YASKAWA

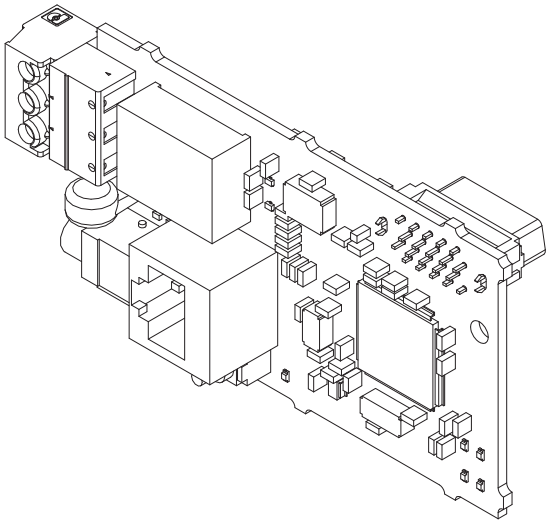
YASKAWA AC Drive Option

LonWorks

Technical Manual

Type SI-W3

To properly use the product, read this manual thoroughly and retain for easy reference, inspection, and maintenance. Ensure the end user receives this manual.



MANUAL NO. SIEP C730600 93B

Table of Contents

1 Preface and Safety

YASKAWA Electric supplies component parts for use in a wide variety of industrial applications. The selection and application of YASKAWA products remain the responsibility of the equipment designer or end user.
YASKAWA accepts no responsibility for the way its products are incorporated into the final system design. Under no circumstances should any YASKAWA product be incorporated into any product or design as the exclusive or sole safety control. Without exception, all controls should be designed to detect faults dynamically and fail safely under all circumstances. All products designed to incorporate a component part manufactured by YASKAWA must be supplied to the end user with appropriate warnings and instructions as to the safe use and operation of that part. Any warnings provided by YASKAWA must be promptly provided to the end user. YASKAWA offers an express warranty only as to the quality of its products in conforming to standards and specifications published in the manual. NO OTHER WARRANTY, EXPRESS OR IMPLIED, IS OFFERED. YASKAWA assumes no liability for any personal injury, property damage, losses, or claims arising from misapplication of its products.

◆ Applicable Documentation

The following manuals are available for the option:

SI-W3 Option

YASKAWA AC Drive Option SI-W3 LonWorks Installation Manual Manual No: TOBP C730600 93	This guide is packaged together with the product and contains information necessary to install the option and set related drive parameters.
YASKAWA AC Drive Option SI-W3 LonWorks Technical Manual Manual No: SIEP C730600 93 (This book)	The technical manual contains detailed information about the option. Access the following sites to obtain the technical manual: U.S.: http://www.yaskawa.com Europe: http://www.yaskawa.eu.com Japan: http://www.e-mechatronics.com Other areas: Check the back cover of these manuals. For questions, contact your local Yaskawa sales office or the nearest Yaskawa representative.

Drive

YASKAWA AC Drive Manuals	Drive manuals contain basic installation and wiring information in addition to detailed parameter setting, fault diagnostic, and maintenance information. The most recent versions of these manuals are available for download on our documentation websites: U.S.: http://www.yaskawa.com Europe: http://www.yaskawa.eu.com Japan: http://www.e-mechatronics.com Other areas: Check the back cover of these manuals. For questions, contact your local Yaskawa sales office or the nearest Yaskawa representative.

◆ Terms

Note: Indicates supplemental information that is not related to safety messages.

Option: YASKAWA AC Drive Option SI-W3 LonWorks

Drive:
- YASKAWA A1000-Series Drive
- YASKAWA U1000-Series Drive
- YASKAWA Z1000-Series Drive
- YASKAWA Z1000U-Series Drive
- YASKAWA AC Drive GA700
- YASKAWA AC Drive GA800
- YASKAWA AC Drive 1000-Series (A1000, U1000, Z1000, Z1000U)

Digital Operator:
- LCD Operator for YASKAWA AC Drive 1000-Series
- LED Operator for YASKAWA AC Drive 1000-Series
- LCD Keypad for YASKAWA AC Drive GA700 and GA800
- LED Keypad for YASKAWA AC Drive GA700 and GA800

◆ Registered Trademarks

- LonWorks is a trademark of ECHELON USA.
- Trademarks are the property of their respective owners.

◆ Supplemental Safety Information

Read and understand this manual before installing, operating, or servicing this option. The option must be installed according to this manual and local codes.

The following conventions are used to indicate safety messages in this manual. Failure to heed these messages could result in serious or possibly even fatal injury or damage to the products or to related equipment and systems.

⚠ DANGER

Indicates a hazardous situation, which, if not avoided, will cause death or serious injury.

⚠ WARNING

Indicates a hazardous situation, which, if not avoided, could cause death or serious injury.

⚠ CAUTION

Indicates a hazardous situation, which, if not avoided, could cause minor or moderate injury.

NOTICE

Indicates an equipment damage message.

■ General Safety

General Precautions

- The diagrams in this section may include options and drives without covers or safety shields to illustrate details. Be sure to reinstall covers or shields before operating any devices. The option should be used according to the instructions described in this manual.
- The diagrams in this manual are provided as examples only and may not pertain to all products covered by this manual.
- The products and specifications described in this manual or the content and presentation of the manual may be changed without notice to improve the product and/or the manual.
- Contact a Yaskawa representative or the nearest Yaskawa sales office and provide the manual number shown on the front cove to order new copies of the manual.

⚠ DANGER

Heed the safety messages in this manual.

Failure to comply will cause death or serious injury.

The operating company is responsible for any injuries or equipment damage resulting from failure to heed the warnings in this manual.

⚠ WARNING

Electrical Shock Hazard

Do not attempt to modify or alter the drive or drive circuitry in any way not explained in this manual.

Failure to comply could cause death or serious injury and will void warranty. Yaskawa is not responsible for any modification of the product made by the user. Do not modify this product.

NOTICE

Do not modify the drive or option circuitry.

Failure to comply could result in damage to the drive or option and will void warranty.

Yaskawa is not responsible for any modification of the product made by the user.

Do not expose the drive or the option to halogen group disinfectants. Do not pack the drive or the option in fumigated or sterilized wooden materials. Do not sterilize the entire package after packing the product.

Failure to comply could damage electrical components in the option.

2 Overview

The LonWorks Communication Option Card (Model SI-W3) is based on LonTalk. It acts as an interface for connecting an AC drive to a LonWorks network using the LonTalk protocol.

With the option card installed to the drive, the following operations are possible with devices using the LonTalk protocol:

- Operate the drive
- Monitor the drive operation status
- Change drive parameter settings

◆ Compatible Products

The option can be used with the products in *Table 1*.

Table 1 Compatible Products

Product Series	Model(s)	Software Version <1>
A1000	CIMR-A□2A□□□□	≥ 1020
	CIMR-A□4A0002 to 4A0675	
	CIMR-A□4A0930 and 4A1200	≥ 3015
	CIMR-A□5A□□□□	≥ 5040 ≥ 1020
U1000	CIMR-U□□A□□□□	≥ 1010
	CIMR-U□□E□□□□	
	CIMR-U□□P□□□□	
	CIMR-U□□W□□□□	
Z1000	CIMR-Z□□A□□□□	≥ 1014
Z1000U	CIMR-Z□□A□□□□	≥ 6110
	CIMR-Z□□E□□□□	
	CIMR-Z□□P□□□□	
	CIMR-Z□□W□□□□	
GA700	CIPR-GA70□2□□□	≥ 1010
	CIPR-GA70□4□□□	
GA800	CIPR-GA80□□□□□	≥ 9010

<1> Refer to “PRG” on the drive nameplate for the software version number.

3 Receiving

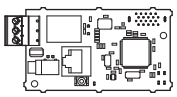
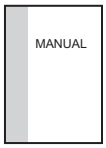
After receiving the option package:

1. Make sure that the option is not damaged and no parts are missing. Contact your sales outlet if the option or other parts appear damaged.

NOTICE: *Do not use damaged parts to connect the drive and the option. Failure to comply could damage the drive and option.*

2. Confirm that the model number on the option nameplate and the model listed in the purchase order are the same. Refer to ***Figure 1*** on page ***9*** for details. Contact the distributor where the option was purchased or the Yaskawa sales office immediately about any problems with the option.

◆ Option Package Contents

Description:	Option	Ground Wire <1>	Screws (M3)	LED Label for YASKAWA AC Drive 1000-Series	LED Label for YASKAWA AC Drive GA700 and GA800	Bar Code Label	Installation Manual
–							
Quantity:	1	1	3 <2>	1	1	1	1

<1> GA700 and GA800 drives do not use the ground wire.
<2> GA700 and GA800 drives use two screws only.

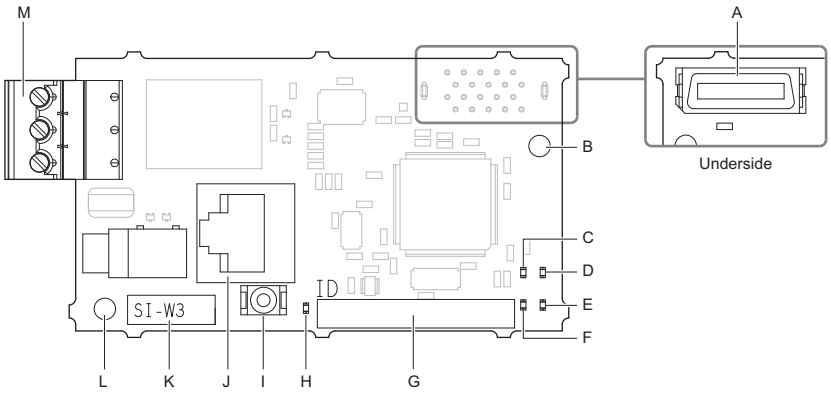
◆ Installation Tools

- A Phillips screwdriver. Phillips screw sizes vary by drive capacity.
- A flat-blade screwdriver (blade depth: 0.4 mm (0.02 in.), width: 2.5 mm (0.1 in.)).
- A pair of diagonal cutting pliers.
- A small file or medium-grit sandpaper.

Note: This manual does not list tools required to prepare option cables for wiring.

4 Option Components

◆ SI-W3 Option



A – Connector (CN5)
B – Installation hole
C – LED (ERR) *<1>*
D – LED (RUN) *<1>*
E – LED (TX) *<1>*
F – LED (RX) *<1>*
G – Neuron ID
H – LED (SERVICE)
I – Service switch
J – Digital operator connector (CN3) *<2>*
K – Model number
L – Ground terminal (FE) and installation hole *<3>*
M – Terminal block CN1

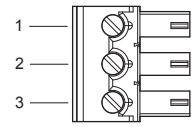
<1> ***Refer to Option LED Display on page 10*** for details on the LEDs.
<2> A Digital Operator, model: JVOP-182, is required for Direct Digital Control (DDC) functionality via connector CN3. ***Refer to Connector CN3 for DDC Functionality via Digital Operator JVOP-182 on page 9*** for details. The Z1000 and Z1000U product series do not support this connector and associated DDC functions.
<3> Connect the provided ground wire during installation. Installation on GA700 and GA800 drives does not require the ground wire.

Figure 1 SI-W3 Option Components

◆ Terminal Block CN1

The communication connector on the option is a pluggable terminal block designated CN1. CN1 is the connection point for a customer-supplied LonWorks network communication cable.

Table 2 Terminal Descriptions

Terminal	Terminal No.	Name	Description
	1	A	Signal Line A
	2	SLD	Shield
	3	B	Signal Line B

◆ Connector CN3 for DDC Functionality via Digital Operator JVOP-182

Note: **1.** The Z1000 and Z1000U do not support this connector and associated DDC functions.
2. Digital operator model JVOP-180 and JVOP-183 are not compatible.

DANGER! *Electric Shock Hazard. Do not touch drive main terminals and control terminals. Failure to comply will result in death or serious injury.*

Connect a digital operator (model: JVOP-182) to connector CN3 using an RJ-45 cable to set Direct Digital Control (DDC) function parameters. Refer to ***Function Modules on page 56*** for details.

◆ Service Switch

The service switch is a neuron ID output switch. Press this switch to output the neuron ID to the network.

■ Neuron ID

A label showing the neuron ID is affixed to the option PCB. Refer to *Figure 1* on page *9* for details.

A bar code label for the neuron ID is affixed to the option and additional labels are provided in the packaging. Additional bar code labels are supplied and may be placed externally on the drive enclosure for easy access to the neuron ID.

■ Initializing Bind Data

Cycle power to the drive while holding down the service switch to clear the bind data and reset the configuration properties to the default settings.

Note: Do not turn off the power to the drive while initializing the bind data. The RUN, RX, TX, and ERR LEDs are lit (ON) during initialization of the bind data.

◆ Option LED Display

The LonWorks Option has five LEDs that indicate the option card or communication status.

■ Defining Option LED States

Figure 2 Option LED Labels

Table 3 Option LED States

LED Name	Indication		Operating Status	Description
	Color	Status		
RUN	Green	ON	Option operating	The option is operating normally.
		Flashing	Network not configured	LonWorks network has not been configured.
		OFF	Power supply OFF	Power is not being supplied to the drive.
			Fatal error occurred	The option has detected a fatal (unrecoverable) error. If the unit does not recover after cycling power, then the option card may need to be replaced.
RX	Green	ON/ Flashing	Receiving	Receiving node data
		OFF	Node data not yet received	No input signal
TX	Green	ON/ Flashing	Sending	Sending data
		OFF	Not sending data	No data is being sent
ERR	Red	ON	Fatal error occurred	The option has detected a fatal (unrecoverable) error. If the unit does not recover after cycling power, then the option card may need to be replaced.
		Flashing	Comm error	The option has detected a CALL or bUS error.
		OFF	Option operating	The option is operating normally.

LED Name	Indication		Operating Status	Description
	Color	Status		
SERVICE	Green	ON	Service switch active	Service switch is being held down
			Hardware fault	The option has detected a fatal (unrecoverable) error. If the unit does not recover after cycling power, then the option card may need to be replaced.
		Flashing	Network not configured	LonWorks network has not been configured
		OFF	Option operating	The option is operating normally.

Note: The RUN, RX, TX, and ERR LEDs are lit (ON) during initialization of the bind data.

5 Installation Procedure

◆ Section Safety

⚠ DANGER

Electrical Shock Hazard

Do not inspect, connect, or disconnect any wiring while the drive is energized.

Failure to comply will cause death or serious injury.

Before servicing, disconnect all power to the equipment and wait for at least the time specified on the warning label. The internal capacitor remains charged even after the drive is de-energized. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. When all indicators are OFF, measure for unsafe voltages to confirm the drive is safe.

⚠ WARNING

Electrical Shock Hazard

Do not operate equipment with covers removed.

Failure to comply could cause death or serious injury.

The diagrams in this section may include options and drives without covers or safety shields to illustrate details. Reinstall covers and shields before operating the drive and run the drive according to the instructions described in this manual.

Do not allow unqualified personnel to perform work on the drive or option.

Failure to comply could cause death or serious injury.

Only authorized personnel familiar with installation, adjustment, and maintenance of AC drives and options may perform work.

Do not remove covers or touch circuit boards while the drive is energized.

Failure to comply could cause death or serious injury.

Do not use damaged wires, stress the wiring, or damage the wire insulation.

Failure to comply could cause death or serious injury.

Fire Hazard

Tighten all terminal screws to the specified tightening torque.

Loose or overtightened connections could cause erroneous operation and damage to the terminal block or start a fire and cause death or serious injury.

NOTICE

Damage to Equipment

Observe proper electrostatic discharge (ESD) procedures when handling the option, drive, and circuit boards.

Failure to comply could cause ESD damage to circuitry.

Never connect or disconnect the motor from the drive while the drive is outputting voltage.

Improper equipment sequencing could damage the drive.

Do not connect or operate any equipment with visible damage or missing parts.

Failure to comply could further damage the equipment.

Do not use unshielded wire for control wiring.

Failure to comply may cause electrical interference resulting in poor system performance. Use shielded, twisted-pair wires and ground the shield to the ground terminal of the drive.

NOTICE

Properly connect all pins and connectors on the option and drive.

Failure to comply could prevent proper operation and damage equipment.

Confirm that all connections are correct after installing the option and connecting peripheral devices.

Failure to comply could damage the option.

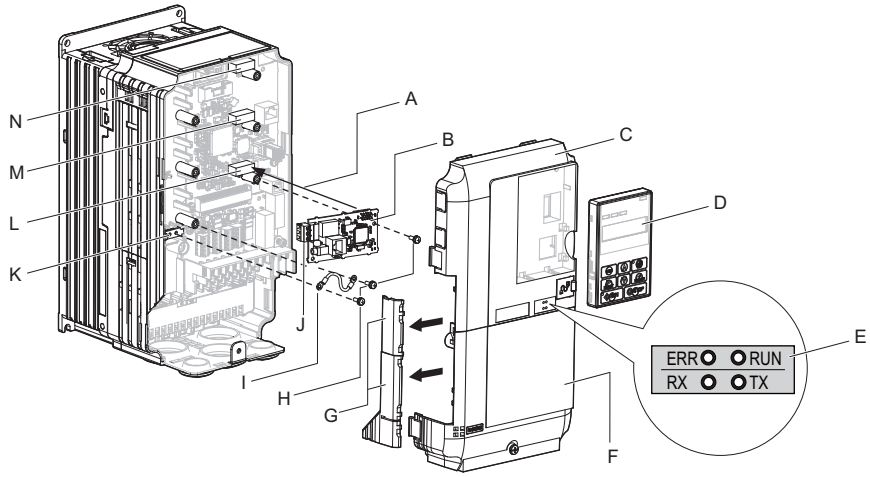
◆ Installing the Option on a 1000-Series Drive

Note: Refer to the Z1000U User Manual packaged with the drive for information on installing the option in Z1000U.

■ Prepare the Drive for the Option

Before beginning the installation procedure:

1. Wire the drive and make the proper connections to drive terminals according to the Quick Start Guide packaged with the drive.
2. Verify that the drive functions normally.
   Refer to ***Figure 3*** for an exploded view of the drive with the option and related components for reference in the installation procedure.



A – Insertion point for CN5
B – SI-W3 option
C – Drive front cover
D – Digital operator
E – LED label
F – Drive terminal cover
G – Removable tabs for wire routing
H – Included screws
I – Ground wire
J – Terminal block CN1
K – Drive grounding terminal (FE)
L – Connector CN5-A
M – Connector CN5-B (Not available for communication option installation.)
N – Connector CN5-C (Not available for communication option installation.)

Figure 3 Drive Components with Option

■ Install the Option

Remove the front covers of the drive before installing the option. Refer to the drive Quick Start Guide for directions on removing the front covers. Cover removal varies depending on drive size. This option can be inserted only into the **CN5-A** connector located on the drive control board.

DANGER! *Electrical Shock Hazard. Do not inspect, connect, or disconnect any wiring while the drive is energized. Failure to comply will cause death or serious injury. Before servicing, disconnect all power to the equipment and wait for at least the time specified on the warning label. The internal capacitor remains charged even after the drive is de-energized. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. When all indicators are OFF, measure for unsafe voltages to confirm the drive is safe.*

1. Shut off power to the drive, wait the appropriate amount of time for voltage to dissipate, then remove the digital operator (D) and front covers (C, F). Refer to the Quick Start Guide packaged with the drive for details on digital operator and cover removal.

NOTICE: *Damage to Equipment. Observe proper electrostatic discharge (ESD) procedures when handling the option, drive, and circuit boards. Failure to comply could cause ESD damage to circuitry.*

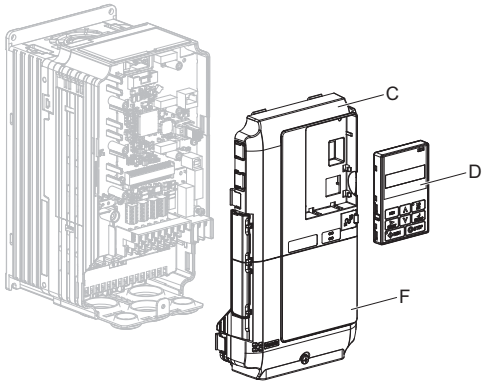


Figure 4 Remove the Digital Operator, Front Cover, and Terminal Cover

2. Affix the LED label (E) in the appropriate position on the drive front cover (C).

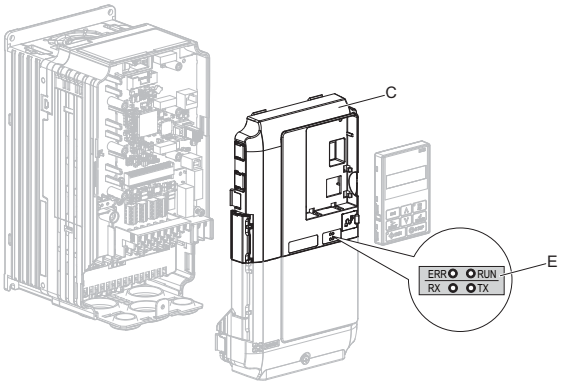


Figure 5 Affix the LED Label

3. Make sure the screws on the left and right sides of the option terminal block (J) are tightened with a tightening torque of 0.5 to 0.6 N·m (4.4 to 5.3 in lbs), then insert the option card (B) into the CN5-A (L) connector on the drive and fasten it into place using one of the included screws (H).

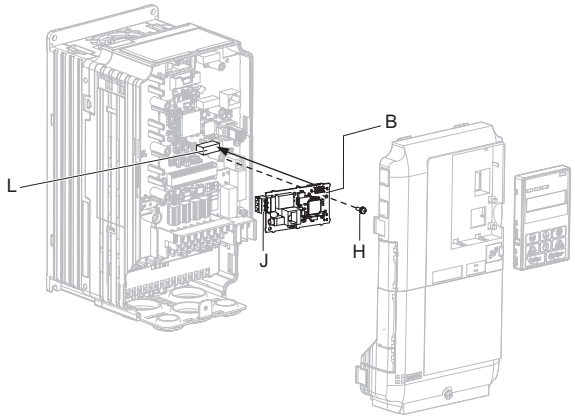


Figure 6 Insert the Option

4. Connect one end of the ground wire (I) to the ground terminal (K) using one of the remaining provided screws (H). Connect the other end of the ground wire (I) to the remaining ground terminal and installation hole on the option (B) using the last remaining provided screw (H). Tighten both screws to 0.5 to 0.6 N·m (4.4 to 5.3 in. lbs).

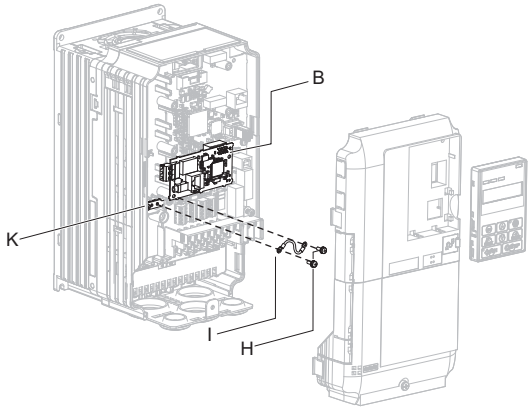
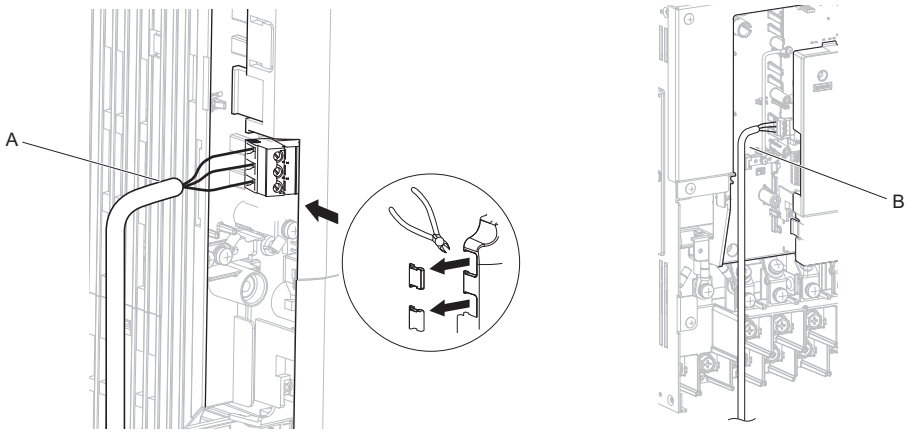


Figure 7 Connect the Ground Wire

Note: The drive has only two ground terminal screw holes (I). Two ground wires should share the same ground terminal when connecting three options.

5. Route the option wiring inside the enclosure as shown in ***Figure 8***-B. Take proper precautions so that the front cover will easily fit back onto the drive.
   Users may also choose to route the option wiring through openings on the front cover of some models. Remove the perforated tabs on the left side of the front cover as shown in ***Figure 8***-A to create the necessary openings on these models.
   Refer to the Peripheral Devices & Options section of the drive instruction manual for more information.

Note: Separate communication cables from main circuit wiring and other electrical lines to avoid potential sources of electrical interference.



A – Route wires through the openings provided on the left side of the front cover. *<1>*

B – Use the open space provided inside the drive to route option wiring.

<1> The drive will not meet Enclosed wall-mounted type (UL Type 1) requirements if wiring is exposed outside the enclosure.

Figure 8 Wire Routing Examples

6. Firmly connect the LonWorks communication cable to the option terminal block CN1.
   Install LonWorks communications cables apart from main-circuit wiring and other electrical and power lines. Ensure the cable end is firmly connected (see ***Figure 22***). Refer to ***Communication Cable Topology on page 25*** for details of installing.
7. Replace and secure the front covers of the drive (C, F) and replace the digital operator (D).

NOTICE: *Do not pinch cables between the front covers and the drive. Failure to comply could cause erroneous operation.*

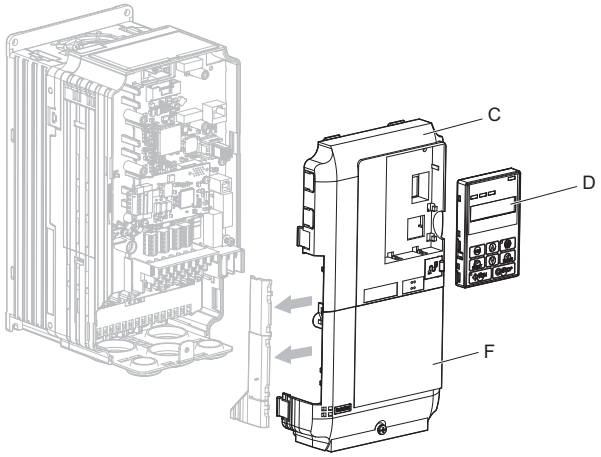


Figure 9 Replace the Front Covers and Digital Operator

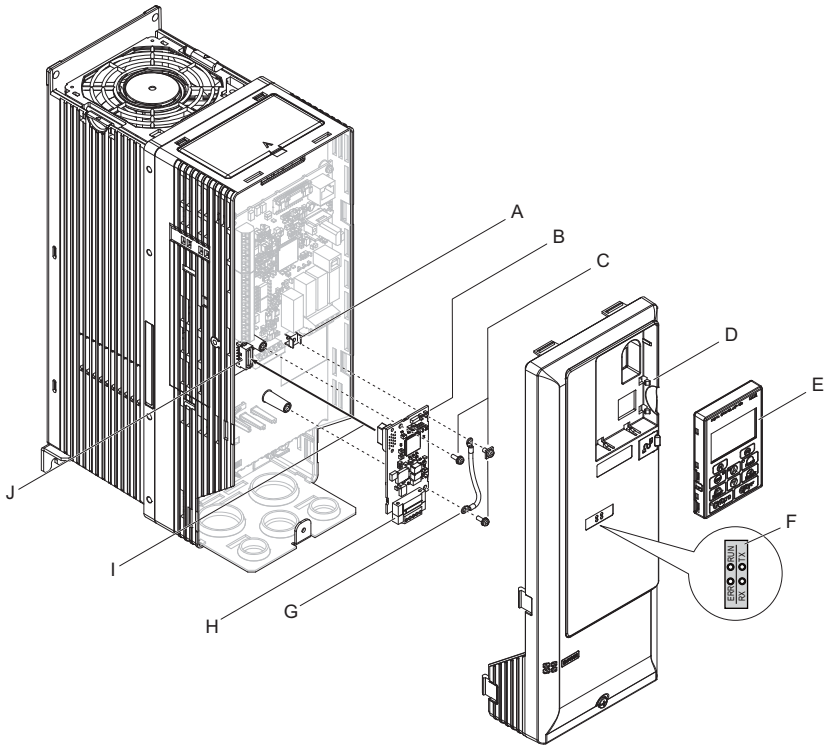
8. Set drive parameters in ***Table 4*** for proper option performance.

◆ Installing the Option on a Z1000 Drive

■ Prepare the Drive for the Option

Before beginning the installation procedure:

1. Wire the drive and make the proper connections to drive terminals according to the User Manual packaged with the drive.
2. Verify that the drive functions normally without the option installed.
   Refer to ***Figure 10*** for an exploded view of the drive with the option and related components for reference in the installation procedure.



A – Drive grounding terminal (FE)
B – SI-W3 option
C – Mounting screw
D – Drive front cover
E – HOA keypad
F – LED label
G – Ground wire
H – Terminal block CN1
I – Insert connector CN5 here
J – Connector CN5

Figure 10 Drive Components with Option

■ Install the Option

Remove the front covers of the drive before installing the option. Refer to the drive User Manual for directions on removing the front covers. Cover removal varies depending on drive size. This option can be inserted only into the **CN5-A** connector located on the drive control board.

DANGER! *Electrical Shock Hazard. Do not inspect, connect, or disconnect any wiring while the drive is energized. Failure to comply will cause death or serious injury. Before servicing, disconnect all power to the equipment and wait for at least the time specified on the warning label. The internal capacitor remains charged even after the drive is de-energized. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. When all indicators are OFF, measure for unsafe voltages to confirm the drive is safe.*

1. Shut off power to the drive, wait the appropriate amount of time for voltage to dissipate, then remove the HOA keypad (E) and front cover (D).

NOTICE: *Damage to Equipment. Observe proper electrostatic discharge (ESD) procedures when handling the option, drive, and circuit boards. Failure to comply could cause ESD damage to circuitry.*

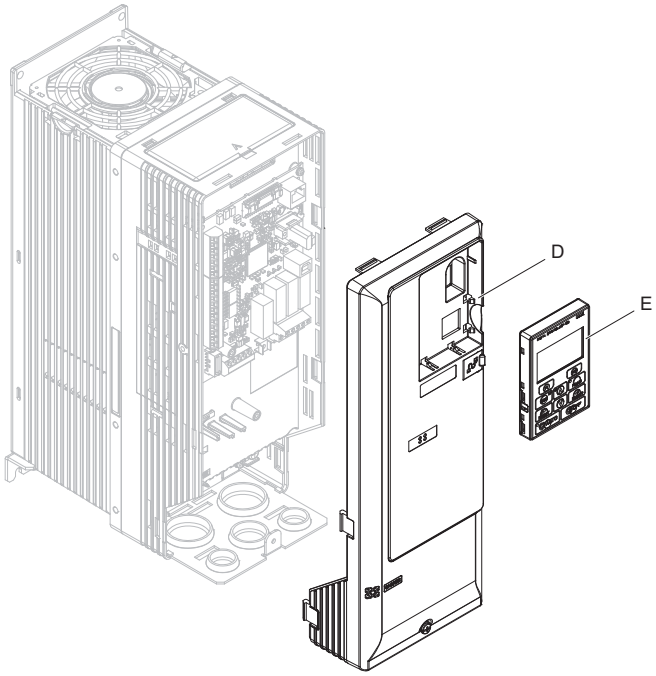


Figure 11 Remove the HOA Keypad and Front Cover

2. Affix the LED label (F) in the appropriate position on the drive front cover (D).

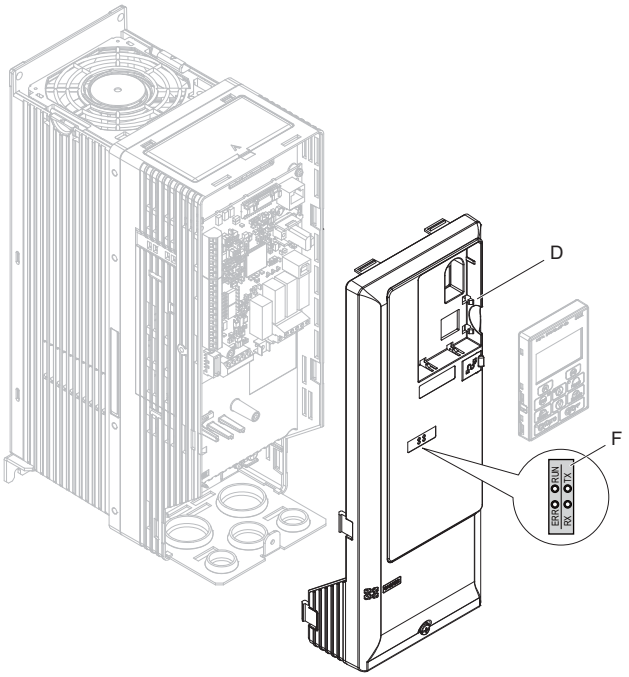


Figure 12 Affix the LED Label

3. Make sure the screws on the left and right sides of the option terminal block (H) are tightened with a tightening torque of 0.5 to 0.6 N·m (4.4 to 5.3 in lbs), then insert the option card (B) into the CN5-A (J) connector on the drive and fasten it into place using one of the included screws (C).

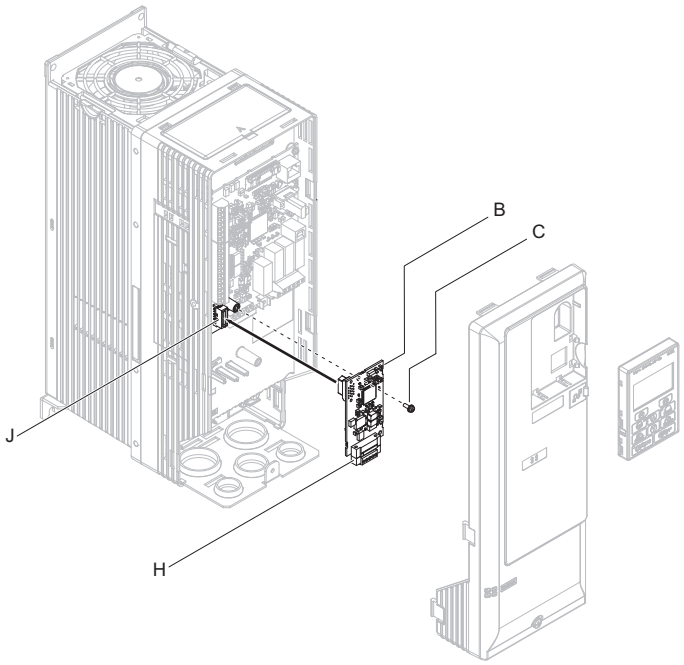


Figure 13 Insert the Option

4. Connect one end of the ground wire (G) to the ground terminal (A) using one of the remaining provided screws (C). Connect the other end of the ground wire (G) to the remaining ground terminal and installation hole on the option using the last remaining provided screw (C). Tighten both screws to 0.5 to 0.6 N·m (4.4 to 5.3 in. lbs).

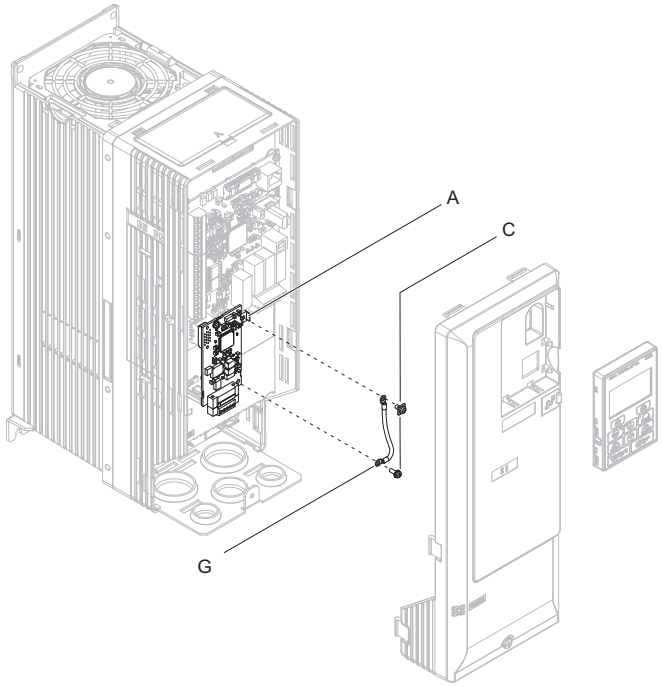


Figure 14 Connect the Ground Wire

Note: The drive has only two ground terminal screw holes (G). Two ground wires should share the same ground terminal when connecting three options.

5. Firmly connect the LonWorks communication cable to the option terminal block CN1.
Install LonWorks communications cables apart from main-circuit wiring and other electrical and power lines. Ensure the cable end is firmly connected (see ***Figure 22***). Refer to ***Communication Cable Topology on page 25*** for details of installing.

6. Replace and secure the front cover of the drive (D) and replace the HOA Keypad (E).

NOTICE: *Do not pinch cables between the front covers and the drive. Failure to comply could cause erroneous operation.*

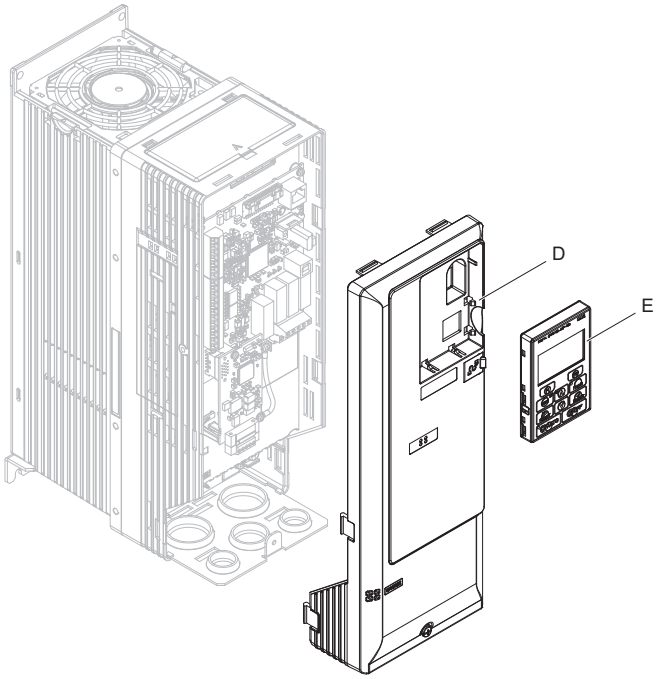


Figure 15 Replace the Front Cover and HOA Keypad

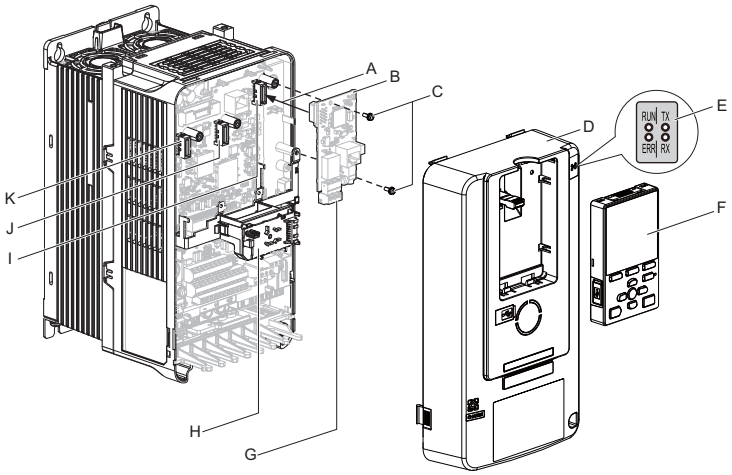
7. Set drive parameters in ***Table 4*** for proper option performance.

◆ Installing the Option on GA700 and GA800 Drives

■ Prepare the Drive for the Option

Before beginning the installation procedure:

1. Wire the drive and make the proper connections to drive terminals according to the manual packaged with the drive.
2. Verify that the drive functions normally.
   Refer to ***Figure 16*** for an exploded view of the drive with the option and related components for reference in the installation procedure.



A – Insertion point for CN5 connector
B – SI-W3 option
C – Included screws
D – Drive front cover
E – LED label
F – Keypad
G – Terminal block CN1
H – LED Status Ring board
I – Connector CN5-A
J – Connector CN5-B (Not available for communication option installation.)
K – Connector CN5-C (Not available for communication option installation.)

Figure 16 Drive Components with Option

■ Install the Option

DANGER! *Electrical Shock Hazard. Do not inspect, connect, or disconnect any wiring while the drive is energized. Failure to comply will cause death or serious injury. Before servicing, disconnect all power to the equipment and wait for at least the time specified on the warning label. The internal capacitor remains charged even after the drive is de-energized. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. When all indicators are OFF, measure for unsafe voltages to confirm the drive is safe.*

Remove the front cover of the drive before installing the option. Refer to the drive instruction manual for directions on removing the front cover. Cover removal varies depending on drive size. This option can be inserted only into the **CN5-A** connector located on the drive control board.

1. Affix the LED label (E) in the appropriate position on the drive front cover (D).

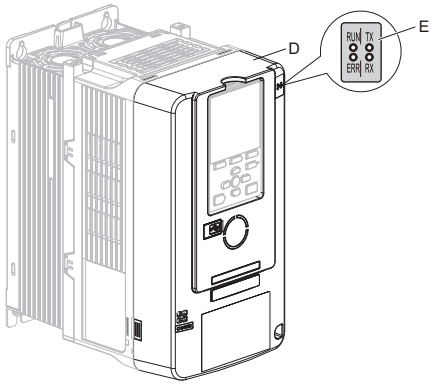


Figure 17 Affix the LED Label

2. Shut off power to the drive, wait the appropriate amount of time for voltage to dissipate, then remove the front cover (D).
Refer to the manual packaged with the drive for details on cover removal.

NOTICE: *Damage to Equipment. Observe proper electrostatic discharge (ESD) procedures when handling the option, drive, and circuit boards. Failure to comply could cause ESD damage to circuitry.*

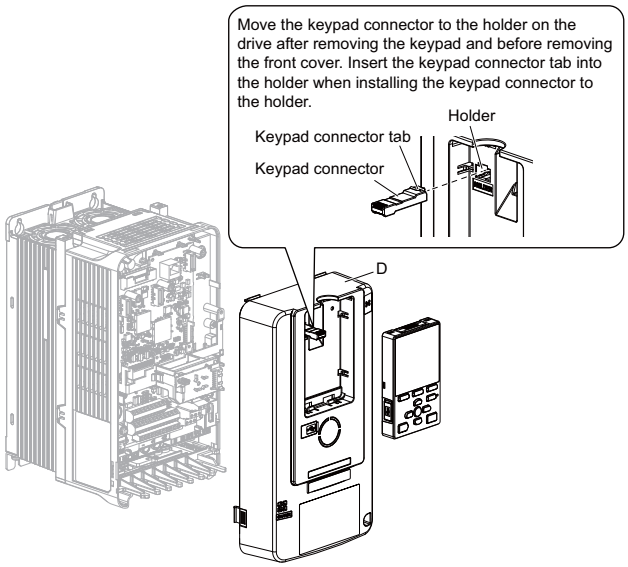


Figure 18 Remove the Front Cover and Keypad

3. Carefully remove the LED Status Ring board (H) and place it on the right side of the drive using the temporary placement holes.
Refer to the manual packaged with the drive for details on removing the LED Status Ring board.

NOTICE: *Do not remove the LED Status Ring board cable connector. Failure to comply could cause erroneous operation and damage the drive.*

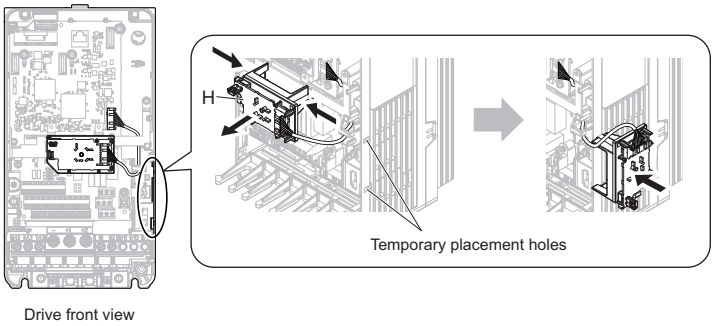


Figure 19 Remove the LED Status Ring Board

4. Insert the option card (B) into the CN5-A connector (I) on the drive and fasten it into place using the included screws (C). Tighten both screws to 0.5 to 0.6 N·m (4.4 to 5.3 in. lbs).

Note: Installing the option card on GA700 and GA800 drives requires only two screws and does not require a ground wire. The option package ships with three screws and a ground wire for installation on other product series.

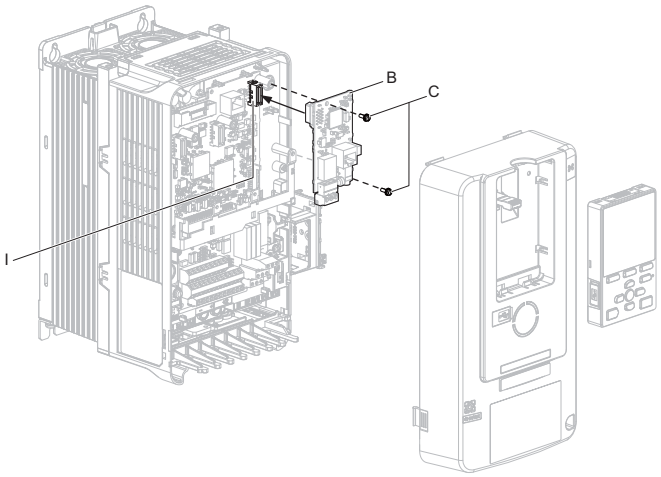


Figure 20 Insert the Option Card

5. Firmly connect the LonWorks communication cable to the option terminal block CN1.
Install LonWorks communications cables apart from main-circuit wiring and other electrical and power lines. Ensure the cable end is firmly connected (see ***Figure 22***).Refer to ***Communication Cable Topology on page 25*** for details of installing.

6. Replace and secure the LED Status Ring board (H).
Use the open space provided inside the LED Status Ring board to route option wiring.

NOTICE: *Do not pinch cables between the front cover or the LED Status Ring board and the drive. Failure to comply could cause erroneous operation.*

7. Replace and secure the front cover of the drive (D) including the keypad (F).

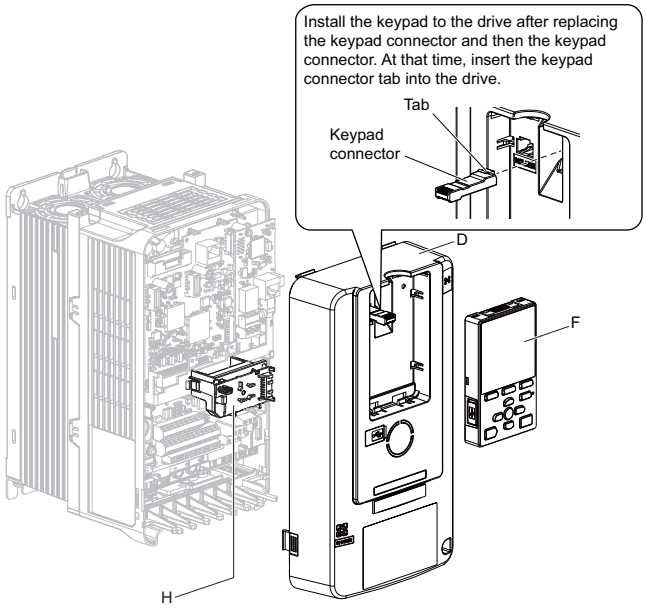


Figure 21 Replace the Front Cover and Keypad

8. Set drive parameters in ***Table 4*** for proper option performance.

◆ Option Connection Diagram

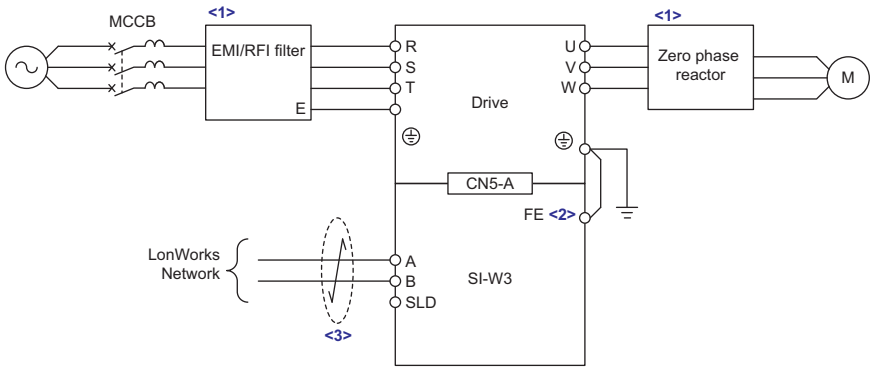


Figure 22 Option Connection Diagram

<1> Electrical interference occurs in the communication signals, install an EMI/RFI filter to the input lines and a zero-phase reactor to the output lines. Refer to ***Electrical Interference Countermeasures on page 24*** for more information.

<2> Connect the provided ground wire during installation on 1000-series drives. Installation on GA700 or GA800 drives does not require the ground wire.

<3> Do not connect the shield line directly to the SLD terminal or the drive ground terminal. Failure to comply may cause electrical interference.

◆ Electrical Interference Countermeasures

To reduce electrical interference from the drive, be sure to install an EMI/RFI filter and zero-phase reactor to the I/O lines.

Failing to take the necessary precautions may cause electrical interference resulting in poor system performance.

Refer to the appropriate drive catalog for information on selecting the appropriate EMI/RFI filter for the input line and zero-phase reactor for the output line.

Filter Install Location	Filter Type	Series/Part Number
Main circuit (input)	EMI/RFI Filter	LNFD series
Main circuit (output to motor)	Zero Phase Reactor	F6054GB, F11080GB, F200160PB

◆ Communication Cable Topology

Route the option wiring according to the following procedures.

1. Prepare the communication cables as shown in ***Figure 23***.

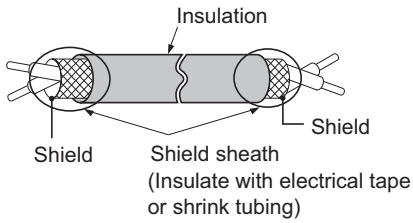


Figure 23 Prepare Ends of Shielded Cable

2. Connect the communication cables to the terminal block as shown in ***Figure 24***. Make sure the screws on the left and right sides of the plug are tightened with a tightening torque of 0.22 to 0.25 (N·m) or 4.4 to 5.3 (inch-lbs).

3. Take particular caution to ensure that each wire is properly connected and wire insulation is not accidentally pinched into electrical terminals. Trim any frayed wires.

WARNING! *Fire Hazard. Tighten all terminal screws to the specified tightening torque. Loose or overtightened connections could cause erroneous operation and damage to the terminal block or start a fire and cause death or serious injury.*

NOTICE: *Heat shrink tubing or electrical tape may be required to ensure that cable shielding does not come into contact with other wiring. Insufficient insulation may cause a short circuit that can damage the option or the drive.*

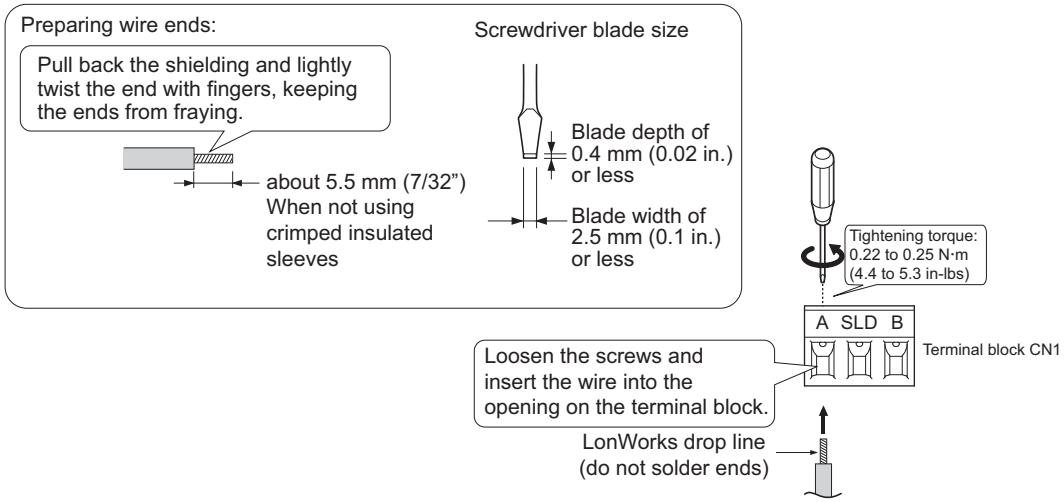


Figure 24 Prepare and Connect Communication Cable Wiring

◆ Termination Resistor Connection

A free topology segment must be terminated. The segment can be terminated anywhere.

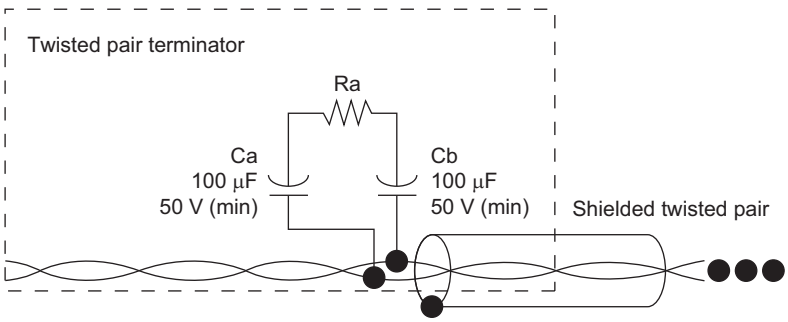


Figure 25 RC Network (Ra = 52.3 Ω ±1%, 1/8W)

◆ XIF Files, Resource Files

XIF files and the resource files for this option card can be obtained from:

USA: www.yaskawa.com
Japan: http://www.e-mechatronics.com
Other areas: Contact Yaskawa's sales department directly or your nearest Yaskawa representative

6 Related Drive Parameters

The parameters in ***Table 4*** set the drive for operation with the option. Confirm proper setting of all parameters in ***Table 4*** before starting network communications. Refer to the Quick Start Guide or Technical Manual packaged with the drive for details on setting parameters.

Table 4 Related Parameters Settings

No. (Addr. Hex)	Name	Description	Values
b1-01 (180)	Reference 1 Source	Selects the input method for frequency reference. 0: Digital operator 1: Analog Input 2: Memobus/Modbus Communications 3: Option PCB 4: Pulse Train Input	Default: 1 Range: 0 to 4 (Set to 3 for LonWorks only)
b1-02 (181)	Run Command 1 Source	Selects the input method for the Run command. 0: Digital operator 1: Digital Input 2: Memobus/Modbus Communications 3: Option PCB	Default: 1 Range: 0 to 3 (Set to 3 for LonWorks only)
F6-01 (3A2) <1>	Communication Error Selection	Selects drive response when a bUS error is detected during communications with the option. 0: Ramp to Stop 1: Coast to Stop 2: Fast Stop (Use C1-09) 3: Alarm Only <1> 4: Alarm - Run at d1-04 5: Alarm - Ramp to Stop	Default: 1 Range: 0 to 5 <2>
F6-02 (3A3)	Comm External Fault (EF0) Detect	Selects the condition for external fault detection (EF0). 0: Always detected 1: Detection during run only	Default: 0 Range: 0, 1
F6-03 (3A4)	Comm External Fault (EF0) Select	Selects drive response for external fault input (EF0) detection during option communications. 0: Ramp to Stop 1: Coast to Stop 2: Fast Stop (Use C1-09) 3: Alarm Only <1>	Default: 1 Range: 0 to 3
F6-06 (3A7) <3>	Torque Reference/Limit by Comm	Selects whether to enable or disable the torque reference and torque limit received from the communication option card. 0: Disabled 1: Enabled <4>	Default: 0 Range: 0, 1
F6-07 (3A8)	MultiStep Ref Priority Select	0: MultiStep References Disabled 1: MultiStep References Enabled	Default: 0 Range: 0, 1
F6-08 (36A)	Comm Parameter Reset @Initialize	Selects whether communication-related parameters F6-☐☐ and F7-☐☐ are set back to original default values when the drive is initialized using parameter A1-03. 0: No Reset - Parameters retained 1: Reset - Back to factory default Note: The setting value is not changed even when F6-08 is set to 1 and the drive is initialized using A1-03.	Default: 0 Range: 0, 1

<1> Setting this parameter to 3 will cause the drive to continue operation after detecting a fault. Take proper measures such as installing an emergency stop switch when using setting 3.
<2> Settings 4 and 5 are not available on 1000-Series drives.
<3> Control method availability of this parameter depends on product series.
• 1000-Series Drives: Parameter is available in CLV, AOLV/PM, and CLV/PM.
In AOLV/PM, this value is read as the Torque Limit.
• GA700, GA800 Drives: Parameter is available in CLV, AOLV, AOLV/PM, and CLV/PM.
<4> The setting specifies that network communications provide the torque reference or torque limit. The motor could rotate if the PLC does not supply a torque reference or torque limit.

7 Basic Operation

◆ Run Command and Frequency Reference Selection

Run commands and frequency references are provided to the drive via the digital operator, external terminals, or communications. Only one method is enabled at a given time. The enabled method is determined by drive parameter setting.

The default drive parameter settings are for run commands and frequency references to be provided by external terminals.

■ Selecting the Reference

Selecting by Drive Parameters

The Run command and frequency reference are selected by changing drive Parameters b1-01, Frequency Reference Selection 1, and b1-02, Run Command Selection 1, as shown below.

Parameter	Operator	External Terminals	MEMOBUS	LonWorks Communications
b1-01, Frequency Reference Selection 1	0	1 (Default)	2	3
b1-02, Run Command Selection 1	0	1 (Default)	2	3

Selecting from the Network (1)

The Run command and frequency reference are selected by setting the nciOpMode variable from to 3 (default: 0) regardless of drive parameter setting.

nciOpMode Set Value	0 (Default)	1	2	3
Frequency Reference	Determined by b1-01	LonWorks Communications	Determined by b1-01	LonWorks Communications
Run Command	Determined by b1-02	Determined by b1-02	LonWorks Communications	LonWorks Communications

Selecting from the Network (2)

The Run command and frequency reference are selected using the nviWriteParam and nviWriteParamVal variables to change b1-01 and b1-02.

To change the frequency reference from external terminals to communications:

1. Set 0180H (the b1-01 register number) for nviWriteParam.
2. Set 3 (reference Option PCB) for nviWriteParamVal.
3. If the setting is changed correctly, 3 (the data written in step 2 above) will be set.
4. If the setting cannot be changed correctly, an error code will be set in nvoErrCode.

Selecting from Control Circuit Terminals (S1 to S8)

The Run command and frequency reference selections are set using drive control circuit terminals S1 to S8:

1. Set b1-01, Frequency Reference Selection 1, to 0 (Digital operator) or 1 (Analog input terminals).
2. Set b1-02, Run Command Selection 1, to 0 (Digital operator) or 1 (Digital input terminals).
3. Set any of H1-01 to H1-05, Multi-function Digital Input Terminal S1 to S8 Function Selection, to 2 (External reference 1/2 selection).

Terminal Status	Frequency Reference and Run Command Selection
OFF	Drive Frequency reference and Run command are determined by b1-01 and b1-02.
ON	Option Card (SI-W3) Frequency reference and Run command from the network are enabled.

8 Network Variables

◆ Drive and Network Variables

Figure 26 outlines the relationship between drive and network variables.

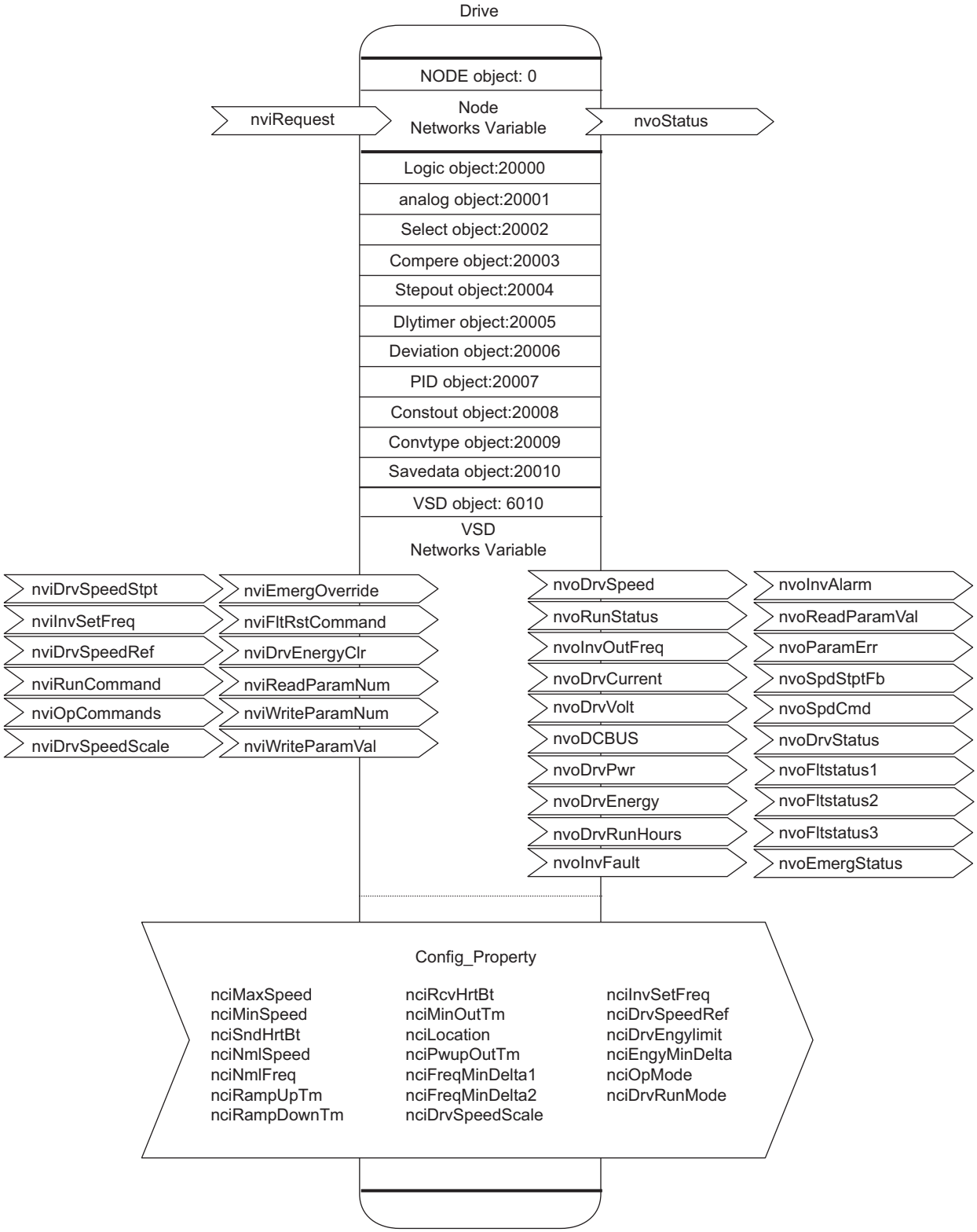


Figure 26 Drive and Network Variables

◆ Node Objects

■ Object Requests

Iput: FSNVT_obj_request nviRequest

Requests the status for each object in a node.

Member Name	Description	
object_id	Object ID number	
	0	Entire node
	1	VSD
	2	logic [0]
	3	logic [1]
	4	logic [2]
	5	logic [3]
	6	logic [4]
	7	logic [5]
	8	logic [6]
	9	logic [7]
	10	Analog [0]
	11	Analog [1]
	12	Analog [2]
	13	Analog [3]
	14	Analog [4]
	15	Analog [5]
	16	Analog [6]
	17	Analog [7]
	18	Analog [8]
	19	Analog [9]
	20	Select [0]
	21	Select [1]
	22	Select [2]
	23	Select [3]
	24	Select [4]
	25	Select [5]
	26	Select [6]
	27	Select [7]
	28	Compare [0]
	29	Compare [1]
	30	Compare [2]
	31	Compare [3]
	32	Compare [4]
	33	Compare [5]

Member Name	Description		
object_id	34	Compare [6]	
	35	Compare [7]	
	36	Stepout [0]	
	37	Dlytimer [0]	
	38	Dlytimer [1]	
	39	Deviation [0]	
	40	Pidmodule [0]	
	41	Pidmodule [1]	
	42	Pidmodule [2]	
	43	Pidmodule [3]	
	44	Constout [0]	
	45	Constout [1]	
	46	Constout [2]	
	47	Constout [3]	
	48	Constout [4]	
	49	Constout [5]	
	50	Convtype [0]	
	51	Convtype [1]	
	52	Convtype [2]	
	53	Convtype [3]	
	54	Savedata [0]	
	55	Savedata [1]	
	56	Savedata [2]	
	57	Savedata [3]	
	Other	invalid_id	
object_request	0	RQ_NORMAL	Enables the object.
	1	RQ_DISABLED	Disable the object
	2	RQ_UPDATE_STATUS	Not supported. (Normal response)
	3	RQ_SELF_TEST	Not supported. (Normal response)
	4	RQ_UPDATE_ALARM	Not supported. (Normal response)
	5	RQ_REPORT_MASK	Not supported. (Returns message: invalid_request.)
	6	RQ_OVERRIDE	Not supported. (Returns message: invalid_request.)
	7	RQ_ENABLE	Enables the object.
	8	RQ_RMV_OVERRIDE	Not supported. (Returns message: invalid_request.)
	9	RQ_CLEAR_STATUS	Not supported. (Returns message: invalid_request.)
	10	RQ_CLEAR_ALARM	Not supported. (Returns message: invalid_request.)
	11	RQ_ALARM_NOTIFY_ENABLED	Not supported. (Returns message: invalid_request.)
	12	RQ_ALARM_NOTIFY_DISABLED	Not supported. (Returns message: invalid_request.)
	13	RQ_MANUAL_CTRL	Not supported. (Returns message: invalid_request.)
	14	RQ_REMOTE_CTRL	Not supported. (Returns message: invalid_request.)
	15	RQ_PROGRAM	Not supported. (Returns message: invalid_request.)
	0xff	RQ_NUL	Not supported. (Returns message: invalid_request.)

■ Object Status

Output: FSNVT_obj_status nvoStatus

Displays the status of objects in a node.

Member Name		Description
object_id		Object ID (refer to the object request)
bit 31	invalid_id	Turns ON if the object_id specified by nviRequest is invalid.
bit 30	invalid_request	Turns ON if the object_request specified by nviRequest is invalid.
bit 29	disabled	Indicates whether or not a given object is enabled for operation. Turns ON when an object is disabled.
bit 28	out_of_limits	Not supported. (Always 0)
bit 27	open_circuit	Not supported. (Always 0)
bit 26	out_of_service	Not supported. (Always 0)
bit 25	mechanical_fault	Not supported. (Always 0)
bit 24	feedback_failure	Not supported. (Always 0)
bit 23	over_range	Not supported. (Always 0)
bit 22	under_range	Not supported. (Always 0)
bit 21	electrical_fault	Not supported. (Always 0)
bit 20	unable_to_measure	Not supported. (Always 0)
bit 19	comm_failure	Not supported. (Always 0)
bit 18	fail_self_test	Not supported. (Always 0)
bit 17	self_test_in_progress	Not supported. (Always 0)
bit 16	locked_out	Not supported. (Always 0)
bit 15	manual_control	Not supported. (Always 0)
bit 14	in_alarm	Not supported. (Always 0)
bit 13	in_override	Not supported. (Always 0)
bit 12	report_mask	Not supported. (Always 0)
bit 11	programming_mode	Not supported. (Always 0)
bit 10	programming_fail	Not supported. (Always 0)
bit 9	alarm_notify_disabled	Not supported. (Always 0)
bit 8 to 0	reserved	Always 0

◆ VSD Input Network Variables

Name	Variable Type	Description
nviDrvSpeedStpt	SNVT_switch	Drive Speed Setpoint
nviInvSetFreq	SNVT_freq_hz	Drive Frequency Reference (Hz)
nviDrvSpeedRef	SNVT_lev_percent	Drive Speed SetFreq (%)
nviRunCommand	SNVT_switch	Drive Run Reference
nviOpCommands	SNVT_state	Drive Operation Commands
nviDrvSpeedScale	SNVT_lev_percent	Drive Speed Setpoint Scaling
nviEmergOverride	SNVT_hvac_emerg	Drive Emergency
nviFltRstCommand	SNVT_switch	Drive Speed Setpoint Scaling
nviDrvEnergyClr	SNVT_switch	Drive Speed Setpoint Scaling
nviReadParamNum	SNVT_count	Drive Parameter Read
nviWriteParamNum	SNVT_count	Drive Parameter Write
nviWriteParamVal	SNVT_count_inc	Drive Parameter Write Data

■ Drive Speed Setpoint (Drive Speed Operation Command)

Input	SNVT_switch nviDrvSpeedStpt
Default	state = FF; value = 0 Frequency reference = nviDrvSpeedStpt (%) × nviDrvSpeedScale (%) × nciNmlFreq (Hz) **Note:** When setting values greater than the maximum output frequency and less than 400 Hz, operation is executed at the maximum output frequency. Values greater than 400 Hz are not set in the drive.
Related network variables, configuration properties	nciRcvHrtBt

This network variable sets drive Run/Stop commands and frequency references.

State	Value	Command
0	NA	Drive stop
1	0.0	Zero-speed operation
1	1 to 200	0.5 to 100.0%
1	201 to 255	100.0%
FF (-1)	NA	Disable

After the power is turned ON, “CALL” is displayed on the digital operator until data is received.

Also, when a receive heartbeat time is set, a communications error is generated and “bUS” is displayed on the digital operator if no data is received within that time period.

■ Drive Frequency Reference (Hz) (Drive Frequency Reference)

Input	SNVT_freq_hz nviInvSetFreq
Setting range	0.0 to 6,553.5 Hz (Effective range: 0.0 to 400.0 Hz)
Default	nciInvSetFreq set value Frequency reference values are restricted by the maximum output frequency and the upper limit frequency that have been set for the drive. Frequency reference = nviInvSetFreq (Hz)
Related network variables, configuration properties	nciRcvHrtBt, nciInvSetFreq

This network variable sets drive frequency reference values in Hz.

Note: When setting values greater than the maximum output frequency and less than 400 Hz, operation is executed at the maximum output frequency. Values greater than 400 Hz are not set in the drive.

After the power is turned ON, “CALL” is displayed on the operator until data is received.

When a receive heartbeat time is set, if no data is received within that time period, a communications error is generated and “bUS” is displayed on the operator.

■ Drive Speed SetFreq (%) (Drive Speed Reference)

Input	SNVT_lev_percent nviDrvSpeedRef
Setting range	-163.840 to 163.835% (Effective range: 0.0 to frequency conversion value 400.0 Hz)
Default	nciDrvspeedRef set value
Related network variables, configuration properties	nciRcvHrtBt

This network variable sets drive speed reference values in percentages.

Note: When setting values greater than the maximum output frequency and less than 400 Hz, operation is executed at the maximum output frequency. Values greater than 400 Hz are not set in the drive.

After the power is turned ON, “CALL” is displayed on the operator until data is received.

When a receive heartbeat time is set, if no data is received within that time period, a communications error is generated and “bUS” is displayed on the operator.

Speed reference value = nviDrvSpeedRef (%) × nviDrvSpeedScale (%) × nciNmlFreq (Hz)

■ Drive Run Reference (Drive Run Reference)

Input	SNVT_switch nviRunCommand
Default	state = FF; value = 0
Related network variables, configuration properties	nciRcvHrtBt

This network variable sets drive Run and Stop commands.

State	Value	Command
0	NA	Drive stop
1	NA	Drive run
FF (Default)	NA	Drive stop

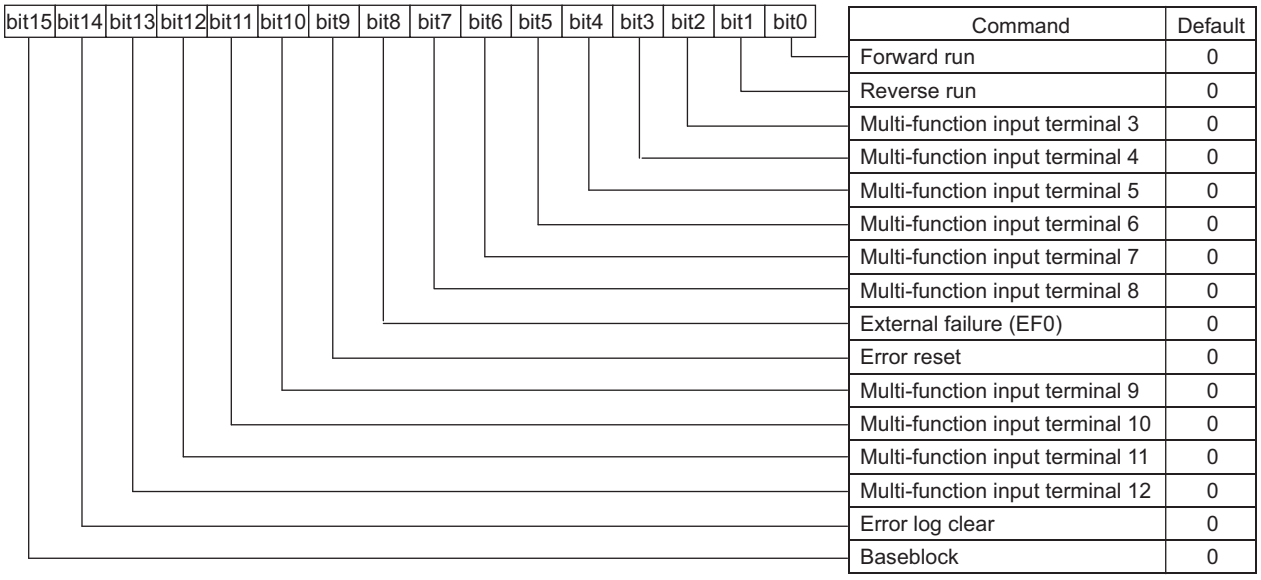
After the power is turned ON, “CALL” is displayed on the operator until data is received.

When a receive heartbeat time is set, if no data is received within that time period, a communications error is generated and “bUS” is displayed on the operator.

■ Drive Operation Commands (Drive Control Commands)

Input	SNVT_state nviOpCommands
Default	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

These network variables control operations such as running and stopping the drive.



Command	Default
Forward run	0
Reverse run	0
Multi-function input terminal 3	0
Multi-function input terminal 4	0
Multi-function input terminal 5	0
Multi-function input terminal 6	0
Multi-function input terminal 7	0
Multi-function input terminal 8	0
External failure (EF0)	0
Error reset	0
Multi-function input terminal 9	0
Multi-function input terminal 10	0
Multi-function input terminal 11	0
Multi-function input terminal 12	0
Error log clear	0
Baseblock	0

There is a logical OR relationship between commands using these variables and other Run command-related network variables and multi-function control terminals.

■ Drive Speed Setpoint Scaling (Drive Speed Scaling)

Input	SNVT_lev_percent nviDrvSpeedScale
Setting range	-163.840% to 163.830% (0.005%). 163.835% is taken as 100%.
Default	nciDrvSpeedScale set value
Related network variables, configuration properties	nciRcvHrtBt

This network variable adjusts the motor rotation direction and speed.

Frequency reference = nviDrvSpeedStpt (or nviDrvspeedfref) × nviDrvSpeedScale × nciNmlfreq

■ Drive Emergency (Drive Emergency Stop)

Input	SNVT_hvac_emerg nviEmergOverride
Setting range	0: Emergency stop clear 4: Emergency stop FF: Disabled
Default	FF

This network variable executes drive emergency stops from the network. When an emergency stop is executed, “EF0” is displayed at the drive.

■ Drive Fault Reset Command (Drive Error Reset)

Input	SNVT_switch nviFltRstCommand
Data range	value ••• NA, state •••-1,0,1
Default	value ••• 0, state ••• - Errors are cleared in state1, and not in 0 or -1.

This network variable performs a reset from the network when a drive error occurs.

■ Drive Energy Clear (Cumulative Power Value Clear)

Input	SNVT_switch nviDrvEnergyClr
Data range	value ••• NA, state ••• -1 (FFH),0,1
Default	value ••• 0, state ••• -1 (FFH) Accumulated power values are cleared in state1, and not in 0 or -1 (FFH).
Related network variables, configuration properties	nvoDrvEnergy, nciDrvEngylimit, nciEngyMinDelta

This network variable clears accumulated power values.

■ Drive Parameter Read (Drive Constant Read Request)

Input	SNVT_count nviReadParamNum
Data range	0000 to FFFFH
Default	0 For register numbers, refer to the Drive instruction manual.
Related network variables, configuration properties	nviWriteParamNum, nvoReadParamVal, nvoParamErr

This network variable is used to read drive constants. Set the register number of the constant that is to be read. After the drive receives the data, it sets the data for that register number in nvoReadParamVal to be output.

■ Drive Parameter Write (Drive Constant Write Request)

Input	SNVT_count nviWriteParamNum
Data range	0000 to FFFFH
Default	0
Related network variables, configuration properties	nviReadParamNum, nvoWriteParamVal, nvoParamErr

This network variable writes drive constants. Set the register number of the constant that is to be written. Then set the changed data in nviWriteParamVal. After the drive receives the data, it sets the data for that register number in nvoReadParamVal to be output.

Note: If no data is set in nviWriteParamVal within 30 seconds after this network variable has been set, an error code is stored in nvoParamErr and the data set in nviWriteParamNum is changed to 0.

■ Drive Parameter Write Data (Drive Constant Write Data)

Input	SNVT_count_inc nviWriteParamVal
Data range	-32,768 to 32,767
Default	0
Related network variables, configuration properties	nviReadParamNum, nvoWriteParamNum, nvoParamErr

This network variable writes drive constants. Set the constant data that is to be changed. After the drive receives the new constant data, it makes the change and then sets the changed constant data in nvoReadParamVal to be output.

Run Command and Frequency Reference Combinations and Priority

The drive provides multiple network variables for Run commands and frequency references, but they can only be used one at a time. This section describes various combinations of network variables and their orders of priority.

- Network Variable Combinations for Run Commands and Frequency References

–	Combination 1	Combination 2	Combination 3
Frequency (speed) reference	nviInvSetFreq	nviDrvSpeedStpt (value)	nviDrvSpeedFref
Run command	nviRunCommand	nviDrvSpeedStpt (state)	nviRunCommand

- Order of priority
  Combination 1 > Combination 2 > Combination 3 (Default: All disabled)
- Precautions when Making the Settings
  - Combination 1
    Set the network variables as follows:
    nviDrvSpeedStpt (state) = FF
    nviDrvSpeedRef = 7FFF
    Do not execute binding for these network variables.
  - Combination 2
    Set the network variables as follows:
    nviInvSetFreq = 7FFF (default)
    nviDrvSpeedRef = 7FFF (default)
    nviRunCommand (state) = FF (default)
    Do not execute binding for these network variables.
  - Combination 3
    Set the network variables as follows:
    nviDrvSpeedStpt (state) = FF
    nviInvSetFreq = 7FFF
    Do not execute binding for these network variables.

◆ VSD Output Network Variables

Name	Variable Type	Description
nvoDrvSpeed	SNVT_lev_percent	Drive Speed Feedback (%)
nvoRunStatus	SNVT_switch	Drive Run Status
nvoInvOutFreq	SNVT_freq_hz	Drive Output Frequency
nvoDrvCurrent	SNVT_amp	Drive Output Current
nvoDrvVolt	SNVT_volt	Drive Output Voltage
nvoDCBUS	SNVT_volt	Drive DC Voltage
nvoDrvPwr	SNVT_power_kilo	Drive Output Power
nvoDrvEnergy	SNVT_elec_kwh_l	Cumulative Drive Energy
nvoDrvRunHours	SNVT_time_hour	Drive Total Running Hours
nvoInvFault	SNVT_switch	Drive Fault Status
nvoInvAlarm	SNVT_switch	Drive Alarm Status
nvoReadParamVal	SNVT_count_inc	Drive Parameter Read Data
nvoParamErr	SNVT_count	Drive Parameter Error
nvoSpdStptFb	SNVT_lev_percent	Drive Speed Setpoint Feedback1
nvoSpdCmd	SNVT_lev_percent	Drive Speed Setpoint Feedback2
nvoDrvStatus	SNVT_state	Drive Status
nvoFltstatus1	SNVT_state	Drive Fault Status1
nvoFltstatus2	SNVT_state	Drive Fault Status2
nvoFltstatus3	SNVT_state	Drive Fault Status3
nvoEmergStatus	SNVT_hvac_emerg	Drive Emerg Status

■ Drive Speed Feedback (%) (Drive Speed Monitoring)

Output	SNVT_lev_percent nvoDrvSpeed
Data range	-163.840% to 163.830% (0.005%)
Service type	Default: Authentication type

This network variable outputs the drive's output frequency as a percentage of the standard motor frequency.

Output Timing	Explanation
Event driven	Sent to network when data is changed.
nciSndHrtBt	When a send heartbeat time is set, the data is output within that time period.
nciMinOutTm	When a minimum output refresh time has been set, data that is changed during the specified time period is not output until that time period has elapsed.
nciFreqMinDelta	Output when the frequency is outside of the recently changed frequency range.

■ Drive Run Status (Drive Run Monitoring)

Output	SNVT_switch nvoRunStatus
Data range	State = 0
Service type	Default: Authentication type
Output timing	Event driven, nciSndHrtBt

This network variable monitors drive Run and Stop status.

State	Value	Command
0	NA	Drive stopped
1	NA	Drive running
FF (Default)	NA	None

Output Timing	Explanation
Event driven	Sent to network when data is changed.
nciSndHrtBt	When a send heartbeat time is set, the data is output within that time period.

■ Drive Output Frequency (Drive Output Frequency Monitoring)

Output	SNVT_freq_hz nvoInvOutFreq
Data range	0 to 6553.4Hz (0.1Hz)
Service type	Default: Authentication type

This network variable outputs drive output frequency.

Output Timing	Explanation
Event driven	Sent to network when data is changed.
nciSndHrtBt	When a send heartbeat time is set, the data is output within that time period.
nciMinOutTm	When a minimum output refresh time has been set, data that is changed during the specified time period is not output until that time period has elapsed.
nciFrefMinDelta2	Output when the frequency is outside of the recently changed frequency range.

■ Drive Output Current (Output Current Monitoring)

Output	SNVT_amp nvoDrvCurrent
Data range	0 to 3,276.6 A
Service type	Default: Authentication type

This network variable outputs drive output current.

Output Timing	Explanation
Event driven	Sent to network when data is changed.
nciSndHrtBt	When a send heartbeat time is set, the data is output within that time period.
nciMinOutTm	When a minimum output refresh time has been set, data that is changed during the specified time period is not output until that time period has elapsed.

■ Drive Output Voltage (Output Voltage Monitoring)

Output	SNVT_volt nvoDrvVolt
Data range	0 to 3276.7 V (Unit: 0.1 V)
Service type	Default: Authentication type

This network variable outputs drive output voltage.

Output Timing	Explanation
Event driven	Sent to network when data is changed.
nciSndHrtBt	When a send heartbeat time is set, the data is output within that time period.
nciMinOutTm	When a minimum output refresh time has been set, data that is changed during the specified time period is not output until that time period has elapsed.

■ Drive DC Voltage (DC Bus Voltage Monitoring)

Output	SNVT_volt nvoDCBus
Data range	0 to 3276.7 V (Unit: 0.1 V)
Service type	Default: Authentication type

This network variable outputs DC bus voltage.

Output Timing	Explanation
Event driven	Sent to network when data is changed.
nciSndHrtBt	When a send heartbeat time is set, the data is output within that time period.
nciMinOutTm	When a minimum output refresh time has been set, data that is changed during the specified time period is not output until that time period has elapsed.

■ Drive Output Power (Output Power Monitoring)

Output	network output SNVT_power_kilo nvoDrvPwr
Data range	0 to 6,553.4 kW (Unit: 0.1 kW)
Service type	Default: Authentication type

This network variable outputs drive output power.

Output Timing	Explanation
Event driven	Sent to network when data is changed.
nciSndHrtBt	When a send heartbeat time is set, the data is output within that time period.
nciMinOutTm	When a minimum output refresh time has been set, data that is changed during the specified time period is not output until that time period has elapsed.

■ Cumulative Drive Energy (Cumulative Power Monitoring)

Output	SNVT_elec_kwh_l nvoDrvEnergy
Cumulative period	100 ms ± 10% (Varies slightly depending on the amount of data sent and received in the network.)
Data range	0 to 429,496,729.4 kwh (Unit: 0.1 kwh)
Service type	Default: Authentication type
Related network variables, configuration properties	nviDrvEnergyClr, nciDrvEngylimit, nciEngyMinDelta

This network variable outputs drive cumulative power.

Cumulative power value = Previous cumulative power value + [Present output power data × (Present output power value acquire time – Previous output power value acquire time)]

Output Timing	Explanation
Event driven	Sent to network when data is changed.
nciSndHrtBt	When a send heartbeat time is set, the data is output within that time period.
nciMinOutTm	When a minimum output refresh time has been set, data that is changed during the specified time period is not output until that time period has elapsed.
nciEngyMinDelta	Output when changed outside of fixed change range.

Note: Do not use this monitoring for accounting systems, etc. as it is used to calculate the charges for power.

■ Drive Total Running Hours (Total Running Hours Monitoring)

Output	SNVT_time_hour nvoDrvRunHours
Data range	0 to 65,534 hours (Unit: 1 hour) The data is invalid when set to FFFF = 65,535 hours.
Service type	Default: Authentication type

This network variable outputs the drive's accumulated running time.

Output Timing	Explanation
Event driven	Sent to the network when the data is changed by more than 1 hour.

■ Drive Fault Status (Drive Fault Monitoring)

Output	SNVT_switch nvoInvFault
Default	state = FF
Service type	Default: Authentication type

This network variable is used to monitor drive fault status.

State	Value	Command
0	NA	Drive normal (after fault cleared)
1	NA	Drive fault occurring
FF (Default)	NA	Drive normal (from turning ON power until fault occurs)

Output Timing	Explanation
Event driven	Sent when fault occurs and when fault is cleared.

◆ Drive Alarm Status (Drive Alarm Monitoring)

Output	SNVT_switch nvoInvAlarm
Default	state = FF
Service type	Default: Authentication type

This network variable monitors drive alarm status.

State	Value	Command
0	NA	Drive normal (after alarm cleared)
1	NA	Drive alarm occurring
FF (Default)	NA	Drive normal (from turning ON power until alarm occurs)

Output Timing	Explanation
Event driven	Sent when alarm occurs and when alarm is cleared.

■ Drive Parameter Read Data (Drive Constant Read Data)

Output	SNVT_count_inc nvoReadParamVal
Data range	-32,768 to 32,767
Default	0
Related network variables, configuration properties	nviReadParamNum, nviWriteParamNum, nviWriteParamVal

This network variable sets and outputs data for constant numbers requested by nviReadParamNum.

Output Timing	Explanation
Event driven	The constant data is sent after normal reception of nviReadParamNum.

■ Drive Parameter Error (Drive Constant Access Error)

Output	SNVT_count nvoParamErr
Related network variables, configuration properties	nviReadParamNum, nviWriteParamNum, nviWriteParamVal

This network variable sets an error code when inappropriate data is set for nviReadParamNum, nviWriteParamNum, or nviWriteParamVal, or when a drive constant access-related error occurs.

Table 5 Error Codes

Error Code	Explanation
0 (00H)	Normal
2 (02H)	Invalid register number • An attempt was made to access a non-existent register number.
33 (21H)	Data setting error • A simple upper limit or lower limit error has occurred in the control data or when writing constants. • When writing constants, the constant setting was invalid.
34 (22H)	Write mode error • An attempt was made to change a constant during operation. • An attempt was made to write read-only data.
35 (23H)	Writing during main circuit undervoltage (Uv) error • An attempt was made to change a constant during a Uv (main circuit undervoltage) alarm.
36 (24H)	An attempt was made to change a constant while it was being processed at the drive.
255 (FFH)	Command input time over • More than 30 seconds elapsed at the input interval for nvoWriteParamNum or nvoWriteParamVal.

Output Timing	Explanation
Event driven	Constant data is sent after normal reception of nviReadParamNum.

■ Drive Speed Setpoint Feedback 1 (Drive Speed Reference Monitor 1)

Output	SNVT_lev_percent nvoSpdStptFb
Default	0 to 163.830% (0.005%)
Service type	Default: Authentication type

This network variable sets and outputs speed reference values from the network.

Output Timing	Explanation
Event driven	Constant data is sent after normal reception of nviReadParamNum.

■ Drive Speed Setpoint Feedback 2 (Drive Speed Reference Monitor 2)

Output	SNVT_lev_percent nvoSpdCmd
Default	0 to 163.835% (0.005%)
Service type	Default: Authentication type

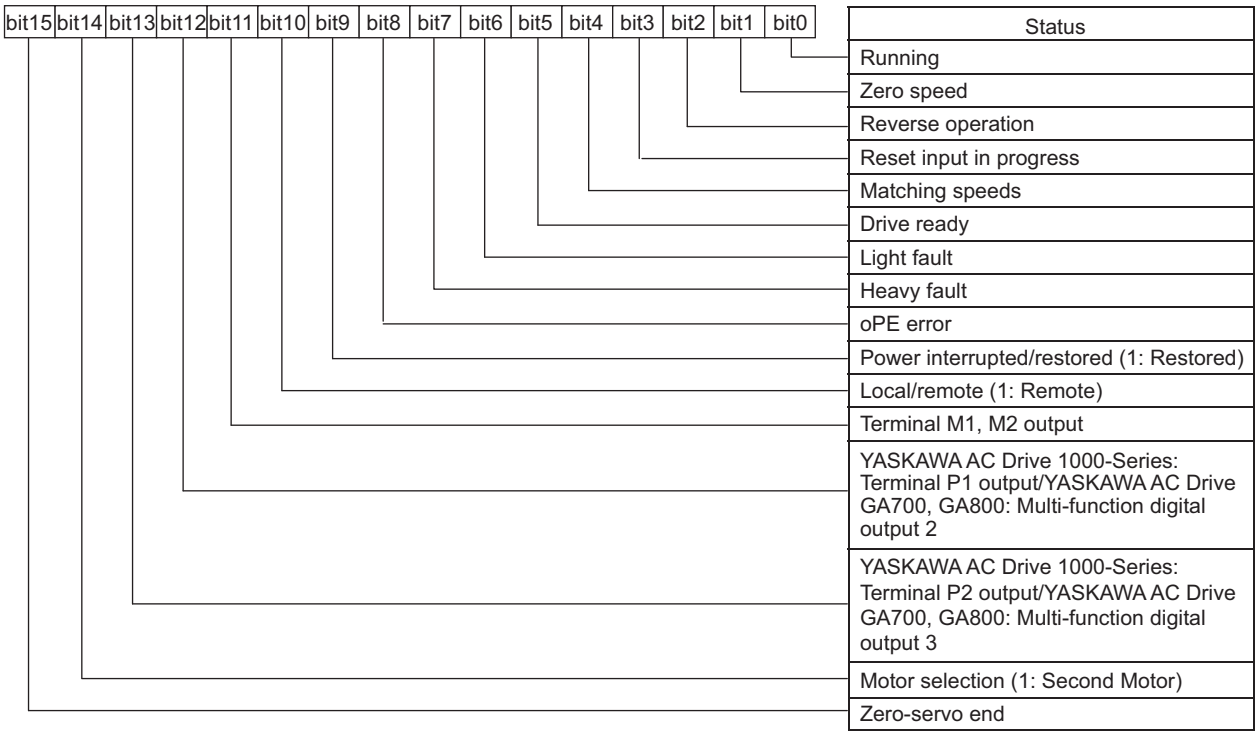
This network variable sets and outputs speed reference values that are set for the drive. It outputs reference values from the places that have frequency reference rights (i.e., external terminals, digital operator, or communications).

Output Timing	Explanation
Event driven	Constant data is sent after normal reception of nviReadParamNum.

■ Drive Status (Drive Status Monitoring)

Output	SNVT_state nvoDrvStatus
Service type	Default: Authentication type

This network variable outputs drive status.

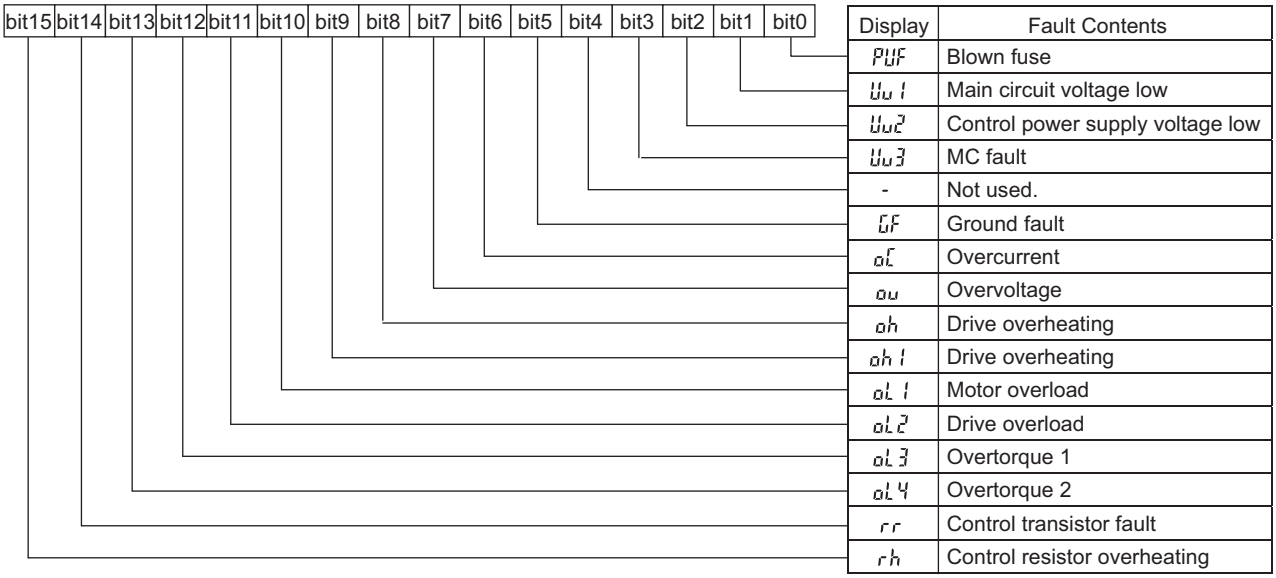


Output Timing	Explanation
Event driven	Sent when status is changed.

■ Drive Fault Status 1 (Drive Fault Status Monitor 1)

Output	SNVT_state nvoFltStatus1
Service type	Default: Authentication type

This network variable outputs drive fault status.

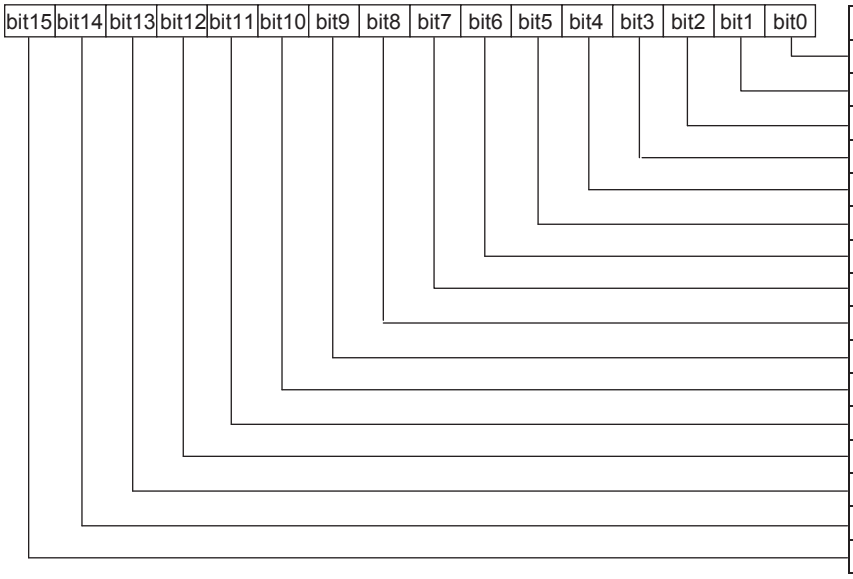


Output Timing	Explanation
Event driven	Sent when any of the above faults occur.

■ Drive Fault Status 2 (Drive Fault Status Monitor 2)

Output	SNVT_state nvoFltStatus2
Service type	Default: Authentication type

This network variable outputs drive fault status.



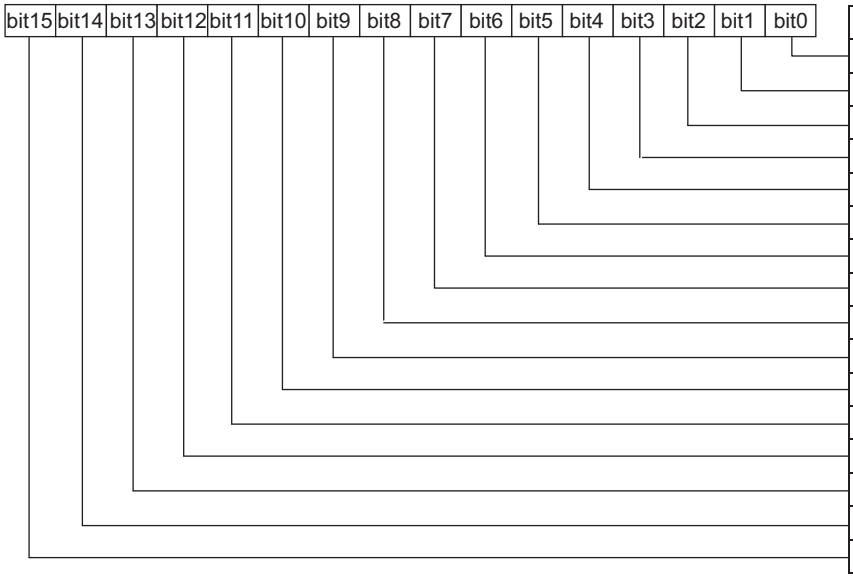
Display	Fault Contents
EF3	External fault 3
EF4	External fault 4
EF5	External fault 5
EF6	External fault 6
EF7	External fault 7
-	Not used.
-	Not used.
oS	Overspeed
dEv	Excessive speed deviation
PGo	PG disconnection
PF	Input phase failure
LF	Output phase failure
oh3	Motor overheating 1
oPr	Operator not connected
Err	EEPROM write failure
oh4	Motor overheating 2

Output Timing	Explanation
Event driven	Sent when any of the above faults occur.

■ Drive Fault Status 3 (Drive Fault Status Monitor 3)

Output	SNVT_state nvoFltStatus3
Service type	Default: Authentication type

This network variable outputs drive fault status.



Display	Fault Contents
cE	MEMOBUS transfer fault
bUS	LonWorks transfer fault
-	Not used.
-	Not used.
cF	Control fault
cuE	Zero-server fault
EF0	External fault
-	PID feedback loss
UL3	Undertorque detection 1
UL4	Undertorque detection 2
oL	Overload during HSB
-	Not used.
-	Not used.
-	Not used.
-	Not used.
cPF	Hardware fault

Output Timing	Explanation
Event driven	Sent when any of the above faults occur.

■ Drive Emerg Status (Drive Emergency Stop Status)

Output	SNVT_hvac_emerg nvoEmergStatus
Default	State = FF
Service type	Default: Authentication type

This network variable monitors drive Run and Stop status.

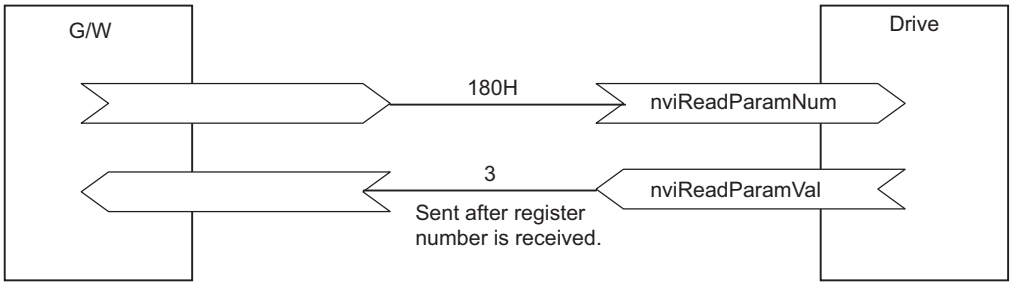
Data	Name	Explanation
0	EMERG_NORMAL	Normal
4	EMERG_SHUTDOWN	Emergency stop
FF (Default)	EMERG_NUL	–

Output Timing	Explanation
Event driven	Sent when any of the above heavy faults major faults occur.

◆ Setting Drive Constants from the Network

■ Reading Drive Constants

1. Set the register number of the drive constant that is to be read to nviReadParamNum in hexadecimal.
2. When the nviReadParamNum data is refreshed, the drive will set the data contents of the applicable drive constant in nvoReadParamVal for output.
3. If invalid data is set in nviReadParamNum due to, for example, a register number being specified for a non-existent drive constant, an error code will be set in nvoParamErr for output.
   Refer to ***Drive Parameter Error (Drive Constant Access Error) on page 40*** for details.
   Example: Reading the Setting for b1-01 (Reference Selection)
   Conditions:
   Frequency selection (b1-01): 180H
   b1-01 setting: 3 (Communications)



   Use the MEMOBUS register number listed on the drive instructions for the drive constant.

■ Writing Drive Constants

Note: Be sure to send data to nviWriteParamNum and nviWriteParamVal in the order described in steps 1 and 2 below. If the order is incorrect, the intended settings will not be made correctly.

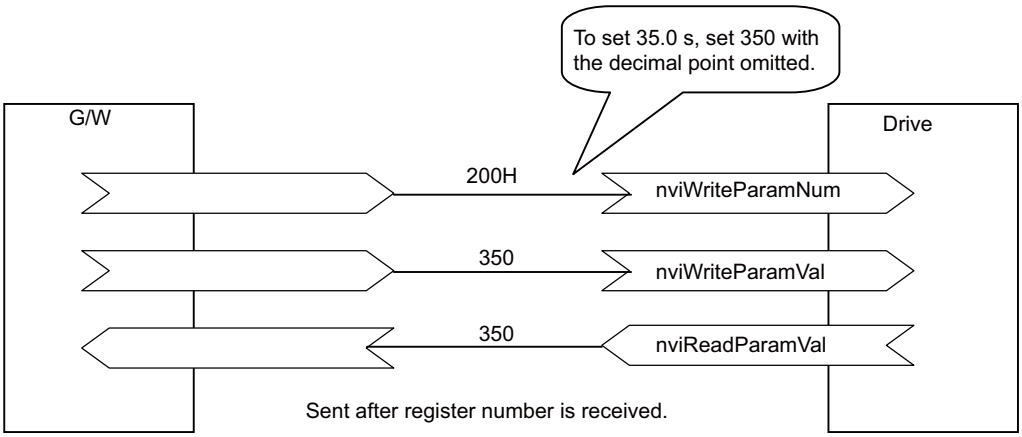
1. Set the register number of the drive constant that is to be changed to nviWriteParamNum in hexadecimal.
2. Enter the settings in nviWriteParamVal.
   Note: If the nviWriteParamVal data is not received within 30 seconds after the nviWriteParamNum data is received, the drive will discard the nviWriteParamNum data.
3. The drive will process the constant change when it receives nviWriteParamNum and nviWriteParamVal. The changed data is set in nvoReadParamVal for output when the change is completed normally.
4. If settings cannot be changed due to, for example, a register number being specified for a non-existent drive constant, an error code will be set in nvoParamErr for output.
   Refer to ***Drive Parameter Error (Drive Constant Access Error) on page 40*** for details.

Example: Changing the C1-01 (Ramp Up Time) Setting

Conditions:

Ramp up time (C1-01): 200H

C1-01 setting: Changed from 10.0 s to 35.0 s.



Note: Refer to *Table 5* for error codes.

9 Configuration Properties

◆ Drive Related Network Configuration Properties

Table 6 Drive Configuration Properties

Name	Variable Type	Description
nciMaxSpeed	SNVT_lev_percent	Maximum Motor Speed
nciMinSpeed	SNVT_lev_percent	Minimum Motor Speed
nciSndHrtBt	SNVT_time_sec	Send Heartbeat Time
nciNmlSpeed	SNVT_rpm	Nominal Motor Speed in RPM (Motor Rated Rotation Frequency)
nciNmlFreq	SNVT_freq_hz	Nominal Motor Frequency (Motor Rated Frequency)
nciRampUpTm	SNVT_time_sec	Drive Ramp Up Time (Drive Acceleration Time)
nciRampDownTm	SNVT_time_sec	Minimum Ramp Down Time (Minimum Deceleration Time)
nciRcvHrtBt	SNVT_time_sec	Receive Heartbeat Time
nciMinOutTm	SNVT_time_sec	Minimum Send Time
nciLocation	SNVT_str_asc	Location Label
nciPwupOutTm	SNVT_time_sec	Power delay Timer
nciFreqMinDelta1	SNVT_lev_percent	Output Frequency Monitor Minimum Change Range Setting 1
nciFreqMinDelta2	SNVT_ freq_hz	Output Frequency Monitor Minimum Change Range Setting 2
nciDrvSpeedScale	SNVT_lev_percent	nviDrvSpeedScale Default
nciInvSetFreq	SNVT_ freq_hz	nviInvSetFreq Default
nciDrvSpeedRef	SNVT_lev_percent	nviDrvSpeedRef Default
nciDrvEngylimit	SNVT_elec_kwh_l	Cumulative Power Monitor Upper Limit: nciDrvEngylimit
nciEngyMinDelta	SNVT_elec_kwh_l	Cumulative Power Monitor Minimum Change Range Setting
nciOpMode	SNVT_count	Reference Selection Mode
nciDrvRunMode	SNVT_switch	Run Command Status Mode

■ Maximum Motor Speed

Network input config	SNVT_lev_percent nciMaxSpeed
Setting range	0.000 to 110.000%
Default	100.000%
SCPT Reference	SCPTmaxSetpoint (50)

Set the motor frequency reference upper limit with the maximum output frequency (E1-04) taken as 100%. This value will be saved in drive constant d2-01 (frequency reference upper limit). It will not be saved during operation.

Set the minimum speed and the maximum speed as follows:

0 ≤ minimum speed ≤ maximum speed ≤ 110.000

■ Minimum Motor Speed

Network input config	SNVT_lev_percent nciMinSpeed
Setting range	0 to 40.000%
Default	0%
SCPT Reference	SCPTminSetpoint (53)

Set the motor frequency reference lower limit with the maximum output frequency (E1-04) taken as 100%. This value will be saved in drive constant d2-02 (frequency reference lower limit).

Set the minimum speed and the maximum speed as follows:

0 ≤ minimum speed ≤ maximum speed ≤ 110.000

■ Send Heartbeat Time

Network input config	SNVT_time_sec nciSndHrtBt
Setting range	0.0 to 6,553.5 s (0.1 s) 6,553.5 s is handled as 0 s.
Default	0 (Invalid)
SCPT Reference	SCPTmaxSendTime (49)

Set the scheduled output time for the output network variable. When this setting is made, the monitor data is output in fixed cycles.

■ Nominal Motor Speed in RPM (Motor Rated Rotation Frequency)

Network input config	SNVT_rpm nciNmlSpeed
Setting range	0 to 65,534 min^{-1} ($1min^{-1}$)
Default	1800 min^{-1}
SCPT Reference	SCPTnomRPM (158)

Set the motor rated rotation frequency.

■ Nominal Motor Frequency (Motor Rated Frequency)

Network input config	SNVT_freq_hz nciNmlFreq
Setting range	0 to 100 Hz (1 Hz)
Default	60 Hz
SCPT Reference	SCPTnomFreq (159)

Set the motor rated frequency.

■ Drive Ramp Up Time (Drive Acceleration Time)

Network input config	SNVT_time_sec nciRampUpTm
Setting range	0.0 to 6,000.0 s (0.1 s)
Default	10.0 s
SCPT Reference	SCPTrampUpTm (160)

Set the motor ramp up time. This value is saved in drive constant C1-01.

■ Minimum Ramp Down Time (Minimum Deceleration Time)

Network input config	SNVT_time_sec nciRampDownTm
Setting range	0.0 to 6000.0 s (0.1 s)
Default	10.0 s
SCPT Reference	SCPTrampDownTm (161).14

Set the motor ramp down time. This value is saved in drive constant C1-02.

■ Receive Heartbeat Time

Network input config	SNVT_time_sec nciRcvHrtBt
Setting range	0.0 to 6,553.4 s (0.1 s) If the set value is 0, no communications error “bUS” is detected.
Default	0 (Invalid)
SCPT Reference	SCPTmaxRcvTime (48)

Set the maximum reception interval for nviDrvSpeedStpt. A “bUS” communications error will be displayed if data is not received within this set time period.

■ Minimum Send Time

Network input config	SNVT_time_sec nciMinOutTm
Setting range	0.0 to 6,553.4 s (0.1 s) When the set value is 0, monitor data output is event driven.
Default	0.5 s
SCPT Reference	SCPTminSendTime (52)

Set the minimum output time for monitor data. The monitor data will be output after the set time has elapsed following a change to the data.

■ Location Label

Network input config	SNVT_str_asc nciLocation
Setting range	0 to 31 bytes
Default	\0 (Null)
SCPT Reference	SCPT_location (17)

Information regarding the physical position of a node can be set separately from the neuron ID (6 bytes).

■ Power Delay Timer

Network input config	SNVT_time_sec nciPwUpOutTm
Setting range	0 to 65534 (1 s)
Default	FFFF (Invalid)
SCPT Reference	SCPT_Pwrupdelay (72)

Set the delay time from when the power is turned ON until network variable output is started.

■ Output Frequency Monitor Minimum Change Range Setting 1

Network input config	SNVT_lev_percent nciFreqMinDelta1
Setting range	-163.840% to 163.830 (0.005%) If the set value is 7FFF, it is set as invalid data.
Default	0%
SCPT Reference	SCPTdefScale (162)

Set the minimum output change range for nvoDrvSpeed.

Set the value for when the power is turned ON.

■ Output Frequency Monitor Minimum Change Range Setting 2

Network input config	SNVT_ freq_hz nciFreqMinDelta2
Setting range	0.0 to 400.0 (Hz) If the set value is 7FFF, it is set as invalid data.
Default	7FFF (Invalid)

Set the minimum output change range for nvoInvOutFreq.

■ nviDrvSpeedScale Default

Network input config	SNVT_lev_percent nciDrvSpeedScale
Setting range	-163.840% to 163.835 (0.005%) If the set value is 7FFF = +163.835%, it is set as invalid data.
Default	100.00%
SCPT Reference	SCPTdefScale (162)

Set the value for nviDrvSpeedScale for when the power is turned ON.

■ nviInvSetFreq Default

Network input config	SNVT_ freq_hz nciInvSetFreq
Setting range	0.0 to 6553.5 (Hz) If the set value is FFFF, it is set as invalid data.
Default	3276.7 (7FFF)FFFF (Invalid)
SCPT Reference	SCPTdefScale (162)

Set the value for nviInvSetFreq for when the power is turned ON.

■ nviDrvSpeedRef Default

Network input config	SNVT_lev_percent nciDrvSpeedRef
Setting range	-163.840% to 163.835 (0.005%) If the set value is 7FFF = +163.835%, it is set as invalid data.
Default	7FFF (Invalid)

Set the value for nviDrvSpeedRef for when the power is turned ON.

■ Cumulative Power Monitor Upper Limit

Network input config	SNVT_elec_kwh_l nciDrvEngylimit
Setting range	-214,748,364.8 to 214,748,364.6 kwh
Invalid value	0x7FFFFFFF (214,748,364.7) If the set value is invalid, the nvoDrvEnergy value accumulates until the maximum value. If the set value is for less than 0, it is treated as 0 and the cumulative power value does not accumulate.
Default	0x7FFFFFFF (214,748,364.7) (Invalid)

Set the cumulative power monitor (nvoDrvEnergy) upper limit. When the cumulative power monitor value exceeds this set value, the accumulation will restart from 0. (Example: If the set value is 1,000.0, the next number after 999.9 will be 0.)

■ Cumulative Power Monitor Minimum Change Range Setting

Network input config	SNVT_elec_kwh_l nciEngyMinDelta
Setting range	-214,748,364.8 to 214,748,364.6 kwh
Valid range	0.1 to 214,748,364.6 No value greater than nvoDrvEngylimit can be set. If nciDrvEngylimit nciEngyMinDelta, the data will be ignored and the set value will not be changed.
Default	Invalid value

Set the minimum change range for the output from the cumulative power monitor (nvoDrvEnergy).

■ Reference Selection Mode

Network input config	SNVT_count nciOpMode

Run command and frequency reference rights can be selected and switched from the network. The selection can be changed as shown below by setting nciOpMode (default: 0) from 0 to 3.

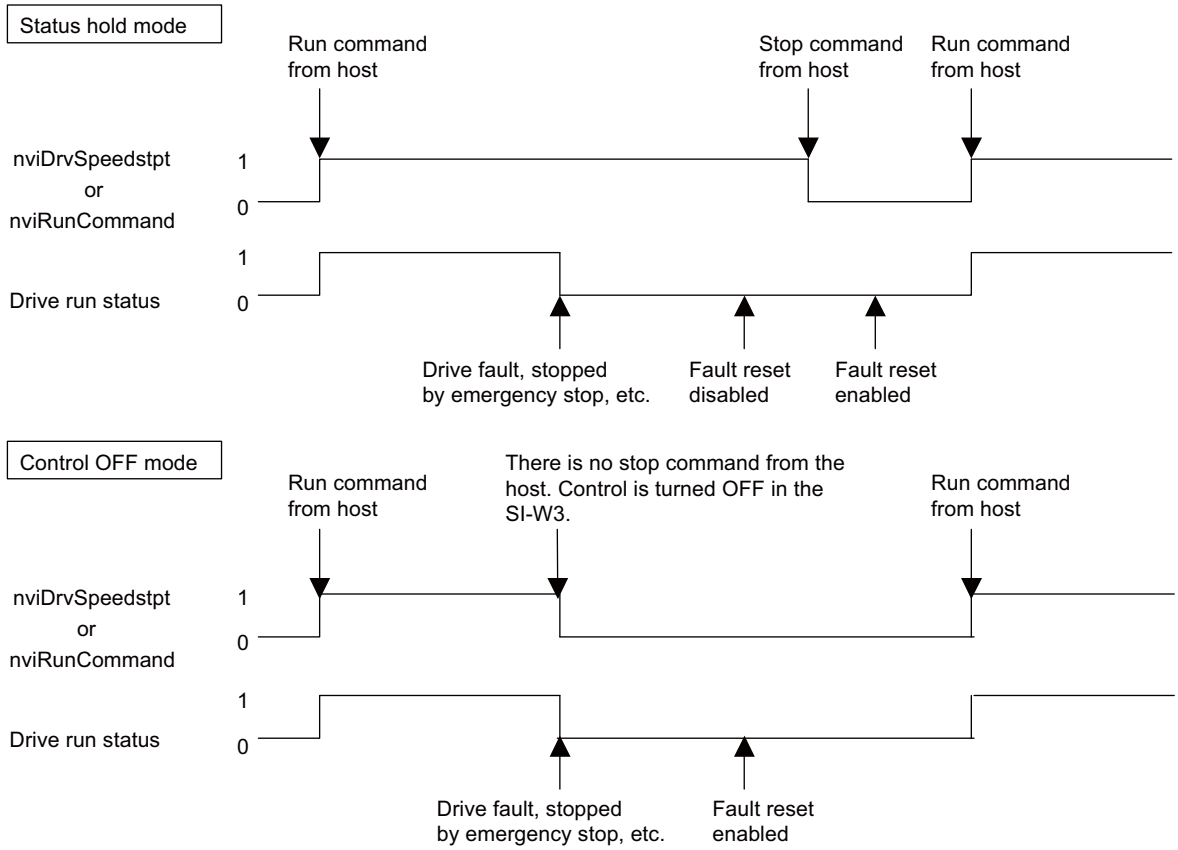
nciOpMode Set Value	0 (Default)	1	2	3
Reference selection	b1-01 set value	Communications	b1-01 set value	Communications
Operation method selection	b1-02 set value	b1-02 set value	Communications	Communications

■ Run Command Status Mode

Network input config	SNVT_switch nciDrvRunMode
Default	State = 0 x FF

If the drive stops during operation for a reason other than a Stop command from the network, determine whether the Run command is to be forced OFF in the SI-W3 from communications or whether the Run command status is to be held as is.

State	Value	Command
0	NA	Status hold
1	NA	OFF
FF (Default)	NA	Status hold



10 Troubleshooting

◆ Drive-Side Error Codes

Drive-side error codes appear on the drive digital operator. *Table 7* lists causes of the errors and possible corrective actions. Refer to the drive Technical Manual for additional error codes that may appear on the drive digital operator.

■ Faults

Both bUS (Option communication error) and EF0 (Option Card External Fault from the option) can appear as an alarm or as a fault. When a fault occurs, the digital operator ALM LED remains lit. When an alarm occurs, the ALM LED flashes.

If communication stops while the drive is running, use the following questions as a guide to help remedy the fault:

- Is the option properly installed?
- Is the communication line properly connected to the option? Is it loose?
- Did a momentary power loss interrupt communications?

Table 7 Fault Displays and Possible Solutions

Digital Operator Display		Fault Name
bUS	bUS	Option Communication Error
		• After establishing initial communication, the connection was lost • Only detected when the run command or frequency reference is assigned to the option (bl-01 = 3 or bl-02 = 3).
Cause		**Possible Solution**
No signal was received from the PLC.		• Check for faulty wiring • Correct any wiring problems
Faulty communications wiring		
An existing short circuit or communications disconnection		Check disconnected cables and short circuits and repair as needed
A data error occurred due to electric interference		• Counteract noise in the control circuit, main circuit, and ground wiring. • If a magnetic contactor is identified as a source of noise, install a surge absorber to the contactor coil. • Use only recommended cables or other shielded line. Ground the shield on the controller side or the drive input power side. • Separate all communication wiring from drive power lines. Install an EMC noise filter to the drive power supply input. • Counteract noise in the master controller (PLC).
The option is not properly connected to the drive		Reinstall the option
Option is damaged		If there are no problems with the wiring and the error continues to occur, replace the option.
Connection Time-out		• The option Receive Heartbeat timer timed out. • Make sure that Receive Heartbeat time is set properly. Check the option connection and communication signal.
Digital Operator Display		**Fault Name**
EF0	EF0	Option Card External Fault
		The alarm function for an external device has been triggered.
Cause		**Possible Solution**
An external fault is being sent from the network.		• Remove the cause of the external fault • Reset the external fault input from the network
Problem with the network program		Check the program used by the network and make the appropriate corrections.
Digital Operator Display		**Fault Name**
oFA00	oFA00	Option Card Connection Error (CN5-A)
		Option is not properly connected.
Cause		**Possible Solution**
The option card installed into port CN5-A is incompatible with the drive.		Connect the option to the correct option port. Note: PG option cards are supported by option ports CN5-B and CN5-C only.

Digital Operator Display		Fault Name
oFA01	oFA01	Option Card Fault (CN5-A)
		Option is not properly connected.
Cause		**Possible Solution**
The option connected to option port CN5-A was changed during run.		De-energize the drive and plug the option into the drive according to *Installation Procedure on page 12*.
Digital Operator Display		**Fault Name**
oFA30 to oFA43	oFA30 to oFA43	Option Card Connection Error (CN5-A)
		Communication ID error.
Cause		**Possible Solution**
The option card connection to port CN5-A is faulty.		1. Turn off the power. 2. Check if the option is properly plugged into the option port. 3. Replace the option if the fault continues to occur.
Digital Operator Display		**Fault Name**
oFb00	oFb00	Option Fault (CN5-B)
		Non-compatible option is connected.
Cause		**Possible Solution**
The option card installed into port CN5-A is incompatible with the drive.		Connect the option to the correct option port. Note: Use connector CN5-B when connecting DO-A3, AO-A3, or two PG options. Use connector CN5-C when connecting only one PG option.
Digital Operator Display		**Fault Name**
oFb02	oFb02	Option Fault (CN5-B)
		Two identical options are connected at the same time.
Cause		**Possible Solution**
An option of the same type is already installed in option port CN5-A, CN5-B, or CN5-C.		Connect the option to the correct option port.
Digital Operator Display		**Fault Name**
oFC00	oFC00	Option Fault (CN5-C)
		Non-compatible option is connected.
Cause		**Possible Solution**
The option card installed into port CN5-C is incompatible with the drive.		Connect the option to the correct option port. Note: AI-A3, DI-A3, and communication options are not supported by option port CN5-C.
Digital Operator Display		**Fault Name**
oFC02	oFC02	Option Fault
		Option Flash write mode.
Cause		**Possible Solution**
An option of the same type is already installed in option port CN5-A, CN5-B, or CN5-C.		Connect the option to the correct option port.

■ Minor Faults and Alarms

Digital Operator Display		Minor Fault Name	
CALL	CALL	Serial communication transmission error	
		Communication is not established.	
Cause		**Possible Solution**	**Minor Fault (H2-☐☐ = 10)**
Communication wiring is faulty.		• Check for wiring errors. • Correct the wiring.	YES
An existing short circuit or communications disconnection		Check disconnected cables and short circuits and repair as needed.	
Programming error on the master side.		Check communications at start-up and correct programming errors.	
Communication circuitry is damaged.		• Perform a self-diagnostics check • If the problem continues, replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.	
Termination resistor of the MEMOBUS/Modbus communications is not enabled.		Set DIP switch S2 to the ON position to enable the termination resistor on a drive located at the end of a network line.	

Digital Operator Display		Minor Fault Name	
CyPo	CyPo	Cycle Power to Active Parameters Comm. Option Parameter Not Upgraded	
Cause		**Possible Solution**	**Minor Fault (H2-☐☐ = 10)**
Drive is not compatible with the option software version.		Turn off the power and upgrade the communication option parameters. Note: An alarm is triggered when the option software version is earlier or an incompatible option is installed to the drive.	YES

◆ Option Compatibility

Users may connect up to 3 options simultaneously depending on the type of option.
Refer to ***Table 8*** for details.

Table 8 Option Compatibility

Option Card	Connector	Number of Cards Possible
PG-B3, PG-X3	CN5-B, C	2 <1>
PG-RT3 <2> <3>, PG-F3 <2> <3>	CN5-C	1
DO-A3, AO-A3	CN5-A, B, C	1
SI-C3, SI-N3, SI-P3, SI-S3, SI-T3, SI-ET3, AI-A3, DI-A3, SI-ES3, SI-B3, SI-M3, SI-W3 <3>, SI-EM3 <3>, SI-EN3 <3>, SI-EP3	CN5-A	1

<1> When connecting two PG option cards, use both CN5-B and CN5-C. When connecting only one PG option card, use the CN5-C connector.
<2> Not available for the application with Motor 2 Selection.
<3> Not available with 1000-Series drive models with a capacities between 450 and 630 kW.

11 European Standards

Figure 27 CE Mark

The CE mark indicates compliance with European safety and environmental regulations. It is required for engaging in business and commerce in Europe.

European standards include the Machinery Directive for machine manufacturers, the Low Voltage Directive for electronics manufacturers, and the EMC guidelines for controlling noise.

This option displays the CE mark based on the EMC guidelines.

EMC Guidelines: 2014/30/EU

Drives used in combination with this option and devices used in combination with the drive must also be CE certified and display the CE mark. When using drives displaying the CE mark in combination with other devices, it is ultimately the responsibility of the user to ensure compliance with CE standards. Verify that conditions meet European standards after setting up the device.

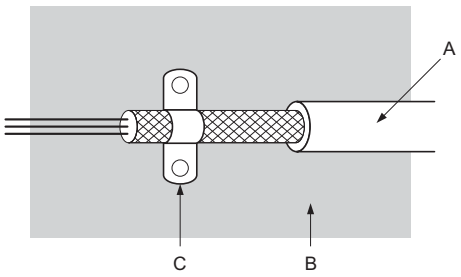
◆ EMC Guidelines Compliance

This option is tested according to European standards EN 61800-3:2004+A1:2012 and complies with EMC guidelines. The CE marking is declared based on the harmonized standards.

■ EMC Guidelines Installation Conditions

Verify the following installation conditions to ensure that other devices and machinery used in combination with this option and drives also comply with EMC guidelines:

1. Use dedicated shield cable for the option and external device (encoder, I/O device, master), or run the wiring through a metal conduit.
2. Keep wiring as short as possible and ground the largest possible surface area of the shield to the metal panel according to ***Figure 29***.



A – Braided shield cable
B – Metal panel
C – Cable clamp (conductive)

Figure 28 Ground Area

■ Option Installation for CE Compliance: Models PG-□□, DI-□□, DO-□□, AI-□□, AO-□□, SI-□□

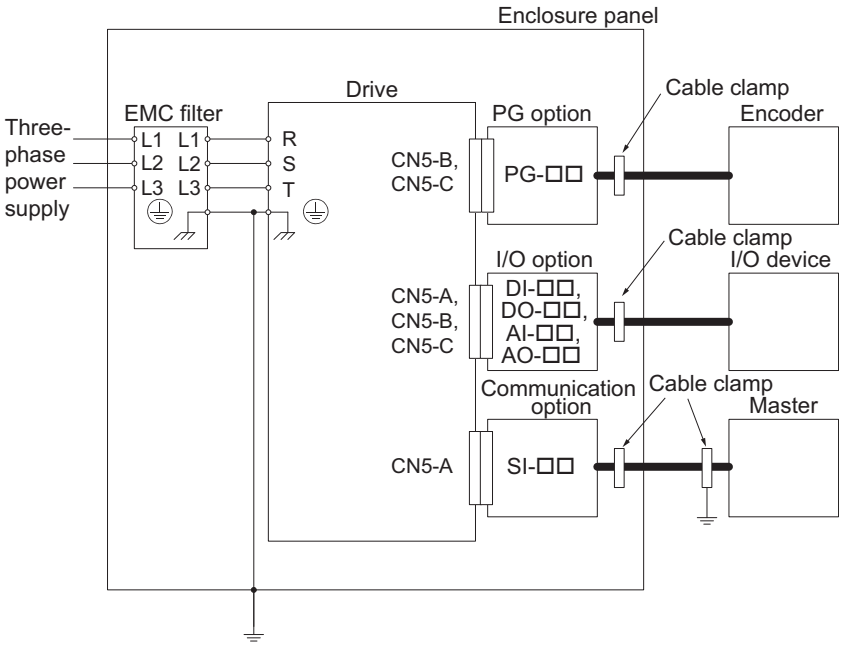


Figure 29 Option Installation for CE Compliance

12 Function Modules

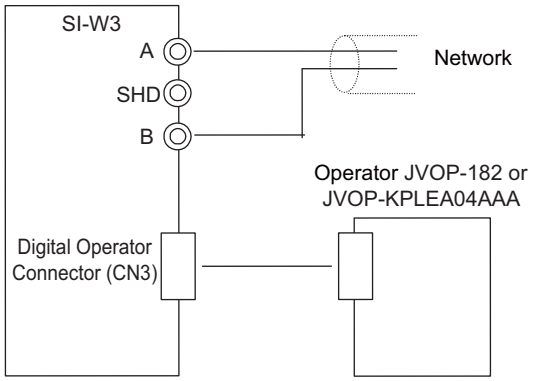
◆ Functions

A Digital Operator, model: JVOP-182 or JVOP-KPLEA04AAA, is required to perform Direct Digital Control (DDC). DDC is the automated control of a condition or process by a digital device. Connecting the JVOP-182 to the CN3 port on the SI-W3 option, allows the user to configure the various functions described in this section via the JVOP-182 LED display. Additionally, functions can be configured via a network connection to terminals A, B and SHD on the SI-W3. Digital operator model JVOP-180 and JVOP-183 are not compatible.

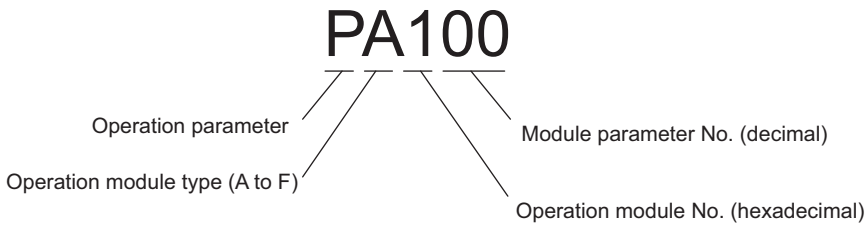
Note: The Z1000 and Z1000U do not support these functions.

Do not turn off the power to the drive for at least 10 seconds after setting the functions with the digital operator. Initialize the bind data when an EEP error occurs.

◆ Connection of Digital Operator for DDC Functionality via JVOP-182



◆ JVOP-182 Digital Operator Display



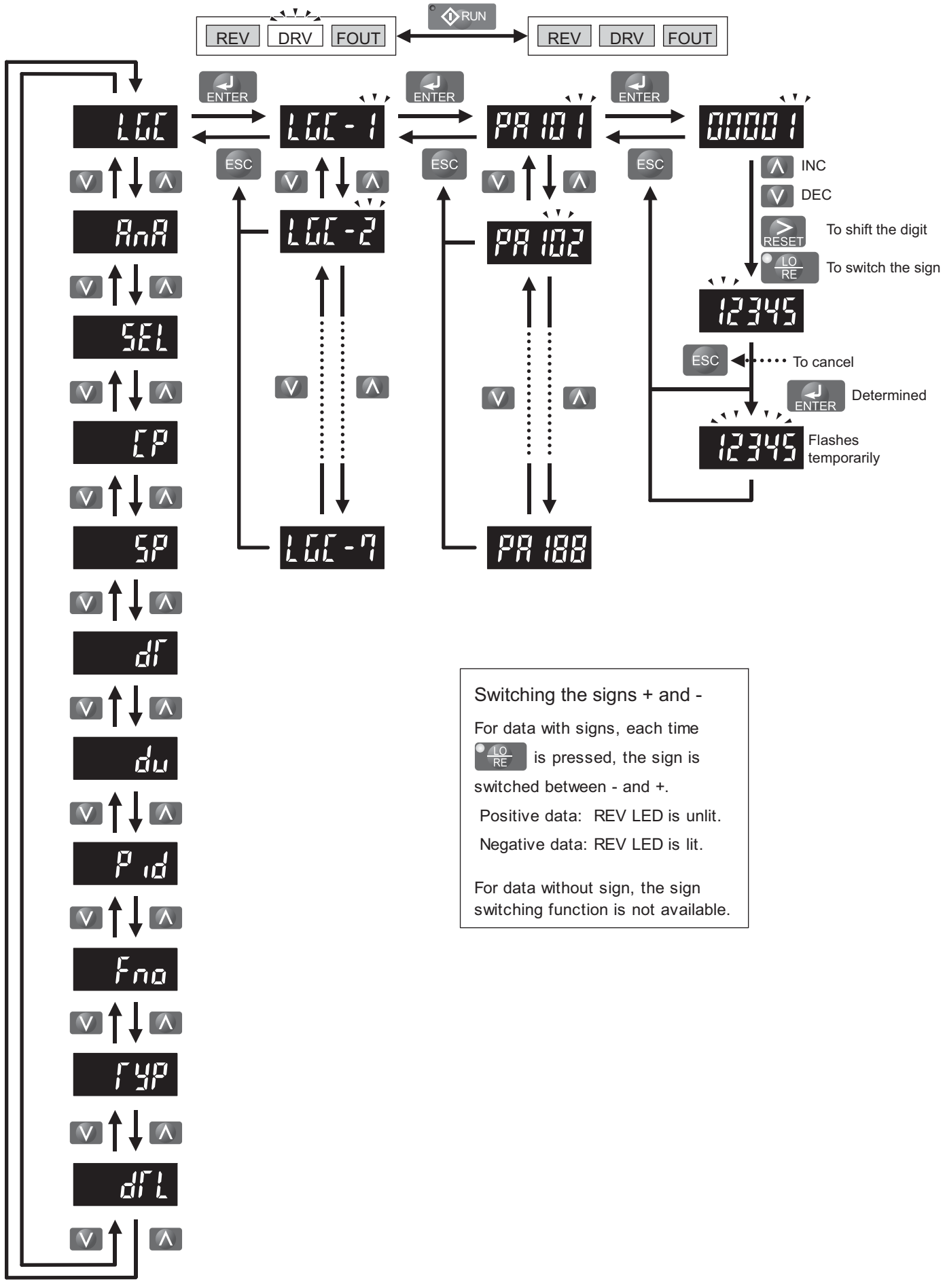
1000-Series Operator Display

GA700 and GA800 Operator Display

Digital Operator Display		Description
onLn	onLn	Option card in online status
oFFLn	oFFLn	Option card in offline status
UnCFG	UnCFG	Network in unconfigured status
CALL	CALL	Option card in standby status for communications
CPF88	CPF88	Option card in error status
bUS	bUS	Option card in communications error status
EEP	EEP	EEPROM error

■ Menu Structure for Digital Operator

1000-Series Menu Structure for Digital Operator



Switching the signs + and -

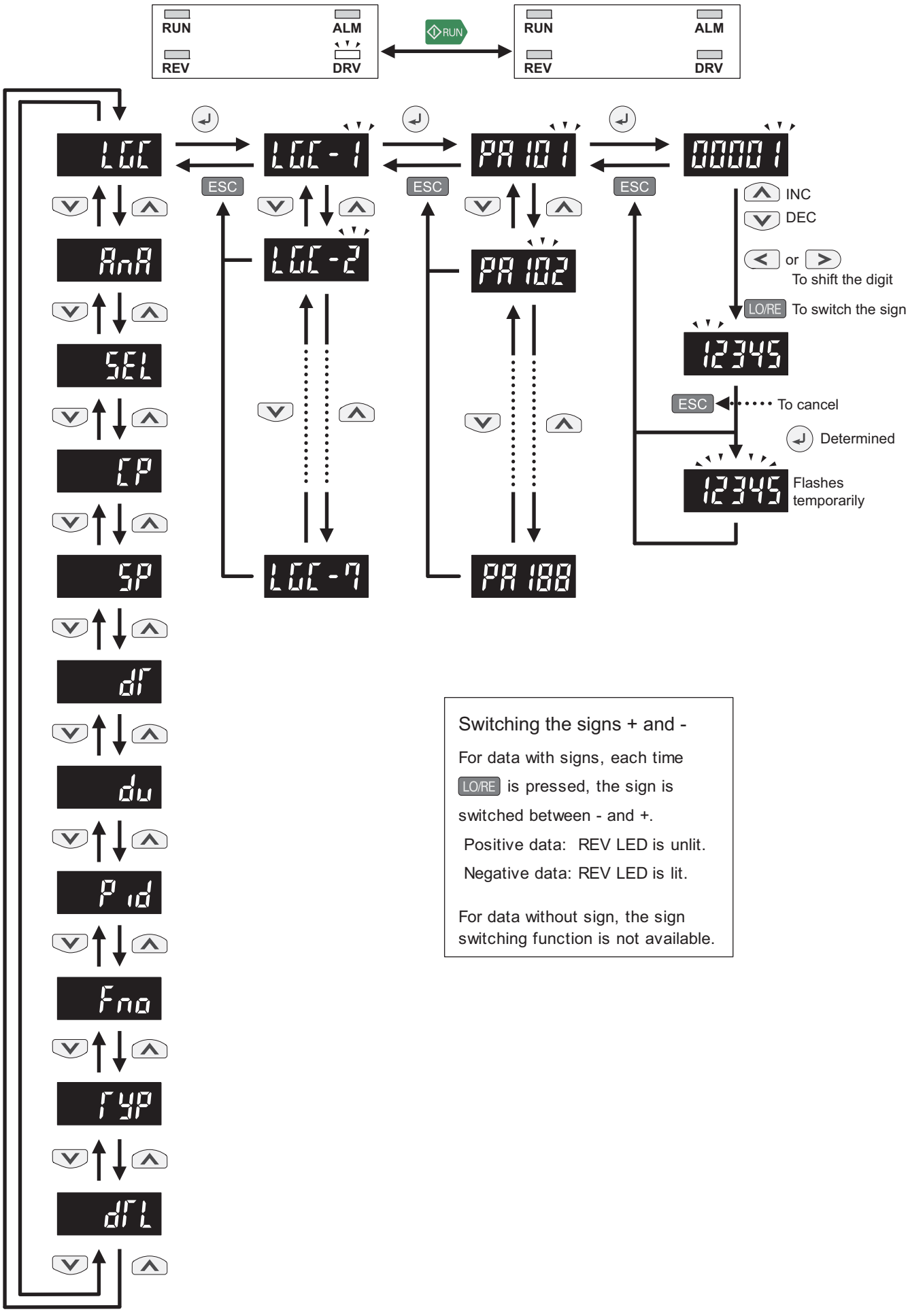
For data with signs, each time LO RE is pressed, the sign is switched between - and +.

Positive data: REV LED is unlit.

Negative data: REV LED is lit.

For data without sign, the sign switching function is not available.

GA700 and GA800 Menu Structure for Digital Operator



Switching the signs + and -

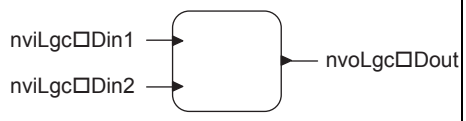
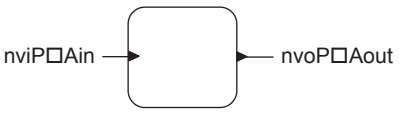
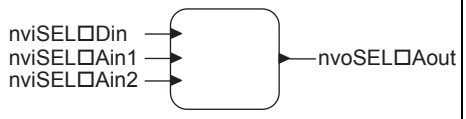
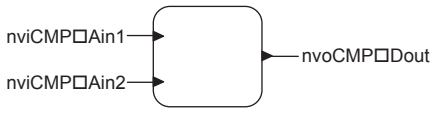
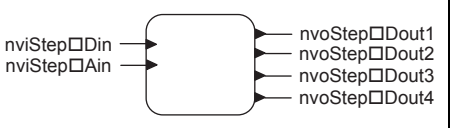
For data with signs, each time LO/RE is pressed, the sign is switched between - and +.

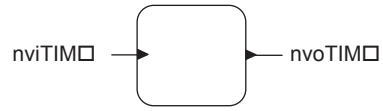
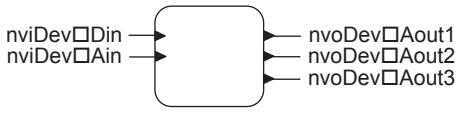
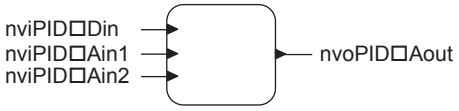
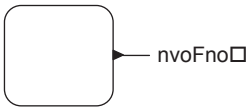
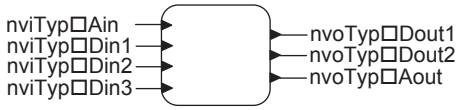
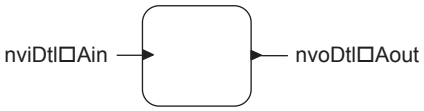
Positive data: REV LED is unlit.

Negative data: REV LED is lit.

For data without sign, the sign switching function is not available.

◆ List of Functions

Name	Display	Parameter	Function Image	Explanation	Default	Register Number
Logic Operation	LgC-□□: 0 to 7 No. of modules: 8	PA000 to PA100		The following operation modes can be selected by setting PA□□00. • 0: AND • 1: OR • 2: Inversion (INV) • 3: Reverse	1	1001H to 1008H
Analog Operation	ANA-□□: 0 to 9 No. of modules: 10	Pb000 to Pb928		The following operation modes can be selected by setting Pb□□02. • 0: Ratio/Bias (R/B) • 1: Analog scheduler (ANA/SCH) • 2: Variation ratio limitter (LIM) • 3: Primary delay filter (FIL)	1	1110H to 1209H
Selection Operation	SEL-□□: 0 to 7 No. of modules: 8	PC000 to PC701		The following operation modes can be selected by setting PC□01. • 0: State data based select (SEL) The data of either nviSEL□Ain1 or nviSEL□Ain2 is output according to the state data of nviSEL□Din. • 1: High select (Hi) The larger of two values is output. • 2: Low select (Lo) The smaller of two values is output.	1	120AH to 1219H
Comparison Operation	Cp-□□: 0 to 7 No. of modules: 8	Pd000 to Pd702		The following operation modes can be selected by setting Pd□01. • 0: Forward operation The output turns ON when nviCMP□Ain1 ≥ nviCMP□Ain2. • 1: Reversed operation The output turns ON when nviCMP□Ain1 ≤ nviCMP□Ain2.	0	121AH to 1231H
Step Output Operation	SP-□□: 0 No. of modules: 1	PE000 to PE018		The following operation modes can be selected by setting PE□01. • 0: First In Last Out (FILO) The outputs nvoStep□Dout1 through 4 turn ON or OFF according to the value of nviStep□Ain in FILO order. • 1: First In First Out (FIFO) The output nvoStep□Dout1 through 4 turn ON or OFF according to the value of nviStep□Ain in FIFO order.	0	1232H to 123CH

Name	Display	Parameter	Function Image	Explanation	Default	Register Number
Delay Timer	dt-□□: 0 and 1 No. of modules: 2	PF000 to PF104		The following operation modes can be selected by setting PF□00. • 0: ON delay The output nvoTIM□ turns ON when the set time period has passed after the input nviTIM□ turned ON. • 1: OFF delay The output nvoTIM□ turns OFF when the set time period has passed after the input nviTIM□ turned OFF.	0	123DH to 1244H
Deviation Output Operation	dv-□□: 0 No. of modules: 1	PG000 to PG013		The following operation modes can be selected by setting PG□01. • 0: Outputs with 3 deviations Three data with the bias set in the data of nviDev□Ain are output. • 1: Outputs with 2 deviations Two data with the bias set in the data of nviDev□Ain are output.	0	1245H to 124AH
PID	pid-□□: 0 to 3 No. of modules: 4	Ph000 to Ph305		The following operation modes can be selected by setting PH□01. • 0: Forward operation PI control on forward operation using the input feedback nviPID□Ain1. • 1: Reverse operation PI control on reversed operation using the input feedback nviPID□Ain1.	0	124BH to 1266H
Constant Output	fno-□□: 0 to 5 No. of modules: 6	PJ000 to PJ501		The data set in the parameter PJ□01 is output.	0	1267H to 1272H
Variable Type Conversion	typ-□□: 0 to 3 No. of modules: 4	PL000 to PL320		The following operation modes can be selected by setting PL□02. • 0: ANA → ANA • 1: ANA → DIG • 2: DIG → ANA	0	1273H to 12BAH
Save Data	dtl-□□: 0 to 3 No. of modules: 4	Po000 to Po300		The data is saved in EEPROM when inputting data. The saved data will not be cleared whenever the power turns OFF.	0	12BBH to 12BEH

■ Items Common to Functions

Sending Data

- Each Function Module outputs response data according to its own function using an output network variable after receiving an input network variable.
- The output method of output network variables for each module can be changed using the common configuration properties nciAoutMinOutTm and nciAoutSendHrtBt, and the minDelta prepared at each module.

Configuration Properties Common to All Function Modules

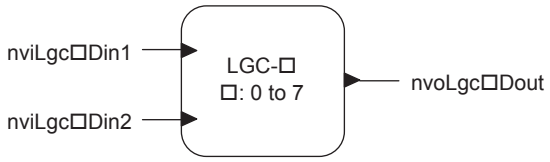
Configuration Property	Explanation	Applicable NVs
nciAoutMinOutTm	Sets a minimum output time of analog data. Analog data is output after the set time period has passed following a change in the data.	ANA data of each Function
nciAoutSendHrtBt	Sets a cycle time to output an analog data. Analog data is output in the set cycle time.	ANA data of each Function
nciDoutSendHrtBt	Sets a cycle time to output the output network variables whose variable type is SNVT_switch. DIG data is output in the set cycle time.	DIG data of each Function

Configuration Properties for Each Function Module

Configuration Property	Explanation	Applicable Function
nciPID0MinDelta to nciPID3MinDelta	Sets a minimum delta of analog data.	PID Function

◆ Logic Operation Function

■ Function Block Image



Number of modules: 8 (0 to 7)

■ Network Variables and Parameters

The Logic Operation Function carries out an operation in a number of stages according to the amount of data stored in the input network variable and saves the result in the network variable.

Network Variables

Network Variable	Variable Type	Type Change	Name and Function
nviLgc□Din1	SNVT_switch	Impossible	DIG input 1
nviLgc□Din2	SNVT_switch	Impossible	DIG input 2
nvoLgc□Dout	SNVT_switch	Impossible	DIG output Outputs the result of logic operation. When ON: state = 1, value = 100.0 When OFF: state = 0, value = 0.0

Parameter

Parameter	Name	Explanation	Default
PA000 to PA700	Operation mode selection	0: AND 1: OR 2: Inversion (INV) 3: Non-equivalence (EQ)	1

■ Operation

The Logic Operation Function has four operation modes: AND, OR, Reverse, and Inversion (INV). Select a mode by setting the parameter PA□01.

The table below shows the output conditions of each operation mode.

Operation	Set Value in PA□01	Input				Output	
		nviLgc□Din1 (SNVT_switch)		nviLgc□Din2 (SNVT_switch)		nviLgc□Dout (SNVT_switch)	
		value	state	value	state	value	state
AND	0	NA	1	NA	1	100	1
		NA	1	NA	0 or -1	0	0
		NA	0 or -1	NA	1	0	0
		NA	0 or -1	NA	0 or -1	0	0
OR	1	NA	1	NA	1	100	1
		NA	1	NA	0 or -1	100	1
		NA	0 or -1	NA	1	100	1
		NA	0 or -1	NA	0 or -1	0	0
Reverse	2	NA	1	NA	1	100	1
		NA	1	NA	0	0	0
		NA	0	NA	1	0	0
		NA	0	NA	0	100	1
		NA	-1	NA	-1	0	0
Inversion (INV)	3	NA	1	–	–	0	0
		NA	0	–	–	100	1
		NA	-1	–	–	0	0

Note: □: Indicates the module number 0 to 7.

Data is sent in event-driven timing, which sends data when the state changes.

Changes to parameter settings are immediately reflected in the operation results in the output network variable.

◆ Analog Operation Function

■ Function Image

Number of modules: 10 (0 to 9)

■ Network Variables and Parameters

The Analog Operation Function carries out an operation in a number of stages or steps according to the amount of data stored in the input network variable and saves the result in the output network variable.

Network Variables

Network Variable	Variable Type	Type Change	Function
nviP□Ain	SNVT_lev_percent	Possible	Executes the operation on the base of the data set in this variable according to the operation mode.
nvoP□Aout	SNVT_lev_percent	Possible	Outputs the operation result.

Parameters

Parameter	Name	Explanation	Default
Pb□00	Variable type	Indicates the variable type of nviP□Ain. Cannot be set from the digital operator.	0
Pb□01	Variable type	Indicates the variable type of nvoP□Aout. Cannot be set from the digital operator.	0
Pb□02	Operation mode selection	0: Ratio/Bias 1: Scheduler 2: Variation ratio limit 3: Primary delay filter	1
Pb□03	Output cycle	Operation output cycle of nvoP□Aout	1.0 s
Pb□04	Variation ratio limit value	Limits the variation of nvoP□Aout.	0
Pb□05	Delay time	Used for operation with primary delay filter.	0
Pb□06	Operation after initialization	0: Calculates as the previous output was 0. 1: Outputs the input value as it is.	0
Pb□07	Ratio	Sets a inclination when Pb□02 = 0.	1.0
Pb□08	Bias	Sets the bias when Pb□02 = 0.	0
Pb□11	Reference point 1X coordinates	Sets the coordinate value x (input).	0
Pb□12	Reference point 2X coordinates	Sets the coordinate value x (input).	0
Pb□13	Reference point 3X coordinates	Sets the coordinate value x (input).	0
Pb□14	Reference point 4X coordinates	Sets the coordinate value x (input).	0
Pb□15	Reference point 5X coordinates	Sets the coordinate value x (input).	0
Pb□16	Reference point 6X coordinates	Sets the coordinate value x (input).	0
Pb□17	Reference point 7X coordinates	Sets the coordinate value x (input).	0
Pb□18	Reference point 8X coordinates	Sets the coordinate value x (input).	0
Pb□21	Reference point 1Y coordinates	Sets the coordinate value y (input).	0
Pb□22	Reference point 2Y coordinates	Sets the coordinate value y (input).	0
Pb□23	Reference point 3Y coordinates	Sets the coordinate value y (input).	0
Pb□24	Reference point 4Y coordinates	Sets the coordinate value y (input).	0
Pb□25	Reference point 5Y coordinates	Sets the coordinate value y (input).	0
Pb□26	Reference point 6Y coordinates	Sets the coordinate value y (input).	0
Pb□27	Reference point 7Y coordinates	Sets the coordinate value y (input).	0
Pb□28	Reference point 8Y coordinates	Sets the coordinate value y (input).	0

■ Operation

The Analog Operation Function has four operation modes that can be selected by setting parameter Pb□02: Ratio/Bias, Analog Schedule, Variation Ratio Limiter, Primary Delay Filter.

The table below shows the output conditions of each operation mode.

Operation Function	Related Parameters	Explanation	Setting
Ratio/Bias	Pb□02	Operation mode selection	0
	Pb□07	Ratio	-3276.8 to 3276.7
	Pb□08	Bias	<1>
Analog Scheduler	Pb□02	Operation mode selection	1
	Pb□11 to □18	Coordinate value x (input)	<1>
	Pb□21 to □28	Coordinate value y (output)	<1>
Variation Ratio Limiter	Pb□02	Operation mode selection	2
	Pb□03	Output cycle	0.1 to 60.0 s
	Pb□04	Variation ratio limit value	<1>
	Pb□06	Operation after initialization	0 or 1
Primary Delay Filter	Pb□02	Operation mode selection	3
	Pb□03	Output cycle	0.1 to 60.0 s
	Pb□05	Delay time	0 to 65534 s
	Pb□06	Operation after initialization	0 or 1

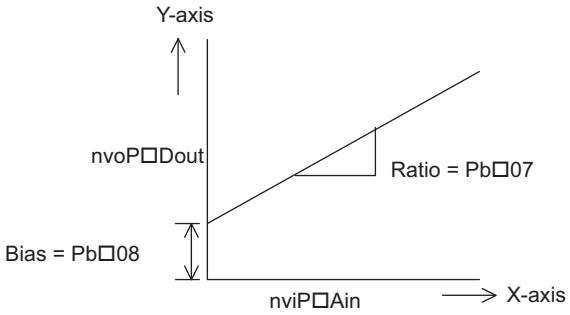
<1> Depends on variable types.

Sending Data

The data is sent in event-driven timing or using nciAoutSndHrtBt and nciMinSendTim.

Ratio/Bias

The data in the input network variable is calculated using the following equation, and the result is sent to the output network variable:

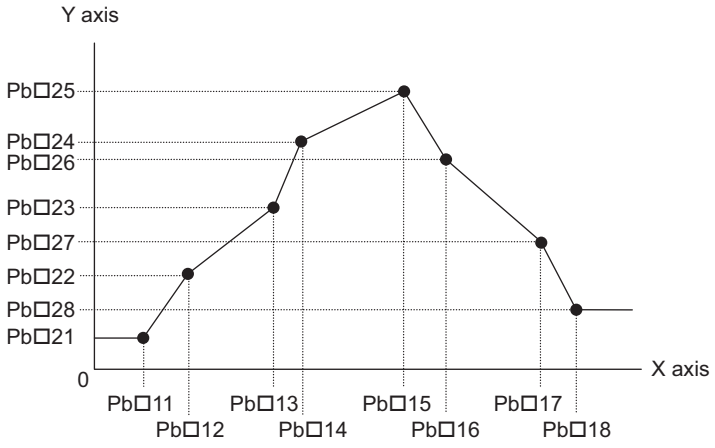


Equation

nvoP□Dout = Pb□07 × nviP□Ain + Pb□08

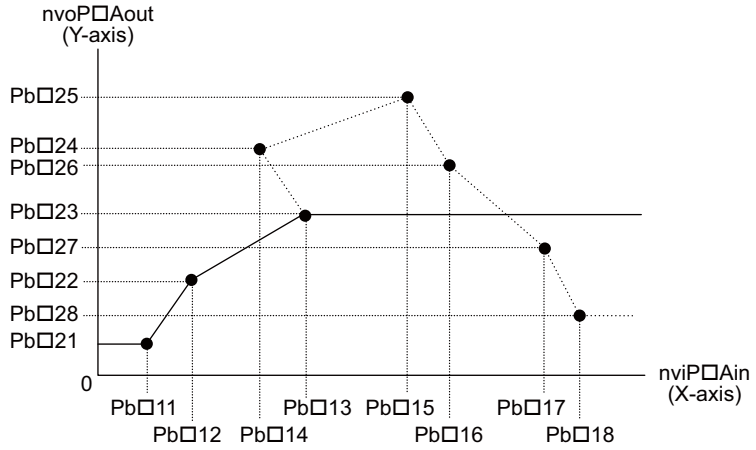
Analog Scheduler

The analog data of the input network variable is compensated using the line graph shown below, and the compensated result is sent to the output network variable.



Note: **1.** Be sure to set the analog input data parameters Pb□11 to Pb□18 in ascending order. If any of the parameters Pb□11to Pb□18 are not set in ascending order, only the setting values of those parameters set in ascending order are valid and all others are invalid.
2. The results from the nvoP□Aout are output and used with the values for the Y-axis set values in correspondence to the parameter set values that were set in ascending order.

Example: When Pb□13 > Pb□14, the line graph will chart as shown in the example below. The set values of parameters Pb□14 and higher are invalid, and the set value of Pb□13 is used for operation.

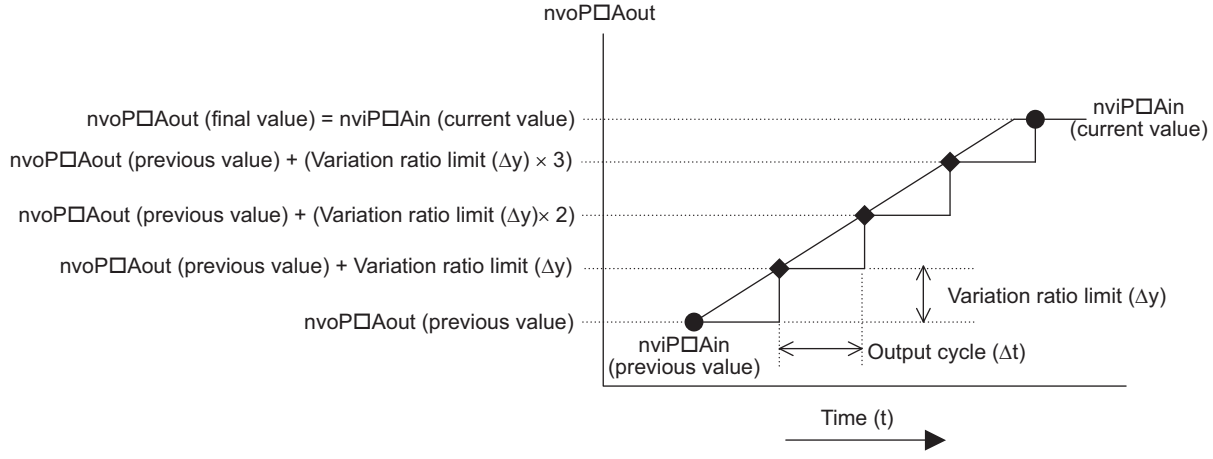


Note: **1.** For the value of nviP□Ain, the value of nvoP□Aout shown with a solid line is output.
2. Parameter Pb□14 was set out of ascending order, so the set values of parameters Pb□14 to Pb□18 and Pb□24 to Pb□28 are invalid. If the value of nviP□Ain is larger than the setting of Pb□13, as shown in this case, nvoP□Aout = Pb□23.

- When parameters Pb□14 to Pb□18 are set in ascending order:
  If nviP□Ain < Pb□11, nvoP□Aout = Pb□21
  If nviP□Ain > Pb□18, nvoP□Aout = Pb□28

Variation Ratio Limiter

The output variation ratio limit is executed on the analog data of input network variable as shown below, and the result is sent to the output network variable.



When the value of nviP□Ain changes from nviP□Ain (previous value) to nviP□Ain (current value), the variation ratio limit value is added to the value of nviP□Aout every output cycle so that the final value of nvoP□Aout is equal to the current value of nviP□Ain.

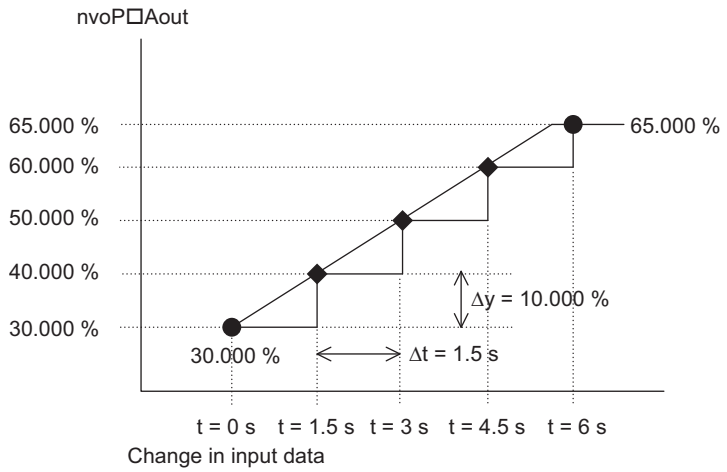
Example: nvoP□Aout data process when the value of nvoP□Ain changes from 30.000 to 65.000

Input and output network variable type: lev_percent

Parameter settings: As shown in the table below

Parameter	Explanation	Setting
Pb□02	Operation mode selection	2
Pb□03	Output cycle	1.5 s
Pb□04	Variation ratio limit value	10.000

After the value of nviP□Ain has changed from 30.000 to 65.000, the value of nvoP□Aout becomes equal to the value of nviP□Ain in six seconds.



Primary Delay Filter

The data of input network variable is calculated using the equation below, and the result is sent to the output network variable:

nvoP□Aout (t) = nvoP□Aout (t-1) + Ts / (Ts + T_L) × (nviP□Ain – nvoP□Aout (t-1))

nvoP□Aout (t): Current output value

nvoP□Aout (t-1): Previous output value

nviP□Ain: Input value

Ts: Output cycle (Pb□03)

T_L: Delay time (Pb□05)

When Ts > T_L, it is judged as Ts = T_L.

◆ Select Operation Function

■ Function Image

Number of modules: 8 (0 to 7)

■ Network Variables and Parameters

The Select Operation Function has three operation modes that can be selected by setting parameter PC□01: State Data Based Select, Hi Select, and Lo Select.

Network Variables

Network Variable	Variable Type	Type Change	Name and Function
nviSEL□Din	SNVT_switch	Impossible	Executes the operation on the base of the data in this parameter according to the operation mode.
nviSEL□Ain1	SNVT_lev_percent	Possible	Input data 1
nviSEL□Ain2	SNVT_lev_percent	Possible	Input data 2
nvoSEL□Aout	SNVT_lev_percent	Possible	Outputs the selected data.

Parameters

Parameter	Name	Explanation	Default
PC□00	Variable type	Indicates the variable type of nviSEL□Ain1 and 2. It is not possible to set this parameter using the digital operator.	0
PC□01	Operation setting	0: State data based select 1: Hi select (Hi) 2: Lo select (Lo)	1

■ Operation

The Select Operation Function has three operation modes that can be selected by setting parameter PC□01: State Data Based Select, Hi Select, and Lo Select.

The table below shows the input conditions of each operation mode

Function	PC□01 Setting	Input Condition		Output Data nvoSEL□Aout
State Data Based Select	0	nviSEL□Din (SNVT_switch)		–
		value	state	
		NA	1	nviSEL□Ain2
		NA	0	nviSEL□Ain1
		NA	-1	nviSEL□Ain1
Hi Select	1	nviSEL□Ain1 ≥ nviSEL□Ain2		nviSEL□Ain1
		nviSEL□Ain1 < nviSEL□Ain2		nviSEL□Ain2
Lo Select	2	nviSEL□Ain1 < nviSEL□Ain2		nviSEL□Ain1
		nviSEL□Ain1 ≥ nviSEL□Ain2		nviSEL□Ain2

State Data Based Select

The data of either the input network variable nviSEL□Ain1 or nviSEL□Ain2 is selected according to the state data of nviSEL□Din, and the data of the selected input network variable is sent to the output network variable nvoSEL□Aout.

When nviSEL□Din (STATE) = 0, nvoSEL□Aout = nviSEL□Ain1

When nviSEL□Din (STATE) = 1, nvoSEL□Aout = nviSEL□Ain2

When nviSEL□Din (STATE) = -1, nvoSEL□Aout = nviSEL□Ain1

Hi Select

The two data of the input network variables nviSEL□Ain1 and nviSEL□Ain2 are compared, and the data of the bigger value is output to the output network variable nvoSEL□Aout.

The input network variable nviSEL□Din is not used.

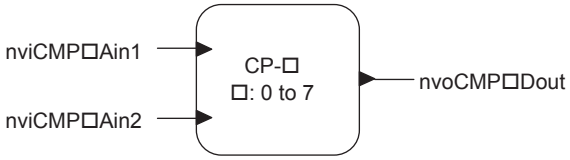
Lo Select

The two data of the input network variables nviSEL□Ain1 and nviSEL□Ain2 are compared, and the data of the smaller value is sent to the output network variable nvoSEL□Aout.

The input network variable nviSEL□Din is not used.

◆ Comparison Operation Function

■ Function Image



Number of modules: 8 (0 to 7)

■ Network Variables and Parameters

The two data of the input network variable nviCMP□Ain2 is compared with that of nviCMP□Ain1. The result is sent to the output network variable according to the forward and the reverse operation.

Network Variables

Network Variable	Variable Type	Type Change	Name and Function
nviCMP□Ain1	SNVT_lev_percent	Possible	Base data for comparison
nviCMP□Ain2	SNVT_lev_percent	Possible	Data to compare
nvoCMP□Dout	SNVT_switch	Impossible	Outputs according to the operation mode.

Parameters

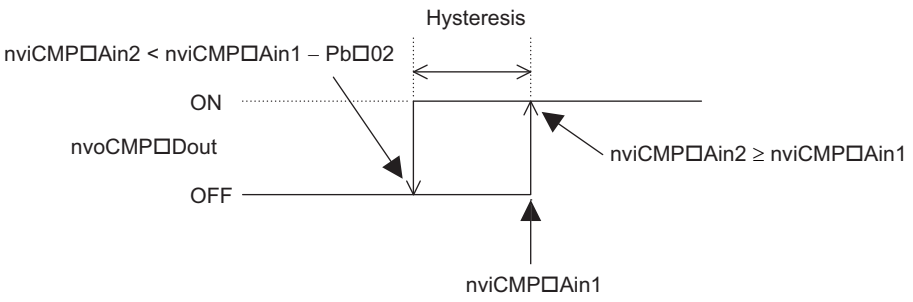
Parameter	Name	Explanation	Default
Pd□00	Variable type	Indicates the variable type of nviCMP□Ain1 and nviCMP□Ain2. It is not possible to set this parameter using the digital operator.	0
Pd□01	Operation mode selection	0: Forward operation 1: Reverse operation	0
Pd□02	Hysteresis	Sets the hysteresis of output variation	0

■ Operation

Forward Operation

When the value of nviCMP□Ain2 is greater than that of nviCMP□Ain1, then nvoCMP□Dout (STATE) = 1 (ON).

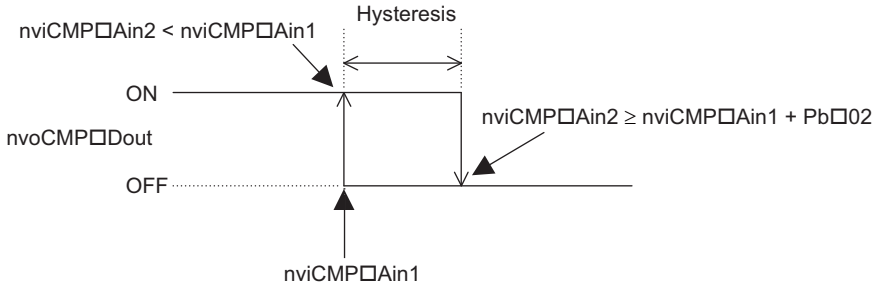
When the value of nviCMP□Ain2 is less than the value “nviCMP□Ain1– Pb□02”, then nvoCMP□Dout (STATE) = 0 (OFF).



Reverse Operation

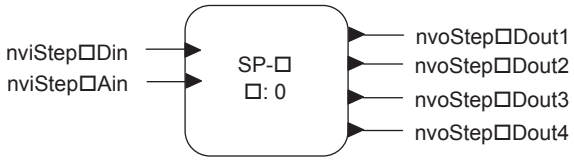
When the value of nviCMP□Ain2 is less than the value of nviCMP□Ain1, then nvoCMP□Dout (STATE) = 1 (ON).

When the value of nviCMP□Ain2 is greater than the value "nviCMP□Ain1+ Pb□02", then nvoCMP□Dout (STATE) = 0 (OFF).



◆ Step Output Operation Function

■ Function Image



Number of modules: 1 (0)

■ Network Variables and Parameters

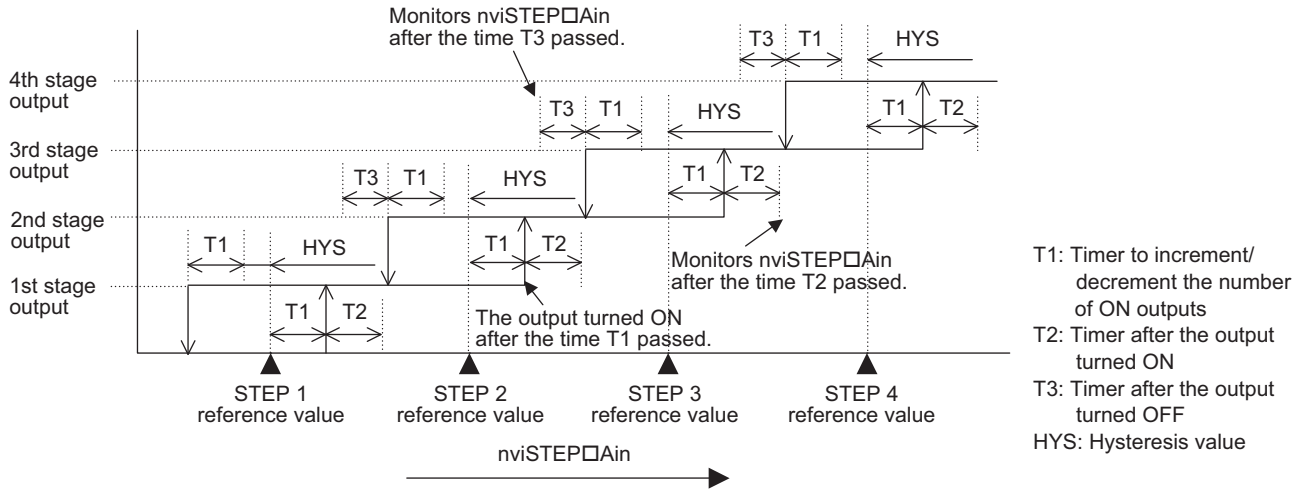
The Step Output Operation Function carries out an operation in a number of stages according to the amount of data stored in the input network variable and saves the result in the output network variable.

Network Variables

Network Variable	Variable Type	Type Change	Name and Function
nviSTEP□Din	SNVT_switch	Impossible	Output interlock state = 0, -1: Interlock state = 1: Release interlock
nviSTEP□Ain	SNVT_lev_percent	Possible	Input data Compares with the reference value, and outputs in order.
nvoSTEP□Dout1	SNVT_switch	Impossible	Step output 1 When ON: state = 1, value = 100.0 When OFF: state = 0, value = 0.0
nvoSTEP□Dout2	SNVT_switch	Impossible	Step output 2 When ON: state = 1, value = 100.0 When OFF: state = 0, value = 0.0
nvoSTEP□Dout3	SNVT_switch	Impossible	Step output 3 When ON: state = 1, value = 100.0 When OFF: state = 0, value = 0.0
nvoSTEP□Dout4	SNVT_switch	Impossible	Step output 4 When ON: state = 1, value = 100.0 When OFF: state = 0, value = 0.0

Parameters

Parameter	Name	Explanation	Default
PE□00	Variable type	It is not possible to change this parameter using the digital operator.	0
PE□01	Operation mode selection	0: FILO (First In Last Out, 1: FIFO (First In First Out)	0
PE□02	Hysteresis	Sets the hysteresis to the reference point to turn OFF the output signal.	0
PE□11	STEP 1 reference value	The reference value to turn ON the output signal.	0
PE□12	STEP 2 reference value	The reference value to turn ON the output signal.	0
PE□13	STEP 3 reference value	The reference value to turn ON the output signal.	0
PE□14	STEP 4 reference value	The reference value to turn ON the output signal.	0
PE□15	Timer to increment/decrement the number of ON outputs	When the value of nviSTEP□Ain is greater than the reference value or less than the value "Reference value - Hysteresis value," the timer starts counting and the number of ON outputs increases or decreases by 1 after the set time. (If the value of nviSTEP□Ain does not satisfy the conditions needed to start the timer, the timer is reset.)	10
PE□16	Timer after the output turned ON	The value of nviSTEP□Ain is discarded within this set time after the output has turned ON.	60
PE□17	Timer after the output turned OFF	The value of nviSTEP□Ain is discarded within this set time after the output has turned OFF.	30
PE□18	Base output position	Set the output network variable that turns ON first. 1: nvoSTEP□Dout1, 2: nvoSTEP□Dout2 3: nvoSTEP□Dout3, 4: nvoSTEP□Dout4	1



Note: The STEP reference values must be set in ascending order. When they are not set in ascending order, only the values that are set in ascending order are valid.
STEP 1 reference value < STEP 2 reference value < STEP 2 reference value < STEP 4 reference value

■ Operation

First In Last Out (FILO)

With this method, the nvoSTEP□Dout that was turned ON first is turned OFF last.

The nvoSTEP□Dout that turns ON first can be specified using the parameter PE□18 (base output position).

Example 1: Order of priority for output when the base position for output is 1.

Output Position	ON Output Order	OFF Output Order
nvoSTEP□Dout1	1	4
nvoSTEP□Dout2	2	3
nvoSTEP□Dout3	3	2
nvoSTEP□Dout4	4	1

Example 2: Order of output priority when the base output position is 2.

Output Position	ON Output Priority	OFF Output Priority
nvoSTEP□Dout1	3	2
nvoSTEP□Dout2	4	1
nvoSTEP□Dout3	1	4
nvoSTEP□Dout4	2	3

While the output is interlocked, all the outputs turns OFF. When the interlock is released, the output turns ON in order from the base output position.

First In First Out (FIFO)

With this method, the nvoSTEP□Dout that was turned ON first is turned OFF first.

After interlocking, the position of the signal to be turned ON first for the next operation is the next one for the position whose signal was last turned ON.

Example 1: Order of priority for output when the base position for output is 1.

Output Position	ON Output Priority	OFF Output Priority
nvoSTEP□Dout1	1	1
nvoSTEP□Dout2	2	2
nvoSTEP□Dout3	3	3
nvoSTEP□Dout4	4	4

Example 2: Output start position when interlocked (Base output position: 1).

STEP 1 reference value: 10.000%

STEP 2 reference value: 30.000%

STEP 3 reference value: 50.000%

STEP 4 reference value: 70.000%

Operation Pattern	Output Position	nvoSTEP□ Dout1	nvoSTEP□ Dout2	nvoSTEP□ Dout3	nvoSTEP□ Dout4	Data of nviSTEP□Ain
1	0-stage output	○	○	○	○	5.000%
2	1-stage output	●	○	○	○	12.000%
3	On being interlocked	○	○	○	○	35.000%
4	1-stage output	○	●	○	○	35.000%
5	2-stage output	○	●	●	○	35.000%
6	3-stage output	○	●	●	●	50.000%
7	On being interlocked	○	○	○	○	50.000%
8	1-stage output	●	○	○	○	20.000%
9	2-stage output	●	●	○	○	40.000%
10	3-stage output	●	●	●	○	80.000%
11	4-stage output	●	●	●	●	80.000%
12	3-stage output	○	●	●	●	60.000%
13	2-stage output	○	○	●	●	40.000%
14	On being interlocked	○	○	○	○	40.000%
15	1-stage output	●	○	○	○	40.000%
16	2-stage output	●	●	○	○	40.000%

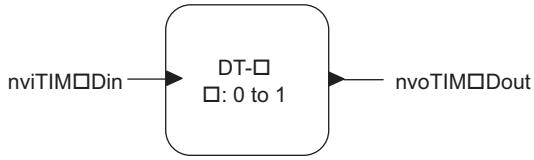
●: Output signal ON, ○: Output signal OFF

The details of the operation pattern described in the table above are in order as follows:

1. All the output signals are OFF because the value of the data of nviSTEP□Ain is less than the STEP 1 reference value.
2. The output Dout1 turns ON first as the base output position is 1.
3. All the outputs are turned OFF by setting the interlock to 0.
4. The operation restarts when the interlock is released. The position that turns ON first is not the position set for the base output position, but the output step next to the output (nvoSTEP□Dout1) that turned ON last before the outputs have been interlocked in pattern 3: nvoSTEP□Dout2.
5. As the value of nviSTEP□Ain increases, the nvoSTEP□Dout3 and nvoSTEP□Dout4 turn ON in order.
6. The operation pattern is the same as pattern 5.
7. All the outputs are turned OFF by setting the interlock to 0.
8. In the same way as in pattern 4, the operation restarts when the interlock is released. The position that turns ON first is not the position set for the base output position, but the output next to the output (nvoSTEP□Dout4) that turned ON last before the outputs have been interlocked in pattern 7: nvoSTEP□Dout1.
9. As the value of nviSTEP□Ain increases, the nvoSTEP□Dout2, nvoSTEP□Dout3, and nvoSTEP□Dout4 turn ON in order.
10. The operation pattern is the same as pattern 5.
11. The operation pattern is the same as pattern 5.
12. The value of the input data of nviSTEP□Ain becomes less than the STEP 4 reference value. The output nvoSTEP□Dout1 that turned ON first among four outputs turns OFF first.
13. The value of nviSTEP□Ain becomes less than the STEP 3 reference value. The output nvoSTEP□Dout2 turns OFF.
14. All the outputs are turned OFF by setting the interlock to 0.
15. In the same way as in pattern 4 and 8, the operation restarts when the interlock is released. The position that turns ON first is not the position set for the base output position, but the output next to the output (nvoSTEP□Dout4) that turned ON last before the outputs have been interlocked in process 11: nvoSTEP□Dout1.
16. The value of nviSTEP□Ain is not changed but more than the STEP 2 reference value. The nvoSTEP□Dout2 turns ON after the set time of the timer.

◆ Delay Timer Function

■ Function Image



■ Network Variables and Parameters

Network Variables

Network Variable	Variable Type	Type Change	Name and Function
nviTIM□Din	SNVT_switch	Impossible	Timer start input state = -1: Output OFF state = 0: Depends on the operation mode state = 1: Depends on the operation mode
nvoTIM□Dout	SNVT_switch	Impossible	Output 1 When ON: state = 1, value = 100.0 When OFF: state = 0, value = 0.0

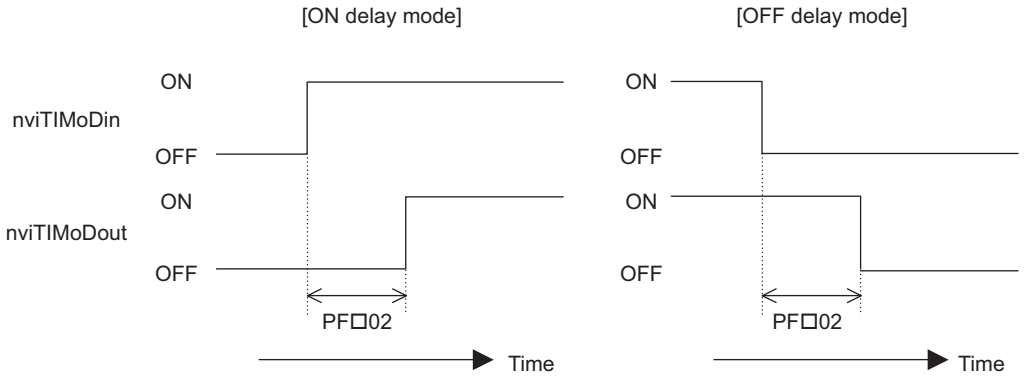
Parameters

Parameter	Name	Explanation	Default
PF□00	Operation mode selection	0: ON delay, 1: OFF delay	0
PF□01	ON delay time	Sets the ON delay time in units of 1 s.	0
PF□02	OFF delay time	Sets the OFF delay time in units of 1 s.	0
PF□04	Operation when the power turns ON	0: nvoTIM□Dout turns ON when the set delay time has passed after nviTIM□Din turned ON. 1: nvoTIM□Dout turns ON when nviTIM□Din turns ON without waiting for the set delay time.	0

■ Operation

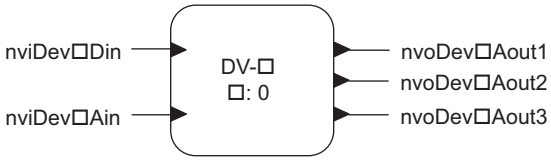
ON/OFF Delay

The ON/OFF Delay mode delays the timing to turn ON/OFF the output network variable nvoTIM□Dout according to the data of the input network variable nviTIM□Din for the set time period as shown in the following figure for details:



◆ Deviation Output Function

■ Function Image



■ Network Variables and Parameters

The value of the deviation added to or subtracted from the analog data (set value) of the input network variable is sent to the output network variable.

Network Variables

Network Variable	Variable Type	Type Change	Name and Function
nviDev□Din	SNVT_switch	Impossible	Used for the operation mode “Outputs with 2 deviation”. Refer to *Ratio/Bias on page 64* for details.
nviDev□Ain	SNVT_lev_percent	Possible	Input data The base data for the data to be output
nviDev□Aout1	SNVT_lev_percent	Possible	The deviation is added to or subtracted from the value according to the operation mode, and the result is sent to the nviDev□Ain.
nvoDev□Aout2	SNVT_lev_percent	Possible	The deviation is added to or subtracted from the value according to the operation mode, and the result is sent to the nviDev□Ain.
nvoDev□Aout3	SNVT_lev_percent	Possible	The deviations is added to or subtracted from the value according to the operation mode, and the result is sent to the nviDev□Ain.

Parameters

Parameter	Name	Explanation	Default
PG□00	Variable type	Impossible to set from the Operator	0
PG□01	Operation mode selection	0: Outputs with 3 deviations 1: Outputs with 2 deviations	0
PG□11	Deviation a	Sets a deviation.	0
PG□12	Deviation b	Sets a deviation.	0
PG□13	Deviation c	Sets a deviation.	0

■ Operation

Outputs with 3 Deviations

Three deviations set in PG□11, PG□12, PG□13 are added to or subtracted from the data of nviDev□Ain as shown below, and the results are sent to nviDev□Aout1, 2, and 3. Each output network variable is calculated using the equation below:

nviDev□Aout1 = nviDev□Ain – PG□11

nvoDev□Aout2 = nviDev□Ain + PG□12

nvoDev□Aout3 = nviDev□Ain + PG□13

Outputs with 2 Deviations

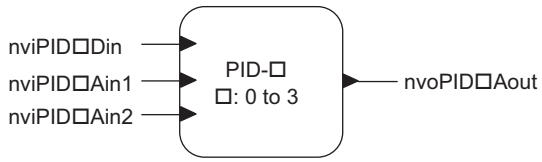
Two output data are set as follows according to the status of nviDev□Din:

- When nviDev□Din = OFF,
  nviDev□Aout1 = 0 (Fixed)
  nvoDev□Aout2 = nviDev□Ain – PG□13
  nvoDev□Aout3 = nviDev□Ain
- When nviDev□Din = ON,
  nviDev□Aout1 = nviDev□Ain
  nvoDev□Aout2 = nviDev□Ain + PG□11
  nvoDev□Aout3 = 100 (Fixed)

Note: If the result of the above operation becomes out of the effective data range, the maximum or minimum value will be output.

◆ PID Function

■ Function Image



■ Network Variables and Parameters

The PID function executes PI control using the data of two input network variables, and is sent to the output network variable.

Network Variables

Network Variable	Variable Type	Type Change	Name and Function
nviPID□Din	SNVT_switch	Impossible	Output interlock 0: Interlock 1: Start control
nviPID□Ain1	SNVT_lev_percent	Possible	Sets value data (SP)
nviPID□Ain2	SNVT_lev_percent	Possible	Process input value (Feedback data) (PV)
nvoPID□Aout	SNVT_lev_percent	Impossible	Outputs the output amount calculated on the base of feedback data. Output range: -5.00 to +105.00%

Parameters

Parameter	Name	Explanation	Default
PH□00	Variable type	Impossible to set from the Operator	0
PH□01	Operation mode selection	0: Forward operation 1: Reversed operation	0
PH□02	Proportional band	0 to 6553.5 s However, when the input network variable type is set to SNVT_flow or SNVT_ppm, the value below the decimal point is rounded up for operation.	1.0
PH□03	Integral time	0 to 6553.5 s	1.0
PH□04	Output when interlocked	The value of the PID output when interlocked	0
PH□05	Reference point	The reference point to be used for operation	50

■ Operation

The PID output when interlocked can be calculated using the following equation:

Forward operation: $P = P_{(0)} - \{(100 / P_b) \times e_i\} - \{(100 \times \theta) / (T_i \times P_b)\} \times e_i$

Reverse operation: $P = P_{(0)} + \{(100 / P_b) \times e_i\} + \{(100 \times \theta) / (T_i \times P_b)\} \times e_i$

P: PID output (%) (-5 to +105%)

$P_{(0)}$: Reference point (PH□05)

P_b: Proportional band (PH□02)

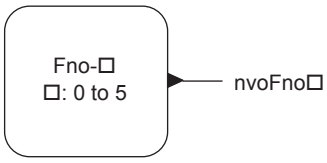
θ: Operation cycle (100 ms)

T_i: Integral time (PH□03)

e_i: Deviation (nviPID□Ain1 – nviPID□Ain2)

◆ Constant Output Function

■ Function Image



■ Network Variables and Parameters

The data set in the parameter is output.

Network Variables

Network Variable	Variable Type	Type Change	Name and Function
nvoFno□Aout	SNVT_lev_percent	Possible	The data set in the parameter is output when the power turns ON.

Parameters

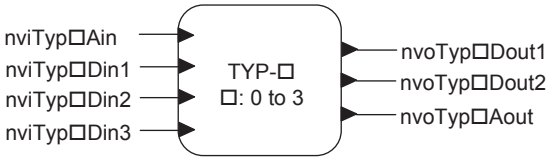
Parameter	Name	Explanation	Default
PJ□00	Variable type	It is not possible to set this parameter using the digital operator.	0
PJ□01	Constant	Set a desired numerical value.	0

■ Operation

The constant set in the parameter is sent to the network variable.

◆ Variable Type Conversion Function

■ Function Image



■ Network Variables and Parameters

The Variable Type Conversion Function converts DIGIN to ANAOUT, and ANA_IN to DIG_OUT.

Network Variables

Network Variable	Variable Type	Type Change	Name and Function
nviTyp☐Din1	SNVT_switch	Impossible	–
nviTyp☐Din2	SNVT_switch	Impossible	–
nviTyp☐Din3	SNVT_switch	Impossible	–
nviTyp☐Ain	SNVT_lev_percent	Possible	–
nvoTyp☐Dout1	SNVT_switch	Impossible	DIG output 1 When ON: state = 1, value = 100.0 When OFF: state = 0, value = 0.0
nvoTyp☐Dout2	SNVT_switch	Impossible	DIG output 2 When ON: state = 1, value = 100.0 When OFF: state = 0, value = 0.0
nvoTyp☐Aout	SNVT_lev_percent	Possible	–

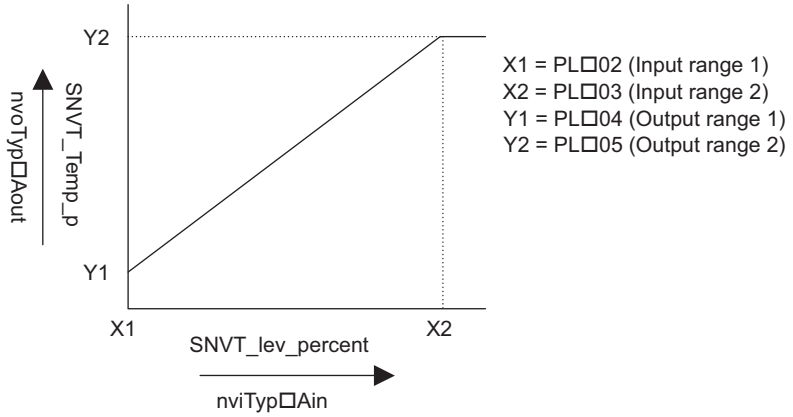
Parameters

Parameter	Name	Explanation	Default
PL☐00	Variable type	It is not possible to set this parameter using the digital operator.	0
PL☐01	Variable type	It is not possible to set this parameter using the digital operator.	0
PL☐02	Input range 1	Sets the input range when converting from ANA to ANA.	0
PL☐03	Input range 2	Sets the input range when converting from ANA to ANA.	0
PL☐04	Output range 1	Set the output range when converting from ANA to ANA.	0
PL☐05	Output range 2	Set the output range when converting from ANA to ANA.	0
PL☐06	Operation mode selection	0: ANA → ANA 1: ANA → DIG 2: DIG → ANA	0
PL☐10	Input reference data	The value to turn ON nvoTyp☐Dout1 when converting from ANA to DIG	999
PL☐11	Input reference data	The value to turn ON nvoTyp☐Dout1 when converting from ANA to DIG	999
PL☐12	Input reference data	The value to turn ON nvoTyp☐Dout1 when converting from ANA to DIG	999
PL☐13	Input reference data	The value to turn ON nvoTyp☐Dout1 when converting from ANA to DIG	999
PL☐14	Input reference data	The value to turn ON nvoTyp☐Dout2 when converting from ANA to DIG	999
PL☐15	Input reference data	The value to turn ON nvoTyp☐Dout2 when converting from ANA to DIG	999
PL☐16	Input reference data	The value to turn ON nvoTyp☐Dout2 when converting from ANA to DIG	999
PL☐17	Input reference data	The value to turn ON nvoTyp☐Dout2 when converting from ANA to DIG	999
PL☐18	Output reference data	The data to be sent if nviTyp☐Din1=ON when converting from DIG to ANA	–
PL☐19	Output reference data	The data to be sent if nviTyp☐Din2=ON when converting from DIG to ANA	–
PL☐20	Output reference data	The data to be sent if nviTyp☐Din3=ON when converting from DIG to ANA	–

■ Operation

Conversion from ANA to ANA
(PL□02 (operation mode selection) = 0)

• Example: Conversion from percent to Temp



Conversion from ANA to DIG (PL□02 (operation mode selection) = 1)

The value of nviTyp□Ain is compared with the set values of PL□10 to 17, and when the value of nviTyp□Ain agrees with a set value of PL□10 to 17, the Dout corresponding to the parameter of the agreed value turns ON.

If an invalid data is input, the outputs turn OFF.

• Example: Conversion from SNVT_lev_percent to SNVT_switch
PL□10: 10.000%, PL□11: 30.000%, PL□12: 50.000%, PL□13: 70.000%,
PL□14: 20.000%, PL□15: 40.000%, PL□16: 60.000%, PL□17: 80.000%

ON Output	Data of nviTyp□Ain (SNVT_lev_percent)									
	0	5	10	20	25	30	35	40	80	75
nvoTyp□Dout1	○	○	●	○	○	●	○	○	○	○
nvoTyp□Dout2	○	○	○	●	○	○	○	●	●	○

●: Output signal ON, ○: Output signal OFF

• Example: Conversion from SNVT_hvac_mode to SNVT_switch
PL□10: 1 (HEAT), PL□11: 3 (COOL), PL□12: 0 (AUTO),
PL□13: 2 (WRMUP), PL□14: 2 (WRMUP), PL□15: 6 (OFF),
PL□16: 999, PL□17: 999

ON Output	Data of nviTyp□Ain (SNVT_hvac_mode)									
	0	4	6	2	1	6	2	7	3	FF
nvoTyp□Dout1	●	○	○	●	●	○	●	○	●	○
nvoTyp□Dout2	○	○	●	●	○	●	●	○	○	○

●: Output signal ON, ○: Output signal OFF

Conversion from DIG to ANA (PL□02 (operation mode selection) = 2

When nviTyp□Din1 is ON, the set value of PL□18 is output to nvoTyp□Aout.

When nviTyp□Din2 is ON, the set value of PL□19 is output to nvoTyp□Aout.

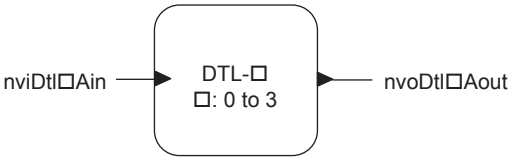
When nviTyp□Din3 is ON, the set value of PL□20 is output to nvoTyp□Aout.

When nviTyp□Din1, nviTyp□Din2, and nviTyp□Din3 are ON simultaneously, the set values are displayed as follows:

nviTyp□Din3 > nviTyp□Din2 > nviTyp□Din1

◆ Save Data Function

■ Function Image



■ Network Variables and Parameters

The Save Data function saves the input data at reception. The saved data is not cleared after the power turns OFF.

Network Variables

Network Variable	Variable Type	Type Change	Name and Function
nviDtl□Ain	SNVT_lev_percent	Possible	–
nvoDtl□Aout	SNVT_lev_percent	Possible	–

Parameters

Parameter	Name	Explanation	Default
Po□00	Variable type	Impossible to set from the Operator	0

■ Operation

The analog input data is saved in the EEPROM to prevent losing the data following a power failure.

Usually, the data of nviDtl□Ain is sent to nvoDtl□Aout.

NOTICE: *Equipment Damage. Do not change the input network variables of this function unless absolutely necessary. Failure to comply will greatly shorten the life of EEPROM.*

◆ Standard Network Variable Types (SNVTs)

The following five standard network variable types can be selected from the Operator for SNVT regarded as the data.

Parameter Setting	Name	Variable Type	Descriptions
0	Percent (Humidity, frequency, etc.)	SNVT_lev_percent	SNVT#: 81 Measurement: Percent Level or Humidity Data type: Fixed Point Scalar - signed long Data size: 2 bytes Data range (Resolution): -163.84 to 163.83% (0.005%/bit). The value 0x7FFF represents invalid data.
1	Pressure	SNVT_Press	SNVT#: 30 Measurement: Gauge Pressure Data type: Fixed Point Scalar - signed long Data size: 2 bytes Data range (Resolution): -3,276.8 to 3,276.7 kilopascals (0.1 kPa)
2	Pressure	SNVT_Press_p	SNVT#: 113 Measurement: Gauge Pressure Data type: Fixed Point Scalar - signed long Data size: 2 bytes Data range (Resolution): -32,768 to 32,766 Pascals (1 Pa). The value 0x7FFF represents invalid data.

Parameter Setting	Name	Variable Type	Descriptions
3	Flow	SNVT_flow	SNVT#: 15 Measurement: Flow Data type: Fixed Point Scalar - unsigned long Data size: 2 bytes Data range (Resolution): 0 to 65,534 l/s (1 l/s). The value 0xFFFF represents invalid data.
4	Temperature	SNVT_temp_p	SNVT#: 105 Measurement: Temperature Data type: Fixed Point Scalar - signed long Data size: 2 bytes Data range (Resolution): -273.17 to 327.66°C (0.01°C). The value 0x7FFF represents invalid data.
5	Concentration	SNVT_ppm	SNVT#: 29 Measurement: Concentration Data type: Fixed Point Scalar - unsigned long Data size: 2 bytes Data range (Resolution): 0 .. 65,535 parts per million (1 ppm) The value 0xFFFF (65,535) represents invalid data.
6	HVAC mode	SNVT_HVAC_mode	SNVT#: 108 Contents: HVAC mode Data type: Enumeration Scalar Data size: 1 byte Data range (Resolution): hvac_t Enumeration Typedef File: SNVT_HV.H
	Enum Definitions Value Identifier 0 HVAC_AUTO: Controller automatically changes between application modes 1 HVAC_HEAT: Heating only 2 HVAC_MRNG_WRMUP: Application-specific morning warm-up 3 HVAC_COOL: Cooling only 4 HVAC_NIGHT_PURGE: Application-specific night purge 5 HVAC_PRE_COOL: Application-specific pre-cool 6 HVAC_OFF: Controller not controlling outputs 7 HVAC_TEST: Equipment being tested 8 HVAC_EMERG_HEAT: Emergency heat mode (heat pump) 9 HVAC_FAN_ONLY: Air not conditioned, fan turned on 10 HVAC_FREE_COOL: Cooling with compressor not running 11 HVAC_ICE: Ice-making mode 0xFF HVAC_NUL: Value not available		

Parameter Setting	Name	Variable Type	Descriptions
7	HVAC mode	SNVT_HVAC_state	SNVT#: 112 Contents: HVAC status Data type: Structure Data size: 12 bytes
	Structure typedef struct { hvac_t mode; signed longheat_output_primary; signed longheat_output_secondary; signed longcool_output; signed longecon_output; signed longfan_output; unsignedin_alarm; } SNVT_hvac_status; Field Definitions Field Units Valid Range Notes modehvac_tcompatible with SNVT_hvac_mode heat_output_primarySNVT_lev_percent-163.83 .. +163.83% primary heat output heat_output_secondarySNVT_lev_percent-163.83 .. +163.83% secondary heat output cool_outputSNVT_lev_percent-163.83 .. +163.83% cooling output econ_outputSNVT_lev_percent-163.83 .. +163.83% economizer output fan_outputSNVT_lev_percent-163.83 .. +163.83% fan output in_alarmboolean0 .. 11 means unit is in alarm		

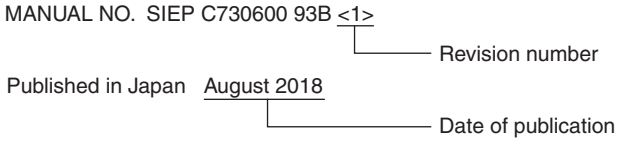
13 Specifications

Table 9 Option Specifications

Items	Specifications
Model	SI-W3
Node Type	Host Application Node
Communication Speed	78 kbps
Communication IC	Neuron chip FT3120
Communication Driver	FT-X1 (free topology)
Protocol	LonTalk protocol node
Network Variables	Total: 236 Standard Network Variable Types (SNVT): Variable Speed Motor Drive function profile Ver1.1
Network Variable Alias	Maximum: 50
Maximum Number of Connections	64 (in one segment)
Total Wiring Length	Max 500 m
Ambient Temperature	-10°C to +50°C (14°F to 122°F)
Humidity	95% RH or lower with no condensation
Storage Temperature	-20°C to +60°C (-4°F to +140°F) allowed for short-term transport of the product
Area of Use	Indoors and free from: • Oil mist, corrosive gas, flammable gas, and dust • Radioactive materials or flammable materials, including wood • Harmful gas or fluids • Salt • Direct sunlight • Falling foreign objects
Altitude	1000 m (3280 ft.) or lower

◆ Revision History

Revision dates and manual numbers appear on the bottom of the back cover.



Date of Publication	Revision Number	Section	Revised Content
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		Back cover	Revision: Address
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YASKAWA AC Drive Option

LonWorks

Technical Manual

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