YASKAWA

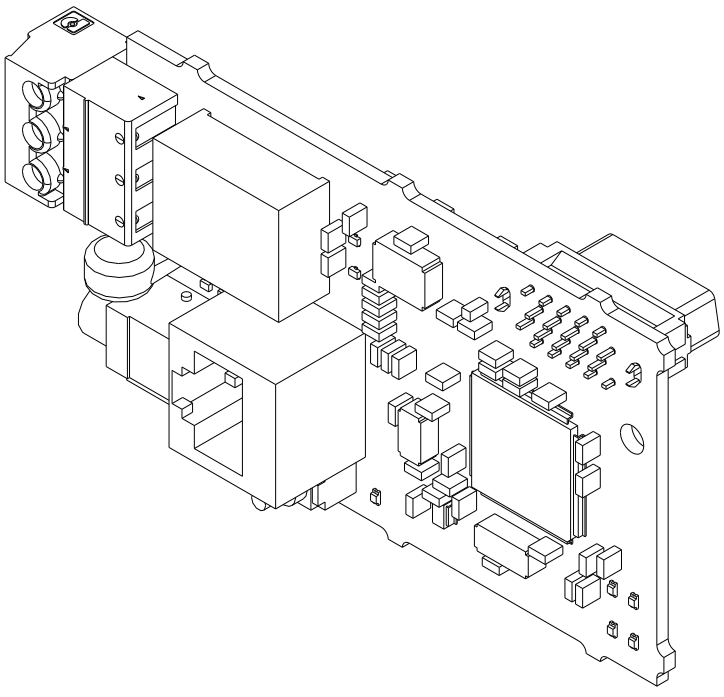
YASKAWA AC Drive Option

LonWorks

Technical Manual

Model SI-W3

To correctly use the product, read this manual thoroughly and keep it for easy reference, inspection, and maintenance. Make sure that the end user receives this manual.



MANUAL NO. SIEP C730600 93D

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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

These manuals are available for the option:

Document	Description
Yaskawa AC Drive Option LonWorks Installation Manual	Read this manual first. The manual provides information about wiring, settings, functions, and troubleshooting. The manual is packaged together with the product.
YASKAWA AC Drive Option 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 Yaskawa or a Yaskawa representative.
YASKAWA AC Drive Manuals	Refer to the drive manual to connect with the option. Drive manuals contain basic installation and wiring information in addition to detailed parameter setting, fault diagnostic, and maintenance information. The manuals also include important information about parameter settings and tuning the drive. The Quick Start Guides are packaged with the drive. 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 Yaskawa or a Yaskawa representative.

◆ Glossary

Terms	Definition
Option	YASKAWA AC Drive Option SI-W3 LonWorks
Keypad	• HOA Operator • LCD Operator • LED Operator • HOA Keypad • LCD Keypad • LED Keypad
Hex. (Example: 900 (Hex.))	Identifies a unit for hexadecimal number format.

◆ Registered Trademarks

- LonWorks and LonTalk are registered trademarks of Echelon Corporation.
- 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 *This signal word identifies a hazard that will cause serious injury or death if you do not prevent it.*

WARNING *This signal word identifies a hazard that can cause death or serious injuries if you do not prevent it.*

CAUTION *This signal word identifies a hazardous situation, which, if not avoided, can cause minor or moderate injury.*

NOTICE *This signal word identifies a property damage message that is not related to personal injury.*

■ Section 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 Yaskawa or a Yaskawa representative and provide the manual number shown on the front cover to order new copies of the manual.

DANGER *Do not ignore the safety messages in this manual. If you ignore the safety messages in this manual, it will cause serious injury or death. The manufacturer is not responsible for injuries or damage to equipment.*

WARNING *Electrical Shock Hazard. Do not modify the drive or option circuitry. Failure to obey can cause serious injury or death, or cause damage to the drive or option and will void warranty. Yaskawa is not responsible for modifications of the product made by the user.*

NOTICE *Damage to Equipment. Do not use steam or other disinfectants to fumigate wood for packaging the drive. Use alternative methods, for example heat treatment, before you package the components. Gas from wood packaging fumigated with halogen disinfectants, for example fluorine, chlorine, bromine, iodine or DOP gas (phthalic acid ester), can cause damage to the drive.*

2 Overview

◆ About This Option

The LonWorks Communication Option (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.

When you install the option to the drive, you can use the LonTalk protocol to do these operations:

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

◆ Compatible Products

You can use the option with these products:

Table 2.1 Compatible Products

Drive	Model	Software Version *1
A1000	CIMR-Ax2Axxxx	≥ 1020
	CIMR-Ax4A0002 - 4A0675	
	CIMR-Ax4A0930, 4A1200	≥ 3015
	CIMR-Ax5Axxxx	≥ 5040 ≥ 1020
U1000	CIMR-UxxAxxxx	≥ 1010
	CIMR-UxxExxxx	
	CIMR-UxxPxxxx	
	CIMR-UxxWxxxx	
U1000L	CIMR-UxxLxxxx	≥ 6210
	CIMR-UxxFxxxx	
	CIMR-UxxRxxxx	
	CIMR-UxxSxxxx	

Drive	Model	Software Version *1
Z1000	CIMR-ZxxAxxxx	≥ 1014
Z1000U	CIMR-ZxxAxxxx	≥ 6110
	CIMR-ZxxExxxx	
	CIMR-ZxxPxxxx	
	CIMR-ZxxWxxxx	
GA700	CIPR-GA70xxxxx	≥ 1010
GA800	CIPR-GA80xxxxx	≥ 9010
HV600	CIPR-HV60xxxxx	≥ 1011
FP605	CIPR-FP65xxxxx	≥ 1010

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

Note:
- Refer to the option package labeling in the field designated “PRG (four digit number)” or the option labeling in the field designated “C/N (S + four digit number)” to identify the option software version.
- For Yaskawa customers in the North or South America region:
  If your product is not listed in Table 2.1, refer to the web page below to confirm this manual is correct for your product. The web page provides a list of option manuals by product, and a direct link to download a PDF of the manual.
  Scan QR code Or refer to: *http://www.yaskawa.com/optionlookup*

3 Receiving

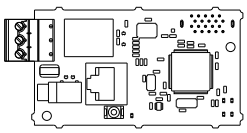
After receiving the option package:

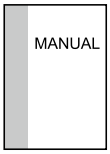
- Make sure that the option is not damaged and no parts are missing.
  Contact your sales outlet if there is damage to the option or other parts. Contact your sales outlet if there is damage to the option or other parts.

  NOTICE *Damage to Equipment. Do not use damaged parts to connect the drive and the option. Failure to comply could damage the drive and option.*
- Make sure that the model number on the option nameplate and the model number on the purchase order are the same. Refer to Figure 4.1 for more information.
- Contact the distributor where you purchased the option or contact Yaskawa or a Yaskawa representative about any problems with the option.

◆ Option Package Contents

Table 3.1 Contents of Package

Option Contents			Quantity
Option			1
Ground Wire *1			1
Screws (M3)			3 *2
LED Labels	1000-Series, Z1000U		1

Option Contents			Quantity
	GA700, GA800		1
	Z1000, HV600, and FP605 *3		1
Bar Code Label			1
Manuals			1

*1 GA700 and GA800 drives do not use the ground wire.
*2 GA700, GA800, HV600, and FP605 drives use two screws only.
*3 LED label has transparent background and white letters. Please make sure that you use the correct label for Z1000, HV600, or FP605.

◆ Installation Tools

You can use these tools to install the option to the drive:

- A Phillips screwdriver or slotted screwdriver (blade depth: 0.4 mm (0.02 in), width: 2.5 mm (0.1 in)) *1.
- 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.

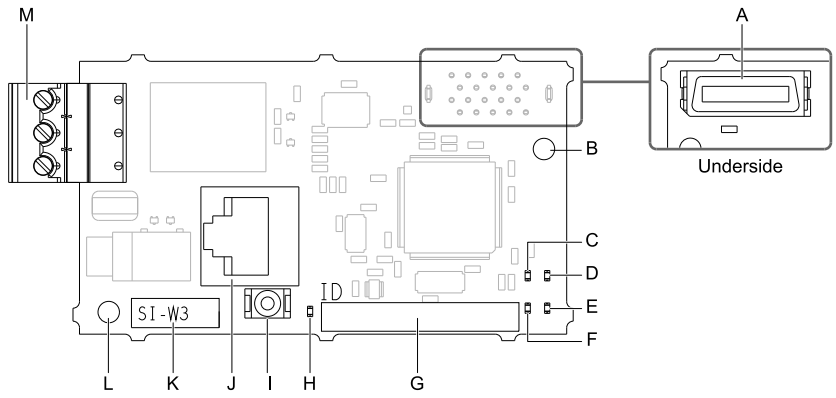
*1 Phillips screw sizes are different for different drive capacities. Prepare different screwdrivers for different screw sizes.

Note:

If you create a connector on the communication cable side, a separate tool is necessary.

4 Option Components

◆ 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 - Keypad connector (CN3) *3
K - Product dependent
L - Ground terminal (FE) and installation hole *2
M - Terminal block CN1

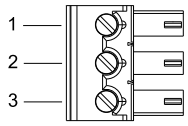
Figure 4.1 Option

*1 Refer to *Option LED States on page 12* for more information about the LEDs.
*2 Connect the included ground wire during installation. The ground wire is not necessary for installation on GA700 and GA800 drives.
*3 Keypad model JVOP-182 is required for Direct Digital Control (DDC) functionality via connector CN3. Refer to *Connector CN3 for Keypad on page 11* for more information. The Z1000 and Z1000U product series do not support this connector and associated DDC functions.

◆ Terminal block CN1

The communication connector on the option is a pluggable terminal block designated CN1. You can remove the communication connector from the circuit board.

Table 4.1 Terminal Descriptions

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

◆ Connector CN3 for Keypad

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

⚠ DANGER *Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, remove the covers before measuring for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

Use an RJ-45 cable to connect a digital operator (model: JVOP-182) to connector CN3 to set Direct Digital Control (DDC) function parameters.

◆ Service Switch

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

■ Neuron ID

A label showing the neuron ID is on the option PCB. Refer to page Figure 4.1 for more information.

A bar code label for the neuron ID is on the option and there are additional labels in the packaging.

■ Initializing Bind Data

To clear the bind data and reset the configuration properties to the default settings, hold down the service switch and cycle power.

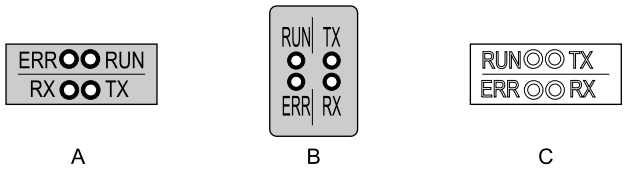
Note:

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

◆ Option LED States

The option has five LEDs:

The operational status of the option LEDs after the power-up diagnostic LED sequence is complete are described in Table 4.2.



A - 1000-Series, Z1000U
B - GA700, GA800
C - Z1000, HV600, and FP605 *1

Figure 4.2 Option LED Labels

*1 LED label has transparent background and white letters. Please make sure that you use the correct label for Z1000, HV600, or FP605.

Table 4.2 Option LED States

LED Name	Indication		Operating State	Description
	Color	Display		
RUN	Green	ON	No Fault	The option is operating normally.
		Flashing	Network status is not configured	You have not configured the LonWorks network.
		OFF	Power supply off	Power is not being supplied to the drive.
			Hardware fault	The option detected a fatal (unrecoverable) error. If the unit does not recover after you cycle power, you may need to replace the option.
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	Hardware fault	The option detected a fatal (unrecoverable) error. If the unit does not recover after you cycle power, you may need to replace the option.
		Flashing	Comm error	The option detected a *CALL* or *bUS* error.
		OFF	No Fault	The option is operating normally.
SERVICE	Green	ON	Service switch active	Service switch is being held down.
			Hardware fault	The option detected a fatal (unrecoverable) error. If the unit does not recover after you cycle power, you may need to replace the option.
		Flashing	Network status is not configured	You have not configured the LonWorks network.
		OFF	No Fault	The option is operating normally.

Note:

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 examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

WARNING *Electrical Shock Hazard. Do not operate the drive when covers are missing. Replace covers and shields before you operate the drive. Use the drive only as specified by the instructions. Some figures in this section include drives without covers or safety shields to more clearly show the inside of the drive. If covers or safety shields are missing from the drive, it can cause serious injury or death.*

WARNING *Electrical Shock Hazard. Only let approved personnel install, wire, maintain, examine, replace parts, and repair the drive. If personnel are not approved, it can cause serious injury or death.*

WARNING *Electrical Shock Hazard. Do not remove covers or touch circuit boards while the drive is energized. If you touch the internal components of an energized drive, it can cause serious injury or death.*

WARNING *Electrical Shock Hazard. Do not use damaged wires, put too much force on the wiring, or cause damage to the wire insulation. Damaged wires can cause serious injury or death.*

WARNING *Fire Hazard. Tighten all terminal screws to the correct tightening torque. Connections that are too loose or too tight can cause incorrect operation and damage to the drive. Incorrect connections can also cause death or serious injury from fire.*

NOTICE *Damage to Equipment. When you touch the option, make sure that you observe correct electrostatic discharge (ESD) procedures. If you do not follow procedures, it can cause ESD damage to the drive circuitry.*

NOTICE *Damage to Equipment. Do not de-energize the drive while the drive is outputting voltage. Incorrect equipment sequencing can cause damage to the drive.*

NOTICE *Do not operate a drive or connected equipment that has damaged or missing parts. You can cause damage to the drive and connected equipment.*

NOTICE *Use Yaskawa connection cables or recommended cables only. Incorrect cables can cause the drive or option to function incorrectly.*

NOTICE *Damage to Equipment. Correctly connect the connectors. Incorrect connections can cause malfunction or damage to the equipment.*

NOTICE *Damage to Equipment. Make sure that all connections are correct after you install the drive and connecting peripheral devices. Incorrect connections can cause damage to the option.*

◆ Procedures to Install and Wire Options on a Drive

Procedures to install and wire the option are different for different drive models.

Refer to the following table to check the procedures to install and wire the option on a drive.

Table 5.1 Procedures to Install and Wire Options on a Drive

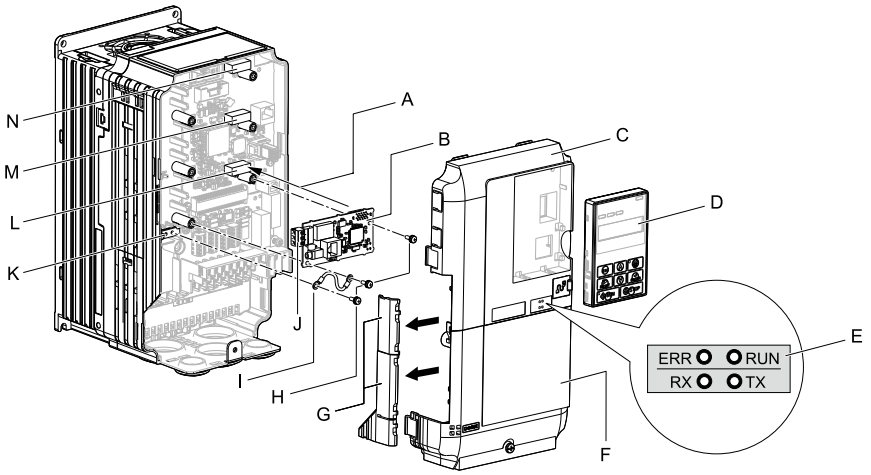
Drive	Procedures to Install and Wire Options on a Drive	Reference Page
A1000	Procedure A	13
U1000	Procedure A	13
U1000L	Procedure A	13
Z1000	Procedure B	17
Z1000U	Procedure A	13
GA700	Procedure C	20
GA800	Procedure C	20
HV600	Procedure D	23
FP605	Procedure D	23

■ Procedure A

This section shows the procedure to install and wire the option on a 1000-series drive.

Prepare the Drive for the Option

Correctly wire the drive as specified by the manual packaged with the drive. Make sure that the drive functions correctly. For information about drive connection and wiring, refer to the manuals for the drive on which you will use this option.



A - Insertion point for CN5 connector
B - Option
C - Drive front cover
D - Keypad
E - LED label
F - Drive terminal cover
G - Removable tabs for wire routing
H - Included screws
I - Ground wire
J - Terminal Block
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 5.1 Drive Components with Option

Install the Option

Use this procedure to install the option.

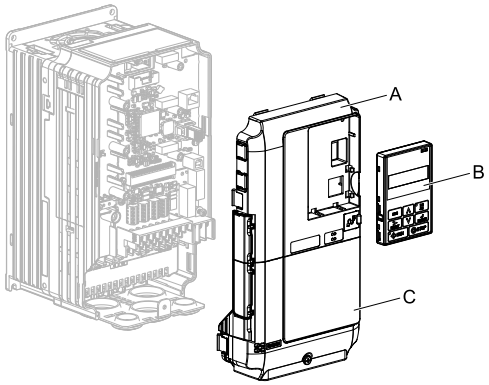
DANGER *Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

1. Remove the keypad (B), front cover (A), and terminal cover (C).

   Shut off power to the drive and wait for the time specified on the drive warning label at a minimum. Make sure that the charge indicator LED is not illuminated, then remove the keypad and front cover. Refer to the drive manuals for more information.

   You can only install this option into the CN5-A connector on the drive control board.

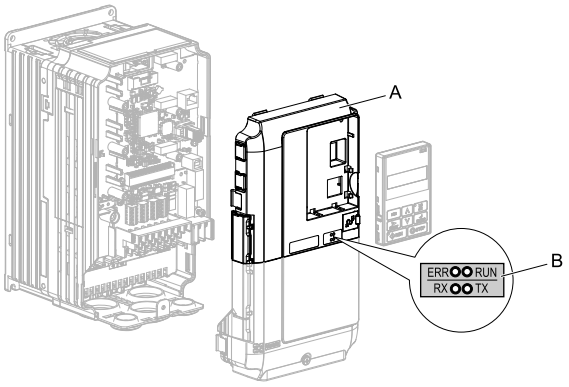
   NOTICE *Damage to Equipment. When you touch the option, make sure that you observe correct electrostatic discharge (ESD) procedures. If you do not follow procedures, it can cause ESD damage to the drive circuitry.*



A - Drive front cover
B - Keypad
C - Drive terminal cover

Figure 5.2 Remove the Keypad, Front Cover, and Terminal Cover

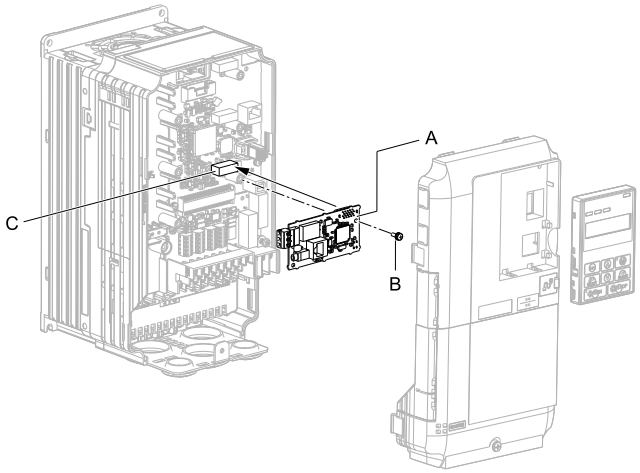
2. Put the LED label (B) in the correct position on the drive front cover (A).



A - Drive front cover **B - LED label**

Figure 5.3 Put the LED Label on the Drive Front Cover

3. Install the option (A) into the CN5-A connector (C) on the drive and use one of the included screws (B) to put it in place.



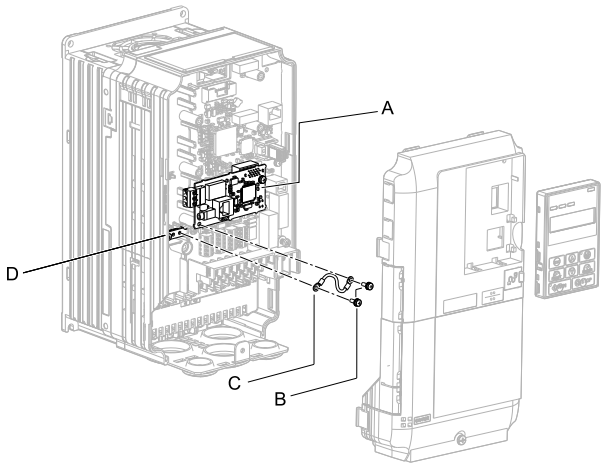
A - Option **C - Connector CN5-A**
B - Included screw

Figure 5.4 Install the Option

4. Use one of the remaining included screws (B) to connect one end of the ground wire (C) to the ground terminal (A). Use the last remaining included screw (B) to connect the other end of the ground wire (C) to the remaining ground terminal and installation hole on the option (A).

   Tighten the screws to a correct tightening torque:

   • 0.5 to 0.6 N•m (4.4 to 5.3 in•lb)



A - Option
B - Included screws
C - Ground wire
D - Drive grounding terminal (FE)

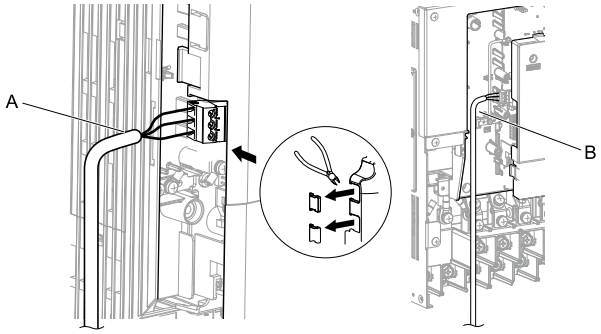
Figure 5.5 Connect the Ground Wire

Note:
The drive has only two ground terminal screw holes. When you connect three options, two options will share one ground terminal.

5. Route the option wiring.
   Procedures to wire the option are different for different drivel models.
   - You can 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 5.6-A to create the necessary openings on these models. To prevent damage to the cable from the cut end, treat the cut surface with sandpaper.
   - Route the option wiring inside the enclosure as shown in Figure 5.6-B.

   Refer to the drive manuals for more information.

Note:
Isolate communication cables from main circuit wiring and other electrical and power lines.



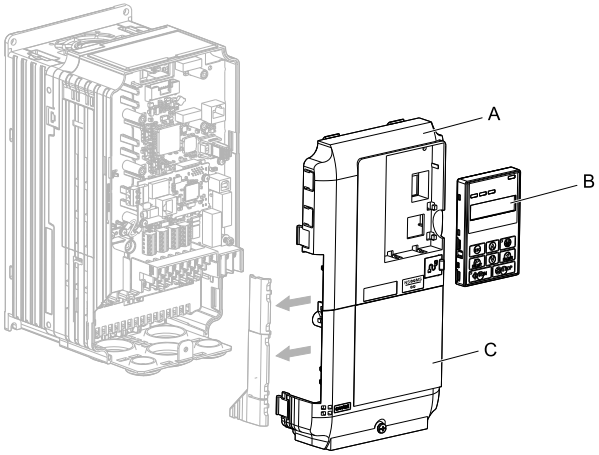
A - Route wires through the openings provided on the left side of the front cover. *1
B - Use the open space provided inside the drive to route option wiring.

Figure 5.6 Wire Routing Examples

*1 If there is wiring outside the enclosure, the drive will not meet Enclosed wall-mounted type (IP20/UL Type 1) requirements.

6. Firmly connect the LonWorks communication cable to terminal block (CN1).
   Isolate communication cables from main circuit wiring and other electrical and power lines. Make sure that you firmly connect the cable end. (Refer to Figure 5.28). Refer to *Communication Cable Topology on page 28* for more information.
7. Reattach the front cover (A), terminal cover (C), and keypad (B).
   Refer to the drive manuals for more information.

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



A - Drive front cover
B - Keypad
C - Drive terminal cover

Figure 5.7 Replace the Front Cover, Terminal Cover, and Keypad

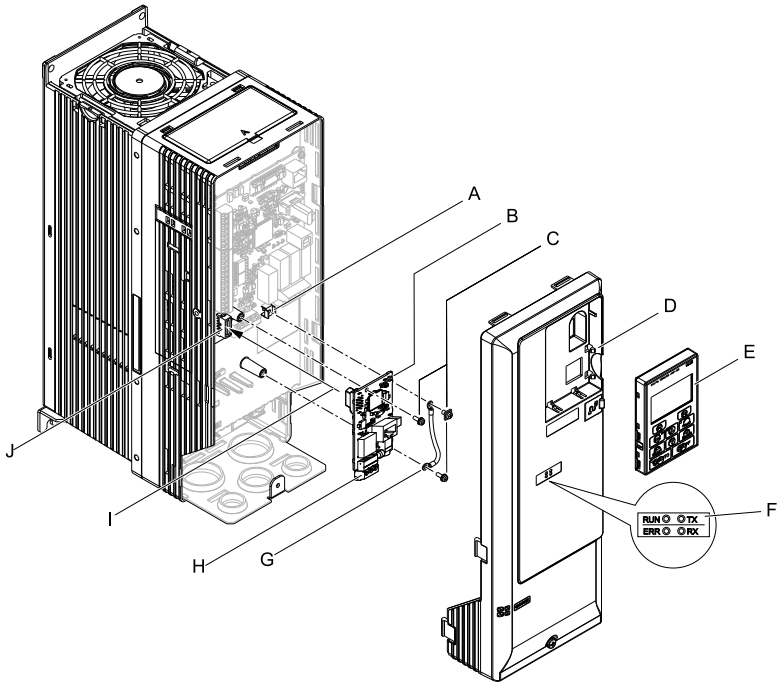
8. Set drive parameters in *Related Drive Parameters on page 29* for correct option performance.

■ Procedure B

This section shows the procedure to install and wire the option on a Z1000 drive.

Prepare the Drive for the Option

Correctly wire the drive as specified by the manual packaged with the drive. Make sure that the drive functions correctly. For information about drive connection and wiring, refer to the manuals for the drive on which you will use this option.



A - Drive grounding terminal (FE)
B - Option
C - Included screws
D - Drive front cover
E - Keypad
F - LED label
G - Ground wire
H - Option modular connector CN1
I - Insertion point for CN5 connector
J - Connector CN5

Figure 5.8 Drive Components with Option

Install the Option

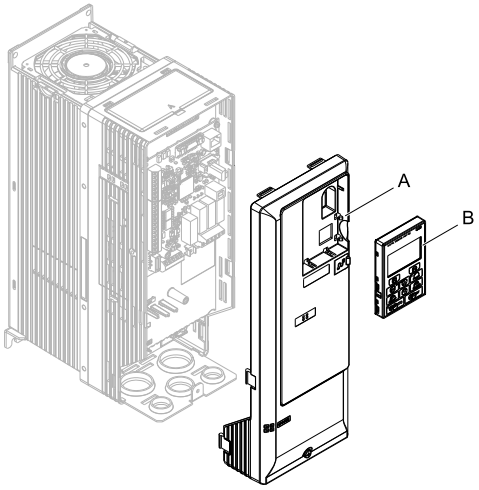
Use this procedure to install the option.

⚠ DANGER *Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

1. Remove the keypad (B) and front cover (A).

   Shut off power to the drive and wait for the time specified on the drive warning label at a minimum. Make sure that the charge indicator LED is unlit, then remove the keypad and front cover. Refer to the drive manuals for more information.

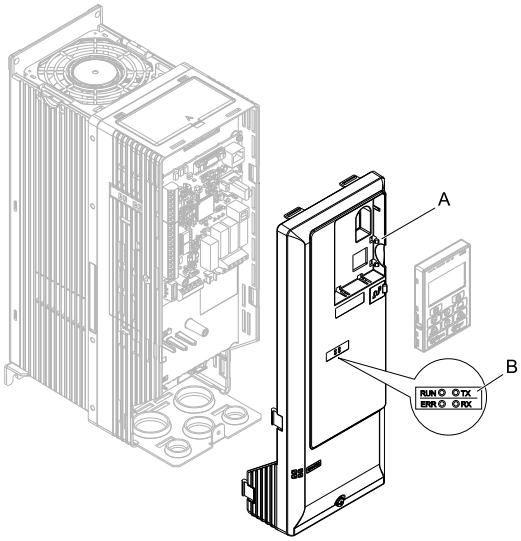
   NOTICE *Damage to Equipment. When you touch the option, make sure that you observe correct electrostatic discharge (ESD) procedures. If you do not follow procedures, it can cause ESD damage to the drive circuitry.*



A - Drive front cover **B - Keypad**

Figure 5.9 Remove the Front Cover and Keypad

2. Put the LED label (B) in the correct position on the drive front cover (A).



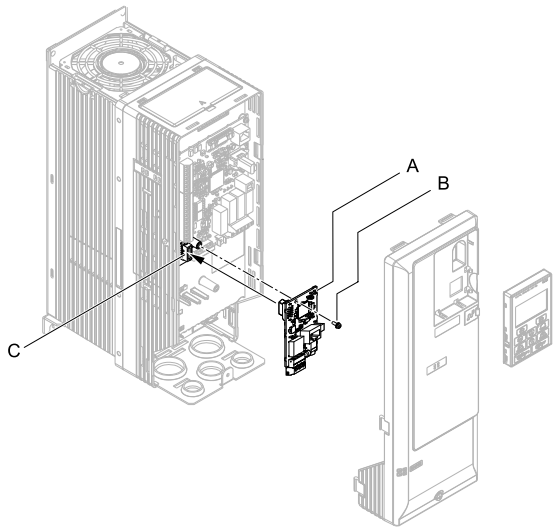
A - Drive front cover **B - LED label**

Figure 5.10 Put the LED Label on the Drive Front Cover

3. Install the option (A) into the CN5 connector (C) on the drive and use one of the included screws (B) to put it in place.

Note:

The drive has only two ground terminals. When you install three options to the drive, connect two ground wires to share one drive ground terminal.



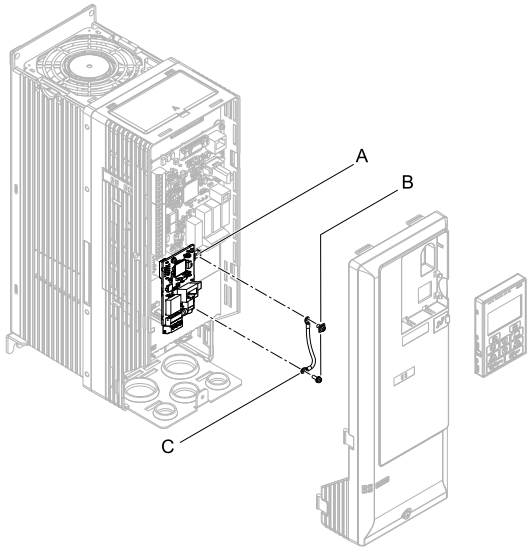
A - Option
B - Included screw
C - Connector CN5

Figure 5.11 Install the Option

4. Use one of the remaining included screws (B) to connect one end of the ground wire (C) to the ground terminal (A). Use the last remaining included screw (B) to connect the other end of the ground wire (C) to the remaining ground terminal and installation hole on the option (A).

   Tighten the screws to a correct tightening torque:

   • 0.5 to 0.6 N•m (4.4 to 5.3 in•lb)



A - Drive grounding terminal (FE)
B - Included screws
C - Ground Wire

Figure 5.12 Connect the Ground Wire

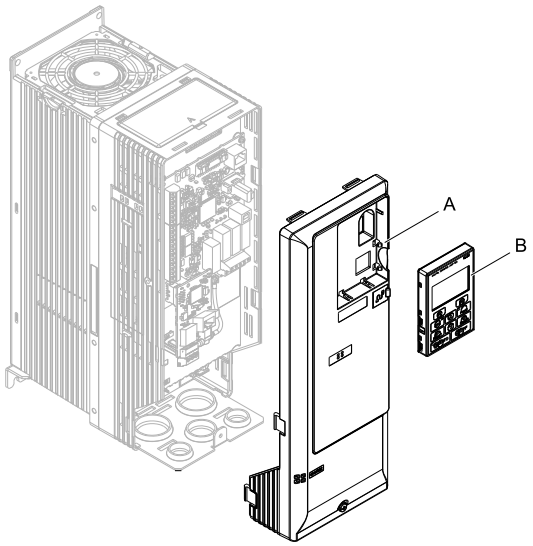
5. Firmly connect the LonWorks communication cable to terminal block (CN1).

   Isolate communication cables from main circuit wiring and other electrical and power lines. Make sure that you firmly connect the cable end. (Refer to Figure 5.28). Refer to *Communication Cable Topology on page 28* for more information.

6. Reattach the drive front cover (A) and the keypad (B).

   Refer to the drive manuals for more information.

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



A - Drive front cover **B - Keypad**

Figure 5.13 Replace the Front Cover and Keypad

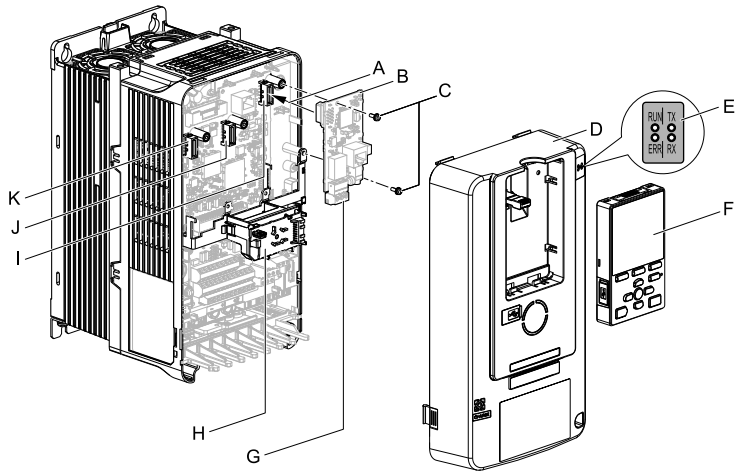
7. Set drive parameters in *Related Drive Parameters on page 29* for correct option performance.

■ Procedure C

This section shows the procedure to install and wire the option on a GA700 or GA800 drive.

Prepare the Drive for the Option

Correctly wire the drive as specified by the manual packaged with the drive. Make sure that the drive functions correctly. For information about drive connection and wiring, refer to the manuals for the drive on which you will use this option.



A - Insertion point for CN5 connector
B - Option
C - Included screws
D - Drive front cover
E - LED label
F - Keypad
G - Terminal Block
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.)

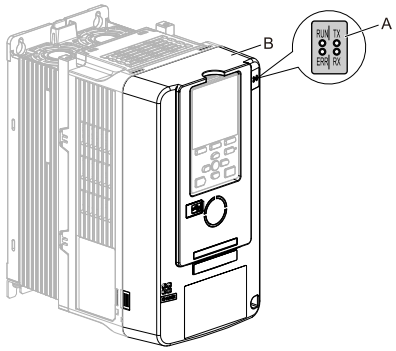
Figure 5.14 Drive Components with Option

Install the Option

Use this procedure to install the option.

⚠ DANGER *Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

1. Put the LED label (A) in the correct position on the drive front cover (B).



A - LED label **B - Drive front cover**

Figure 5.15 Put the LED Label on the Drive Front Cover

2. Remove the keypad (E) and front cover (D).

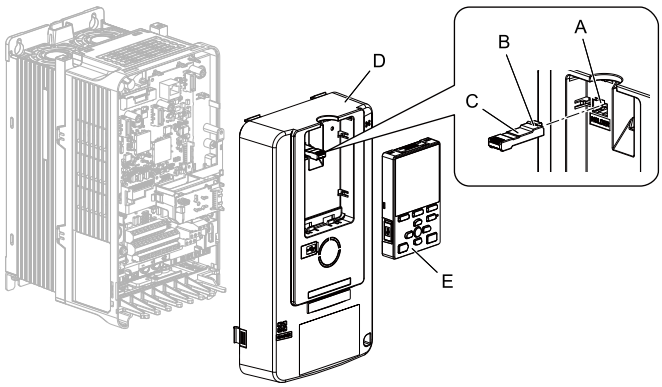
   Shut off power to the drive and wait for the time specified on the drive warning label at a minimum. Make sure that the charge indicator LED is unlit, then remove the keypad and front cover. Refer to the drive manuals for more information.

   You can only install this option into the CN5-A connector on the drive control board.

   NOTICE *Damage to Equipment. When you touch the option, make sure that you observe correct electrostatic discharge (ESD) procedures. If you do not follow procedures, it can cause ESD damage to the drive circuitry.*

Note:

1. Remove the keypad, then move the keypad connector to the holder on the drive, then remove the front cover.
2. Put the keypad connector tab into the holder when you install the keypad connector to the holder.



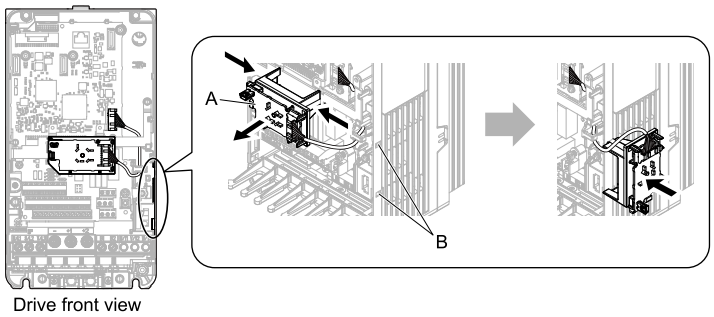
A - Holder
B - Keypad connector tab
C - Keypad connector
D - Drive front cover
E - Keypad

Figure 5.16 Remove the Front Cover and Keypad

3. Carefully remove the LED Status Ring board (A) and put it in the temporary placement holes (B) on the right side of the drive.

   Refer to the drive manuals for more information.

   NOTICE *Do not remove the LED Status Ring board cable connector. If you disconnect the LED Status Ring board, it can cause incorrect operation and damage to the drive.*



A - LED Status Ring board **B - Temporary placement holes**

Figure 5.17 Remove the LED Status Ring Board

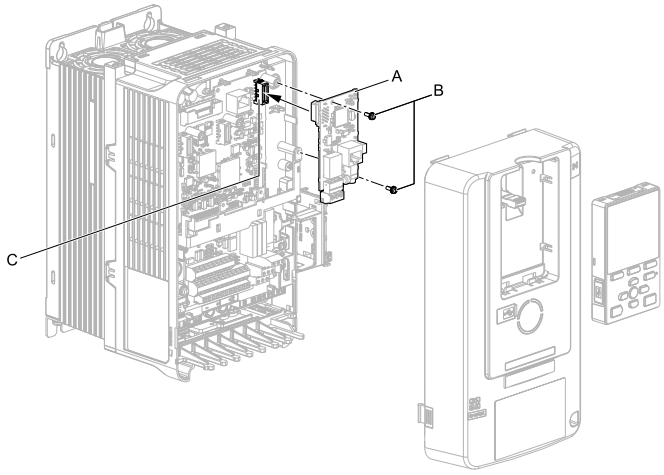
4. Install the option (A) into the CN5-A connector (C) on the drive and use the included screws (B) to put it in place.

   Tighten the screws to a correct tightening torque:

   - 0.5 to 0.6 N•m (4.4 to 5.3 in•lb)

Note:

1. A ground wire is not necessary. Do not use the ground wire.
2. Only two screws are necessary to install the option on a GA700 and GA800 drive.



A - Option **C - Connector CN5-A**
B - Included screws

Figure 5.18 Install the Option

5. Firmly connect the LonWorks communication cable to terminal block (CN1).

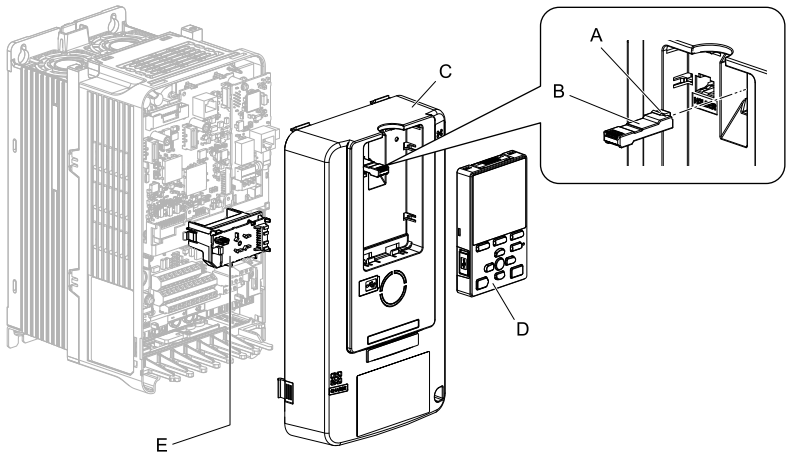
   Isolate communication cables from main circuit wiring and other electrical and power lines. Make sure that you firmly connect the cable end. (Refer to Figure 5.28). Refer to *Communication Cable Topology on page 28* for more information.

6. Reattach the LED Status Ring board (E). front cover (C), and keypad (D).

   Refer to the drive manuals for more information.

   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.*

Note:
Replace the keypad connector then install the keypad.



A - Keypad connector tab
B - Keypad connector
C - Drive front cover
D - Keypad
E - LED Status Ring board

Figure 5.19 Install the LED Status Ring board, Front Cover, and Keypad

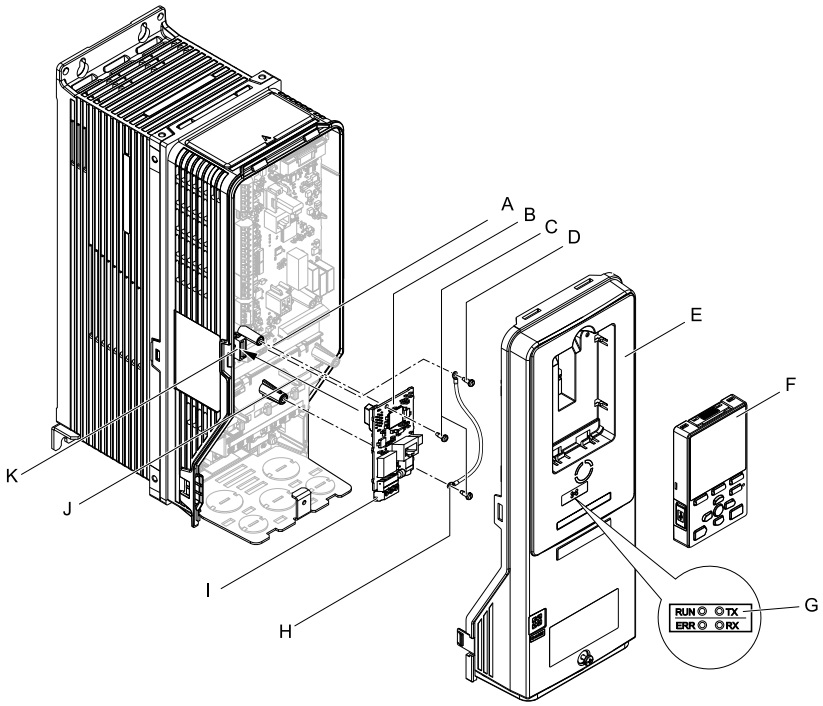
7. Set drive parameters in *Related Drive Parameters on page 29* for correct option performance.

■ Procedure D

This section shows the procedure to install and wire the option on an HV600 or FP605 drive.

Prepare the Drive for the Option

Correctly wire the drive as specified by the manual packaged with the drive. Make sure that the drive functions correctly. For information about drive connection and wiring, refer to the manuals for the drive on which you will use this option.



A - Drive grounding terminal (FE)
B - Option
C - Included screws
D - Ground screw
E - Drive front cover
F - Keypad
G - LED label
H - Ground wire
I - Option modular connector CN1
J - Insertion point for connector (HV600: CN5, FP605: CN5-A)
K - Connector (HV600: CN5, FP605: CN5-A)

Figure 5.20 Drive Components with Option

Install the Option

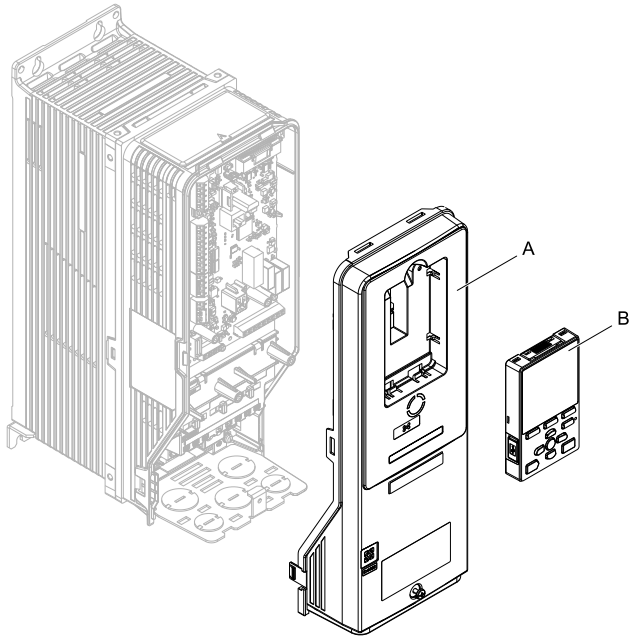
Use this procedure to install the option.

⚠ DANGER *Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

1. Remove the keypad (B) and front cover (A).

   Shut off power to the drive and wait for the time specified on the drive warning label at a minimum. Make sure that the charge indicator LED is unlit, then remove the keypad and front cover. Refer to the drive manuals for more information.

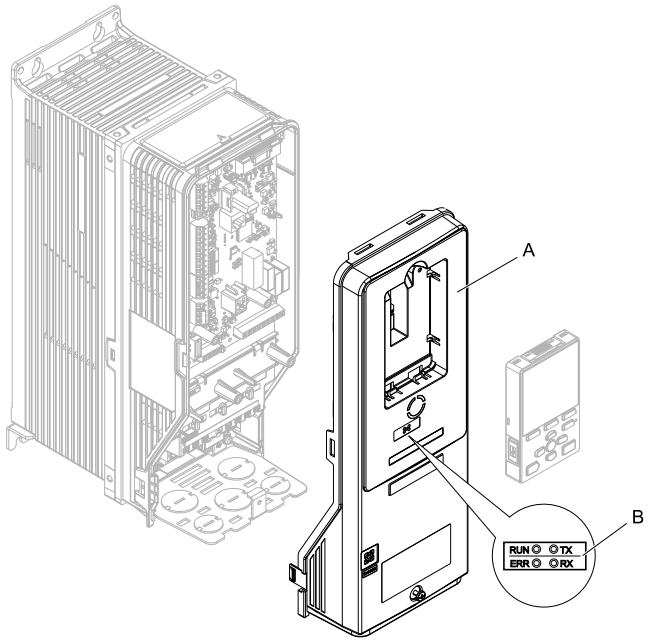
   NOTICE *Damage to Equipment. When you touch the option, make sure that you observe correct electrostatic discharge (ESD) procedures. If you do not follow procedures, it can cause ESD damage to the drive circuitry.*



A - Drive front cover **B - Keypad**

Figure 5.21 Remove the Front Cover and Keypad

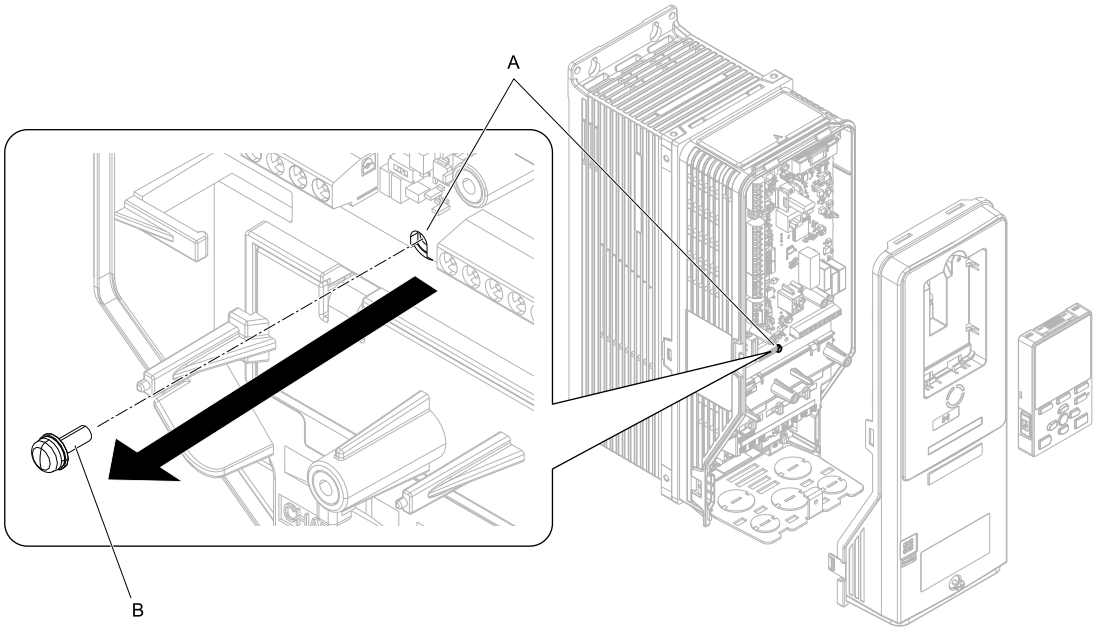
2. Put the LED label (B) in the correct position on the drive front cover (A).



A - Drive front cover **B - LED label**

Figure 5.22 Put the LED Label on the Drive Front Cover

3. Remove the screw (B) installed in the drive grounding terminal (A).

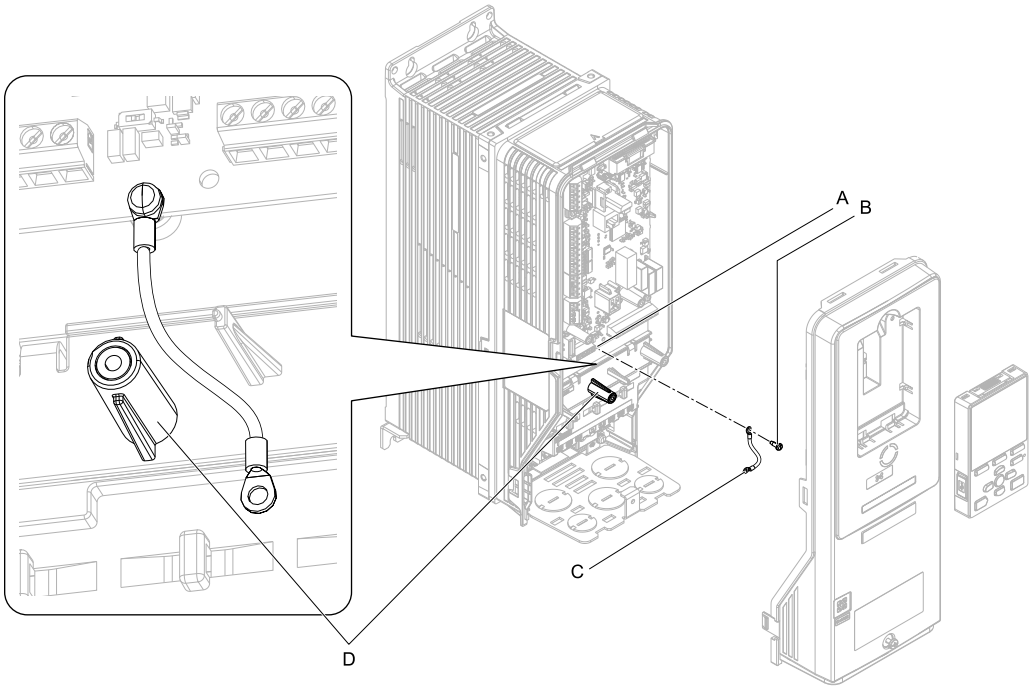


A - Drive grounding terminal (FE) **B - Ground screw**

Figure 5.23 Remove the Screw from the Drive Grounding Terminal

4. Use the screw (B) installed in the FE ground terminal of the drive (A) to connect one end of the included ground wire (C) to the ground terminal on the drive.
   Tighten the screw to a correct tightening torque:
   - 0.5 N·m to 0.6 N·m (4.4 in·lb to 5.3 in·lb)

Note:
Route ground wire on the right side of the stud (D).

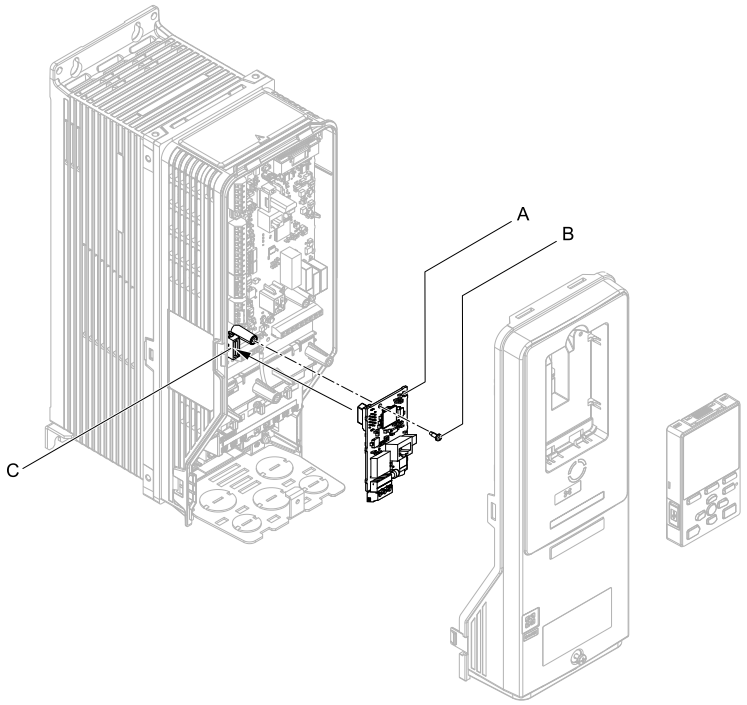


A - Drive grounding terminal (FE) **C - Ground wire**
B - Ground screw **D - Stud**

Figure 5.24 Connect the Ground Wire

5. Install the option (A) into the connector (C) (HV600: CN5, FP605: CN5-A) on the drive and use the included screws (B) to put it in place.
   Tighten the screw to a correct tightening torque:
   - 0.5 N·m to 0.6 N·m (4.4 in·lb to 5.3 in·lb)

Note:
Only two screws are necessary to install the option on HV600 and FP605 drives.

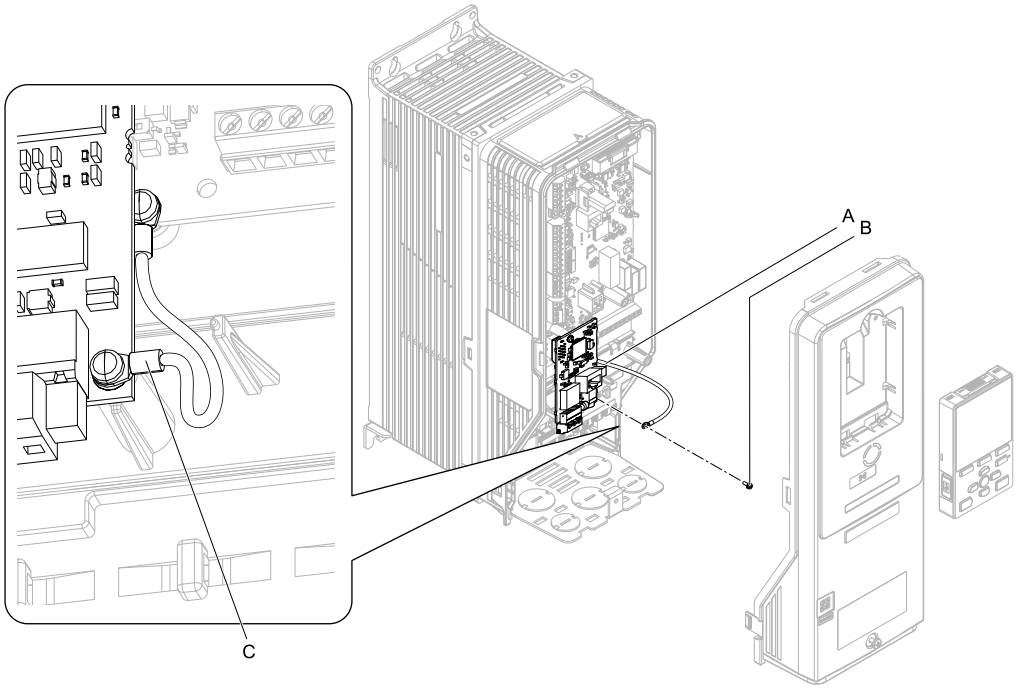


A - Option
B - Included screw
C - Connector CN5

Figure 5.25 Install the Option

6. Use one of the remaining included screws (B) to connect the ground wire (A) to the ground terminal and installation hole on the option.
   Tighten the screw to a correct tightening torque:
   - 0.5 N·m to 0.6 N·m (4.4 in·lb to 5.3 in·lb)

Note:
Wire the ground wire as specified by Figure 5.26.



A - Ground wire
B - Included screw
C - Crimp terminal

Figure 5.26 Connect the Ground Wire

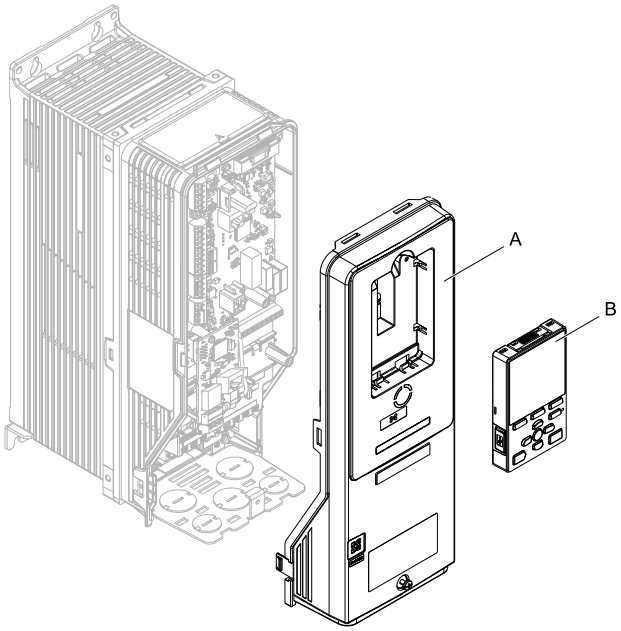
7. Firmly connect the LonWorks communication cable to terminal block (CN1).

   Isolate communication cables from main circuit wiring and other electrical and power lines. Make sure that you firmly connect the cable end. (Refer to Figure 5.28). Refer to *Communication Cable Topology on page 28* for more information.

8. Reattach the drive front cover (A) and the keypad (B).

   Refer to the drive manuals for more information.

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



A - Drive front cover **B - Keypad**

Figure 5.27 Replace the Front Cover and Keypad

9. Set drive parameters in *Related Drive Parameters on page 29* for correct option performance.

◆ Option Connection Diagram

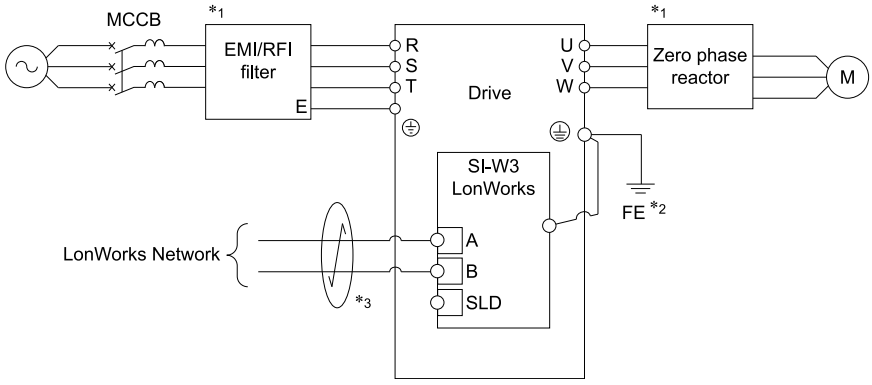


Figure 5.28 Option Connection Diagram

*1 If there is electrical interference 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 27* for more information.

*2 Connect the included ground wire for installations on 1000-series, HV600, and FP605 drives.

The ground wire is not necessary for installation on GA700 or GA800 drives.

*3 Do not connect the shield line directly to the SLD terminal or the drive ground terminal. Failure to obey can cause electrical interference.

◆ Electrical Interference Countermeasures

If there is electrical interference in the communication signals, install an EMI/RFI filter to the input lines and a zero-phase reactor to the output lines.

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

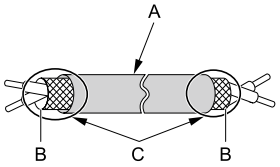
Filter Install Location	Filter Type	Series/Part Number
Main circuit (input)	Noise filter	LNFD series
Main circuit (output to motor)	Zero-Phase Reactor	F6054GB, F11080GB, F200160PB

◆ Communication Cable Topology

Use only a dedicated LonWorks communication cable.

Route the option wiring as specified by these procedures.

1. Prepare the communication cables as shown in Figure 5.29.



A - Sheath
B - Shield
C - Use electrical tape or shrink tubing to insulate the cable.

Figure 5.29 Prepare Ends of Shielded Cable

2. Connect the communication cables to the terminal block as shown in Figure 5.30.

   Make sure that the terminal block CN1 is firmly fixed when you connect the terminal block CN1 to the circuit board.

   Tighten the screws to a correct tightening torque:

   • 0.22 to 0.25 N•m (0.0 to 0.0 in•lb)

3. Make sure that you correctly connect the wires and that you did not accidentally pinch wire insulation in the terminals.

   Trim any frayed wires.

⚠ WARNING *Fire Hazard. Tighten all terminal screws to the correct tightening torque. Connections that are too loose or too tight can cause incorrect operation and damage to the drive. Incorrect connections can also cause death or serious injury from fire.*

NOTICE *Do not let wire shields touch other signal lines or equipment. Insulate the wire shields with electrical tape or shrink tubing. If you do not insulate the wire shields, it can cause a short circuit and damage the drive.*

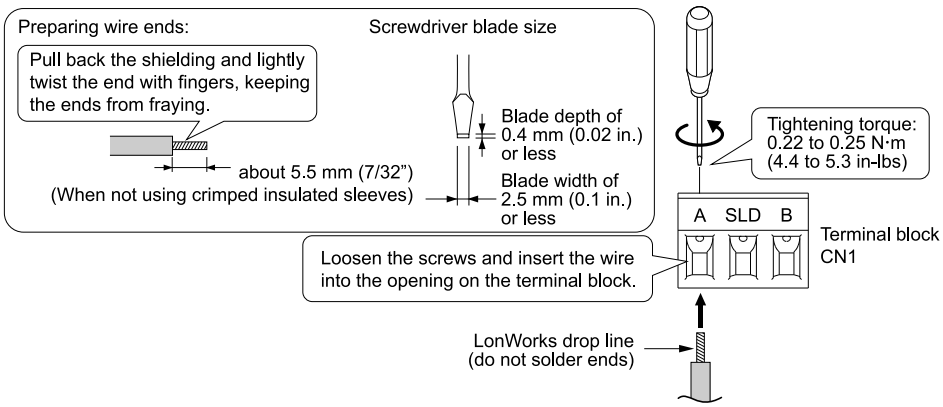


Figure 5.30 Prepare and Connect Communication Cable Wiring

◆ Termination Resistor Connection

You must terminate a free topology segment. You can terminate the segment anywhere.

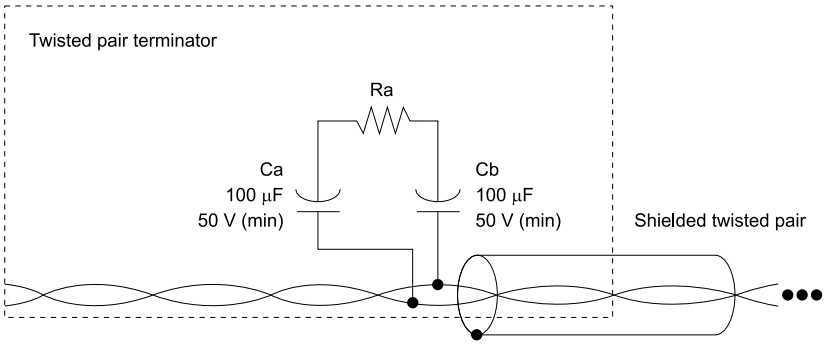


Figure 5.31 RC Network (Ra = 52.3 Ω ±1%, 1/8W)

◆ XIF Files, Resource Files

XIF files and dedicated resource files for the option are not packaged with the option.

Contact Yaskawa or your nearest sales representative. You can download drive manuals from the Yaskawa product and technical information website shown on the back cover of this manual.

6 Related Drive Parameters

These parameters set the drive for operation with the option. Confirm correct parameter settings in this table before you start network communications.

Note:

Hex.: MEMOBUS addresses that you can use to change parameters over network communication are represented in hexadecimal numbers.

No. (Hex.)	Name	Description	Default (Range)
b1-01 (0180)	Frequency Reference Selection 1	Selects the input method for frequency reference. 0 : Keypad 1 : Analog Input 2 : Memobus/Modbus Communications 3 : Option PCB 4 : Pulse Train Input **Note:** • Set *b1-02 = 3 [Run Command Selection 1 = Option PCB]* to use the master device and serial communications to start and stop the drive. Set *b1-01 = 3* to use the master device to control the frequency reference of the drive. • The default setting is different for different drives. Refer to the instruction manual of your specific drive for more information.	1 (0 - 4)
b1-02 (0181)	Run Command Selection 1	Selects the input method for the Run command. 0 : Keypad 1 : Digital Input 2 : Memobus/Modbus Communications 3 : Option PCB 7 : AUTO Command + Term Run 8 : AUTO Command + Serial Run 9 : AUTO Command + Option Run **Note:** • Set *b1-02 = 3* to start and stop the drive with the master device using serial communications. Set *b1-01 = 3 [Frequency Reference Selection 1 = Option PCB]* to use the master device to control the frequency reference of the drive. • Settings *7* to *9* are available in HV600 software versions PRG: 1011 and later.	1 (0 - 9)
F6-01 (03A2)	Communication Error Selection	Selects drive response when the drive detects a *bUS [Option Communication Error]* error during communications with the option. 0 : Ramp to Stop 1 : Coast to Stop 2 : Fast Stop (Use C1-09) 3 : Alarm Only 4 : Alarm - Run at d1-04 5 : Alarm - Ramp Stop **Note:** • When you set this parameter to *3* or *4*, the drive will continue operation after it detects a fault. Separately prepare safety protection equipment and systems, for example fast-stop switches. • Refer to the drive manual to know if settings *4* and *5* are available. Settings 4 and 5 are available in A1000 software versions PRG: 1021 and later.	1 (0 - 5)

No. (Hex.)	Name	Description	Default (Range)
		• The setting range for 1000-Series drives is different for different software versions. Refer to the Peripheral Devices & Options section of the drive instruction manual for more information.	
F6-02 (03A3)	Comm External Fault (EF0) Detect	Selects the conditions at which *EF0 [Option Card External Fault]* is detected. 0 : Always Detected 1 : Detected during RUN Only	0 (0, 1)
F6-03 (03A4)	Comm External Fault (EF0) Select	Selects the operation of the drive when *EF0 [Option Card External Fault]* is detected. 0 : Ramp to Stop 1 : Coast to Stop 2 : Fast Stop (Use C1-09) 3 : Alarm Only **Note:** When you set this parameter to *3*, the drive will continue operation after it detects a fault. Separately prepare safety protection equipment and systems, for example fast stop switches.	1 (0 - 3)
F6-06 (03A7)	Torque Reference/Limit by Comm	Sets the function that enables and disables the torque reference and torque limit received from the communication option. 0 : Disabled 1 : Enabled **Note:** • Control method availability of this parameter is different for different product series. –1000-Series Parameter is available in *A1-02 = 3, 6, 7 [Control Method Selection = Closed Loop Vector, PM Advanced Open Loop Vector, PM Closed Loop Vector]*. When you enable this parameter, *d5-01 [Torque Control Selection]* sets the drive to read the value as the Torque Limit value or the Torque Reference value. *d5-01 = 0*: Torque Limit *d5-01 = 1*: Torque Reference When *A1-02 = 6 [Control Method Selection = PM Advanced Open Loop Vector]*, the drive reads this value as the Torque Limit. –GA700, GA800 Parameter is available in *A1-02 = 2, 3, 4, 6, 7, 8 [Control Method Selection = Open Loop Vector, Closed Loop Vector, Advanced Open Loop Vector, PM Advanced Open Loop Vector, PM Closed Loop Vector, EZ Vector Control]*. When you enable this parameter, *d5-01 [Torque Control Selection]* sets the drive to read the value as the Torque Limit value or the Torque Reference value. *d5-01 = 0*: Torque Limit *d5-01 = 1*: Torque Reference When *A1-02 = 2, 8 [Control Method Selection = Open Loop Vector, EZ Vector Control]*, the drive reads this value as the Torque Limit. –HV600, FP605 Parameter is available in *A1-02 = 8 [Control Method Selection = EZ Vector Control]*. When *A1-02 = 8 [Method Selection = EZ Vector Control]*, the drive reads this value as the Torque Limit. • If the PLC does not supply a torque reference or torque limit when *F6-06 = 1 [Torque Reference/Limit by Comm = Enabled]*, the motor cannot rotate.	0 (0, 1)
F6-07 (03A8)	Multi-Step Ref @ NetRef/ ComRef	0 : MultiStep References Disabled 1 : MultiStep References Enabled	0 (0, 1)
F6-08 (036A)	Comm Parameter Reset @Initialize	Selects whether communication-related parameters *F6-xx and F7-xx* are set back to original default values when you use parameter *A1-03 [Initialize Parameters]* to initialize the drive. 0 : No Reset - Parameters Retained 1 : Reset - Back to Factory Default **Note:** When you set *F6-08* to *1* and you then use *A1-03* to initialize the drive, the drive will not change this setting value.	0 (0, 1)

7 Basic Operation

◆ Run Command and Frequency Reference Selection

The keypad, external terminals, or network communication send Run commands and frequency references to the drive. Only one method is active at a time.

Drive parameter settings determine the enabled method.

The default drive parameter settings use external terminals for Run commands and frequency references.

■ Selecting the Reference

Selecting by Drive Parameters

Change *b1-01 [Frequency Reference Selection 1]*, and *b1-02 [Run Command Selection 1]* as shown below to select the Run command and frequency reference.

Parameter	Operator	External Terminals	MEMOBUS	LonWorks (Option)
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)

Set the nciOpMode variable from 0 to 3 (default: 0) to select the Run command and frequency reference. Parameter settings do not have an effect.

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

Selecting from the Network (2)

Use the nviWriteParam and nviWriteParamVal variables to change *b1-01* and *b1-02* to select the Run command and frequency reference.

To change the frequency reference from external terminals to communications:

1. Set 0180 (Hex.) (the *b1-01* register number) for nviWriteParam.
2. Set 3 (reference Option PCB) for nviWriteParamVal.
3. When you change the setting correctly, it will set 3 (the data written in step 2 above).
4. If you cannot change the stetting correctly, it will set an error code in nvoErrCode.

Selecting from Control Circuit Terminals (S1 to S8)

Note:

This function is not available with HV600.

Drive control circuit terminals S1 to S8 set the Run command and frequency reference selections.

1. Set *b1-01 [Frequency Reference Selection 1]* to *0 [Keypad]* or *1 [Analog Input]*.
2. Set *b1-02 [Run Command Selection 1]* to *0 [Keypad]* or *1 [Digital Input]*.
3. Set any of *H1-01 to H1-08 [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 (Determined by b1-01 and b1-02.)
ON	Option (SI-W3) (Frequency reference and Run command from the network are enabled.)

8 Network Variables

◆ Drive and Network Variables

Figure 8.1 outlines the relationship between drive and network variables.

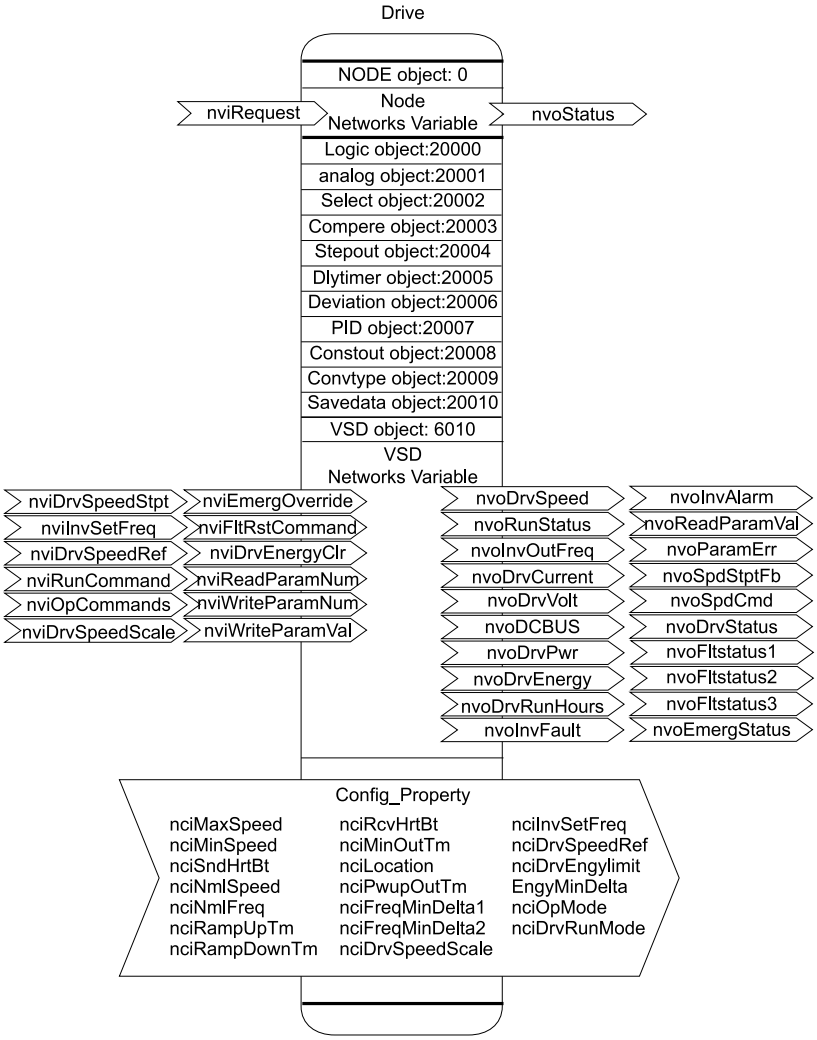


Figure 8.1 Drive and Network Variables

◆ 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]

Member Name	Description	
	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]
	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]
object_id	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

Member Name	Description		
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
Shows 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)

Member Name	Description	
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 you set 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

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

Input	SNVT_freq_hz nviInvSetFreq
Setting range	0.0 - 6,553.5 Hz (Effective range: 0.0 - 400.0 Hz *1)
Default	nciInvSetFreq set value The maximum output frequency and the upper limit frequency set in the drive limit the frequency reference values. Frequency reference = nviInvSetFreq (Hz)
Related network variables, configuration properties	nciRcvHrtBt

*1 Effective range is 0.0 - 240.0 Hz for Z1000.

This network variable sets drive frequency reference values in Hz.

Note:

When you set values greater than the maximum output frequency and less than 400 Hz *Drive Frequency Reference (Hz) (Drive Frequency Reference) on page 35*, operation is executed at the maximum output frequency. Values greater than 400 Hz *Drive Frequency Reference (Hz) (Drive Frequency Reference) on page 35* are not set in the drive.

*1 When you use Z1000, set values greater than the maximum output frequency and less than 240 Hz.

After you turn ON the power, "*CALL*" is shown on the operator until it receives data.

When you set a receive heartbeat time, if no data is received in that time period, a communications error is generated and "*bUS*" is shown on the operator.

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

Input	SNVT_lev_percent nviDrvSpeedRef
Setting range	-163.840 - 163.835% (Effective range: 0.0 - 400.0 Hz *1)
Default	nciDrvspeedRef set value Speed reference value = nviDrvSpeedRef (%) × nviDrvSpeedScale (%) × nciNmlFreq (Hz)
Related network variables, configuration properties	nciRcvHrtBt

*1 Effective range is 0.0 - 240.0 Hz for Z1000.

This network variable sets drive speed reference values in percentages.

Note:

When you set 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.

*1 When you use Z1000, set values greater than the maximum output frequency and less than 240 Hz.

After you turn ON the power, "*CALL*" is shown on the operator until it receives data.

When you set a receive heartbeat time, if no data is received in that time period, a communications error is generated and "*bUS*" is shown on the operator.

■ Drive Run Reference (Drive Run Reference)

Input	SNVT_switch nviRunCommand
Default	state = FF; value = 0 Speed reference value = nviDrvSpeedRef (%) × nviDrvSpeedScale (%) × nciNmlFreq (Hz)
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

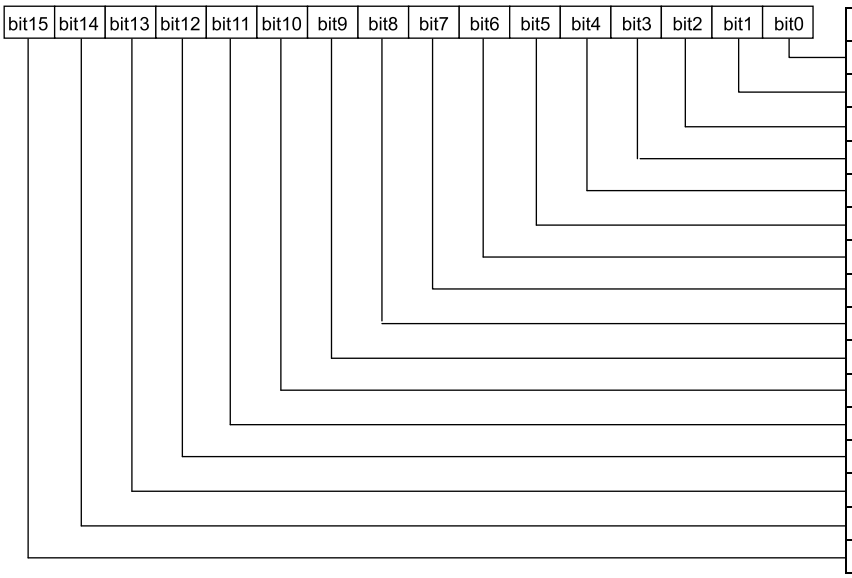
After you turn ON the power, "*CALL*" is shown on the operator until it receives data.

When you set a receive heartbeat time, if no data is received in that time period, a communications error is generated and "*bUS*" is shown on the operator.

■ Drive Operation Commands (Drive Control Commands)

Input	SNVT_state nviOpCommands
Default	0000 0000 0000 0000

These network variables control operations, for example 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% - 163.830% (0.005%) 163.835% is taken as 100%. Frequency reference = nviDrvSpeedStpt (or nviDrvspeedfref) × nviDrvSpeedScale × nciNmlfreq
Default	nciDrvSpeedScale set value
Related network variables, configuration properties	nciRcvHrtBt

This network variable adjusts the motor rotation direction and speed.

■ Drive Emergency (Drive Emergency Stop)

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

This network variable does drive emergency stops from the network. When the drive does an emergency stop, EF0 is shown on 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 does 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 (FF (Hex.)),0,1
Default	value ••• 0, state ••• -1 (FF (Hex.)) Accumulated power values are cleared in state1, and not in 0 or -1 (FF (Hex.)).
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 - FFFF (Hex.)
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 in 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
Setting 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 you can only use them 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)
- Network Variable
  Do not execute binding for these network variables.
  - 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% - 163.830% (0.005%)
Service type	Default: Authentication type

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

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

■ Drive Run Status (Drive Run Monitoring)

Output	SNVT_switch nvoRunStatus
Default	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 you set a send heartbeat time, the data is output in 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 you set a send heartbeat time, the data is output in that time period.
nciMinOutTm	When you set a minimum output refresh time, data that is changed during the specified time period is not output until that time period is expired.
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 you set a send heartbeat time, the data is output in that time period.
nciMinOutTm	When you set a minimum output refresh time, data that is changed during the specified time period is not output until that time period is expired.

■ 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 you set a send heartbeat time, the data is output in that time period.
ciMinOutTm	When you set a minimum output refresh time, data that is changed during the specified time period is not output until that time period is expired.

■ 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 you set a send heartbeat time, the data is output in that time period.
nciMinOutTm	When you set a minimum output refresh time, data that is changed during the specified time period is not output until that time period is expired.

■ Drive Output Power (Output Power Monitoring)

Output	network output SNVT_power_kilo nvoDrvPwr
Data range	0 - 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 you set a send heartbeat time, the data is output in that time period.
nciMinOutTm	When you set a minimum output refresh time, data that is changed during the specified time period is not output until that time period is expired.

■ 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 - 429496729.4 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 you set a send heartbeat time, the data is output in that time period.
nciMinOutTm	When you set a minimum output refresh time, data that is changed during the specified time period is not output until that time period is expired.
nciEngyMinDelta	Output when changed outside of fixed change range.

Note:

Do not use this monitoring for accounting systems because it calculates 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) **Note:** 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 changes 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)

Input	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)

Input	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 8.1 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 *Uv [Undervoltage]* error • An attempt was made to change a constant during a *Uv [Undervoltage]* alarm.

Error Code	Explanation
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 (for example, external terminals, keypad, or communications).

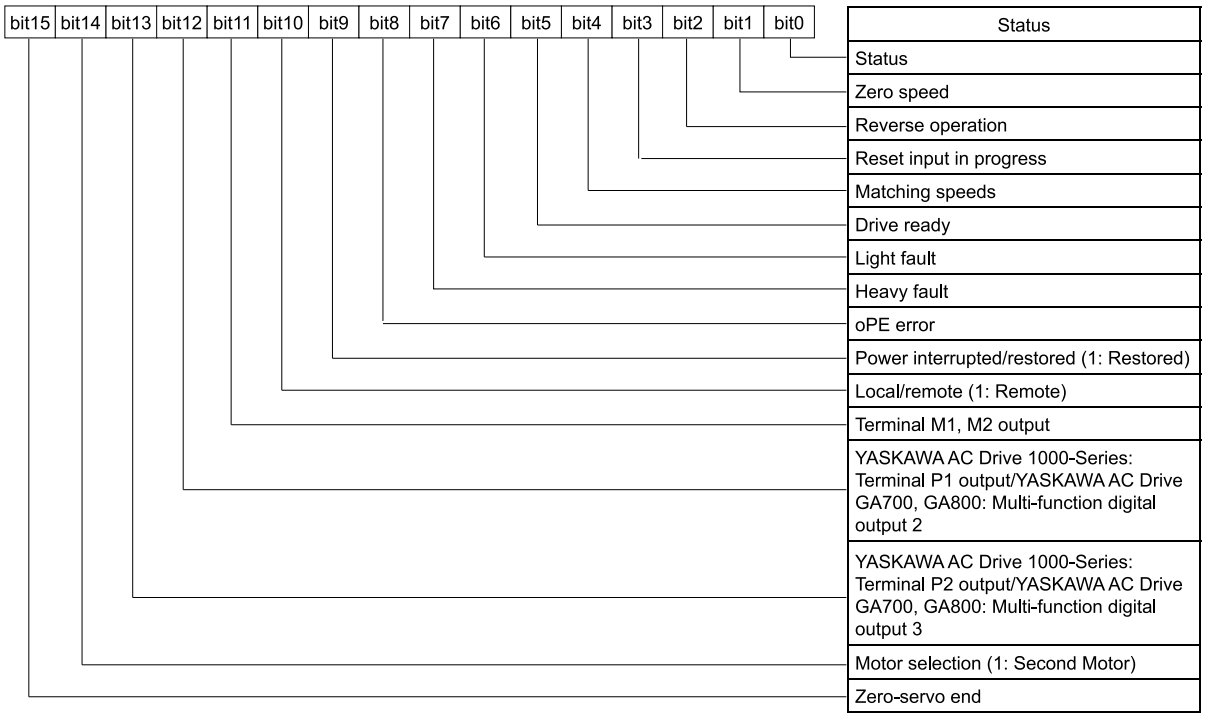
Criteria is nciNmlFreq.

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.

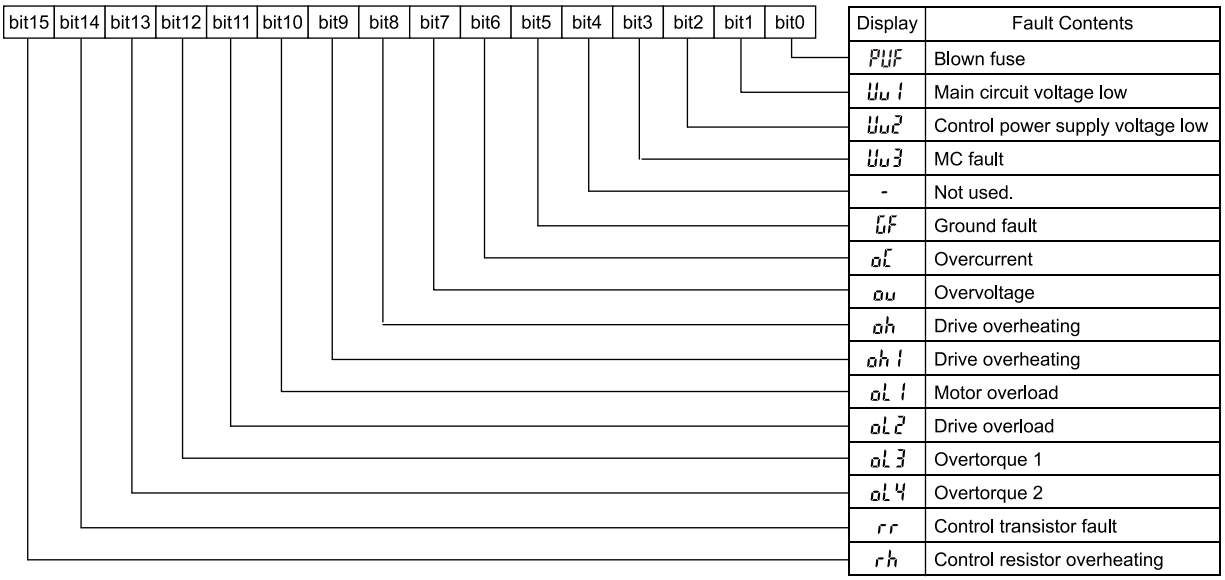


Output Timing	Explanation
Event driven	Sent when status is changed.

■ 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.

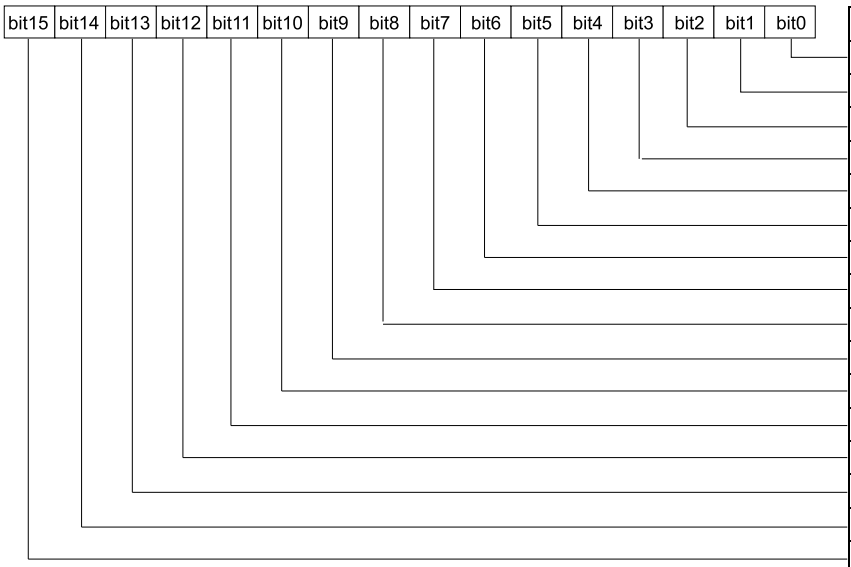


Output Timing	Description
Event driven	Sent when any of the above faults occur.

■ 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.



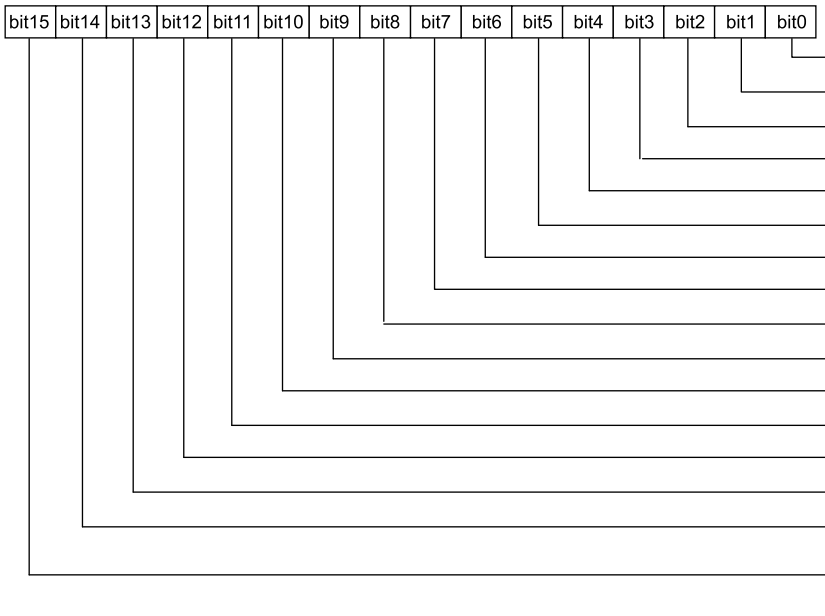
Display	Fault Contents
EF3	External fault 3
EF4	External fault 4
EF5	External fault 5
EF6	External fault 6
EF7	External fault 7
-	Not used.
-	Not used.
oS	Overspeed
dEv	Excessive speed deviation
PGo	PG disconnection
PF	Input phase failure
LF	Output phase failure
oh3	Motor overheating 1
oPr	Operator not 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
cvE	Zero-server fault
EF0	External fault
FbL	PID feedback loss
UL3	Undertorque detection 1
UL4	Undertorque detection 2
oL7	Overload during HSB
-	Not used.
-	Not used.
-	Not used.
-	Not used.
CPF oFA	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.

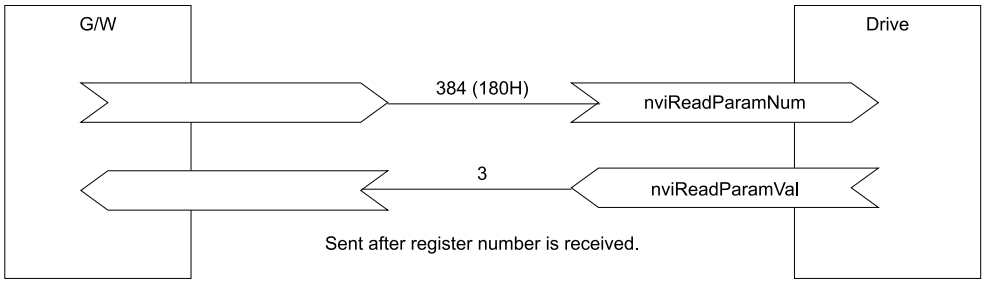
Data	Name	Explanation
0	EMERG_NORMAL	Normal
4	EMERG_SHUTDOWN	Emergency stop
FF (Default)	EMERG_NUL	-

Output Timing	Explanation
Event driven	Sent when any of the above 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 you set invalid data in nviReadParamNum because of, for example, a register number that is specified for a non-existent drive constant, it will set an error code in nvoParamErr for output.
   Refer to *Drive Parameter Error (Drive Constant Access Error) on page 42* for more information.
   - Example: Reading the Setting for *b1-01 [Frequency Reference Selection 1]*
     – *b1-01 [Frequency Reference Selection 1]*: 384 (180 (Hex.)
     – *b1-01* setting: *3 [Option PCB]*



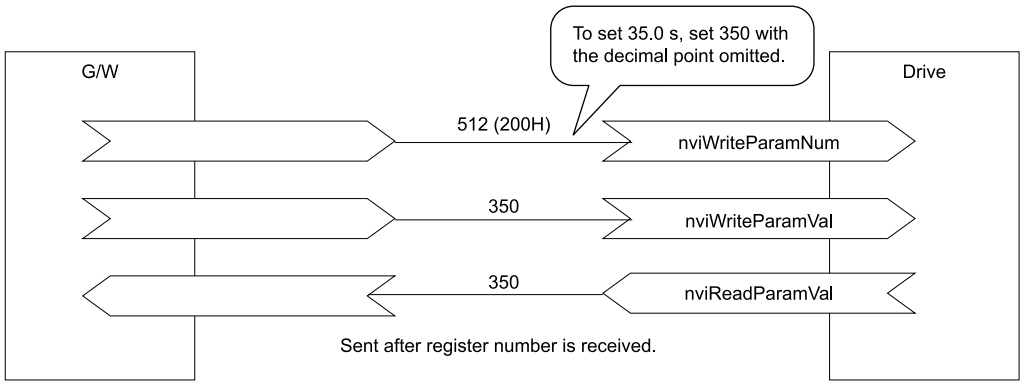
Use the MEMOBUS register number listed on the drive instructions for the drive constant.

■ Writing Drive Constants

Note:
Make sure that you 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 correct.

1. Set the register number of the drive constant that is to be changed to nviWriteParamNum in hexadecimal.
2. Enter the settings in nviWriteParamVal.
   If the nviWriteParamVal data is not received in 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 you cannot change settings because of, for example, a register number that is specified for a non-existent drive constant, it will set an error code in nvoParamErr for output.
   Refer to *Drive Parameter Error (Drive Constant Access Error) on page 42* for more information.
   - Example: Changing the *C1-01 [Acceleration Time 1]* Setting
     – *C1-01*: 512 (200 (Hex.))
     – *C1-01* setting: Changed from 10.0 s to 35.0 s.

Note:
To set 35.0 s, set 350 with the decimal point omitted.



Refer to Table 8.1 for error codes.

9 Configuration Properties

◆ Drive Related Network Configuration Properties

Table 9.1 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 - 110.000%
Default	100.000%
SCPT Reference	SCPTmaxSetpoint (50)

Set the motor frequency reference upper limit with *E1-04 [Maximum Output Frequency]* 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:

$0 \leq$ minimum speed $\leq$ maximum speed ≤ 110.000

■ Minimum Motor Speed

Network input config	SNVT_lev_percent nciMinSpeed
Setting range	0.000 - 110.000%
Default	0%
SCPT Reference	SCPTminSetpoint (53)

Set the motor frequency reference lower limit with *E1-04 [Maximum Output Frequency]* taken as 100%.

This value will be saved in drive constant *d2-02 [Frequency Reference Lower Limit]*. It will not be saved during operation.

Set the minimum speed and the maximum speed as follows:

$0 \leq$ minimum speed $\leq$ maximum speed ≤ 110.000

■ Send Heartbeat Time

Network input config	SNVT_time_sec nciSndHrtBt
Setting range	0.0 - 6,553.5 s (0.1 s) **Note:** 6,553.5 s is handled as 0 s.
Default	0 s (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 - 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 - 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 - 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 [Acceleration Time 1]*.

■ 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 [Deceleration Time 1]*.

■ 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, the drive will not detect communications error "*bUS*".
Default	0 s (Invalid)
SCPT Reference	SCPTmaxRcvTime (48)

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

■ Minimum Send Time

Network input config	SNVT_time_sec nciMinOutTm
Setting range	0.0 - 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 is expired after a change to the data.

■ Location Label

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

You can set information about the physical position of a node separately from the neuron ID (6 bytes).

■ Power Delay Timer

Network input config	SNVT_time_sec nciPwUpOutTm
Setting range	0 - 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% - 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.

■ nviInvSetFreq Default

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

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

■ nviInvSetFreq Default

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

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: When 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 - 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	1.0 kwh

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

■ Reference Selection Mode

Network input config	SNVT_count nciOpMode

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

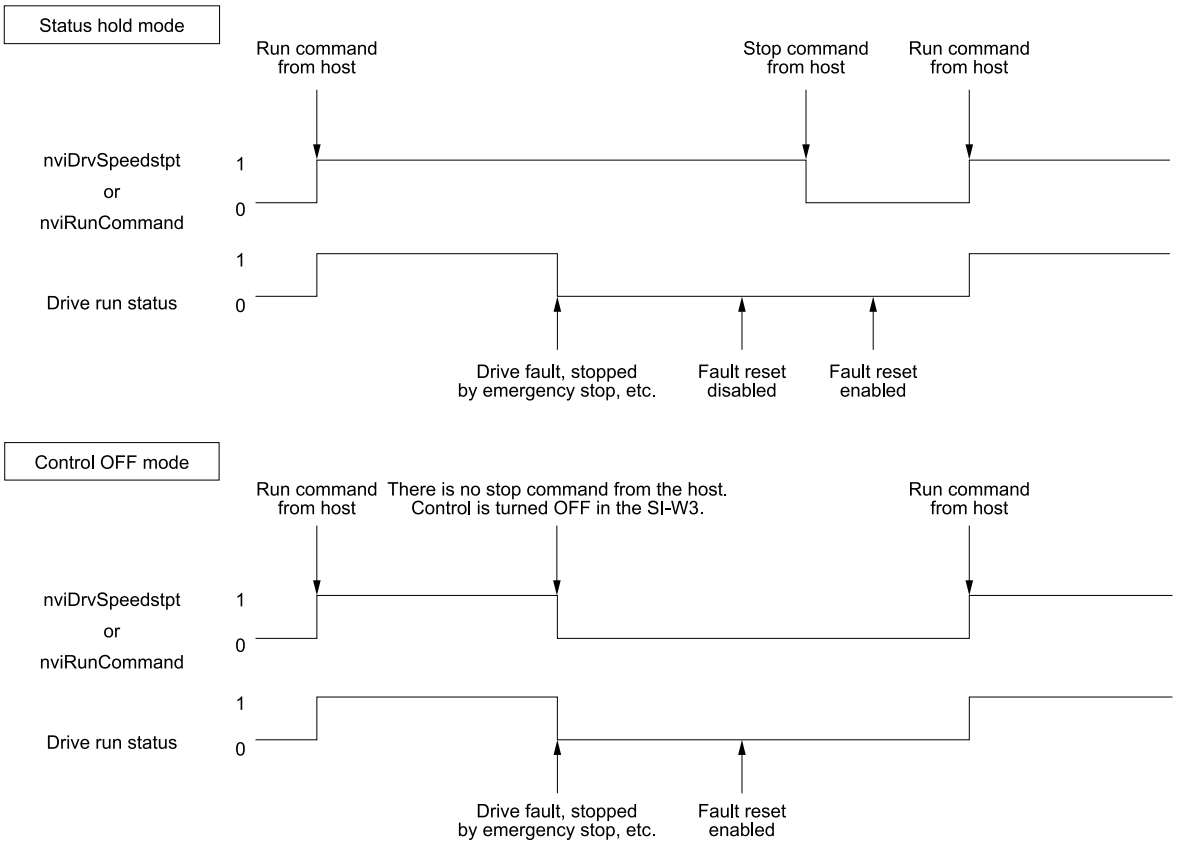
nciOpMode Set Value	0 (Default)	1	2	3
Reference selection	b1-01 set value	LonWorks	b1-01 set value	LonWorks
Operation method selection	b1-02 set value	b1-02 set value	LonWorks	LonWorks

■ 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 keypad. *Faults on page 51* lists causes of the errors and possible corrective actions. Refer to the drive Technical Manual for additional error codes that can appear on the drive keypad.

■ Faults

Both *bUS [Option Communication Error]* and *EF0 [Option Card External Fault]* can appear as a fault. When a fault occurs, the digital characters shown on the keypad does not flash but stay lit. The keypad ALM LED also stays lit. When an alarm occurs, the ALM LED flashes.

Note:

Normally, *o2-24 = 2 [LED Light Function Selection = Keypad LED Light Disable]* is set as a factory default, so the ALM LED does not light.

If communication stops while the drive is running, use these questions as a guide to help remove 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?

Code	Name	Causes	Possible Solutions
bUS	Option Communication Error	The drive did not receive a signal from the controller.	• Check for wiring errors. • Correct the wiring.
		The communications cable wiring is incorrect.	
		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	• Prevent noise in the control circuit, main circuit, and ground wiring. • If you identify a magnetic contactor 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).
		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.
EF0	Option Card External Fault	The option received an external fault from the controller.	1. Find the device that caused the external fault and remove the caus. 2. Clear the external fault input from the controller.
		A programming error occurred on the controller side.	Examine the operation of the controller program.
oFA00	Option Not Compatible with Port	The option connected to connector CN5-A is not compatible.	Connect the option to the correct connector. • Use connector CN5-A when you connect the option. To use other options, refer to those option manuals.
oFA01	Option Card Fault (CN5-A)	The option connected to option port CN5-A was changed during run.	1. De-energize the drive. 2. Connect the option to the correct option port.
oFA03, oFA04	Option Card Error (CN5-A)	A fault occurred in the option.	1. De-energize the drive. 2. Make sure that the option is correctly connected to the connector. 3. If the problem continues, replace the option.
oFA30 to oFA43	Option Card Connection Error (CN5-A)	A fault occurred in the option.	1. De-energize the drive. 2. Make sure that the option is correctly connected to the connector. 3. If the problem continues, replace the option.
oFb00	Option Not Compatible with Port	The option connected to connector CN5-B is not compatible.	Connect the option to the correct connector. • Use connector CN5-A when you connect the option. To use other options, refer to those option manuals.
oFb02	Option Fault	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.
oFC00	Option Fault (CN5-B)	The option connected to connector CN5-C is not compatible.	Connect the option to the correct connector. • Use connector CN5-A when you connect the option. To use other options, refer to those option manuals.
oFC02	Option Fault	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

Code	Name	Causes	Possible Solutions
CALL	Serial Comm Transmission Error	The communications cable wiring is incorrect.	• Examine for wiring errors. • Correct the wiring.
		An existing short circuit or communications disconnection	Examine for disconnected cables and short circuits and repair as necessary.
		Programming error on the master side	Check communications at start-up and correct programming errors.
		There is damage to the communication circuitry.	• Do a self-diagnostics check. • If the problem continues, replace either the control board or the entire drive. For instructions on how to replace the control board, contact Yaskawa or a Yaskawa representative.
CyPo	Cycle Power to Active Parameters	Comm. Option Parameter Not Upgraded	Re-energize the drive to update the communication option parameters.

◆ Option Compatibility

You can connect a maximum of 3 options at the same time depending on the type of option.

Note:
- You can only connect one option to Z1000 and HV600 drives. Connect the option to the CN5 connector.
- You can connect two options to an FP605 drive. Connect the communication option to the CN5-A connector.
- Compatible communication options are different for different models. Refer to the drive manuals for more information.

Table 10.1 Option Compatibility

Option	Connector	Number of Options Possible
PG-B3 *1*, PG-X3 *1*	CN5-B, C	2 *2*
PG-RT3 *1 *3 *4*, PG-F3 *1 *3 *4*	CN5-C	1
DO-A3 *5*, AO-A3 *5*	CN5-A, B, and C	1
SI-C3, SI-N3, SI-P3, SI-S3, SI-T3, SI-ET3, SI-ES3, SI-B3, SI-M3, SI-W3 *4*, SI-EM3 *4*, SI-EN3 *4*, SI-EP3, JOHB-SMP3, AI-A3 *5 *6*, DI-A3 *5 *6*	CN5-A	1

*1 Not available for GA500, HV600, or FP605 drives.
*2 To connect two PG options, use the CN5-C and CN5-B connectors. To connect only one PG option, use the CN5-C connector.
*3 If you use the motor switching function, you cannot use this option.
*4 Not available for 1000-Series drive models with capacities between 450 and 630 kW (650 to 1000 HP).
*5 Not available for GA500 or HV600 drives.
*6 To use AI-A3 and DI-A3 input statuses as monitors, connect the options to CN5-A, CN5-B, or CN5-C.

11 Function Modules

◆ Functions

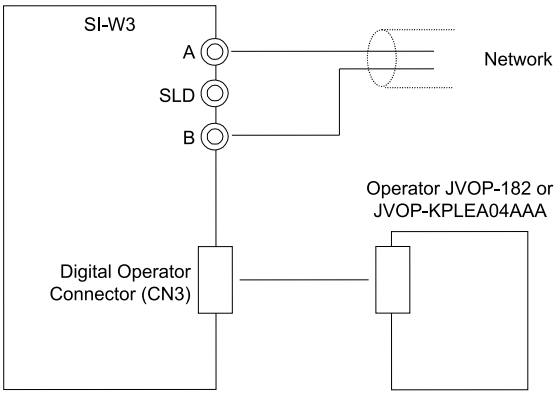
Keypad models JVOP-182 or JVOP-KPLEA04AAA are necessary to do Direct Digital Control (DDC).

DDC is the automated control of a condition or process by a digital device. Connect the JVOP-182 to the CN3 port on the SI-W3 option 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 SLD on the SI-W3.

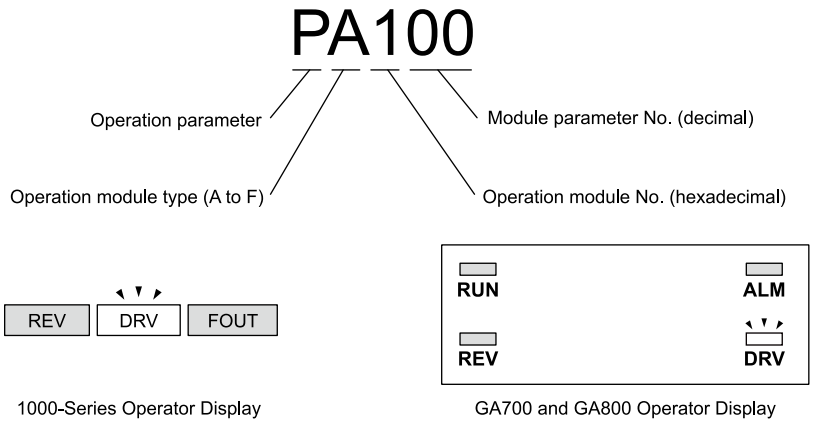
Note:
- Keypad model JVOP-180, JVOP-183, and JVOP-KPLCB04AEB are not compatible.
- The Z1000 and Z1000U do not support these functions.

Do not turn off the power to the drive for at least 10 seconds after setting the functions with the keypad. Failure to comply could cause *EEP* error occurs to circuitry. Initialize the bind data when an *EEP* error occurs.

◆ Connection of Keypad for DDC Functionality via JVOP-182



◆ Keypad Display



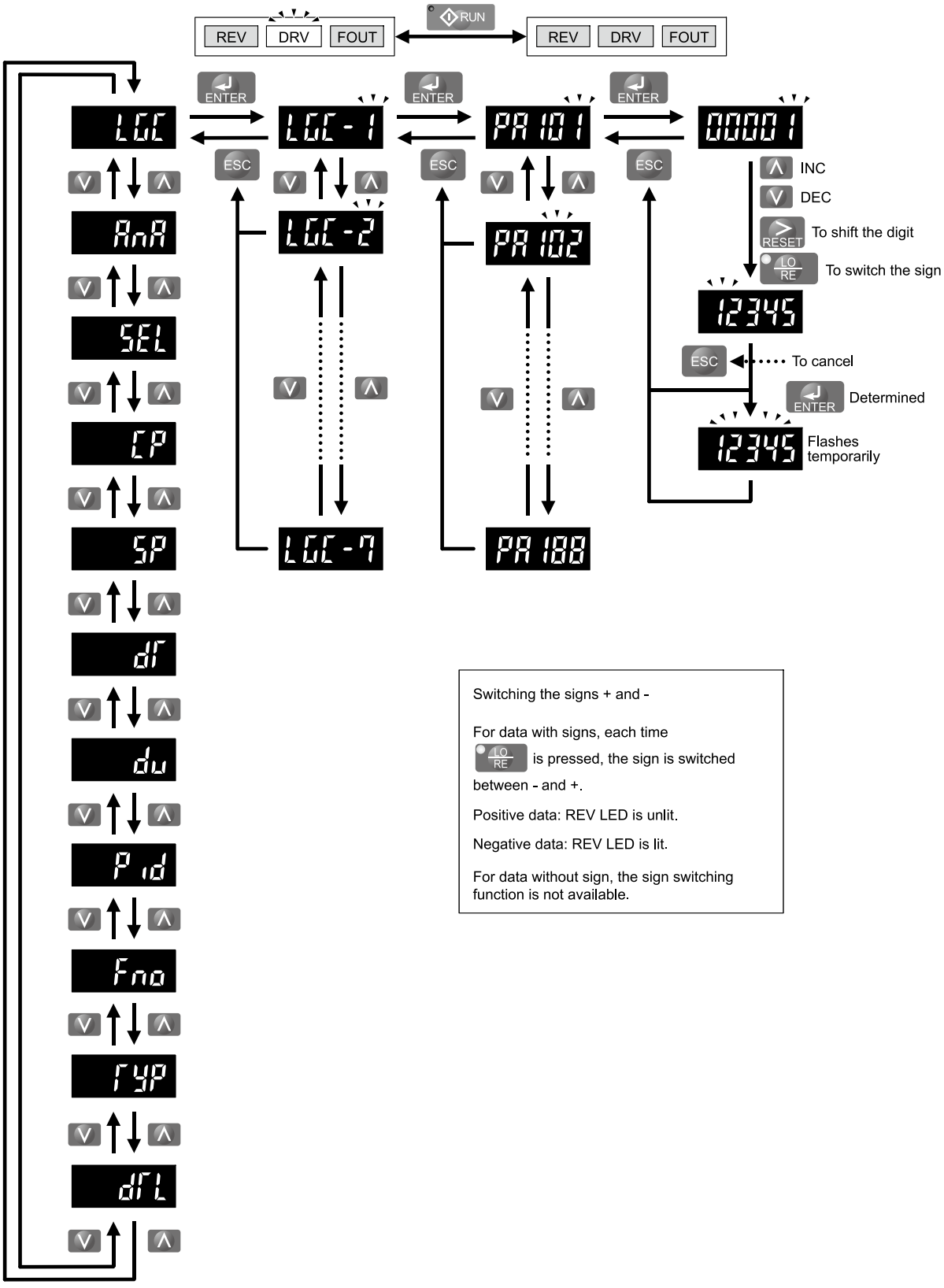
1000-Series Operator Display

GA700 and GA800 Operator Display

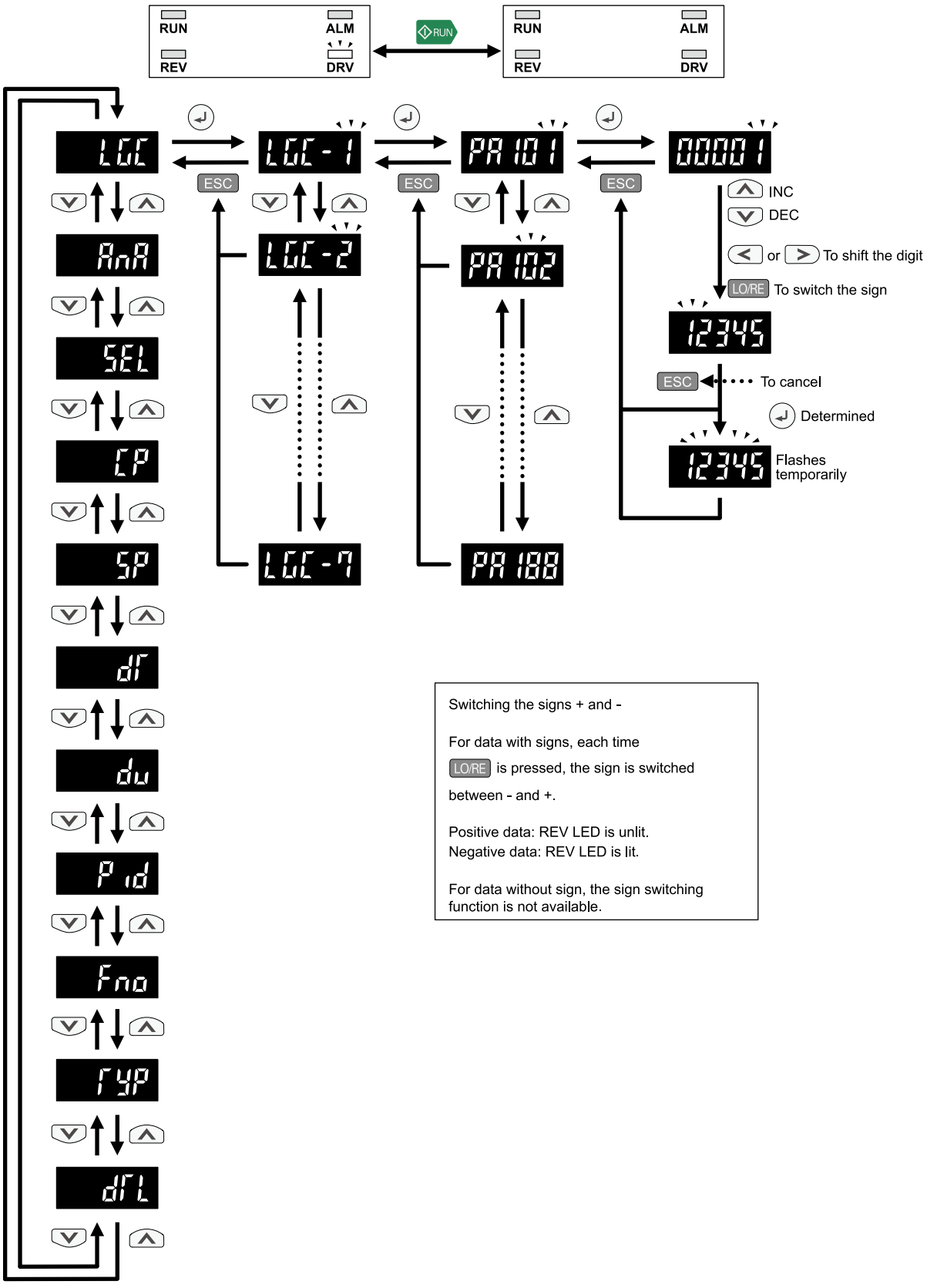
Display		Description
onLn	onLn	Option in online status
oFFLn	oFFLn	Option in offline status
UnCFG	UnCFG	Network in unconfigured status
CALL	CALL	Option in standby status for communications
CPF88	CPF88	Option in error status
bUS	bUS	Option in communications error status
EEP	EEP	EEPROM error

■ Menu Structure for Keypad

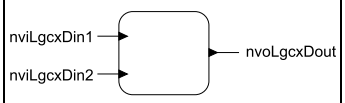
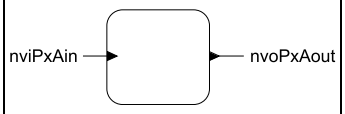
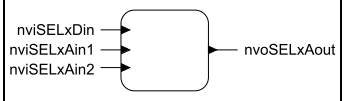
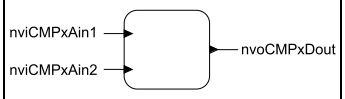
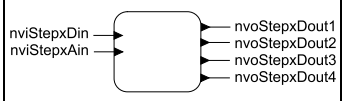
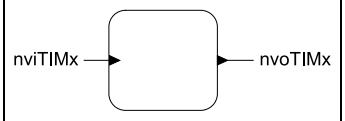
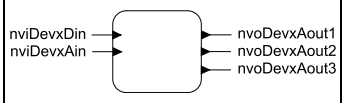
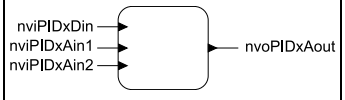
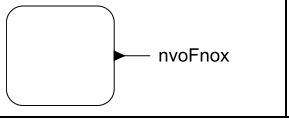
1000-Series Menu Structure for Keypad

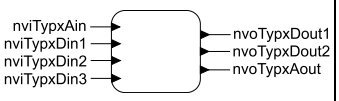
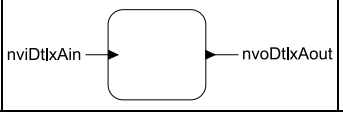


GA700 and GA800 Menu Structure for Digital Operator



◆ List of Functions

Name	Display	Parameter	Function Image	Operation	Default	Register Number
Logic Operation	LgC-x x: 0 - 7 No. of modules: 8	PA000 - PA700		The following operation modes can be selected by setting PAx00. • 0: AND • 1: OR • 2: Inversion (INV) • 3: Reverse	1	1001 - 1008 (Hex.)
Analog Operation	ANA-x x: 0 - 9 No. of modules: 10	Pb000 - Pb928		The following operation modes can be selected by setting Pbx02. • 0: Ratio/Bias (R/B) • 1: Analog scheduler (ANA/SCH) • 2: Variation ratio limiter (LIM) • 3: Primary delay filter (FIL)	1	1110 - 1209 (Hex.)
Selection Operation	SEL-x x: 0 - 7 No. of modules: 8	PC000 - PC701		The following operation modes can be selected by setting PCx01. • 0: State data based select (SEL) The data of either nviSELxAin1 or nviSELxAin2 is output according to the state data of nviSELxDin. • 1: High select (Hi) The larger of two values is output. • 2: Low select (Lo) The smaller of two values is output.	1	120A - 1219 (Hex.)
Comparison Operation	Cp-x x: 0 - 7 No. of modules: 8	Pd000 - Pd702		The following operation modes can be selected by setting Pdx01. • 0: Forward operation The output turns ON when nviCMPxAin1 ≥ nviCMPxAin2. • 1: Reverse operation The output turns ON when nviCMPxAin1 ≤ nviCMPxAin2.	0	121A - 1231 (Hex.)
Step Output Operation	SP-x x: 0 No. of modules: 1	PE000 - PE018		The following operation modes can be selected by setting PEx01. • 0: First In Last Out (FILO) The outputs nvoStepxDout1 through 4 turn ON or OFF according to the value of nviStepxAin in FILO order. • 1: First In First Out (FIFO) The output nvoStepxDout1 through 4 turn ON or OFF according to the value of nviStepxAin in FIFO order.	0	1232 - 123C (Hex.)
Delay Timer	dt-x x: 0, 1 No. of modules: 2	PF000 - PF104		The following operation modes can be selected by setting PFx00. • 0: ON delay The output nvoTIMx turns ON when the set time period has passed after the input nviTIMx turned ON. • 1: OFF delay The output nvoTIMx turns OFF when the set time period has passed after the input nviTIMx turned OFF.	0	123D - 1244 (Hex.)
Deviation Output Operation	dv-x x: 0 No. of modules: 1	PG000 - PG013		The following operation modes can be selected by setting PGx01. • 0: Outputs with 3 deviations Three data with the bias set in the data of nviDevxAin are output. • 1: Outputs with 2 deviations Two data with the bias set in the data of nviDevxAin are output.	0	1245 - 124A (Hex.)
PID	pid-x x: 0 - 3 No. of modules: 4	Ph000 to Ph305		The following operation modes can be selected by setting PHx01. • 0: Forward operation PI control on forward operation using the input feedback nviPIDxAin1. • 1: Reverse operation PI control on reversed operation using the input feedback nviPIDxAin1.	0	124B - 1266 (Hex.)
Constant Output	fno-x x: 0 - 5 No. of modules: 6	PJ000 - PJ501		The data set in the parameter PJx01 is output.	0	1267 - 1272 (Hex.)

Name	Display	Parameter	Function Image	Operation	Default	Register Number
Variable Type Conversion	typ-x x: 0 - 3 No. of modules: 4	PL000 - PL320		The following operation modes can be selected by setting PLx02. • 0: ANA → ANA • 1: ANA → DIG • 2: DIG → ANA	0	1273 - 12BA (Hex.)
Save Data	dtl-x x: 0 - 3 No. of modules: 4	Po000 - Po300		The data is saved in EEPROM when inputting data. The saved data will not be cleared whenever the power turns OFF.	0	12BB - 12BE (Hex.)

■ 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.
- You can change the output method of output network variables for each module using the common configuration properties nciAoutMinOutTm and nciAoutSendHrtBt and the minDelta prepared at each module.

Configuration Properties Common to All Function Modules

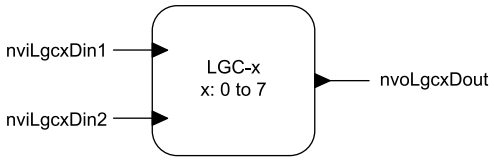
Configuration Property	Explanation	Applicable NVs
nciAoutMinOutTm	Sets a minimum output time of analog data. Analog data is output after the set time period is expired after a change in the data.	ANA data of each Function
nciAoutSendHrtBt	Sets a cycle time to output an analog data. Analog data is output 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
nviLgcxDin1	SNVT_switch	Impossible	DIG input 1
nviLgcxDin2	SNVT_switch	Impossible	DIG input 2
nvoLgcxDout	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

Parameters

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). Set parameter PAx01 to select a mode.

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

Function	Set Value in PAx01	Input				Output	
		nviLgcxDin1 (SNVT_switch)		nviLgcxDin2 (SNVT_switch)		nvoLgcxDout (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:

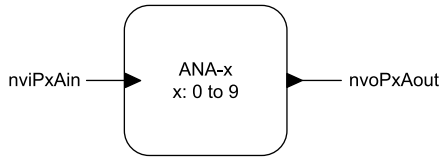
x: Indicates the module number 0 to 7.

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	Name and Function
nviPxAin	SNVT_lev_percent	Possible	Executes the operation on the base of the data set in this variable according to the operation mode.
nvoPxAout	SNVT_lev_percent	Possible	Outputs the operation result.

Parameters

Parameter	Name	Explanation	Default
Pbx00	Variable type	Indicates the variable type of nviPxAin. Cannot be set from the keypad.	0
Pbx01	Variable type	Indicates the variable type of nvoPxAout. Cannot be set from the keypad.	0
Pbx02	Operation mode selection	0: Ratio/Bias 1: Scheduler 2: Variation ratio limit 3: Primary delay filter	1
Pbx03	Output cycle	Operation output cycle of nvoPxAout.	1.0 s
Pbx04	Variation ratio limit value	Limits the variation of nvoPxAout.	0
Pbx05	Delay time	Used for operation with primary delay filter.	0
Pbx06	Operation after initialization	0: Calculates as the previous output was 0. 1: Outputs the input value as it is.	0
Pbx07	Ratio	Sets a inclination when Pbx02 = 0.	1.0
Pbx08	Bias	Sets the bias when Pbx02 = 0.	0
Pbx11	Reference point 1X coordinates	Sets the coordinate value x (input).	0
Pbx12	Reference point 2X coordinates	Sets the coordinate value x (input).	0
Pbx13	Reference point 3X coordinates	Sets the coordinate value x (input).	0
Pbx14	Reference point 4X coordinates	Sets the coordinate value x (input).	0
Pbx15	Reference point 5X coordinates	Sets the coordinate value x (input).	0
Pbx16	Reference point 6X coordinates	Sets the coordinate value x (input).	0
Pbx17	Reference point 7X coordinates	Sets the coordinate value x (input).	0
Pbx18	Reference point 8X coordinates	Sets the coordinate value x (input).	0
Pbx21	Reference point 1Y coordinates	Sets the coordinate value y (input).	0
Pbx22	Reference point 2Y coordinates	Sets the coordinate value y (input).	0
Pbx23	Reference point 3Y coordinates	Sets the coordinate value y (input).	0
Pbx24	Reference point 4Y coordinates	Sets the coordinate value y (input).	0
Pbx25	Reference point 5Y coordinates	Sets the coordinate value y (input).	0
Pbx26	Reference point 6Y coordinates	Sets the coordinate value y (input).	0
Pbx27	Reference point 7Y coordinates	Sets the coordinate value y (input).	0
Pbx28	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 Pbx02: 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	Pbx02	Operation mode selection	0
	Pbx07	Ratio	-3276.8 to 3276.7
	Pbx08	Bias	*1
Analog Scheduler	Pbx02	Operation mode selection	1
	Pbx11 to x18	Coordinate value x (input)	*1
	Pbx21 to x28	Coordinate value y (output)	*1
Variation Ratio Limiter	Pbx02	Operation mode selection	2
	Pbx03	Output cycle	0.1 to 60.0 s
	Pbx04	Variation ratio limit value	*1
	Pbx06	Operation after initialization	0 or 1
Primary Delay Filter	Pbx02	Operation mode selection	3
	Pbx03	Output cycle	0.1 to 60.0 s
	Pbx05	Delay time	0 - 65534 s
	Pbx06	Operation after initialization	0 or 1

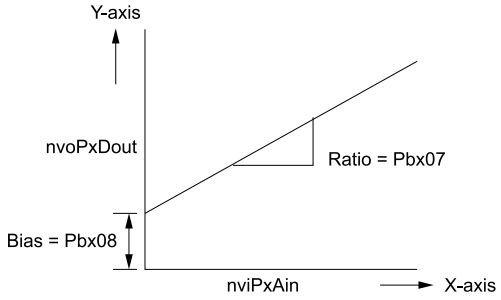
*1 Depends on variable types.

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:

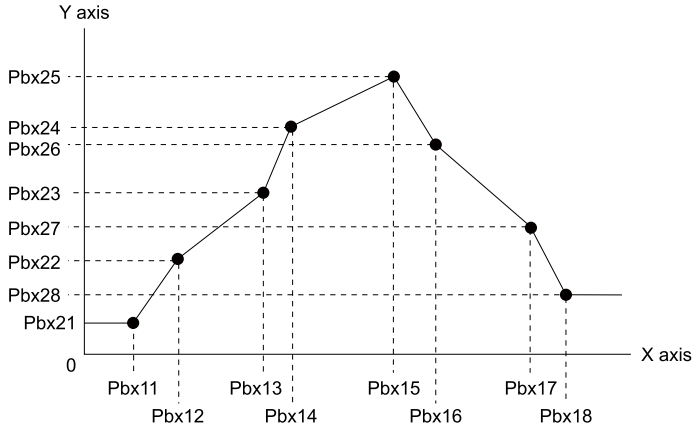


Equation

nvoPxDout = Pbx07 × nviPxAin + Pbx08

Analog Scheduler

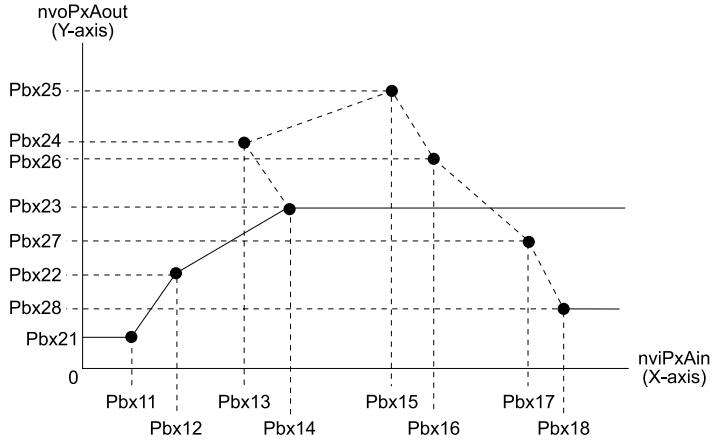
The analog data of the input network variable is compensated using the line graph shown below, and the compensated result is sent to the output network variable.



Note:

1. Set the analog input data parameters Pbx11 to Pbx18 in ascending order.
2. If any of the parameters Pbx11to Pbx18 are not set in ascending order, only the setting values of those parameters set in ascending order are valid and all others are invalid.
   The results from the nvoPxAout 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 Pbx13 > Pbx14, the line graph will chart as shown in the example below. The set values of parameters Pbx14 and higher are invalid, and the set value of Pbx13 is used for operation.



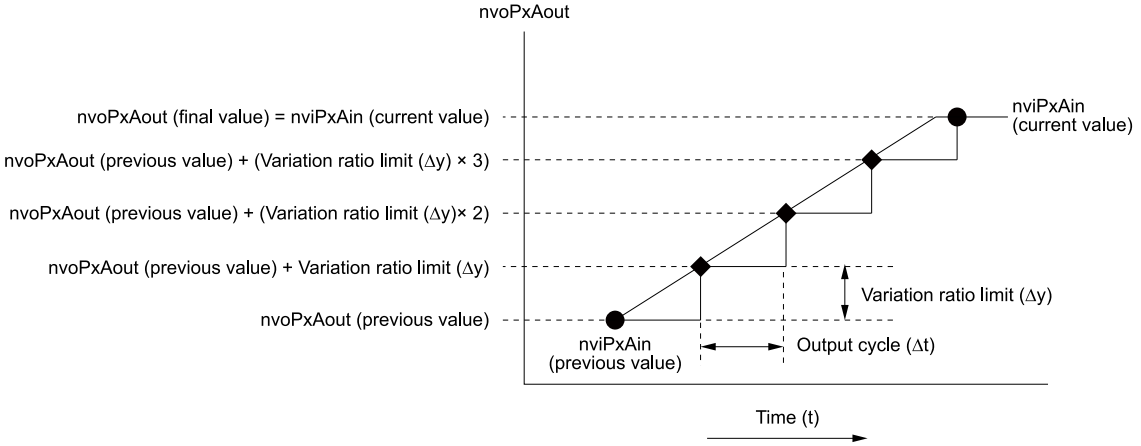
Note:

1. For the value of nviPxAin, the value of nvoPxAout shown with a solid line is output.
2. Parameter Pbx14 was set out of ascending order, so the set values of parameters Pbx14 to Pbx18 and Pbx24 to Pbx28 are invalid. If the value of nviPxAin is larger than the setting of Pbx13, as shown in this case, nvoPxAout = Pbx23.

- When parameters Pbx14 to Pbx18 are set in ascending order:
  - If nviPxAin < Pbx11, nvoPxAout = Pbx21
  - If nviPxAin > Pbx18, nvoPxAout = Pbx28

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 nviPxAin changes from nviPxAin (previous value) to nviPxAin (current value), the variation ratio limit value is added to the value of nviPxAout every output cycle so that the final value of nvoPxAout is equal to the current value of nviPxAin.

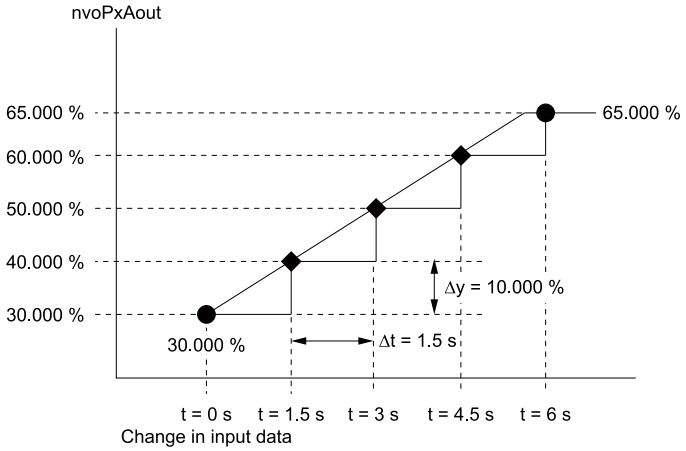
Example: nvoPxAout data process when the value of nvoPxAin changes from 30.000 to 65.000

Input and output network variable type: lev_percent

Parameter settings: As shown in the table below

Parameter	Explanation	Setting
Pbx02	Operation mode selection	2
Pbx03	Output cycle	1.5 s
Pbx04	Variation ratio limit value	10.000

After the value of nviPxAin changes from 30.000 to 65.000, the value of nvoPxAout becomes equal to the value of nviPxAin 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:

nvoPxAout (t) = nvoPxAout (t-1) + Ts/(Ts + TL) × (nviPxAin – nvoPxAout (t-1))

nvoPxAout (t): Current output value

nvoPxAout (t-1): Previous output value

nviPxAin: Input value

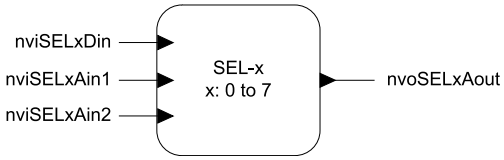
Ts: Output cycle (Pbx03)

T_L: Delay time (Pbx05)

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 with parameter PCx01: State Data Based Select, Hi Select, and Lo Select.

Network Variables

Network Variable	Variable Type	Type Change	Name and Function
nviSELxDin	SNVT_switch	Impossible	Executes the operation on the base of the data in this parameter according to the operation mode.
nviSELxAin1	SNVT_lev_percent	Possible	Input data 1
nviSELxAin2	SNVT_lev_percent	Possible	Input data 2
nvoSELxAout	SNVT_lev_percent	Possible	Outputs the selected data.

Parameters

Parameter	Name	Explanation	Default
PCx00	Variable type	Indicates the variable type of nviSELxAin1 and 2. You cannot use the keypad to set this parameter.	0
PCx01	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 with parameter PCx01: State Data Based Select, Hi Select, and Lo Select.

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

Function	PCx01 Setting	Input Condition		Output Data nvoSELxAout
State Data Based Select	0	nviSELxDin (SNVT_switch)		-
		value	state	
		NA	1	nviSELxAin2
		NA	0	nviSELxAin1
		NA	-1	nviSELxAin1
Hi Select	1	nviSELxAin1 ≥ nviSELxAin2		nviSELxAin1
		nviSELxAin1 < nviSELxAin2		nviSELxAin2
Lo Select	2	nviSELxAin1 < nviSELxAin2		nviSELxAin1
		nviSELxAin1 ≥ nviSELxAin2		nviSELxAin2

State Data Based Select

The data of the input network variables nviSELxAin1 or nviSELxAin2 is selected according to the state data of nviSELxDin, and the data of the selected input network variable is sent to the output network variable nvoSELxAout.

When nviSELxDin (STATE) = 0, nvoSELxAout = nviSELxAin1

When nviSELxDin (STATE) = 1, nvoSELxAout = nviSELxAin2

When nviSELxDin (STATE) = -1, nvoSELxAout = nviSELxAin1

Hi Select

The data of the input network variables nviSELxAin1 and nviSELxAin2 are compared, and the data of the bigger value is output to the output network variable nvoSELxAout.

The input network variable nviSELxDin is not used.

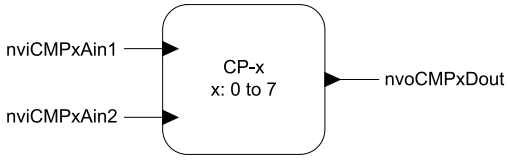
Lo Select

The data of the input network variables nviSELxAin1 and nviSELxAin2 are compared, and the data of the smaller value is sent to the output network variable nvoSELxAout.

The input network variable nviSELxDin is not used.

◆ Comparison Operation Function

■ Function Image



Number of modules: 8 (0 to 7)

■ Network Variables and Parameters

The data of the input network variable nviCMPxAin2 is compared to nviCMPxAin1. 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
nviCMPxAin1	SNVT_lev_percent	Possible	Base data for comparison
nviCMPxAin2	SNVT_lev_percent	Possible	Data to compare
nvoCMPxDout	SNVT_switch	Impossible	Outputs according to the operation mode.

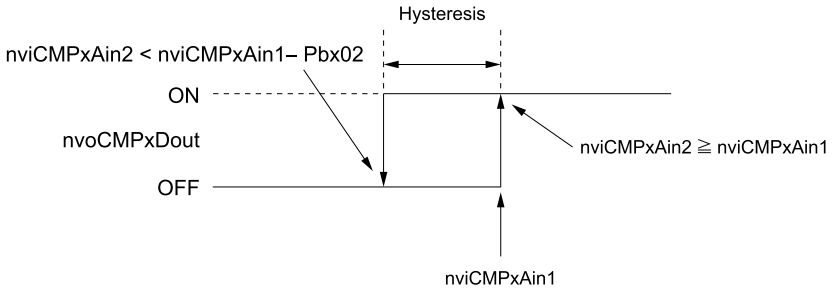
Parameters

Parameter	Name	Explanation	Default
Pdx00	Variable type	Indicates the variable type of nviCMPxAin1 and nviCMPxAin2. You cannot use the keypad to set this parameter.	0
Pdx01	Operation mode selection	0: Forward operation 1: Reverse operation	0
Pdx02	Hysteresis	Sets the hysteresis of output variation	0

■ Operation

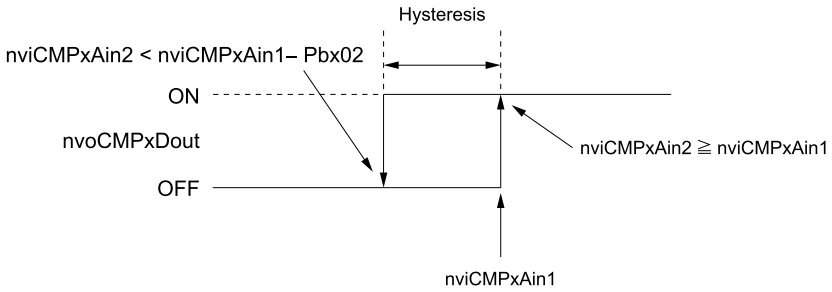
Forward Operation

When the value of nviCMPxAin2 is greater than nviCMPxAin1, then nvoCMPxDout (STATE) = 1 (ON).
When the value of nviCMPxAin2 is less than “nviCMPxAin1 − Pbx02”, then nvoCMPxDout (STATE) = 0 (OFF).



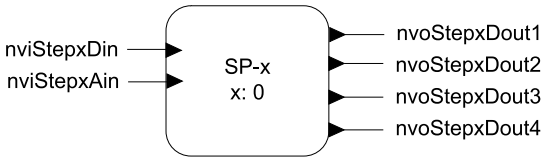
Reverse Operation

When the value of nviCMPxAin2 is less than nviCMPxAin1, then nvoCMPxDout (STATE) = 1 (ON). When the value of nviCMPxAin2 is greater than “nviCMPxAin1 + Pbx02”, then nvoCMPxDout (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.

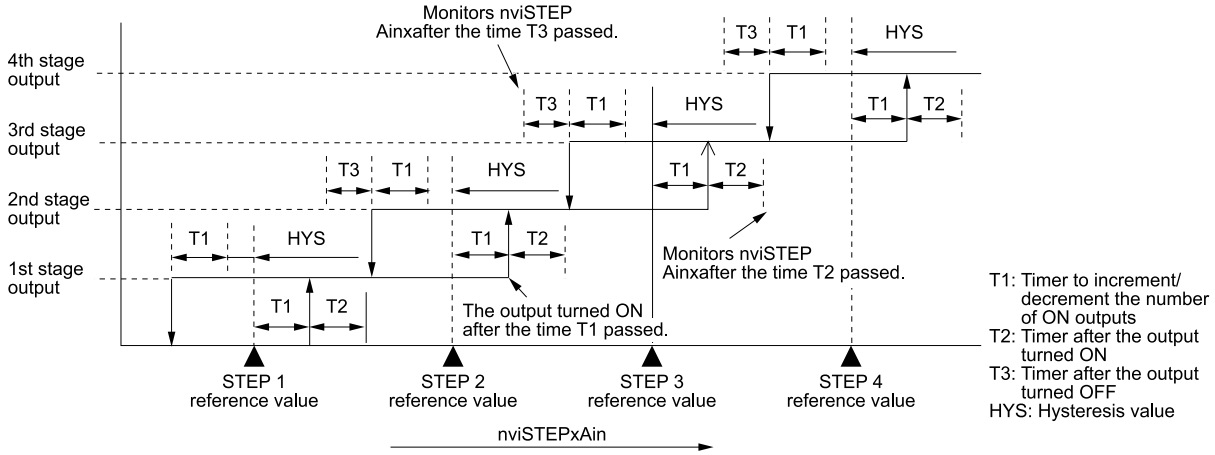
Network Variables

Network Variable	Variable Type	Type Change	Name and Function
nviSTEPxDin	SNVT_switch	Impossible	Output interlock state = 0, -1: Interlock state = 1: Release interlock
nviSTEPxAin	SNVT_lev_percent	Possible	Input data Compares with the reference value, and outputs in order.
nvoSTEPxDout1	SNVT_switch	Impossible	Step output 1 When ON: state = 1, value = 100.0

Network Variable	Variable Type	Type Change	Name and Function
			When OFF: state = 0, value = 0.0
nvoSTEPxDout2	SNVT_switch	Impossible	Step output 2 When ON: state = 1, value = 100.0 When OFF: state = 0, value = 0.0
nvoSTEPxDout3	SNVT_switch	Impossible	Step output 3 When ON: state = 1, value = 100.0 When OFF: state = 0, value = 0.0
nvoSTEPxDout4	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
PEx00	Variable type	It is not possible to change this parameter using the keypad.	0
PEx01	Operation mode selection	0: FILO (First In Last Out) 1: FIFO (First In First Out)	0
PEx02	Hysteresis	Sets the hysteresis to the reference point to turn OFF the output signal.	0
PEx11	STEP 1 reference value	The reference value to turn ON the output signal.	0
PEx12	STEP 2 reference value	The reference value to turn ON the output signal.	0
PEx13	STEP 3 reference value	The reference value to turn ON the output signal.	0
PEx14	STEP 4 reference value	The reference value to turn ON the output signal.	0
PEx15	Timer to increment/ decrement the number of ON outputs	When the value of nviSTEPxAin 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 nviSTEPxAin does not satisfy the conditions needed to start the timer, the timer is reset.)	10
PEx16	Timer after the output turned ON	The value of nviSTEPxAin is discarded in this set time after the output has turned ON.	60
PEx17	Timer after the output turned OFF	The value of nviSTEPxAin is discarded in this set time after the output has turned OFF.	30
PEx18	Base output position	Set the output network variable that turns ON first. 1: nvoSTEPxDout1 2: nvoSTEPxDout2 3: nvoSTEPxDout3 4: nvoSTEPxDout4	1



Note:

The STEP reference values must be set in ascending order. If 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 nvoSTEPxDout that was turned ON first is turned OFF last.

The nvoSTEPxDout that turns ON first can be specified using the parameter PEx18 (base output position).

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

Output Position	ON Output Priority	OFF Output Priority
nvoSTEPxDout1	1	4
nvoSTEPxDout2	2	3
nvoSTEPxDout3	3	2
nvoSTEPxDout4	4	1

- Example 2: Order of output priority when the base output position is 3.

Output Position	ON Output Priority	OFF Output Priority
nvoSTEPxDout1	3	2
nvoSTEPxDout2	4	1
nvoSTEPxDout3	1	4
nvoSTEPxDout4	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 nvoSTEPxDout 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 output priority when the base output position is 1.

Output Position	ON Output Priority	OFF Output Priority
nvoSTEPxDout1	1	1
nvoSTEPxDout2	2	2
nvoSTEPxDout3	3	3
nvoSTEPxDout4	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	nvoSTEPxDout1	nvoSTEPxDout2	nvoSTEPxDout3	nvoSTEPxout4	Data of nviSTEPxAin
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%

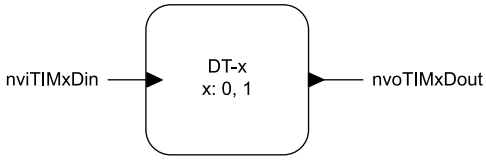
Operation Pattern	Output Position	nvoSTEPxDout1	nvoSTEPxDout2	nvoSTEPxDout3	nvoSTEPxout4	Data of nviSTEPxAin
13	2-stage output	○	○	●	●	40.000%
14	On being interlocked	○	○	○	○	40.000%
15	1-stage output	●	○	○	○	40.000%
16	2-stage output	●	●	○	○	40.000%

●: 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 nviSTEPxAin 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 (nvoSTEPxDout1) that turned ON last before the outputs have been interlocked in pattern 3. This means nvoSTEPxDout2.
5. As the value of nviSTEPxAin increases, the nvoSTEPxDout3 and nvoSTEPxDout4 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 (nvoSTEPxDout4) that turned ON last before the outputs have been interlocked in pattern 7: nvoSTEPxDout1. This means nvoSTEPxDout1.
9. As the value of nviSTEPxAin increases, the nvoSTEPxDout2, nvoSTEPxDout3, and nvoSTEPxDout4 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 nviSTEPxAin becomes less than the STEP 4 reference value. The output nvoSTEPxDout1 that turned ON first among four outputs turns OFF first.
13. The value of nviSTEPxAin becomes less than the STEP 3 reference value. The output nvoSTEPxDout2 turns OFF.
14. All the outputs are turned OFF by setting the interlock to 0.
15. In the same way as in patterns 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 (nvoSTEPxDout4) that turned ON last before the outputs have been interlocked in process 11: nvoSTEPxDout1. This means nvxSTEPoDout1.
16. The value of nviSTEPxAin is not changed but more than the STEP 2 reference value. The nvoSTEPxDout2 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
nviTIMxDin	SNVT_switch	Impossible	Timer start input state = -1: Output OFF state = 0: Depends on the operation mode state = 1: Depends on the operation mode
nvoTIMxDout	SNVT_switch	Impossible	Output 1 When ON: state = 1, value = 100.0 When OFF: state = 0, value = 0.0

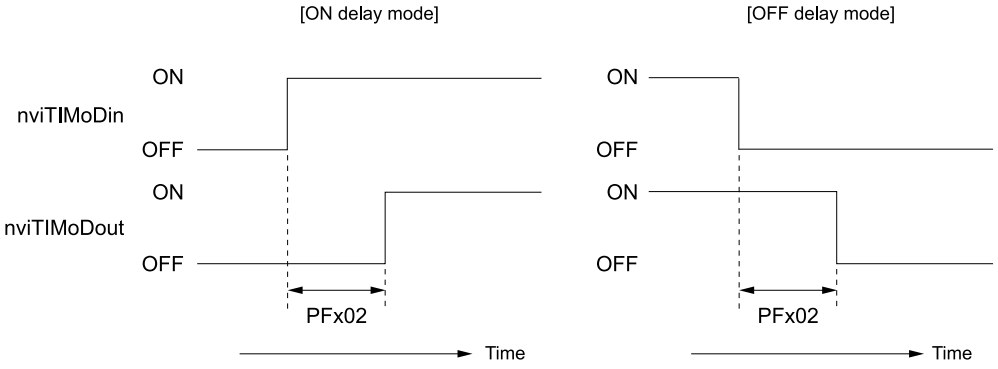
Parameters

Parameter	Name	Explanation	Default
PFx00	Operation mode selection	0: ON delay 1: OFF delay	0
PFx01	ON delay time	Sets the ON delay time. Units: 1 s	0
PFx02	ON delay time	Sets the OFF delay time. Units: 1 s	0
PFx04	Operation when the power turns ON	0: nvoTIMxDout turns ON when the set delay time is expired after nviTIMxDin turned ON. 1: nvoTIMxDout turns ON when nviTIMxDin turns ON without waiting for the set delay time.	0

■ Operation

ON/OFF Delay

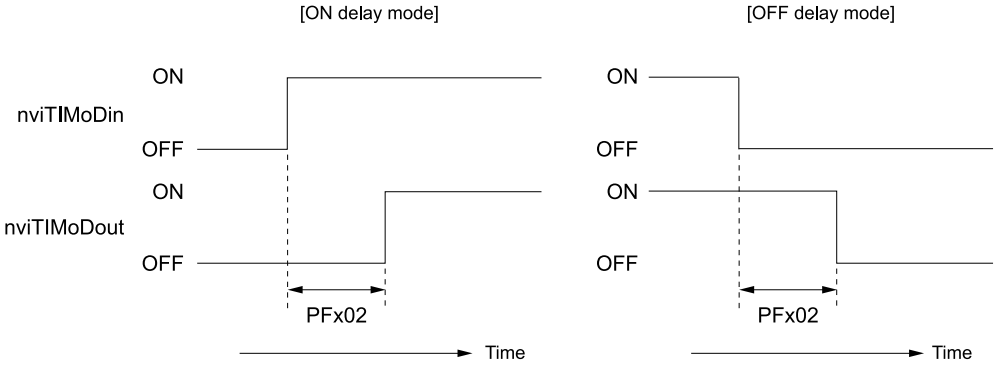
The ON/OFF Delay mode delays the timing to turn ON/OFF the output network variable nvoTIMxDout according to the data of the input network variable nviTIMxDin for the set time period as shown in the following figure for details:



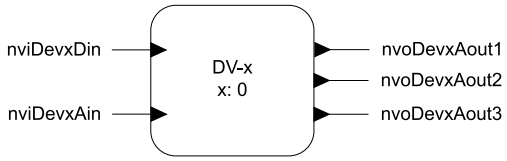
◆ Deviation Output Function

■ ON/OFF Delay

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



■ 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 foutput network variable.

Network Variables

Network Variable	Variable Type	Type Change	Name and Function
nviDevxDin	SNVT_switch	Impossible	Used for the operation mode “Outputs with 2 deviation”. Refer to 61 for more information.
nviDevxAin	SNVT_lev_percent	Possible	Input data The base data for the data to be output.
nviDevxAout1	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 nviDevxAin.
nvoDevxAout2	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 nviDevxAin.
nvoDevxAout3	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 nviDevxAin.

Parameters

Parameter	Name	Explanation	Default
PGx00	Variable type	Impossible to set from the Operator	0
PGx01	Operation mode selection	0: Outputs with 3 deviations 1: Outputs with 2 deviations	0
PGx11	Deviation a	Sets a deviation.	0
PGx12	Deviation b	Sets a deviation.	0
PGx13	Deviation c	Sets a deviation.	0

■ Operation

Outputs with 3 Deviations

Three deviations set in PGx11, PGx12, PGx13 are added to or subtracted from the data of nviDevxAin as shown below, and the results are sent to nviDevxAout1, 2, and 3. Each output network variable is calculated using the equation below:

nviDevxAout1 = nviDevxAin - PGx11

nvoDevxAout2 = nviDevxAin + PGx12

nvoDevxAout3 = nviDevxAin + PGx13

Outputs with 2 Deviations

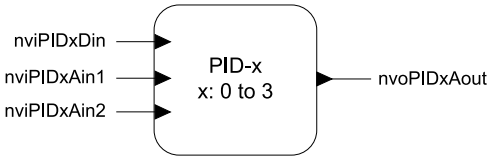
Two output data are set as follows according to the status of nviDevxDin:

- When nviDevxDin = OFF,
  nviDevxAout1 = 0 (Fixed)
  nvoDevxAout2 = nviDevxAin - PGx13
  nvoDevxAout3 = nviDevxAin
- When nviDevxDin = ON,
  nviDevxAout1 = nviDevxAin
  nvoDevxAout2 = nviDevxAin + PGx11
  nvoDevxAout3 = 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
nviPIDxDin	SNVT_switch	Impossible	Output interlock 0: Interlock 1: Start control
nviPIDxAin1	SNVT_lev_percent	Possible	Sets value data (SP)
nviPIDxAin2	SNVT_lev_percent	Possible	Process input value (Feedback data) (PV)
nvoPIDxAout	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
PHx00	Variable type	Impossible to set from the Operator	0
PHx01	Operation mode selection	0: Forward operation 1: Reversed operation	0
PHx02	Proportional band	0 - 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
PHx03	Integral time	0 - 6553.5 s	1.0
PHx04	Output when interlocked	The value of the PID output when interlocked	0
PHx05	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 - +105%)

$P_{(0)}$: Reference point (PHx05)

P_b: Proportional band (PHx02)

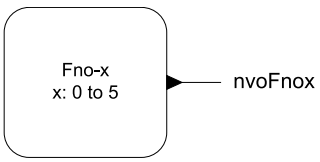
θ: Operation cycle (100 ms)

T_i: Integral time (PHx03)

e_i: Deviation (nviPIDxAin1 − nviPIDxAin2)

◆ 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
nvoFnoxAout	SNVT_lev_percent	Possible	The data set in the parameter is output when the power turns ON.

Parameters

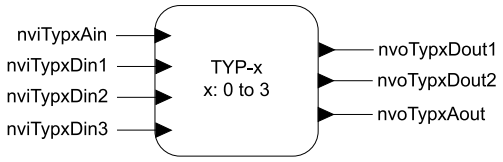
Parameter	Name	Explanation	Default
PJx00	Variable type	It is not possible to set this parameter using the keypad.	0
PJx01	Constant	Set a desired numerical value.	0

■ 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
nviTypxDin1	SNVT_switch	Impossible	-
nviTypxDin2	SNVT_switch	Impossible	-
nviTypxDin3	SNVT_switch	Impossible	-
nviTypxAin	SNVT_lev_percent	Possible	-
nvoTypxDout1	SNVT_switch	Impossible	DIG output 1 When ON: state = 1, value = 100.0 When OFF: state = 0, value = 0.0
nvoTypxDout2	SNVT_switch	Impossible	DIG output 2 When ON: state = 1, value = 100.0 When OFF: state = 0, value = 0.0
nvoTypxAout	SNVT_lev_percent	Possible	-

Parameters

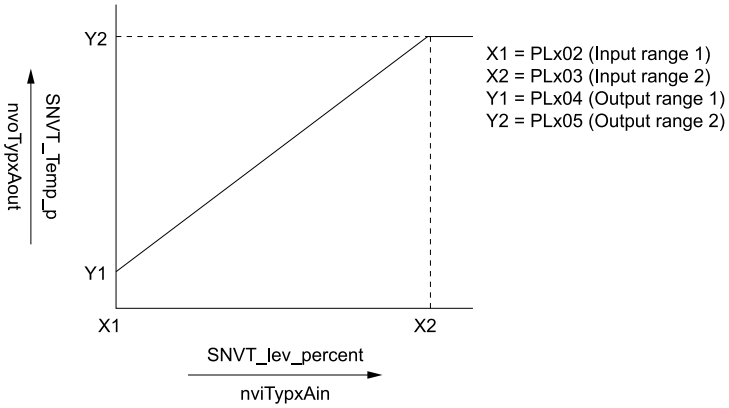
Parameter	Name	Explanation	Default
PLx00	Variable type	You cannot use the keypad to set this parameter.	0
PLx01	Variable type	You cannot use the keypad to set this parameter.	0
PLx02	Input range 1	Sets the input range when converting from ANA to ANA.	0
PLx03	Input range 2	Sets the input range when converting from ANA to ANA.	0
PLx04	Output range 1	Set the output range when converting from ANA to ANA.	0
PLx05	Output range 2	Set the output range when converting from ANA to ANA.	0
PLx06	Operation mode selection	0: ANA → ANA 1: ANA → DIG 2: DIG → ANA	0
PLx10	Input reference data	The value to turn ON nvoTypxDout1 when converting from ANA to DIG	999

Parameter	Name	Explanation	Default
PLx11	Input reference data	The value to turn ON nvoTypxDout1 when converting from ANA to DIG	999
PLx12	Input reference data	The value to turn ON nvoTypxDout1 when converting from ANA to DIG	999
PLx13	Input reference data	The value to turn ON nvoTypxDout1 when converting from ANA to DIG	999
PLx14	Input reference data	The value to turn ON nvoTypxDout2 when converting from ANA to DIG	999
PLx15	Input reference data	The value to turn ON nvoTypxDout2 when converting from ANA to DIG	999
PLx16	Input reference data	The value to turn ON nvoTypxDout2 when converting from ANA to DIG	999
PLx17	Input reference data	The value to turn ON nvoTypxDout2 when converting from ANA to DIG	999
PLx18	Output reference data	The data to be sent if nviTypxDin1=ON when converting from DIG to ANA	-
PLx19	Output reference data	The data to be sent if nviTypxDin2=ON when converting from DIG to ANA	-
PLx20	Output reference data	The data to be sent if nviTypxDin3=ON when converting from DIG to ANA	-

■ Operation

Conversion from ANA to ANA (PLx02 (operation mode selection) = 0)

- Example: Conversion from percent to Temp



Conversion from ANA to DIG (PLx02 (operation mode selection) = 1)

The value of nviTypxAin is compared with the set values of PLx10 to 17, and when the value of nviTypxAin agrees with a set value of PLx10 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
  PLx10: 10.000%, PLx11: 30.000%, PLx12: 50.000%, PLx13: 70.000%,
  PLx14: 20.000%, PLx15: 40.000%, PLx16: 60.000%, PLx17: 80.000%

ON Output	Data of nviTypxAin (SNVT_lev_percent)									
	0	5	10	20	25	30	35	40	80	75
nvoTypxDout1	○	○	●	○	○	●	○	○	○	○
nvoTypxDout2	○	○	○	●	○	○	○	●	●	○

●: Output signal ON, ○: Output signal OFF

- Example: Conversion from SNVT_hvac_mode to SNVT_switch
  PLx10: 1 (HEAT), PLx11: 3 (COOL), PLx12: 0 (AUTO), PLx13: 2 (WRMUP),
  PLx14: 2 (WRMUP), PLx15: 6 (OFF), PLx16: 999, PLx17: 999

ON Output	Data of nviTypxAin (SNVT_lev_percent)									
	0	4	6	2	1	6	2	7	3	FF
nvoTypxDout1	●	○	○	●	●	○	●	○	●	○
nvoTypxDout2	○	○	●	●	○	●	●	○	○	○

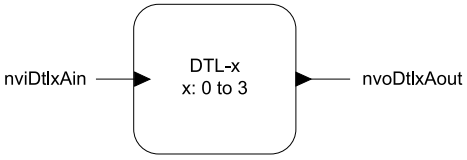
●: Output signal ON, ○: Output signal OFF

Conversion from DIG to ANA (PLx02 (operation mode selection) = 2)

When nviTypxDin1 is ON, the set value of PLx18 is output to nvoTypxAout.
When nviTypxDin2 is ON, the set value of PLx19 is output to nvoTypxAout.
When nviTypxDin3 is ON, the set value of PLx20 is output to nvoTypxAout.

◆ 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
nviDtlxAin	SNVT_lev_percent	Possible	-
nvoDtlxAout	SNVT_lev_percent	Possible	-

Parameters

Parameter	Name	Explanation	Default
Pox00	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 nviDtlxAin is sent to nvoDtlxAout.

NOTICE *Damage to Equipment. Do not change the input network variables of Save Data 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	Description
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.

<table>
<tr><th>Parameter Setting</th><th>Name</th><th>Variable Type</th><th>Description</th></tr>
<tr><td>3</td><td>Flow</td><td>SNVT_flow</td><td>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.</td></tr>
<tr><td>4</td><td>Temperature</td><td>SNVT_temp_p</td><td>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.</td></tr>
<tr><td>5</td><td>Concentration</td><td>SNVT_ppm</td><td>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.</td></tr>
<tr><td rowspan="2">6</td><td>HVAC mode</td><td>SNVT_HVAC_mode</td><td>SNVT#: 108
Contents: HVAC mode
Data type: Enumeration Scalar
Data size: 1 bytes
Data range (Resolution): hvac_t Enumeration
Typedef File: SNVT_HV.H</td></tr>
<tr><td colspan="3">Enum Definitions
• Value Identifier
<table>
<tr><td>0</td><td>HVAC_AUTO:</td><td>Controller automatically changes between application modes</td></tr>
<tr><td>1</td><td>HVAC_HEAT:</td><td>Heating only</td></tr>
<tr><td>2</td><td>HVAC_MRNG_WRMUP:</td><td>Application-specific morning warm-up</td></tr>
<tr><td>3</td><td>HVAC_COOL:</td><td>Cooling only</td></tr>
<tr><td>4</td><td>HVAC_NIGHT_PURGE:</td><td>Application-specific night purge</td></tr>
<tr><td>5</td><td>HVAC_PRE_COOL:</td><td>Application-specific pre-cool</td></tr>
<tr><td>6</td><td>HVAC_OFF:</td><td>Controller not controlling outputs</td></tr>
<tr><td>7</td><td>HVAC_TEST:</td><td>Equipment being tested</td></tr>
<tr><td>8</td><td>HVAC_EMERG_HEAT:</td><td>Emergency heat mode (heat pump)</td></tr>
<tr><td>9</td><td>HVAC_FAN_ONLY:</td><td>Air not conditioned, fan turned on</td></tr>
<tr><td>10</td><td>HVAC_FREE_COOL:</td><td>Cooling with compressor not running</td></tr>
<tr><td>11</td><td>HVAC_ICE:</td><td>Ice-making mode</td></tr>
<tr><td>0xFF</td><td>HVAC_NUL:</td><td>Value not available</td></tr>
</table></td></tr>
<tr><td>7</td><td>HVAC mode</td><td>SNVT_HVAC_state</td><td>SNVT#: 112
Contents: HVAC status
Data type: Structure
Data size: 12 bytes</td></tr>
</table>

Parameter Setting	Name	Variable Type	Description
	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		

12 European Standards

Figure 12.1 CE Mark

The CE mark indicates compliance with European safety and environmental regulations.

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

It is required for engaging in business and commerce in Europe.

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

EMC Directive: 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 Directive Compliance

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

■ Option Installation

Verify the following installation conditions to make sure that other devices and machinery used with this option and drive 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 12.2 and Figure 12.3.

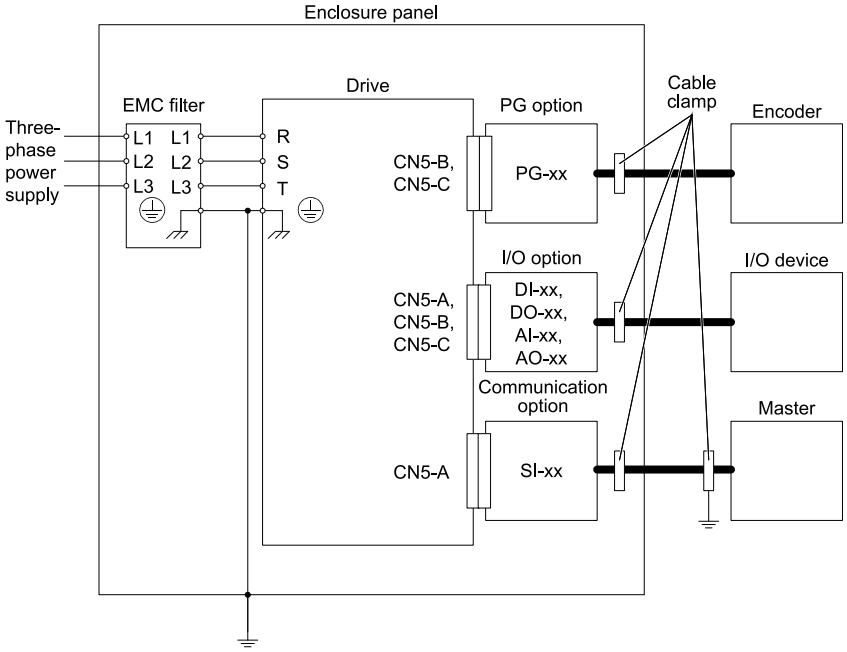


Figure 12.2 Option Installation for CE Compliance: 1000-Series, GA700, GA800

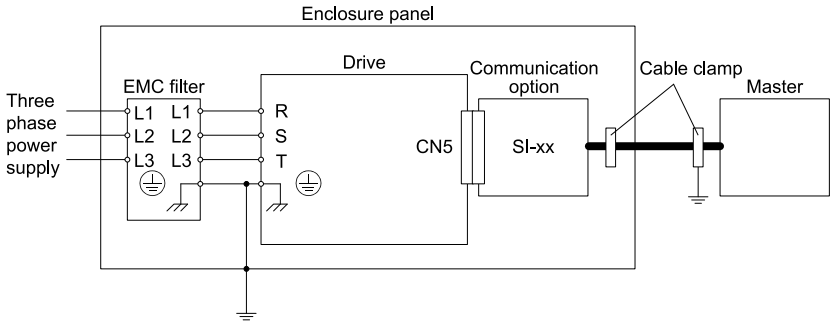


Figure 12.3 Option Installation for CE Compliance: HV600

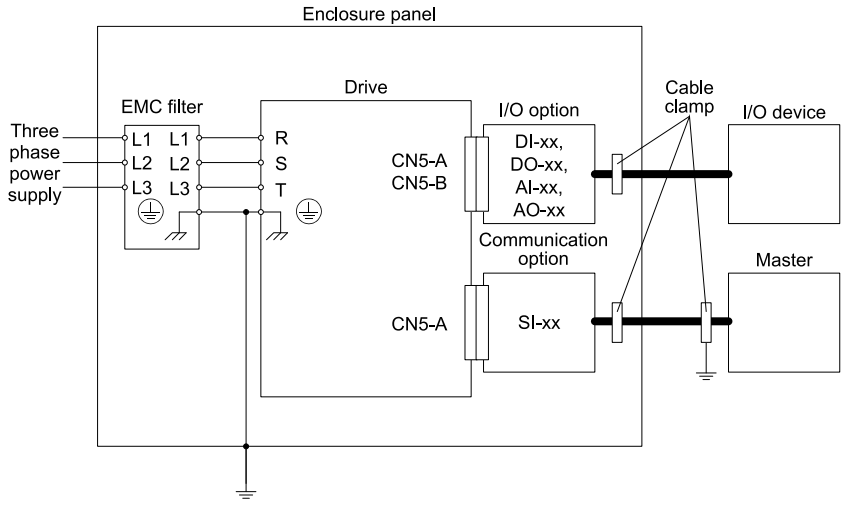
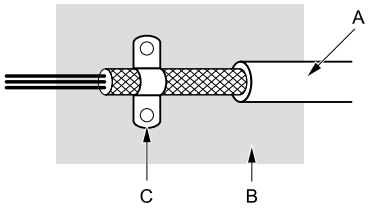


Figure 12.4 Option Installation for CE Compliance: FP605

3. Ground the largest possible surface area of the shield to the metal panel.
   Yaskawa recommends using cable clamps.



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

Figure 12.5 Ground Area

13 Specifications

◆ Specifications

Table 13.1 Option Specifications

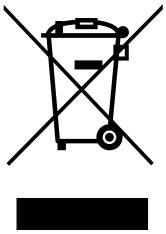
Items	Specifications
Model	SI-W3
Node Type	Host Application Node
Communication Speed	78 kbps
Communication IC	Neuron chip FT3120
Communication Driver	FT-X1 (free topology)
Communication Protocol	LonTalk protocol node
Network Variable	Total: 236 Standard Network Variable Types (SNVT): Variable Speed Motor 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 - +50°C (14°F - 122°F)
Humidity	Up to 95% RH (no condensation)
Storage Temperature	-20°C - +60°C (-4°F - 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	Up to 1000 m (3280 ft)

14 Disposal

◆ Disposal Instructions

Correctly dispose of the product and packing material as specified by applicable regional, local, and municipal laws and regulations.

◆ WEEE Directive



The wheelie bin symbol on this product, its manual, or its packaging identifies that you must recycle it at the end of its product life.

You must discard the product at an applicable collection point for electrical and electronic equipment (EEE). Do not discard the product with usual waste.

Revision History

Date of Publication	Revision Number	Section	Revised Content
November 2021	3	All	Addition: Information on FP605 Revision: Reviewed and corrected entire documentation
February 2020	2	All	Addition: Applicable product series Revision: Reviewed and corrected entire documentation
		Chapter 14	Addition: Disposal
August 2018	1	All	Addition: Applicable product series
December 2016	-	-	First Edition

YASKAWA AC Drive Option

LonWorks

Technical Manual

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