Pr. 340* = "0"
	1	PU operation mode	
	2	NET operation mode	
	3, 4	External/PU combined operation mode	
	6	NET operation mode	
	7	X12 (MRS) signal ON .... NET operation mode	
		X12 (MRS) signal OFF ... external operation mode	
10, 12 *2	0	NET operation mode	Switching between the PU and NET operation mode is enabled *3
	1	PU operation mode	Same as when *Pr. 340* = "0"
	2	NET operation mode	NET operation mode fixed
	3, 4	External/PU combined operation mode	Same as when *Pr. 340* = "0"
	6	NET operation mode	Switching between the PU and NET operation mode is enabled while running *3
	7	External operation mode	Same as when *Pr. 340* = "0"

*1 Operation mode can not be directly changed between the PU operation mode and network operation mode.

*2 The *Pr. 340* settings "2, 12" are mainly used for communication operation using the inverter RS-485 terminal.
When a value other than "9999" (selection of automatic restart after instantaneous power failure) is set in *Pr. 57 Restart coasting time*, the inverter will resume the same operation state which was in before after power has been restored from an instantaneous power failure.
When *Pr.340* = "1, 10", a start command turns off if power failure has occurred and then restored during a start command is on.

*3 Operation mode can be changed between the PU operation mode and network operation mode with PU/EXT of the operation panel (FR-DU07) and X65 signal.

(3) Operation mode switching method



For the switching method from the external terminal, refer to *the inverter manual (applied)*.
Refer to *page 96* for a switching method from the network.

CAUTION

- When starting the inverter in network operation mode at powering on or an inverter reset, set a value other than 0 in *Pr. 340*. *(Refer to page 18)*
- When setting a value other than 0 in *Pr. 340*, make sure that the initial settings of the inverter are correct.

4.4 Operation and Speed Command Source (Pr. 338, Pr. 339, Pr. 550)

(1) Select control source for the network operation mode *(Pr. 550)*

A control location for the network operation mode can be selected from either the inverter RS-485 terminal or communication option.

When using a communication option, set "0 or 9999 (initial value)" in *Pr. 550*.

Parameter Number	Name	Initial Value	Setting Range	Description
550	NET mode operation command source selection	9999	0	Control source of the communication option is valid (control source of the inverter RS-485 terminal is invalid)
			1	Control source of the inverter RS-485 terminal is valid (control source of the communication option is invalid)
			9999	Automatic recognition of the communication option Normally, control source of the RS-485 terminal is valid. When a communication option is mounted, the control source of the communication option is valid.

Refer to the inverter manual (applied) for details.

(2) Selection of control source for the network operation mode (*Pr. 338*, *Pr. 339*)

- As control sources, there are operation command source that controls signals related to the start command and function selection of the inverter and speed command source that controls signals related to frequency setting.
- In network operation mode, commands from the external terminals and communication are as listed below.

Control Location Selection					*Pr. 338 Communication operation command source* / *Pr. 339 Communication speed command source*	0:NET			1:External			Remarks
						0:NET	1: External	2: External	0:NET	1: External	2: External	
Fixed functions (Functions equivalent to terminals)					Running frequency from communication	NET	—	NET	NET	—	NET	
					Terminal 2	—	External	—	—	External	—	
					Terminal 4	—	External		—	External		
					Terminal 1	Compensation						
Selective functions	*Pr. 178 to Pr. 189* settings	0	RL	Low-speed operation command/ remote setting clear		NET	External		NET	External		*Pr. 59* = "0" (multi-speed) *Pr. 59* = "1, 2" (remote)
		1	RM	Middle-speed operation command/ remote setting deceleration		NET	External		NET	External		
		2	RH	High-speed operation command/ remote setting acceleration		NET	External		NET	External		
		3	RT	Second function selection		NET			External			
		4	AU	Terminal 4 input selection		—	Combined		—	Combined		
		5	JOG	Jog operation selection		—			External			
		6	CS	Automatic restart after instantaneous power failure selection		External						
		7	OH	External thermal relay input		External						
		8	REX	15-speed selection		NET	External		NET	External		*Pr. 59* = "0" (multi-speed)
		9	X9	Third function		NET			External			
		10	X10	Inverter operation enable signal		External						

Control Location Selection				*Pr. 338 Communication operation command source* / *Pr. 339 Communication speed command source*	0:NET			1:External			Remarks
					0:NET	1: External	2: External	0:NET	1: External	2: External	
Selective functions	*Pr. 178 to Pr. 189* settings	11	X11	FR-HC connection, instantaneous power failure detection	External						
		12	X12	PU operation external interlock	External						
		13	X13	External DC injection brake operation is started	NET			External			
		14	X14	PID control valid terminal	NET	External		NET	External		
		15	BRI	Brake opening completion signal	NET			External			
		16	X16	PU operation-external operation switching	External						
		17	X17	Load pattern selection forward rotation reverse rotation boost	NET			External			
		18	X18	V/F swichover	NET			External			
		19	X19	Load torque high speed frequency	NET			External			
		20	X20	S-pattern acceleration/deceleration C switching terminal	NET			External			
		22	X22	Orientation command *1	NET			External			
		23	LX	Pre-excitation	NET			External			
		24	MRS	Output stop	Combined			External			*Pr. 79* ≠ "7"
				PU operation interlock	External						*Pr. 79* = "7" When the X12 signal is not assigned
		25	STOP	Start self-holding selection	—			External			
		26	MC	Control mode swichover	NET			External			
		27	TL	Torque limit selection	NET			External			
		28	X28	Start time tuning	NET			External			
		37	X37	Traverse function selection	NET			External			
		42	X42	Torque bias selection 1 *1	NET			External			
		43	X43	Torque bias selection 2 *1	NET			External			
		44	X44	P/PI control switchover	NET			External			

Control Location Selection					Pr. 338 Communication operation command source / Pr. 339 Communication speed command source	0:NET			1:External			Remarks
						0:NET	1: External	2: External	0:NET	1: External	2: External	
Selective functions	Pr. 178 to Pr. 189 settings	50	SQ	Sequence start		Combined			External			
		60	STF	Forward rotation command		NET			External			
		61	STR	Reverse rotation command		NET			External			
		62	RES	Reset		External						
		63	PTC	PTC thermistor selection		External						
		64	X64	PID forward rotation action switchover		NET	External		NET	External		
		65	X65	PU/NET operation switchover		External						
		66	X66	NET/external operation switchover		External						
		67	X67	Command source switchover		External						
		68	NP	Conditional position pulse train sign *1		External						
		69	CLR	Conditional position droop pulse clear *1		External						
		70	X70	DC feeding operation permission		NET			External			
		71	X71	DC feeding cancel		NET			External			
		74	X74	Magnetic flux decay output shutoff signal		NET			External			

*1 Available only when used with the FR-A7AP.

[Explanation of table]
External :Control by signal from external terminal is only valid.
NET :Control from network is only valid
Combined :Operation from either external terminal or communication is valid.
— :Operation from either external terminal or computer is invalid.
Compensation :Control by signal from external terminal is only valid if *Pr. 28 Multi-speed input compensation* setting is "1".

4.4.1 Communication EEPROM write selection (Pr. 342)

When parameter write is performed from the communication option, write to RAM is enabled. Set when frequent parameter changes are necessary.

Parameter Number	Name	Initial Value	Setting Range	Description
342	Communication EEPROM write selection	0	0	Parameter values written by communication are written to the EEPROM and RAM.
			1	Parameter values written by communication are written to the RAM.

· When changing the parameter values frequently, set "1" in *Pr. 342* to write them to the RAM. Performing frequent parameter write with "0 (initial value)" (EEPROM write) set will shorten the life of the EEPROM.

REMARKS

When "1" (write to RAM only) is set in *Pr. 342*, powering off the inverter will erase the changed parameter values. Therefore, the parameter values available when power is switched on again are the values stored in EEPROM previously.

4.5 Operation at Communication Error Occurrence

4.5.1 Operation selection at communication error occurrence (Pr. 500 to Pr. 502)

You can select operations at communication error occurrences by setting *Pr. 500 to Pr. 502* under network operation.

(1) The set time from when a communication line error occurrence until communication error output

You can set the waiting time from when a communication line error occurs until it is recognized as a communication error.

Parameter Number	Name	Setting Range	Minimum Setting Increments	Initial Value
500	Communication error execution waiting time	0 to 999.8s	0.1s	0

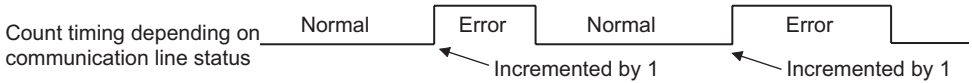
If the communication line error still persists after the time set in *Pr. 500* has elapsed, it is recognized as a communication error.

When the error is restored to normal communication within the set time, it is not regarded as a communication error and operation continues.

(2) Display and erasure of communication error occurrence count

The cumulative number of communication error occurrences can be indicated.
Write "0" to erase this cumulative count.

Parameter Number	Name	Setting Range	Minimum Setting Increments	Initial Value
501	Communication error occurrence count display	0	1	0



At the point of communication line error occurrence, *Pr. 501 Communication error occurrence count display* is incremented by 1.

CAUTION

The communication error count occurrence is stored into RAM temporarily. Since this data is stored in EEPROM at one-hour intervals, performing power-on reset or inverter may cause the *Pr. 501* data to be the value stored in EEPROM the last time depending on the reset timing.

(3) Inverter operation selection at communication error occurrence

You can select the inverter operation if a communication line error or an error of the option unit itself occurs.

Parameter Number	Name	Setting Range	Minimum Setting Increments	Initial Value
502	Stop mode selection at communication error	0, 1, 2, 3	1	0

About setting

●Operation at error occurrence

Alarm Definition	*Pr. 502* Setting	Operation	Indication	Alarm Output
Communication line	0	Continued *	Normal indication *	Not provided *
	1			
	2			
	3			
Communication option itself	0, 3	Coast to stop	E. 1 or E. 3 lit	Provided
	1, 2	Decelerated to stop	E. 1 or E. 3 lit after stop	Provided after stop

*When the error returns to normal communication within the time set in *Pr. 500,* it is not regarded as a communication line error (E.OP3).

●Operation at error recognition after elapse of *Pr. 500* time

Alarm Definition	*Pr. 502* Setting	Operation	Indication	Alarm Output
Communication line	0	Coast to stop	E.OP3 lit	Provided
	1	Decelerated to stop	E.OP3 lit after stop	Provided after stop
	2			Not provided
	3	Continued	Normal indication	
Communication option itself	0, 3	Coast to stop	E. 1 or E.3 lit	Provided
	1, 2	Decelerated to stop	E. 1 or E.3 lit after stop	Provided after stop

●**Operation at error removal**

Alarm Definition	*Pr. 502* Setting	Operation	Indication	Alarm Output
Communication line	0	Kept stopped	E.OP3 kept lit	Kept provided
	1			
	2	Restart	Normal indication	Not provided
	3	Continued		
Communication option itself	0, 3	Kept stopped	E. 1 or E.3 kept lit	Kept provided
	1, 2			

CAUTION

1. **A communication line error [E.OP3 (alarm data: HA3)] is an error that occurs on the communication line, and an error of the communication option unit itself [E. 1 (alarm data: HF1), E. 3 (alarm data: HF3)] is a communication circuit error in the option.**
2. **The alarm output indicates alarm output signal (terminal ABC1) or alarm bit output.**
3. **When the setting was made to provide an alarm output, the error definition is stored into the alarm history. (The error definition is written to the alarm history when an alarm output is provided.)**
   When no alarm output is provided, the error definition overwrites the alarm indication of the alarm history temporarily, but is not stored.
   After the error is removed, the alarm indication is reset and returns to the ordinary monitor, and the alarm history returns to the preceding alarm indication.
4. **When the *Pr. 502* setting is "1" or "2", the deceleration time is the ordinary deceleration time setting (e.g. *Pr. 8*, *Pr. 44*, *Pr. 45*).**
5. **The acceleration time at a restart is the ordinary acceleration time setting (e.g. *Pr. 7*, *Pr. 44*).**
6. **When the *Pr. 502* setting is "2", the operation/speed command at a restart is the one given before the error occurrence.**
7. **When a communication line error occurs at the *Pr. 502* setting of "2", removing the error during deceleration causes acceleration to restart at that point. (Acceleration is not restarted if the error is that of the option unit itself.)**

4.5.2 Alarm and measures

(1) The inverter operates as follows at alarm occurrences.

Alarm Location	Status		Operation Mode		
			Network Operation	External Operation	PU Operation
Inverter	Inverter operation		**Inverter trip**	Inverter trip	Inverter trip
	Data communication		**Continued**	Continued	Continued
Communication line	Inverter operation		**Inverter trip (depends on the *Pr. 502* setting)**	Continued	Continued
	Data communication		**Stop**	Stop	Stop
Communication option	Communication option connection error	Inverter operation	**Inverter trip (depends on the *Pr. 502* setting)**	Inverter trip (depends on the *Pr. 502* setting)	Inverter trip (depends on the *Pr. 502* setting)
		Data communication	**Continued**	Continued	Continued
	Error of communication option itself	Inverter operation	**Inverter trip (depends on the *Pr. 502* setting)**	Continued	Continued
		Data communication	**Stop**	Stop	Stop

(2) Measures at alarm occurrences

Alarm Indication	Alarm Definition	Measures
E.OP3	Communication line error	Check the LED status of the option unit and remove the cause of the alarm. (Refer to *page 5* for LED indication status) Inspect the master.
E.1, E.2, E.3	Option alarm	Check the connection between the inverter and option unit for poor contact, etc. and remove the cause of the error. Fit the communication option in the option connector 3.

When alarms other than the above are displayed, refer to the inverter manual and remove the cause of the alarm.

4.6 Inverter Reset

(1) Operation conditions of inverter reset

Which resetting method is allowed or not allowed in each operation mode is described below.

Resetting Method			Operation Mode		
			Network Operation	External Operation	PU Operation
Reset from the network	Inverter reset Index H2107 *(Refer to page 94)* *1		Allowed	Disallowed	Disallowed
	Reset node service *(Refer to page 62)*		Allowed	Disallowed	Disallowed
	Error reset at inverter fault *(Refer to page 33)* *2	*Pr.349* = 0	Allowed	Allowed	Allowed
		Pr.349 = 1		Disallowed	Disallowed
Turn on the terminal RES-SD			Enabled	Enabled	Enabled
Switch off inverter power			Enabled	Enabled	Enabled
Reset from the PU/DU	Inverter reset		Enabled	Enabled	Enabled
	Reset at inverter fault		Enabled	Enabled	Enabled

*1 Inverter reset can be made any time.
*2 Reset can be made only when the protective function of the inverter is activated.

CAUTION

1. **When a communication line error has occurred, reset cannot be made from the network.**
2. **The inverter is set to the external operation mode if it has been reset in network operation mode in the initial status.**
   To resume the network operation, the inverter must be switched to the network operation mode again.
   Set a value other than "0" in *Pr. 340* to start in network operation mode. *(Refer to page 18.)*
3. **The inverter can not be controlled for about 1s after release of a reset command .**

(2) Error reset operation selection at inverter fault

When used with the communication option (FR-A7NCA), an error reset command* from network can be made invalid in the external operation mode or PU operation mode.

Parameter Number	Name	Initial Value	Setting Range	Function
349	Communication reset selection	0	0	Error reset* is enabled independently of operation mode
			1	Error reset* is enabled only in the network operation mode

* Index 6040h *(Refer to page 111.)*

4.7 Frequency and Speed Conversion Specifications

When the running speed monitor is selected, each monitor and setting are determined by the combination of *Pr. 37* and *Pr. 144* as listed below. (The units within the thick frame are the initial values.)

Pr. 37 Setting	*Pr. 144* Setting	Output Frequency Monitor	Set Frequency Monitor	Running Speed Monitor	Frequency Setting Parameter Setting
0 (initial value)	0	Hz	Hz	r/min *1	Hz
	2 to 10	Hz	Hz	r/min *1	Hz
	102 to 110	Hz (r/min) *3	Hz (r/min) *3	r/min *1	Hz (r/min) *3
1 to 9998	0	Hz	Hz	Machine speed *1	Hz
	2 to 10	Hz (Machine speed) *3	Hz (Machine speed) *3	Machine speed *1	Hz (Machine speed) *3
	102 to 110	Hz	Hz	r/min *1	Hz

*1 Motor speed r/min conversion formula ..... frequency × 120/number of motor poles (*Pr. 144*)
Machine speed conversion formula ..... *Pr. 37* × frequency/*Pr. 505**
* *Pr. 505* is always set as frequency (Hz).
For *Pr. 144* in the above formula, the value is "*Pr. 144*-100" when "102 to 110" is set in *Pr. 144* and the value is "4" when *Pr. 37* = 0 and *Pr. 144* = 0.

*2 The increments for Hz are 0.01Hz, machine speed are 1m/min, and r/min are 1r/min.

*3 When the FR-A7NCA is not mounted, the unit of the value is as in parenthesis.

REMARKS

Refer to the inverter manual (applied) for details of *Pr. 37, Pr. 144, and Pr. 505*.

5 FUNCTIONS

5.1 Output from the Inverter to the Network

Main items to be output from the inverter (FR-A7NCA) to the network and their descriptions are explained below.

Item	Description	Refer to Page
Inverter monitor	Monitor various items such as inverter output frequency and output current.	91
Operation mode read	Read the operation mode of the inverter.	96
Parameter read	Read parameter settings of the inverter.	97, 98
Inverter status	Monitor the output signal of the inverter.	108
Alarm definition	Monitor the alarm history of the inverter.	99

REMARKS

Refer to *the inverter manual (applied)* for functions controllable from the network in each operation mode.

5.2 Input to the Inverter from the Network

Main items which can be commanded from the network to the inverter and their descriptions are explained below.

Item	Description	Refer to Page
Frequency setting	Set the running frequency of the inverter.	103, 105, 109, 110
Operation mode write	Set the operation mode of the inverter.	96
Run command	Set the control input command such as forward operation signal (STF) and reverse rotation signal (STR).	101, 107
Inverter reset	Reset the inverter.	94, 111
Parameter write	Set parameters of the inverter.	97, 98
Parameter clear	Return parameters to the initial values.	95

REMARKS

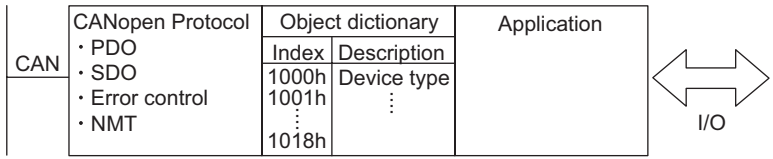
Refer to *the inverter manual (applied)* for functions controllable from the network in each operation mode.

6 CANopen DEFINITIONS

6.1 Communication method

There are two objects for CANopen data communication objects: Process Data Object (PDO) and Service Data Object (SDO).
PDO has features such as transmission of real time data and no response (Ack) requirement, and can be used for general process data transmission. SDO has features such as peer to peer communication and correct communication by response waiting and can handle a large amount of data. Therefore it is used for setting change and diagnosis of device.

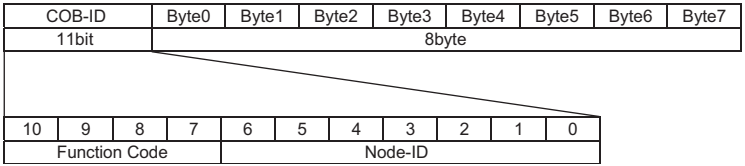
Device model of CANopen communication is indicated below.



Refer to a CANopen standard material for details.

6.2 Message format

A message format consists of "COB.ID" and "data part".
COB-ID (Communication Object ID) is a message header part and consists of 11 bit length data. In addition, a data part is 8 byte length and data arrangement of word length and long length is "little endian (arranged in order from the lowest byte)".



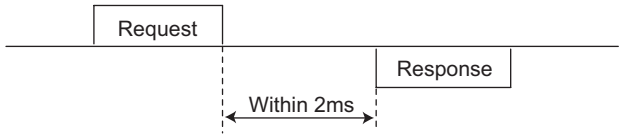
Direction of message	COB-ID		Description	Reference page
From master to slave	000h		Network ManagemenT service (NMT)	60
From master to slave	080h		SYNChronisation service (SYNC)	74
From slave to master	080h	+ Node-ID	EMergenCY service (EMCY)	80
From slave to master	180h	+ Node-ID	1st Transmit PDO(Drive Profile TPDO1)	45
From master to slave	200h	+ Node-ID	1st Receive PDO(Drive Profile RPDO1)	41
From slave to master	— *		2nd Transmit PDO(Drive Profile TPDO6)	46
From master to slave	— *		2nd Receive PDO(Drive Profile RPDO6)	42
From slave to master	— *		3rd Transmit PDO(Manufacture TPDO21)	47
From master to slave	— *		3rd Receive PDO(Manufacture RPDO21)	43
From slave to master	580h	+ Node-ID	Transmit SDO	50
From master to slave	600h	+ Node-ID	Receive SDO	48
From master to slave	700h	+ Node-ID	Network management(NMT, Guarding, Heartbeat)	63, 65
From slave to master			Network management(Bootup protocol)	66

* Set any empty COB-ID in the system.

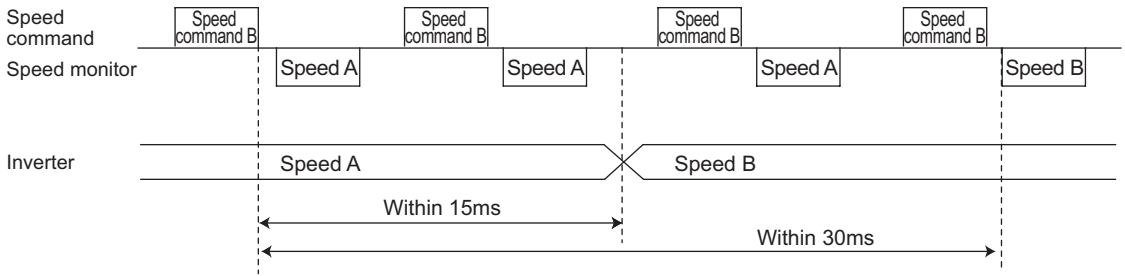
6.3 Response Level

6.3.1 Response level of PDO

(1) Response level of CANopen bus

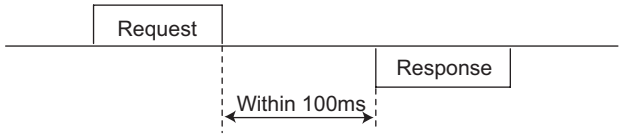


(2) Reflect timing on the atcual speed or speed monitor after speed setting

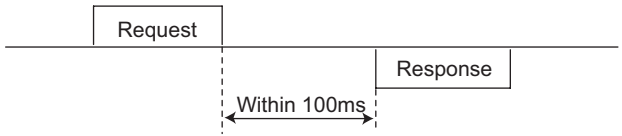


6.3.2 Response level of SDO

(1) Reading

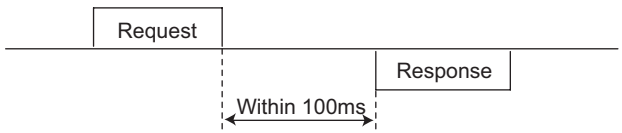


(2) Writing



(3) Parameter clearing
The inverter will not respond until parameter clear processing complete (about 5s) after sending parameter all clear command.

(4) At inverter reset
Inverter reset processing is executed after sending a response message.



7.1 Process Data Object (PDO)

7.1.1 Receive PDO

Standard				A7NCA Support
PDO No.	Mapping object Index	Mapping object name	Description	
1	6040h	control word	controls the state machine	○ (1stRPDO)
2	6040h 6060h	control word modes_of_operation	controls the state machine and mode of operation	—
3	6040h 607Ah	control word target_position	controls the state machine and the target position(pp)	—
4	6040h 60FFh	control word target_velocity(pv)	controls the state machine and the target velocity(pv)	—
5	6040h 6071h	control word target_torque	controls the state machine and the target torque(tq)	—
6	6040h 6042h	control word target_velocity(vl)	controls the state machine and the nominal speed(vl)	○ (2ndRPDO)
7	6040h 60FEh	control word digital_outputs	controls the state machine and the digital outputs	—
8	6040h 6060h	control word modes_of_operation	controls the state machine and mode of operation(Broadcast PDO)	—
9 to 20	—	—	reserved	—
21	4010h 4012h	Control input command Set frequency (RAM)	(A7NCA-specific format)	○ (3rdRPDO)
22 to 64	—	—	manufacturer specific	—

(1) 1st Receive PDO (PDO No.1)

<format>

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
Byte0	Reset Fault	—	—	—	Enable Operation	Quick Stop	Disable Voltage	Switch On	(Index 6040h-00h)control word
Byte1	—	—	—	—	—	—	—	—	
Byte2	(blank)								
Byte3	(blank)								
Byte4	(blank)								
Byte5	(blank)								
Byte6	(blank)								
Byte7	(blank)								

<Mapping parameter>

Index	Sub Index	Description	Read/Write	Default
1400h	00h	number of entries	ro	2
	01h	COB-ID used by PDO	rw	200h + Node-ID
	02h	transmission type	rw	255
1600h	00h	number of mapped objects	ro	1
	01h	control word	ro	60400010h

(2) 2nd Receive PDO (PDO No.6)

<format>

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
Byte0	Reset Fault	—	—	—	Enable Operation	Quick Stop	Disable Voltage	Switch On	(Index 6040h-00h)control word
Byte1	—	—	—	—	—	—	—	—	
Byte2	target_velocity (vl) (L)								(Index 6042h-00h) target_velocity(vl)
Byte3	target_velocity (vl) (H)								
Byte4	(blank)								
Byte5	(blank)								
Byte6	(blank)								
Byte7	(blank)								

* Forward rotation : target_velocity (vl) > 0
Reverse rotation : target_velocity (vl) < 0

<Mapping parameter>

Index	Sub Index	Description	Read/Write	Default
1405h	00h	number of entries	ro	2
	01h	COB-ID used by PDO	rw	80000300h + Node-ID
	02h	transmission type	rw	255
1605h	00h	number of mapped objects	ro	2
	01h	control word	ro	60400010h
	02h	target_velocity(vl)	ro	60420010h

(3) 3rd Receive PDO (PDO No.21)

<format>

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
Byte0	RT	JOG	RL	RM	RH	STR	STF	—	(Index 4010h-00h) Control input command
Byte1	—	—	—	RES	STOP	MRS	CS	AU	
Byte2	Set Frequency (RAM) (L)								(Index 4012h-01h) Set Frequency (RAM)
Byte3	Set Frequency (RAM) (H)								
Byte4	(blank)								
Byte5	(blank)								
Byte6	(blank)								
Byte7	(blank)								

<Mapping parameter>

Index	Sub Index	Description	Read/Write	Default
1414h	00h	number of entries	ro	2
	01h	COB-ID used by PDO	rw	80000400h + Node-ID
	02h	transmission type	rw	255
1614h	00h	number of mapped objects	ro	2
	01h	Control input command	ro	40100010h
	02h	Set Frequency (RAM)	ro	40120110h

7.1.2 Transmit PDO

Standard				A7NCA Support
PDO No.	Mapping object Index	Mapping object name	Description	
1	6041h	status word	shows status	○ (1stTPDO)
2	6041h 6061h	status word modes_of_operation_display	shows status and the actual mode of operation	—
3	6041h 6064h	status word position_actual_value	shows the status and the actual position (pp)	—
4	6041h 606Ch	status word velocity_actual_value	shows the status and the actual velocity (pv)	—
5	6041h 6077h	status word torque_actual_value	shows the status and the actual torque (tq)	—
6	6041h 6044h	status word vl_control_effort	shows the status and the actual speed (vl)	○ (2ndTPDO)
7	6041h 60FDh	status word digital_inputs	shows the status and the digital inputs	—
8 to 20	—	—	reserved	—
21	4011h 4013h	Inverter status Output frequency	(A7NCA-specific format)	○ (3rdTPDO)
22 to 64	—	—	manufacturer specific	○

(1) 1st Transmit PDO (PDO No.1)

<format>

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte0	—	Switched On Disabled	Quick Stop	Voltage Disabled	Fault	Operation Enabled	Switched On	Ready to Switch On
Byte1	—	—	—	—	Internal Limit Active	Target Reached	Remote	—
Byte2	(blank)							
Byte3	(blank)							
Byte4	(blank)							
Byte5	(blank)							
Byte6	(blank)							
Byte7	(blank)							

(Index 6041h-00h) status word

<Mapping parameter>

Index	Sub Index	Description	Read/Write	Default
1800h	00h	number of entries	ro	5
	01h	COB-ID used by PDO	rw	180h + Node-ID
	02h	transmission type	rw	255
	03h	inhibit time	rw	0
	04h	Reserved	—	Without (error response)
	05h	event timer	rw	0
1A00h	00h	number of mapped objects	ro	1
	01h	status word	ro	60410010h

(2) 2nd Transmit PDO (PDO No.6)

<format>

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
Byte0	—	Switched On Disabled	Quick Stop	Voltage Disabled	Fault	Operation Enabled	Switched On	Ready to Switch On	(Index 6041h-00h) status word
Byte1	—	—	—	—	Internal Limit Active	Target Reached	Remote	—	
Byte2	vl_control_effort (L)								(Index 6044h-00h) vl_control_effort
Byte3	vl_control_effort (H)								
Byte4	(blank)								
Byte5	(blank)								
Byte6	(blank)								
Byte7	(blank)								

* Forward rotation : vl_control_effort > 0
Reverse rotation : vl_control_effort < 0

<Mapping parameter>

Index	Sub Index	Description	Read/Write	Default
1805h	00h	number of entries	ro	5
	01h	COB-ID used by PDO	rw	80000280h + Node-ID
	02h	transmission type	rw	255
	03h	inhibit time	rw	0
	04h	Reserved	—	Without (error response)
	05h	event timer	rw	0
1A05h	00h	number of mapped objects	ro	2
	01h	status word	ro	60410010h
	02h	vl_control_effort	ro	60440010h

(3) 3rd Transmit PDO (PDO No.21)

<format>

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
Byte0	Error	Frequency detection	IPF	Overload	Up to frequency	During reverse rotation	During forward rotation	Running	(Index 4011h-00h) Inverter status
Byte1	Operation ready	—	—	—	—	—	—	—	
Byte2	Output frequency (L)								(Index 4013h-01h) Output frequency
Byte3	Output frequency (H)								
Byte4	(blank)								
Byte5	(blank)								
Byte6	(blank)								
Byte7	(blank)								

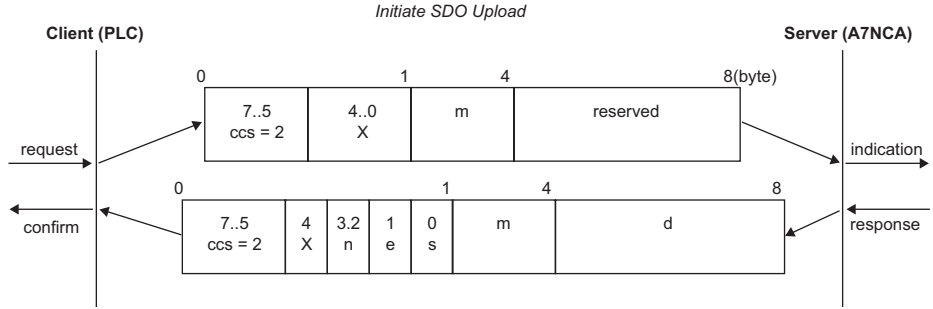
<Mapping parameter>

Index	Sub Index	Description	Read/Write	Default
1814h	00h	number of entries	ro	5
	01h	COB-ID used by PDO	rw	80000380h + Node-ID
	02h	transmission type	rw	255
	03h	inhibit time	rw	0
	04h	Reserved	—	Without (error response)
	05h	event timer	rw	0
1A14h	00h	number of mapped objects	ro	2
	01h	Inverter status	ro	40110010h
	02h	Output frequency	ro	40130110h

7.2 Service Data Object (SDO)

7.2.1 SDO Upload (SDO read)

<model>



<request format>

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte0	ccs(2)			blank(0)				
Byte1	Index (L)							
Byte2	Index (H)							
Byte3	Sub-Index							
Byte4	(blank)							
Byte5	(blank)							
Byte6	(blank)							
Byte7	(blank)							

<response format>

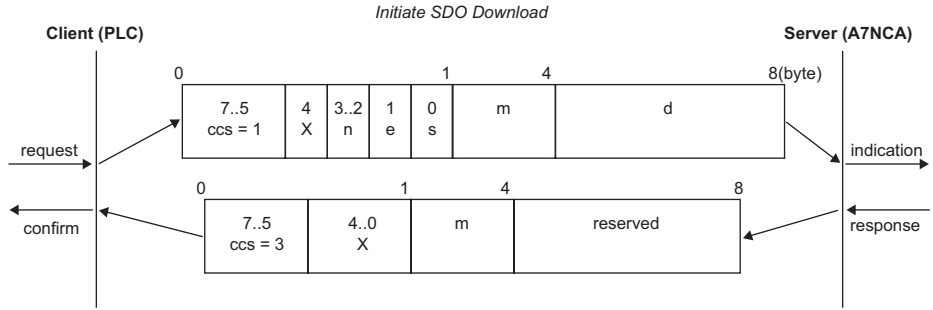
	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte0	scs(2)			blank(0)	n		e	s
Byte1	Index (L)							
Byte2	Index (H)							
Byte3	Sub-Index							
Byte4	Read data (L)							
Byte5	Read data (ML)							
Byte6	Read data (MH)							
Byte7	Read data (H)							

e	s	n *	Meaning
0	0	Invalid	(reservation)
0	1	Invalid	4byte is read
1	0	Invalid	Unspecified read data is included.
1	1	Valid	[4-n]byte is read

* When n (Byte3, Byte2) becomes valid, n indicates the number of byte whose data (Byte4 to Byte7) is not used.

7.2.2 SDO Download (SDO write)

<model>



<request format>

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte0	ccs(1)			blank(0)	n		e	s
Byte1	Index (L)							
Byte2	Index (H)							
Byte3	Sub-Index							
Byte4	Write data (L)							
Byte5	Write data (ML)							
Byte6	Write data (MH)							
Byte7	Write data (H)							

e	s	n *	Meaning
0	0	Invalid	(reservation)
0	1	Invalid	Write 4 byte
1	0	Invalid	Unspecified read data is included.
1	1	Valid	Write [4-n] byte.

* When n (Byte3, Byte2) becomes valid, n indicates the number of byte whose data (Byte4 to Byte7) is not used.

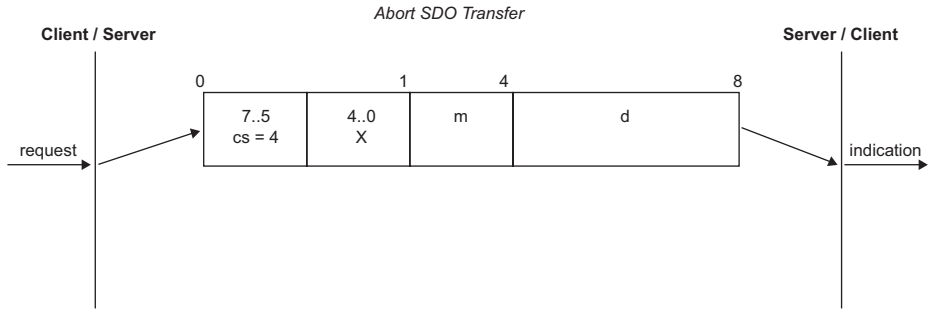
<response format>

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte0	scs(3)			blank(0)				
Byte1	Index (L)							
Byte2	Index (H)							
Byte3	Sub-Index							
Byte4	(blank)							
Byte5	(blank)							
Byte6	(blank)							
Byte7	(blank)							

7.2.3 SDO Abort Code (SDO error code)

Protocol for returning abort code

<model>



<response format>

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte0	cs(4)			blank(0)				
Byte1	Index (L)							
Byte2	Index (H)							
Byte3	Sub-Index							
Byte4	Abort code (L)							
Byte5	Abort code (ML)							
Byte6	Abort code (MH)							
Byte7	Abort code (H)							

Abort Code	Description
0503 0000h	Toggle bit not alternated.
0504 0000h	SDO protocol timed out.
0504 0001h	Client/server command specifier not valid or unknown.
0504 0002h	Invalid block size (block mode only).
0504 0003h	Invalid sequence number (block mode only).
0504 0004h	CRC error (block mode only).
0504 0005h	Out of memory.
0601 0000h	Unsupported access to an object.
0601 0001h	Attempt to read a write only object.
0601 0002h	Attempt to write a read only object.
0602 0000h	Object does not exist in the object dictionary.
0604 0041h	Object cannot be mapped to the PDO.
0604 0042h	The number and length of the objects to be mapped would exceed PDO length.
0604 0043h	General parameter incompatibility reason.
0604 0047h	General internal incompatibility in the device.
0606 0000h	Access failed due to an hardware error.
0607 0010h	Data type does not match, length of service parameter does not match
0607 0012h	Data type does not match, length of service parameter too high
0607 0013h	Data type does not match, length of service parameter too low
0609 0011h	Sub-index does not exist.
0609 0030h	Value range of parameter exceeded (only for write access).
0609 0031h	Value of parameter written too high.
0609 0032h	Value of parameter written too low.
0609 0036h	Maximum value is less than minimum value.
0800 0000h	general error
0800 0020h	Data cannot be transferred or stored to the application.
0800 0021h	Data cannot be transferred or stored to the application because of local control.
0800 0022h	Data cannot be transferred or stored to the application because of the present device state.
0800 0023h	Object dictionary dynamic generation fails or no object dictionary is present (e.g. object dictionary is generated from file and generation fails because of an file error).

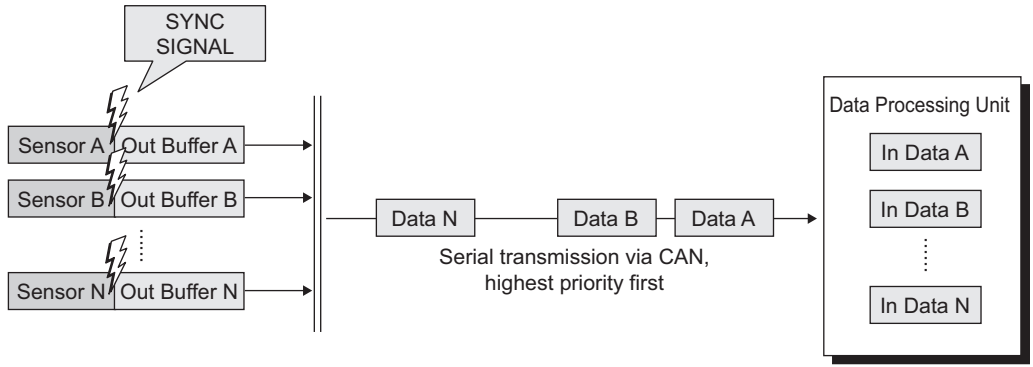
7.3 SYNC Object

SYNC object has two types as stated below and uses an object dictionary in the following.
<Related object dictionary>

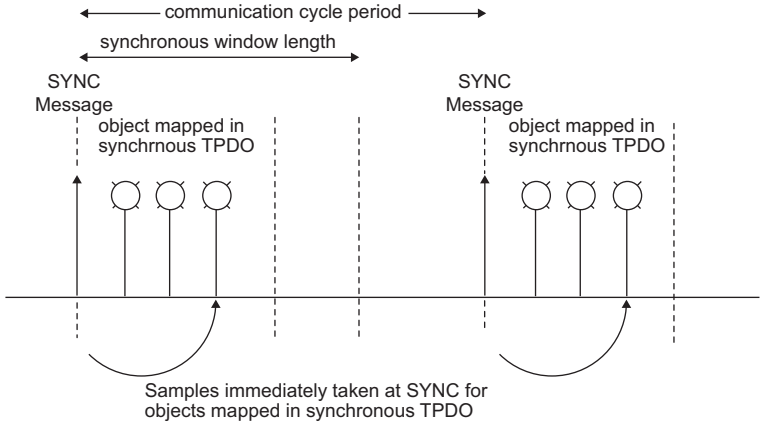
Index	Sub-Index	Name	Unit	Detail	Reference page
1005h	00h	COB-ID SYNC message	—	COB-ID of SYNC message	74

7.3.1 Bus Synchronization and Sampling

<model>
Output synchronous TPDO triggered by SYNC message periodically broadcasted.
(1) Concept

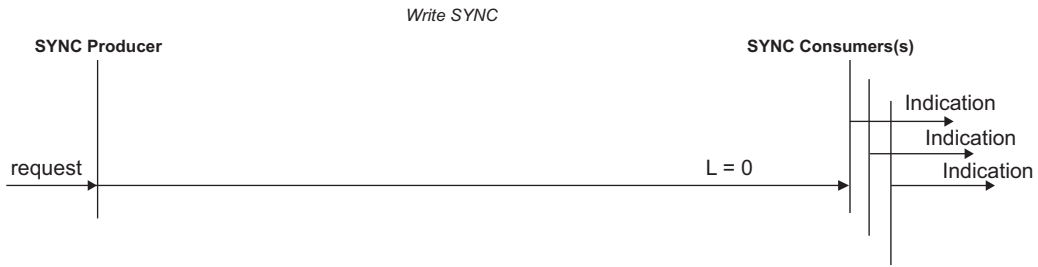


(2) Time-line



<request format>

Without. Send COB-ID only.

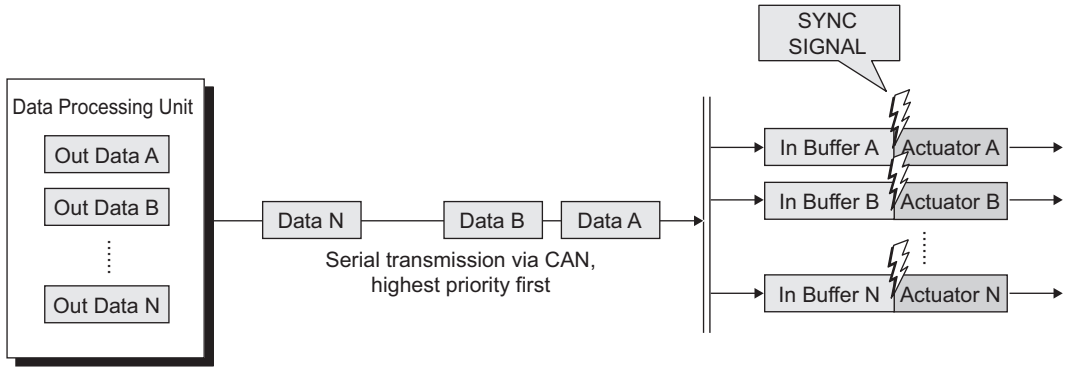


7.3.2 Bus Synchronization and Actual

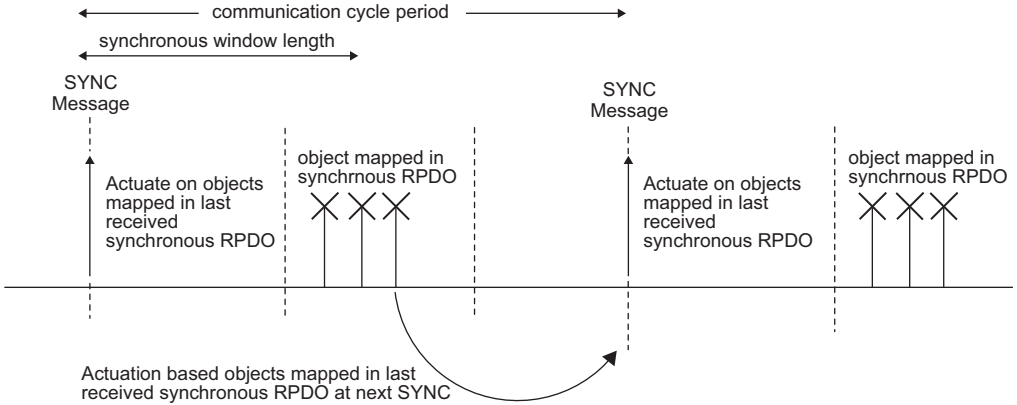
<model>

Process synchronous RPDO received triggered by SYNC message (SYNC SIGNAL) periodically broadcasted.

(1) Concept

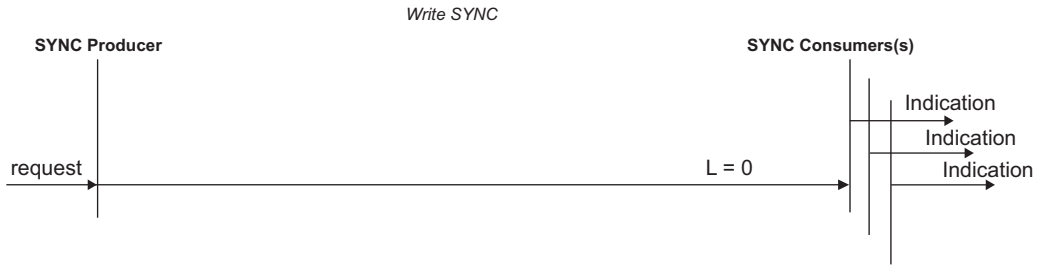


(2) Time-line



<request format>

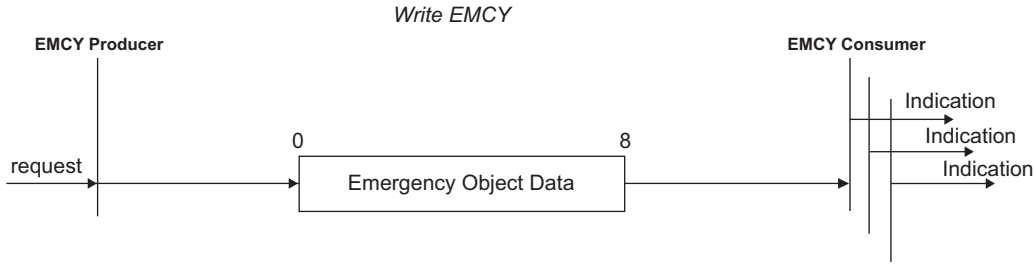
Without. Send COB-ID only.



7.4 Emergency object

This object is used for reporting an inverter error from the slave to the master.

<model>



<request format>

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte0	Emergency Error Code(L)							
Byte1	Emergency Error Code(H)							
Byte2	Error Register (same description as Index1001h)							
Byte3	blank(0)							
Byte4	blank(0)							
Byte5	blank(0)							
Byte6	blank(0)							
Byte7	blank(0)							

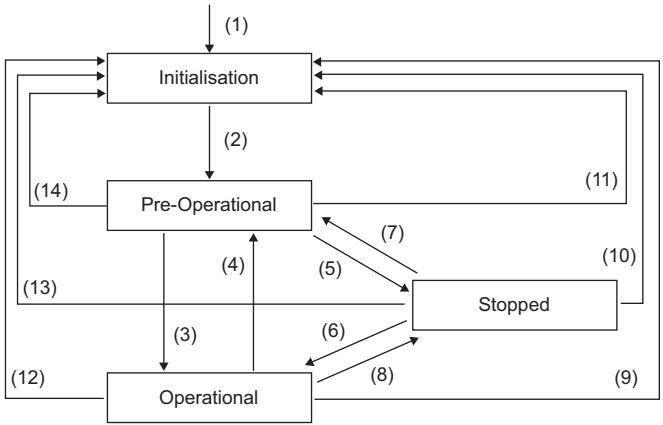
Emergency Error Code		Corresponding inverter alarm
0000	no error	
2213	over-current in ramp function	E.OC1 E.OC3
2214	over-current in the sequence	E.OC2
2300	current on device output side	E.THT E.OLT E.THM
2310	continuous over current	E.CDO
2330	earth leakage	E.GF
3130	phase failure	E.LF E.ILF
3200	DC link voltage	E.OV1 to E.OV3
3220	DC link under-voltage	E.UVT
3331	field circuit interrupted	E.IPF
4210	excess temperature device	E.FIN E.FAN
4310	excess temperature drive	E.PTC E.OHT
5000	device hardware	E.OPT E.OP3
5112	U2 = supply + 24V	E.P24
5114	U4 = manufacturer specific	E.AIE
5400	power section	E.13
5420	chopper	E.BE
5430	input stages	E.IOH
5530	EEPROM	E.PE E.PE2
6010	software reset (watchdog)	E.6 E.7 E.CPU

Emergency Error Code		Corresponding inverter alarm
6100	internal software	E.RET
6304	data record No. 4	E.4
6305	data record No. 5	E.5
6308	data record No. 8	E.8
6309	data record No. 9	E.9
630A	data record No. 10	E.10
630B	data record No. 11	E.11
630C	data record No. 12	E.12
630E	data record No. 14	E.14
630F	data record No. 15	E.15
7400	computation circuit	E.1 to E.3
7510	serial interface No. 1	E.PUE E.CTE E.SER
FF00 to FFFF	device specific	

7.5 Network Management object (NMT)

7.5.1 Status transition of NMT state

The status transition as option unit CANopen slave is indicated below.
(determined in CANopen standard)



Transition No	Operation
(1)	Power on or inverter reset
(2)	Initialization complete. Send Boot-Up protocol and transit to "Pre-Operational".
(3), (6)	Receive Start-Remote-Node protocol and transit to "Operational".
(4), (7)	Receive Enter-Pre-Operational protocol and transit to "Pre-Operational".
(5), (8)	Receive Stop-Remote-Node protocol and transit to "Stopped".
(9), (10), (11)	Receive Reset-Node protocol and transit to "Initialization".
(12), (13), (14)	Receive Reset-Communication protocol and transit to "Initialization".

7.5.2 Status transition matrix of NMT state

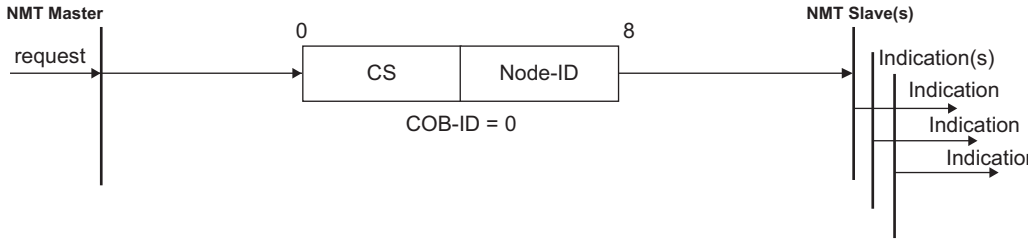
The table below shows available services in each status.

Service name	NMT State			
	Initializing	Pre-Operational	Operational	Stopped
Boot-Up	○			
SDO		○	○	
Emergency		○	○	
SYNC / TIME		○	○	
Heartbeat / Nodeguard		○	○	○
PDO			○	

○ : Service usable

7.5.3 Module Control Service

Changes to NMT state (node status).
<model>



<request format>

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte0	CS							
Byte1	Node-ID(0 to 127)							

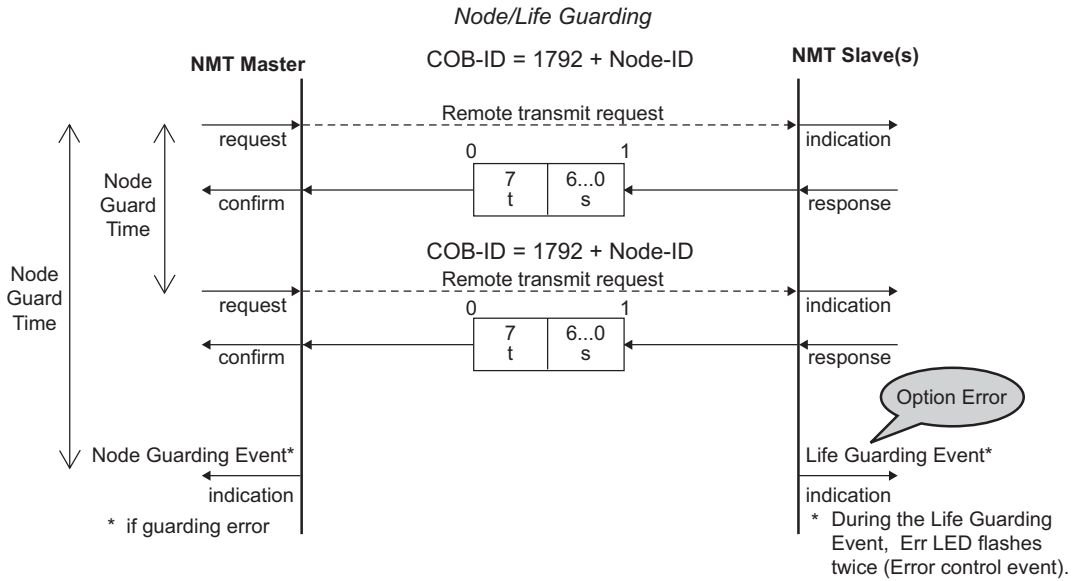
CS	Module Control Service	Description
1	Start Remote Node	Changes to NMT state (node status) to "Operational status"
2	Stop Remote Node	Changes to NMT state (node status) to "Stop"
128	Enter Pre-Operational	Changes to NMT state (node status) to "Pre-Operation state".
129	Reset Node	Changes to NMT state (node status) to "Initialization state". Inverter reset.
130	Reset Communication	Switches NMT state to "Pre-Operation state". Resets the option unit only.

Node-ID	Meaning
0	All nodes execute Module Control Service.
1 to 127	Specified nodes execute Module Control Service.

7.5.4 Error Control Service

(1) Guarding

Used when the master sends a request to the slave for obtaining the device state of the slave.
When the slave can not recieve the request in [Node Life time], option error (E. OP3) occurs.
<model>



[Node Guard Time] : (Index 100Ch)Setting time of Guard Time (0 to 65535ms)
[Node Life Time] : [Node Guard Time](ms) × [Life Time Factor(Index 100Dh)]

<response format>

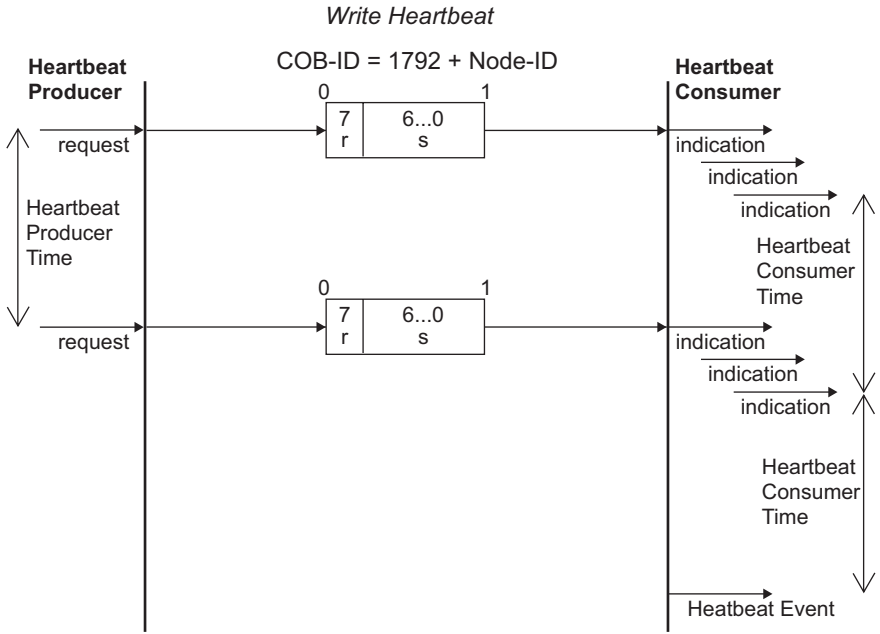
	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte0	r(0)	s (0 to 127)						

s	Meaning (NMT Status)
4	Stopped
5	Operational
127	Pre-Operational

(2) Heartbeat

Used for notifying the device state of itself without request.

<model>



<Transmission format>

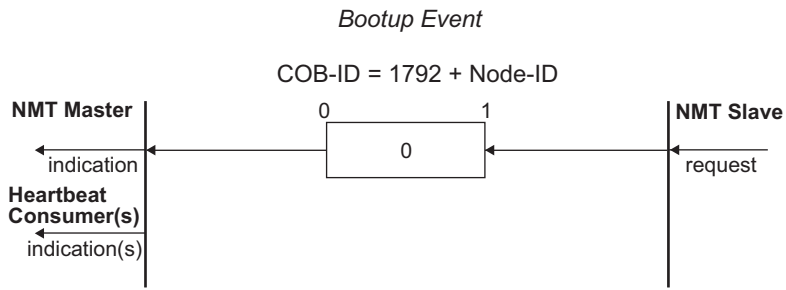
	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte0	r(0)	s (0 to 127)						

s	Meaning (NMT Status)
0	Bootup
4	Stopped
5	Operational
127	Pre-Operational

(3) Bootup

Transmits the own node address at startup.

<model>



<Transmission format>

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte0	700h + Node ID							

8 OBJECT DICTIONARY

8.1 Object List

	Index	Sub Index	Name	Data Type	Attribute *	Reference page
Communication Profile Area	1000h	00h	device type	UNSIGNED32	ro	71
	1001h	00h	error register	UNSIGNED8	ro	72
	1002h	00h	manufacturer status register	UNSIGNED32	ro	73
	1005h	00h	COB-ID SYNC	UNSIGNED32	rw	74
	1008h	00h	manufacturer device name	Vis-String	const	75
	100Ah	00h	Manufacturer Software Version	Object for manufacturer setting. Do not set.	const	—
	100Ch	00h	guard time	UNSIGNED16	rw	75
	100Dh	00h	life time factor	UNSIGNED8	rw	76
	1010h	00h	store parameters	UNSIGNED32	rw	77
	1011h	00h	restore default parameters	UNSIGNED32	rw	79
	1014h	00h	COB-ID EMCY	UNSIGNED32	ro	80
	1015h	00h	Inhibit Time EMCY	UNSIGNED16	rw	81
	1017h	00h	Producer heartbeat time	UNSIGNED16	rw	81
	1018h	00h	Identity Object	Identity (23h)	ro	82
	1400h	00h	1st Receive PDO parameter	PDO_COMMUNICATION_PARAMETER(0020h)	rw	84
	1405h	00h	2nd Receive PDO parameter	PDO_COMMUNICATION_PARAMETER(0020h)	rw	84
	1414h	00h	3rd Receive PDO parameter	PDO_COMMUNICATION_PARAMETER(0020h)	rw	84
	1600h	00h	1st Receive PDO Mapping	PDO_MAPPING(0021h)	ro	86
	1605h	00h	2nd Receive PDO Mapping	PDO_MAPPING(0021h)	ro	86
	1614h	00h	3rd Receive PDO Mapping	PDO_MAPPING(0021h)	ro	86
	1800h	00h	1st Transmit PDO parameter	PDO_COMMUNICATION_PARAMETER(0020h)	rw	87
	1805h	00h	2nd Transmit PDO parameter	PDO_COMMUNICATION_PARAMETER(0020h)	rw	87
	1814h	00h	3rd Transmit PDO parameter	PDO_COMMUNICATION_PARAMETER(0020h)	rw	87
	1A00h	00h	1st Transmit PDO Mapping	PDO_MAPPING(0021h)	ro	90
	1A05h	00h	2nd Transmit PDO Mapping	PDO_MAPPING(0021h)	ro	90
	1A14h	00h	3rd Transmit PDO Mapping	PDO_MAPPING(0021h)	ro	90

	Index	Sub Index	Name	Data Type	Attribute *	Reference page
Manufacturer Specific Area	2000h to 2063h	00h	Inverter monitor	UNSIGNED16	ro	91
	2106h	00h	Alarm clear	UNSIGNED16	wo	94
	2107h	00h	Inverter reset	UNSIGNED16	wo	94
	2108h	00h	Parameter Clear	UNSIGNED16	wo	95
	2109h	00h	Operation Mode	UNSIGNED16	rw	96
	3000h to 3385h	00h	Parameter area *(Pr. 0 to Pr. 901)*	UNSIGNED16	rw	97
	3386h to 33ABh	00h	Parameter area *(Pr. 902 to Pr. 939)* Number of entry record	UNSIGNED8	ro	98
		01h	Offset / Gain value	UNSIGNED16	rw	98
		02h	Analog value	UNSIGNED16	rw	98
	33ACh to 33E7h	00h	Parameter area *(Pr. 940 to Pr. 999)*	UNSIGNED16	rw	97
	3400h	00h	Alarm history 1, 2	UNSIGNED16	rw	99
	3401h	00h	Alarm history 3, 4	UNSIGNED16	ro	99
	3402h	00h	Alarm history 5, 6	UNSIGNED16	ro	99
	3403h	00h	Alarm history 7, 8	UNSIGNED16	ro	99
	4000h	00h	Control input command (w) / Inverter status (r)	UNSIGNED16	rw	101
	4001h	00h	Number of Entries	UNSIGNED8	ro	103
		01h	Set frequency (RAM) (w) / Output frequency (r)	UNSIGNED16	rw	103
		02h	Set frequency (RAM) (w) / Running Speed (r)	UNSIGNED16	rw	103

	Index	Sub Index	Name	Data Type	Attribute *	Reference page
Manufacturer Specific Area	4002h	00h	Number of Entries	UNSIGNED8	ro	105
		01h	Set frequency (RAM)	UNSIGNED16	rw	105
		02h	Set frequency (EEPROM)	UNSIGNED16	wo	105
	4003h	00h	Number of Entries	UNSIGNED8	ro	106
		01h	Set speed (RAM)	UNSIGNED16	rw	106
		02h	Set speed (EEPROM)	UNSIGNED16	wo	106
	4010h	00h	Control input command (w)	UNSIGNED16	wo	107
	4011h	00h	Inverter status (r)	UNSIGNED16	ro	108
	4012h	00h	Number of Entries	UNSIGNED8	ro	109
		01h	Set frequency (RAM) (w)	UNSIGNED16	wo	109
		02h	Set speed (RAM) (w)	UNSIGNED16	wo	109
	4013h	00h	Number of Entries	UNSIGNED8	ro	110
		01h	Output frequency (r)	UNSIGNED16	ro	110
		02h	Running Speed (r)	UNSIGNED16	ro	110

	Index	Sub Index	Name	Data Type	Attribute *	Reference page
Device Profile Area	6040h	00h	controlword	UNSIGNED16	rw	111
	6041h	00h	statusword	UNSIGNED16	ro	114
	6042h	00h	vl_target_velocity	INTEGER16	rw	116
	6043h	00h	vl_velocity_demand	INTEGER16	ro	116
	6044h	00h	vl_control_effort	INTEGER16	ro	117
	6046h	00h	vl_velocity_min_max_amount	UNSIGNED32		118
	6048h		vl_velocity_acceleration	vl_velocity_acceleration deceleration_record	rw	120
		01h	Delta_speed	UNSIGNED32	rw	120
		02h	Delta_time	UNSIGNED16	rw	120
	6049h		vl_velocity_deceleration	vl_velocity_acceleration deceleration_record	rw	123
		01h	Delta_speed	UNSIGNED32	rw	123
		02h	Delta_time	UNSIGNED16	rw	123
	604Ah		vl_velocity_quick_stop	vl_velocity_acceleration deceleration_record	rw	125
		01h	Delta_speed	UNSIGNED32	rw	125
		02h	Delta_time	UNSIGNED16	rw	125
	605Ah	00h	quick_stop_option_code	INTEGER16	rw	127
	6060h	00h	modes_of_operation	INTEGER8	wo	128
	6061h	00h	modes_of_operation_display	INTEGER8	ro	129
	67FFh	00h	Single Device Type	UNSIGNED32	ro	130

* rw .... read / write, ro ... read only, wo ..... write only.

8.2 Object Detail of Communication Profile Area

8.2.1 (Index 1000h) Device Type

Sub Index	Item	Description
00h	Name	Device Type
	Data type	UNSIGNED32 (32 bit unsigned)
	Default value	00010192h
	Access attribute	Read Only
	Availability of mapping to PDO	Disable

<Detail>

Bit	Description	REMARKS
0 to 15	Device Profile Number	0192h (Drive Profile is 402)
16 to 23	Additional Information (Type)	01h (Frequency Converter)
24 to 31	Additional Information (mode bits)	00h

8.2.2 (Index 1001h) Error Register

Sub Index	Item	Description
00h	Name	Error Register
	Data type	UNSIGNED8 (8 bit unsigned)
	Default value	0 (Inverter alarm is not occurred.)
	Access attribute	Read Only
	Availability of mapping to PDO	Enable

<Detail>

Bits corresponding to emergency error code of emergency object turn to 1.

Bit	Description	REMARKS
0	Generic Error	1 when an error related to any of the followings occurs: 0x1000 generic error, 0x5000 device hardware, 0x6000 device software, 0x7000 additional modules, 0x9000 external error, 0xF000 additional functions of emergency error code and 0 when no error occurs.
1	Current	1 when an error related to 0x2000 current of emergency error code occurs and 0 when no error occurs.
2	Voltage	1 when an error related to 0x3000 voltage of emergency error code occurs and 0 when no error occurs.
3	Temperature	1 when an error related to 0x4000 temperature of emergency error code occurs and 0 when no error occurs.
4	Communication Error	1 when an error related to 0x8000 monitoring of emergency error code occurs and 0 when no error occurs.
5	Device Profile Defined Error	(Not supported) Always 0
6	Reserved(0)	Always 0
7	Manufacturer Specific Error	(Not supported) Always 0

8.2.3 (Index 1002h) Manufacturer Status Register

Sub Index	Item	Description
00h	Name	Manufacturer Status Register
	Data type	UNSIGNED32 (32 bit unsigned)
	Default value	0 (Inverter alarm is not occurred.)
	Access attribute	Read Only
	Availability of mapping to PDO	Enable

<Detail>

Bit	Description	REMARKS	
0	Running (RUN signal)	0: Not running, 1: Running	Signals are not affected by settings of *Pr.190 to Pr.196* (output terminal function selection).
1	During forward rotation	0: Not forward rotation, 1: Forward rotation	
2	During reverse rotation	0: Not reverse rotation, 1: Reverse rotation	
3	Up-to-running frequency (SU signal)	0: Not reached the running frequency, 1: Reached the running frequency	
4	Overload (OL signal)	0: Not overloaded, 1: Overloaded	
5	Instantaneous power failure (IPF signal)	0: Instantaneous power failure not occurred, 1: Instantaneous power failure occurred	
6	Frequency detection (FU signal)	0: Frequency detection not exercised, 1: Frequency detection exercised	
7	Error	0: Inverter alarm not occurred, 1: Inverter alarm occurred	
8 to 14	(Inhibited)	(Always 0)	
15	Operation ready completion	0: Operation ready not completed, 1: Operation ready completed	
16 to 31	(Inhibited)	(Always 0)	

8.2.4 (Index 1005h) COB-ID SYNC

Sub Index	Item	Description
00h	Name	COB-ID for SYNC Object
	Data type	UNSIGNED32 (32 bit unsigned)
	Default value	00000080h
	Access attribute	Read / Write
	Availability of mapping to PDO	Disable

<Detail>

Bit	Description	REMARKS
0 to 10	COB-ID of SYNC Object	
11 to 28	(Not used)	Always 0
29	Selection of COB-ID length (0: 11 bit length, 1: 29 bit length)	Always 0 (When 1 is set on this bit, SDO abort code returns.) ([Value range of parameter exceeded(write access only)] = 06090030h)
30	Selection of SYNC Object generation (0: Not generate, 1: Generate)	Always 0 (When 1 is set on this bit, SDO abort code returns.) ([Value range of parameter exceeded(write access only)] = 06090030h)
31	(Not used)	Always 0

8.2.5 (Index 1008h) Manufacturer Device Name

Sub Index	Item	Description
00h	Name	Manufacturer Device Name
	Data type	VISIBLE_STRING(ASCII data)
	Default value	(Below)
	Access attribute	Const
	Availability of mapping to PDO	Disable

<Detail>

Model	Description	REMARKS
A700	"A700" = 41h 37h 30h 30h	

8.2.6 (Index 100Ch) Guard Time

Sub Index	Item	Description
00h	Name	Guard Time
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	0
	Unit	ms
	Access attribute	Read / Write
	Availability of mapping to PDO	Disable

<Detail>

A factor to determine the Time out value ([Node Life Time]) in Node Guarding Protocol.
[Node Life Time], a factor to determine the check time of polling receive interval in Guarding protocol, is determined by [Guard Time] × [Life Time Factor].

REMARKS

- When 0 is set in [Guard Time], Guarding operation is made invalid.
- Guarding protocol : Refer to *page 63*.
- [Life Time Factor] : Refer to *page 78*.

8.2.7 (Index 100Dh) Life Time Factor

Sub Index	Item	Description
00h	Name	Life Time Factor
	Data type	UNSIGNED8 (8 bit unsigned)
	Default value	0
	Unit	ms
	Access attribute	Read / Write
	Availability of mapping to PDO	Disable

<Detail>
A factor to determine the Time out value ([Node Life Time]) in Node Guarding Protocol.
[Node Life Time], a factor to determine the check time of polling receive interval in Guarding protocol, is determined by [Guard Time] × [Life Time Factor].

REMARKS

- When 0 is set in [Guard Time], Guarding operation is made invalid.
- Guarding protocol : Refer to *page 63*.
- [Life Time Factor] : Refer to *page 78*.

8.2.8 (Index 1010h) store parameters

Sub Index	Item	Description
00h	Name	Largest Subindex Supported
	Data type	UNSIGNED8 (8 bit unsigned)
	Default value	3
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Disable
01h	Name	Save All Parameters
	Data type	UNSIGNED32 (32 bit unsigned)
	Default value	—
	Unit	—
	Access attribute	Read / Write
	Availability of mapping to PDO	Disable
02h	Name	Save Communication Parameters
	Data type	UNSIGNED32 (32 bit unsigned)
	Default value	—
	Unit	—
	Access attribute	Read / Write
	Availability of mapping to PDO	Disable
03h	Name	Save Application Parameters
	Data type	UNSIGNED32 (32 bit unsigned)
	Default value	—
	Unit	—
	Access attribute	Read / Write
	Availability of mapping to PDO	Disable

<Detail>
When "save" is written to Sub Index, "Store process" is performed and the value of object dictionary is saved to EEPROM.
To write "save", align from "e". (e(65h) v(76h) a(61h) s(73h))

Sub Index	Store process
01h	Save the all entry.
02h	Save Index1000h to 1FFFh(Communication Profile Area).
03h	Save Index6000h to 9FFFh(Device Profile Area).

When "save" is written, the corresponding store process is performed, and SDO response is returned.
When save is failed, SDO abort is returned (Abort code: 0606 0000h).
When an incorrect character string is written, store process is not performed, and SDO Abort is returned (Abort code: 0800 002xh).

When Sub Index is read, availability of automatic parameter save is returned.

Bit	Meaning
0	1: Save the parameter by writing "save" to Sub Index. 0: Not save the parameter even if "save" is written to Sub Index.
1	1: The parameter is automatically saved. 0: The parameter is not automatically saved. (Save manually)
2 to 31	Reserved. Read value is 0.

8.2.9 (Index 1011h) restore default parameters

Sub Index	Item	Description
00h	Name	Number of Entries
	Data type	UNSIGNED8 (8 bit unsigned)
	Default value	3
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Disable
01h	Name	Restore All Default Parameters
	Data type	UNSIGNED32 (32 bit unsigned)
	Default value	—
	Unit	—
	Access attribute	Read / Write
	Availability of mapping to PDO	Disable
02h	Name	Restore Communication Default Parameters
	Data type	UNSIGNED32 (32 bit unsigned)
	Default value	—
	Unit	—
	Access attribute	Read / Write
	Availability of mapping to PDO	Disable
03h	Name	Restore Application Default Parameters
	Data type	UNSIGNED32 (32 bit unsigned)
	Default value	—
	Unit	—
	Access attribute	Read / Write
	Availability of mapping to PDO	Disable

<Detail>
When "load" is written to Sub Index, "Restore process" is performed.
To write "load", align from "d". (d(64h) a(61h) o(6Fh) l(6Ch))

Sub Index	Restore process
01h	All entries return to the default values. (All clear + Option EEPROM clear)
02h	Index1000h to 1FFFh(Communication Profile Area) return to the default values.
03h	Index6000h to 9FFFh(Device Profile Area) return to the default values.

8.2.10 (Index 1014h) COB-ID EMCY

Sub Index	Item	Description
00h	Name	Emergency COB-ID
	Data type	UNSIGNED32 (32 bit unsigned)
	Default value	00000080h + NodeID
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Disable

<Detail>
Valid / Invalid switchover of Emergency protocol and COB-ID used in Emergency protocol is available.
(Refer to page 57.)

Bit	Description	REMARKS
0 to 10	COB-ID used in Emergency protocol	
11 to 28	Always 0	
29	Always 0	
30	(reservation) Always 0	
31	0: Emergency protocol is valid. 1: Emergency protocol is invalid.	

8.2.11 (Index 1015h) Inhibit Time EMCY

Sub Index	Item	Description
00h	Name	Inhibit Time EMCY
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	0
	Unit	100μs
	Access attribute	Read / Write
	Availability of mapping to PDO	Disable

<Detail>
For Emergency protocol. Transmission disabled time can be set.
Setting range is "0 to 65535μs".
Necessary to implement Emergency protocol in Vector slave source.

8.2.12 (Index 1017h) Producer Heartbeat Time

Sub Index	Item	Description
00h	Name	Producer Heartbeat Time
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	0
	Unit	ms
	Access attribute	Read / Write
	Availability of mapping to PDO	Disable

<Detail>
Set the Heartbeat transmission interval when Heartbeat protocol is used. *(Refer to page 65.)*

8.2.13 (Index 1018h) Identity

Sub Index	Item	Description
00h	Name	Number of Entries
	Data type	UNSIGNED8 (8 bit unsigned)
	Default value	4
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Disable
01h	Name	Vendor ID
	Data type	UNSIGNED32 (32 bit unsigned)
	Default value	000001D0h
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Disable
02h	Name	Product Code
	Data type	UNSIGNED32 (32 bit unsigned)
	Default value	00000030h (48)
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Disable
03h	Name	Revision Number
	Data type	UNSIGNED32 (32 bit unsigned)
	Default value	—
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Disable

Sub Index	Item	Description
04h	Name	Serial Number
	Data type	UNSIGNED32 (32 bit unsigned)
	Default value	Use within the range of 00000000h to 0000FFFFh.
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Disable

<Detail>

- Return some basic information of node. (Vender ID, Product code, Revision number, Serial number)
- Vender ID is allocated to each manufacturers.
- Product code is allocated to each products.
- Revision number is the version of the product.

Bit	Description	REMARKS
0 to 15	Minor Revision Number	Incremented when the setting which does not change the operation or the action of CANopen has been made. For example, minor bug fix, etc.
16 to 31	Major Revision Number	Incremented when the setting which changes the operation or the action of CANopen has been made. For example, addition / deletion of object, etc.

- Serial number is the unique number of the product.

8.2.14 (Index 1400h to 15FFh) Recive PDO Parameters

Sub Index	Item	Description
00h	Name	Lagrgest Subindex Supported
	Data type	UNSIGNED8 (8 bit unsigned)
	Default value	2
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Disable
01h	Name	COB-ID used by PDO
	Data type	UNSIGNED32 (32 bit unsigned)
	Default value	Index 1400h:200h + Node-ID Index 1405h:80000300h + Node-ID Index 1414h:80000400h + Node-ID Index 1401h to 1404h, 1406h to 1413h, 1415h to 15FFh:disabled
	Unit	—
	Access attribute	Read Only (other than Index 1400,1405,1414) Read / Write (Index 1400, 1405, 1414)
	Availability of mapping to PDO	Disable
02h	Name	Transmission Type
	Data type	UNSIGNED8 (8 bit unsigned)
	Default value	255
	Unit	—
	Access attribute	Read / Write
	Availability of mapping to PDO	Disable

REMARKS

Refer to *page 87* for details of (Index 1800h to 19FFh) Transmit PDO Parameters.

<Detail>
Perform a communication setting of Receive PDO.

<table>
<tr><th>Sub Index</th><th>Bit</th><th>Description</th></tr>
<tr><td>00h</td><td>0 to 7</td><td>The sub-index 0h contains the number of valid entries within the communication record. Its value is at least 2.</td></tr>
<tr><td rowspan="4">01h</td><td>0 to 10</td><td>COB-ID</td></tr>
<tr><td>11 to 28</td><td>Always 0</td></tr>
<tr><td>29</td><td>Always 0
11-bit ID (CAN 2.0A)</td></tr>
<tr><td>30</td><td>0: RTR allowed on this PDO
1: no RTR allowed on this PDO</td></tr>
<tr><td></td><td>31</td><td>0: PDO exists (valid)
1: PDO does not exist (invalid)</td></tr>
<tr><td>02h</td><td>0 to 7</td><td>Description of transmission type
<table>
<tr><th rowspan="2">Transmission Type</th><th colspan="5">PDO Transmission</th></tr>
<tr><th>cyclic</th><th>acyclic</th><th>synchronous</th><th>asynchronous</th><th>RTR only</th></tr>
<tr><td>0</td><td></td><td>valid</td><td>valid</td><td></td><td></td></tr>
<tr><td>1 to 240</td><td>valid</td><td></td><td>valid</td><td></td><td></td></tr>
<tr><td>241 to 251</td><td colspan="5">reserved</td></tr>
<tr><td>252</td><td></td><td></td><td>valid</td><td></td><td>valid</td></tr>
<tr><td>253</td><td></td><td></td><td></td><td>valid</td><td>valid</td></tr>
<tr><td>254</td><td></td><td></td><td></td><td>valid</td><td></td></tr>
<tr><td>255</td><td></td><td></td><td></td><td>valid</td><td></td></tr>
</table></td></tr>
</table>

8.2.15 (Index 1600h to 17FFh) Recive PDO Mapping

Sub Index	Item	Description
00h	Name	Number of mapped application objects in PDO
	Data type	UNSIGNED8 (8 bit unsigned)
	Default value	—
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Disable
01h to 40h	Name	PDO mapping for the nth application object to be mapped
	Data type	UNSIGNED32 (32 bit unsigned)
	Default value	*Refer to page 40*
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Disable

<Detail>
Perform a mapping of Receive PDO.

8.2.16 (Index 1800h to 19FFh) Transmit PDO Parameters

Sub Index	Item	Description
00h	Name	Lagrgest Subindex Supported
	Data type	UNSIGNED8 (8 bit unsigned)
	Default value	4
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Disable
01h	Name	COB-ID used by PDO
	Data type	UNSIGNED32 (32 bit unsigned)
	Default value	Index 1800h: 180h + Node-ID Index 1805h: 80000280h + Node-ID Index 1814h: 80000380h + Node-ID Index 1801h to 1804h, 1806h to 1813h, 1815h to 19FFh:disabled
	Unit	—
	Access attribute	Read Only (other than Index 1800,1805,1814) Read / Write (Index 1800, 1805, 1814)
	Availability of mapping to PDO	Disable
02h	Name	Transmission Type
	Data type	UNSIGNED8 (8 bit unsigned)
	Default value	255
	Unit	—
	Access attribute	Read / Write
	Availability of mapping to PDO	Disable
03h	Name	Inhibit Time
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	—
	Unit	100μs
	Access attribute	Read / Write
	Availability of mapping to PDO	Disable

Sub Index	Item	Description
05h	Name	Event Timer
	Data type	UNSIGNED8 (8 bit unsigned)
	Default value	—
	Unit	ms
	Access attribute	Read / Write
	Availability of mapping to PDO	Disable

REMARKS

Refer to *page 84* for details of (Index 1400h to 15FFh) Recive PDO Parameters.

<Detail>
Perform a communication setting of Transmit PDO.

<table>
<tr><th>Sub Index</th><th>Bit</th><th>Description</th></tr>
<tr><td>00h</td><td>0 to 7</td><td>The sub-index 0h contains the number of valid entries within the communication record. Its value is 4.</td></tr>
<tr><td rowspan="4">01h</td><td>0 to 10</td><td>COB-ID</td></tr>
<tr><td>11 to 28</td><td>Always 0</td></tr>
<tr><td>29</td><td>Always 0
11-bit ID (CAN 2.0A)</td></tr>
<tr><td>30</td><td>0: RTR allowed on this PDO
1: no RTR allowed on this PDO</td></tr>
<tr><td></td><td>31</td><td>0: PDO exists (valid)
1: PDO does not exist (invalid)</td></tr>
<tr><td>02h</td><td>0 to 7</td><td>Description of transmission type
<table>
<tr><th rowspan="2">Transmission Type</th><th colspan="5">PDO Transmission</th></tr>
<tr><th>cyclic</th><th>acyclic</th><th>synchronous</th><th>asynchronous</th><th>RTR only</th></tr>
<tr><td>0</td><td></td><td>valid</td><td>valid</td><td></td><td></td></tr>
<tr><td>1 to 240</td><td>valid</td><td></td><td>valid</td><td></td><td></td></tr>
<tr><td>241 to 251</td><td colspan="5">reserved</td></tr>
<tr><td>252</td><td></td><td></td><td>valid</td><td></td><td>valid</td></tr>
<tr><td>253</td><td></td><td></td><td></td><td>valid</td><td>valid</td></tr>
<tr><td>254</td><td></td><td></td><td></td><td>valid</td><td></td></tr>
<tr><td>255</td><td></td><td></td><td></td><td>valid</td><td></td></tr>
</table></td></tr>
<tr><td>03h</td><td>0 to 15</td><td>Sub-index 3h contains the inhibit time. This time is a minimum interval for PDO transmission. The value is defined as multiple of 100μs. It is not allowed to change the value while the PDO exists (Bit 31 of sub-index 1 is 0).</td></tr>
<tr><td>05h</td><td>0 to 7</td><td>By setting the Sub Index 05h, PDO is sent with Sub Index 05h setting value.
(The setting increments is 1ms.)</td></tr>
</table>

8.2.17 (Index 1A00 to 1BFFh)Transmit PDO Parameters

Sub Index	Item	Description
00h	Name	number of mapped application objects in PDO
	Data type	UNSIGNED8 (8 bit unsigned)
	Default value	—
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Disable
01h to 40h	Name	PDO mapping for the nth application object to be mapped
	Data type	UNSIGNED32 (32 bit unsigned)
	Default value	*Refer to page 44*
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Disable

<Detail>
Perform a mapping of Transmit PDO.

8.3 Object Detail of Manufacturer Specific Area

8.3.1 (Index 2000h to 2063h) Monitor of the inverter

Sub Index	Item	Description
00h	Name	(Refer to the following table)
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	—
	Unit	(Refer to the following table)
	Access attribute	Read Only
	Availability of mapping to PDO	Enable

<Detail>
Return the monitor data of the inverter.

Index	Name	Unit	
		01800 or less	02160 or more
2000h	Output frequency	0.01Hz	0.01Hz
2001h	Output current	0.01A	0.1A
2002h	Output voltage	0.1V	0.1V
2004h	Frequency setting	0.01Hz	0.01Hz
2005h	Running speed	1r/m	1r/m
2006h	Motor torque	0.1%	0.1%
2007h	Converter output voltage	0.1V	0.1V
2008h	Regenerative brake duty	0.1%	0.1%
2009h	Electronic thermal relay function load factor	0.1%	0.1%
200Ah	Output current peak value	0.01A	0.1A
200Bh	Converter output voltage peak value	0.1V	0.1V
200Ch	Input power	0.01kW	0.1kW
200Dh	Output power	0.01kW	0.1kW

Index	Name	Unit	
		01800 or less	02160 or more
200Eh	Input terminal *2	1	1
200Fh	Output terminal *3	1	1
2010h	Load meter	0.1%	0.1%
2011h	Motor excitation current	0.01A	0.1A
2012h	Position pulse *1	0.1%	0.1%
2013h	Cumulative energization time	1h	1h
2014h	Reference voltage output	—	—
2015h	Orientation status *1	1	1
2016h	Actual operation time	1h	1h
2017h	Motor load factor	0.1%	0.1%
2018h	Cumulative power	1kWh	1kWh
201Fh	Torque command	0.1%	0.1%
2020h	Torque current command	0.1%	0.1%
2021h	Motor output	0.01kW	0.1kW
2022h	Feedback pulse *1	—	—
2031h	Power saving effect	Pr. variable	Pr. variable
2032h	Cumulative saving power	Pr. variable	Pr. variable
2033h	PID set point	0.1%	0.1%
2034h	PID measured value	0.1%	0.1%
2035h	PID deviation	0.1%	0.1%
2039h	Option input terminal status1 *4	—	—
203Ah	Option input terminal status2 *5	—	—
203Bh	Option output terminal status *6	—	—

*1 Available only when the FR-A7AP is mounted.

*2 Input terminal monitor details

b15															b0
—	—	—	—	CS	RES	STOP	MRS	JOG	RH	RM	RL	RT	AU	STR	STF

*3 Output terminal monitor details

b15															b0
—	—	—	—	—	—	—	—	—	ABC2	ABC1	FU	OL	IPF	SU	RUN

*4 Details of option input terminal monitor 1 (input terminal status of FR-A7AX)
— all terminals are off when an option is not fitted.

b15															b0
X15	X14	X13	X12	X11	X10	X9	X8	X7	X6	X5	X4	X3	X2	X1	X0

*5 Details of option input terminal monitor 2 (input terminal status of FR-A7AX)
— all terminals are off when an option is not fitted.

b15															b0
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	DY

*6 Details of option output terminal monitor (output terminal status of FR-A7AY/A7AR)
— all terminals are off when an option is not fitted.

b15															b0
—	—	—	—	—	—	RA3	RA2	RA1	Y6	Y5	Y4	Y3	Y2	Y1	Y0

8.3.2 (Index 2106h) Alarm clear

Sub Index	Item	Description
00h	Name	Alarm clear
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	—
	Unit	—
	Access attribute	Write Only
	Availability of mapping to PDO	Enable

<Detail>
Perform an alarm clear by writing "any data".

8.3.3 (Index 2107h) Inverter reset

Sub Index	Item	Description
00h	Name	Inverter reset
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	—
	Unit	—
	Access attribute	Write Only
	Availability of mapping to PDO	Disable

<Detail>
Reset the inverter by writing "9696h".

8.3.4 (Index 2108h) Parameter Clear

Sub Index	Item	Description
00h	Name	Parameter Clear
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	—
	Unit	—
	Access attribute	Write Only
	Availability of mapping to PDO	Disable

<Detail>
Perform parameter clear / all parameter clear.
Clear type can be selected with the written value.

Written Value	Description
965Ah	Parameter Clear
99AAh	All Parameter Clear
5A96h	Parameter Clear (except for communication parameter)
AA99h	All Parameter Clear (except for communication parameter)
Other than the above	Nothing is done.

REMARKS

Respond error when the inverter is not receptive.

8.3.5 (Index 2109h) Operation Mode

Sub Index	Item	Description
00h	Name	Operation Mode
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	—
	Unit	—
	Access attribute	Read / Write
	Availability of mapping to PDO	Disable

<Detail>
Respond error if the inverter is not receptive when requesting.

Value	Description
0000h	External operation mode
0001h	PU operation mode
0002h	External JOG operation mode
0003h	PU JOG operation mode
0004h	NET operation mode
0005h	External / PU combined operation mode
Other than the above	Nothing is done.

REMARKS

Respond error if the inverter is not receptive when requesting the change.

8.3.6 (Index 3000h to 3385h, 33ACh to 33E7h) Normal Parameter Area

Sub Index	Item	Description
00h	Name	Parameter area *(Pr.0 to Pr.901, Pr.940 to Pr.999)*
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	—
	Unit	—
	Access attribute	Read / Write
	Availability of mapping to PDO	Enable

<Detail>
Perform read / write of normal parameter area *(Pr. 0 to Pr. 901, Pr. 940 to Pr. 999)*.

REMARKS

Respond error if the inverter is not receptive when requesting.

8.3.7 (Index 3386h to 33ABh) Calibration Parameter Area

Sub Index	Item	Description
00h	Name	Number of Entries
	Data type	UNSIGNED8 (8 bit unsigned)
	Default value	2
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Disable
01h	Name	Parameter Area *(Pr.902 to Pr.939)* (Offset value)
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	—
	Unit	—
	Access attribute	Read / Write
	Availability of mapping to PDO	Enable
02h	Name	Parameter Area *(Pr.902 to Pr.939)* (Analog value)
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	—
	Unit	—
	Access attribute	Read / Write
	Availability of mapping to PDO	Enable

<Detail>
Perform read / write of calibration parameter area *(Pr. 902 to Pr. 939)*.
Respond error if the inverter is not receptive when requesting.

8.3.8 (Index 3400h to 3403h) Alarm history 1 to 8

Sub Index	Item	Description
00h	Name	Alarm history 1 to 8
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	—
	Unit	—
	Access attribute	Read / Write (Index 3400h), Read Only (Index 3401h to 3403h)
	Availability of mapping to PDO	Enable

<Detail>
Read alarm history

Index No.	Sub Index	High Byte	Low Byte
3400h *	00h	Alarm history 2	Alarm history 1
3401h	00h	Alarm history 4	Alarm history 3
3402h	00h	Alarm history 6	Alarm history 5
3403h	00h	Alarm history 8	Alarm history 7

* Writing any value will clear the alarm definition.

<List of alarm definition>

Data	Description
00h	No alarm
10h	OC1
11h	OC2
12h	OC3
20h	OV1
21h	OV2
22h	OV3
30h	THT
31h	THM
40h	FIN
50h	IPF
51h	UVT
52h	ILF

Data	Description
60h	OLT
70h	BE
80h	GF
81h	LF
90h	OHT
91h	PTC
A0h	OPT
A3h	OP3
B0h	PE
B1h	PUE
B2h	RET
B3h	PE2
C0h	CPU

Data	Description
C1h	CTE
C2h	P24
C4h	CDO
C5h	IOH
C6h	SER
C7h	AIE
C8h	USB
D0h	OS *
D1h	OSD *
D2h	ECT *
D3h	OD *
D5h	MB1
D6h	MB2

Data	Description
D7h	MB3
D8h	MB4
D9h	MB5
DAh	MB6
DBh	MB7
DCh	EP *
F1h	E.1
F2h	E.2
F3h	E.3
F6h	E.6
F7h	E.7
FBh	E.11
FDh	E.13

* Appears when the FR-A7AP (option) is fitted.

Refer to the inverter manual for details of alarm definitions.

8.3.9 (Index 4000h) Control input command (w) / Inverter status (r)

Sub Index	Item	Description
00h	Name	Control input command (w) / Inverter status (r)
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	—
	Unit	—
	Access attribute	Read / Write
	Availability of mapping to PDO	Enable

<Detail>
Perform control command to the inverter. And read the inverter status.
When written at the same time as Index 4010h control input command (w) (written at the same time with SDO and PDO), the latter writing has priority.

(1) Control input command (Writing)

The following items can be sent to the inverter as control input command.

bit	Definition	bit	Definition
0	(blank)	7	RT (second function selection) *1
1	STF (Forward rotation command) *3	8	AU (current input selection) *1
2	STR (Reverse rotation command) *3	9	CS (selection of automatic restart after instantaneous power failure) *1, *2
3	RH (high-speed operation command) *1	10	MRS (output shutoff)
4	RM (middle-speed operation command) *1	11	STOP (start self-holding selection) *1, *2
5	RL (low-speed operation command) *1	12	RES (reset) *1, *2
6	JOG (jog operation selection) *1, *2	13 to 15	(blank)

*1 Signal names are initial values. Definitions change according to the *Pr. 180 to Pr. 189 (input terminal function selection)*.
*2 The signal within parentheses is the default setting. Since jog operation/automatic restart after instantaneous power failure/start self-holding/ reset cannot be controlled by the network, they are invalid in the initial status.
*3 STF and STR are valid only when the internal status of the FR-A7NCA *(Refer to page 112)* is Operation Enable.
The motor runs at the speed of target_velocity at transition to Operation Enable.
(To change the rotation direction at transition to Operation Enable, set target_velocity to negative speed.)

(2) Inverter status (Reading)

Bit difinitions are as follows.

bit	Definition	
0	RUN (inverter running)	Signals are not affected by settings of *Pr.190 to Pr.196* (output terminal function selection).
1	FWD (During forward rotation)	
2	REV (Reverse running)	
3	SU (up-to-frequency)	
4	OL (overload)	
5	IPF (instantaneous power failure)	
6	FU (frequency detection)	
7	ABC1 (alarm)	
8 to 14	(blank)	
15	Operation ready completion (READY)	

8.3.10 (Index 4001h) Set frequency (Set Speed) (w) / Output frequency (Running speed) (r)

Sub Index	Item	Description
00h	Name	Number of Entries
	Data type	UNSIGNED8 (8 bit unsigned)
	Default value	2
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Disable
01h	Name	Set frequency (w) / Output frequency (r)
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	—
	Unit	0.01Hz (frequency)
	Access attribute	Read / Write
	Availability of mapping to PDO	Enable
02h	Name	Set speed (w) / Running Speed (r)
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	—
	Unit	1r/min (speed)
	Access attribute	Read / Write
	Availability of mapping to PDO	Enable

<Detail>
Perform frequency setting to the inverter. And read the output frequency.
When written at the same time as Index 4012h set frequency (w), set speed (w) (written at the same time with SDO and PDO), the latter writing has priority.

(1) Writing

Perform the set frequency (speed) writing in 0.01Hz (1r/min) increments.

(2) Reading

Perform the output frequency (running speed) reading in 0.01Hz (1r/min) increments.

REMARKS

Refer to *page 34* conversion of set speed and running speed.

8.3.11 (Index 4002h) Set Frequency

Sub Index	Item	Description
00h	Name	Number of Entries
	Data type	UNSIGNED8 (8 bit unsigned)
	Default value	2
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Disable
01h	Name	Set Frequency (RAM)
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	—
	Unit	0.01Hz
	Access attribute	Read / Write
	Availability of mapping to PDO	Enable
02h	Name	Set Frequency (EEPROM)
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	—
	Unit	0.01Hz
	Access attribute	Write Only
	Availability of mapping to PDO	Enable

<Detail>
Perform reading / writing of the set frequency (RAM / EEPROM) to the inverter.
When written at the same time as Index 4012h set frequency (w), set speed (w) (written at the same time with SDO and PDO), the latter writing has priority.

8.3.12 (Index 4003h) Set Speed

Sub Index	Item	Description
00h	Name	Number of Entries
	Data type	UNSIGNED8 (8 bit unsigned)
	Default value	2
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Disable
01h	Name	Set Speed (RAM)
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	—
	Unit	1r/min
	Access attribute	Read / Write
	Availability of mapping to PDO	Enable
02h	Name	Set Speed (EEPROM)
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	—
	Unit	1r/min
	Access attribute	Write Only
	Availability of mapping to PDO	Enable

<Detail>
Perform reading / writing of the set speed (RAM / EEPROM) to the inverter.
When written at the same time as Index 4012h set frequency (w), set speed (w) (written at the same time with SDO and PDO), the latter writing has priority.

REMARKS

Refer to *page 34* conversion of set speed and running speed.

8.3.13 (Index 4010h) Control Input Command (w)

Sub Index	Item	Description
00h	Name	Control Input Command (w)
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	—
	Unit	—
	Access attribute	Write Only
	Availability of mapping to PDO	Enable

<Detail>
Perform control command to the inverter.
When written at the same time as Index 4000h control input command (w) (written at the same time with SDO and PDO), the latter writing has priority.
The following items can be sent to the inverter as control input command.

bit	Definition	bit	Definition
0	(blank)	7	RT (second function selection) *1
1	STF (Forward rotation command) *3	8	AU (current input selection) *1
2	STR (Reverse rotation command) *3	9	CS (selection of automatic restart after instantaneous power failure) *1, *2
3	RH (high-speed operation command) *1	10	MRS (output shutoff)
4	RM (middle-speed operation command) *1	11	STOP (start self-holding selection) *1, *2
5	RL (low-speed operation command) *1	12	RES (reset) *1, *2
6	JOG (jog operation selection) *1, *2	13 to 15	(blank)

*1 Signal names are initial values. Definitions change according to the *Pr. 180 to Pr. 189 (input terminal function selection)*.
*2 The signal within parentheses is the default setting. Since jog operation/automatic restart after instantaneous power failure/start self-holding/ reset cannot be controlled by the network, they are invalid in the initial status.
*3 STF and STR are valid only when the internal status of the FR-A7NCA *(Refer to page 112)* is Operation Enable.
The motor runs at the speed of target_velocity at transition to Operation Enable.
(To change the rotation direction at transition to Operation Enable, set target_velocity to negative speed.)

8.3.14 (Index 4011h) Inverter Status (r)

Sub Index	Item	Description
00h	Name	Inverter Status (r)
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	—
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Enable

<Detail>
Read the inverter status.
Bit definitions are as follows.

bit	Definition	
0	RUN (inverter running)	Signals are not affected by settings of *Pr.190 to Pr.196* (output terminal function selection).
1	FWD (During forward rotation)	
2	REV (Reverse running)	
3	SU (up-to-frequency)	
4	OL (overload)	
5	IPF (instantaneous power failure)	
6	FU (frequency detection)	
7	ABC1 (alarm)	
8 to 14	(blank)	
15	Operation ready completion (READY)	

8.3.15 (Index 4012h) Set Frequency (w) / Set Speed (w)

Sub Index	Item	Description
00h	Name	Number of Entries
	Data type	UNSIGNED8 (8 bit unsigned)
	Default value	2
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Disable
01h	Name	Set Frequency (w)
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	—
	Unit	0.01Hz (frequency)
	Access attribute	Write Only
	Availability of mapping to PDO	Enable
02h	Name	Set Speed (w)
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	—
	Unit	1r/min (speed)
	Access attribute	Write Only
	Availability of mapping to PDO	Enable

<Detail>
Perform frequency (speed) setting to the inverter in 0.01Hz (1r/min) increments.
When index 4001h set frequency (w)/output frequency (r) set speed (w)/running speed (r) are set at the same time (when written by SDO and PDO simultaneously), the value written later has precedence.

REMARKS

Refer to *page 34* conversion of set speed and running speed.

8.3.16 (Index 4013h) Output Frequency (r) / Running Speed (r)

Sub Index	Item	Description
00h	Name	Number of Entries
	Data type	UNSIGNED8 (8 bit unsigned)
	Default value	2
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Disable
01h	Name	Output Frequency (r)
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	—
	Unit	0.01Hz (frequency)
	Access attribute	Read Only
	Availability of mapping to PDO	Enable
02h	Name	Running Speed (r)
	Data type	UNSIGNED16 (16 bit unsigned)
	Default value	—
	Unit	1r/min (speed)
	Access attribute	Read Only
	Availability of mapping to PDO	Enable

<Detail>
Read output frequency (running speed) in 0.01Hz (1r/min) increments.

REMARKS

Refer to *page 34* conversion of set speed and running speed.

8.4 Object detail of Device Profile Area

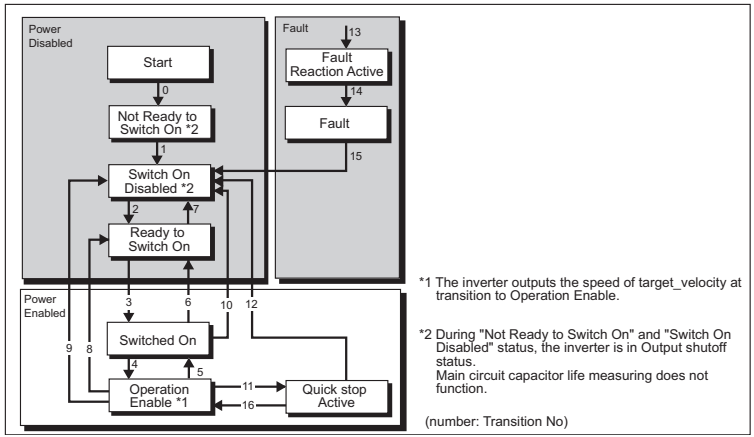
8.4.1 (Index 6040h) controlword

Sub Index	Item	Description
00h	Name	controlword
	Data Type	UNSIGNED16 (16 bit unsigned)
	Default value	—
	Unit	—
	Access attribute	Read / Write
	Availability of mapping to PDO	Enable

<Detail>
Control command to the inverter.

Bit	Description	Remarks
0	Switch On	
1	Disable voltage	Output shutoff
2	Quick Stop	Stop command
3	Enable Operation	
4 to 6	(not used)	(bit operation invalid)
7	Reset Fault	Alarm reset
8 to 15	(not used)	(bit operation invalid)

<Status transition>
Refer to the table below to send a command for status transition.



<Relationship between command and bit combination>

Bit combination / Command	Bit7 Fault Reset	Bit3 Enable Operation	Bit2 Quick Stop	Bit1 Disable Voltage	Bit0 Switch On	Transition No
Shutdown	0	—	1	1	0	2, 6, 8
Switch On	0	—	1	1	1	3
Disable Voltage	0	—	—	0	—	7, 9, 10, 12
Quick Stop	0	—	0	1	—	7, 10, 11
Disable Operation	0	0	1	1	1	5
Enable Operation	0	1	1	1	1	4, 16
Fault Reset	0⇒1	—	—	—	—	15

0 : OFF 1 : ON — : whichever is ok

Each inverter status indicated in <Status transition> on *page 112* is as follows:

Inverter Status	Description
Start	Power-on
Not Ready to Switch On	During reset
Switch On Disabled	• Reset is completed • Inverter is at a stop • The status changes by a command
Ready to Switch On	• Inverter is at a stop • The status changes by a command
Switched On	• Inverter is at a stop • The status changes by a command
Operation Enable	During operation
Quick Stop Active	At deceleration to stop by QuickStop excecution
Fault Reaction Active	— ("Fault Reaction Active" status is not available with the FR-A7NCA.)
Fault	Alarm occurrence status

8.4.2 (Index 6041h) Statusword

Sub Index	Item	Description
00h	Name	statusword
	Data Type	UNSIGNED16 (16 bit signed)
	Default value	—
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Enable

<Detail>
Indicate the current status of the inverter.

Bit	Description	Remarks
0	Ready to Switch On	
1	Switch On	
2	Operation enabled	
3	Fault	
4	Voltage enabled	1 is set when high voltage is being supplied to the inverter. (Always 1)
5	Quick stop	1 is set when the inverter is responding to the Quick stop request at reset.
6	Switch on disabled	
7	Warning	1 is set when the inverter is in Warning status.
8	Manufacturer spesific	
9	Remote	1 is set during parameter change from the network and command message execution. Set 0 in local mode.
10	Reserved	
11	Internal limit active	1 when (Index 6046h Subindex 01h) vl_velocity_min_amount is bigger than (Index 6042h Subindex 00h) vl_target velocity and (Index 6042h Subindex 00h) vl_target velocity is bigger than (Index 6046h Subindex 02h) vl_velocity_max_amount.
12	Reserved	
13	Reserved	
14	Manufacturer specific	
15	Manufacturer specific	

<Relationship between status and bit combination>
The table below shows each status of *Page 112* of the status transition diagram.

Bit combination / Command	Bit6 Switch on disabled	Bit5 Quick Stop	Bit3 Fault	Bit2 Operation Enabled	Bit1 Switch on	Bit0 Ready to Switch On
Not ready to switch on	0	—	0	0	0	0
Switch on disabled	1	—	0	0	0	0
Ready to switch on	0	1	0	0	0	1
Switched on	0	1	0	0	1	1
Operation enabled	0	1	0	1	1	1
Quick stop active	0	0	0	1	1	1
Fault reaction active	0	—	1	1	1	1
Fault	0	—	1	0	0	0

0 : OFF 1 : ON — : whichever is ok

8.4.3 (Index 6042h) vl_target_velocity

Sub Index	Item	Description
00h	Name	vl target velocity
	Data Type	INTEGER16 (16 bit signed)
	Default value	0
	Unit	1 r/min
	Access attribute	Read / Write
	Availability of mapping to PDO	Enable

<Detail>
Perform speed setting only.

8.4.4 (Index 6043h) vl_velocity_demand

Sub Index	Item	Description
00h	Name	vl velocity demand
	Data Type	INTEGER16 (16 bit signed)
	Default value	—
	Unit	1 r/min
	Access attribute	Read Only
	Availability of mapping to PDO	Enable

<Detail>
Instantaneous speed provided by Ramp function and can be changed by the inverter only.
This is the running speed and uses a value converted from output frequency and uses frequency and speed conversion for increments change. *(Refer to page 34.)*

8.4.5 (Index 6044h) vl_control_effort

Sub Index	Item	Description
00h	Name	vl control effort
	Data Type	INTEGER16 (16 bit signed)
	Default value	—
	Unit	1 r/min
	Access attribute	Read Only
	Availability of mapping to PDO	Enable

<Detail>

Displays the motor speed.

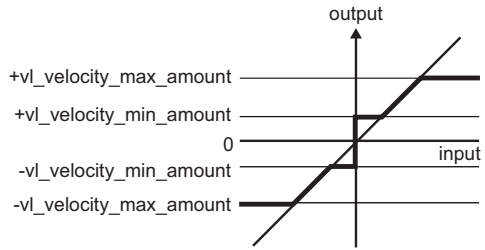
Running speed monitor (value converted from output frequency) is returned for open loop control and actual speed monitor (speed feedback value) is returned for closed loop control. *(Refer to page 34.)*

8.4.6 (Index 6046h) vl_velocity_min_max_amount

Sub Index	Item	Description
00h	Name	Number of Entries
	Data Type	UNSIGNED8 (8 bit unsigned)
	Default value	2
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Disable
01h	Name	vl velocity min amount *(Pr. 2)*
	Data Type	UNSIGNED32 (32 bit unsigned)
	Default value	— *
	Unit	1rpm
	Access attribute	Read / Write
	Availability of mapping to PDO	Enable
02h	Name	vl velocity max amount *(Pr. 1)*
	Data Type	UNSIGNED32 (32 bit unsigned)
	Default value	— *
	Unit	1rpm
	Access attribute	Read / Write
	Availability of mapping to PDO	Enable

* Depends on the inverter setting value *(Pr. 1, Pr. 2)*.

<Detail>
Speed maximum and speed minimum.
The setting range of Sub Index 01h, 02h are same as the *Pr. 1* and *Pr. 2*.
Changing the speed maximum value and speed minimum value of Index 6046 changes the *Pr.1 Maximum frequency* and *Pr.2 Minimum frequency* value as well.



8.4.7 (Index 6048h) vl_velocity_acceleration

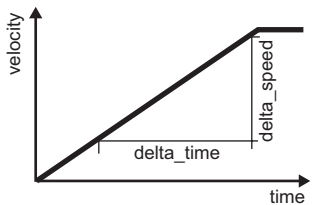
Sub Index	Item	Description
00h	Name	Number of Entries
	Data Type	UNSIGNED8 (8 bit unsigned)
	Default value	2
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Disable
01h	Name	Delta speed *(Pr. 20)*
	Data Type	UNSIGNED32 (32 bit unsigned)
	Default value	— *
	Unit	1r/min
	Access attribute	Read / Write
	Availability of mapping to PDO	Enable
02h	Name	Delta time *(Pr. 7)*
	Data Type	UNSIGNED16 (16 bit unsigned)
	Default value	— *
	Unit	s
	Access attribute	Read / Write
	Availability of mapping to PDO	Enable

* Depends on the inverter setting value *(Pr. 7, Pr. 20)*.

<Detail>
Slope of acceleration. It is formed as a ratio of Delta_speed and delta_time.
The setting range of Sub Index 01h, 02h are same as the *Pr. 7* and *Pr. 20*.
When parameter 0 is defined for delta time, this function follows set-point directly.
Use delta_speed as *Pr.20 Acceleration/deceleration reference frequency* and delta_time as *Pr.7 Acceleration time*.
In addition, the setting range of delta_time can be changed using *Pr.21 Acceleration/deceleration time increments*.
You can set the time taken by the motor to accelerate from 0Hz to the set frequency (1 to 400Hz) of *Pr. 20 Acceleration/deceleration reference frequency.* (Refer to *the inverter manual (applied)* for details of *Pr. 20*.)

Parameter Number	Name	Initial Value	Setting Range	Description	
21	Acceleration/ deceleration time increments	0	0	Increments: 0.1s Range: 0 to 3600s	Increments and setting range of acceleration/deceleration time setting can be changed.
			1	Increments: 0.01s Range: 0 to 360s	

$$vl\ velocity\ acceleration = \frac{delta\ speed}{delta\ time} = a_B$$



CAUTION

The setting increments of acceleration time changes according to the *Pr. 21* setting. The value 0.1 times greater than the setting value is written to the inverter when *Pr. 21* = 1. When the *Pr. 21* setting has been changed, set the acceleration time again.
(Example) When *Pr. 21* = "0" and the setting of acceleration time is "5.0"s, and if the setting of *Pr. 21* is changed to "1", the setting value of acceleration time will change to "0.5" s.
Refer to *the inverter manual (applied)* for details.

REMARKS

Refer to the inverter manual (applied) for details of *Pr.7, Pr.20, and Pr.21*.

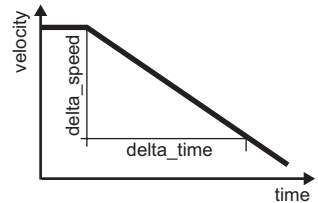
8.4.8 (Index 6049h) vl_velocity_deceleration

Sub Index	Item	Description
00h	Name	Number of Entries
	Data Type	UNSIGNED8 (8 bit unsigned)
	Default value	2
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Disable
01h	Name	Delta speed *(Pr. 20)*
	Data Type	UNSIGNED32 (32 bit unsigned)
	Default value	—*
	Unit	1r/min
	Access attribute	Read / Write
	Availability of mapping to PDO	Enable
02h	Name	Delta time *(Pr. 8)*
	Data Type	UNSIGNED16 (16 bit unsigned)
	Default value	—*
	Unit	s
	Access attribute	Read / Write
	Availability of mapping to PDO	Enable

* Depends on the inverter setting value *(Pr. 8, Pr. 20)*.

<Detail>
Slope of deceleration. It is formed as a ratio of Delta_speed and delta_time.
The setting range of Sub Index 01h, 02h are same as the *Pr. 8* and *Pr. 20*.
When parameter 0 is defined for delta time, this function follows set-point directly.
Regard delta_speed as *Pr.20 Acceleration/deceleration reference frequency* and delta_time as *Pr.8 Deceleration time*.
You can set the time taken by the motor to decelerate from the set frequency (1 to 400Hz) of *Pr. 20 Acceleration/deceleration reference frequency* to 0Hz. (Refer to *the inverter manual (applied)* for details of *Pr. 20*.)

$$vl\ velocity\ deceleration = \frac{delta\ speed}{delta\ time} = a_v$$



CAUTION

The setting increments of deceleration time changes according to the *Pr. 21* setting. The value 0.1 times greater than the setting value is written to the inverter when *Pr. 21* = 1. When the *Pr. 21* setting has been changed, set the deceleration time again.
(Example) When *Pr. 21* = "0" and the setting of deceleration time is "5.0"s, and if the setting of *Pr. 21* is changed to "1", the setting value of deceleration time will change to "0.5" s.
Refer to *the inverter manual (applied)* for details.

REMARKS

Refer to the inverter manual (applied) for details of *Pr.8, Pr.20 and Pr.21*.

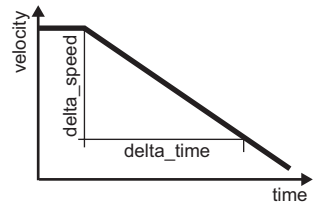
8.4.9 (Index 604Ah) vl_velocity_quick_stop

Sub Index	Item	Description
00h	Name	Number of Entries
	Data Type	UNSIGNED8 (8 bit unsigned)
	Default value	2
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Disable
01h	Name	Delta speed *(Pr. 20)*
	Data Type	UNSIGNED32 (32 bit unsigned)
	Default value	—*
	Unit	1r/min
	Access attribute	Read / Write
	Availability of mapping to PDO	Enable
02h	Name	Delta time *(Pr. 8)*
	Data Type	UNSIGNED16 (16 bit unsigned)
	Default value	—*
	Unit	s
	Access attribute	Read / Write
	Availability of mapping to PDO	Enable

* Depends on the inverter setting value *(Pr. 8, Pr. 20)*.

<Detail>
Slope of quick stop. It is formed as a ratio of Delta_speed and delta_time.
The setting range of Sub Index 01h, 02h are same as the *Pr. 8* and *Pr. 20*.
Regard delta_speed as *Pr.20 Acceleration/deceleration reference frequency* and delta_time as *Pr.8 Deceleration time*.
You can set the time taken by the motor to decelerate from the set frequency (1 to 400Hz) of *Pr. 20 Acceleration/deceleration reference frequency* to 0Hz. (Refer to *the inverter manual (applied)* for details of *Pr. 20*.)
(Note that the deceleration time depends on the setting of *Pr. 44*, etc.)

$$\text{velocity quick stop} = \frac{\text{delta speed}}{\text{delta time}} = a_s$$



CAUTION

The setting increments of deceleration time changes according to the *Pr. 21* setting. The value 0.1 times greater than the setting value is written to the inverter when *Pr. 21* = 1. When the *Pr. 21* setting has been changed, set the deceleration time again.
(Example) When *Pr. 21* = "0" and the setting of deceleration time is "5.0"s, and if the setting of *Pr. 21* is changed to "1", the setting value of deceleration time will change to "0.5" s.
Refer to *the inverter manual (applied)* for details.

REMARKS

Refer to the inverter manual (applied) for details of *Pr.8 , Pr.20 and Pr.21*.

8.4.10 (Index 605Ah) Quick_stop_option_code

Sub Index	Item	Description
00h	Name	Quick_stop_option_code
	Data Type	INTEGER16 (16 bit signed)
	Default value	2
	Unit	—
	Access attribute	Read / Write
	Availability of mapping to PDO	Disable

<Detail>
Select the operation for when Quick stop function is executed.
Abort code 0609 0030 is returned when 3, 4, 7, or 8 is written.

Value	Description	Remarks
-1 ··· -32768	Manufacturer specific	
0	Disable drive function	Output shutoff
1	Slow down on slow down ramp	Decelerate to stop along the slope of vl_velocity_deceleration
2	Slow down on quick stop ramp	Decelerate to stop along the slope of vl_velocity_quick_stop
3	—	
4	—	
5	Slow down on slow down ramp and stay in QUICK STOP	Decelerate to stop along the slope of vl_velocity_deceleration (The status transition remains Quick stop activ even after quick stop completion)
6	Slow down on quick stop ramp and stay in QUICK STOP	Decelerate to stop along the slope of vl_velocity_quick_stop (The status transition remains Quick stop activ even after quick stop completion)
7	—	
8	—	
9 ··· 32767	Reserved	

8.4.11 (Index 6060h) modes_of_operation

Sub Index	Item	Description
00h	Name	Modes of operation
	Data Type	INTEGER8 (8 bit signed)
	Default value	2
	Unit	—
	Access attribute	Read / Write
	Availability of mapping to PDO	Enable

<Detail>
The current mode of the inverter is reflected on modes of operation display.
FR-A7NCA supports Velocity Mode.

Value	Description
2	Velocity Mode

8.4.12 (Index 6061h) modes_of_operation_display

Sub Index	Item	Description
00h	Name	Modes of operation display
	Data Type	INTEGER8 (8 bit signed)
	Default value	2
	Unit	—
	Access attribute	Read Only
	Availability of mapping to PDO	Enable

<Detail>
Indicates the current operation mode.

Value	Description
2	Velocity Mode

8.4.13 (Index 67FFh) Single_Device_Type

Sub Index	Item	Description
00h	Name	Device Type
	Data Type	UNSIGNED32 (32 bit unsigned)
	Default value	00010192h
	Access attribute	Read Only
	Availability of mapping to PDO	Disable

<Detail>
67FFh and offset 800h indicates a type and function of a device.

Bit	Description	Remarks
0 to 15	Device Profile Number	0192h (Drive Profile is 402)
16 to 23	Additional Information (Type)	01h (Frequency Converter)
24 to 31	Additional Information (mode bits)	00h

9 TROUBLESHOOTING

If a fault occurs and the inverter fails to operate properly, locate the cause of the fault and take proper corrective action by referring to the troubleshooting below. If the corresponding information is not found in the table, the inverter has problem, or the component parts are damaged, contact your sales representative.

Display		Possible Causes	Check Point	Corrective Action
Operation panel of inverter	ERR LED of FR-A7NCA			
0.00	Single flash	Network error such as communication frame error occurred.	• Check that all cables are connected properly. • Check that baud rate setting is correct. • Check that the network cable is properly terminated.	• Check for a cable and connector. • Check for baud rate setting. • Check for cable termination.
0.00	On	Bus off occurrence	• Check that all cables are connected properly. • Check that baud rate setting is correct. • Check that Network power is on.	• Check for a cable and connector. • Check for baud rate setting. • Check for the Network power.
E.OP3	Double flash	Life Garding Event occurrence (Remote request from the master was not received within Node Life Time.)	Check for Guard: Node Life Time (Index 100Ch Guard Time × Index 100Dh Life Time Factor).	Send remote request within Node Life Time (Guard Time × Life Time Factor).

EDS file

For the EDS file (A700.EDS) of the FR-A700 series, contact your sales representative.

REVISIONS

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

Print Date	*Manual Number	Revision
Jun., 2006	IB(NA)-0600259ENG-A	First edition