YASKAWA

YASKAWA AC Drive-Option Card

Digital Output
Installation Manual

Type DO-A3

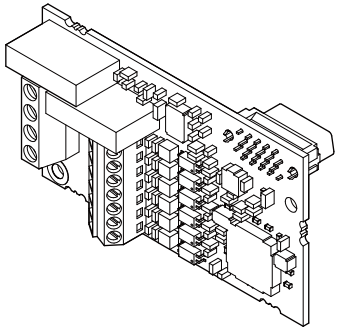
To properly use the product, read this manual thoroughly and retain for easy reference, inspection, and maintenance. Ensure the end user receives this manual.

安川インバータ オプションカード

ディジタル出力
取扱説明書

形式　DO-A3

製品を安全にお使い頂くために，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。



MANUAL NO. TOBP C730600 41A

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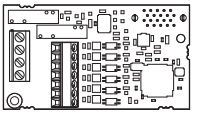
1 Preface

Yaskawa manufactures products used as components in a wide variety of industrial systems and equipment. The selection and application of Yaskawa products remain the responsibility of the equipment manufacturer or end user. Yaskawa accepts no responsibility for the way its products are incorporated into the final system design. Under no circumstances should any Yaskawa product be incorporated into any product or design as the exclusive or sole safety control. Without exception, all controls should be designed to detect faults dynamically and fail safely under all circumstances. All systems or equipment designed to incorporate a product manufactured by Yaskawa must be supplied to the end user with appropriate warnings and instructions as to the safe use and operation of that part. Any warnings provided by Yaskawa must be promptly provided to the end user. Yaskawa offers an express warranty only as to the quality of its products in conforming to standards and specifications published in the Yaskawa manual. NO OTHER WARRANTY, EXPRESS OR IMPLIED, IS OFFERED. Yaskawa assumes no liability for any personal injury, property damage, losses, or claims arising from misapplication of its products.

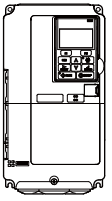
◆ Applicable Documentation

This instruction manual has been written for the items listed below. Use this option card for its intended purpose only.

Option Card

	**YASKAWA AC Drive-Option Card** **Digital Output DO-A3 Installation Manual (this book)** **Document Number: TOBP C730600 41**
	Read this manual first. It contains information required to install the option card and set up related drive parameters.

Drive

	Refer to the manual of the drive this option card is being used with. The manual for the drive covers basic installation, wiring, operation procedures, functions, troubleshooting, and maintenance information. It also includes important information on parameter settings and how to tune the drive. To obtain instruction manuals for Yaskawa products access these sites: **Europe**: http://www.yaskawa.eu.com **Japan**: http://www.e-mechatronics.com **Other areas**: contact a Yaskawa representative.

◆ Registered Trademarks

- Company names and product names listed in this manual are the registered trademarks of those companies.

◆ Supplemental Safety Information

Read and understand this manual before installing, operating or servicing this option unit.

The option unit must be installed according to this manual and local codes.

The following conventions are used to indicate safety messages in this manual. Failure to heed these messages could result in serious or possibly even fatal injury or damage to the products or to related equipment and systems.

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

Indicates an equipment damage message.

■ General Safety

General Precautions

- The diagrams in this section may include option units and drives without covers or safety shields to illustrate details. Be sure to reinstall covers or shields before operating any devices. The option board should be used according to the instructions described in this manual.
- Any illustrations, photographs, or examples used in this manual are provided as examples only and may not apply to all products to which this manual is applicable.
- The products and specifications described in this manual or the content and presentation of the manual may be changed without notice to improve the product and/or the manual.
- When ordering a new copy of the manual due to damage or loss, contact your Yaskawa representative or the nearest Yaskawa sales office and provide the manual number shown on the front cover.

⚠ DANGER

Heed the safety messages in this manual.

Failure to comply will result in death or serious injury.

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

NOTICE

Do not expose the drive to halogen group disinfectants.

Failure to comply may cause damage to the electrical components in the option unit

Do not pack the drive in wooden materials that have been fumigated or sterilized.

Do not sterilize the entire package after the product is packed.

2 Product Overview

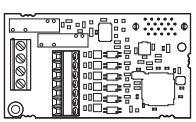
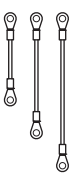
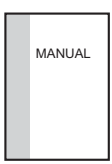
◆ About This Product

By installing this option card to the drive's control board, the user can expand the number of digital outputs available used to monitor drive operation status (alarm signals, zero speed detection, etc.). This option card provides 8 outputs: 6 photocoupler outputs and 2 relay outputs.

The drive instruction manual lists parameters settings that determine the type of outputs signals for each output terminal on the option card.

◆ Checking Package Contents

Table 1 Items Included with this Option Card

Package Contents	Option Card	Lead Lines (for grounding)	Screws (M3)	Manual (this book)
–				
Number of Items	1	3	3	1

- Inspect the Option Card for damage. If the Option Card appears damaged upon receipt, contact the shipper immediately.
- Verify receipt of the correct model by checking the model number printed on the Name plate of the Option Card. (see ***Figure 1***)
- If you have received the wrong model or the Option Card does not function properly, contact your supplier.

◆ Tools Required for Installation

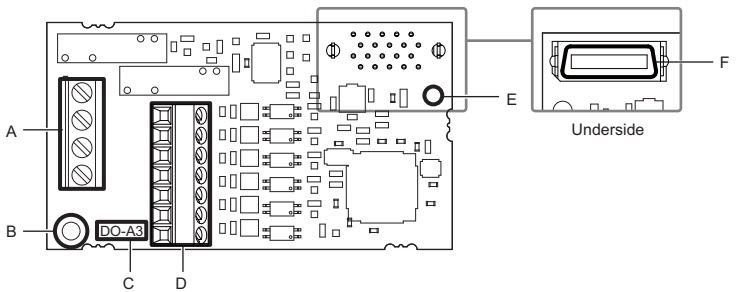
A Phillips screwdriver PH1 (#1) is needed to install this option card.

Additionally a straight-edge screwdriver (blade depth: 0.4 mm, width: 2.5 mm) will be needed to wire the terminal block.

Note: Other tools are required for preparing cables.

3 Option Card Components

◆ Option Card



A – Terminal block TB1
B – Ground terminal
C – Model number
D – Terminal block TB2
E – Installation hole
F – Connector (CN5)

Figure 1 Option Card

◆ Terminal Block

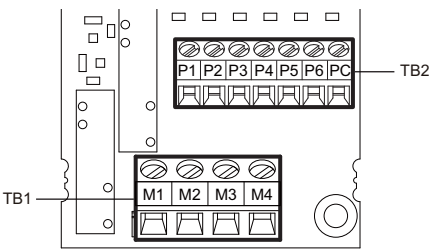


Figure 2 Terminal Block

4 Electrical Installation

◆ Safety Messages

⚠ DANGER

Electric Shock Hazard

Power to the drive must be shut off when installing this option card.
Even though the power has been shut off, voltage still remains in the drive's DC bus. Wait before removing the front cover once the drive has been turned off.

The CHARGE light on the drive will go out after voltage in the DC bus drops below 50 V, at which point it is safe to remove the front cover.

Due to the risk of electric shock, be sure that all LEDs have gone out and that the DC bus voltage has reached a safe level prior to performing any work on the drive.

⚠ WARNING

Electrical Shock Hazard

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

Failure to comply could result in death or serious injury.

Maintenance, inspection, and replacement of parts must be performed only by authorized personnel familiar with installation, adjustment and maintenance of AC drives and Option Cards.

NOTICE

Damage to Equipment

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

Failure to comply may result in ESD damage to circuitry.

Never shut the power off while the drive is outputting voltage.

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

Do not operate damaged equipment.

Failure to comply may cause further damage to the equipment.

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

Properly connect all pins and connectors.

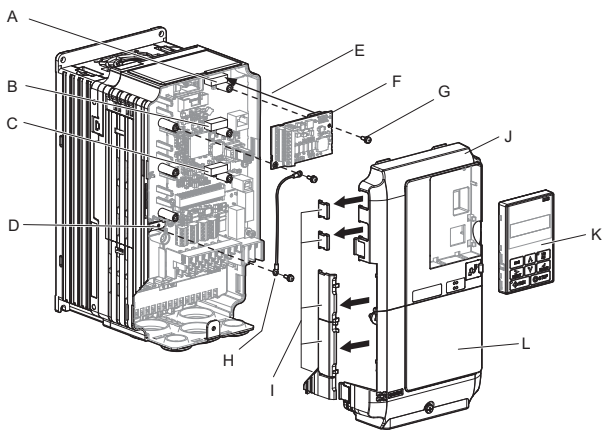
Failure to comply may prevent proper operation and possibly damage equipment.

◆ Installing the Option Card

Only one analog output option card can be installed to a drive. The card may be installed to any one of the ports available for option cards, CN5-A, CN5-B, or CN5-C. See the drive manual for directions on removing the front cover.

1. Shut off power to the drive, wait the appropriate amount of time for voltage to dissipate, then remove the operator and front cover.
2. Insert the CN5 connector on the option card into the matching CN5 connector on the drive, then fasten it into place using one of the screws included with the option card.
   Connect one of the lead lines using one of the screws to the ground terminal.

Note: There are only two screw holes on the drive for ground terminals. If three option cards are connected, two of the lead lines will need to share the same ground terminal.

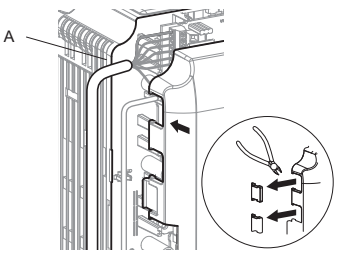


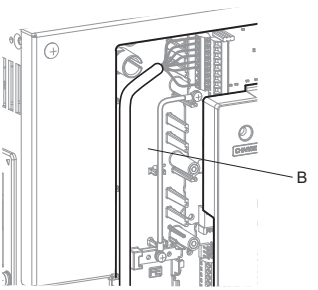
A – Connector CN5-C
B – Connector CN5-B
C – Connector CN5-A
D – Drive grounding terminal (FE)
E – Insert connector CN5 here
F – Option card
G – Mounting screw
H – Lead line
I – Use wire cutters to create an opening for cable lines
J – Front cover
K – Digital operator
L – Terminal cover

Figure 3 Installing an Option Card

3. Wire the option card to the terminal block on the option card.

For wiring instructions, see ***Connection Diagram on page 13***.
In the drives CIMR-A□2A0004 to 0040 and 4A0002 to 0023 the cable might need to be routed through the top cover to the outside. In this case cut out the perforated openings at the left side of the drive top cover. Make sure no sharp edges that can damage the cable remain.
In the drives CIMR-A□2A0056 to 0211, 4A0031 to 0165 the cable can be routed inside the drive.





A – Wires should pass through the access hold provided on the left side of the front cover. (CIMR-A□2A0004 to 0040, 4A0002 to 0023)

B – Use the open space provided inside the drive to route option card wiring. (CIMR-A□2A0056 to 0211, 4A0031 to 0165)

Figure 4 Wiring space

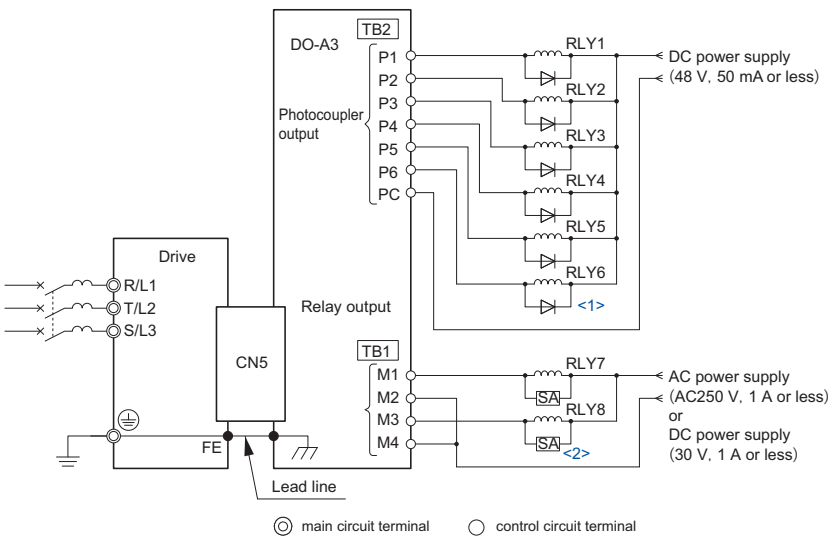
4. Place the front cover back onto the drive.

Note: **1.** Take care when wiring the option card so that the front cover easily fits back onto the drive. Make sure a cable is not caught between the front cover and the drive when putting the cover back on.
2. The drive will not be used as NEMA Type1 if there is any exposed wiring outside the enclosure.

◆ Connection Diagram

Refer to ***Figure 5*** when wiring the terminal block on the option card.

Information on the types of output terminals are listed in ***Terminal Output Types on page 14***.



<1> Double check the polarity on the diode when connecting a DC relay.
<2> A surge absorber should be installed when using an AC relay.

Figure 5 Wiring the Option Card and Drive

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

- Always use shielded line when connecting this option card to a PLC or some other type of control device, and keep wiring distance under 50 m. Prepare wire ends as described in "Treating Terminal Ends for Shielded Lines" (page ***18***).
- Make sure that control lines to the option card, main circuit wiring, and power lines are separated from one another.

■ Output Interface Circuit

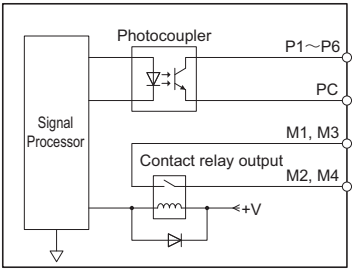


Figure 6 Output Interface Circuit

◆ Terminal Output Types

Table 2 Terminal Output Types

Terminal Block	Terminal	Output <1>	Output Type	Output Level
TB1	M1	Contact relay output 1	N.O. output	Max voltage and current: 250 Vac, 1 A 30 Vdc, 1 A
	M2			
	M3	Contact relay output 2		
	M4			
TB2	P1	Photocoupler output 1	Open-collector output	Max voltage and current: 48 Vdc, 50 mA
	P2	Photocoupler output 2		
	P3	Photocoupler output 3		
	P4	Photocoupler output 4		
	P5	Photocoupler output 5		
	P6	Photocoupler output 6		
	PC	Photocoupler output common	Emitter common	

<1> Set drive parameters to determine the function assigned to each output.

◆ Wire Gauges and Tightening Torque

Wire gauge specifications are listed below in ***Table 3***.
Yaskawa recommends using crimp terminals for easy of wiring and to ensure proper connection. Crimp terminal specifications can be found in ***Table 4***.

Table 3 Wire Gauges and Tightening Torque

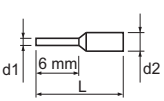
Terminal Signal	Screw Size	Tightening Torque (N•m)	Bare Cable		Wiring Gauges with Crimp Terminals		Wire Type
			Possible Gauges mm^2 (AWG)	Recommended Gauges mm^2 (AWG)	Possible Gauges mm^2 (AWG)	Recommended Gauges mm^2 (AWG)	
P1 to P6, PC	M2	0.22 to 0.25	Stranded wire: 0.25 to 1.0 (24 to 17) Single line: 0.25 to 1.5 (24 to 16)	0.75 (18)	0.25 to 0.5 (24 to 20)	0.5 (20)	Shielded twisted pair, etc.
M1 to M4	M3	0.5 to 0.6	Stranded wire: 0.25 to 1.5 (24 to 16) Single line: 0.25 to 2.5 (24 to 13)		0.25 to 1.0 (24 to 17)		

■ Crimp Terminals

Yaskawa recommends using CRIMPFOX ZA-3 by Phoenix Contact to crimp the terminal ends.

Note: Wire ends should be properly trimmed so no wire extends out from the crimp terminals.

Table 4 Crimp Terminal Sizes

	Wire Gauge mm^2 (AWG)	Model	L (mm)	d1 (mm)	d2 (mm)	Manufacturer
	0.25 (24)	AI 0.25 - 6YE	10.5	0.8	2	Phoenix Contact
	0.34 (22)	AI 0.34 - 6TQ	10.5	0.8	2	
	0.5 (20)	AI 0.5 - 6WH	14	1.1	2.5	
	1.0	AI 1-6RD	12	1.5	3.0	

◆ Wiring Procedure

When wiring the option card, wire ends should be prepared as shown in ***Figure 7***. See ***Wire Gauges and Tightening Torque on page 15*** to make sure the proper tightening torque is applied to each terminal end.

Take particular precautions to ensure that each cable is properly connected, and that wire covering has not been accidentally inserted into the terminals.

NOTICE: *Insulation or tape may be required to ensure that shielded lines do not come into contact with other wiring. Insufficient insulation may cause a short circuit that can damage the option card and the drive.*

NOTICE: *Follow the tightening torque specifications in this manual for all terminal screws. Failing to do so may keep the drive from functioning properly and could damage the terminal block.*

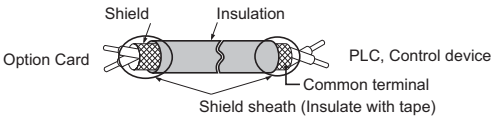


Figure 7 Treating Terminal Ends for Shielded Line

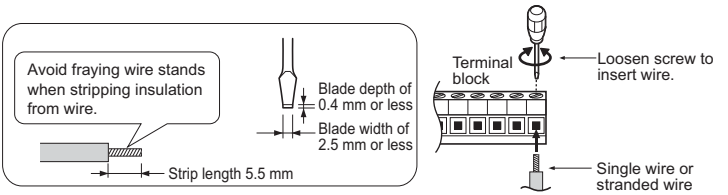


Figure 8 Terminal Block Wiring

5 Related Parameters

The following parameters are used to set up the drive for operation with an option card. Set parameters appropriate for the application.

Table 5 Related Parameters

No.	Parameter	Description	Setting Range
F5-01 to F5-08	Output Function Selection Parameters	Select from a range of functions for each output terminal. <1>	000 to 192
F5-09	Output Mode Selection	0: Individual output 1: Binary code 2: Multi-function output (set function in parameters F5-01 through F5-08)	0 to 2

<1> See the drive manual for more information on setting the F5 parameters.

◆ Setting the Output Mode

Table 6 below shows how output terminal contents change according to the output mode set in F5-09.

Table 6 F5-09 and Output Mode

Terminal Block	Terminal	F5-09 = 0 Individual Output (default)	F5-09 = 1 Binary Code Output	F5-09 = 2 Multi-Function Output
TB1	M1-M2	Zero speed	During run	Determined by F5-01
	M3-M4	Speed agree	Alarm (excluding bb)	Determined by F5-02
TB2	P1-PC	oC, GF (Overcurrent)	Binary code output (see *Table 7*)	Determined by F5-03
	P2-PC	ov (Overvoltage)		Determined by F5-04
	P3-PC	oH2 (Drive overheat) or oL2 (overload)		Determined by F5-05
	P4-PC	Not used		Determined by F5-06
	P5-PC	oS (Overspeed)	Zero speed	Determined by F5-07
	P6-PC	oH, oH1 (Drive overheat) or oL1 (Overload)	Speed agree	Determined by F5-08

Table 7 Binary Coded Output (F5-09 = 1)

Coded Output	Description	TB2			
		P1-PC	P2-PC	P3-PC	P4-PC
0	Normal operation (no fault)	0	0	0	0
1	oC, GF (Overcurrent)	1	0	0	0
2	ov (Overvoltage)	0	1	0	0
3	oL2 (Drive overload)	1	1	0	0
4	oH, oH1 (Drive overheat)	0	0	1	0
5	oS (Overspeed)	1	0	1	0
6	Not used	0	1	1	0
7	rr, rH (Braking resistor overheat)	1	1	1	0
8	EF1 to EF12 (External fault)	0	0	0	1
9	CPF□□, oFA□□, oFb□□, oFC□□ (Drive hardware fault) <1>	1	0	0	1
A	oL1 (Motor overload)	0	1	0	1
B	Not used	1	1	0	1
C	Uv1, Uv2, Uv3 (Undervoltage)	0	0	1	1
D	dEv (Speed deviation)	1	0	1	1
E	PGo (PG disconnect)	0	1	1	1
F	Not used	1	1	1	1

<1> Boxes □□ represent wild cards.

6 Troubleshooting

◆ Error Codes Displayed on the Drive Operator

The table below lists the various fault codes related to this option card.
Further detail on various faults can be found in the manual for the drive.

- Check all cables connected to the option card.
- Make sure the option card is properly installed to the drive.

Table 8 Fault Display

Digital Operator Display		Fault Name
oFA01	oFA01	Option Card Connection Error at CN5-A
Cause		**Possible Solution**
Option card at port CN5-A was changed during run.		Switch the power off and reconnect the option card.
Digital Operator Display		**Fault Name**
oFb01	oFb01	Option Card Connection Error at CN5-B
Cause		**Possible Solution**
Option card at port CN5-B was changed during run.		Switch the power off and reconnect the option card.
Digital Operator Display		**Fault Name**
oFb02	oFb02	Duplicate Option at Port CN-B
Cause		**Possible Solution**
Same type of option card connected to ports CN5-A and CN5-B.		Use only compatible option cards. See note <*1*>.
Digital Operator Display		**Fault Name**
oFC01	oFC01	Option Card Connection Error at CN5-C
Cause		**Possible Solution**
Option card at port CN5-C was changed during run.		Switch the power off and reconnect the option card.
Digital Operator Display		**Fault Name**
oFC02	oFC02	Duplicate Option Connected
Cause		**Possible Solution**
Same type of option card connected to ports CN5-A, CN5-B, and CN5-C.		Use only compatible option cards. See note <*1*>.

<1> Depending the type of option card, only a certain number of cards may be connected at the same time. Refer to table below. More details can be found in the option card section of the drive instruction manual.

Table 9 Option Card Installation

Option Card	Connector	Number of Cards Possible
SI-C3, SI-N3, SI-P3, SI-S3, AI-A3, DI-A3 <2>	CN5-A	1
PG-B3, PG-X3	CN5-B, C	2 <3>
DO-A3, AO-A3	CN5-A, B, C	1

<2> The AI-A3 and DI-A3 option can also be installed to option ports CN5-B and CN5-C, but are then used for monitoring purposes only. Input levels are then displayed in U1-17, U1-21 to U1-23. Here, the option cards cannot be used to set the frequency reference or replace the drive analog input with higher resolution inputs.
<3> If only one PG option card is connected to the drive, use the CN5-C connector. If two PG option cards are connected, use both CN5-B and CN5-C.

7 Specifications & Warranty Information

◆ Specifications

Table 10 Specifications

Model	DO-A3
Photocoupler Output	6 outputs (common emitter) Max. allowable voltage/current: 48 Vdc / 50 mA
Contact Relay Output	2 outputs (independent) Max. allowable voltage/current: 250 Vac / 1 A, 30 Vdc / 1 A
Ambient Temperature	–10°C to 50°C
Humidity	95% RH or less with no condensation
Storage Temperature	–20°C to 60°C allowed for short-term transport of the product
Area of Use	Indoor (free of corrosive gas, airborne particles, etc.)
Altitude	1000 m or less

◆ Revision History

The revision dates and numbers of the revised manuals are given on the bottom of the back cover.

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Digital Output
Installation Manual

IRUMA BUSINESS CENTER (SOLUTION CENTER)
480, Kamifujisawa, Iruma, Saitama 358-8555, Japan
Phone 81-4-2962-5696 Fax 81-4-2962-6138

YASKAWA ELECTRIC AMERICA, INC.
2121 Norman Drive South, Waukegan, IL 60085, U.S.A.
Phone 1-847-887-7000 Fax 1-847-887-7370

YASKAWA ELÉTRICO DO BRASIL LTDA.
Avenida Fagundes Filho, 620 São Paulo-SP CEP 04304-000, Brazil
Phone 55-11-3585-1100 Fax 55-11-5581-8795

YASKAWA ELECTRIC EUROPE GmbH
Hauptstraβe 185, 65760 Eschborn, Germany
Phone 49-6196-569-300 Fax 49-6196-569-398

YASKAWA ELECTRIC UK LTD.
1 Hunt Hill Orchardton Woods Cumbernauld, G68 9LF, United Kingdom
Phone 44-1236-735000 Fax 44-1236-458182

YASKAWA ELECTRIC KOREA CORPORATION
7F, Doore Bldg. 24, Yeoido-dong, Youngdungpo-Ku, Seoul 150-877, Korea
Phone 82-2-784-7844 Fax 82-2-784-8495

YASKAWA ELECTRIC (SINGAPORE) PTE. LTD.
151 Lorong Chuan, #04-01, New Tech Park 556741, Singapore
Phone 65-6282-3003 Fax 65-6289-3003

YASKAWA ELECTRIC (SHANGHAI) CO., LTD.
No.18 Xizang Zhong Road. Room 1702-1707, Harbour Ring Plaza Shanghai 200001, China
Phone 86-21-5385-2200 Fax 86-21-5385-3299

YASKAWA ELECTRIC (SHANGHAI) CO., LTD. BEIJING OFFICE
Room 1011A, Tower W3 Oriental Plaza, No.1 East Chang An Ave.,
Dong Cheng District, Beijing 100738, China
Phone 86-10-8518-4086 Fax 86-10-8518-4082

YASKAWA ELECTRIC TAIWAN CORPORATION
9F, 16, Nanking E. Rd., Sec. 3, Taipei, Taiwan
Phone 886-2-2502-5003 Fax 886-2-2505-1280

YASKAWA ELECTRIC CORPORATION

YASKAWA

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