YASKAWA

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YASKAWA AC Drive 1000-Series Option

Digital Input
Installation Manual

Type DI-A3

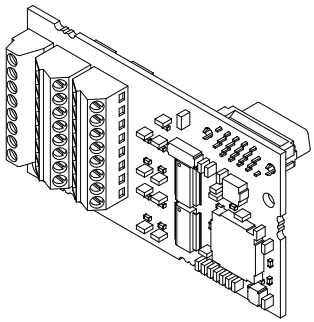
To properly use the product, read this manual thoroughly and retain for easy reference, inspection, and maintenance. Ensure the end user receives this manual.

安川インバータ 1000シリーズ オプション

ディジタル入力
取扱説明書

形式　DI-A3

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MANUAL NO. TOBP C730600 39B

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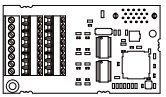
1 Preface and Safety

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.

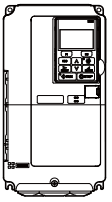
◆ Applicable Documentation

The following manuals are available for the option:

Digital Input DI-A3 Option

	**Yaskawa AC Drive 1000-Series Option Digital Input DI-A3 Installation Manual Manual No: TOBPC73060039**	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.

Yaskawa Drive

	**Yaskawa AC Drive 1000-Series Quick Start Guide**	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. Access these sites to obtain Yaskawa instruction manuals: U.S.: http://www.yaskawa.com Europe: http://www.yaskawa.eu.com Japan: http://www.e-mechatronics.com For questions, contact your local Yaskawa sales office or the nearest Yaskawa representative.
	Yaskawa AC Drive 1000-Series Technical Manual	

◆ Terms

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

Drive: Yaskawa AC Drive 1000-Series

Option: Yaskawa AC Drive 1000-Series Option Digital Input DI-A3

◆ Registered Trademarks

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.

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 Digital Input Option DI-A3 allows the user to set the drive frequency/speed reference using binary coded digital inputs.

The option has the following features:

- Binary 16-bit, 4-digit BCD input
- Binary 12-bit, 3-digit BCD input
- Binary 8-bit, 2-digit BCD input

The input signal is +24 Vdc 8mA isolated input.

◆ Applicable Models

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

Table 1 Applicable Models

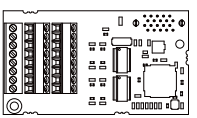
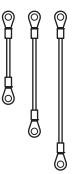
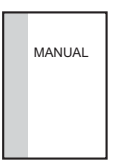
Drive Series	Drive Model Number
A1000	All models
L1000A	All models

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 1*** 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 Wires	Screws (M3)	Installation Manual
–				
Quantity:	1	3	3	1

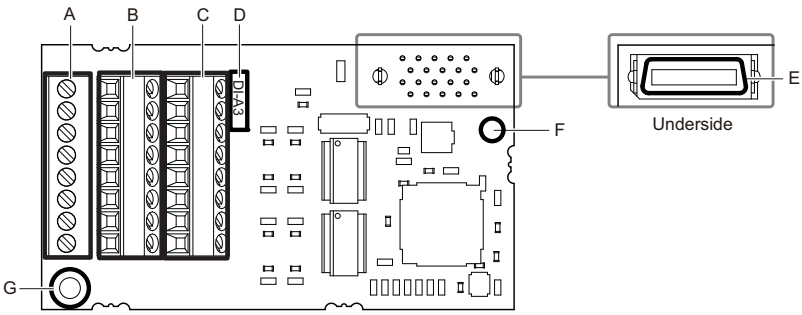
◆ Tools Required for Installation

- 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

◆ Digital Input DI-A3 Option

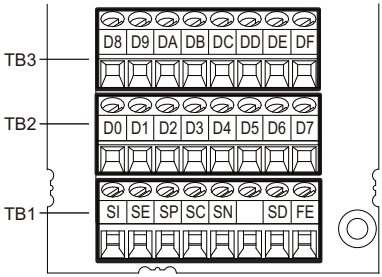


A – Terminal block TB1
B – Terminal block TB2
C – Terminal block TB3
D – Model number
E – Connector (CN5)
F – Installation hole
G – Ground terminal and installation hole <1>

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

Figure 1 Digital Input DI-A3 Option

◆ Terminal Blocks TB1, TB2, and TB3



Refer to *Table 4* on page *22* for details on TB1, TB2, and TB3 terminal functions and signal levels.

5 Installation Procedure

◆ Section Safety

⚠ DANGER

Electric 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. 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.

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⚠ WARNING

Do not use damaged wires, place excessive on wiring, or damage the wire insulation.

Failure to comply could result in death or serious injury.

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.

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.

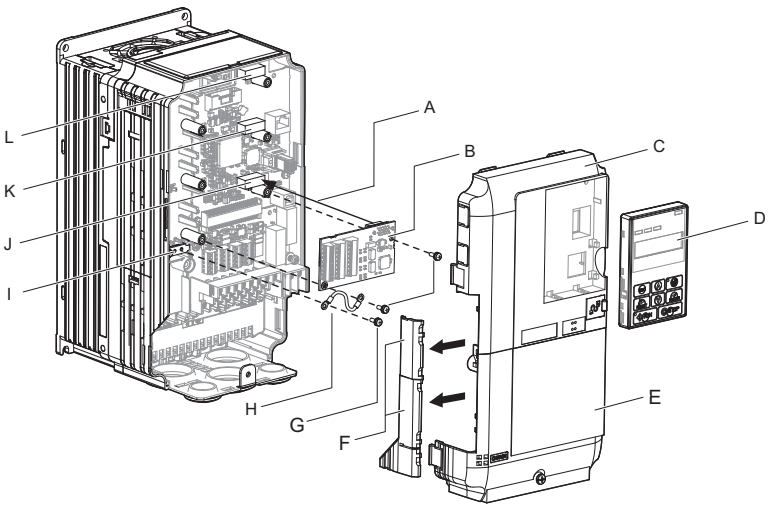
Check wiring to ensure that all connections are correct after installing the option and connecting any other devices.

Failure to comply may result in damage to the option.

◆ 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 2 shows an exploded view of the drive with the option and related components for reference.



A – Insertion point for CN5
B – Option card
C – Front cover
D – Digital operator
E – Terminal cover
F – Removable tabs for wire routing
G – Included screws
H – Ground wire
I – Drive grounding terminal (FE)
J – Connector CN5-A
K – Connector CN5-B
L – Connector CN5-C

Figure 2 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, E). 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.*

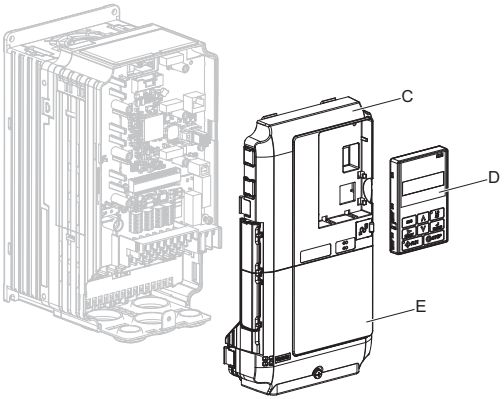


Figure 3 Remove the Front Covers and Digital Operator

2. Insert the option card (B) into the CN5-A (J), CN5-B (K), or CN5-C (L) connector located on the drive and fasten it into place using one of the included screws (F).

Note: Install the option to ports CN5-B and CN5-C on the drive for monitoring purposes only and input levels will be displayed in monitor U1-17. The option will not set the frequency reference or replace the drive analog input with higher resolution inputs when connected to ports CN5-B or CN5-C.

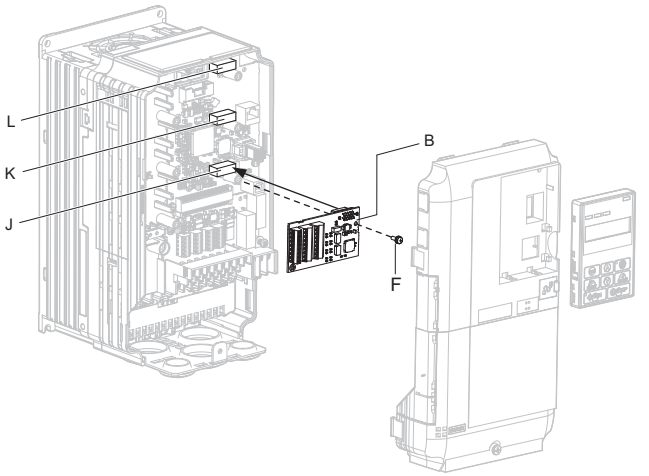


Figure 4 Insert the Option Card

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

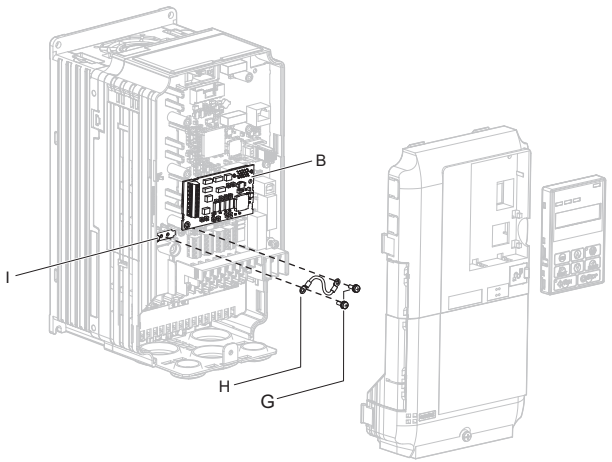


Figure 5 Connect the Ground Wire

Note: **1.** The option package includes three ground wires. Use the longest wire when plugging the option into connector CN5-C on the drive side. Use the next longest wire when plugging the option into connector CN5-B. Use the shortest wire when plugging the option into connector CN5-A. ***Refer to Option Package Contents on page 8*** for more information.

2. There are two screw holes on the drive for use as ground terminals (I). When connecting three options, two ground wires will need to share the same drive ground terminal.

4. Prepare and connect the wire ends as shown in ***Figure 6*** and ***Figure 7***. ***Refer to Wire Gauges, Tightening Torques, and Crimp Terminals on page 21*** to confirm that the proper tightening torque is applied to each terminal. Take particular precaution to ensure that each wire is properly connected and wire insulation is not accidentally pinched into electrical terminals.

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

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

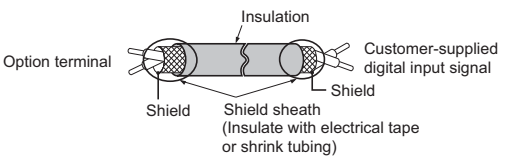


Figure 6 Preparing Ends of Shielded Cable

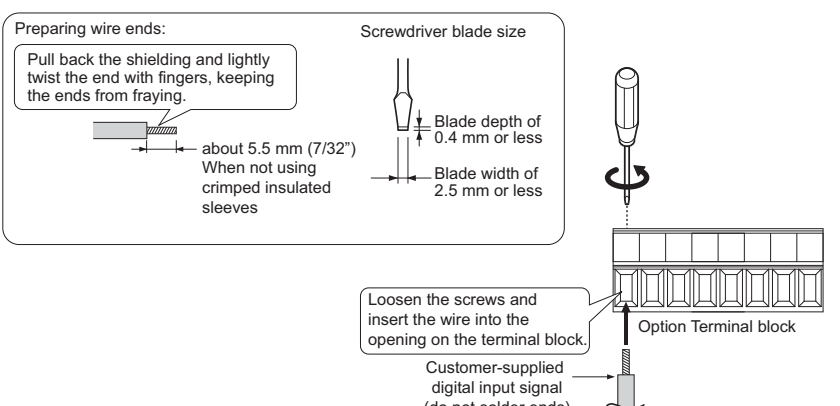


Figure 7 Preparing and Connecting Cable Wiring

5. Wire the customer-supplied digital input signal to the terminal blocks on the option. Refer to ***Figure 8*** for wiring instructions.

Connection Diagram
Refer to ***Table 4*** on page ***22*** for a detailed description of the option board terminal functions. To ensure accurate control, use a stable power supply for the voltage reference source

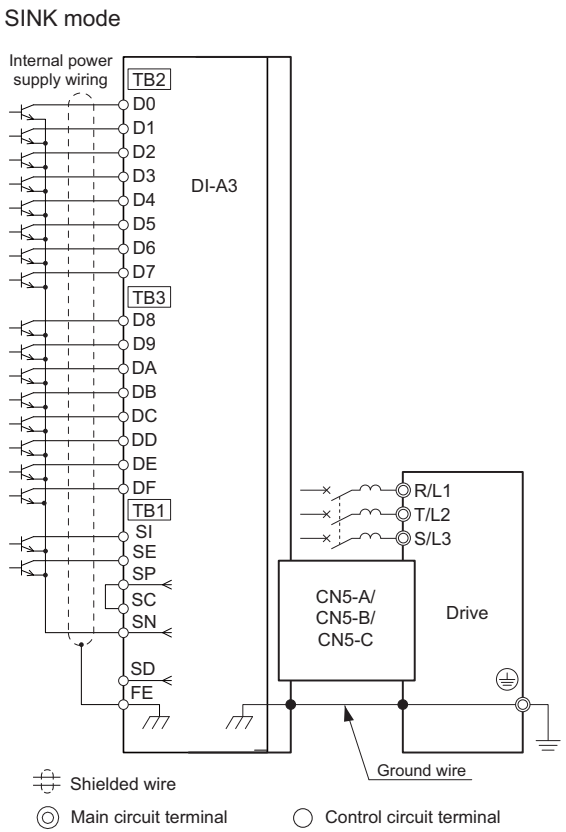


Figure 8 Option Connection Diagram

6. Set the option for SINK mode or SOURCE mode depending on the application.

SINK Mode

- To use the internal power supply of the drive, connect a wire jumper between terminals SP and SC.
- To use an external power supply, connect the positive lead from the power supply to terminal SC on the option. Do not connect the negative lead to terminal SN on the option.

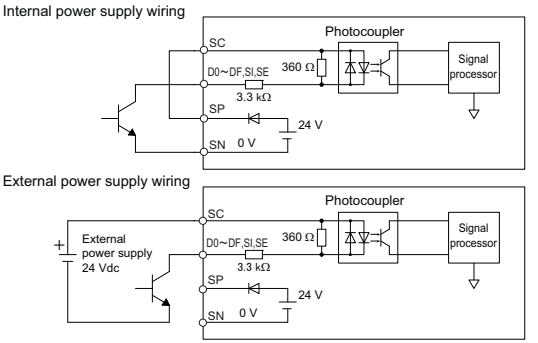


Figure 9 SINK Mode Connection Diagram

SOURCE Mode

- To use internal power supply of the drive, short terminals SN and SC.
- To use an external power supply, connect the negative lead from the power supply to terminal SC on the option. Do not connect the positive lead to terminal SP.

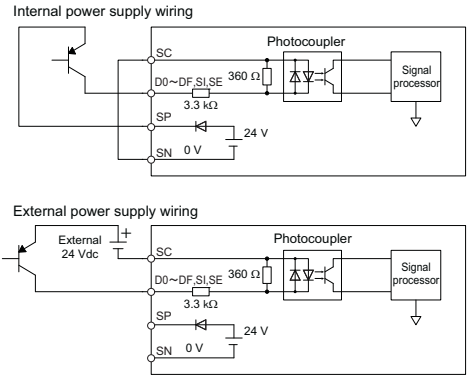
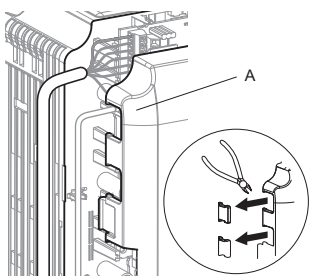
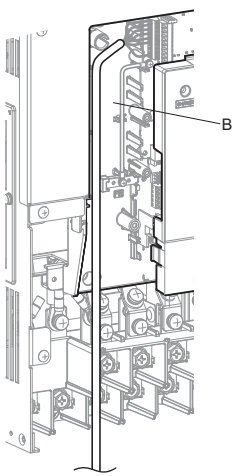


Figure 10 SOURCE Mode Connection Diagram

7. 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 on 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 Yaskawa AC Drive Technical Manual for more information.





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

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

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

Figure 11 Wire Routing Examples

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

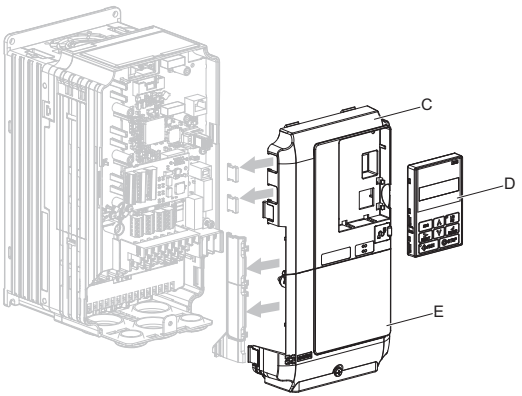


Figure 12 Replace the Front Covers and Digital Operator

Note: Take proper precautions when wiring the option so that the front covers will easily fit back onto the drive. Make sure cables are not pinched between the front covers and the drive when replacing the covers.

9. Set drive parameters in ***Table 5*** for proper option performance.

◆ Wire Gauges, Tightening Torques, and Crimp Terminals

■ Wire Gauges and Tightening Torques

Wire gauge and torque specifications are listed in ***Table 2***.

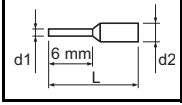
Table 2 Wire Gauges and Tightening Torques

Terminal signal	Screw Size	Tightening Torque N·m (in·lb)	Bare Cable		Crimp Terminals		Wire Type
			Applicable Gauges mm^2	Recomm. Gauge mm^2	Applicable Gauges mm^2	Recomm. Gauge mm^2	
D0 to DF SI, SE, SP, SC, SN, SD, FE	M2	0.22 to 0.25 (1.95 to 2.21)	Stranded wire: 0.25 to 1.0 (24 to 17 AWG) Solid wire: 0.25 to 1.5 (24 to 16 AWG)	0.75 (18 AWG)	0.25 to 0.5 (24 to 20 AWG)	0.5 (20 AWG)	Shielded twisted pair, etc.

■ Crimp Terminals

Yaskawa recommends using CRIMPFOX 6 by Phoenix Contact or equivalent crimp terminals with the specifications listed in ***Table 3*** for wiring to ensure proper connections.

Table 3 Crimp Terminal Sizes

	Wire Gauge mm^2	Phoenix Contact Model	L mm (in)	d1 mm (in)	d2 mm (in)
	0.25 (24 AWG)	AI 0.25 - 6YE	10.5 (13/32)	0.8 (1/32)	2 (5/64)
	0.34 (22 AWG)	AI 0.34 - 6TQ	10.5 (13/32)	0.8 (1/32)	2 (5/64)
	0.5 (20 AWG)	AI 0.5 - 6WH	14 (9/16)	1.1 (3/64)	2.5 (3/32)

◆ Terminal Functions

Table 4 Option Terminal Functions

Terminal Block	Terminal	BCD, Signed						BCD, Unsigned		Binary, Signed		
		F3-01 = 0 to 5						F3-01 = 6 <1>		F3-01 = 7		
		8-bit		12-bit		16-bit		16-bit		8-bit	12-bit	16-bit
		F3-03 = 0		F3-03 = 1		F3-03 = 2				F3-03 = 0	F3-03 = 1	F3-03 = 2
TB2	D0	1 digit (0 to 9)	1	1 digit (0 to 9)	1	1 digit (0 to 9)	1	1 digit (0, 2, 4, 6, 8)	2	bit 0	bit 0	bit 0
	D1		2		2		2		4	bit 1	bit 1	bit 1
	D2		4		4		4		8	bit 2	bit 2	bit 2
	D3		8		8		8	2 digits (0 to 9)	1	bit 3	bit 3	bit 3
	D4	2 digits (0 to 15) <2>	1	2 digits (0 to 9)	1	2 digits (0 to 9)	1		2	bit 4	bit 4	bit 4
	D5		2		2		2		4	bit 5	bit 5	bit 5
	D6		4		4		4		8	bit 6	bit 6	bit 6
	D7		8		8		8	3 digits (0 to 9)	1	bit 7	bit 7	bit 7
TB3	D8	–	–	3 digits (0 to 15) <2>	1	3 digits (0 to 9)	1		2	–	bit 8	bit 8
	D9		–		2		2		4	–	bit 9	bit 9
	DA		–		4		4		8	–	bit 10	bit 10
	DB		–		8		8	4 digits (0 to 9)	1	–	bit 11	bit 11
	DC	–	–	–	–	4 digits (0 to 15) <2>	1		2	–	–	bit 12
	DD		–		–		2		4	–	–	bit 13
	DE		–		–		4		8	–	–	bit 14
	DF		–		–		8	5 digits (0 to 3)	1	–	–	bit 15
TB1	SI	Signed 0: Forward 1: Reverse							2	Signed 0: Forward 1: Reverse		
	SE	Set (Read) signal 1: Reads values set to D0 to DF, SI										
	SP	24 V ±5% internal power supply										
	SC	Input signal common										
	SN	Internal power supply common: 0 V										
	SD	Cable shield 2 (open)										
	FE	Shield ground										

<1> Setting parameter F3-01 to 6 is only possible when F3-03 = 2. Once enabled, the frequency reference can be set to any value between 0.00 to 399.98 Hz with a BCD signal. It is not possible to use a negative reference because the signed bit SI is also used. The smallest bit of the first digit starts with 2, so 0.02 Hz is the smallest frequency reference setting unit.

<2> The most significant digits can be set from 0 to 15 in BCD and signed input. Other digits can be set from 0 to 9.

◆ Input Timing

To use a DC analog reference signal to activate a digital input, the external controller must activate the input according to ***Figure 13***. The external controller should switch off the SET digital input signal and wait at least 1 ms before the changing digital inputs. After changing the inputs, the controller should wait at least 1 ms before enabling the SET signal. The SET signal should be activated for at least 3 ms.

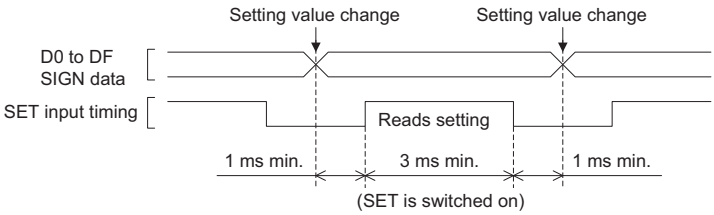


Figure 13 SET Input Timing

6 Related Parameters

The parameters outlined in the following sections are used to set up the drive for operation with the option. Set parameters as needed. Parameter setting methods can be found in the drive Quick Start Guide or Technical Manual.

Table 5 Related Parameters

No. (Addr. Hex)	Name	Description	Values
F3-01 (390) <1>	Digital Input Option Card Input Selection	Selects the method to input the option data. 0: BCD1% unit 1: BCD0.1% unit 2: BCD0.01% unit 3: BCD1 Hz unit 4: BCD0.1 Hz unit 5: BCD0.01 Hz unit 6: BCD custom setting (5-digit input), 0.02 Hz units 7: Binary input Digital operator display units are determined by parameter o1-03.	Default: 0 Range: 0 to 7
F3-03 (3B9)	Digital Input Option DI-A3 Data Length Selection	0: 8-bit 1: 12-bit 2: 16-bit	Default: 2 Range: 0 to 2

<1> Binary input is not possible if o1-03 is set to 2 or 3. The setting of F3-01 will then be disregarded and setting units will be determined by o1-03.

7 Troubleshooting

◆ Drive-Side Error Codes

Table 6 lists the various fault codes related to the option. Refer to the drive Technical Manual for further details on fault codes.

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

- Cable connections.
- Make sure the option is properly installed to the drive.
- Did a momentary power loss interrupt communications?

Table 6 Fault Displays, Causes, and Possible Solutions

Digital Operator Display		Fault Name
oFA01	oFA01	Option Fault (CN5-A) Option is not properly connected
Cause		**Possible Solution**
Option at drive port CN5-A was changed during run.		Turn the power off and check the connectors between the drive and option.
Digital Operator Display		**Fault Name**
oFb01	oFb01	Option Fault (CN5-B) Option is not properly connected
Cause		**Possible Solution**
Option at drive port CN5-B was changed during run.		Turn the power off and check the connectors between the drive and option.
Digital Operator Display		**Fault Name**
oFb02	oFb02	Option Fault (CN5-B) Two of the same options are connected simultaneously
Cause		**Possible Solution**
DI-A3 option connected to CN5-B port while another option was connected to CN5-A port.		Only one of the options: DI-A3, AI-A3, or SI-☐☐ can be connected to the drive at the same time.
Digital Operator Display		**Fault Name**
oFC01	oFC01	Option connection error at drive port CN5-C
Cause		**Possible Solution**
Option at drive port CN5-C was changed during run.		Turn the power off and check the connectors between the drive and option.

Digital Operator Display		Fault Name
oFC02	oFC02	Option Fault (CN5-C) Two of the same options are connected simultaneously
Cause		**Possible Solution**
DI-A3 option connected to CN5-C port while another option was connected to CN5-A port.		Only one of these options, DI-A3, AI-A3, or SI-☐☐ can be connected to the drive at the same time.
Digital Operator Display		**Fault Name**
oPE05	oPE05	Run command/frequency reference source selection error
Cause		**Possible Solution**
Frequency reference is assigned to an option (b1-01 = 3) but an option is not connected.		Reconnect the option to the drive.

◆ Preventing Noise Interference

Take the following steps to prevent erroneous operation caused by noise interference:

- Use shielded wire for the signal lines.
- Limit the length of wiring under 50 m (164 ft.).
- Separate the control wiring to the option, main circuit wiring, and power lines.

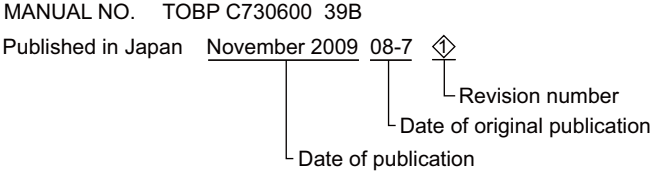
8 Specifications

Table 7 Option Specifications

Item	Description
Model	DI-A3
Input Terminals	18 terminals (including SET and SIGN signals)
Input Signal Type (Parameter Settings)	Binary 16-bit, 4-digit BCD Binary 12-bit, 3-digit BCD Binary 8-bit, 2-digit BCD
Input Signal	SINK, SOURCE, external power supply Photocoupler input: 24 Vdc, 8 mA
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

◆ Revision History

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



Date of Publication	Revision Number	Section	Revised Content
July 2010	③	Back cover	Revision: Address
July 2010	②	Entire Document	Edited for procedural clarity and readability.
		Back cover	Revision: Address
November 2009	①	Chapter 4	Correction: Table 2 Terminal Function Selection setting range for BCD
July 2008	–	–	First edition

YASKAWA AC Drive 1000-Series Option

Digital Input
Installation Manual

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