MITSUBISHI ELECTRIC

TRANSISTORIZED INVERTER

-INSTRUCTION MANUAL-

LONWORKS® COMMUNICATION OPTION

FR-E5NL

Thank you for choosing the Mitsubishi transistorized inverter option unit.
This instruction manual gives handling information and precautions for use of this equipment. Incorrect handling might cause an unexpected fault. Before using the equipment, please read this manual carefully to use the equipment to its optimum.
Please forward this manual to the end user.

This section is specifically about safety matters

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

⚠ **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 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 removed. Otherwise, you may access the exposed high-voltage terminals and charging part and get an electric shock.**
- **Even if power is off, do not remove the front cover except for wiring or periodic inspection. You may access the charged inverter circuits and get an electric shock.**
- **Before starting wiring or inspection, switch power off, wait for more than 10 minutes, and check for no residual voltage with a tester or the like.**

⚠ WARNING

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

2. Injury Prevention

⚠ CAUTION

- Apply only the voltage specified in the instruction manual to each terminal to prevent burst, damage, etc.
- 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 burst, damage, etc.
- While power is on or for some time after power-off, do not touch the inverter as it is hot and you may get burnt.

3. Additional instructions

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

(1) Transportation and mounting

⚠ CAUTION

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

(2) Test operation and adjustment

⚠ CAUTION

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

(3) Usage

⚠ WARNING
● Do not modify the equipment.

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

(4) Maintenance, inspection and parts replacement

⚠ CAUTION
● Do not test the equipment with a megger (measure insulation resistance).

(5) Disposal

⚠ CAUTION
● Treat as industrial waste.

(6) General instruction

All illustrations given in this manual may have been drawn with covers or safety guards removed to provide 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.

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1.PRE-OPERATION INSTRUCTIONS

1.1 Unpacking and Product Confirmation

Take the option unit out of the package, check the unit name, and confirm that the product is as you ordered and intact.
This product is an inboard option unit designed for exclusive use in the Mitsubishi FR-E500 series inverter (FR-E540-0.4K to 7.5K).

1.2 Packing Confirmation

Make sure that the package includes the following

- Instruction manual.....1
- Mounting screws M3 × 6 2
- Neuron® ID Bar code sticker 1
  (Since one of the stickers should be retained for the builder's records, three stickers are enclosed.)
- Connector for the option unit.....1

1.3 XIF File

Using the configuration software enables easy network setting.
To use the configuration software, an XIF file is necessary. The XIF file is a file that recognizes features and functions of devices. Refer to the instruction manual of the configuration software for details on installation and how to use the XIF file.
Please contact your sales representative for the XIF file.

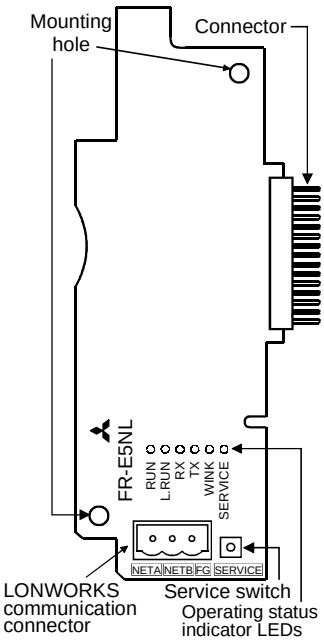
CAUTION

Since memory for write enable application is not provided, application files (file extensions .nxe, .apb) are not supplied.

1.4 Instruction Manual Note

(1) Echelon®, Neuron®, and LONWORKS® are trademarks of Echelon corporation in the U.S.A. and other countries.

1.5 Structure



Name		Function
Service switch		Press this switch to initialize the network management computer.
Operating status indicator LEDs	RUN	Display the unit operation status. ON :Normal operation OFF :Alarm (watchdog timer expiration etc.) detection
	L.RUN	Display the handshaking status with the inverter. ON :Normal operation OFF :Alarm detection
	RX *	Display the receiving status of packet from the network. ON(for about 50ms) :Receiving OFF :Stop receiving
	TX	Display the transmission status of packet to the network. ON(for about 50ms) :Transmitting OFF :Stop transmission
	WINK	Display the receiving status of WINK message from the network. Flicker three times :Receiving WINK message OFF :Stop
	SERVICE	Display the status of node and service switch. ON :Service switch pressed status Flicker :Unconfigured status OFF :Configured status

*"RX LED" turns on when the inverter autonomously sends data due to heart beat or event driven function even if a communication cable has not been installed.

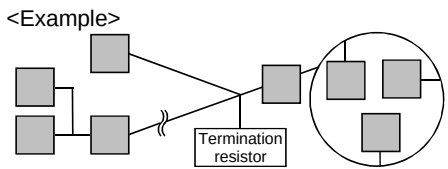
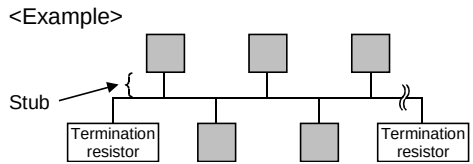
Name		Function
LONWORKS communication connector	NETA	To be connected to a twisted pair cable.
	NETB	
	FG	To be connected to ⏚ of the inverter.

1.6 Inverter Option Specifications

Type		Inverter inboard option fitted to the terminal block (can be mounted/dismounted to/from the inverter front face)
Number of stations occupied		One inverter occupies one node.
Communication cable	Free topology	Twisted pair cable equivalent to EBT0.65mm×1p (ICT 0.65mm×1p, manufactured by Fuji Cable (Ltd.) made)
	Bus topology	Twisted pair cable equivalent to EBT1.3mm×1p (ICT 1.3mm×1p, manufactured by Fuji Cable (Ltd.) made)

* When the option unit (FR-E5NL) is plugged in, the protective structure (JEM1030) is open type (IP00).

1.7 Communication Specification

<table>
<tr><td colspan="2">Number of units connected</td><td colspan="2">64 units maximum including the inverter in the same segment.</td></tr>
<tr><td colspan="2">Communication speed</td><td colspan="2">78kbps</td></tr>
<tr><td rowspan="2">Maximum cable length</td><td>Free topology (connect a terminating resistor at any one point)</td><td> 
</td><td>500m</td></tr>
<tr><td>Bus topology (connect a terminating resistor at both ends)</td><td> 
</td><td>2700m
(The total length of each node stub should be 3m maximum.)</td></tr>
<tr><td rowspan="2">Event reception and transmission</td><td>Event reception</td><td colspan="2">Number of events receivable at a time : 20
Reception time per event : 100ms maximum
(when not conflicting with event transmission)</td></tr>
<tr><td>Event transmission</td><td colspan="2">Transmission time per event
Without bind : 200ms
With bind : [retry interval time]×[number of retries]</td></tr>
</table>

* Refer to the LONWORKS FTF-10A Free Topology Transceiver User's Guide for details.

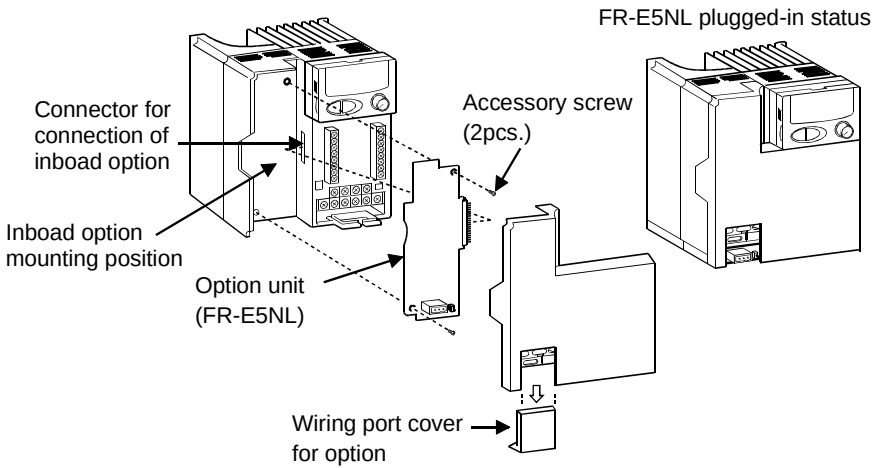
2.INSTALLATION

2.1 Pre-Installation Instructions

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

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

2.2 Installation Procedure



(1) Remove the front cover and option wiring port cover. (Refer to the inverter manual.)
(2) Remove the sponge from the inboard option connector, align the option unit connector with the inboard option connector of the inverter, and securely insert it far enough into the inverter.
(3) Securely fix the two top and bottom places of the option unit 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 looseness.
(4) Reinstall the front cover of the inverter. (Refer to the inverter manual.)

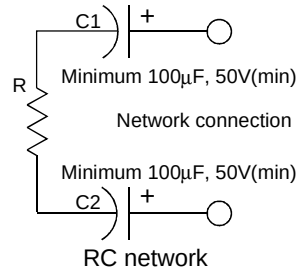
REMARKS

While the inboard option is plugged in, store the option wiring port cover carefully.
When this option is plugged in, the protective structure of the inverter is the open type (IP00).
If the inverter cannot recognize the plugged-in option, the E.OPT error appears. (Refer to the inverter manual.)

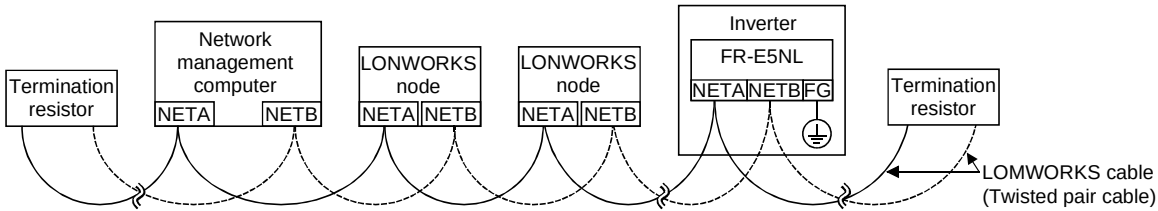
2.3 System Configuration Example

(1) Mount the option unit (FR-E5NL) on the inverter. (Refer to page 6.)
(2) Connect the LONWORKS node, option unit, network management computer, and terminating resistance with the LONWORKS cable. Select a terminating resistance so that resistance values of R of the RC network are the same as shown below.
- Free topology (Refer to page 5) R = 52.3Ω±1% 1/8W
- Bus topology (Refer to page 5) R = 105Ω±1% 1/8W

(3) Install the network management tool on the network management computer to assign the network address and bind (association function) the network variable, etc. to the LONWORKS node.



(Example) Bus topology (without stub)



REMARKS

The network management tool is not included with this product. Please purchase it separately.
For the network management tool, LonMaker™ by Echelon® Co. is recommended. Lon Maker™ is a registered trademark of Echelon® Co.
When the option unit has been replaced because of a fault or others, perform "Commission" or "Replace" from the network management tool after switching on the inverter. After performing "Commission" or "Replace", reset the inverter (switch power off once, then on again or turn the RES signal on).

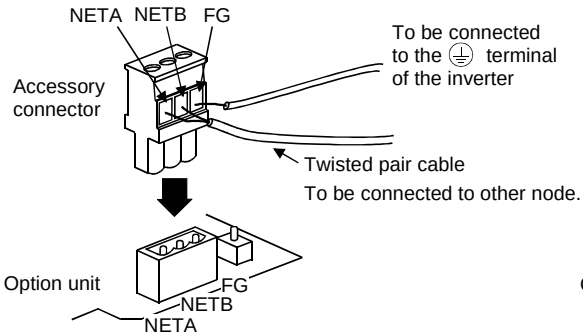
2.4 LONWORKS Communication Cable

Use an accessory connector and a shield twisted pair cable to make a network connection cable.

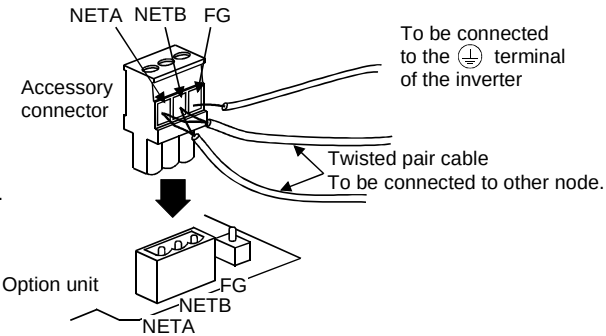
(1) Insert a flat-blade screwdriver (maximum width 3.75mm) into the upper hole of the connector plug and open the clamp in the lower hole to allow the wire to be inserted.

(2) Insert the shield twisted pair cable into NETA and NETB of the connector. Connect FG to the ⏚ terminal of the inverter. Tighten the fastening screws to the recommended tightening torques. Leave the other end of the cable unconnected.
Recommended tightening torque : 0.22 to 0.25N•m

<When using one twisted pair cable>



<When using two twisted pair cables>



CAUTION

Change the number of twisted pair cables to be connected to NETA and NETB according to the system used.

3. INVERTER SETTING

3.1 Parameter List

When this option unit is mounted, extended functions of the following parameters become available. Perform setting as required.

Parameter Number	Name	Setting Range	Minimum Setting Increments	Factory Setting	Refer to Page
338	operation control command source	0, 1	1	0	19
339	speed command source	0, 1, 10	1	0	19
340	link startup mode selection	0, 1, 2	1	0	14
387	initial communication delay time	0 to 120s	0.1s	0s	31
388	heartbeat send time interval	0 to 999.8s	0.1s	0s	31
389	minimum heartbeat send time	0 to 999.8s	0.1s	0.5s	31
390	% set reference frequency	1 to 400Hz	0.01Hz	60Hz	35
391	heartbeat receive time interval	0 to 999.8s	0.1s	0s	34
392	event driven detection width	0.00 to 163.83%	0.01%	0%	36
500	communication error recognition waiting time	0 to 999.8s	0.1s	0	21
501	communication error occurrence count display	0	1	0	22
502	communication error-time stop mode selection	0, 1, 2, 3	1	0	23

When this option is mounted, the setting values of the following parameters are extended.

Parameter Number	Name	Setting Range	Minimum Setting Increments	Factory Setting	Refer to Page
128	PID action selection	0, 20, 21, 50, 51, 60, 61	-	0	28

3.2 Operation Mode

The inverter mounted with the option unit (FR-E5NL) has the following operation modes:

(1) PU operation [PU]..... Controls the inverter from the keyboard of the operation panel or parameter unit (FR-PU04) (referred to as the "PU") installed to 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 other nodes on a network via the option unit (FR-E5NL). (The operation signal and running frequency can be entered from the control circuit terminals depending on the Pr. 338 "operation control command source" and Pr. 339 "speed command source" setting.)

3.2.1 Operation mode switching

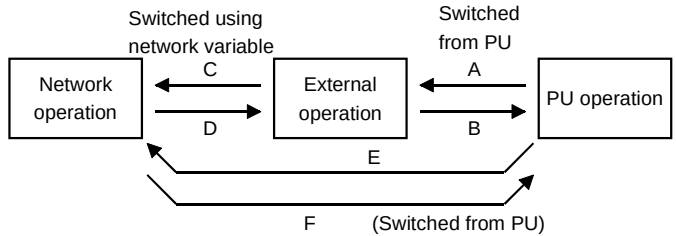
(1) Operation mode switching conditions

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.
   (For setting, use the inverter's operation panel or optional parameter unit.)

Pr. 79 Setting	Operation Mode Selection	Switching to Network Operation Mode
0	PU or external operation	Disallowed when the PU mode is selected. Allowed when the external mode is selected.
1	PU operation	Disallowed
2	External operation	Allowed
3, 4	External/PU combined operation	Disallowed
6	Switch-over	Allowed
7	External operation (PU operation interlock)	Allowed only in the external operation mode when the PU interlock signal (MRS) is on.
8	PU or external (signal switching)	Allowed only in the external operation mode (X16 on).

(2) Operation mode switching method



Symbol	Switching Type	Switching Method
A	PU operation → External operation	Operate the external operation key on the PU.
B	External operation → PU operation	Operate the PU operation key on the PU.
C	External operation → Network operation	Switched to the network operation mode via network.
D	Network operation → External operation	Switched to the network operation mode via network.
E	PU operation → Network operation	Switching allowed from the PU by setting Pr. 79 and Pr. 340. (Refer to page 16.)
F	Network operation → PU operation	Switching allowed from the PU by setting Pr. 79 and Pr. 340. (Refer to page 16.)

*1 In the switch-over mode (Pr. 79 = 6), switching in E and F is allowed regardless of the Pr. 340 setting. (Refer to page 18.)

CAUTION

1. **When "1" or "10" is set in Pr. 340 "link startup mode selection", the operation mode is network operation at power on or inverter reset.**
2. **When setting "1" or "10" in Pr. 340, the initial settings of the inverter must be made.**

(3) Link startup mode selection (Pr. 340)

The operation mode at power on and at restoration from instantaneous power failure can be selected. To choose the network operation mode, set "1" or "10" in Pr. 340. The Pr. 340 "link startup mode selection" value may be changed in any operation mode.

After the link has started, parameter write is enabled by network variable.

Pr. 340 Setting	Pr. 79	Operation Mode	Mode at Power On or at Restoration from Instantaneous Power Failure
0 (Factory Setting)	0	PU or external operation	Inverter operates in the external operation mode.
	1	PU operation	Inverter operates in the PU operation mode.
	2	External operation	Inverter operates in the external operation mode.
	3	External/PU combined operation	Inverter operates in the external/PU combined operation mode. Input running frequency from the PU and the start signal from outside.
	4	External/PU combined operation	Inverter operates in the external/PU combined operation mode. Input running frequency from outside and the start signal from the PU.
	6*1	Switch-over	Inverter operates in the external operation mode. Operation mode is switched while running.
	7	PU operation interlock	MRS signal ON ..... Inverter operates in the external operation mode. (Operation mode can be switched to the PU operation mode from the parameter unit.) MRS signal OFF ..... Inverter operates in the external operation mode.
	8	Operation mode switch-over by the external signal	X16 signal ON..... Inverter operates in the external operation mode. X16 signal OFF..... Inverter operates in the PU operation mode.

*1 Pr.79 = "6" and Pr.128 to Pr.134 "PID control" are not activated simultaneously.
Switch over mode is made invalid, and the inverter performs the operation same as when "0" is set in Pr.79. PID control via network can be used.

Pr. 340 Setting	Operation Mode		Mode at Power On or at Restoration from Instantaneous Power Failure
	Pr. 79		
1	0	PU or network operation	Inverter operates in the network operation mode. (Network variable need not be used for switching)
	1	PU operation	Inverter operates in the PU operation mode.
	2	Network operation	Inverter operates in the network operation mode. (Network variable need not be used for switching)
	3	External/PU combined operation	Inverter operates in the external/PU combined operation mode. Input running frequency from the PU and the start signal from outside.
	4	External/PU combined operation	Inverter operates in the external/PU combined operation mode. Input running frequency from outside and the start signal from the PU.
	6*1	Switch-over	Inverter operates in the network operation mode. Operation mode is switched while running. Refer to page 18 for details.
	7	PU operation interlock	MRS signal ON ..... Inverter operates in the network operation mode. (Operation mode can be switched to the external operation mode by the network variable.) MRS signal OFF ..... Inverter operates in the external operation mode.
	8	Operation mode switch-over by the external signal	X16 signal ON..... Inverter operates in the network operation mode. (Operation mode can be switched to the external operation mode by the network variable.) X16 signal OFF..... Inverter operates in the PU operation mode.

*1 Pr.79 = "6" and Pr.128 to Pr.134 "PID control" are not activated simultaneously.
Switch over mode is made invalid, and the inverter performs the operation same as when "0" is set in Pr.79. PID control via network can be used.

Pr. 340 Setting	Pr. 79	Operation Mode	Mode at Power On or at Restoration from Instantaneous Power Failure
10	0	PU or network operation	Inverter operates in the network operation mode. Operation mode can be switched between the PU operation and the network operation.
	1	PU operation	Inverter operates in the PU operation mode.
	2	Network operation	Inverter operates in the network operation mode.
	3	External/PU combined operation	Inverter operates in the external/PU combined operation mode. Input running frequency from the PU and the start signal from outside.
	4	External/PU combined operation	Inverter operates in the external/PU combined operation mode. Input running frequency from outside and the start signal from the PU.
	6*1	Switch-over	Inverter operates in the network operation mode. Operation mode can be switched between the PU operation and the network operation.
	7	PU operation interlock	MRS signal ON ..... Inverter operates in the external operation mode. (Operation mode can be switched to the PU operation mode by the parameter unit.) MRS signal OFF ..... Inverter operates in the external operation mode.
	8	Operation mode switch-over by the external signal	X16 signal ON..... Inverter operates in the external operation mode. X16 signal OFF..... Inverter operates in the PU operation mode.

*1 Pr.79 = "6" and Pr.128 to Pr.134 "PID control" are not activated simultaneously.
Switch over mode is made invalid, and the inverter performs the operation same as when "0" is set in Pr.79. PID control via network can be used.

*2 When Pr. 79 = "7, 8", the inverter operates in the same manner as when "0" is set in Pr. 340. (When powering on, the inverter will not operate in the network operation mode.)

When "0" or "6" is set in Pr. 79 when Pr. 340 = "10", the operation can be switched between the PU operation and the network operation from the operation panel or the parameter unit (FR-PU04).

• Operation panel

Use PU display on the operation mode switching menu to change the operation mode to the PU operation mode and OP.Md display to the network operation mode.

• FR-PU04

Use PU to change the operation mode to the PU operation and EXT to the network operation.

(4) Switch-over mode

You can select between PU operation, external operation and network operation.

Operation Mode Switching	Switching Operation/Operating Status
External operation to PU operation	Change the operation mode to the PU operation mode from the operation panel or parameter unit. •Rotation direction is the same as that of external operation. •Set frequency is as set by the potentiometer (frequency setting potentiometer). (Note that the setting will disappear when power is switched off or the inverter is reset.)
External operation to network operation	Mode change command to the network operation mode is transmitted from the network. •Rotation direction is the same as that of external operation. •Set frequency is as set by the potentiometer (frequency setting potentiometer). (Note that the setting will disappear when power is switched off or the inverter is reset.)
PU operation to external operation	Press the external operation key of the parameter unit. •Rotation direction is determined by the external operation input signal. •Set frequency is determined by the external frequency setting signal.
PU operation to network operation	Mode change command to the network operation mode is transmitted from the network. •Rotation direction and set frequency are the same as those of PU operation.
Network operation to external operation	The switch-over command to the external operation mode is sent from the network. •Rotation direction is determined by the external operation input signal. •Set frequency is determined by the external frequency setting signal.
Network operation to PU operation	Select the PU operation mode with the operation panel or parameter unit. •Rotation direction and set frequency are the same as those of network operation.

3.3 Operation and Speed Command Source

In the network operation mode, commands from the external terminals and network variables are as listed below.

Control location selection	Pr. 338 "operation control command source"	0: NET	0: NET	1: External	1: External	Remarks
	Pr. 339 "speed command source"	**0: NET**	**1: External**	**0: NET**	**1: External**	
Fixed functions (Functions equivalent to terminals)	Forward rotation command (STF)	NET	NET	External	External	
	Reverse rotation command (STR)	NET	NET	External	External	
	Reset (RES)	Combined	Combined	Combined	Combined	
	Network operation frequency	NET	—	NET	—	
	2	—	External	—	External	
	4	—	External	—	External	

Control location selection			Pr. 338 "operation control command source"	0: NET	0: NET	1: External	1: External	Remarks
			Pr. 339 "speed command source"	0: NET	1: External	0: NET	1: External	
Selective functions	Pr. 180 to Pr. 183 settings	0	Low-speed operation command/ Remote setting clear (RL)	NET	External	NET	External	Pr. 59≠"0": Remote setting
		1	Middle-speed operation command/ Remote setting deceleration (RM)	NET	External	NET	External	
		2	High-speed operation command/ Remote setting acceleration (RH)	NET	External	NET	External	
		3	Second function selection (RT)	NET	NET	External	External	
		4	Current input selection (AU)	—	Combined	—	Combined	
		5	Start self-holding selection (STOP)	—	—	External	External	
		6	Output shut-off (MRS)	Combined	Combined	External	External	*1
		7	External thermal relay input (OH)	External	External	External	External	
		8	15-speed selection (REX)	NET	External	NET	External	Pr. 59 = 0
		16	PU operation-external (network) operation switching (X16)	External	External	External	External	
		18	Magnetic flux-V/F switching (X18)	NET	NET	External	External	

External : Control by signal from external terminal is only valid.
NET : Control from network is only valid.
Combined : Control from both external terminal and network is valid.
— : Control from both external terminal and network is invalid.

*1 When "7" (PU operation interlock function) is set in Pr. 79 "operation mode selection", only the external terminal is made valid independently of the Pr. 338 and Pr. 339 settings, since this function is also used by terminal MRS.

3.4 Operation at Communication Error Occurrence

3.4.1 Operation selection at communication error occurrence

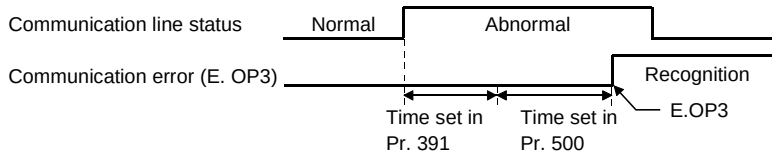
You can select operations at communication error occurrences by setting Pr. 500 to Pr. 502 under network operation.

- Parameter setting

1) Pr. 500 "communication error recognition waiting time"

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

Parameter Number	Setting Range	Minimum Setting Increments	Factory Setting
500	0 to 999.8s	0.1s	0



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

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

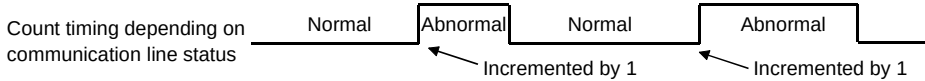
REMARKS

For detection of communication error, set the heart beat receive time interval (Pr. 391) and set the send time interval from the other node to be shorter than the heart beat receive time interval. When data is not received for more than the heart beat receive time interval after the first reception, it is considered as a communication line fault, then "option alarm (E.OPT)" is displayed and the inverter stops. (Refer to page 34.)

2) Pr. 501 "communication error occurrence count display"

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

Parameter Number	Setting Range	Minimum Setting Increments	Factory Setting
501	0	1	0



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

CAUTION

The communication error occurrence count is stored into RAM temporarily. Since this data is stored in E^2PROM at one-hour intervals, performing power-on reset or inverter reset may cause the Pr. 501 data to be the value stored in E^2PROM the last time depending on the reset timing.

3) Pr. 502 "communication error-time stop mode selection"

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

Parameter Number	Setting Range	Minimum Setting Increments	Factory Setting
502	0, 1, 2, 3	1	0

(About setting)

Fault	Pr. 502 Setting	At Fault Occurrence			At Error Recognition after Elapse of Pr. 500 Time			At Fault Removal		
		Operation	Indication	Alarm output	Operation	Indication	Alarm output	Operation	Indication	Alarm output
Communication line	0	Continued *	Normal indication *	Not provided *	Coast to stop	E.OPT lit	Provided	Kept stopped	E.OPT kept lit	Kept provided
	1				Decelerated to stop	E.OPT lit after stop	Provided after stop			
	2						Not provided	Restart	Normal indication	Not provided
	3				Continued	Normal indication				
Option itself	0, 3	Coast to stop	E. 3 lit	Provided	Coast to stop	E. 3 lit	Provided	Kept stopped	E. 3 kept lit	Kept provided
	1, 2	Decelerated to stop	E. 3 lit after stop	Provided after stop	Decelerated to stop	E. 3 lit after stop	Provided after stop			

* If the fault status returns to the normal communication status within the time set in Pr. 500, communication line fault (E.OPT) does not occur.

CAUTION

1. **A communication line fault [E.OPT (alarm data: HA0)] is a fault that occurs on the communication line, and a fault of the option unit itself [E. 3 (alarm data: HF3)] is a communication circuit fault in the option.**
2. **The alarm output is the ABC contact output or alarm bit output.**
3. **When the setting was made to provide an alarm output, the fault definition is stored into the alarm history.**
   (The fault definition is written to the alarm history when an alarm output is provided.)
   When no alarm output is provided, the fault definition overwrites the alarm indication of the alarm history temporarily, but is not stored.
   After the fault 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 fault occurrence.**
7. **When a communication line fault occurs at the Pr. 502 setting of "2", removing the fault during deceleration causes acceleration to restart at that point.**
   (Acceleration is not restarted if the fault is that of the option unit itself.)

3.4.2 Alarm and measures

(1) The inverter operates as follows at alarm occurrences

Fault Location	Status		Operation Mode		
			PU operation	External operation	Network operation
Inverter alarm	Inverter operation		Inverter trip	Inverter trip	Inverter trip
	Data communication		Continued	Continued	Continued
Communication line	Inverter operation		Continued	Continued	Inverter trip (Depends on the Pr. 502 setting)
	Data communication		Stop	Stop	Stop
Option itself	Communication option connection fault	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
	FR-E5NL alarm	Inverter operation	Continued	Continued	Inverter trip (Depends on the Pr. 502 setting)
		Data communication	Stop	Stop	Stop

(2) Measures at alarm occurrences

Alarm Indication	Alarm Definition	Measures
E. OPT	Communication line alarm	Check the LED states of the option unit (FR-E5NL) and remove the cause of the alarm. (Refer to page 3for the LED indication status) Check the other nodes on the network.
E. 3	Option alarm	Check the connection between the inverter and option unit (FR-E5NL) for poor contact, etc. and remove the cause of the alarm.

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

3.4.3 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
Network variable	Inverter reset (Command request network variable) (Refer to page 76.) • Inverter reset can be made any time.	Allowed	Disallowed	Disallowed
	Error reset at inverter fault (Inverter input signal network variable) (Refer to page 61.) • Reset can be made only when the protective function of the inverter is activated.	Allowed	Allowed	Allowed
Connect terminals RES-SD		Allowed	Allowed	Allowed
Switch off inverter power		Allowed	Allowed	Allowed

CAUTION

1. **When a communication line fault has occurred, reset cannot be made from any other node on the network.**
2. **The inverter is set to the external operation mode if it has been reset in the network operation mode.**
   To resume the network operation, the inverter must be switched to the network operation again.
   (When "1" or "10" is set in Pr. 340 "link startup mode selection", switching is not needed. Refer to page 14.)
3. **Communication stops for about 1s during inverter reset.**

3.5 PID Control

The PID set point and PID process variable used for PID control are enabled for operation on LONWORKS. Refer to the inverter manual for details of PID control.

- Pr. 128 "PID action selection"

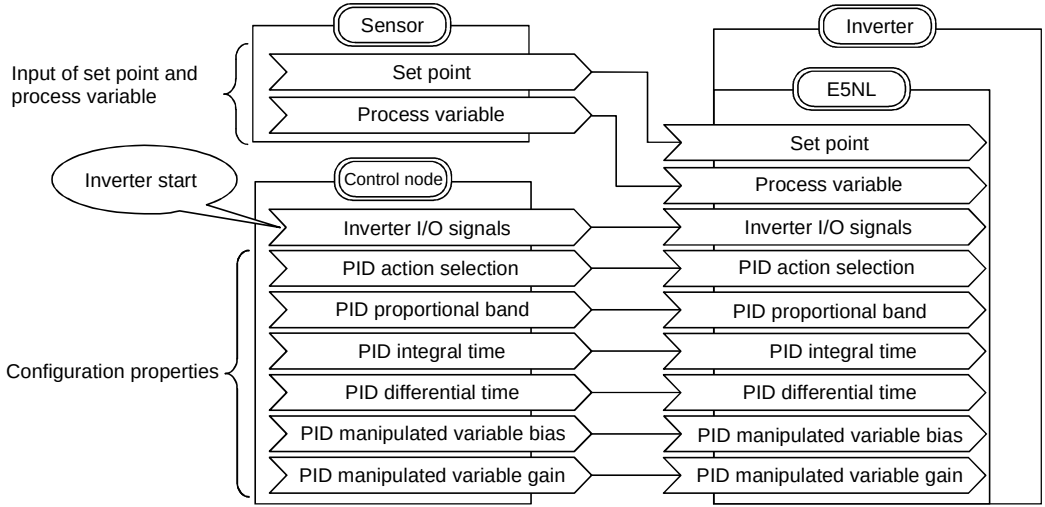
Parameter Number	Setting Range	Minimum Setting Increments	Factory Setting
128	0, 20, 21, 50, 51, 60, 61	—	0

Pr. 128 Setting	Set Point Input	Process Variable Input	Operation
0	No PID control		
20	Set point signal input (Terminal 2)	Process variable input (terminal 4)	PID reverse action
21			PID forward action
50 *	Set point communication input (Network)	Deviation value signal input (Network)	PID reverse action
51 *			PID forward action
60 *		Process variable input (Network)	PID reverse action
61 *			PID forward action

* Points to note regarding the setting values 50, 51, 60, and 61.

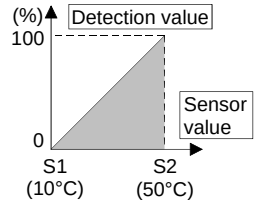
- Enter the set point and process variable (deviation input) in %. At this time, the frequency set in Pr. 902 "frequency setting voltage bias" corresponds to 0% and and the frequency set in Pr. 903 "frequency setting voltage gain" corresponds to 100%.
- Pr. 338 "operation command control location selection" and Pr. 339 "speed command control location selection" are enabled for setting.
- Pr.79 = 6 (Switch-over mode) is made invalid.
- When the FR-E5NL is not fitted, setting the values will not activate the PID control.

(1) System configuration example

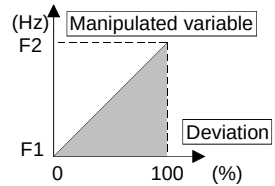


(2) Setting procedure example

1) Sensor calibration (Control range setting) calibrates the sensor in % that is used as the basis of the set point and process variable.
For example, when you want to exercise control at 10°C to 50°C, make calibration so that 0% data is sent at 10°C and 100% data at 50°C.



2) Set reverse/forward action in Pr.128 "PID action selection" according to the control.
First, set a slightly larger value in "PID proportional band" and "PID integral time" and a slightly smaller value in "PID differential time".
In "PID process variable bias" and "PID process variable gain", set the frequencies to be output by the inverter when the deviation (difference between set point and zero process variable) is 0% and 100%.



3) Input of set point and process variable
Set the target value (%) of control in "Set point".
Enter the currently measured value (%) in "Process variable".
Example:When 0% = 10°C, 100% = 50°C, set point = 25°C

Set 37.5% in "Set point".
Enter the % equivalent of the current temperature in "Process variable".

(3) Starting the inverter

Turning ON the forward/reverse rotation signal of the "inverter input signal (nviInvInputSig)" starts the inverter and initiates PID control.
While simultaneously performing actual operation and looking at the system, decrease the PID proportional band and increase the PID integral time and PID differential time to make adjustment.

3.6 Initial Communication Delay Time

- Pr. 387 "initial communication delay time"

You can set the time from when the inverter starts until when data is sent to network at power-on or inverter reset.

Parameter Number	Setting Range	Minimum Setting Increments	Factory Setting
387	0 to 120s	0.1s	0s

* This setting is valid only at power-on or inverter reset and does not affect normal data transmission.

3.7 Heartbeat Send Time

1) Pr. 388 "heartbeat send time interval"
   You can set the heartbeat send time interval.

Parameter Number	Setting Range	Minimum Setting Increments	Factory Setting
388	0 to 999.8s	0.1s	0s

2) Pr. 389 "minimum heartbeat send time"
   You can set the minimum heartbeat send time.

Parameter Number	Setting Range	Minimum Setting Increments	Factory Setting
389	0 to 999.8s	0.1s	0.5s

Pr. 388 Setting	Pr. 389 Setting	Operation
0	0	Data is sent when a data send event occurs. * The network variable that frequently changes in data is the cause of a LONWORKS traffic jam since data are output frequently. In that case, set the Pr. 392 "event driven detection width", Pr. 388 "heartbeat send time interval" and Pr. 389 "minimum heartbeat send time" to make adjustment.
Other than 0	0	Data are sent at the heartbeat send time intervals (Pr. 388 setting) regardless of whether a data send event exists or not.
0	Other than 0	Data are sent at occurrence of data send event. Note that the send time interval will not be shorter than Pr. 389 "minimum heart beat send time".
Pr. 388 setting ≠ 0 Pr. 389 setting ≠ 0 Pr. 388 setting > Pr. 389 setting		Whether a data send event exists or not is checked at intervals of the minimum heartbeat send time (Pr. 389 setting). Data is sent if an event exists. If an event does not exist, data is sent when the heartbeat send time interval (Pr. 388 setting) has elapsed.
Pr. 388 setting ≠ 0 Pr. 389 setting ≠ 0 Pr. 388 setting = Pr. 389 setting		Data are sent at intervals of the minimum heartbeat send time (Pr. 389 setting) regardless of whether a data send event exists or not.
Pr. 388 setting ≠ 0 Pr. 389 setting ≠ 0 Pr. 388 setting < Pr. 389 setting		

* At power-on/inverter reset, data is not sent before the Pr.387 "initial communication delay time (nciPwUpOutTm) (Refer to page 31.)".

With the settings, you set the heartbeat send times of the following network variables.

Network Variable Name		In/Out	Refer to Page
Speed monitor (0.005%/bit)	SNVT_lev_percent nvoDrvSpeed	Out	52
Inverter output signal	SNVT_state nvoInvOutputSig	Out	54
Output frequency monitor (0.1Hz/bit)	SNVT_freq_hz nvoInvOutFreq	Out	57
Output frequency monitor (0.005%/bit)	SNVT_lev_percent nvoInvOutFreqP	Out	58
Output current monitor (0.1A/bit)	SNVT_amp nvoDrvCurnt	Out	59
Output voltage monitor (0.1V/bit)	SNVT_volt nvoDrvVolt	Out	59
Actual operation time monitor (1h/bit) *1	SNVT_time_hour nvoDrvRunHours	Out	60
Cumulative power monitor (1kWh/bit) *2	SNVT_time_kwh nvoDrvRunPower	Out	60
Emergency stop status	SNVT_hvac_emerg nvoEmergStatus	Out	66
Alarm status	SNVT_switch nvoDrvAlarm	Out	68
Monitor data	SNVT_count nvoInvMonData	Out	72
Output frequency monitor (0.01Hz/bit)	SNVT_count nvoInvOutFreq2	Out	73

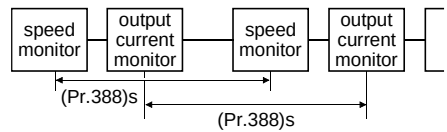
*1 Displayed in 10 increments on the operation panel or parameter unit (FR-PU04).

*2 Monitoring is enabled during network operation. You can not monitor from the operation panel or parameter unit (FR-PU04).

REMARKS

Regardless of monitor numbers to be binded by network management tool such as LonMaker, the send time interval of one network variable is the Pr. 388 (Pr. 389) set time.

For example, when speed monitor and output current monitor are binded, the send time interval of speed monitor is Pr. 388 (Pr. 389)s and the send time interval of output current monitor is Pr. 388 (Pr. 389)s. Due to the limitations on each data send time, the actual send time interval is 1.1s even when the heart beat send time interval (Pr. 388) is set to less than 1.0s. (It takes 1.2s when the monitor data is set.)



3.8 Heartbeat Receive Time

- Pr. 391 "heartbeat receive time interval"
  In input network variable receive, you can set the time interval at which data is received from network. Excess of the time interval of receive from the network over the set value is regarded as communication line fault detection, causing "Option fault (E.OP3)" to appear and the inverter to stop.

* Communication line fault detection is disabled when 3 is set in Pr. 502 "alarm stop mode selection".

Parameter Number	Setting Range	Minimum Setting Increments	Factory Setting
391	0 to 999.8s	0.1s	0s

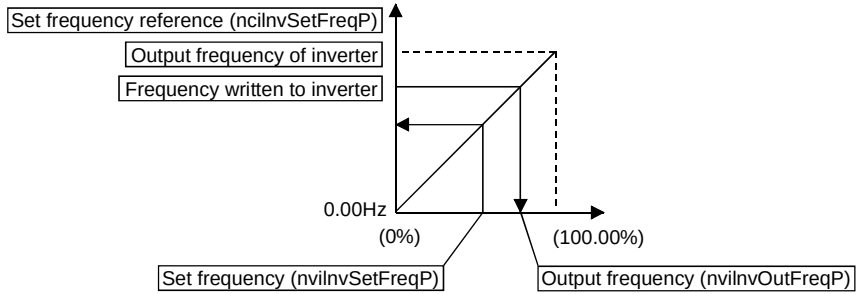
The setting determines the data send timings of the following network variables.

Network Variable Name		In/Out	Refer to Page
Start/stop and simple speed setting	SNVT_switch nviDrvSpeedStpt	In	50
Speed adjustment	SNVT_lev_percent nviDrvSpeedScale	In	51
Inverter input signal	SNVT_state nviInvInputSig	In	53
Set frequency (0.1Hz/bit)	SNVT_freq_hz nviInvSetFreq	In	56
Set frequency (0.005%/bit)	SNVT_lev_percent nviInvSetFreqP	In	56
PID set point (0.005%/bit)	SNVT_lev_percent nviInvPIDTarget	In	69
PID process variable (0.005%/bit)	SNVT_lev_percent nviInvPIDValue	In	69
PID deviation (0.005%/bit)	SNVT_lev_percent nviInvPIDDev	In	70
Set frequency (0.01Hz/bit)	SNVT_count nviInvSetFreq2	In	72

3.9 % Set Reference Frequency

You can set the frequency (e.g. set frequency, output frequency) in % or set the reference frequency for monitoring the output frequency in %.
You cannot set the frequency at the resolution less than the minimum frequency resolution of the inverter.

Parameter Number	Setting Range	Minimum Setting Increments	Factory Setting
390	1 to 400Hz	0.01Hz	60Hz



3.10 Event Driven Detection Width

You can set the event driven detection widths (varying widths) of the monitor-related output network variables in 0.01% increments.
A 100% value that will be the basis of the detection width varies with the network variable.
This setting can reduce traffic jams caused by occurrence of many send events due to consecutive value changes.

Parameter Number	Setting Range	Minimum Setting Increments	Factory Setting
392	0.00 to 163.83%	0.01%	0%

With the setting, you can set the event driven detection widths of the following network variables.
When the inverter operation status has changed, e.g. from a stop to startup or from running to a stop, the monitored value is output even when the value is within the event driven detection width.

Example: output frequency monitoring, when ivent driven detection width (Pr. 392) = 100% and reference value (Pr. 390) = set frequency = 60Hz

Since the monitored value is output once at startup from a stop status, the startup monitor output is 0.5Hz when the starting frequency is 0.5Hz. Hence, the second monitor is output when the frequency rises above "0.5Hz + 60Hz (Pr. 390 setting × Pr. 392 setting)" = "60.5Hz". (The monitored value is not a value output at a time when frequency reaches 60Hz. Use the SU signal to detect output frequency, etc.)

Network Variable Name	In/ Out	100% Value	Expression for Calculating Detection Width (0.005% Increments)	Refer to Page
Speed monitor (0.005%/bit) SNVT_lev_percent nvoDrvSpeed	Out	—	* Make direct setting since the target network variable and detection width have the same SNVT type.	52
Output frequency monitor (0.1Hz/bit) SNVT_freq_hz nvoInvOutFreq	Out	% set reference frequency	Varying width of frequency monitor value/% set reference frequency × 100%	57

Network Variable Name	In/ Out	100% Value	Expression for Calculating Detection Width (0.005% Increments)	Refer to Page
Output frequency monitor (0.005%/bit) SNVT_lev_percent nvoInvOutFreqP	Out	—	* Make direct setting since the target network variable and detection width have the same SNVT type.	58
Output current monitor (0.1A/bit) SNVT_amp nvoDrvCurnt	Out	Rated current of inverter	Varying width of current monitor value/ rated current of inverter × 100%	59
Output voltage monitor (0.1V/bit) SNVT_volt nvoDrvVolt	Out	Rated voltage of inverter	Varying width of voltage monitor value/ rated voltage of inverter × 100%	59
Monitor data SNVT_count nvoInvMonData	Out	100% reference value varies with the monitor data. (Refer to page 37.)	Varying width of monitor data value/ reference value of corresponding monitor × 100%	72
Output frequency monitor (0.01Hz/bit) SNVT_count nvoInvOutFreq2	Out	% set reference frequency	Varying width of frequency monitor value/% set reference frequency × 100%	73

REMARKS

100% value of monitor data (Equivalent to the monitor full-scale value used with the monitor display selection function of the inverter)

Monitor Name	Monitor Increments	100% Value
Output frequency	0.01Hz	Value set in Pr. 55 "frequency monitoring reference"
Output current	0.01A	Value set in Pr. 56 "current monitoring reference"
Output voltage	0.1V	800V
Frequency setting	0.01Hz	Value set in Pr. 55 "frequency monitoring reference"

4. FUNCTION OVERVIEW

4.1 Function Overview

The following table lists the functions which can be executed from the network:

Control Location	Item	Operation Mode		
		PU operation	External operation	Network operation
Network variable	Operation command	Disallowed	Disallowed	Allowed (*4)
	Running frequency setting	Disallowed	Disallowed	Allowed (*4)
	Monitoring	Allowed	Allowed	Allowed
	Parameter write	Disallowed (*3)	Disallowed (*3)	Allowed (*3)
	Parameter read	Allowed	Allowed	Allowed
	Inverter reset	Disallowed	Disallowed	Allowed (*1)
	Error reset at inverter fault	Allowed (*1)	Allowed (*1)	Allowed (*1)
	Stop command (*2)	Disallowed	Disallowed	Allowed
	PID control	Disallowed	Disallowed	Allowed
Control circuit terminal	Inverter reset terminal	Allowed	Allowed	Allowed
	Operation command	Disallowed	Allowed	Allowed (*4)
	Frequency setting	Disallowed	Allowed	Allowed (*4)

*1 At occurrence of a communication line fault, the inverter cannot be reset from the network. (For inverter reset, refer to the inverter manual.)
*2 As set in Pr. 75 "PU stop selection".
*3 As set in Pr. 77 "parameter write disable selection".
For parameters write-enabled during operation, refer to the inverter manual.
*4 As set in Pr. 338 and Pr. 339 (Refer to page 19.)

REMARKS

1. The inverter operates in the external operation mode if it is reset from the network in the network operation mode. The setting "1" or "10" in Pr. 340 selects network operation mode.

4.1.1 Output from inverter to network

- Monitor function

  The following items can be monitored by the network:

  (1)Output frequency ..... 0.1Hz/bit, 0.005%/bit increments (Refer to pages 57, 73)
  (2)Output current ..... 0.1A/bit increments (Refer to page 59.)
  (3)Output voltage..... 0.1V/bit increments (Refer to page 59.)
  (4)Alarm definition ..... (Refer to page 62.)
  (5)Special monitoring ..... Monitor data set using monitor code (SNVT_niv InvMonCode) (Refer to page 71.)
  (6)Inverter status

Terminal	Output Definition (Signal)	Terminal	Output Definition (Signal)
—	Forward running	—	Overload alarm (OL)
—	Reverse running	FU	Frequency detection (FU)*1
RUN	Inverter running (RUN) *1	ABC	Alarm output (ABC) *
—	Up to frequency (SU)		

*1 These are factory-set signals. Output signals can be changed by output terminal function selection (Pr. 190 to 192).

CAUTION

For item (6) , you can monitor the inverter status with the network variable (nvoInvOutputSig) of the inverter output signal. (Refer to page 54.)

- Parameter read

  Parameters of the inverter can be read to the network. (Refer to page 74.)
  For the parameter data code list, refer to the inverter manual.

4.1.2 Input from network to inverter

- Operation command
  Any of the following commands can be output from the network to the inverter as an operation command any time:

Terminal	Operation Command (Signal)	Terminal	Operation Command (Signal)
STF	Forward rotation command (STF)	STR	Reverse rotation command (STR)
RH	High speed operation command (RH) *1	RM	Middle speed operation command (RM) *1
RL	Low speed operation command (RL) *1	MRS	Output stop (MRS) *

*1 These are factory-set signals. Input signals can be changed by input terminal function selection (Pr. 180 to Pr. 183). Note that some signals do not accept a command from the master module according to the settings. Refer to page 19 for details.

- Set frequency
  The set frequency is written from the network to the inverter when it is changed. (Refer to pages 56, 72.)
  The running frequency may either be written to E^2PROM or to RAM. When changing the frequency continuously, always write the data to the inverter RAM. (Refer to page 55.)

- Parameter write
  Functions can be written from the network. Note that write during inverter operation will result in a mode error. (Refer to page 74.)
  For the parameter data code list, refer to the inverter manual.

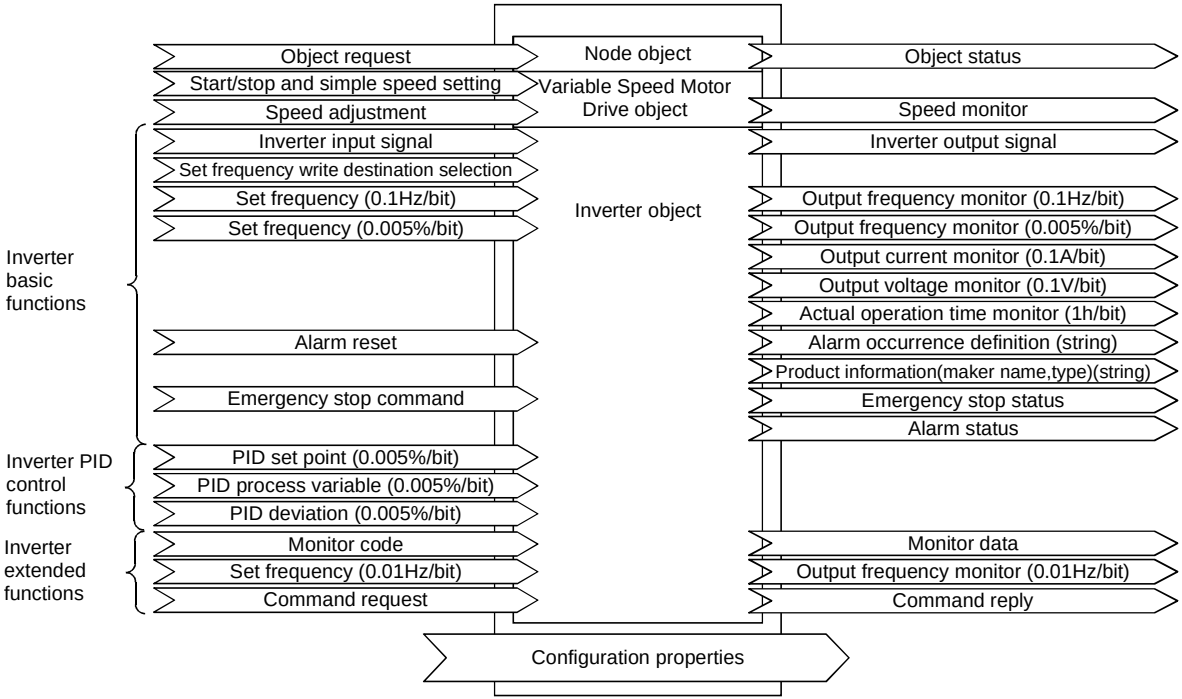
- Inverter reset
  You can reset the inverter or reset an inverter error. (Refer to pages 61, 76.)

- PID control
  The network can be used to exercise process control, e.g. flow rate, air volume or pressure. (Refer to page 69, 86)

5.OBJECT OVERVIEW

This chapter describes detailed object definitions for use of LONWORKS system.

5.1 Object Map



5.2 Network Variable List

No.	Type	Name		In/ Out	Storage Location	Factory Setting	Refer to Page
1	Standard network variable	Object request	SNVT_obj_request nviRequest	In	—	0H	48
2		Object status	SNVT_obj_status nvoStatus	Out		0H	49
3		Start/stop and simple speed setting	SNVT_switch nviDrvSpeedStpt	In		state=FFH value=0	50
4		Speed adjustment	SNVT_lev_percent nviDrvSpeedScale	In		100.00%	51
5		Speed monitor	SNVT_lev_percent nvoDrvSpeed	Out		0.000%	52
6		Inverter input signal	SNVT_state nviInvInputSig	In		0	53
7		Inverter output signal	SNVT_state nvoInvOutputSig	Out		8000H	54
8		Set frequency write destination selection	SNVT_switch nviInvSetFreqSw	In		state=0H value=0	55
9		Set frequency (0.1Hz/bit)*1	SNVT_freq_hz nviInvSetFreq	In	Inverter side RAM/ E^2PROM	7FFFH	56
10		Set frequency (0.005%/bit)	SNVT_lev_percent nviInvSetFreqP	In		100.00%	56
11		Output frequency monitor (0.1Hz/bit)*1	SNVT_freq_hz nvoInvOutFreq	Out	—	0.0Hz	57
12		Output frequency monitor (0.005%/bit)	SNVT_lev_percent nvoInvOutFreqP	Out		0.000%	58
13		Output current monitor (0.1A/bit)*1	SNVT_amp nvoDrvCurnt	Out		0.0A	59

No.	Type	Name		In/ Out	Storage Location	Factory Setting	Refer to Page
14	Standard network variable	Output voltage monitor (0.1V/bit)*1	SNVT_volt nvoDrvVolt	Out	—	0.0V	59
15		Actual operation time monitor (1 h/bit)	SNVT_time_hour nvoDrvRunHours	Out	Inverter side E^2PROM	0h	60
16		Cumulative power monitor (1kWh/bit)*2	SNVT_time_kwh nvoDrvRunPower	Out		0kWh	60
17		Alarm reset	SNVT_switch nviInvAlarmReset	In	—	state=0H value=0H	61
18		Alarm occurrence definition (string)	SNVT_str_asc nvoInvAlarmStr	Out		0	62
19		Product information (maker name, type) (string)	SNVT_str_asc nvoInvTypeInfo	Out		MITSUBISHI FR-E5NL	64
20		Emergency stop command	SNVT_hvac_emerg nviEmergOverride	In		0H	65
21		Emergency stop status	SNVT_hvac_emerg nvoEmergStatus	Out		0H	66
22		Alarm status	SNVT_switch nvoDrvAlarm	Out		state=0H value=0H	68
23		PID set point (0.005%/bit)	SNVT_lev_percent nviInvPIDTarget	In		0.000%	69
24		PID process variable (0.005%/bit)	SNVT_lev_percent nviInvPIDValue	In		0.000%	69
25		PID deviation (0.005%/bit)	SNVT_lev_percent nviInvPIDDev	In		0.000%	70
26		Monitor code	SNVT_count nviInvMonCode	In		0	71
27		Monitor data	SNVT_count nvoInvMonData	Out		0	72

No.	Type	Name		In/ Out	Storage Location	Factory Setting	Refer to Page
28	Standard network variable	Set frequency (0.01Hz/bit)	SNVT_count nviInvSetFreq2	In	Inverter side RAM/ E^2PROM	0.00Hz	72
29		Output frequency monitor (0.01Hz/bit)	SNVT_count nvoInvOutFreq2	Out	—	0.00Hz	73
30		Command request	SNVT_str_asc nviInvCmdReq	In		0	74
31		Command reply	SNVT_str_asc nvoInvCmdReply	Out		0	78
32	Configuration property	Initial communication delay time (0.1s/bit)	SNVT_time_sec nciPwUpOutTm	In	Inverter side E^2PROM	0	80
33		Forward/reverse rotation prevention	SNVT_count nciInvFwdRevLock	In		Pr.78*3	81
34		% set reference frequency (0.1Hz/bit)*1	SNVT_freq_hz nciInvSetFreqBas	In		60Hz	82
35		Maximum frequency (0.1Hz/bit)*1	SNVT_freq_hz nciInvMaxFreq	In		Pr.1*3	83
36		Minimum frequency (0.1Hz/bit)*1	SNVT_freq_hz nciInvMinFreq	In		Pr.2*3	83
37		Heartbeat send time interval (0.1s/bit)	SNVT_time_sec nciSndHrtBt	In		0	84
38		Minimum heartbeat send time (0.1s/bit)	SNVT_time_sec nciMinOutTm	In		0.5s	84

No.	Type	Name		In/ Out	Storage Location	Factory Setting	Refer to Page
39	Configuration property	Acceleration time (0.1s/bit)	SNVT_time_sec nciRampUpTm	In	Inverter side E^2PROM	Pr.7*3	85
40		Deceleration time (0.1s/bit)	SNVT_time_sec nciRampDownTm	In		Pr.8*3	85
41		PID action selection	SNVT_count nciInvPIDSwitch	In		Pr.128*3	86
42		PID proportional band (0.1%/bit)	SNVT_count nciInvPIDPro	In		Pr.129*3	87
43		PID integral time (0.1s/bit)	SNVT_time_sec nciInvPIDIntTm	In		Pr.130*3	87
44		PID differential time (0.1s/bit)*1	SNVT_time_sec nciInvPIDDiffTm	In		Pr.134*3	88
45		PID manipulated variable bias (0.1Hz/bit)*1	SNVT_freq_hz nciInvPIDOpeBias	In		Pr.902*3	89
46		PID manipulated variable gain (0.1Hz/bit)*1	SNVT_freq_hz nciInvPIDOpeGain	In		Pr.903*3	90
47		Heartbeat receive time interval	SNVT_time_sec nciRcvHrtBt	In		0	90
48		Maximum speed (0.005%/bit)	SNVT_lev_percent nciMaxSpeed	In		Pr.1*3	91
49		Minimum speed (0.005%/bit)	SNVT_lev_percent nciMinSpeed	In		Pr.2*3	91

No.	Type	Name		In/ Out	Storage Location	Factory Setting	Refer to Page
50	Configuration property	Reference speed setting (1r/min/bit)	SNVT_rpm nciNmlSpeed	In	Inverter side E^2PROM	1800r/min	92
51		Reference frequency setting (0.1Hz/bit)*1	SNVT_freq_hz nciNmlFreq	In		60Hz	92
52		Speed adjustment default value	SNVT_lev_percent nciDrvSpeedScale	In	—	100.00%	93
53		Event driven detection width (0.005%/bit)	SNVT_lev_percent nviInvEvtDuty	In	Inverter side E^2PROM	0%	93
54 to 62	System reserved						—

*1 Displayed in 0.01 increments on the operation panel or parameter unit (FR-PU04).
*2 Displayed in 10 increments on the operation panel or parameter unit (FR-PU04).
*3 Refer to the inverter manual for the corresponding parameter factory settings.

REMARKS

Set "2" in Pr.77 "parameter write disabled selection" to write to the configuration property during inverter operation.

6.NETWORK VARIABLE DETAILS

6.1 LONWORKS Object

6.1.1 Setting range of object ID

The setting values of object ID are 0 to 4 and are as listed below.
When any values from 5 to 65535 are set for object ID, nvalid_id bit of object status (nvoStatus) becomes 1 and command set for object request is made invalid.

Object ID	Description
0	Node object
1	VariableSpeedMotorDrive object [LONMARK object]
2	Inverter basic function
3	Inverter PID control function
4	Inverter extended function

6.1.2 Object request (network input SNVT_obj_request nviRequest)

You can make a request to get the object status.

Member Name	Description		Factory Setting
object_id	Stores the object ID		0H
object_request	0H RQ_NORMAL	In the External operation mode (*3), it shifts to the Network operation mode.	
	1H RQ_DISABLED	Makes the inverter object invalid.	
	2H RQ_UPDATE_STATUS	Update object status (nvoStatus).	
	3H RQ_SELF_TEST	Not supported (*1)	
	4H RQ_UPDATE_ALARM	Updates in_alarm bit of the object status (nvoStatus).	
	5H RQ_REPORT_MASK	Changes bit (invalid_id, invalid_request, disabled, manual_control, in_alarm, in_override, report_mask) supported by object status (nvoStatus) to "1".	
	6H RQ_OVERRIDE	Not supported (*1)	
	7H RQ_ENABLE	Makes the inverter object valid.	
	8H RQ_RMV_OVERRIDE	Not supported (*1)	
	9H RQ_CLEAR_STATUS	Clears all bits of the object status (nvoStatus) to "0".	
	10H RQ_CLEAR_ALARM	Clear in_alarm bit of object status (nvoStatus) to "0". (*2)	
	11H RQ_ALARM_NOTIFY_ENABLED	Not supported (*1)	
	12H RQ_ALARM_NOTIFY_DISABLED		
	13H RQ_MANUAL_CTRL	Shifts the inverter to the External operation mode.	
	14H RQ_REMOTE_CTRL	Shifts the inverter to the Network operation mode.	
	15H RQ_PROGRAM	Not supported (*1)	
	FFH RQ_NUL	Nothing is done.	
	Other than the above	Not supported (*1)	

*1 Changes the invalid_request of the object status (nvoStatus) to "1" when data is set.
*2 Use alarm reset (nviInvAlarmReset) to reset the alarm status of the inverter.
*3 Can also be switched from the switch over mode. (Refer to the inverter manual for details of the switch over mode.)

6.1.3 Object status (network output SNVT_obj_status nvoStatus)

You can indicate the condition of the node.

Member Name	Description	Factory Setting
object_id	The setting value of object request (nviRequest) written to object_id is displayed.	0H
invalid_id	Changes to "1" if an illegal object ID is specified in object_id of the object request (nviRequest).	
invalid_request	Changes to "1" if object_request not supported by the object request (nviRequest) is set.	
disabled	Changes to "1" if the object of the inverter is invalid.	
out_of_limits	Not supported (*1)	
open_circuit		
out_of_service		
Mechanical_fault		
feedback_failure		
over_range		
under_range		
electrical_fault		
unable_to_measure		
comm_failure		
fail_self_test		
self_test_in_progress		
locked_out		
manual_control	Changes to "1" if the operation mode of the inverter is other than the Network operation mode.	
in_alarm	Changes to "" is during the inverter is in the alarm status.	
in_override	Changes to "1" if the operation mode of the inverter is Network operation mode and run command and speed command are not given via the network.	
report_mask	Changes to "1" when RQ_REPORT_MASK is sent from the object request (nviRequest).	
programming_mode	Not supported (*1)	
programming_fail		
alarm_notify_disabled		

*1 "0" is always set in the unsupported functions bit position.

6.2 Variable Speed Motor Drive Object

6.2.1 Start/stop and simple speed setting (network input SNVT_switch nviDrvSpeedStpt)

You can set "start/stop" and "simple setting of set frequency".

nviInvSetFreq	nviDrvSpeedStpt		Operation
	state	value	
7FFFH	0H	NA	Stop
	1H	0	Run at a 0% frequency.
		1 to 200	Run at a 0.5 to 100% frequency. nciNmiFreq × nviDrvSpeedStpt × nviDrvSpeedScale
		201 to 255	Run at a 100% frequency. nciNmiFreq × 100% × nviDrvSpeedScale
	2H to FFH	NA	No operation (invalid)
0Hz to 400Hz	0H	NA	Stop
	1H	0	Run at a 0% frequency.
		1 to 255	Run at an nviInvSetFreq frequency.
	2H to FFH	NA	No operation (invalid)

* Set "start/stop" in state and "simple speed setting" in value. The factory setting is state: FFH, value:0.
The nviInvSetFreq setting is determined by "set frequency (nviInvSetFreq)". (Refer to page 56.)
The rotation direction (forward/reverse rotation) is determined by whether "speed adjustment (nviDrvSpeedScale)" is positive or negative.(Refer to page 51.)
As the set frequency, set its ratio to "speed adjustment (nviDrvSpeedScale)" (0.5% increments). (Refer to page 51.)

REMARKS

The variable is initialized to "FFH" (Factory Setting) at power-on or if it is not updated at the "heartbeat receive time interval (nciRcvHrtBt)".

6.2.2 Speed adjustment (0.005% increments) (network input SNVT_lev_percent nviDrvSpeedScale)

You can set the frequency command in 0.005% increments on the assumption that the frequency set in "reference frequency setting (nciNmlFreq) (Refer to page 92.) is 100%.

Data Name	Range	Increments	Factory Setting
nviDrvSpeedScale	-163.840% to 163.830%	0.005%/bit	100.00% (NciDrvSpeedScale value)

* Positive value: Motor in forward rotation status, Negative value: Motor in reverse rotation status
Control cannot be exercised at less than the minimum frequency resolution (0.01Hz) of the inverter.

Data acceptance timing: At network variable receive (nv_update_occurs event)

Calculation expression: Frequency command = | (reference frequency setting × speed adjustment × simple speed setting) |

Example: "Simple speed setting (nviDrvSpeedStpt.value) (Refer to page 50.)" = 50%
"Reference frequency setting (nciNmlFreq) (Refer to page 92.)" = 60.00Hz
When speed adjustment (nviDrvSpeedScale) = -150%,
| (60.00Hz × -150% × 50%) | = 45Hz
Since the calculation result is negative, a "reverse rotation command" is given.

REMARKS

The variable is initialized to 100.00% (Factory Setting) at power-on or if it is not updated at the "heartbeat receive time interval (nciRcvHrtBt)".

6.2.3 Speed monitor (0.005% increments) (network output SNVT_lev_percent nvoDrvSpeed)

You can set the output frequency in 0.005% increments on the assumption that the frequency set in "reference frequency setting (nciNmlFreq) (Refer to page 92.)" is 100%.

Data Name	Range	Increments	Factory Setting
nvoDrvSpeed	-163.840% to 163.830%	0.005%/bit	0.000%

* Positive value: Motor in forward rotation status, Negative value: Motor in reverse rotation status
Monitor is disabled at less than the minimum frequency resolution (0.01Hz) of the inverter.

Calculation expression: Output frequency = | (reference frequency setting × speed monitor × simple speed setting) |

Example: "Simple speed setting (nviDrvSpeedStpt.value) (Refer to page 50.)" = 50%
"Reference frequency setting (nciNmlFreq) (Refer to page 92.)" = 60.00Hz
When speed monitor = -150%, | (60.00Hz × -150% × 50%) | = 45Hz
Since the calculation result is negative, the motor is in a "reverse rotation status".

Data send event : When data changes in 0.005% increments

Data send timing : As set in Pr. 388 "heartbeat send time interval" and Pr. 389 "minimum heartbeat send time". (Refer to pages 31, 84.)

6.3 Inverter Basic Functions

6.3.1 Inverter input signal (network input SNVT_state nviInvInputSig)

A 16-bit-wide input signal to the inverter.

Bit	Signal Name	Description	Factory Setting
0	Forward rotation command	A forward rotation command.	0
1	Reverse rotation command	A reverse rotation command.	
2	RH terminal function (high speed) *	The functions assigned to the RH, RM and RL terminals are selected. In a factory-set status, multiple speeds can be selected by RH/RM/RL combination.	
3	RM terminal function (middle speed) *		
4	RL terminal function (low speed) *		
5 to 8	Not used	System reserved	
9	MRS terminal function *	The function assigned to the MRS terminal is selected. In a factory-set status, the inverter output stops when the MRS signal turns ON.	
10 to 15	Not used	System reserved	

* Using Pr. 180 to Pr. 183, you can assign the terminal functions.
Data acceptance timing: At network variable receive (nv_update_occurs event)

REMARKS

The command given to the inverter is determined by the combination of the forward and reverse rotation commands.

Forward Rotation Command	Reverse Rotation Command	Rotation Direction Command to Inverter
Stop	Stop	Stop
Stop	Reverse rotation	Reverse rotation
Forward rotation	Stop	Forward rotation
Forward rotation	Reverse rotation	Stop

6.3.2 Inverter output signal (network output SNVT_state nvoInvOutputSig)

A 16-bit-wide output signal to the inverter.

Bit	Signal Name	Description	Factory Setting
0	During forward running	OFF :Other than during forward running (during stop, during reverse running) ON :During forward running	0
1	During reverse running	OFF :Other than during reverse running (during stop, during forward running) ON :During reverse running	
2	During running (RUN)*	Remains ON during inverter running.	
3	Up to frequency (SU)	Turns ON when the output frequency has reached the set frequency ± Pr. 41.	
4	Overload (OL)	Turns ON when stall prevention is activated, and turns OFF when stall prevention is deactivated.	
5	Not used	System reserved	
6	Frequency detection (FU)*	Turns ON when the output frequency reaches any set frequency.	
7	Alarm detection (ABC)*	Turns ON when the output has stopped due to occurrence of an inverter alarm.	
8 to 13	Not used	System reserved	
14	Error status flag	Turns ON when the output has stopped due to occurrence of an inverter alarm.	
15	Ready signal	Turns ON when the inverter is placed in the READY status at completion of initial setting after a hardware reset made after power-on.	1

* Using Pr. 190 to Pr. 192, you can assign the terminal functions.

Data send timing : As set in Pr. 388 "heartbeat send time interval" and Pr. 389 "minimum heartbeat send time". (Refer to pages 31, 84.)

6.3.3 Set frequency write destination selection (network input SNVT_switch nviInvSetFreqSw)

When writing the set frequency of any of the following network variables, you can select either of the internal memories of the inverter, RAM and E^2PROM, as the write destination.

- "Set frequency (0.1Hz increments) (nviInvSetFreq)"
- "Set frequency (0.005% increments) (nviInvSetFreqP)"
- "Set frequency (0.01Hz increments) (nviInvSetFreq2)"

state	value	Operation
0H (Factory setting)	Any value	Write destination: RAM (Switching power off erases the written value. You can prevent the write life of the E^2PROM from becoming shorter.)
1H		Write destination: E^2PROM (Switching power off does not erase the written value.)

* value: Not used
The factory setting is 0.

Data acceptance timing: At network variable receive (nv_update_occurs event)

CAUTION

When changing the set frequency frequently, set "RAM write."
With "write to E^2PROM" being selected, frequent setting of the set frequency will shorten the life of the E^2PROM.

6.3.4 Set frequency (0.1Hz increments) (network input SNVT_freq_hz nviInvSetFreq)

You can set the frequency command in 0.1Hz increments.

Data Name	Range	Increments	Factory Setting
nviInvSetFreq	0.0Hz to 400.0Hz, 7FFFH	0.1Hz/bit	7FFFH

* Depending on the setting, the operation that can be set in "start/stop and simple speed setting (nviDrvSpeedStpt)" changes.
7FFFH is not reflected as the actual set frequency value. (Refer to page 50.)

Data acceptance timing: At network variable receive (nv_update_occurs event)

6.3.5 Set frequency (0.005% increments) (network input SNVT_lev_percent nviInvSetFreqP)

You can monitor the output frequency of the inverter in 0.005% increments on the assumption that the frequency set in "% set reference frequency (nciInvSetFreqBas) (Refer to pages 35, 82.)" is 100%.

Data Name	Range	Increments	Factory Setting
nviInvSetFreqP	0.00% to 163.83%	0.005%/bit	100.00%

* Control cannot be exercised at less than the minimum frequency resolution (0.01Hz) of the inverter.

Example: % set reference frequency = 60.0Hz Set frequency to be written = 30.0Hz
Set frequency = 30.0/60.0 = 0.5
Set 50.000%.

Data acceptance timing: At network variable receive (nv_update_occurs event)

6.3.6 Output frequency monitor (0.1Hz increments) (network output SNVT_freq_hz nvoInvOutFreq)

You can monitor the output frequency of the inverter in 0.1Hz increments.

Data Name	Range	Increments	Factory Setting
nvoInvOutFreq	0.0Hz to 400.0Hz	0.1Hz/bit	0.0Hz

Data send event : When data changes in 0.1Hz increments
Data send timing : As set in Pr. 388 "heartbeat send time interval" and Pr. 389 "minimum heartbeat send time". (Refer to pages 31, 84.)

REMARKS

This variable is similar to "output frequency monitor (0.005% increments)" but may sometimes differ from it in data send timing since they are different in mutual resolution.

6.3.7 Output frequency monitor (0.005% increments) (network output SNVT_lev_percent nvoInvOutFreqP)

You can monitor the output frequency of the inverter in 0.005% increments on the assumption that the frequency set in "% set reference frequency (nciInvSetFreqBas) (Refer to pages 35, 82.)" is 100%.

Data Name	Range	Increments	Factory Setting
nvoInvOutFreqP	0.00% to 163.83%	0.005%/bit	0.000%

* Monitor is disabled at less than the minimum frequency resolution (0.01Hz) of the inverter.

Example: Inverter output frequency = 90.0Hz % set reference frequency = 60.0Hz
Output frequency monitor = 90.0/60.0 =1.5
150.000% is monitored.

Data send event : When data changes in 0.005% increments

Data send timing : As set in Pr. 388 "heartbeat send time interval" and Pr. 389 "minimum heartbeat send time". (Refer to pages 31, 84.)

REMARKS

This variable is similar to "output frequency monitor (0.1Hz increments)" but may sometimes differ from it in data send timing since they are different in mutual resolution.

6.3.8 Output current monitor (0.1A increments) (network output SNVT_amp nvoDrvCurnt)

You can monitor the output current of the inverter in 0.1A increments.

Data Name	Range	Increments	Factory Setting
nvoDrvCurnt	0.0A to 3276.7A	0.1A/bit	0.0A

Data send event : When data changes in 0.1A increments
Data send timing : As set in Pr. 388 "heartbeat send time interval" and Pr. 389 "minimum heartbeat send time". (Refer to pages 31, 84.)

6.3.9 Output voltage monitor (0.1V increments) (network output SNVT_volt nvoDrvVolt)

You can monitor the output voltage of the inverter in 0.1V increments.

Data Name	Range	Increments	Factory Setting
nvoDrvVolt	0.0V to 3276.7V	0.1V/bit	0.0V

Data send event : When data changes in 0.1V increments
Data send timing : As set in Pr. 388 "heartbeat send time interval" and Pr. 389 "minimum heartbeat send time". (Refer to pages 31, 84.)

6.3.10 Actual operation time monitor (network output SNVT_time_hour nvoDrvRunHours)

You can monitor the actual operation time (cumulative inverter output time) of the inverter in 1 hour increments.

Data Name	Range	Increments	Factory Setting
nvoDrvRunPower	0 to 65534h	1h/bit	0h

* Displayed in 10 increments on the operation panel or parameter unit (FR-PU04).

Data send event : When data changes in 1 hour increments

Data send timing : As set in Pr. 388 "heartbeat send time interval" and Pr. 389 "minimum heartbeat send time". (Refer to pages 31, 84.)

6.3.11 Cumulative power monitor (1kWh increments) (network output SNVT_time_kwh nvoDrvRunPower)

You can monitor the cumulative power of the inverter in 1kWh increments.

Data Name	Range	Increments	Factory Setting
nvoDrvRunHours	0 to 65535kWh	1kWh/bit	0kWh

* Monitoring is enabled during network operation. You can not monitor from the operation panel or parameter unit (FR-PU04).

Data send event : When data changes in 1kWh increments.

Data send timing : As set in Pr. 388 "heartbeat send time interval" and Pr. 389 "minimum heartbeat send time". (Refer to pages 31, 84.)

6.3.12 Alarm reset (network input SNVT_switch nviInvAlarmReset)

You can reset the inverter at inverter alarm occurrence.

Data Name	Range	Increments	Factory Setting
nviInvAlarmReset. state	0H, 1H	—	0H
nviInvAlarmReset. value	—	—	0H

state	value	Operation
0H	Don't care	Without alarm reset
1H		With alarm reset

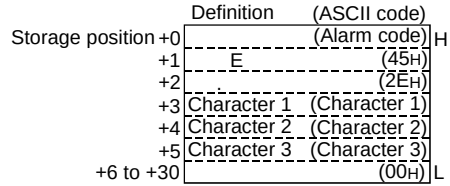
* value: Not used

When the inverter is not during an alarm, performing this operation does not reset the inverter.

Data acceptance timing: At network variable receive (nv_update_occurs event)

6.3.13 Alarm occurrence definition (network output SNVT_str_asc nvoInvAlarmStr)

At inverter alarm occurrence, you can confirm the alarm definition of the inverter with a character string.



* If an inverter alarm occurs at power-on/inverter reset, data is not sent before the Pr.387 "initial communication delay time (nciPwUpOutTm) (Refer to pages 31, 80.)". The factory setting of +0 to +30 is 0.

Data send timing: At inverter alarm occurrence

Alarm Code Correspondence Table

Definition	+0	+1	+2	+3	+4	+5	+6 to +30
	Alarm code	E	.	Character 1	Character 2	Character 3	
OC1	10H	E (45H)	. (2EH)	O (4FH)	C (43H)	1 (31H)	
OC2	11H	E (45H)	. (2EH)	O (4FH)	C (43H)	2 (32H)	
OC3	12H	E (45H)	. (2EH)	O (4FH)	C (43H)	3 (33H)	
OV1	20H	E (45H)	. (2EH)	O (4FH)	V (56H)	1 (31H)	
OV2	21H	E (45H)	. (2EH)	O (4FH)	V (56H)	2 (32H)	
OV3	22H	E (45H)	. (2EH)	O (4FH)	V (56H)	3 (33H)	
THT	30H	E (45H)	. (2EH)	T (54H)	H (48H)	T (54H)	

Definition	+0	+1	+2	+3	+4	+5	+6 to +30
	Alarm code	E	.	Character 1	Character 2	Character 3	
THM	31H	E (45H)	. (2EH)	T (54H)	H (48H)	M (4DH)	
FIN	40H	E (45H)	. (2EH)	F (46H)	I (49H)	N (4EH)	
OLT	60H	E (45H)	. (2EH)	O (4FH)	L (4CH)	T (54H)	
BE	70H	E (45H)	. (2EH)	B (42H)	E (45H)	Space (20H)	
GF	80H	E (45H)	. (2EH)	G (47H)	F (46H)	Space (20H)	
LF	81H	E (45H)	. (2EH)	L (4CH)	F (46H)	Space (20H)	
OHT	90H	E (45H)	. (2EH)	O (4FH)	H (48H)	T (54H)	
OPT	A0H	E (45H)	. (2EH)	O (4FH)	P (50H)	T (54H)	
PE	B0H	E (45H)	. (2EH)	P (50H)	E (45H)	Space (20H)	
PUE	B1H	E (45H)	. (2EH)	P (50H)	U (55H)	E (45H)	
RET	B2H	E (45H)	. (2EH)	R (52H)	E (45H)	T (54H)	
CPU	C0H	E (45H)	. (2EH)	C (43H)	P (50H)	U (55H)	
P24	C2H	E (45H)	. (2EH)	P (50H)	2 (32H)	4 (34H)	
E3	F3H	E (45H)	. (2EH)	E (45H)	3 (33H)	Space (20H)	
E6	F6H	E (45H)	. (2EH)	E (45H)	6 (36H)	Space (20H)	
E7	F7H	E (45H)	. (2EH)	E (45H)	7 (37H)	Space (20H)	

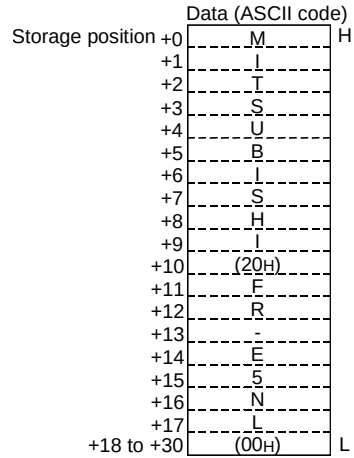
* ASCII code in parentheses

6.3.14 Product information (maker name, type) (network output SNVT_str_asc nvoInvTypeInfo)

When an alarm has occurred at the inverter, you can send the "maker name (MITSUBISHI)" and "type (FR-E5NL)" data as a character string.

* At power-on/inverter reset, data is not sent before the Pr.387 "initial communication delay time (nciPwUpOutTm) (Refer to pages 31, 80.)". The display is factory-set to "MITSUBISHI FR-E5NL".

Data send timing: At power-on/inverter reset/inverter alarm occurence



6.3.15 Emergency stop command (network input SNVT_hvac_emerg nviEmergOverride)

You can give an emergency stop command during inverter operation.

Name	Description		
nviEmergOverride	Stores any of the following requests.		
	0H(Factory setting)	EMERG_NORMAL	Emergency stop cancel
	4H	EMERG_SHUTDOWN	Emergency stop
	FFH	EMERG_NUL	Invalid (no operation)

* If "EMERG_SHUTDOWN" is requested during inverter operation, the inverter decelerates to a stop independently of the operation mode.

Emergency Stop	Emergency Stop Cancel
• The deceleration time depends on the Pr. 8, Pr. 44 and other settings. • When the inverter starts decelerating under the emergency stop command, "PS" appears in the display section of the option panel or parameter unit (FR-PU04) and the inverter is put in an emergency stop status. • An emergency stop status cannot be canceled unless emergency stop cancel operation is performed. • During occurrence of a communication line alarm, an emergency stop command is not accepted. • During an inverter stop, an emergency stop command is invalid.	• During an inverter stop, turn OFF all start commands (forward rotation command, reverse rotation command) and request "EMERG_NORMAL". When the inverter recognizes this status, it cancels the emergency stop and also "PS" shown in the display section disappears. • During deceleration made under an emergency stop command, performing emergency stop cancel operation will not cancel an emergency stop immediately. Perform emergency stop cancel operation during an inverter stop.

Data acceptance timing: At network variable receive (nv_update_occurs event)

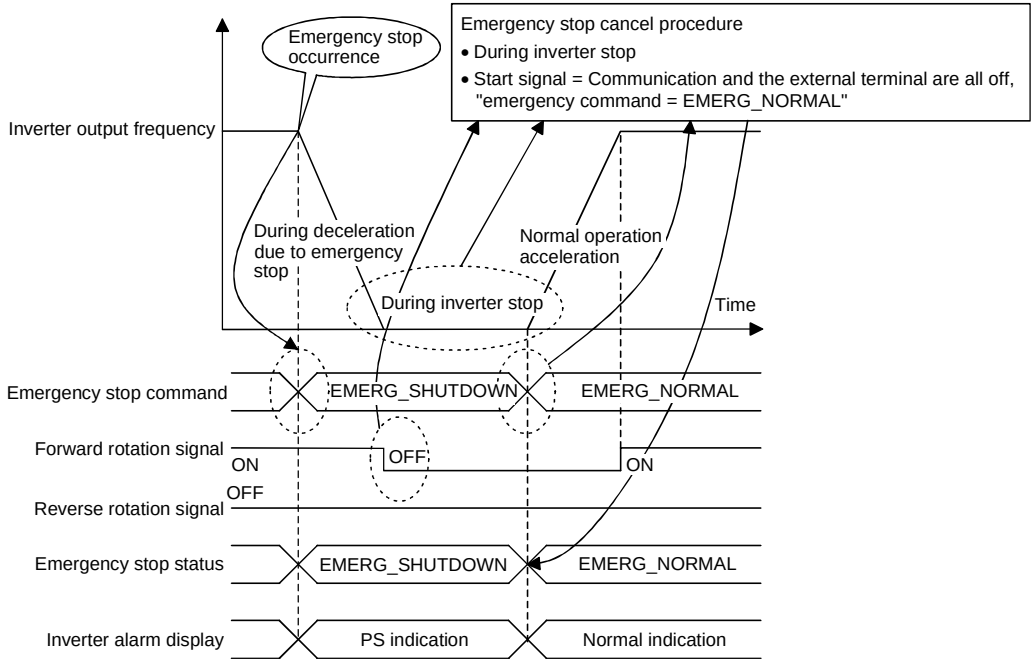
6.3.16 Emergency stop status (network output SNVT_hvac_emerg nvoEmergStatus)

You can indicate the emergency stop status of the inverter.

Name	Description		
nvoEmergStatus	Returns either of the following statuses.		
	0H(Factory setting)	EMERG_NORMAL	During normal or emergency stop cancel
	4H	EMERG_SHUTDOWN	During emergency stop

Data send event : When the value data changes at emergency stop command receive
Data send timing : As set in Pr. 388 "heartbeat send time interval" and Pr. 389 "minimum heartbeat send time". (Refer to pages 31, 84.)

Operation Timing Chart



6.3.17 Alarm status (network output SNVT_switch nvoDrvAlarm)

You can indicate the alarm status of the inverter.

nvoDrvAlarm		Operation
state	value	
0H (Factory setting)	Don't care	Inverter normal
1H	Don't care	During inverter alarm

* The value is factory-set to 0H.

Data send timing : As set in Pr. 388 "heartbeat send time interval" and Pr. 389 "minimum heartbeat send time". (Refer to pages 31, 84.)

6.4 Inverter PID Control Functions

6.4.1 PID set point (network input SNVT_lev_percent nviInvPIDTarget)

Enter the target value of air volume, temperature or the like in 0.005% increments.

Data Name	Range	Increments	Factory Setting
nviInvPIDTarget	0.00% to 100.00%	0.005%/bit	0.000%

* Control cannot be exercised at less than the minimum resolution (0.01%) of the inverter.
  The values less than 0.00% or more than 100.00% are made invalid.

Example: When setting 30°C as the set point using a 10°C/0%, 50°C/100% detector
((30-10) / (50-10)) × 100 = 50%
As the PID set point, enter 50.00%.

Data acceptance timing: At network variable receive (nv_update_occurs event)

6.4.2 PID process variable (network input SNVT_lev_percent nviInvPIDValue)

Enter the measured value of air volume, temperature or the like in 0.005% increments.

Data Name	Range	Increments	Factory Setting
nviInvPIDValue	0.00% to 100.00%	0.005%/bit	0.000%

* Control cannot be exercised at less than the minimum resolution (0.01%) of the inverter.
  The values less than 0.00% or more than 100.00% are made invalid.

Example: When the process variable is 25°C on a 10°C/0%, 50°C/100% detector
((25-10) / (50-10)) × 100 = 37.5%
As the PID process variable, enter 37.50%.

Data acceptance timing: At network variable receive (nv_update_occurs event)

6.4.3 PID deviation (network input SNVT_lev_percent nviInvPIDDev)

Enter the set value of air volume, temperature or the like in 0.005% increments.

Data Name	Range	Increments	Factory Setting
nviInvPIDDev	-100.00% to +100.00%	0.005%/bit	0.000%

* Control cannot be exercised at less than the minimum resolution (0.01%) of the inverter.
The values less than -100.00% or more than 100.00% are made invalid.

Example: When the set point is 25°C and the current temperature is 30°C on a 10°C/0%, 50°C/100% detector (deviation: +5°C)
(5/ (50-10)) × 100 = 12.5%
As the PID deviation, enter 12.50%.

Data acceptance timing: At network variable receive (nv_update_occurs event)

6.5 Inverter Extended Functions

6.5.1 Monitor code (network input SNVT_count nviInvMonCode)

When you set the monitor code you want to monitor, the monitor value corresponding to that code enters "monitor data (nvoInvMonData) (Refer to page 72.)".

Data Name	Range	Increments	Factory Setting
nviInvMonCode	0H to 0003H	—	0H

<Monitor Code Table>

Code Number	Description	Increments
0000H	No monitoring *1	——
0001H	Output frequency *2	0.01Hz
0002H	Output current	0.01A
0003H	Output voltage	0.1V
0017H	Actual operation time	1h
0019H	Cumulative power	1kWh

*1 The value of the first monitor is 0, and the value is the value previously monitored when switched from an other monitor.

*2 When "0" is not set in Pr.37, output frequency monitor changes to rotation monitor.
(increment at speed monitoring: 1r/min)
Note that the speed display of higher than 65535 (FFFFH) is 65535 (FFFFH).

*3 When monitor data other than the above is set, monitor data (nvoInvMonData) becomes an arbitrary value.

Data acceptance timing: At network variable receive (nv_update_occurs event)

6.5.2 Monitor data (network output SNVT_count nvoInvMonData)

You can monitor the data of the monitor type set in "monitor code (nviInvMonCode) (Refer to page 71.)".

Data Name	Range	Increments	Factory Setting
nvoInvMonData	0 to 65535	*	0

* For the monitor data increments, use the corresponding increments according to the monitor code table. (Refer to pages 71.)

(Example) If the monitored value is 60.00Hz, "6000" is displayed.

Data send event : When the monitor value data changes

Data send timing : As set in Pr. 388 "heartbeat send time interval" and Pr. 389 "minimum heartbeat send time". (Refer to pages 31, 84.)

6.5.3 Set frequency (0.01Hz increments) (network input SNVT_count nviInvSetFreq2)

You can set the frequency command in 0.01Hz increments.

Data Name	Range	Increments	Factory Setting
NviInvSetFreq2	0.00Hz to 400.00Hz	0.01Hz/bit	0.00Hz

(Example) If you want to set 120.00Hz, set "12000", the value 100 times greater than the desired frequency.

Data acceptance timing: At network variable receive (nv_update_occurs event)

6.5.4 Output frequency monitor (0.01Hz increments) (network output SNVT_count nvoInvOutFreq2)

You can monitor the output frequency of the inverter in 0.01Hz increments.

Data Name	Range	Increments	Factory Setting
NvoInvOutFreq2	0.00Hz to 400.00Hz	0.01Hz/bit	0.00Hz

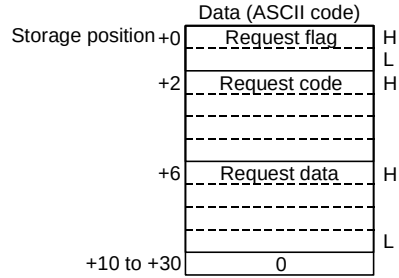
(Example) If the monitored value is 120.00Hz, "12000", the value 100 times greater, is displayed.

Data send event : When the data changes in 0.01Hz increments

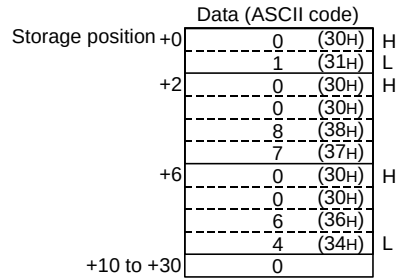
Data send timing : As set in Pr. 388 "heartbeat send time interval" and Pr. 389 "minimum heartbeat send time". (Refer to pages 31, 84.)

6.5.5 Command request (network input SNVT_str_asc nviInvCmdReq)

You can set the instruction code and written data for executing operation mode rewrite, parameter read and write, alarm history reference, parameter clear or the like.
The format is as shown below. The data to be set are in ASCII code. The factory setting of +0 to +30 is 0.



Example: When writing Pr. 7 "acceleration time" = 10.0s



Data acceptance timing: At network variable receive (nv_update_occurs event) and when request flag = 1

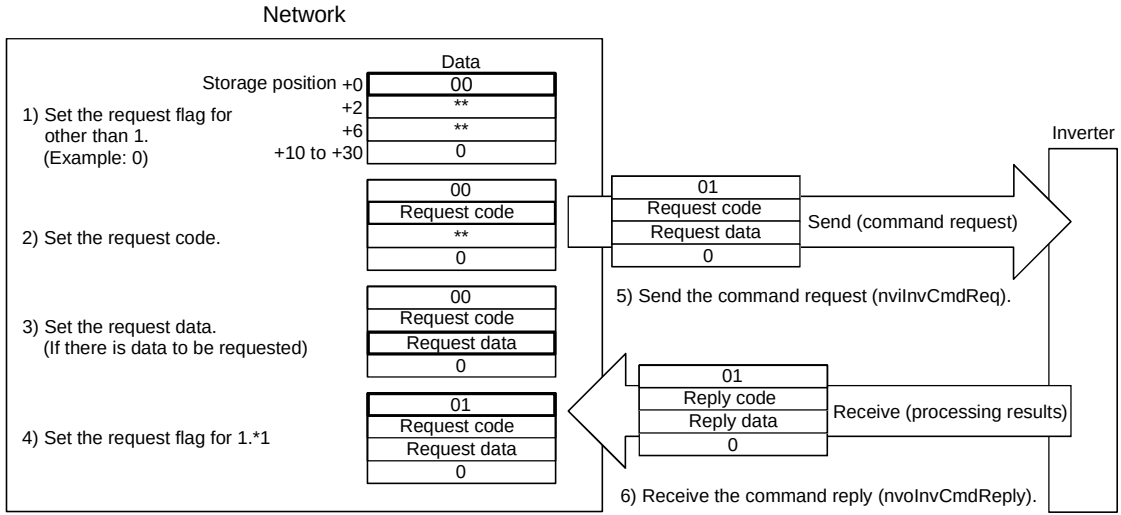
Request flag	01H	Command request is made
	Other than 01H	Command request is not made
Request code	Set the request code of the command.	
Request data	Set the data at writting. (Set 0000H at reading.)	

Command List

Item	Code Number	Description
Operation mode read	007BH	0000H: Network operation 0001H: External operation 0002H: PU operation
Operation mode write	00FBH	0000H: Network operation 0001H: External operation 0002H: PU operation (Setting is enabled only during switch over mode (Pr.79=6).)
Alarm history No. 1, No. 2 read	0074H	Reads the most recent No. 1 and 2 alarms.
Alarm history No. 3, No. 4 read	0075H	Reads the most recent No. 3 and 4 alarms.
Alarm history No. 5, No. 6 read	0076H	Reads the most recent No. 5 and 6 alarms.
Alarm history No. 7, No. 8 read	0077H	Reads the most recent No. 7 and 8 alarms.
Set frequency (RAM) read	006DH	Reads the set frequency (RAM).
Set frequency (E^2PROM) read	006EH	Reads the set frequency (E^2PROM).
Set frequency (RAM) write	00EDH	Writes the set frequency to RAM.
Set frequency (E^2PROM) write	00EEH	Writes the set frequency to E^2PROM.

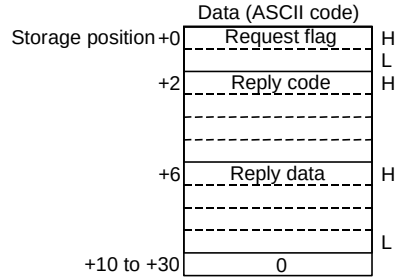
Item		Code Number	Description
Parameter read		0000H to 006CH	Refer to the data code list in the inverter manual, and perform read/ write as required. It should be noted that some parameters cannot be accessed.
Parameter write		0080H to 00ECH	
Batch alarm definition clear		00F4H	9696H: Batch-clears the alarm history.
Parameter clear		00FCH	9966H: All clear 9696H: Parameter clear (parameters values other than calibrated values are reset to factory settings.)
Inverter reset		00FDH	9696H: Resets the inverter.
Link parameter expansion setting	Read	007FH	Changes parameter values by setting 0000H to 0009H. For details of the setting value, refer to the parameter data code list in the inverter manual.
	Write	00FFH	
Second parameter changing	Read	006CH	Pr. 902 to Pr. 905 0000H: Offset/gain 0001H: Analog 0002H: Analog value of terminal
	Write	00ECH	

Command processing is performed in the following procedure.

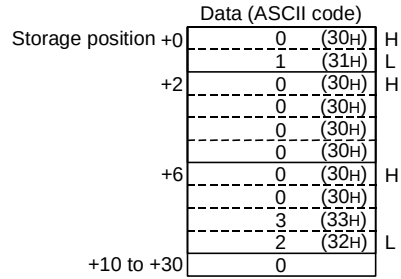


6.5.6 Command reply (network output SNVT_str_asc nvoInvCmdReply)

Gives a reply to the command requested in "command request (nviInvCmdReq) (Refer to page 74.)". The data entered are the reply code and read data as the command processing results.
The format is as shown below. The data to be set are in ASCII code. The factory setting of +0 to +30 is 0.



Example: When reading the inverter parameter, Pr. 8 "deceleration time" = 5.0s



Reply flag	01_H	Reply to command request
Reply code (Results in response to the command request enter)	0000_H	Normal completion of command
	Other than 0000_H	Command execution error 0001_H: Mode error (different operation mode) 0002_H: Instruction code error (specified instruction code does not exist) 0003_H: Data range error (data written is outside the range) 0004_H: Written data error (Data transfer error due to poor inverter-option contact or like)
Reply data	The data is set at reading. (A given value is set at writing.)	

Data send event : At command processing completion

REMARKS

Refer to page 74 for the command processing procedure.

6.6 Configuration Properties

6.6.1 Initial communication delay time (network input config SNVT_time_sec nciPwUpOutTm)

You can set the time from when the inverter starts until when data is sent to LONWORKS at power-on or inverter reset.

Data Name	Range	Increments	Factory Setting
nciPwUpOutTm	0.0s to 120.0s	0.1s/bit	Refer to Pr. 387 "initial communication delay time" (page 31)

* The set value is reflected on Pr. 387 "initial communication delay time". (Refer to page 31.)

Data acceptance timing: At network variable receive (nv_update_occurs event)

6.6.2 Forward/reverse rotation prevention (network input config SNVT_count nciInvFwdRevLock)

You can limit the rotation direction of the inverter. (Used to disable rotation in the wrong direction in a system where an air conditioning fan or the like is fixed in rotation direction.)

Data Name	Range	Increments	Factory Setting
nciInvFwdRevLock	0H, 1H, 2H	—	Instruction Manual of the Inverter Refer to Pr. 78 "reverse rotation prevention selection"

* The set value is reflected on Pr. 78 "reverse rotation prevention selection".

ciInvFwdRevLock	Operation
0H	Both forward rotation and reverse rotation enabled
1H	Reverse rotation disabled
2H	Forward rotation disabled

* Value is not used.

Data acceptance timing: At network variable receive (nv_update_occurs event)

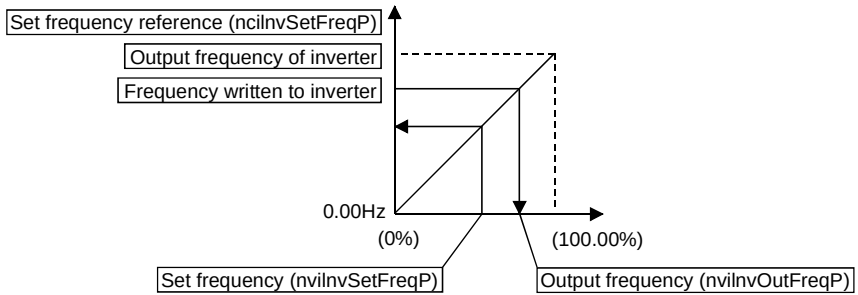
6.6.3 % set reference frequency (network input config SNVT_freq_hz nciInvSetFreqBas)

You can set the reference frequency of "set frequency (nviInvSetFreqP) (Refer to page 56.)" and "output frequency monitor (nvoInvOutFreqP) (Refer to page 57.)".

Data Name	Range	Increments	Factory Setting
nciInvSetFreqBas	1.0Hz to 400.0Hz	0.1Hz/bit	Refer to Pr. 390 "% set reference frequency" (page 35)

* The set value is reflected on Pr. 390 "% set reference frequency". (Refer to page 35.)

Data acceptance timing: At network variable receive (nv_update_occurs event)



6.6.4 Maximum frequency (0.1Hz increments) (network input config SNVT_freq_hz nciInvMaxFreq)

You can set the maximum frequency to be output by the motor to the inverter in 0.1Hz increments.

Data Name	Range	Increments	Factory Setting
nciInvMaxFreq	0.0Hz to 120.0Hz	0.1Hz/bit	Instruction Manual of the Inverter Refer to Pr. 1 "maximum frequency"

* The set value is reflected on either Pr. 1 "maximum frequency" or Pr. 18 "High-spped maximum frequency".

Data acceptance timing: At network variable receive (nv_update_occurs event)

6.6.5 Minimum frequency (0.1Hz increments) (network input config SNVT_freq_hz nciInvMinFreq)

You can set the minimum frequency to be output by the motor to the inverter in 0.1Hz increments.

Data Name	Range	Increments	Factory Setting
nciInvMinFreq	0.0Hz to 120.0Hz	0.1Hz/bit	Instruction Manual of the Inverter Refer to Pr. 2 "minimum frequency".

* The set value is reflected on Pr. 2 "minimum frequency".

Data acceptance timing: At network variable receive (nv_update_occurs event)

6.6.6 Heartbeat send time interval (network input config SNVT_time_sec nciSndHrtBt)

You can set the time interval at which data is sent to network in output network variable send.

Data Name	Range	Increments	Factory Setting
NciSndHrtBt	0.0s to 999.8s	0.1s/bit	Refer to Pr. 388 "heartbeat send time interval" (page 31)

* The set value is reflected on Pr. 388 "heartbeat send time interval". (Refer to page 31.)

Data acceptance timing: At network variable receive (nv_update_occurs event)

6.6.7 Minimum heartbeat send time (network input config SNVT_time_sec nciMinOutTm)

You can set the minimum time at which data is sent to network in output network variable send.

Data Name	Range	Increments	Factory Setting
nciMinOutTm	0.0s to 999.8s	0.1s/bit	Refer to Pr. 389 "minimum heartbeat send time" (page 31)

* The set value is reflected on Pr. 389 "minimum heartbeat send time". (Refer to page 31.)

Data acceptance timing: At network variable receive (nv_update_occurs event)

6.6.8 Acceleration time (network input config SNVT_time_sec nciRampUpTm)

You can set the time taken by the motor to accelerate from 0Hz to the acceleration/deceleration reference frequency.

Data Name	Range	Increments	Factory Setting
nciRampUpTm	0.0s to 3600.0s /0.00s to 360.00	0.1s/bit /0.01s/bit	Refer to Pr. 7 "acceleration time" in the inverter manual

* The set value is reflected on Pr. 7 "acceleration time".
The acceleration/deceleration reference frequency can be changed within the range 1Hz to 400Hz by changing the Pr. 20 setting.
Changing the Pr. 21 setting changes the acceleration time setting. When Pr.21="1", the value obtained by multiplying the setting value by 0.1 is written to the inverter.

Example: When Pr. 21 = "0", setting "5.0"s for the acceleration time and "1" in Pr. 21 changes the acceleration time to "0.5" s.

Data acceptance timing: At network variable receive (nv_update_occurs event)

6.6.9 Deceleration time (network input config SNVT_time_sec nciRampDownTm)

You can set the time taken by the motor to decelerate from the acceleration/deceleration reference frequency to 0Hz.

Data Name	Range	Increments	Factory Setting
nciRampDownTm	0.0s to 3600.0s /0.00s to 360.00	0.1s/bit /0.01s/bit	Refer to Pr. 8 "deceleration time" in the inverter manual

* The set value is reflected on Pr. 8 "deceleration time".
The acceleration/deceleration reference frequency can be changed within the range 1Hz to 400Hz by changing the Pr. 20 setting.
Changing the Pr. 21 setting changes the deceleration time setting. When Pr. 21="1", the value obtained by multiplying the setting value by 0.1 is written to the inverter.

Example: When Pr. 21 = "0", setting "5.0"s for the deceleration time and "1" in Pr. 21 changes the deceleration time to "0.5" s.

Data acceptance timing: At network variable receive (nv_update_occurs event)

6.6.10 PID action selection (network input config SNVT_count nciInvPIDSwitch)

You can set whether the PID control of the inverter will be exercised or not.

Data Name	Range	Increments	Factory Setting
nciInvPIDSwitch	0, 20, 21, 50, 51, 60, 61	—	Refer to Pr. 128 "PID operation selection" (page 28)

State	Value	Operation
0	Don't care	No PID control
20	Don't care	PID reverse action (process variable signal input) (terminal No. 4)
21	Don't care	PID forward action (process variable signal input) (terminal No. 4)
50	Don't care	PID reverse action (deviation value communication input) (network variable)
51	Don't care	PID forward action (deviation value communication input) (network variable)
60	Don't care	PID reverse action (process variable communication input) (network variable)
61	Don't care	PID forward action (process variable communication input) (network variable)

* Value is not used.
The set value is reflected on Pr. 128 "PID operation selection".

Data acceptance timing: At network variable receive when the inverter is at a stop (nv_update_occurs event)

REMARKS

For the way to use PID control, refer to page 28 and the inverter manual.

6.6.11 PID proportional band (network input config SNVT_count nciInvPIDPro)

You can set the proportional band of the PID control of the inverter.

Data Name	Range	Increments	Factory Setting
nciInvPIDPr.o	0.0% to 1000.0%, 6553.5	0.1%/bit	Refer to Pr. 129 "PID proportional band" in the inverter manaul

* The set value is reflected on Pr. 129 "PID proportional band".
Setting 0.0% or 6553.5 disables proportional control.

(Example) If you want to set 50.0%, set "500", the value 10 times greater than the desired setting.

Data acceptance timing: At network variable receive when the inverter is at a stop (nv_update_occurs event)

REMARKS

For the way to use PID control, refer to page 28 of the inverter manual.

6.6.12 PID integral time (network input config SNVT_time_sec nciInvPIDIntTm)

You can set the integral time of the PID control of the inverter.

Data Name	Range	Increments	Factory Setting
nciInvPIDIntTm	0.0s to 3600.0s, 6553.5	0.1s/bit	Refer to Pr. 130 "PID integral time" in the inverter manual

* The set value is reflected on Pr. 130 "PID integral time".
Setting 0.0s or 6553.5 disables integral control.

Data acceptance timing: At network variable receive when the inverter is at a stop (nv_update_occurs event)

REMARKS

For the way to use PID control, refer to page 28 and the inverter manual.

6.6.13 PID differential time (network input config SNVT_time_sec nciInvPIDDiffTm)

You can set the differential time of the PID control of the inverter.

Data Name	Range	Increments	Factory Setting
nciInvPIDDiffTm	0.0s to 10.0s, 6553.5	0.1s/bit	Refer to Pr. 134 "PID differential time" in the inverter manual

* The set value is reflected on Pr. 134 "PID differential time".
Setting 0.0s or 6553.5 disables differential control.

Data acceptance timing: At network variable receive when the inverter is at a stop (nv_update_occurs event)

REMARKS

For the way to use PID control, refer to page 28 and the inverter manual.

6.6.14 PID manipulated variable bias (0.1Hz increments) (network input config SNVT_freq_hz nciInvPIDOpeBias)

You can set the manipulated variable of the inverter in 0.1Hz increments when the deviation (difference between set point and process variable) under PID control is 0%.

Data Name	Range	Increments	Factory Setting
nciInvPIDOpeBias	0.0Hz to 60.0Hz	0.1Hz/bit	Refer to Pr. 902 "frequency setting voltage bias" in the inverter manual

* The set value is reflected on Pr. 902 "frequency setting voltage bias".

Data acceptance timing: At network variable receive (nv_update_occurs event)

REMARKS

For the way to use PID control, refer to page 28 and the inverter manual.

6.6.15 PID manipulated variable gain (0.1Hz increments) (network input config SNVT_freq_hz nciInvPIDOpeGain)

You can set the manipulated variable of the inverter in 0.1Hz increments when the deviation (difference between set point and process variable) under PID control is 100%.

Data Name	Range	Increments	Factory Setting
nciInvPIDOpeGain	1.0Hz to 400.0Hz	0.1Hz/bit	Refer to Pr. 903 "frequency setting voltage gain" in the inverter manual

* The set value is reflected on Pr. 903 "frequency setting voltage gain".

Data acceptance timing: At network variable receive (nv_update_occurs event)

REMARKS

For the way to use PID control, refer to page 28 and the inverter manual.

6.6.16 Heartbeat receive time interval (network input config SNVT_time_sec nciRcvHrtBt)

You can set the time interval at which data is received from LONWORKS in input network variable receive.

Data Name	Range	Increments	Factory Setting
NciRcvHrtBt	0.0s to 999.8s	0.1s/bit	Refer to Pr. 391 "heartbeat receive time interval" (page 34)

* The set value is reflected on Pr. 391 "heartbeat receive time interval". (Refer to page 34.)

Data acceptance timing: At network variable receive (nv_update_occurs event)

6.6.17 Maximum speed (0.005% increments) (network input config SNVT_lev_percent nciMaxSpeed)

You can set the maximum speed to be output by the inverter to the motor in 0.005% increments.

Data Name	Range	Increments	Factory Setting
nciMaxSpeed	0.000% to 163.830%	0.005%/bit	Refer to Pr. 1 "maximum frequency" in the inverter manual

* The set value is reflected on either Pr. 1 "maximum frequency" or Pr. 18 "High-spped maximum frequency".
Control cannot be exercised at less than the minimum frequency resolution (0.01Hz) of the inverter.
The reference value is "reference speed setting (nciNmlSpeed) (Refer to page 92.)" or "reference frequency setting (nciNmlFreq) (Refer to page 92.)".

Data acceptance timing: At network variable receive (nv_update_occurs event)

6.6.18 Minimum speed (0.005% increments) (network input config SNVT_lev_percent nciMinSpeed)

You can set the minimum speed to be output by the inverter to the motor in 0.005% increments.

Data Name	Range	Increments	Factory Setting
nciMinSpeed	0.000% to 163.830%	0.005%/bit	Refer to Pr. 2 "minimum frequency" in the inverter manual

* The set value is reflected on Pr. 2 "minimum frequency".
Control cannot be exercised at less than the minimum frequency resolution (0.01Hz) of the inverter.
The reference value is "reference speed setting (nciNmlSpeed) (Refer to page 92.)" or "reference frequency setting (nciNmlFreq) (Refer to page 92.)".

Data acceptance timing: At network variable receive (nv_update_occurs event)

6.6.19 Reference speed setting (network input config SNVT_rpm nciNmlSpeed)

Set the speed used as the reference of "speed adjustment (nviDrvSpeedScale) (Refer to page 51.)", "speed monitor (nviDrvSpeed) (Refer to page 52.)", "maximum speed (nviMaxSpeed) (Refer to page 91.)" and "minimum speed (nviMinSpeed) (Refer to page 91.)".

Data Name	Range	Increments	Factory Setting
nciNmlSpeed	30r/min to 12000r/min	1r/min/bit	The value obtained from converting Pr. 390 "% set reference frequency " in 1r/min increments (Refer to page 35)

* The set value is reflected on Pr. 390 "% set reference frequency". (Refer to page 35.)
The set value is converted from the speed increments (4 poles) into the frequency increments and the conversion result is then written.
<Frequency = 4 (poles) × speed/120> (Note: The calculation result is rounded down.)

Data acceptance timing: At network variable receive (nv_update_occurs event)

6.6.20 Reference frequency setting (network input config SNVT_freq_hz nciNmlFreq)

Set the frequency used as the reference of "speed adjustment (nviDrvSpeedScale) (Refer to page 51.)", "speed monitor (nvoDrvSpeed) (Refer to page 52.)", "maximum speed (nciMaxSpeed) (Refer to page 91.)" and "minimum speed (nciMinSpeed) (Refer to page 91.)".

Data Name	Range	Increments	Factory Setting
nciNmlFreq	1.0Hz to 400.0Hz	0.1Hz/bit	Refer to Pr. 390 "% set reference frequency " (page 35)

* The set value is reflected on Pr. 390 "% set reference frequency". (Refer to page 35.)

Data acceptance timing: At network variable receive (nv_update_occurs event)

6.6.21 Speed adjustment default value (network input config SNVT_lev_percent nciDrvSpeedScale)

You can set the default value of "speed adjustment (nviDrvSpeedScale) (Refer to page 51.)".

Data Name	Range	Increments	Factory Setting
nciDrvSpeedScale	-163.840% to 163.830%	0.005%/bit	100.00%

* Write and read the value from the network. You can not write and read from the inverter. The value stored in the inverter is rounded down.
  For example, 1.005% is rounded down to 1.000%.

Data acceptance timing: At network variable receive (nv_update_occurs event)

6.6.22 Event driven detection width (network input config SNVT_lev_percent nciInvEvtDuty)

You can set the event driven detection widths (varying widths) of the monitor-related output network variables in 0.005% increments.

Data Name	Range	Increments	Factory Setting
nciInvEvtDuty	0.000% to 163.830%	0.005%/bit	Refer to Pr. 392 "event driven detection width" (page 36)

* The set value is reflected on Pr. 392 "event driven detection width". (Refer to page 36.)
  Control cannot be exercised at less than the minimum frequency resolution (0.01Hz) of the inverter.
  The value stored in the inverter is rounded up.
  For example, 1.005% is rounded up to 1.010%.

Data acceptance timing: At network variable receive (nv_update_occurs event)

7.TROUBLESHOOTING

(1) Operation mode does not switch to network operation mode
- Check that the option units (FR-E5NL) and LONWORKS dedicated cables are fitted properly. (Check for contact fault, open cable, etc.)
- Check that the node addresses are set to the correct positions.
- Check that the inverter is in the external operation mode.
- Check that the operation mode switching network variable is running.
- Check that the operation mode switching network variable has been written correctly.

(2) Inverter does not start in network operation mode
- Check that the inverter starting network variable has been written correctly.
- Check that the inverter starting network variable is running.
- Check that the inverter is providing output.

(3) When "E.OPT" or "E. 3" is displayed.
- Refer to page 25.

REVISIONS

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

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