

## YASKAWA AC Drive Option

# Analog Monitor

## Installation Manual

Type AO-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.

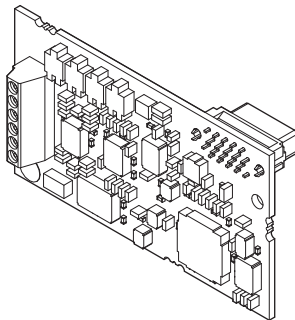
## 安川インバータ オプション

# アナログモニタ

## 取扱説明書

形式 AO-A3

製品を安全にお使いいただくために、この取扱説明書を必ずお読みください。  
また、本書をお手元に保管していただくとともに、最終的に本製品をご使用になるユーザー様のお手元に確実に届けられるよう、お取り計らい願います。



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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

The following manuals are available for the option:

#### Analog Monitor AO-A3 Option

<b>YASKAWA AC Drive Option Analog Monitor AO-A3 Installation Manual Manual No: TOBP C730600 79 (This book)</b>	This guide is packaged together with the product and contains information necessary to install the option and set related drive parameters.
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#### Yaskawa Drive

<b>YASKAWA AC Drive Manuals</b>	Drive manuals contain basic installation and wiring information in addition to detailed parameter setting, fault diagnostic, and maintenance information. The most recent versions of these manuals are available for download on our documentation websites: U.S.: <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: Check the back cover of these manuals. For questions, contact Yaskawa or a Yaskawa representative.
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## ◆ Terms

<b>Note:</b>	Indicates supplemental information that is not related to safety messages
<b>Option:</b>	YASKAWA AC Drive Option Analog Monitor
<b>Drive:</b>	<ul style="list-style-type: none"><li>• YASKAWA AC Drive 1000-Series (A1000, L1000A, D1000, R1000, U1000, U1000L)</li><li>• YASKAWA AC Drive GA700</li><li>• YASKAWA AC Drive GA800</li><li>• YASKAWA AC Drive CR700</li><li>• YASKAWA AC Drive CH700</li><li>• YASKAWA AC Drive FP605</li></ul>
<b>Keypad:</b>	<ul style="list-style-type: none"><li>• LCD Operator for YASKAWA AC Drive 1000-Series</li><li>• LED Operator for YASKAWA AC Drive 1000-Series</li><li>• LCD Keypad for YASKAWA AC Drive GA700, GA800, CR700, CH700, and FP605</li><li>• LED Keypad for YASKAWA AC Drive GA700, GA800, CR700, CH700, and FP605</li></ul>
<b>Energy-Saving Unit:</b>	<ul style="list-style-type: none"><li>• YASKAWA D1000 Series Power Regenerative Converter</li><li>• YASKAWA R1000 Series Power Regenerative Unit</li></ul>

## ◆ 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 cause death or serious injury.**

### **WARNING**

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

# 1 Preface and Safety

---

## CAUTION

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

## NOTICE

Indicates an equipment damage message.

### ■ General Safety

#### General Precautions

- The diagrams in this 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.
- 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

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

Failure to comply will cause death or serious injury.

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

### **WARNING**

#### **Electrical Shock Hazard**

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

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

### **NOTICE**

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

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

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

Failure to comply could damage electrical components in the option.

# 2 Overview

The Analog Monitor Option AO-A3 allows the user to expand the number of available analog outputs to monitor performance.

The option uses parameters and the output signal gain and bias to assign functions to output terminals V1 and V2.

The option has two analog outputs, an 11-bit signed (1/2048) output resolution, and a -10 to 10 Vdc non-isolated output voltage.

### ◆ Compatible Products

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

**Table 1 Compatible Products**

Product Series	Model(s)
A1000	All models
L1000A	All models
U1000	All models
U1000L	All models
D1000	All models
R1000	All models
GA700	All models
GA800	All models
CR700	All models
CH700	All models
FP605	All models

**Note:** For Yaskawa customers in the North or South America region:  
If your product is not listed in *Table 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.

Scan QR code



Or refer to: <http://www.yaskawa.com/optionlookup>



## 3 Receiving

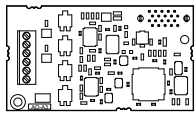
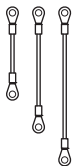

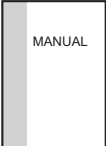
After receiving the option package:

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

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

2. Confirm that the model number on the option nameplate and the model listed in the purchase order are the same. Refer to [Figure 1](#) on page [10](#) for details. Contact the distributor where the option was purchased or contact Yaskawa or a Yaskawa representative about any problems with the option.

### ◆ Option Package Contents

Description:	Option	Ground Wires <1>	Screws (M3)	Installation Manual
-				
Quantity:	1	3	3 <2>	1

<1> GA700, GA800, CR700, and CH700 drives do not use the ground wire.

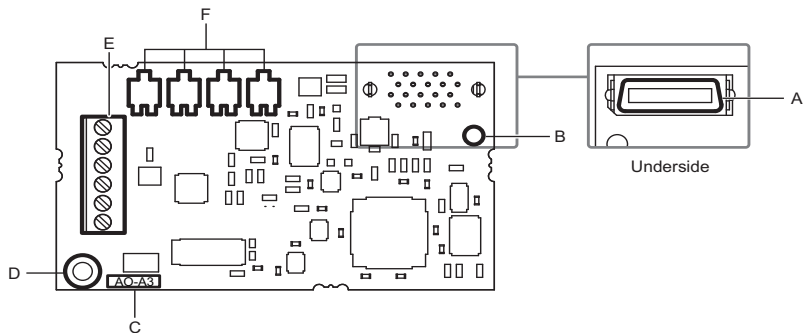
<2> GA700, GA800, CR700, CH700, and FP605 drives use two screws only.

### ◆ Installation Tools

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

# 4 Option Components

### ◆ Analog Monitor Option



**A – Connector (CN5)**

**B – Installation hole**

**C – Option model number**

**D – Ground terminal (FE) and installation hole <1>**

**E – Terminal Block TB1**

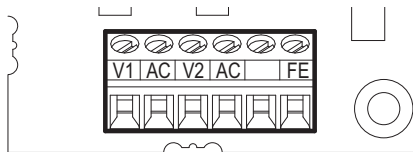
**F – Potentiometers <2>**

<1> Connect the provided ground wire during installation. Installation on GA700, GA800, CR700, and CH700 drives does not require the ground wire.

<2> Do not adjust the potentiometers on the option. The potentiometers are factory set and may change the voltage output characteristics and cause output signal inaccuracy if misadjusted.

**Figure 1 Analog Monitor AO-A3 Option Components**

### ◆ Terminal Block TB1



Refer to [Table 5](#) on page 37 for details on TB1 terminal functions and signal levels.

## 5 Installation Procedure

### ◆ Section Safety

#### DANGER

##### **Electrical Shock Hazard**

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

Failure to comply will cause death or serious injury.

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

#### WARNING

##### **Electrical Shock Hazard**

**Do not operate equipment with covers removed.**

Failure to comply could cause death or serious injury.

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

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

Failure to comply could cause death or serious injury.

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

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

Failure to comply could cause death or serious injury.

### **WARNING**

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

Failure to comply could cause death or serious injury.

#### **Fire Hazard**

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

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

### **NOTICE**

#### **Damage to Equipment**

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

Failure to comply could cause ESD damage to circuitry.

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

Improper equipment sequencing could damage the drive.

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

Failure to comply could further damage the equipment.

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

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

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

Failure to comply could prevent proper operation and damage equipment.

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

Failure to comply could damage the option.

### ◆ Option Installation and Wiring Procedures

Procedures for installing and wiring options differ depending on the product.

Refer to [Table 4](#) to check the procedures for installing and wiring options on a drive.

**Table 2 Option Installation and Wiring Procedures**

Product Series	Option Installation and Wiring Procedures	Page
A1000	Procedure A	<a href="#">14</a>
L1000A	Procedure A	<a href="#">14</a>
U1000	Procedure A	<a href="#">14</a>
U1000L	Procedure A	<a href="#">14</a>
D1000	Procedure A	<a href="#">14</a>
R1000	Procedure A	<a href="#">14</a>
GA700	Procedure B	<a href="#">21</a>
GA800	Procedure B	<a href="#">21</a>
CR700	Procedure B	<a href="#">21</a>
CH700	Procedure B	<a href="#">21</a>
FP605	Procedure C	<a href="#">28</a>

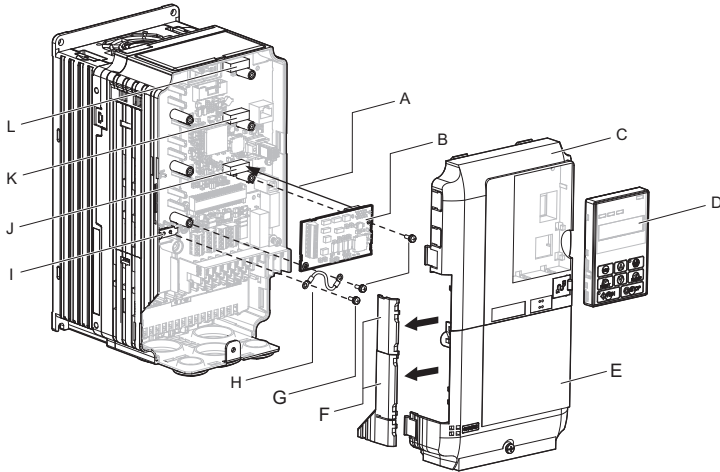
## 5 Installation Procedure

### ■ Procedure A

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

#### Prepare the Drive for the Option

1. Correctly wire the drive as specified by the manual packaged with the drive.
2. Make sure that the drive functions correctly.  
Refer to [Figure 2](#) for an exploded view of the drive with the option and related components for reference in the installation procedure.



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

Figure 2 Drive Components with Option

### Install the Option

Refer to the instructions below to install the option.

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

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

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

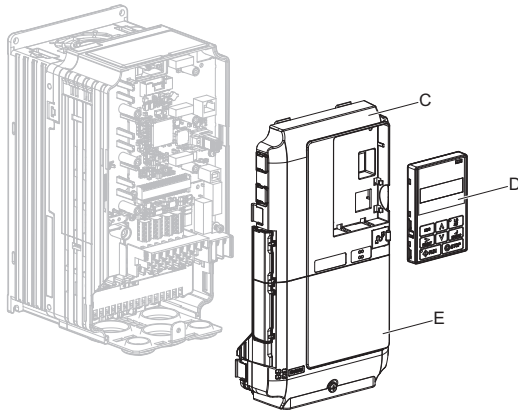
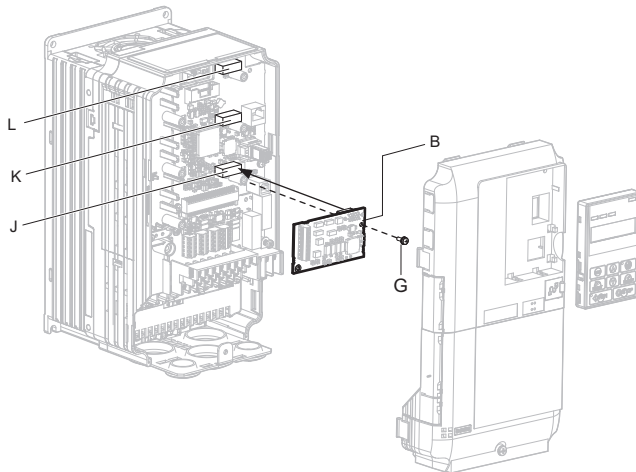


Figure 3 Remove the Keypad, Front Cover, and Terminal Cover

## 5 Installation Procedure

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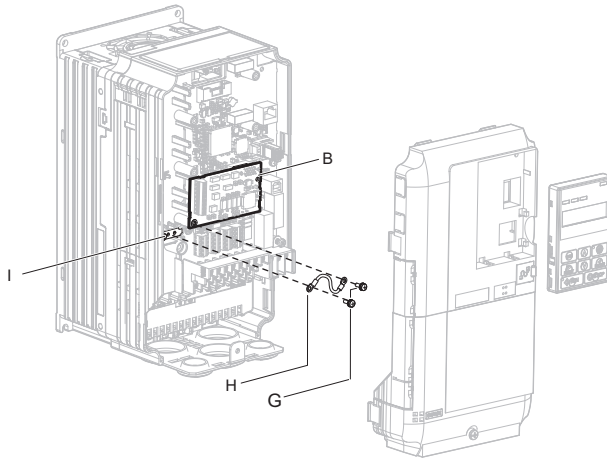
2. Insert the option card (B) into the CN5-A (J), CN5-B (K), or CN5-C (L) connector on the drive and fasten it into place using one of the included screws (G). Tighten both screws to 0.5 to 0.6 N·m (4.4 to 5.3 in·lb).



**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 provided 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). Tighten both screws to 0.5 to 0.6 N·m (4.4 to 5.3 in·lb).



**Figure 5 Connect the Ground Wire**

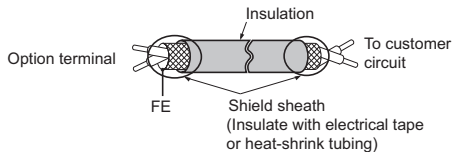
- Note:**
1. The option package includes three ground wires. Use the longest wire to connect the option to CN5-C. Use the next longest wire to connect the option to CN5-B. Use the shortest wire to connect the option to CN5-A. Refer to [Option Package Contents on page 9](#) for more information.
  2. The drive has only two ground terminal screw holes (I). Two ground wires should share the same ground terminal when connecting three options.

## 5 Installation Procedure

4. Prepare and connect the wire ends as shown in [Figure 6](#) and [Figure 7](#). Refer to [Wire Gauges and Tightening Torques on page 36](#) 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.

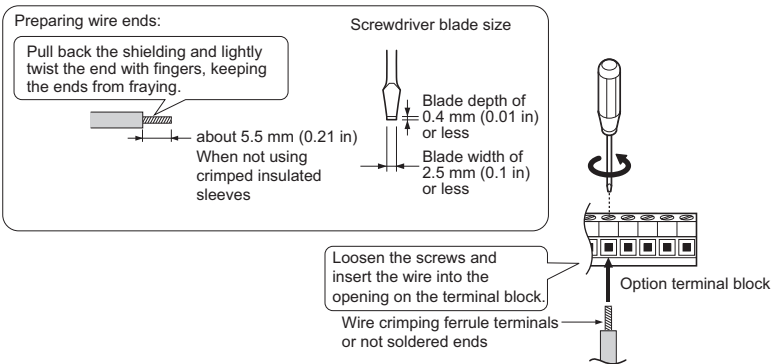
**WARNING! Fire Hazard.** Tighten all terminal screws according to the specified tightening torque. Loose electrical connections could result in death or serious injury by fire due to overheating electrical connections. Tightening screws beyond the specified tightening torque may cause erroneous operation,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



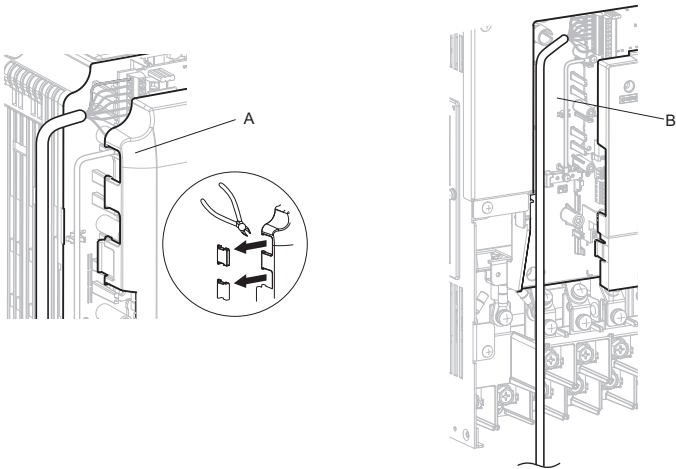
**Figure 6 Prepare Ends of Shielded Cable**

5. Wire the customer-supplied circuit to the terminal block on the option according to [Figure 7](#). Refer to [Figure 26](#) for the AO-A3 Option connection diagram. Refer to [Table 5](#) for a detailed description of the option terminal functions.



**Figure 7 Connect Cable Wiring**

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



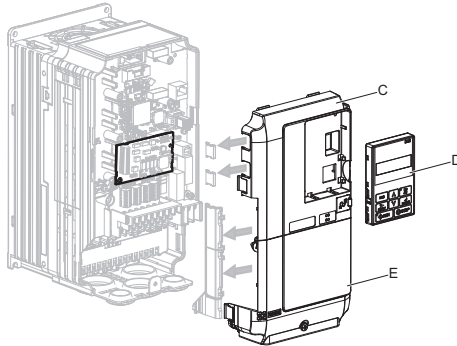
**Figure 8 Wire Routing Examples**

## 5 Installation Procedure

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7. Reattach the drive front covers (C, E) and the keypad (D).

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



**Figure 9** Replace the Front Covers and Keypad

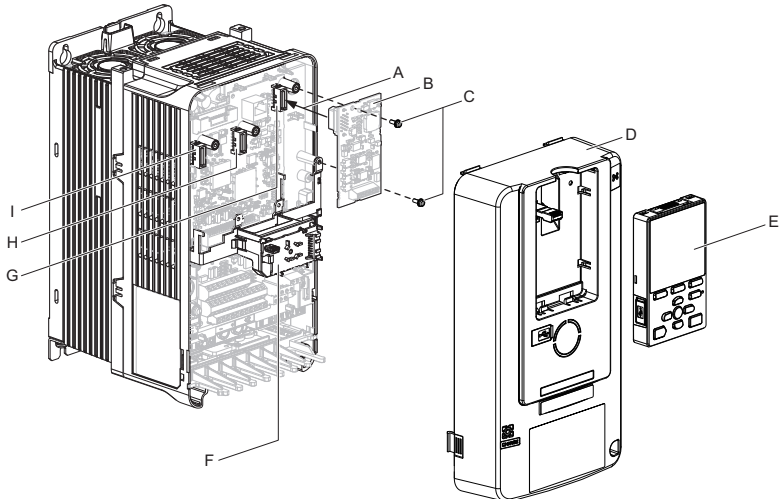
8. Set drive parameters in [Table 6](#) for correct option performance.

### ■ Procedure B

This section shows the procedure to install and wire the option on a GA700, GA800, CR700, or CH700 drive.

#### Prepare the Drive for the Option

1. Correctly wire the drive as specified by the manual packaged with the drive.
2. Make sure that the drive functions correctly.  
Refer to [Figure 10](#) for an exploded view of the drive with the option and related components for reference in the installation procedure.



A – Insertion point for CN5 connector

B – AO-A3 option

C – Included screws

D – Drive front cover

E – Keypad

F – LED Status Ring board

G – Connector CN5-A

H – Connector CN5-B

I – Connector CN5-C

Figure 10 Drive Components with Option

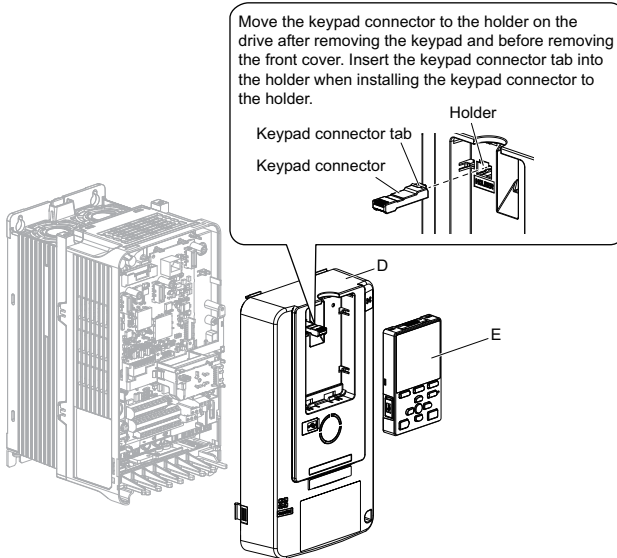
## 5 Installation Procedure

### Install the Option

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

1. Shut off power to the drive, wait the appropriate amount of time for voltage to dissipate, confirm all charge indicator LEDs extinguish, then remove the front cover (D) including the keypad (E). Refer to the manual packaged with the drive for details on cover removal.

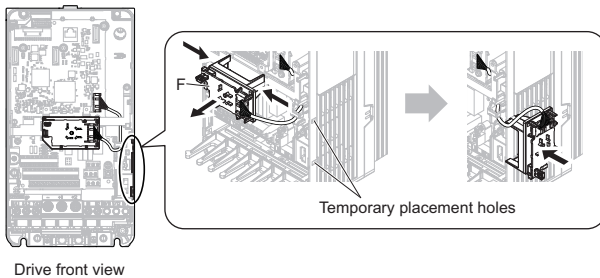
**NOTICE:** *Observe proper electrostatic discharge (ESD) procedures when handling the option, drive, and circuit boards. Failure to comply could cause ESD damage to circuitry.*



**Figure 11 Remove the Front Cover Including Keypad**

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

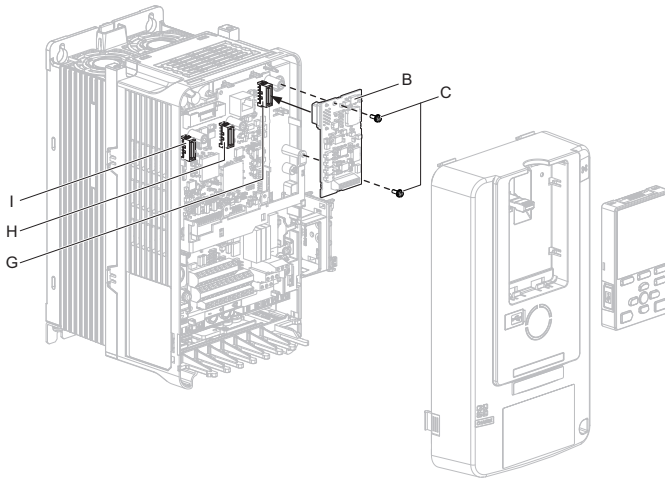
**NOTICE:** Do not remove the LED Status Ring board cable connector. Failure to comply could cause erroneous operation and damage the drive.



**Figure 12 Remove the LED Status Ring Board**

## 5 Installation Procedure

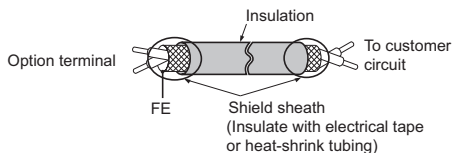
3. Insert the option card (B) into the CN5-A (G), CN5-B (H) and CN5-C (I) connector on the drive and fasten it into place using the included screws (C). Tighten both screws to 0.5 to 0.6 N·m (4.4 to 5.3 in·lb).



**Figure 13** Insert the Option Card

**Note:** Installing the option card on GA700, GA800, CR700, and CH700 drives requires only two screws and does not require a ground wire. The option package ships with three screws and ground wires for installation on other product series. Do not use the ground wire or the extra screw.

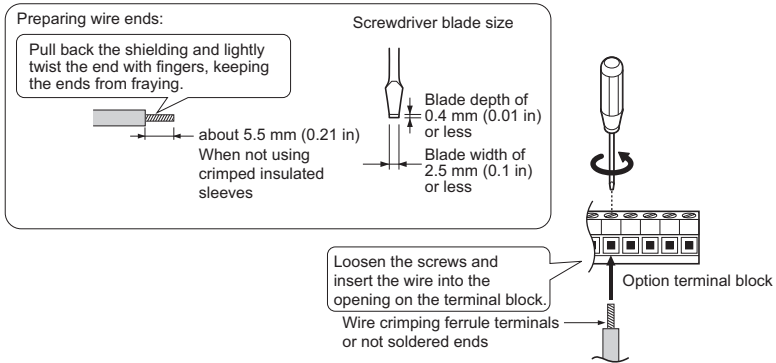
4. Prepare the wire ends as shown in **Figure 14**.



**Figure 14** Prepare Ends of Shielded Cable



5. Wire the customer-supplied circuit to the terminal block on the option according to **Figure 15**. Refer to **Figure 26** for the AO-A3 Option connection diagram. Refer to **Table 5** for a detailed description of the option terminal functions.



**Figure 15 Connect Cable Wiring**

## 5 Installation Procedure

6. Reattach the LED Status Ring board (F) and the front cover of the drive (D) including the keypad (E).

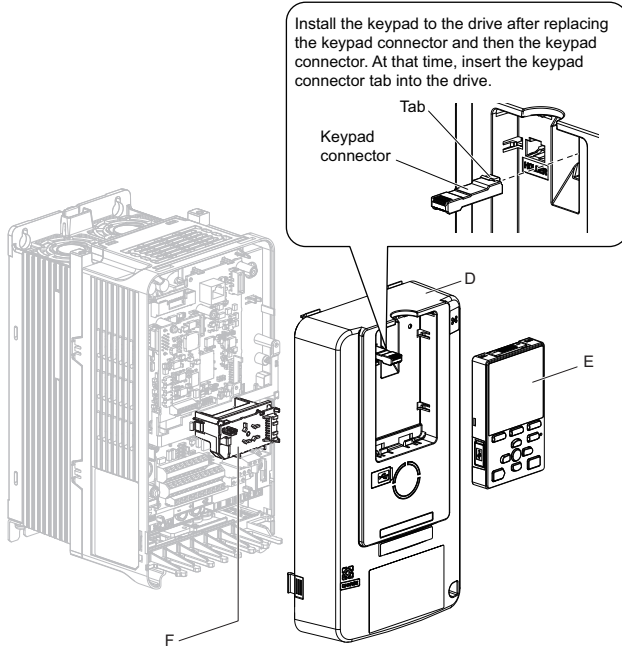


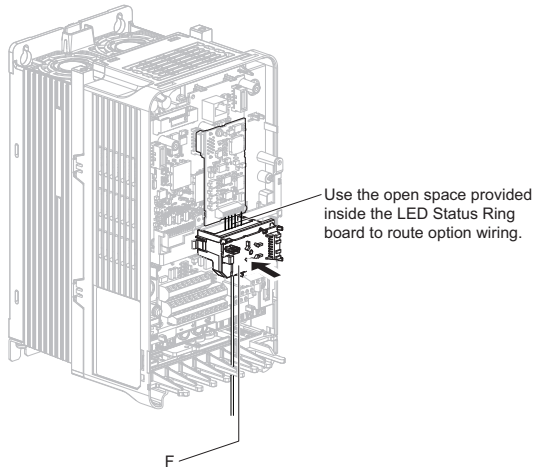
Figure 16 Replace the LED Status Ring Board, Front Cover, and Keypad

## 5 Installation Procedure

Reattach the LED Status Ring board (F).

Use the open space provided inside the LED Status Ring board to route option wiring when using connector CN5-B.

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



7. Set drive parameters in [Table 6](#) for correct option performance.

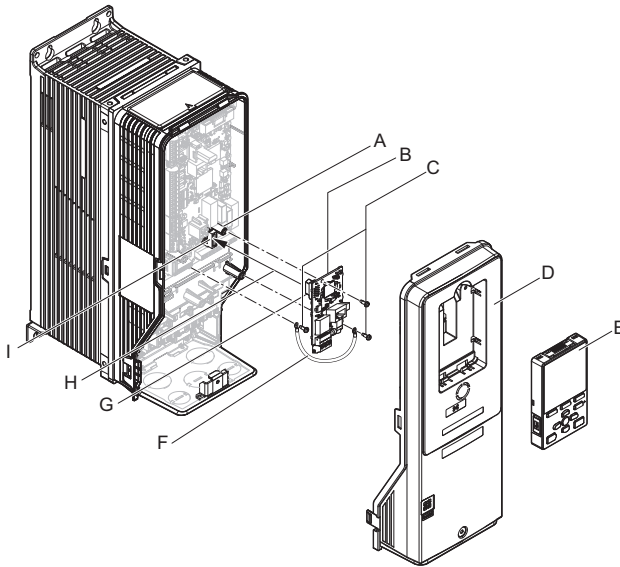
## 5 Installation Procedure

### ■ Procedure C

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

#### Prepare the Drive for the Option

1. Correctly wire the drive as specified by the manual packaged with the drive.
2. Make sure that the drive functions correctly.  
Refer to [Figure 17](#) for an exploded view of the drive with the option and related components for reference in the installation procedure.



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

Figure 17 Drive Components with Option

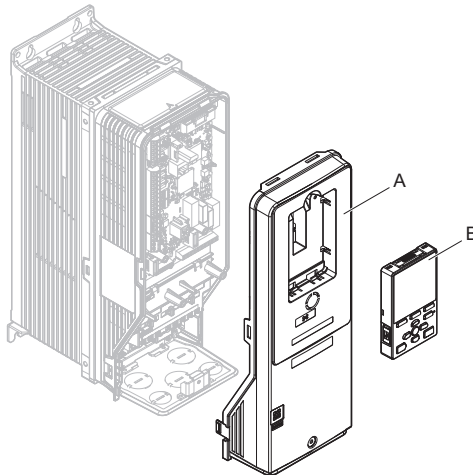
### Install the Option

Refer to the instructions below to install the option.

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

1. Shut off power to the drive, wait the appropriate amount of time for voltage to dissipate, then remove the keypad (B) and front covers (A). Refer to the manual packaged with the drive for details on keypad and cover removal.

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



A – Drive front cover

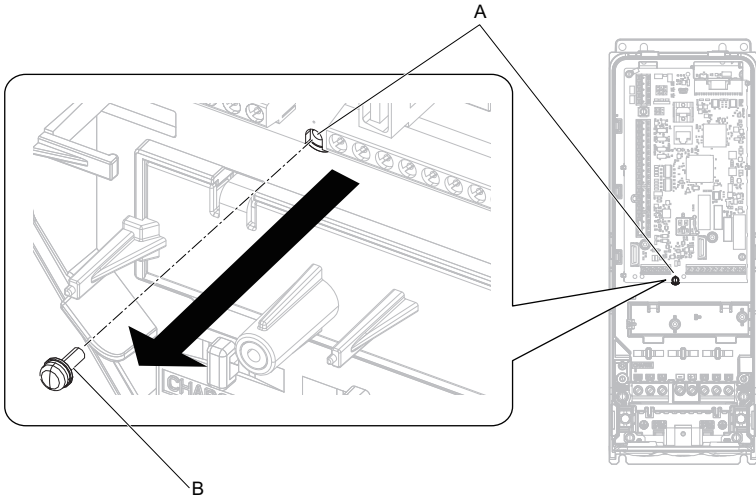
B – Keypad

Figure 18 Remove the Front Cover and Keypad

## 5 Installation Procedure

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



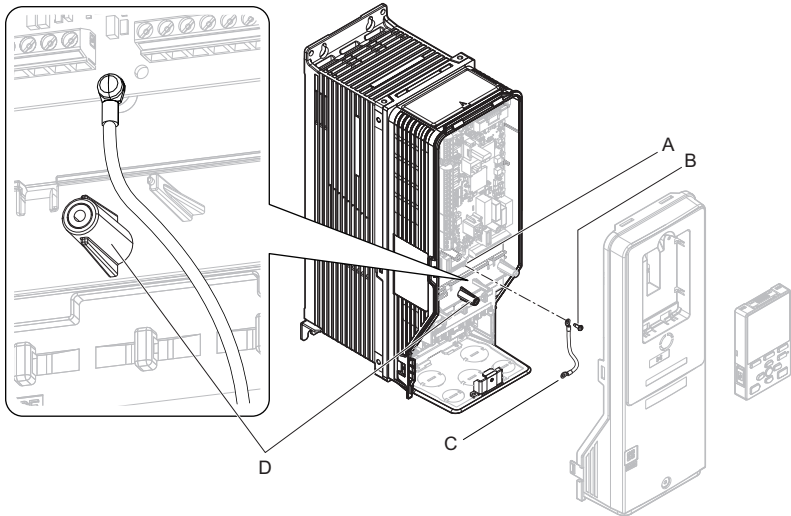
A – Drive grounding terminal (FE)

B – Included screw

Figure 19 Remove the Screw from the Drive Grounding Terminal

- 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)

**B** – Included screw

**C** – Ground wire

**D** – Stud

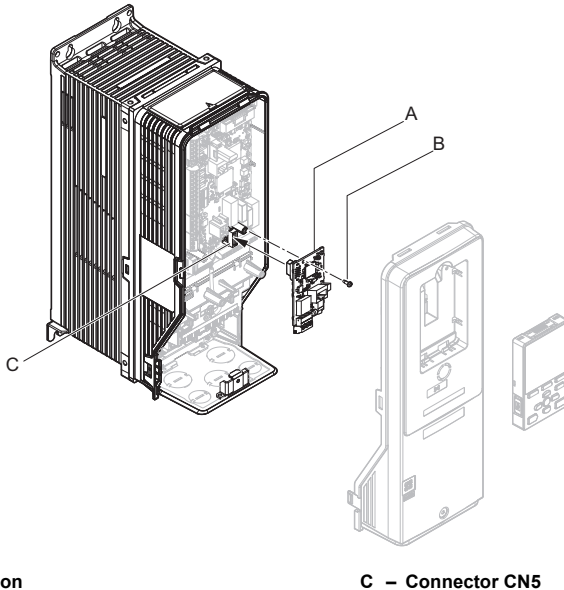
**Figure 20** Connect the Ground Wire

## 5 Installation Procedure

4. Install the option (A) into the CN5-B connector (C) on the drive and use the included screw (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:**

1. Only two screws are necessary to install the option on FP605 drive.
2. The option package contains three screws and three ground wires.

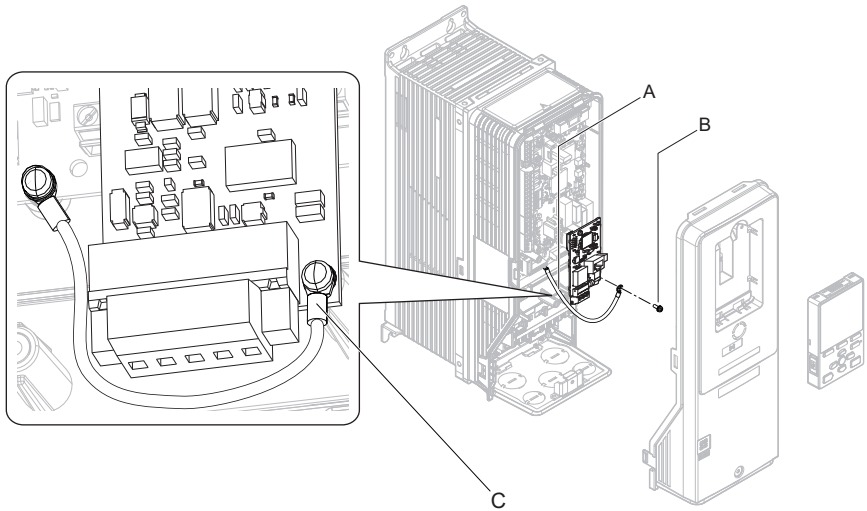


**Figure 21 Install the Option**



5. 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:** Refer to [Figure 22](#) for instruction about crimp terminal orientation (C) and wire routing.



**A** – Ground wire  
**B** – Included screw

**C** – Crimp terminal

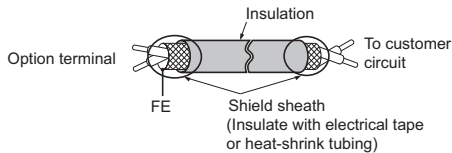
**Figure 22** Connect the Ground Wire

## 5 Installation Procedure

6. Prepare and connect the wire ends as shown in [Figure 23](#) and [Figure 24](#). Refer to [Wire Gauges and Tightening Torques on page 36](#) 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.

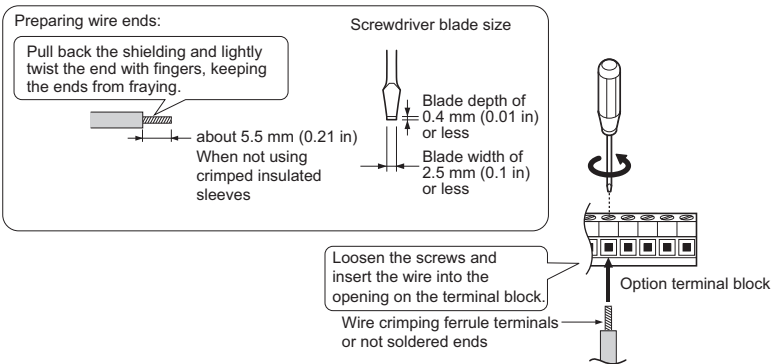
**WARNING! Fire Hazard.** Tighten all terminal screws according to the specified tightening torque. Loose electrical connections could result in death or serious injury by fire due to overheating electrical connections. Tightening screws beyond the specified tightening torque may cause erroneous operation, 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 23 Prepare Ends of Shielded Cable**

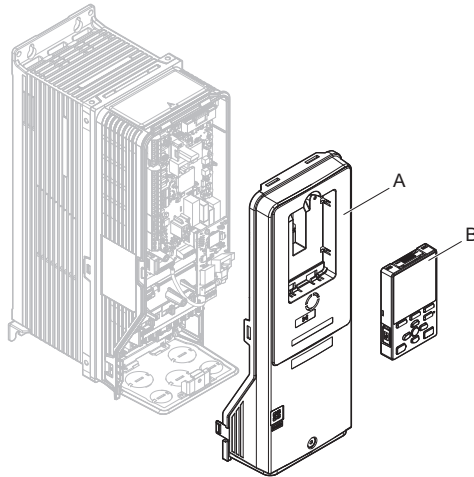
7. Wire the customer-supplied circuit to the terminal block on the option according to [Figure 24](#). Refer to [Figure 26](#) for the AO-A3 Option connection diagram. Refer to [Table 5](#) for a detailed description of the option terminal functions.



**Figure 24 Connect Cable Wiring**

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

**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

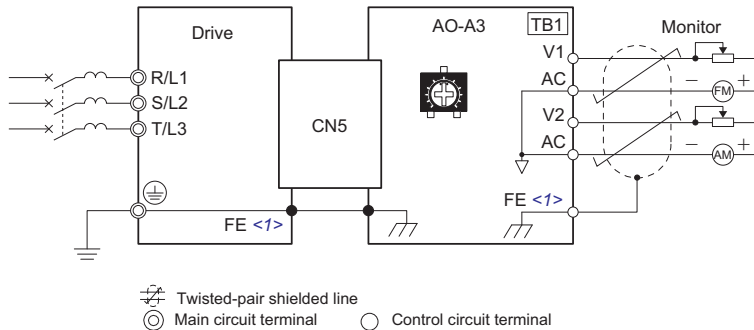
**Figure 25 Replace the Front Covers and Keypad**

9. Set the drive parameters in [Table 6](#) for correct option performance.

## 5 Installation Procedure

### ◆ Option Connection Diagram

Refer to [Table 5](#) on page 37 for a detailed description of the option board terminal functions. To ensure accurate control, use a stable power supply for the voltage reference source.



<1> Connect the provided ground wire for installations on 1000-series and FP605 drives. The ground wire is not necessary for installation on GA700, GA800, CR700, and CH700 drives.

Figure 26 Option Connection Diagram

**NOTICE:** Do not adjust the potentiometers on the option. The potentiometers are factory set and may change the voltage output characteristics and cause output signal inaccuracy if misadjusted.

### ◆ Wire Gauges, Tightening Torques and Ferrule-Type Terminals

#### ■ Wire Gauges and Tightening Torques

Wire gauge and torque specifications are listed in [Table 3](#).

Table 3 Wire Gauges and Tightening Torques

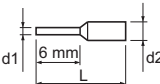
Terminal signal	Screw Size	Tightening Torque N·m (in·lb)	Bare Wire		Ferrule-Type Terminals		Wire Type
			Recommended Gauge mm <sup>2</sup>	Applicable Gauges mm <sup>2</sup>	Recommended Gauge mm <sup>2</sup>	Applicable Gauges mm <sup>2</sup>	
V1, V2, AC, FE	M2	0.22 to 0.25 (1.95 to 2.21)	0.75 (18 AWG)	Stranded wire: 0.25 to 1.0 (24 to 17 AWG) Solid wire: 0.25 to 1.5 (24 to 16 AWG)	0.5 (20 AWG)	0.25 to 0.5 (24 to 20 AWG)	Shielded twisted pair, etc.

### ■ Ferrule-Type Terminals

Yaskawa recommends using CRIMPFOX 6 by Phoenix Contact or equivalent ferrule-type terminals with the specifications listed in *Table 4* for wiring to ensure proper connections.

**Note:** Properly trim wire ends so loose wire ends do not extend from the crimp terminals.

**Table 4 Ferrule-Type Terminal Sizes**

Ferrule-Type Terminal	Wire Gauge mm <sup>2</sup>	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 5 Option Terminal Functions**

Terminal	Function	Signal Level	Description
V1	Analog voltage output 1	-10 to 10 V	<ul style="list-style-type: none"> <li>• Analog voltage output for an external monitoring device &lt;/&gt;</li> <li>• Output resolution 11-bit plus sign (1/2048)</li> <li>• Maximum load current 3 mA</li> </ul>
V2	Analog voltage output 2		
AC	Common	0 V	Common for analog voltage output
FE	Ground	-	Used for grounding shielded lines

<1> Set the functions and output levels for terminals V1 and V2 using drive parameters. See the drive Instruction Manual for directions on setting parameters.

# 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. Refer to the manual packaged with the drive for details on setting parameters.

### ◆ Parameter Table

“RUN” indicates that the parameter can be changed during run.

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

**Table 6 Related Parameters**

No. (Hex.)	Name	Description	Values
F4-01 (391) </>	Terminal V1 Monitor Selection	Sets the monitor signal for output from terminal V1.	Default when installed to drive: 102 (output frequency) Default when installed to energy-saving unit: 000 (reserved) Range: 000 to 999
F4-02 (392) RUN	Terminal V1 Monitor Gain	Sets the gain for voltage output via terminal V1, where 100% equals 10 V output.	Default: 100.0% Min: -999.9 Max: 999.9
F4-03 (393) </>	Terminal V2 Monitor Selection	Sets the monitor signal for output from terminal V2.	Default when installed to drive: 103 (output voltage) Default when installed to energy-saving unit: 000 (reserved) Range: 000 to 999
F4-04 (394) RUN	Terminal V2 Monitor Gain	Sets the gain for voltage output via terminal V2, where 100% equals 10 V output. Terminal output voltage is limited to 10 V. <?>	Default: 50.0% Min: -999.9 Max: 999.9
F4-05 (395) RUN	Terminal V1 Monitor Bias	Sets the amount of bias added to the voltage output via terminal V1. <?>	Default: 0.0% Min: -999.9 Max: 999.9
F4-06 (396)	Terminal V2 Monitor Bias	Sets the amount of bias added to the voltage output via terminal V2. <?>	Default: 0.0% Min: -999.9 Max: 999.9
F4-07 (397)	Terminal V1 Signal Level Select	Sets the voltage level for the analog output. 0: 0 V to 10 V	Default: 0 Range: 0, 1
F4-08 (398)	Terminal V2 Signal Level Select	1: -10 V to 10 V	Default: 0 Range: 0, 1

- <1> A setting of 031 or 000 applies no drive monitor to the analog output. With this setting, terminal functions as well as V1 and V2 output levels can be set by a PLC via a communication option or MEMOBUS/Modbus (through mode).
- <2> The drive outputs voltage while this parameter is being adjusted. Voltage levels can be adjusted to match the specifications of an external meter.

# 7 Troubleshooting

### ◆ Drive-Side Error Codes

*Table 7* lists the various fault codes related to the option. Refer to the drive instruction manual for further details on fault codes.


Confirm the following items upon receiving an error notification on the drive keypad:

1. Correct and secure cable connections including ground wiring.
2. Proper option installation.
3. No momentary power loss occurred.

**Table 7 Fault Displays, Causes, and Possible Solutions**

Keypad Display		Fault Name
oFA01	oFA01	Option is not properly connected.
<b>Cause</b>		<b>Possible Solution</b>
The option connected to option port CN5-A was changed during run.		De-energize the drive and plug the option into the drive according to <i>Installation Procedure on page 11</i> .
Keypad Display		Fault Name
oFb01	oFb01	Option Card Fault (CN5-B) Option is not properly connected.
<b>Cause</b>		<b>Possible Solution</b>
Option in drive port CN5-B was changed during run.		De-energize the drive and plug the option into the drive according to <i>Installation Procedure on page 11</i> .
Keypad Display		Fault Name
oFb02	oFb02	Option Fault (CN5-B) Two identical options are connected at the same time.
<b>Cause</b>		<b>Possible Solution</b>
Same type of option connected to ports CN5-A and CN5-B.		Use only compatible options.
Keypad Display		Fault Name
oFC01	oFC01	Option is not properly connected.
<b>Cause</b>		<b>Possible Solution</b>
Option at drive port CN5-C was changed during run.		De-energize the drive and plug the option into the drive according to <i>Installation Procedure on page 11</i> .



Keypad Display		Fault Name
	oFC02	Option Fault (CN5-C) Two identical options are connected at the same time.
Cause		Possible Solution
Same type of option connected to unit ports CN5-A, CN5-B, and CN5-C.		Use only compatible options.

### ◆ Option Compatibility

Users may connect up to 3 options simultaneously depending on the type of option. Refer to [Table 8](#) for details.

- Note:**
1. You can connect two options to an FP605 drive. Connect the communication option to the CN5-B connector.
  2. Compatible communication options are different for different models. Refer to the drive manuals for more information.

**Table 8 Option Compatibility**

Option Card	Connector	Number of Cards 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, AO-A3	CN5-A, B, 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-EM3D <4>, SI-EN3 <4>, SI-EN3D <4>, SI-EP3, JOHB-SMP3, AI-A3 <5>, DI-A3 <5>	CN5-A	1

<1> Not available with FP605.

<2> When connecting two PG option cards, use both CN5-B and CN5-C. When connecting only one PG option card, use the CN5-C connector.

<3> Not available for the application with Motor 2 Selection.

<4> Not available with 1000-Series products with a capacities between 450 and 630 kW.

<5> When you use the input status of AI-A3 and DI-A3 as a monitor, you can connect AI-A3 and DI-A3 to CN5-A, CN5-B, and CN5-C.

## 7 Troubleshooting

---

### ◆ Preventing Electrical Signal Interference

Take the following steps to prevent erroneous operation caused by electrical signal 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.

### ■ Interface Circuit

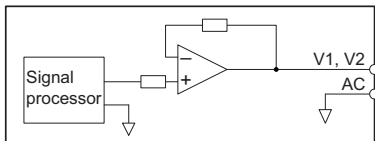


Figure 27 Output Interface Circuit

## 8 European Standards



Figure 28 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 guidelines 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 Guidelines: 2014/30/EU**

Drives used in combination with this option and devices used in combination with the drive must also be CE certified and display the CE mark.

When using drives displaying the CE mark in combination with other devices, it is ultimately the responsibility of the user to ensure compliance with CE standards. Verify that conditions meet European standards after setting up the device.

---

### ◆ **EMC Guidelines Compliance**

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

### ■ **EMC Guidelines Installation Conditions**

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

1. Use dedicated shield cable for the option and external device (encoder, I/O device, master), or run the wiring through a metal conduit.
2. Keep wiring as short as possible and ground the largest possible surface area of the shield to the metal panel according to [Figure 29](#) and [Figure 30](#).

## 8 European Standards

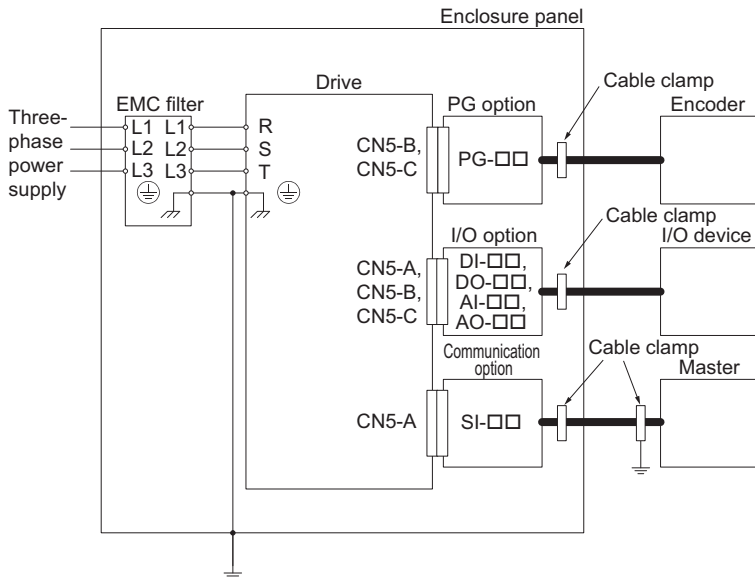
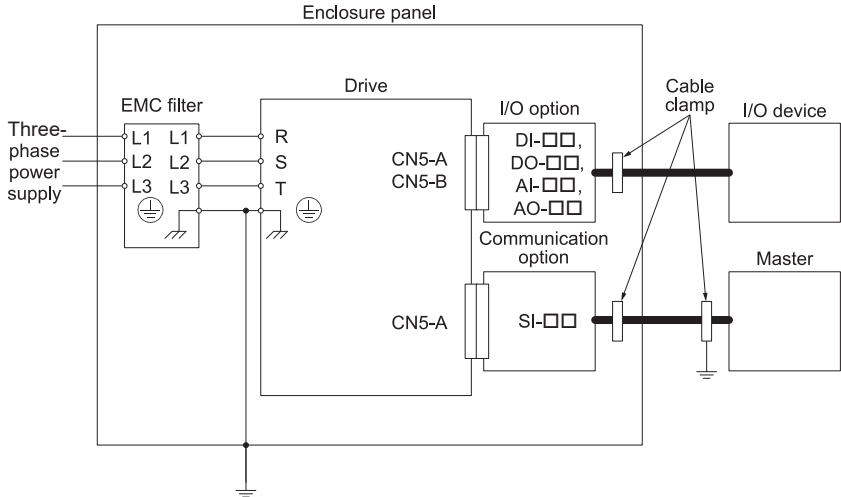
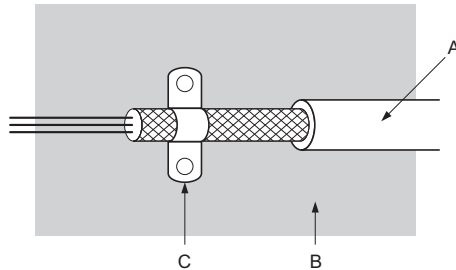


Figure 29 Option Installation for CE Compliance: 1000-Series, GA700, GA800, CR700, CH700



**Figure 30 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 31 Ground Area**

# 9 Specifications

**Table 9 Option Specifications**

Item	Description
Model	AO-A3
Analog Output Terminals	2 terminals
Voltage Output	Output signal voltage: -10 to 10 Vdc Output resolution: 11-bit plus sign (1/2048) Maximum load current: 3 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	Indoors and free from: <ul style="list-style-type: none"><li>• Oil mist, corrosive gas, flammable gas, and dust</li><li>• Radioactive materials or flammable materials, including wood</li><li>• Harmful gas or fluids</li><li>• Salt</li><li>• Direct sunlight</li><li>• Falling foreign objects</li></ul>
Altitude	1000 m (3280 ft) or lower

## 10 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 wheeled 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.

# 10 Disposal

## ◆ Revision History

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

MANUAL NO.

TOBP C730600 79B <1>-0

Web revision number

Revision number

Published in Japan April 2017

Date of publication

Date of Publication	Revision Number	Web Rev. No.	Section	Revised Content
February 2022	<8>	0	All	Addition: Information on FP605. Revision: Reviewed and corrected entire documentation.
July 2020	<7>	0	Back cover	Revision: Address
January 2020	<6>	0	Back cover	Revision: Address
October 2018	<5>	0	All	Addition: Applicable product series Revision: Reviewed and corrected entire documentation.
			Back cover	Revision: Address
August 2018	<4>	0	–	Address in Japanese version.
July 2017	<3>	0	Chapter 2	Addition: Note in Table 1
July 2017	<2>	0	Back cover	Revision: Address
April 2017	<1>	0	All	Addition: Applicable product series Revision: Reviewed and corrected entire documentation.
			Back cover	Revision: Address
April 2016	–	–	–	First edition



# YASKAWA AC Drive Option Analog Monitor Installation Manual

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# YASKAWA

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In the event that the end user of this product is to be the military and said product is to be employed in any weapons systems or the manufacture thereof, the export will fall under the relevant regulations as stipulated in the Foreign Exchange and Foreign Trade Regulations. Therefore, be sure to follow all procedures and submit all relevant documentation according to any and all rules, regulations and laws that may apply.

Specifications are subject to change without notice for ongoing product modifications and improvements.

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MANUAL NO.

TOBP C730600 79E <8>-0

Published in Japan February 2022  
20-2-22