

## YASKAWA AC Drive Option Motor Feedback Resolver TS2640N321E64 Interface Installation Manual

Type: PG-RT3

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

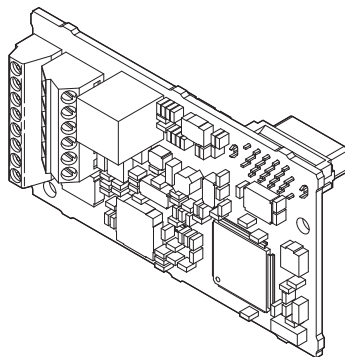
安川インバータ オプション

## レゾルバインタフェース (TS2640N321E64用)

### 取扱説明書

形 式 PG-RT3

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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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# Table of Contents

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<b>1</b>	<b>PREFACE AND SAFETY</b> .....	<b>4</b>
<b>2</b>	<b>OVERVIEW</b> .....	<b>9</b>
<b>3</b>	<b>RECEIVING</b> .....	<b>10</b>
<b>4</b>	<b>OPTION COMPONENTS</b> .....	<b>11</b>
<b>5</b>	<b>INSTALLATION PROCEDURE</b> .....	<b>12</b>
<b>6</b>	<b>RELATED PARAMETERS</b> .....	<b>32</b>
<b>7</b>	<b>TROUBLESHOOTING</b> .....	<b>34</b>
<b>8</b>	<b>EUROPEAN STANDARDS</b> .....	<b>39</b>
<b>9</b>	<b>SPECIFICATIONS</b> .....	<b>41</b>

## 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:

#### Option

<b>YASKAWA AC Drive Option Motor Feedback Resolver TS2640N321E64 Interface PG-RT3 Installation Manual Manual No: TOBP C730600 87 (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 and Abbreviations

- Note:** Indicates supplemental information that is not related to safety messages
- Option:** YASKAWA AC Drive Option Motor Feedback Resolver TS2640N321E64 Interface: Type PG-RT3
- Drive:**
- YASKAWA AC Drive 1000-Series (A1000, U1000)
  - YASKAWA AC Drive GA700
  - YASKAWA AC Drive GA800
  - YASKAWA AC Drive CR700
  - YASKAWA AC Drive CH700
- Keypad:**
- LCD Operator for YASKAWA AC Drive 1000-Series
  - LED Operator for YASKAWA AC Drive 1000-Series
  - LCD Keypad for YASKAWA AC Drive GA700, GA800, CR700, and CH700
  - LED Keypad for YASKAWA AC Drive GA700, GA800, CR700, and CH700
- PG:** Pulse Generator, Encoder, or Resolver mounted on the motor
- CLV:** Closed Loop Vector Control
- CLV/PM:** PM Closed Loop Vector Control

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## ◆ Registered Trademarks

Trademarks are the property of their respective owners.

# 1 Preface and Safety

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## ◆ 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.**

### **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 wooden materials that have been fumigated or sterilized. Do not sterilize the entire package after the product is packed.**

Failure to comply could damage the electrical components in the option.



## 2 Overview

The PG-RT3 Option enables the user to connect to a resolver that meets Yaskawa's specifications such as the TS2640N321E64 made by Tamagawa Seiki Co., Ltd. The PG-RT3 Option facilitates motor speed feedback to the drive and takes advantage of Closed Loop Vector control and PM Closed Loop Vector control. The option increases control accuracy and performance.

This PG encoder signal allows the drive to compensate for subtle variations in the load while providing the drive with the necessary data to control the output frequency and maintain an accurate constant speed.

The option reads a 10 kHz maximum input frequency from the PG encoder. Select a PG encoder with 10 kHz maximum output when operating at maximum speed.

### ◆ Compatible Products

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

**Table 1 Compatible Products**

Product Series	Model(s)
A1000	All models <1> <2>
U1000	All models
GA700	All models
GA800	All models
CR700	All models
CH700	All models

<1> Only available in software version S1017 and later. The software version (PRG) is indicated on the nameplate affixed to the side of the drive.

<2> The option is not compatible with drive models 4A0930 and 4A1200.

### 3 Receiving

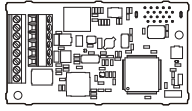


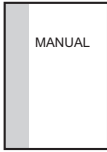
After receiving the option package:

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 11 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 Wire <1>	Screws (M3)	Installation Manual
—				
Quantity:	1	1	3 <2>	1

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

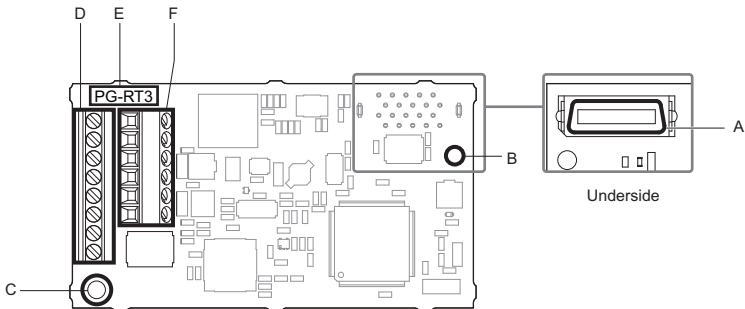
<2> GA700, GA800, CR700, and CH700 drives use two screws only.

#### ◆ 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

## ◆ PG-RT3 Option

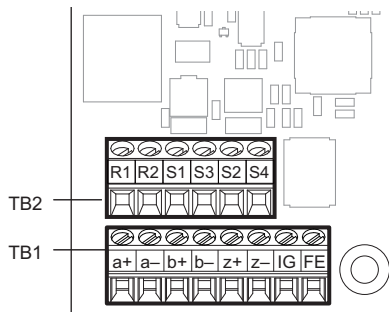


- A – Connector (CN5)
- B – Installation hole
- C – Ground terminal (FE) and installation hole <1>
- D – Terminal block TB1
- E – Option model number
- F – Terminal block TB2

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

Figure 1 PG-RT3 Option Components

## ◆ Terminal Blocks TB1 and TB2



Refer to [Table 5](#) on page 31 for details on TB1 and TB2 terminal functions and signal levels.

# 5 Installation Procedure

### ◆ Section Safety

#### DANGER

##### **Electric 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.

## 5 Installation Procedure

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### ◆ Procedures for Installing and Wiring Options on a Drive

Procedures for installing and wiring options differ depending on the drive model.

Refer to [Table 2](#) to check the procedures for installing and wiring options on a drive.

**Table 2 Procedures for Installing and Wiring Options on a Drive**

Product Series	Procedures for Installing and Wiring Options on a Drive	Page
A1000	Procedure A	<a href="#">15</a>
U1000	Procedure A	<a href="#">15</a>
GA700	Procedure B	<a href="#">22</a>
GA800	Procedure B	<a href="#">22</a>
CR700	Procedure B	<a href="#">22</a>
CH700	Procedure B	<a href="#">22</a>

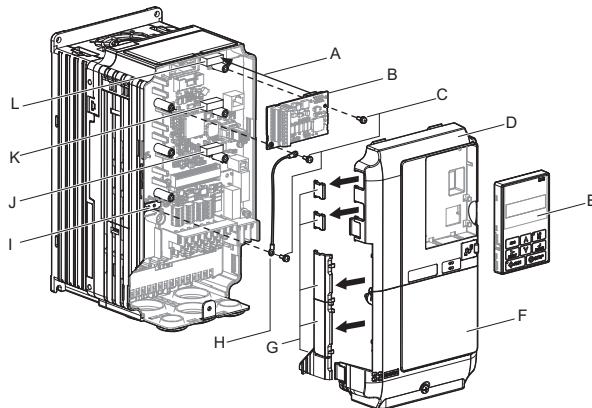
### ■ Procedure A

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

#### Prepare the Drive for the Option

Before beginning the installation procedure:

1. Wire the drive and make the proper connections to drive terminals according to the manual packaged with the drive.
2. Verify that the drive functions normally.  
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         | H - Ground wire  |
| B - Option card                     | I - Drive grounding terminal (FE)                                  |
| C - Included screws                 | J - Connector CN5-A<br>(Not available for PG option installation.) |
| D - Front cover                     | K - Connector CN5-B<br>(Not available for PG option installation.) |
| E - Keypad                          | L - Connector CN5-C  |
| F - Terminal cover                  |  |
| G - Removable tabs for wire routing |  |

Figure 2 Drive Components with Option

## 5 Installation Procedure

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### Install the Option

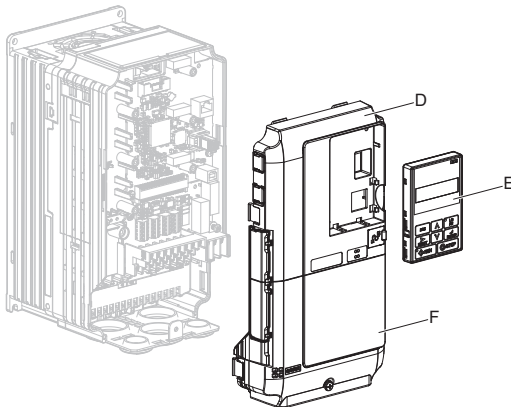
Refer to the instructions below to install the option.

**Note:** Refer to the instruction manual of a specific drive for information on removing and installing the keypads and the covers.

**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 (E), front cover (D), and terminal cover (F). Refer to the manual packaged with the drive for details on keypad and cover removal.

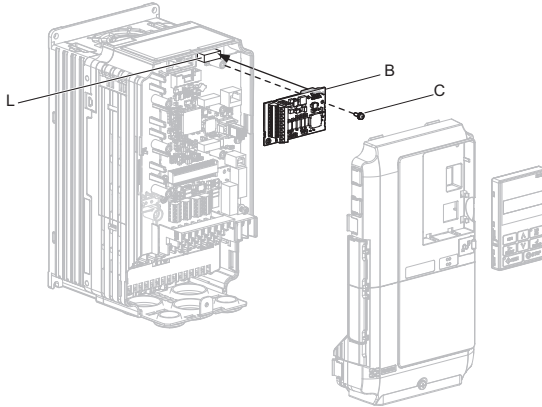
**NOTICE:** *Observe proper electrostatic discharge (ESD) procedures when handling the option, drive, and circuit boards. Failure to comply could cause ESD damage to circuitry.*



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



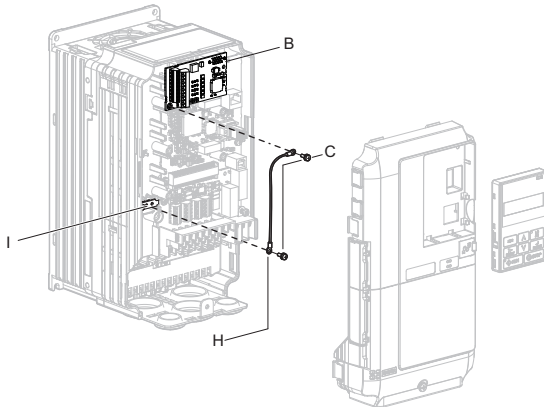
2. Insert the option card (B) into the CN5-C (L) connector on the drive and fasten it into place using the included screws (C). Tighten both screws to 0.5 to 0.6 N·m (4.4 to 5.3 in·lb).



**Figure 4 Insert the Option Card**

## 5 Installation Procedure

3. Connect the ground wire (H) to the ground terminal (I) using one of the remaining provided screws (C). 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 (C).



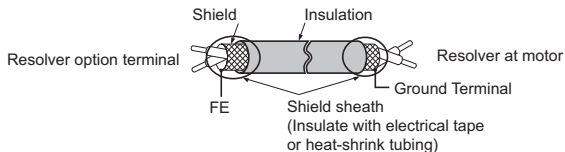
**Figure 5 Connect the Ground Wire**

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

4. Prepare and connect the wire ends as shown in [Figure 6](#) and [Figure 7](#). Refer to [Wire Gauges and Tightening Torques on page 30](#) 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.

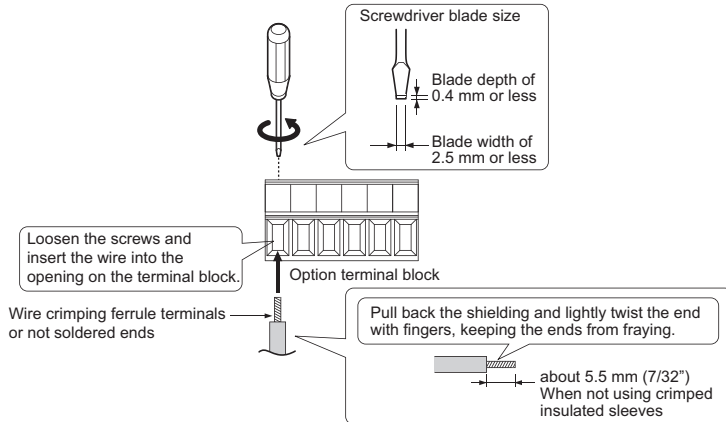
**WARNING! Fire Hazard.** Tighten all terminal screws according to the specified tightening torque. Loose electrical connections could result in death or serious injury by fire due to overheating electrical connections. Tightening screws beyond the specified tightening torque may result in erroneous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

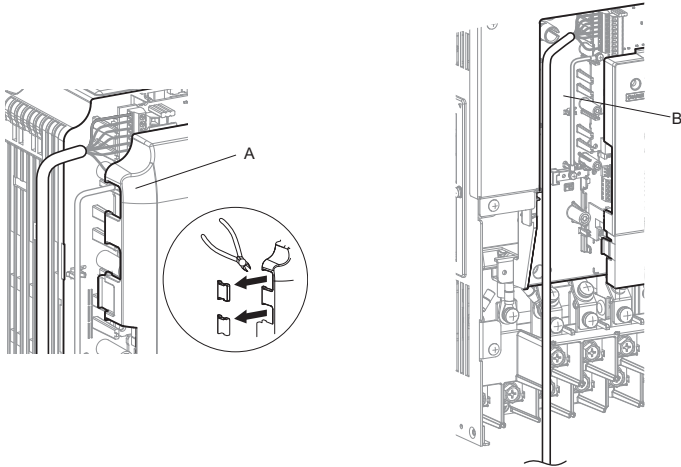
5. Wire the motor PG encoder to the terminal block on the option according to [Figure 7](#). Refer to [Figure 19](#) for the PG-RT3 Option and PG Encoder connection diagram. Refer to [Table 5](#) for a detailed description of the option terminal functions.



**Figure 7 Connect Cable Wiring**

## 5 Installation Procedure

6. 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.



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

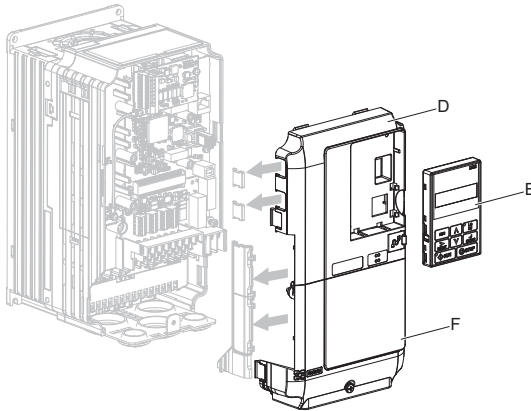
**B – Use the open space provided inside the drive to route option wiring.**

<1> The drive will not meet Enclosed wall-mounted type (IP20/UL Type 1) requirements if wiring is exposed outside the enclosure.

**Figure 8 Wire Routing Examples**

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

**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**

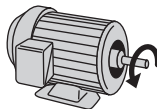
8. Connect the PG encoder outputs to the option.
9. After connecting the resolver outputs to the option, apply power to the drive and manually rotate the motor and check the rotation direction by viewing monitor U1-05 on the keypad.

**WARNING!** Sudden Movement Hazard. Lock out the Run circuit to prevent issuing a Run command prior to manually rotating the motor shaft with the drive energized. Failure to comply could cause death or serious injury.

The value in U6-18 increases during forward rotation (value will reset to 0 after exceeding 65535), and decreases during reverse rotation (counts back from 65535 after reaching 0).

If the value in U6-18 decreases while the motor is rotating forwards as shown in [Figure 10](#), switch the resolver rotation setting (F1-05 = 1) to change how the drive reads the direction of the motor resolver.

**Note:** Setting A1-03 = 1110, 2220, or 3330 will reset F1-05 to factory default. Re-set the parameter to switch direction again.



**Figure 10 Forward direction**

## 5 Installation Procedure

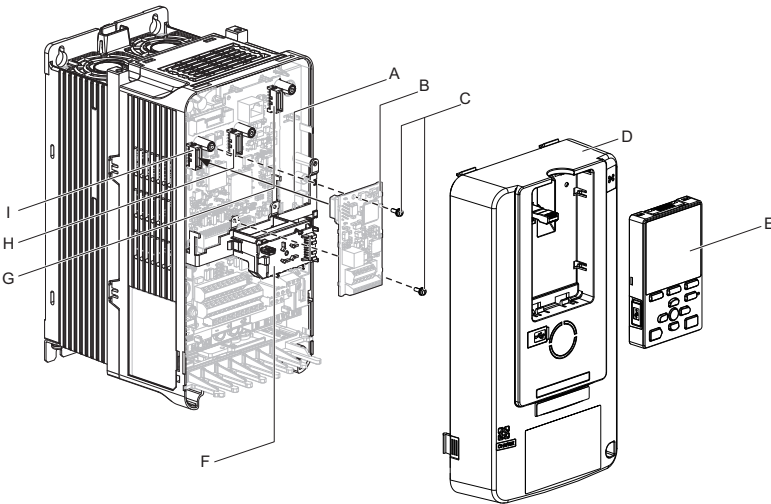
### ■ Procedure B

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

#### Prepare the Drive for the Option

Before beginning the installation procedure:

1. Wire the drive and make the proper connections to drive terminals according to the manual packaged with the drive.
2. Verify that the drive functions normally.  
Refer to [Figure 11](#) 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** – PG-RT3 option

**C** – Included screws

**D** – Drive front cover

**E** – Keypad

**F** – LED Status Ring board

**G** – Connector CN5-A  
(Not available for PG option installation.)

**H** – Connector CN5-B  
(Not available for PG option installation.)

**I** – Connector CN5-C

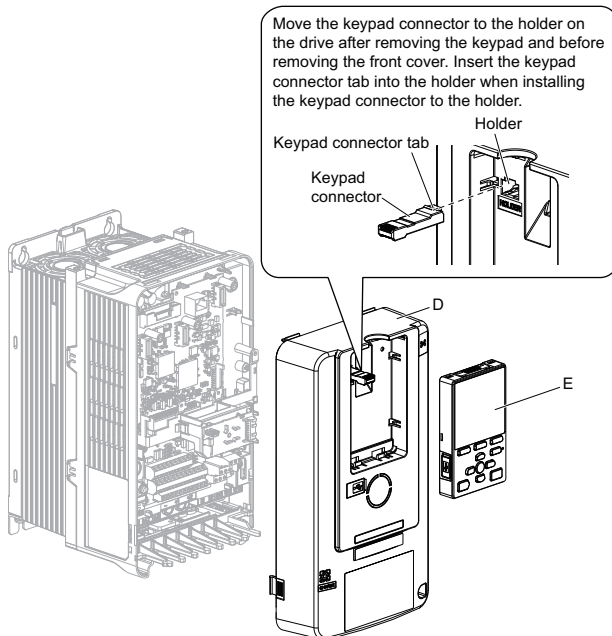
**Figure 11 Drive Components with Option**

### Install the Option

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

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.



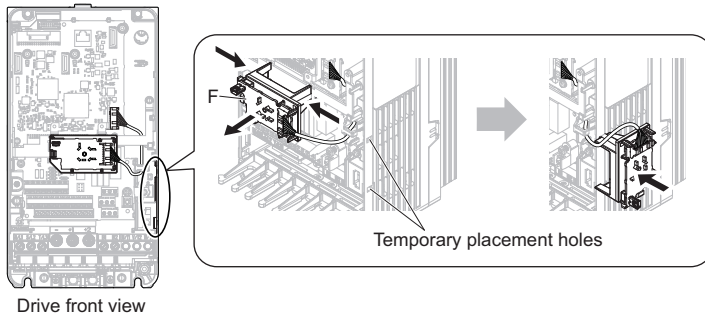
**Figure 12 Remove the Front Cover Including Keypad**

## 5 Installation Procedure

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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.

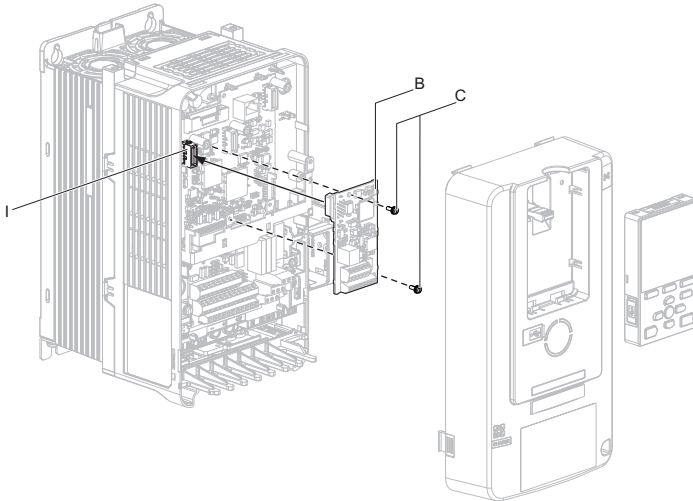


**Figure 13 Remove the LED Status Ring Board**



3. Insert the option card (B) into the CN5-C (I) connector on the drive and fasten 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).

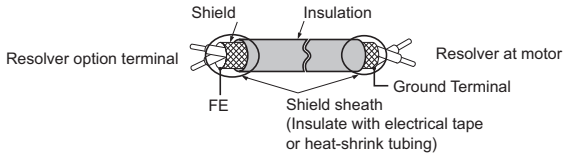
**Note:** Installing the option card on a GA700, GA800, CR700, and CH700 drive requires only two screws and does not require a ground wire. The option package ships with three screws and ground wires for installation on other product series. Do not use the ground wire or the extra screw.



**Figure 14 Insert the Option Card**

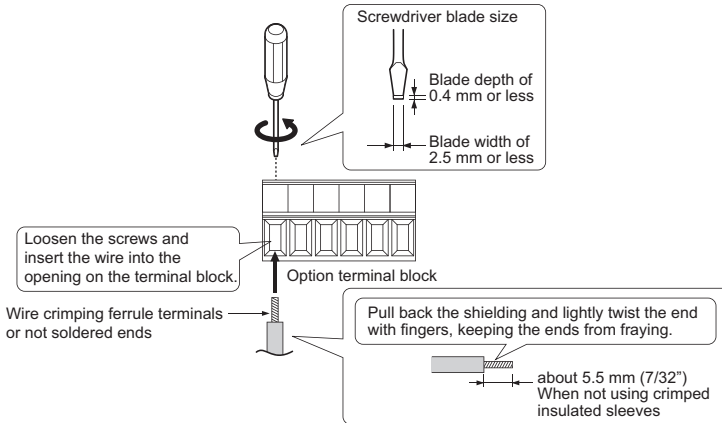
## 5 Installation Procedure

4. Prepare the wire ends as shown in **Figure 15**.



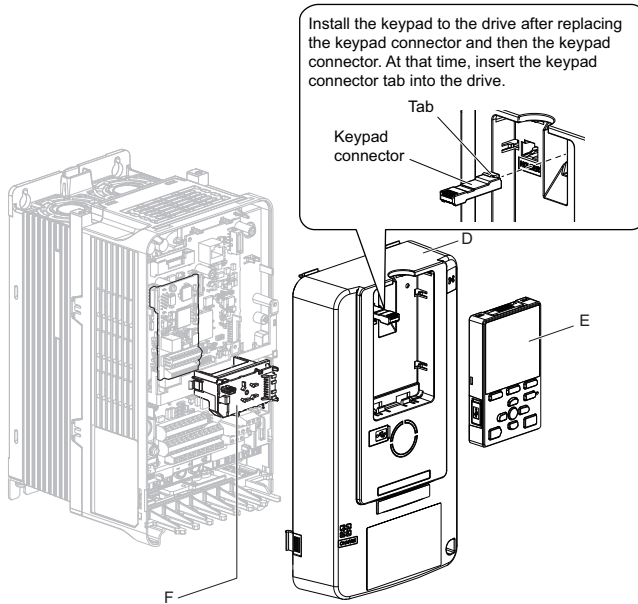
**Figure 15 Prepare Ends of Shielded Cable**

5. Wire the motor PG encoder to the terminal block on the option according to **Figure 16**. Refer to **Figure 19** for the PG-RT3 Option and PG Encoder connection diagram. Refer to **Table 5** for a detailed description of the option terminal functions.



**Figure 16 Connect Cable Wiring**

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



**Figure 17 Replace the LED Status Ring Board, Front Cover, and Keypad**

7. Connect the PG encoder outputs to the option.

## 5 Installation Procedure

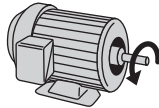
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8. After connecting the resolver outputs to the option, apply power to the drive and manually rotate the motor and check the rotation direction by viewing monitor U1-05 on the keypad.

**WARNING!** *Sudden Movement Hazard. Lock out the Run circuit to prevent issuing a Run command prior to manually rotating the motor shaft with the drive energized. Failure to comply could cause death or serious injury.*

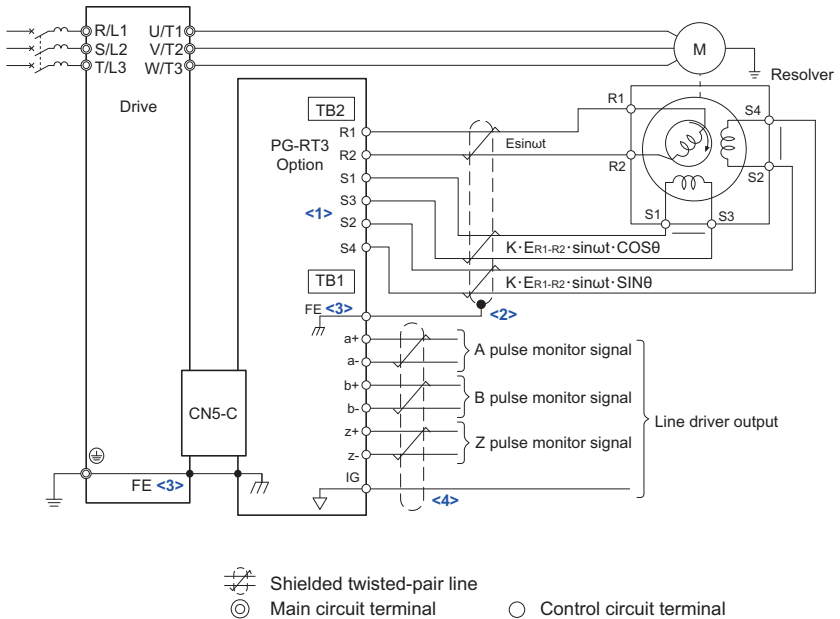
9. The value in U6-18 increases during forward rotation (value will reset to 0 after exceeding 65535), and decreases during reverse rotation (counts back from 65535 after reaching 0). If the value in U6-18 decreases while the motor is rotating forwards as shown in **Figure 10**, switch the PG rotation setting (F1-05 = 1) to change how the drive reads the direction of the motor resolver.

**Note:** Setting A1-03 to 1110, 2220, or 3330 will reset F1-05 to factory default. Re-set the parameter to switch direction again.



**Figure 18 Forward direction**

## ◆ Connection Diagram



- <1> Connect resolver terminals S1 through S4 to PG-RT3 option terminals S1 through S4. Be sure not to mistakenly connect the resolver to drive terminals S1 through S4.
- <2> Ground the shield on the PG encoder side and the drive side. Remove the shield ground from one end of the signal line or remove the shield ground connection on both ends if electrical interference problems arise in the PG encoder signal.
- <3> Connect one of the included ground wires between the option FE terminal and the drive ground terminal connected to earth ground for 1000-Series installation.  
Fasten the option FE terminal in the ground plate using one of the included screws for GA700, GA800, CR700, and CH700 installation.
- <4> Yaskawa recommends using shielded twisted-pair lines.

**Figure 19 PG-RT3 Option and Resolver Connection Diagram**

## 5 Installation Procedure

### ◆ Wire Gauges, Tightening Torques, and Crimp Terminals

#### ■ Wire Gauges and Tightening Torques

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

**Table 3 Wire Gauges and Tightening Torques**

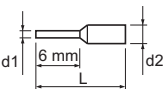
Terminal Signal	Screw Size	Tightening Torque N·m (in·lb)	Bare Cable		Crimp Terminals		Wire Type
			Recomm. Gauge mm <sup>2</sup>	Applicable Gauges mm <sup>2</sup>	Applicable Gauges mm <sup>2</sup>	Recomm. Gauge mm <sup>2</sup>	
R1, R2, S1, S2, S3, S4	M2	0.22 to 0.25 (1.95 to 2.21)	0.75 (18 AWG)	Stranded wire: 0.25 to 1.0 (24 to 17 AWG)	0.5 (20 AWG)	0.25 to 0.5 (24 to 20 AWG)	Shielded twisted pair, etc.
a+, a-, b+, b-, z+, z-, IG, FE				Solid wire: 0.25 to 1.5 (24 to 16 AWG)			Shielded cable, etc.

#### ■ Crimp Terminals

Yaskawa recommends using CRIMPFOX 6 by Phoenix Contact or equivalent crimp 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 Crimp Terminal Sizes**

	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 Block	Terminal	Function	Description
TB1	a+	A pulse monitor signal	Outputs a resolver monitor signal for the A, B, and Z channels. <ul style="list-style-type: none"> <li>• Signal voltage: RS-422 level</li> <li>• Pulses: 1024 ppr &lt;I&gt;</li> </ul>
	a-	A pulse inverse monitor signal	
	b+	B pulse monitor signal	
	b-	B pulse inverse monitor signal	
	z+	Z pulse monitor signal	
	z-	Z pulse inverse monitor signal	
	IG	Monitor ground	0 V
	FE	Ground	Ground terminal for shielded cable.
TB2	R1	Resolver signal	Excitation signal relative to the resolver <ul style="list-style-type: none"> <li>• Output voltage: 7 Vrms</li> <li>• Output frequency: 10 kHz</li> </ul>
	R2		
	S1 <2>	Signal from resolver (COS)	Sine wave from resolver Transformation Ratio: 0.5 ±5%
	S3 <2>		
	S2 <2>	Signal from resolver (SIN)	
S4 <2>			

<1> Irregular monitor pulses can occur with faulty wiring or a defective resolver.

<2> Connect resolver terminals S1 through S4 to PG-RT3 terminals S1 through S4. Be sure not to connect the resolver to drive terminals S1 through S4.

# 6 Related Parameters

The parameters in *Table 6* set the drive for operation with the option. Set parameters as needed. Refer to the manual packaged with the drive for details on setting parameters.

**Note:** Hex.: MEMOBUS addresses used to change parameters over network communication are represented in hexadecimal numbers.

**Table 6 Related Parameters**

No. (Hex.)	Name	Description	Control Method	Values
A1-02 (102)	Control Method Selection	0: V/f Control 1: Closed Loop V/f Control 2: Open Loop Vector Control 3: Closed Loop Vector Control 4: Advanced Open Loop Vector Control 5: PM Open Loop Vector Control 6: PM Advanced Open Loop Vector 7: PM Closed Loop Vector Control 8: EZ Open Loop Vector Control <b>NOTE:</b> Set to 1, 3, 7 when using PG-RT3.	All Modes	Default: </> Range: </>
F1-02 (381)	PG Feedback Loss Selection	Selects the stopping method after PG disconnect (PGo). 0: Ramp to stop 1: Coast to stop 2: Fast Stop (Use C1-09) 3: Alarm only 4: No alarm display <b>NOTICE:</b> Use settings 3 and 4 under special circumstances only. Failure to comply could damage the motor and connected machinery.	CLV CLV/PM	Default: 1 Range: </>
F1-03 (382)	Operation Select at Overspeed	Selects the stopping method after detecting overspeed (oS). 0: Ramp to stop 1: Coast to stop 2: Fast Stop (Use C1-09) 3: Alarm only <b>NOTICE:</b> Use setting 3 under special circumstances only. Failure to comply could damage the motor and connected machinery.	CLV CLV/PM	Default: 1 Range: 0 to 3
F1-04 (383)	Operation Select at Overspeed	0: Ramp to stop 1: Coast to stop 2: Fast Stop (Use C1-09) 3: Alarm only <b>NOTICE:</b> Use setting 3 under special circumstances only. Failure to comply could damage the motor and connected machinery.	CLV CLV/PM	Default: </> Range: 0 to 3



## 6 Related Parameters

No. (Hex.)	Name	Description	Control Method	Values
F1-05 (384)	PG 1 Rotation Selection	0: Pulse A leads 1: Pulse B leads	CLV CLV/PM	Default: <1> Range: 0, 1
F1-08 (387)	PG Overspeed Level	Sets the level for detecting overspeed (oS) as a percentage of the maximum output frequency.	CLV CLV/PM	Default: 115 Min: 0 Max: 120
F1-09 (388)	Overspeed Detection Delay Time	Sets the time required for the motor to exceed the level set in F1-08 to trigger a fault (oS).	CLV CLV/PM	Default: <2> Min: 0.0 Max: 2.0
F1-10 (389)	Speed Deviation Detection Level	Sets the degree of speed deviation to trigger a dEv fault. Set as a percentage of the maximum output frequency.	CLV CLV/PM	Default: 10 Min: 0 Max: 50
F1-11 (38A)	Speed Deviation Detect Delay Time	Sets the time required for a speed deviation situation to trigger a fault.	CLV CLV/PM	Default: 0.5 Min: 0.0 Max: 10.0
F1-14 (38D)	PG Open-Circuit Detection Time	Sets the time in seconds for the resolver disconnect to be detected. <b>Note:</b> An ov or oC error may occur depending on motor speed and load conditions.	CLV CLV/PM	Default: 2.0 Min: 0.0 Max: 10.0
F1-18 (3AD)	Deviation 3 Detection Selection	0: Disabled n: Number of times a dv3 situation must be detected to trigger a fault.	CLV/PM	Default: 10 Min: 0 Max: 10
F1-19 (3AE)	Deviation 4 Detection Selection	0: Disabled n: Number of times a dv4 situation must be detected to trigger a fault.	CLV/PM	Default: 128 Min: 0 Max: 5000

<1> Varies by drive model.

<2> Dependent upon A1-02.

# 7 Troubleshooting

### ◆ Drive-Side Error Codes

*Table 7* lists the various fault codes related to the option and pulse generator. Refer to the drive Technical 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
dEv	dEv	Speed Deviation (for Control Mode with PG)
		The deviation between the speed reference and speed feedback is greater than the setting in F1-10 for longer than the time set to F1-11.
<b>Cause</b>		<b>Possible Solution</b>
The load is too heavy.		Reduce the load.
The acceleration and deceleration times are set too short.		Increase the acceleration and deceleration times (C1-01 through C1-08).
The load is locked up.		Check the machine.
Parameters are set inappropriately.		Check F1-10 and F1-11 settings.
Motor brake is engaged.		Ensure the motor brake releases properly.
Keypad Display		Fault Name
dv3	dv3	Inversion Detection
		<ul style="list-style-type: none"> <li>• Torque reference and acceleration are in opposite directions.</li> <li>• The speed reference and actual motor speed differ by over 30% for the number of pulses set to parameter F1-18.</li> </ul>
<b>Cause</b>		<b>Possible Solution</b>
The Z channel pulse offset is not set properly to E5-11.		Set the value for $\Delta\theta$ to E5-11 as specified on the motor nameplate. Replacing the resolver or changing the application so the motor rotates in reverse requires readjustment of the Z channel pulse offset.
The PG encoder is replaced or rotational direction for the motor is changed.		Perform the Z-pulse Offset Tuning (T2-01 = 3).
An external force on the load side caused the motor to move.		<ul style="list-style-type: none"> <li>• Make sure the motor is rotating in the proper direction.</li> <li>• Investigate problems on the load side causing motor rotation in the opposite direction and counteract the problem.</li> </ul>

## 7 Troubleshooting



Noise interference along the resolver cable.	1. Confirm that the PG encoder is properly connected and all shielded lines are properly grounded.		
The resolver is disconnected or is not wired properly.	2. Cycle power. Replace the PG option card or the PG encoder if the problem continues after cycling power.		
The resolver rotational direction set to F1-05 is in the opposite direction of the motor wiring.	Make sure motor wiring for each phase (U, V, W) is connected properly.		
The PG option or PG encoder is damaged.	If the problem continues after correcting wiring and cycling power, replace the PG option or the PG encoder.		
Keypad Display		Fault Name	
	dv4	Inversion Prevention Detection	
		Pulses indicate that the motor is rotating in the opposite direction of the speed reference. Set the number of pulses to trigger inverse detection to F1-19. <b>Note:</b> Set F1-19 = 0 to disable inverse detection in applications where the motor may rotate in the opposite direction of the speed reference and avoid nuisance faults.	
Cause		Possible Solution	
An external force on the load side caused the motor to move.		<ul style="list-style-type: none"> <li>• Confirm that the motor is rotating in the proper direction.</li> <li>• Investigate problems on the load side causing motor rotation in the opposite direction and counteract the problem.</li> </ul>	
The Z channel pulse offset is not set properly to E5-11.		Set the value for $\Delta\theta$ to E5-11 as specified on the motor nameplate.	
The PG encoder is replaced or rotational direction for the motor is changed.		Perform the Z-pulse Offset Tuning (T2-01 = 3).	
Noise interference along the resolver cable.		Check resolver wiring and make sure all wiring including shielded wiring is properly connected.	
Resolver is disconnected or is not wired properly, or the PG option or resolver are damaged.		Check PG encoder wiring and confirm that all wiring, including shielded wiring, is properly connected.	
The PG option or PG encoder is damaged.		If the problem continues after correcting wiring and cycling power, replace the PG option or the PG encoder.	
Keypad Display		Fault Name	
	oFA00	Non-compatible option is connected to drive port CN5-A.	
Cause		Possible Solution	
The option card installed into port CN5-A is incompatible with the drive.		Use only compatible options. The PG option cannot be connected to CN5-A. For other options, refer to the Installation Manual for that option.	

## 7 Troubleshooting

Keypad Display		Fault Name
oFb00	oFb00	Non-compatible option is connected to drive port CN5-B.
<b>Cause</b>		<b>Possible Solution</b>
The option card installed into port CN5-A is incompatible with the drive.		Connect the option to the correct option port. <b>Note:</b> When connecting DO-A3, AO-A3, PG-B3, or PG-X3, use CN5-B. When connecting only one PG option, use CN5-C.
Keypad Display		Fault Name
oFC01	oFC01	Option Connection Error at drive port CN5-C
<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 Installation Procedure on Page 12.
Keypad Display		Fault Name
oFC50	oFC50	PG Encoder Option A/D Conversion Error Error with the A/D conversion level (VCC level), or A/D conversion timed out.
<b>Cause</b>		<b>Possible Solution</b>
The option is damaged.		Replace the option.
Keypad Display		Fault Name
oFC51	oFC51	PG Encoder Option Analog Circuit Error Internal power supply voltage level error
<b>Cause</b>		<b>Possible Solution</b>
The option is damaged.		Replace the option.
Keypad Display		Fault Name
oFC52	oFC52	PG Encoder Communication Timeout Serial encoder timed out waiting to receive data
<b>Cause</b>		<b>Possible Solution</b>
Resolver wiring is incorrect.		Correct the wiring.
Resolver cable is disconnected.		Reconnect the cable.
Keypad Display		Fault Name
oFC53	oFC53	PG Encoder Communication Data Error Serial encoder CRC checksum error
<b>Cause</b>		<b>Possible Solution</b>
Resolver wiring is incorrect.		Correct the wiring.
Resolver cable is disconnected.		Reconnect the cable.

Keypad Display		Fault Name
	oFC55	Resolver Error Resolver disconnected or damaged
Cause		Possible Solution
Resolver wiring is incorrect.		Correct the wiring.
Resolver cable is disconnected.		Reconnect the cable.
The option is damaged.		Replace the option.
Keypad Display		Fault Name
	oS	Overspeed The motor speed feedback exceeded the F1-08 setting.
Cause		Possible Solution
Overshoot is occurring.		<ul style="list-style-type: none"> <li>Increase the settings for C5-01 (Speed Control Proportional Gain 1) and reduce C5-02 (Speed Control Integral Time 1).</li> <li>Adjust the input signal using parameters H6-02 through H6-05.</li> <li>Enable Feed Forward Control and perform Inertia Auto-Tuning in CLV.</li> </ul>
Incorrect speed feedback scaling when terminal RP is used as speed feedback input in V/f control.		Set H6-02 to the value of the speed feedback signal frequency when the motor runs at the maximum speed.
Inappropriate parameter settings.		Check the setting for the overspeed detection level and the overspeed detection time (F1-08 and F1-09).
Resolver cable is disconnected.		Reconnect the cable.

**Table 8 Operation Error Displays, Causes, and Possible Solutions**

Keypad Display		Fault Name
	oPE02	Parameter Range Setting Error Use U1-18 to find parameters set outside range.
Cause		Possible Solution
Parameters were set outside the possible range.		Set parameters to the proper values. <b>Note:</b> When multiple errors occur simultaneously, other errors are given precedence over oPE02.
Keypad Display		Fault Name
	oPE06	Control Method Selection Error Correct the setting for the control method.
Cause		Possible Solution
Control method requires installing a PG option, but no PG option is installed (A1-02 = 1, 3, or 7).		<ul style="list-style-type: none"> <li>Connect a PG option.</li> <li>Correct the value set to A1-02.</li> </ul>

## 7 Troubleshooting

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### ◆ Preventing Electrical Interference

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

1. Use shielded wire for the PG encoder signal lines.
2. Use PG encoder signal cables that are shorter than 10 m (32 ft).
3. Separate option control wiring from main circuit input power wiring and motor output power cables using conduit or cable tray dividers.
4. Ground the shield of the cable on the PG encoder side and the drive side.
5. Verify that the shield is properly grounded and ground one end of the signal line or remove the ground connection on both ends if electrical interference problems arise in the PG encoder signal.

## 8 European Standards



Figure 20 CE Mark

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

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

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

### **EMC Guidelines:** 2014/30/EU

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

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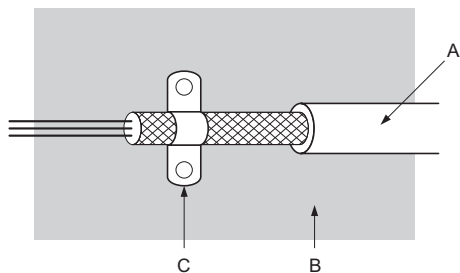
### ◆ **EMC Guidelines Compliance**

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 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 22](#).



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

Figure 21 Ground Area

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

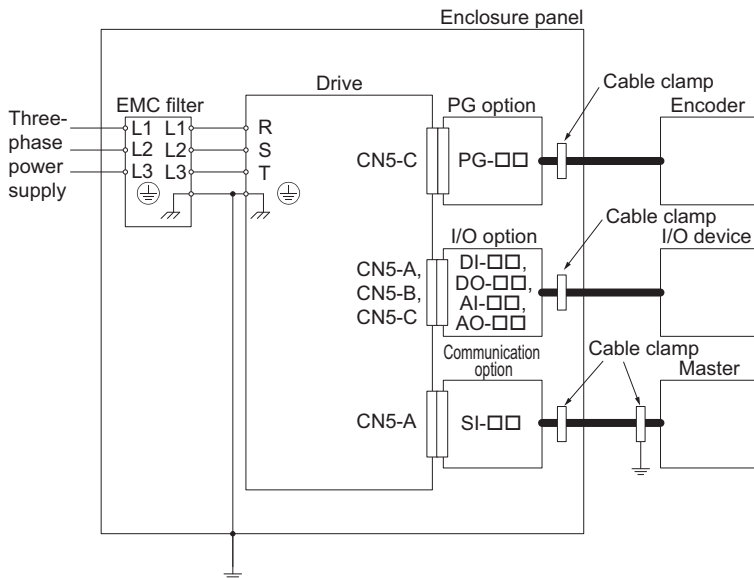


Figure 22 Option Installation for CE Compliance



# 9 Specifications

**Table 9 Option Specifications**

Items	Specifications
<b>Model</b>	PG-RT3
<b>Resolver Model</b>	<p>Yaskawa recommends resolver PN: TS2640N321E64 by Tamagawa Seiki Co., Ltd.</p> <ul style="list-style-type: none"> <li>• Input voltage: AC 7 Vrms 10 kHz</li> <li>• Transformation ratio [K]: <math>0.5 \pm 5\%</math></li> <li>• Input current: 100 mArms max.</li> </ul> <p><b>Note:</b> A resolver meeting or exceeding specifications in this table is also suitable for use. Contact Yaskawa or a Yaskawa representative for the information of other compatible resolvers.</p>
<b>Transformation Resolution</b>	4096 p/rev
<b>Transformation accuracy</b>	$\pm 4$ LSB (absolute value at stop)
<b>Repeatability</b>	$\pm 2$ LSB (simulates 1024 p/rev encoder)
<b>Max. Revolution</b>	24000 min <sup>-1</sup>
<b>Encoder Wiring Length</b>	10 m (32 ft) maximum
<b>Compatible Control Mode</b>	CLV, CLV/PM
<b>Pulse Monitor Output</b>	Monitor for A, B, and Z channels pulse output: Matches RS-422 level
<b>Resolver Disconnect Detection</b>	Available
<b>Ambient Temperature</b>	-10°C to 50°C (14°F to 122°F)
<b>Humidity</b>	95% RH or lower with no condensation
<b>Storage Temperature</b>	-20°C to 60°C (-4°F to 140°F) allowed for short-term transport of the product
<b>Area of Use</b>	<p>Indoors and free from:</p> <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>
<b>Altitude</b>	1000 m (3280 ft) or lower

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## ◆ Revision History

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

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Date of Publication	Rev. No	Section	Revised Content
September 2018	<4>	All	Addition: Applicable product series Revision: Reviewed and corrected entire documentation.
		Back cover	Revision: Address
June 2018	<3>	–	Address in Japanese version.
June 2017	<2>	Back cover	Revision: Address
March 2017	<1>	All	Addition: Applicable product series Revision: Reviewed and corrected entire documentation.
		Back cover	Revision: Address
April 2016	–	–	First edition

# YASKAWA AC Drive Option Motor Feedback Resolver TS2640N321E64 Interface Installation Manual

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# YASKAWA

**YASKAWA ELECTRIC CORPORATION**

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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