

# YASKAWA AC Drive 1000-Series Option DeviceNet Installation Manual

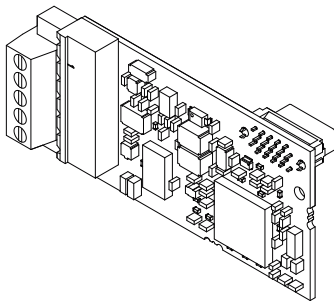
Type: SI-N3

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

## 安川インバータ 1000シリーズ オプション DeviceNet 通信 取扱説明書

形 式 SI-N3

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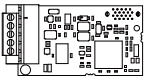
# 1 Preface and Safety

Yaskawa manufactures products used as components in a wide variety of industrial systems and equipment. The selection and application of Yaskawa products remain the responsibility of the equipment manufacturer 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 systems or equipment designed to incorporate a product 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 Yaskawa manual. NO OTHER WARRANTY, EXPRESS OR IMPLIED, IS OFFERED. Yaskawa assumes no liability for any personal injury, property damage, losses, or claims arising from misapplication of its products.

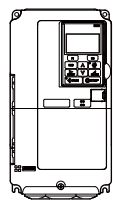
### ◆ Applicable Documentation

The following manuals are available for the option:

#### DeviceNet SI-N3 Option

	<b>Yaskawa AC Drive 1000-Series Option DeviceNet Installation Manual Manual No: TOBPC73060043 (this book)</b>	Read this manual first. The installation manual is packaged with the option and contains information required to install the option and set up related drive parameters.
	<b>Yaskawa AC Drive 1000-Series Option DeviceNet Technical Manual Manual No: SIEPC73060043</b>	The technical manual contains detailed information about the option. Access the following sites to obtain the technical manual: U.S.: <a href="http://www.yaskawa.com">http://www.yaskawa.com</a> Europe: <a href="http://www.yaskawa.eu.com">http://www.yaskawa.eu.com</a> Japan: <a href="http://www.e-mechatronics.com">http://www.e-mechatronics.com</a> Other areas: Contact a Yaskawa representative.

#### Yaskawa Drive

	<b>Yaskawa AC Drive 1000-Series Quick Start Guide</b>	The drive manuals cover basic installation, wiring, operation procedures, functions, troubleshooting, and maintenance information the manuals also include important information about parameter settings and drive tuning.
	<b>Yaskawa AC Drive 1000-Series Technical Manual</b>	Access these sites to obtain Yaskawa instruction manuals: U.S.: <a href="http://www.yaskawa.com">http://www.yaskawa.com</a> Europe: <a href="http://www.yaskawa.eu.com">http://www.yaskawa.eu.com</a> Japan: <a href="http://www.e-mechatronics.com">http://www.e-mechatronics.com</a> Other areas: Contact a Yaskawa representative.

## ◆ Terms and Abbreviations

<b>Note:</b>	Indicates supplemental information that is not related to safety messages.
<b>Drive:</b>	Yaskawa AC Drive 1000-Series
<b>Option:</b>	Yaskawa AC Drive 1000-Series DeviceNet Option SI-N3
<b>CLV:</b>	Closed Loop Vector Control
<b>AOLV/PM:</b>	Advanced Open Loop Vector Control for PM
<b>CLV/PM:</b>	Closed Loop Vector Control for PM

## ◆ Registered Trademarks

- DeviceNet is a trademark of the ODVA.
- Trademarks are the property of their respective owners.

## ◆ Supplemental Safety Information

Read and understand this manual before installing, operating, or servicing this option. Install the option according to this manual and local codes.

The following conventions indicate safety messages in this manual. Failure to heed these messages could cause fatal injury or damage products and related equipment and systems.

### **DANGER**

**Indicates a hazardous situation, which, if not avoided, will result in death or serious injury.**

### **WARNING**

**Indicates a hazardous situation, which, if not avoided, could result in death or serious injury.**

### **CAUTION**

**Indicates a hazardous situation, which, if not avoided, could result in minor or moderate injury.**

## 1 Preface and Safety

### NOTICE

**Indicates an equipment damage message.**

#### ■ General Safety

##### General Precautions

- The diagrams in this book may include options and drives without covers or safety shields to illustrate details. Be sure to reinstall covers or shields before operating any devices. Use the option according to the instructions described in this manual.
- Any illustrations, photographs, or examples used in this manual are provided as examples only and may not apply to all products to which this manual is applicable.
- 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.
- When ordering new copies of the manual, contact a Yaskawa representative or the nearest Yaskawa sales office and provide the manual number shown on the front cover.

### DANGER

**Heed the safety messages in this manual.**

Failure to comply will result in death or serious injury.

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

### NOTICE

**Do not modify the drive or option circuitry.**

Failure to comply could result in damage to the drive or option and will void warranty. Yaskawa is not responsible for any modification of the product made by the user. This product must not be modified.

**Do not expose the drive or option to halogen group disinfectants.**

Failure to comply may cause damage to the electrical components in the drive or option. Do not pack the drive in wooden materials that have been fumigated or sterilized. Do not sterilize the entire package after the product is packed.

## 2 Product Overview

### ◆ About This Product

The SI-N3 Option provides a communications connection between the drive and an ODVA DeviceNet network. The SI-N3 Option connects the drive to a DeviceNet network and facilitates the exchange of data.

DeviceNet is a communications link that connects industrial devices (e.g., limit switches, photoelectric switches, valve manifolds, motor starters, smart motor controllers, operator interfaces, and variable frequency drives) and control devices (e.g., programmable controllers and computers) to a network. DeviceNet is a simple networking solution that reduces the cost and time to wire and install factory automation devices while providing interchangeability of similar components from multiple vendors.

Installing the option to a drive allows a DeviceNet master device to:

- operate the drive
- monitor the operation status of the drive
- change parameter settings.



Figure 1 DeviceNet Approved

### ◆ Applicable Models

The option can be used with the models in [Table 1](#).

Table 1 Applicable Models

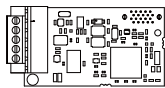



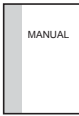
Drive Series	Drive Model Number
A1000	All models

### 3 Receiving

Please perform the following tasks upon receiving the option:

- Inspect the option for damage. Contact the shipper immediately if the option appears damaged upon receipt.
- Verify receipt of the correct model by checking the model number printed on the option nameplate. (Refer to [Figure 2](#) on page 9 for more information).
- Contact your supplier if you have received the wrong model or the option does not function properly.

#### ◆ Option Package Contents

Description:	Option	Ground Wire	Screws (M3)	LED Label	Installation Manual
—					
Quantity:	1	1	3	1	1

#### ◆ Tools Required for Installation

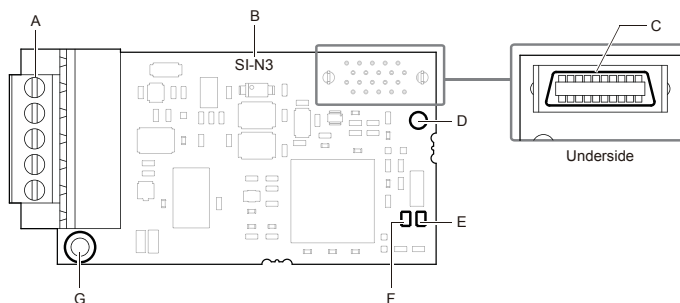
- A Phillips screwdriver (M3 metric / #1, #2 U.S. standard size) is required to install the option.
- A straight-edge screwdriver (blade depth: 0.4 mm, width: 2.5 mm) is required to wire the option terminal block.
- A pair of diagonal cutting pliers.
- A small file or medium-grit sandpaper.

**Note:** Tools required to prepare option cables for wiring are not listed in this manual.



## 4 Option Components

### ◆ DeviceNet Option



**A – Terminal block CN1**

**B – Model number**

**C – Connector (CN5)**

**D – Installation hole**

**E – LED (MS) <1>**

**F – LED (NS) <1>**

**G – Ground terminal and installation hole <2>**

<1> Refer to [Option LED Display on page 10](#) for details on the LEDs.

<2> The ground wire provided in the option shipping package must be connected during installation.

**Figure 2 DeviceNet Option Components**

### ◆ Terminal Block CN1

The communication terminal is a pluggable terminal block that serves as the connection point of the DeviceNet network communication cable to the option.

**Table 2 Terminal Descriptions**

Terminal	Pin	Color	Signal	Description
	1	Black	V-	Network common
	2	Blue	CAN_L	CAN data Low
	3	—	Shield	Cable shield
	4	White	CAN_H	CAN data High
	5	Red	V+	Communications network power DC +24V

## 4 Option Components

### ◆ Option LED Display

The option has two bicolor, red/green LEDs: one for Module Status (MS) and one for Network Status (NS).

The operational states of the LEDs after completion of the DeviceNet power-up diagnostic LED sequence are described in [Table 4](#). Wait at least 2 seconds for the power-up diagnostic process to complete before verifying the states of the LEDs.

**Table 3 Option LED States**

Name	Display		Operating Status	Remarks
	Color	Status		
MS	—	OFF	Power supply OFF	Power is not being supplied to the drive.
	Green	ON	Option operating	The option is operating normally.
	Green	Flashing	Option initializing	There is an incorrect baud rate setting or there is a MAC ID.
	Red	ON	Fatal error occurred	A fatal (irrecoverable) error occurred in the option.
	Red	Flashing	Non-fatal error occurred	A non-fatal (recoverable) error occurred.
	Green/Red	Flashing	Device self-test	Device in self-test mode.
NS	—	OFF	Offline or Power supply OFF	—
	Green	ON	Online communications established	Device is on-line and has connections in the established state.
	Green	Flashing	Online communications not established	Device is on-line but has no connections in the established state. Duplicate MAC ID test has been passed and is on-line but has no open connections to other nodes.
	Red	ON	Communications error	An error occurred disabling DeviceNet communications. <ul style="list-style-type: none"><li>• MAC ID duplication</li><li>• Bus off detected</li></ul>
	Red	Flashing	Communications time-out	A communications time-out occurred with the master.
	Green/Red	Flashing	Communication faulted	Specific communication faulted device. <ul style="list-style-type: none"><li>• The device has detected a network access error and is in the communications faulted state.</li><li>• The device has then received and accepted an Identify communication fault request-long protocol message.</li></ul>

### ■ Power-Up Diagnostics

An LED test is performed each time the drive is powered up. The initial boot sequence may take several seconds. The option is successfully initialized when the LEDs complete the diagnostic LED sequence. The LEDs then assume operational conditions shown in [Table 3](#).

**Table 4 Power-Up Diagnostic LED Sequence**

Sequence	Module Status (MS)	Network Status (NS)	Time (ms)
1	Green	OFF	250
2	Red	OFF	250
3	Green	Green	250
4	Green	Red	250
5	Green	OFF	-

# 5 Installation Procedure

### ◆ Section Safety

#### DANGER

##### Electrical Shock Hazard

**Do not connect or disconnect wiring while the power is on.**

Failure to comply will result in death or serious injury.

Disconnect all power to the drive and wait at least the amount of time specified on the drive front cover safety label. After all indicators are off, measure the DC bus voltage to confirm safe level, and check for unsafe voltages before servicing. The internal capacitor remains charged after the power supply is turned off.

#### WARNING

##### Electrical Shock Hazard

**Do not remove the front covers of the drive while the power is on.**

Failure to comply could result in death or serious injury.

The diagrams in this section may include options and drives without covers or safety shields to show details. Be sure to reinstall covers or shields before operating any devices. Use the option according to the instructions described in this manual.

**Do not allow unqualified personnel to use equipment.**

Failure to comply could result in death or serious injury.

Maintenance, inspection, and replacement of parts must be performed only by authorized personnel familiar with installation, adjustment, and maintenance of this product.

**Do not touch circuit boards while the power to the drive is on.**

Failure to comply could result in death or serious injury.

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

Failure to comply could result in death or serious injury.



### WARNING

#### Fire Hazard

**Tighten all terminal screws to the specified tightening torque.**

Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections.

### NOTICE

#### Damage to Equipment

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

Failure to comply may result in ESD damage to circuitry.

**Never shut the power off while the drive is running or outputting voltage.**

Failure to comply may cause the application to operate incorrectly or damage the drive.

**Do not operate damaged equipment.**

Failure to comply may cause further damage to the equipment.

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

**Tighten all terminal screws to the specified tightening torque.**

Failure to comply could result in damage to the terminal block.

**Do not use unshielded cable for control wiring.**

Failure to comply may cause electrical interference resulting in poor system performance.

Use shielded twisted-pair wires and ground the shield to the ground terminal of the drive.

**Properly connect all pins and connectors.**

Failure to comply may prevent proper operation and possibly damage equipment.

**Check wiring to ensure that all connections are correct after installing the option and connecting any other devices.**

Failure to comply may result in damage to the option.

## 5 Installation Procedure

### ◆ Prior to Installing the Option

Prior to installing the option, wire the drive, make the necessary connections to the drive terminals, and verify that the drive functions normally. Refer to the Quick Start Guide packaged with the drive for information on wiring and connecting the drive.

**Figure 3** shows an exploded view of the drive with the option and related components for reference.

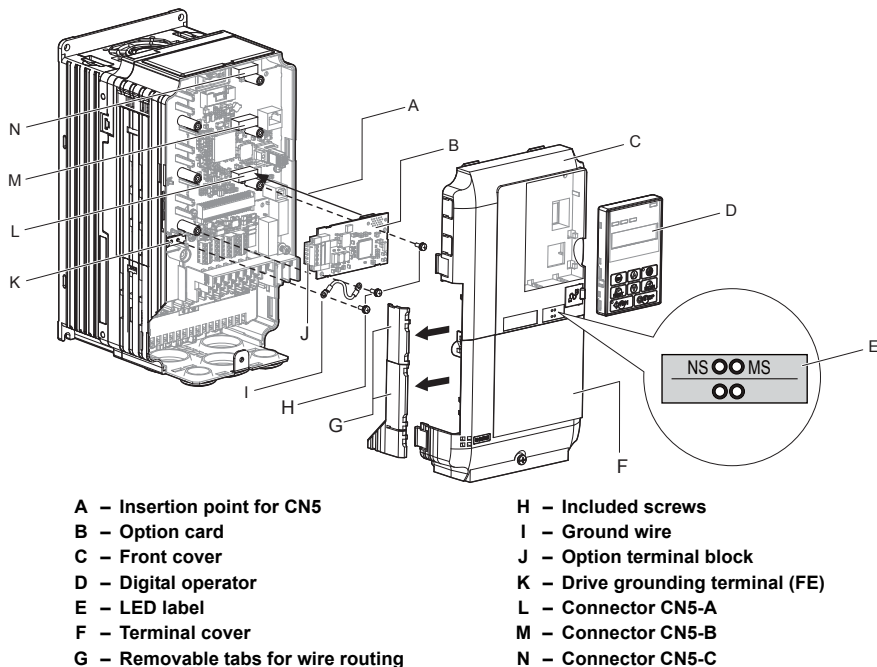


Figure 3 Drive Components with Option

### ◆ Installing the Option

Refer to the instructions below to install the option.

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

**DANGER!** *Electrical Shock Hazard. Disconnect all power to the drive and wait at least the amount of time specified on the drive front cover safety label. After all indicators are off, measure the DC bus voltage to confirm safe level, and check for unsafe voltages before servicing to prevent electric shock. The internal capacitor remains charged even after the power supply is turned off.*

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

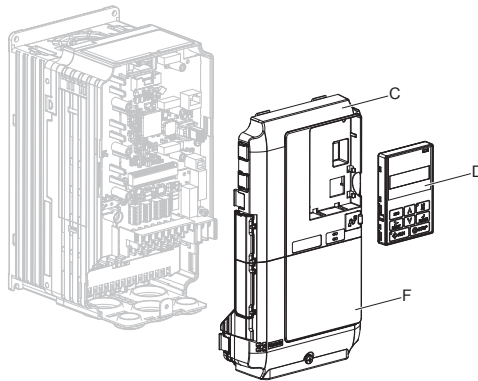


Figure 4 Remove the Front Covers and Digital Operator

## 5 Installation Procedure

2. With the front covers and digital operator removed, apply the LED label (E) in the appropriate position on the drive top front cover (C).

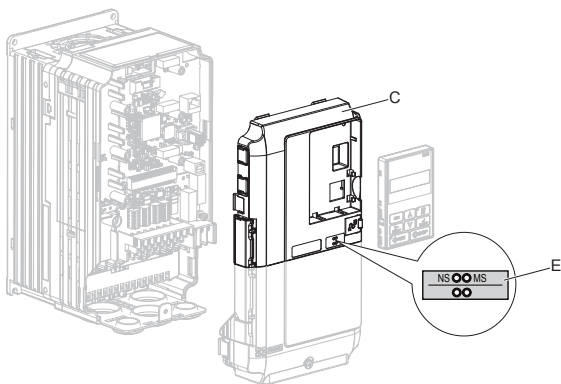


Figure 5 Apply the LED Label

3. Insert the option card (B) into the CN5-A connector (L) located on the drive and fasten it using one of the included screws (H).

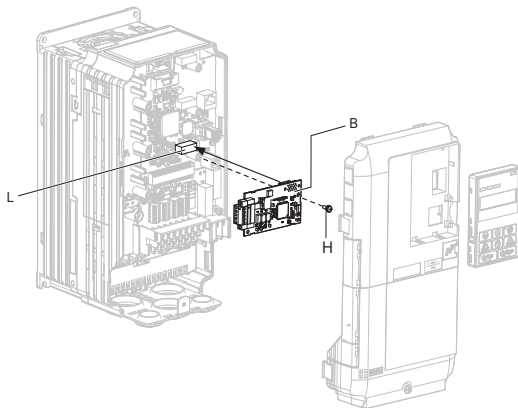
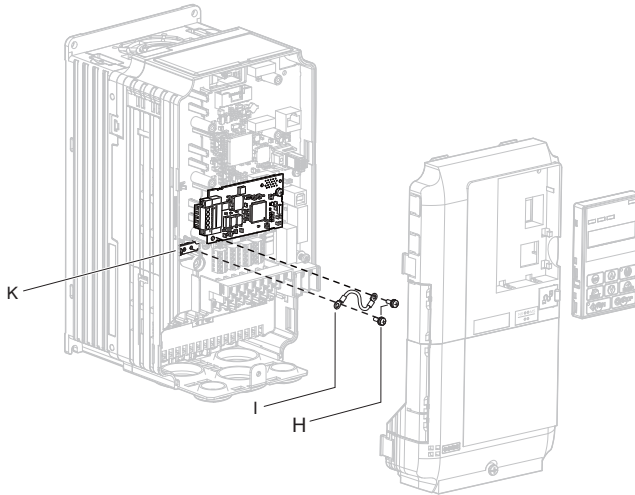


Figure 6 Insert the Option Card



4. Connect the ground wire (I) to the ground terminal (K) using one of the remaining provided screws (H). Connect the other end of the ground wire (I) to the remaining ground terminal and installation hole on the option using the last remaining provided screw (H).



**Figure 7 Connect the Ground Wire**

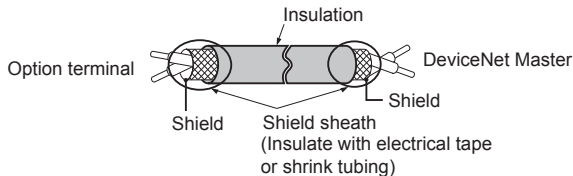
**Note:** There are two screw holes on the drive for use as ground terminals. When connecting more than two options, two ground wires will need to share the same drive ground terminal.

5. Select the proper type and length of communication cables and drop line. Refer to the ODVA website ([www.odva.org](http://www.odva.org)) for more information on network cabling.  
**Refer to Trunk Line and Drop Line Lengths on page 34** for a quick reference on selecting trunk line and drop line lengths.

Only connect network termination resistors ( $121\ \Omega$ ,  $\pm 1\%$ ,  $1/4\ W$ ) to the two end nodes of the trunk line. Refer to ODVA specifications for more details on DeviceNet termination.

## 5 Installation Procedure

6. Prepare the communication cables as shown in **Figure 8**.

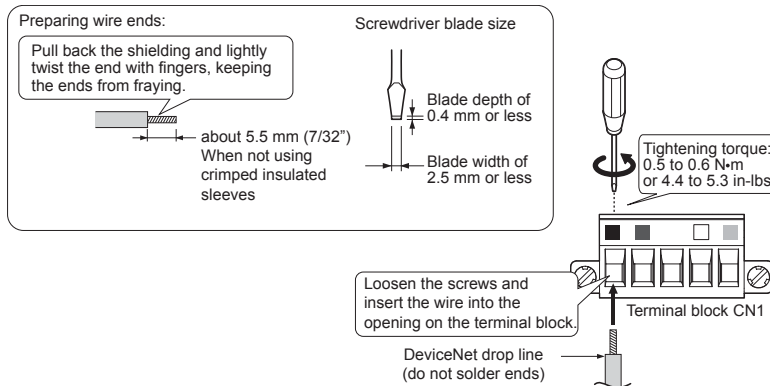


**Figure 8** Preparing Ends of Shielded Cable

7. Connect the communication cables to the terminal block as shown in **Figure 9**. When attaching the CN1 connector plug on the terminal block to the socket, make sure the screws on the left and right sides of the plug are tightened with a tightening torque of 0.5 to 0.6 (N·m) or 4.4 to 5.43 (inch-lbs). Take particular caution to ensure that each wire is properly connected and wire insulation is not accidentally pinched into electrical terminals. Trim any frayed wires.

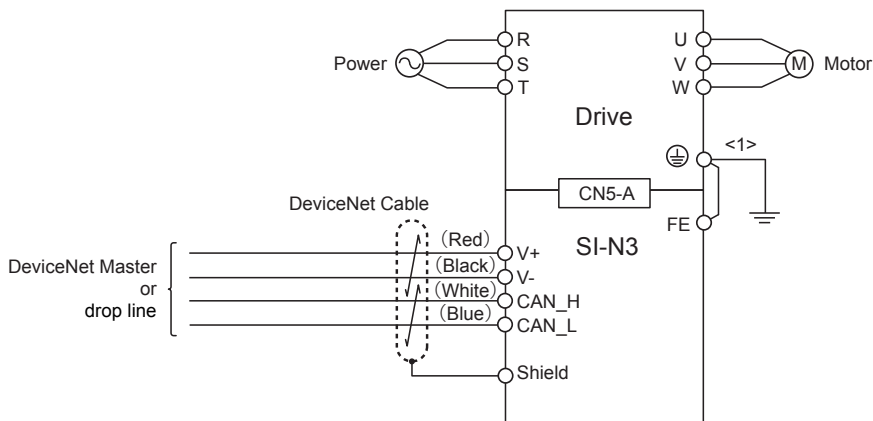
**WARNING! Fire Hazard.** Tighten all terminal screws according to the specified tightening torque. Loose electrical connections could result in death or serious injury by fire due to overheating electrical connections. Tightening screws beyond the specified tightening torque may result in erroneous operation, damage to the terminal block, or cause a fire.

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



**Figure 9** Preparing and Connecting Communication Cable Wiring

### Connection Diagram



**Figure 10 Option Connection Diagram**

<1> The ground wire provided in the option shipping package must be connected during installation.

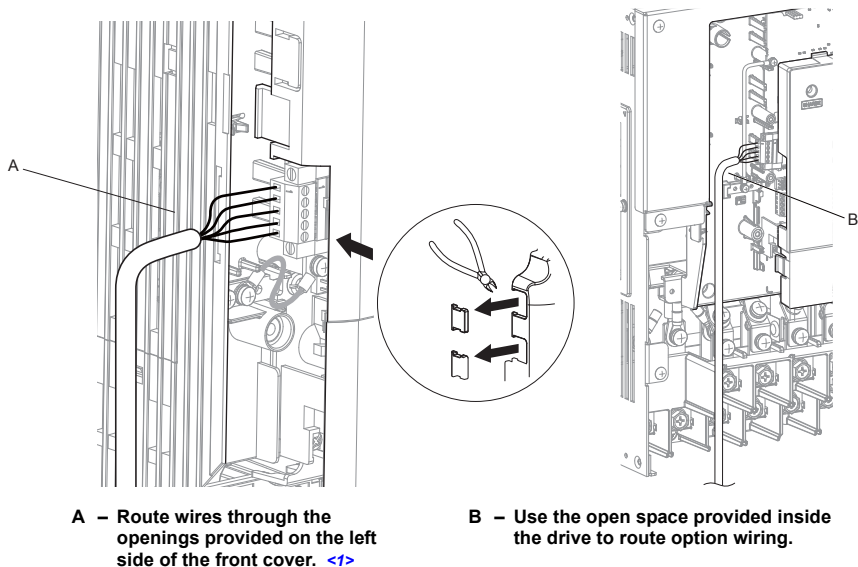
## 5 Installation Procedure

### 8. Route the option wiring.

Depending on the drive model, some drives may require routing the wiring through the side of the front cover to the outside. In these cases, cut out the perforated openings in the left side of the drive front cover as shown in **Figure 11-A**, and leave no sharp edges to damage wiring.

Route the wiring inside the enclosure as shown in **Figure 11-B** for drives that do not require routing through the front cover. Refer to the Peripheral Devices & Options section of the drive Technical Manual for more information.

**Note:** Separate communication cables from main circuit wiring and other electrical lines.

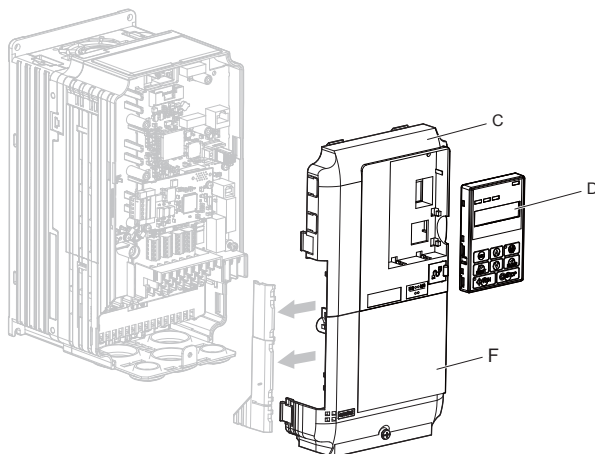


<1> The drive will not meet NEMA Type 1 requirements if wiring is exposed outside the enclosure.

**Figure 11 Wire Routing Examples**

### 9. After wiring the terminal block, recheck the option wire routing performed in step 8.

10. Replace and secure the front covers of the drive (C, F) and replace the digital operator (D).



**Figure 12 Replace the Front Covers and Digital Operator**

**Note:** Take proper precautions when wiring the option so that the front covers will easily fit back onto the drive. Make sure no cables are pinched between the front covers and the drive when replacing the covers.

11. Set drive parameters in [Table 6](#) for proper option performance.

## 5 Installation Procedure

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### ◆ Option MAC ID

#### ■ Parameter F6-50, MAC ID Setting 0 to 64

The option MAC ID is set with drive parameter F6-50. MAC ID settings between 0~63 are considered valid MAC IDs; setting 64 indicates a network-settable MAC ID.

The option reads the MAC ID value from F6-50 upon power-up and upon a network reset.

### ◆ Option Baud Rate

The option supports standard baud rates of 125 kbps, 250 kbps, and 500 kbps.

**Table 5 Parameter F6-51 Baud Rate Setting**

Description	Value
125 kbps	0
250 kbps	1
500 kbps	2
Programmable from Network	3
Auto Detect	4

#### ■ Auto Baud Rate Sensing (F6-51 = 4)

Setting parameter F6-51 to 4 enables automatic baud rate detection and allows the option to automatically determine the baud rate of the DeviceNet network.

**Note:** Auto baud rate sensing is valid only when there is more than one node physically on the DeviceNet network segment. If the auto baud rate sensing fails to detect the baud rate, the drive digital operator will display “bUS” and the option LEDs will be OFF (NS) and solid green (MS).

### ◆ EDS Files

To facilitate network implementation, obtain an EDS file from one of the following websites depending on your region:

US: <http://www.yaskawa.com>

Europe: <http://www.yaskawa.eu.com>

Japan: <http://www.e-mechatronics.com>

Other areas: contact a Yaskawa representative.

## 6 Related Parameters

The following parameters are used to set up the drive for operation with the option.

Confirm proper setting of the all parameters in [Table 6](#) before starting network communications.

**Table 6 Related Parameters**

No. (Addr. Hex)	Name	Description	Values
b1-01 (180) </>	Frequency Reference Selection 1	Selects the frequency reference input source 0: Digital Operator - Digital preset speed d1-01 to d1-17 1: Terminals - Analog input terminal A1 or A2 2: MEMOBUS/Modbus communications 3: Option 4: Pulse Input (Terminal RP)	Default: 1 Range: 0 to 4
b1-02 (181) </>	Run Command Selection 1	Selects the run command input source 0: Digital Operator - RUN and STOP keys 1: Digital input terminals S□ 2: MEMOBUS/Modbus communications 3: Option	Default: 1 Range: 0 to 3
F6-01 (3A2)	Communications Error Operation Selection	Determines drive response when a BUS error is detected during communications with the option 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only </>	Default: 1 Range: 0 to 3
F6-02 (3A3)	External Fault from Comm. Option Detection Selection	Sets the condition for external fault detection (EF0) 0: Always detected 1: Detected only during operation	Default: 0 Range: 0, 1
F6-03 (3A4)	External Fault from Comm. Option Operation Selection	Determines drive response for external fault input (EF0) detection during DeviceNet communication 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only </>	Default: 1 Range: 0 to 3
F6-06 (3A7) </>	Torque Reference/ Torque Limit Selection from Comm. Option	0: Torque reference / torque limit via network communications are disabled. 1: Torque reference / torque limit via network communications are enabled. </>	Default: 0 Range: 0, 1
F6-07 (3A8)	Multi-Step Speed Enable/Disable Selection when NefRef/ ComRef is Selected	0: Multi-step speed reference disabled (F7 functionality) 1: Multi-step speed reference allowed (V7 functionality)	Default: 0 Range: 0, 1

## 6 Related Parameters

No. (Addr. Hex)	Name	Description	Values
F6-08 (36A)	Reset Communication Parameters	Determines which F6-□□ and F7-□□ parameters are reset to default values when initializing the drive using A1-03. 0: Do not reset parameters 1: Reset parameters	Default: 0 Range: 0, 1
F6-50 (3C1) <5> <7>	DeviceNet MAC ID	Selects the drive MAC address <b>Note:</b> Used in the DeviceNet Object	Default: <8> Min: 0 Max: 64
F6-51 (3C2) <7>	DeviceNet Communication Speed	DeviceNet communication speed 0: 125 kbps 1: 250 kbps 2: 500 kbps 3: Programmable from network 4: Auto detect <b>Note:</b> Used in the DeviceNet Object	Default: <9> Range: 0 to 4
F6-52 (3C3) <6>	DeviceNet PCA Setting	I/O Polled Consuming Assembly data instance <b>Note:</b> Used in the Connection Object	Default: 21 Min: 0 Max: 255
F6-53 (3C4) <6>	DeviceNet PPA Setting	I/O Polled Producing Assembly data instance <b>Note:</b> Used in the Connection Object	Default: 71 Min: 0 Max: 255
F6-54 (3C5) <7>	DeviceNet Idle Mode Fault Detection	When detection is enabled and idle messages are detected, the option will set Run and Frequency to 0. 0: Detection enabled 1: No detection	Default: 0 Range: 0, 1
F6-55 (3C6)	DeviceNet Baud Rate Monitor	<b>(Read only)</b> DeviceNet actual communication speed 0: 125 kbps 1: 250 kbps 2: 500 kbps <b>Note:</b> Used in the DeviceNet Object	Default: 0 Range: 0 to 2
F6-56 (3D7)	DeviceNet Speed Scaling	Sets the scaling factor for the Speed Monitor in the DeviceNet Object Class 2A hex <b>Note:</b> Used in the AC/DC Drive Object	Default: 0 Min: -15 Max: 15
F6-57 (3D8)	DeviceNet Current Scaling	Sets the scaling factor for the Output Current Monitor in the DeviceNet Object Class 2A hex <b>Note:</b> Used in the AC/DC Drive Object	Default: 0 Min: -15 Max: 15
F6-58 (3D9)	DeviceNet Torque Scaling	Sets the scaling factor for the Torque Monitor in the DeviceNet Object Class 2A hex <b>Note:</b> Used in the AC/DC Drive Object	Default: 0 Min: -15 Max: 15
F6-59 (3DA)	DeviceNet Power Scaling	Sets the scaling factor for the Power Monitor in the DeviceNet Object Class 2A hex <b>Note:</b> Used in the AC/DC Drive Object	Default: 0 Min: -15 Max: 15



No. (Addr. Hex)	Name	Description	Values
F6-60 (3DB)	DeviceNet Voltage Scaling	Sets the scaling factor for the Voltage Monitor in the DeviceNet Object Class 2A <b>Note:</b> Used in the AC/DC Drive Object	Default: 0 Min: -15 Max: 15
F6-61 (3DC)	DeviceNet Time Scaling	Sets the scaling factor for the Time Monitor in the DeviceNet Object Class 2A hex <b>Note:</b> Used in the AC/DC Drive Object	Default: 0 Min: -15 Max: 15
F6-62 (3DD)	DeviceNet Heartbeat Interval	Sets the heartbeat interval <b>Note:</b> Used in the Identity Object	Default: 0 Min: 0 Max: 10
F6-63 (3DE)	DeviceNet Network MAC ID	<b>(Read only)</b> Actual MAC address <b>Note:</b> Used in the DeviceNet Object	Default: 0 Min: 0 Max: 63
U6-98 (7F8)	Previous Option Fault	Displays previous faulted status. 0: No fault 1: Option failure 2: PLC in idle state 3: Force fault 1000: Network power loss 1001: Connection timeout 1002: Duplicate MAC ID 1003: Bus-off <b>Note:</b> Used in option faults	Range: 0 to 3; 1000 to 1003
U6-99 (7F9)	Current Option Fault	Displays the most recent fault status. 0: No fault 1: Option failure 2: PLC in idle state 3: Force fault 1000: Network power loss 1001: Connection timeout 1002: Duplicate MAC ID 1003: Bus-off <b>Note:</b> Used in option faults	Range: 0 to 3; 1000 to 1003

- <1> To start and stop the drive with the DeviceNet master device using serial communications, set b1-02 to 3 or set the Net Control bit in the assemblies or Control Supervisor Object. To control the frequency reference of the drive via the master device, set b1-01 to 3 or set the Net Reference bit in the assemblies or AC/DC object.
- <2> Setting F6-01 or F6-03 to 3 will allow the drive to continue to operate after detecting a fault. When allowing the drive to continue operation after fault detection, be sure to take proper safety measures such as installing an emergency stop switch.
- <3> Enabled in CLV, AOLV/PM, and CLV/PM control modes (A1-02 = 3, 6, or 7). When enabled, d5-01 determines whether the value is read as the torque limit value (d5-01 = 0) or read as the torque reference value (d5-01 = 1). This value is read as the torque limit in CLV/PM.
- <4> Default setting specifies that the torque reference or torque limit is to be provided via network communications (F6-06 = 1). The motor may not rotate if no torque reference or torque limit is supplied from the PLC.
- <5> All MAC addresses must be unique.
- <6> Setting unavailable values will initialize Polled Consuming Assembly (PCA) and Polled Producing Assembly (PPA).
- <7> Cycle power for setting changes to take effect.

## 6 Related Parameters

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<8> Regional default settings

Setting 0: Japan, China, Europe, India, and Asia (Drive model code: CIMR-AA□A, CIMR-AB□A, CIMR-AC□A, CIMR-AD□A, CIMR-AT□A)

Setting 64: USA (Drive model code: CIMR-AU□A)

<9> Regional default settings

Setting 0: Japan, China, Europe, India, and Asia (Drive model code: CIMR-AA□A, CIMR-AB□A, CIMR-AC□A, CIMR-AD□A, CIMR-AT□A)

Setting 4: USA (Drive model code: CIMR-AU□A)

## 7 Configuring DeviceNet Messaging

This section provides information on the methods used to control the drive on DeviceNet.

### ◆ Drive Configuration on DeviceNet

#### ■ Polled Configuration

Configure the drive DeviceNet polled connection before receiving commands from a master device. The two parameters that must be configured are:

- F6-52: Polled Consuming Assembly (PCA)

**Note:** Output assembly consumed by the drive.

- F6-53: Polled Producing Assembly (PPA)

**Note:** Input assembly produced by the drive.

The default connection paths for the option are set for Extended Speed Control.

The PCA and PPA parameters can be accessed by two methods:

- A software configuration tool (not supplied), and Yaskawa Electronic Data Sheet (EDS)

**Note:** The PCA and PPA parameters can be accessed from the “DN: Polled Config” parameter group.

- A software configuration tool (not supplied), via a DeviceNet message path, such as Extended Speed Control

**Note:** Use DeviceNet Connection Object to change the PCA or PPA if required by the application. (Class 5, Instance 1, Attributes 14 and 16)

One of each PCA and PPA assembly from the following table must be selected to configure the drive for polled operation.

**Table 7 Supported Polled Assemblies (PCA and PPA)**

Assy Number (decimal)	Description	Type	Bytes	Page
20	Basic Speed Control Output - 20 (0x14)	PCA	4	<a href="#">30</a>
21	Extended Speed Control Output - 21 (0x15) (Default Setting)	PCA	4	<a href="#">30</a>
22	Speed and Torque Control Output - 22 (0x16)	PCA	6	—
23	Extended Speed and Torque Control Output - 23 (0x17)	PCA	6	—
70	Basic Speed Control Input - 70 (0x46)	PPA	4	<a href="#">30</a>
71	Extended Speed Control Input - 71 (0x47) (Default Setting)	PPA	4	<a href="#">30</a>
72	Speed and Torque Control Input - 72 (0x48)	PPA	6	—
73	Extended Speed and Torque Control Input - 73 (0x49)	PPA	6	—
100	MEMOBUS/Modbus Message Command (Vendor Specific Yaskawa Electric (YE) Assy) - 100 (0x64)	PCA	5	—

## 7 Configuring DeviceNet Messaging

Assy Number (decimal)	Description	Type	Bytes	Page
101	Standard Control (Vendor Specific Yaskawa Electric (YE) Assy) - 101 (0x65)	PCA	8	—
102	Accel/Decel Time (Vendor Specific Yaskawa Electric (YE) Assy) - 102 (0x66)	PCA	8	—
105	Enhanced Speed Control, Dynamic (Vendor Specific Yaskawa Electric (YE) Assy) - 105 (0x69)	PCA	8	—
106	Enhanced Control (Vendor Specific Yaskawa Electric (YE) Assy) - 106 (0x6A)	PCA	8	—
107	Standard DI/DO Control (Vendor Specific Yaskawa Electric (YE) Assy) - 107 (0x6B)	PCA	8	—
108	Enhanced Torque Control, Dynamic (Vendor Specific Yaskawa Electric (YE) Assy) - 108 (0x6C)	PCA	8	—
120	Speed Command 1 (Vendor Specific Yaskawa Electric (YE) Assy) - 120 (0x78)	PCA	4	—
121	Torque Command 1 (Vendor Specific Yaskawa Electric (YE) Assy) - 121 (0x79)	PCA	4	—
122	Speed Command 2 (Vendor Specific Yaskawa Electric (YE) Assy) - 122 (0x7A)	PCA	6	—
123	Torque Command 2 (Vendor Specific Yaskawa Electric (YE) Assy) - 123 (0x7B)	PCA	6	—
124	Speed Dynamic Assy (Vendor Specific Yaskawa Electric (YE) Assy) - 124 (0x7C)	PCA	8	—
125	Torque Dynamic Assy (Vendor Specific Yaskawa Electric (YE) Assy) - 125 (0x7D)	PCA	8	—
126	Speed/Torque Assy (Vendor Specific Yaskawa Electric (YE) Assy) - 126 (0x7E)	PCA	8	—
130	Speed Status (Vendor Specific Yaskawa Electric (YE) Assy) - 130 (0x82)	PPA	4	—
131	Current Status (Vendor Specific Yaskawa Electric (YE) Assy) - 131 (0x83)	PPA	4	—
132	Current & Speed Status (Vendor Specific Yaskawa Electric (YE) Assy) - 132 (0x84)	PPA	6	—
134	Speed Status Dynamic Assy (Vendor Specific Yaskawa Electric (YE) Assy) - 134 (0x86)	PPA	8	—
135	Current Status Dynamic Assy (Vendor Specific Yaskawa Electric (YE) Assy) - 135 (0x87)	PPA	8	—
136	Torque and Speed Status (Vendor Specific Yaskawa Electric (YE) Assy) - 136 (0x88)	PPA	8	—
150	MEMOBUS/Modbus Message Reply (Vendor Specific Yaskawa Electric (YE) Assy) - 150 (0x96)	PPA	5	—
151	Standard Status 1 (Vendor Specific Yaskawa Electric (YE) Assy) - 151 (0x97)	PPA	8	—
152	Standard Status 2 (Vendor Specific Yaskawa Electric (YE) Assy) - 152 (0x98)	PPA	8	—
155	Enhanced Speed Status, Dynamic (Vendor Specific Yaskawa Electric (YE) Assy) - 155 (0x9B)	PPA	8	—
156	Enhanced Control Status (Vendor Specific Yaskawa Electric (YE) Assy) - 156 (0x9C)	PPA	8	—
157	Standard DI/DO Status (Vendor Specific Yaskawa Electric (YE) Assy) - 157 (0x9D)	PPA	8	—

## 7 Configuring DeviceNet Messaging

Assy Number (decimal)	Description	Type	Bytes	Page
158	Enhanced Torque Status, Dynamic (Vendor Specific Yaskawa Electric (YE) Assy) - 158 (0x9E)	PPA	8	—
199	Change of State Response (Vendor Specific Yaskawa Electric (YE) Assy) - 199 (0xC7)	PPA	8	—

## 7 Configuring DeviceNet Messaging

### ◆ Drive Operation on DeviceNet

#### ■ Polled Assemblies Quick Reference

Refer to the option Technical Manual for details on polled assemblies and other message types.

#### Output Assemblies/Drive Consumes

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
20 DeviceNet Basic Speed Control	0	-	-	-	-	-	Fault Reset	-	Run Fwd
	1	-							
	2	Speed Reference (Low Byte)							
	3	Speed Reference (High Byte)							

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
21 DeviceNet Extended Speed Control	0	-	Net Ref	Net Ctrl	-	-	Fault Reset	Run Rev	Run Fwd
	1	-							
	2	Speed Reference (Low Byte)							
	3	Speed Reference (High Byte)							

#### Input Assemblies/Drive Produces

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
70 DeviceNet Basic Speed Control	0	-	-	-	-	-	Running 1 (FWD)	-	Faulted
	1	-							
	2	Speed Actual (Low Byte)							
	3	Speed Actual (High Byte)							

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
71 DeviceNet Extended Speed Control	0	At Speed	Ref from Net	Ctrl from Net	Ready	Running 2 (REV)	Running 1 (FWD)	Warning	Faulted
	1	State							
	2	Speed Actual (Low Byte)							
	3	Speed Actual (High Byte)							

## 8 Troubleshooting

### ◆ Drive-Side Error Codes

**Table 8** lists the various fault codes related to the option. Refer to the drive Technical Manual for further details on the fault codes.

### ■ Faults

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

Check the following items first when an error code occurs on the drive:

- Communication cable connections.
- Make sure the option is properly installed to the drive.
- Operation status of the controller program and controller CPU.
- Did a momentary power loss interrupt communications?

**Table 8 Fault Displays, Causes, and Possible Solutions**

Digital Operator Display		Fault Name
bUS	bUS	Option Communication Error
		The connection was lost after establishing initial communication. Only detected when the run command frequency reference is assigned to the option (bl-01 = 3 or bl-02 = 3).
Cause		Possible Solution
Master controller (PLC) has stopped communicating		Check for faulty wiring. Correct any wiring problems.
Communication cable is not connected properly		
A data error occurred due to noise		<ul style="list-style-type: none"><li>• Counteract noise in the control circuit wiring, main circuit lines, and ground wiring.</li><li>• If a magnetic contactor is the noise source, install a surge absorber to the contactor coil.</li><li>• Use cables recommended by Yaskawa or another type of shielded line. Ground the shield on the controller side and on the option side.</li></ul>
Option is damaged		If there are no wiring problems and the fault continues to occur, replace the option.
Network power loss		The power on the DeviceNet network cable is 0. Verify power is available between option terminals V+ (red) and V- (black).
Connection timeout		The option Expected Packet Rate (EPR) timer timed out. Make sure that EPR time is set properly.
Duplicate MAC ID		The option MAC ID and at least one other node have the same MAC ID. Verify F6-50 is set properly. All MAC IDs must be unique.


## 8 Troubleshooting

Digital Operator Display		Fault Name
EF0	EF0	External Fault Input from the option
		The alarm function for an external device has been triggered.
Cause		Possible Solution
An external fault is being sent from the main controller (PLC)		<ul style="list-style-type: none"><li>Remove the cause of the external fault</li><li>Reset the external fault input from the PLC device</li></ul>
Problem with the PLC program		Check the program used by the PLC and make the appropriate corrections.
Digital Operator Display		Fault Name
oFA00	oFA00	Non-Compatible option connected to drive port CN5-A
		Option is not properly connected.
Cause		Possible Solution
Non-compatible option connected to drive port CN5-A		Use only compatible options. Connect the SI-N3 to CN5-A. For other option connections refer to the Installation Manual for those options.
Digital Operator Display		Fault Name
oFA01	oFA01	Option Fault (CN5-A)
		Option is not properly connected.
Cause		Possible Solution
Problem with the connector between the drive and option		Turn the power off and check the connectors between the drive and option.
Digital Operator Display		Fault Name
oFA30 to oFA43	oFA30 to oFA43	Option Fault (CN5-A)
		Communication ID error
Cause		Possible Solution
Option hardware fault		Replace the option. Contact Yaskawa for assistance.
Digital Operator Display		Fault Name
oFb00	oFb00	Non-Compatible option connected to drive port CN5-B
		Non-compatible option is connected.
Cause		Possible Solution
Non-compatible option connected to drive port CN5-B		Use only compatible options. Connect the SI-N3 to CN5-A. For other option connections refer to the Installation Manual for those options.



Digital Operator Display		Fault Name
oFb02	oFb02	Option Fault (CN5-B)
		Two of the same option are connected simultaneously.
Cause		Possible Solution
AI-A3, DI-A3 or SI-□□ connected to the CN5-B port while an option was connected to CN5-A		Only one of these options, AI-A3, DI-A3 or SI-□□ option can be connected to the drive at the same time. The SI-N3 must be connected to CN5-A.
Digital Operator Display		Fault Name
oFC00	oFC00	Non-Compatible option connected to drive port CN5-C
		Non-compatible option is connected.
Cause		Possible Solution
Non-compatible option connected to port CN5-C		Use only compatible options. Connect the SI-N3 to CN5-A. For other option connections refer to the Installation Manual for those options.
Digital Operator Display		Fault Name
oFC02	oFC02	Option Fault (CN5-C)
		Two of the same options are connected simultaneously.
Cause		Possible Solution
AI-A3, DI-A3 or SI-□□ connected to the CN5-C port while an option was connected to CN5-A		Only one of these options, AI-A3, DI-A3 or SI-□□ option can be connected to the drive at the same time. The SI-N3 must be connected to CN5-A.

## ■ Minor Faults and Alarms

Digital Operator Display		Minor Fault Name	
	CALL	Serial Communication Transmission Error	
		Communication has not yet been established.	
Cause		Possible Solution	Minor Fault (H2-□□ = 10)
Communication wiring or terminal resistor connection is faulty. There is a short circuit, or an option component is not connected properly		Check for wiring errors and correct the wiring. Remove any ground shorts and reconnect loose wires.	Yes
Master-side programming error		Check communications at start-up and correct programming errors.	
Damaged communication circuitry		Perform a self-diagnostics check and replace the drive if the fault continues to occur.	

## 9 Trunk Line and Drop Line Lengths

# 9 Trunk Line and Drop Line Lengths

Refer to [www.odva.org](http://www.odva.org) for more information regarding wiring DeviceNet networks.

### ◆ Trunk Line

The maximum allowable trunk line length depends on the type of cable used and the network baud rate. The total cable length includes the length of the trunk and the sum of all the drop lines.

**Table 9 Trunk Line Cable Length**

Baud Rate (kbps)	Thick Cable	Thin Cable
125	500 m (1640 ft.)	100 m (328 ft.)
250	250 m (787 ft.)	100 m (328 ft.)
500	100 m (328 ft.)	100 m (328 ft.)

To calculate the maximum total length for trunk lines of mixed thick and thin cables, use the following formulas:

- 125 kbps:  $L_{\text{thick}} + (5 \times L_{\text{thin}}) \leq 500 \text{ m (1640 ft.)}$
- 250 kbps:  $L_{\text{thick}} + (2.5 \times L_{\text{thin}}) \leq 250 \text{ m (787 ft.)}$
- 500 kbps:  $L_{\text{thick}} + L_{\text{thin}} \leq 100 \text{ m (328 ft.)}$

### ◆ Drop Line

The drop line is measured from the tap on the trunk line to the transceiver of the DeviceNet node. The total cable length includes the length of the trunk and the sum of all the drop lines.

**Table 10 Drop Line Cable Length**

Baud Rate (kbps)	Maximum at Each Drop	Maximum Total
125	6 m (20 ft.)	156 m (511 ft.)
250		78 m (256 ft.)
500		39 m (128 ft.)

# 10 Specifications

Table 11 Option Specifications

Items	Specifications
Model	SI-N3
SI-N3 Supported Messages	<ul style="list-style-type: none"> <li>• Group 2 Server (UCMM capable).</li> <li>• Explicit Messages: Fragmentation is supported. Up to 32 bytes can be input and output.</li> <li>• Polled I/O Messages: Fragmentation is not supported. Up to 8 bytes can be input and output.</li> <li>• Faulted Node Recovery / Offline Connection Set Messages / Automatic Device Replacement (ADR).</li> <li>• Change of State Message (COS). COS can be used as an I/O Input Assembly.</li> </ul>
I/O Assembly Instance	Input: 17 types (4~8 bytes) Output: 18 types (4~8 bytes)
DeviceNet Specification	Conformance Level 19: Passed
DeviceNet Profile	AC Drive
Input Power	Voltage: 11~25 Vdc Current: 40 mA
Connector Type	5-pin open-style screw connector
Physical Layer Type	Isolated Physical Layer CAN transceiver + photocoupler
MAC ID Setting	Programmable from drive keypad or network: MAC ID 0 to 63
Communications Speed/Baud Rate	Programmable from drive keypad or network: <ul style="list-style-type: none"> <li>• 125/250/500 kbps</li> <li>• Auto Baud Rate</li> <li>• Idle Mode Detect</li> <li>• Heartbeat</li> </ul>
Ambient Temperature	-10 °C to +50 °C (14 °F to 122 °F)
Humidity	95% RH or lower with no condensation
Storage Temperature	-20 °C to +60 °C (-4 °F to 140 °F) allowed for short-term transport of the product
Area of Use	Indoor (free of corrosive gas, airborne particles, etc.)
Altitude	1000 m (3280 ft.) or lower

## 10 Specifications

### ◆ Revision History

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

MANUAL NO. TOBP C730600 43A

Published in Japan    May 2010    08-7    ◇

└─ Date of publication    └─ Date of original publication    └─ Revision number

Date of Publication	Revision Number	Section	Revised Content
March 2013	◇5	Back cover	Revision: Address
November 2010	◇4	Front cover, back cover	Revision: Format
		Entire Document	Edited for procedural clarity and readability.
July 2010	◇3	Back cover	Revision: Address
July 2010	◇2	Entire Document	Edited for procedural clarity and readability.
		Back cover	Revision: Address
May 2010	◇1	Back cover	Revision: Address
July 2008	—	—	First edition

# YASKAWA AC Drive 1000-Series Option

## DeviceNet

## Installation Manual

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YASKAWA ELECTRIC CORPORATION

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MANUAL NO. TOBP C730600 43C

Published in Japan March 2013 08-7  0  
12-12-10