

DX200 OPTIONS INSTRUCTIONS

FOR ARM INTERFERENCE WITH SPECIFIED CUBIC AREA CHECK FUNCTION

Upon receipt of the product and prior to initial operation, read these instructions thoroughly and retain for future reference.

MOTOMAN INSTRUCTIONS

MOTOMAN-□□□ INSTRUCTIONS
DX200 INSTRUCTIONS
DX200 OPERATOR'S MANUAL (for each purpose)
DX200 MAINTENANCE MANUAL

The DX200 operator's manuals above correspond to specific usage. Be sure to use the appropriate manual.

Part Number: 165986-1CD
Revision: 0



MANDATORY

- This manual explains the arm interference with specified cubic area check function of the DX200 system. Read this manual carefully and be sure to understand its contents before handling the DX200.
- General items related to safety are listed in Chapter 1: Safety of the DX200 Instructions. To ensure correct and safe operation, carefully read the DX200 Instructions before reading this manual.



CAUTION

- The drawing in this manual are shown with the protective covers or shields removed for clarity. Be sure all covers and shields are replaced before operating this product.
- The drawing and photos in this manual are representative examples and differences may exist between them and the delivered product.
- YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications.
If such modification is made, the manual number will also be revised.
- If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.
- YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product's warranty.

Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the DX200.

In this manual, the Notes for Safe Operation are classified as “WARNING”, “CAUTION”, “MANDATORY”, or “PROHIBITED”.



WARNING

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



CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to personnel and damage to equipment. It may also be used alert against unsafe practice.



MANDATORY

Always be sure to follow explicitly the items listed under this heading.



PROHIBITED

Must never be performed.

Even items described as “CAUTION” may result in a serious accident in some situations. At any rate, be sure to follow these important items.



To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as “CAUTION” and “WARNING”.



WARNING

- Before operating the manipulator, check that servo power is turned OFF pressing the emergency stop buttons on the front door of the DX200 and the programming pendant. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.

Injury or damage to machinery may result if the emergency stop circuit cannot stop the manipulator during an emergency. The manipulator should not be used if the emergency stop buttons do not function.

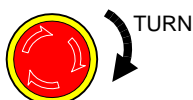
Figure 1: Emergency Stop Button



- Once the emergency stop button is released, clear the cell of all items which could interfere with the operation of the manipulator. Then turn the servo power ON.

Injury may result from unintentional or unexpected manipulator motion.

Figure 2: Release of Emergency Stop



- Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
 - View the manipulator from the front whenever possible.
 - Always follow the predetermined operating procedure.
 - Keep in mind the emergency response measures against the manipulator's unexpected motion toward you.
 - Ensure that you have a safe place to retreat in case of emergency.

Improper or unintended manipulator operation may result in injury.

- Confirm that no person is present in the P-point maximum envelope of the manipulator and that you are in a safe location before:
 - Turning ON the power for the DX200.
 - Moving the manipulator with the programming pendant.
 - Running the system in the check mode.
 - Performing automatic operations.

Injury may result if anyone enters the P-point maximum envelope of the manipulator during operation. Always press an emergency stop button immediately if there is a problem.

The emergency stop buttons are located on the right of front door of the DX200 and the programming pendant.



CAUTION

- Perform the following inspection procedures prior to conducting manipulator teaching. If problems are found, repair them immediately, and be sure that all other necessary processing has been performed.
 - Check for problems in manipulator movement.
 - Check for damage to insulation and sheathing of external wires.
- Always return the programming pendant to the hook on the cabinet of the DX200 after use.

If the programming pendant is inadvertently left on the manipulator, on a fixture, or on the floor, the manipulator or a tool may collide with the programming pendant during manipulator movement, which may result in personal injury or equipment damage.

- Read and understand the Explanation of the Warning Labels in the Setup manual before operating the manipulator.

Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product.

The MOTOMAN usually consists of the manipulator, the controller, the programming pendant, and the manipulator cables.

In this manual, the equipment is designated as follows:

Equipment	Manual Designation
DX200 controller	DX200
DX200 programming pendant	Programming pendant
Cable between manipulator and DX200	Manipulator cables

Arm Interference w/ Specified Area Check

Descriptions of the programming pendant keys, buttons, and displays are shown as follows:

Equipment		Manual Designation
Programming Pendant	Character Keys Symbol Keys	The keys which have characters printed on them are denoted with []. ex. [ENTER]
	Axis Keys Numeric Keys	"Axis Keys" and "Numeric Keys" are generic names for the keys for axis operation and number input.
	Keys pressed simultaneously	When two keys are to be pressed simultaneously, the keys are shown with a "+" sign between them, ex. [SHIFT]+[COORD]
	Displays	The menu displayed in the programming pendant is denoted with { }. ex. {JOB}

Description of the Operation Procedure

In the explanation of the operation procedure, the expression "Select ●●●" means that the cursor is moved to the object item and the SELECT key is pressed, or that the item is directly selected by touching the screen.

Registered Trademark

In this manual, names of companies, corporations, or products are trademarks, registered trademarks, or brand names for each company or corporation. The indication of (R) and ™ are omitted.

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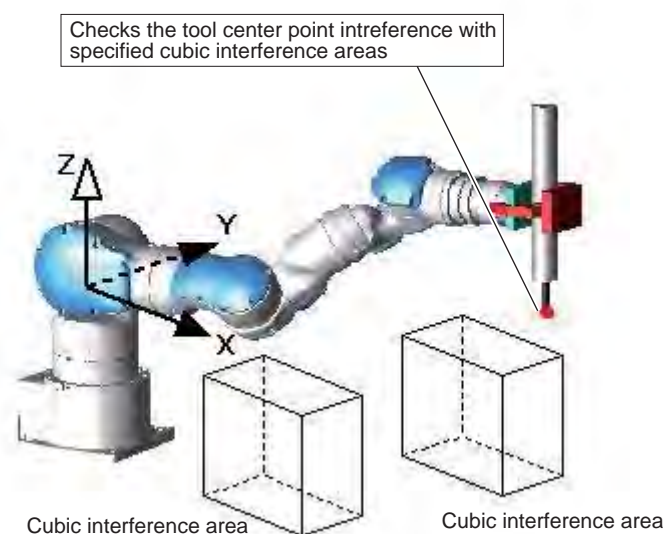
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1 Arm Interference with Specified Cubic Area Check Function

1.1 Outline of this Function

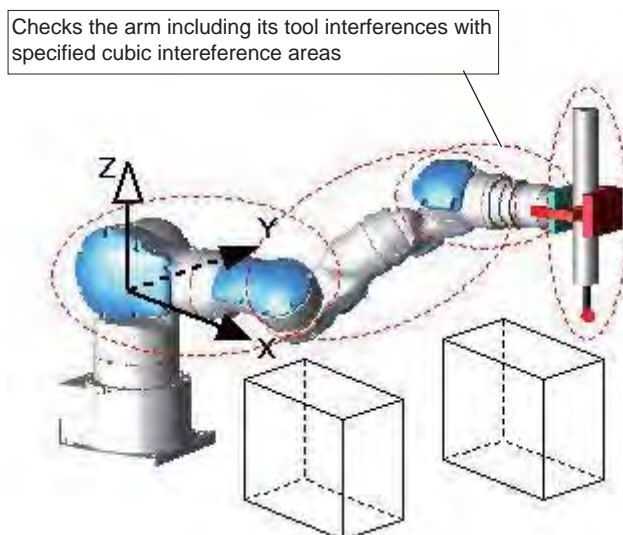
The “check function of tool center point interferences with specified cubic areas”, which is a standard feature of the DX200, turns ON the corresponding its system output signals “#50080 to #50157:CUBE INTERFERENCE Signal” when the tool center point interfered with specified cubic areas.

Fig. 1-1: Tool Center Point Interference with Specified Cubic Area



On the other hand, the “check function of arm interferences with specified cubic areas”, turns ON the corresponding its system output signals “#50080 to #50157:CUBE INTERFERENCE Signal” when the manipulator’s arm including its tool center point interfered with specified cubic areas.

Fig. 1-2: Arm Interference with Specified Cubic Area

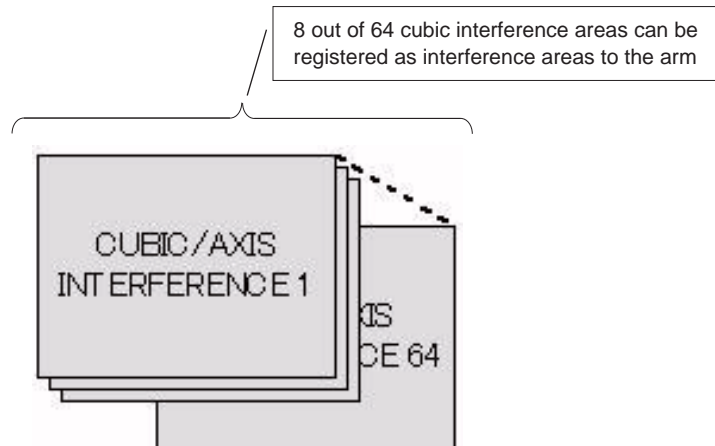


1.2 Setting of Arm Interference with Specified Cubic Area Check Function

1.2.1 Cubic Interference Area

Up to 64 cubic interference areas can be registered. Of these 64, up to 8 areas can be registered as interference areas to the arm.

Fig. 1-3: Numbers of Cubic Interference Area



The cubic interference areas are displayed by pressing {Main Menu} → {ROBOT} → {INTERFERENCE AREA}.

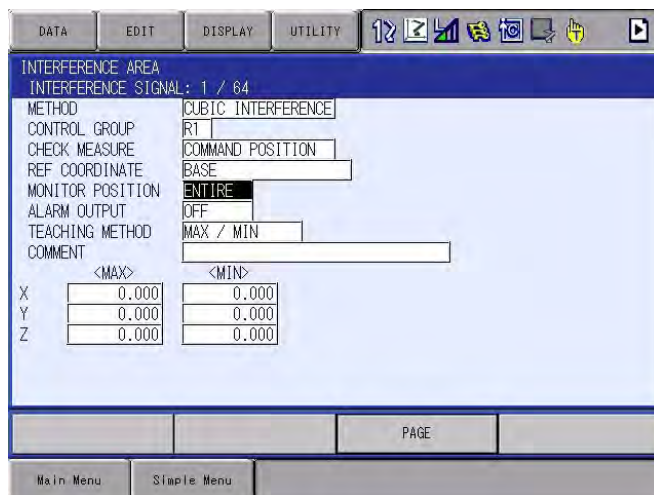
For the settings of the cubic interference area, refer to Section 8.6.2 “Cubic Interference Area” in Chapter 8 “System Setup” of the “DX200 INSTRUCTIONS” (165292-1CD).

On the cubic interference area setting window, display an INTERFERENCE SIGNAL window to be the subject of the arm interference with specified cubic areas check function.

Move the cursor key to the {MONITOR POSITION}.

Press [ENTER] to alternate “TOOL CENTER POINT” and “ENTIRE”.

Select “ENTIRE” and this interference's signal is set as one of the subject cubic areas of the arm interference.





Out of 64 possible interference areas, 8 cubic interference areas can be set to "ENTIRE" at "MONITOR POSITION" at maximum. If more than 8 areas are tried to be set, the following alarm occurs.

ERORR 1510: Cannot edit. The maximum number of cubic interference that is able to be set to "ENTIRE" is exceeded.

Under the condition that "ENTIRE" is set to "MONITOR POSITION", if 0.000[mm] is set as one of the cubic interference area side length, the DX200 will automatically regards the length as 0.001 [mm] to define the cubic interference area. Then, it starts checking the interferences with the arm.

For example, set an interference area with the length of X-axis direction as 0.000[mm] and other directions follows.



<Max. value> <Min. value>

X: 0.000 [mm] 0.000 [mm]

Y: 50.000 [mm] -50.000 [mm]

Z: 50.000 [mm] -50.000 [mm]

Taking the settings mentioned above, the DX200 will automatically define the cubic interference area as follows.

<Max. value> <Min. value>

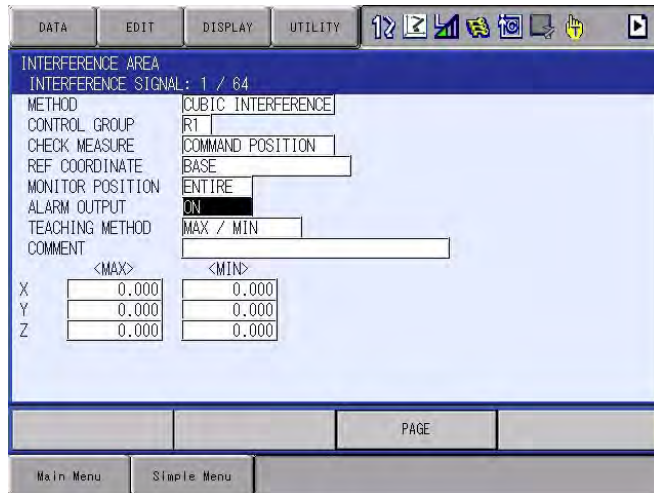
X: 0.005 [mm] -0.005 [mm]

Y: 50.000 [mm] -50.000 [mm]

Z: 50.000 [mm] -50.000 [mm]

Set "ON" to {ALARM OUTPUT} after setting "ENTIRE" to {MONITOR POSITION}. The following alarm occurs and the manipulator stops immediately when the robot arm including the tool center point interferes with the already specified cubic interference areas.

AL 4903: CUBE INTEREFERENCE (ENTIRE)



The alarm occurs only under the following conditions after "ON" is set to {ALARM OUTPUT}.



When the robot is operated by JOG operation or move instruction.

However, the alarm would not occur when the manipulator is already inside of the interference cubic area before setting "ON" to {ALARM OUTPUT}.

1.2.2 Tool Interfere File

The manipulator's tool part shape must be registered by the customer because its tool shape varies depending on the work that the manipulator performs. The shape can be registered with TOOL INTERFERE file.

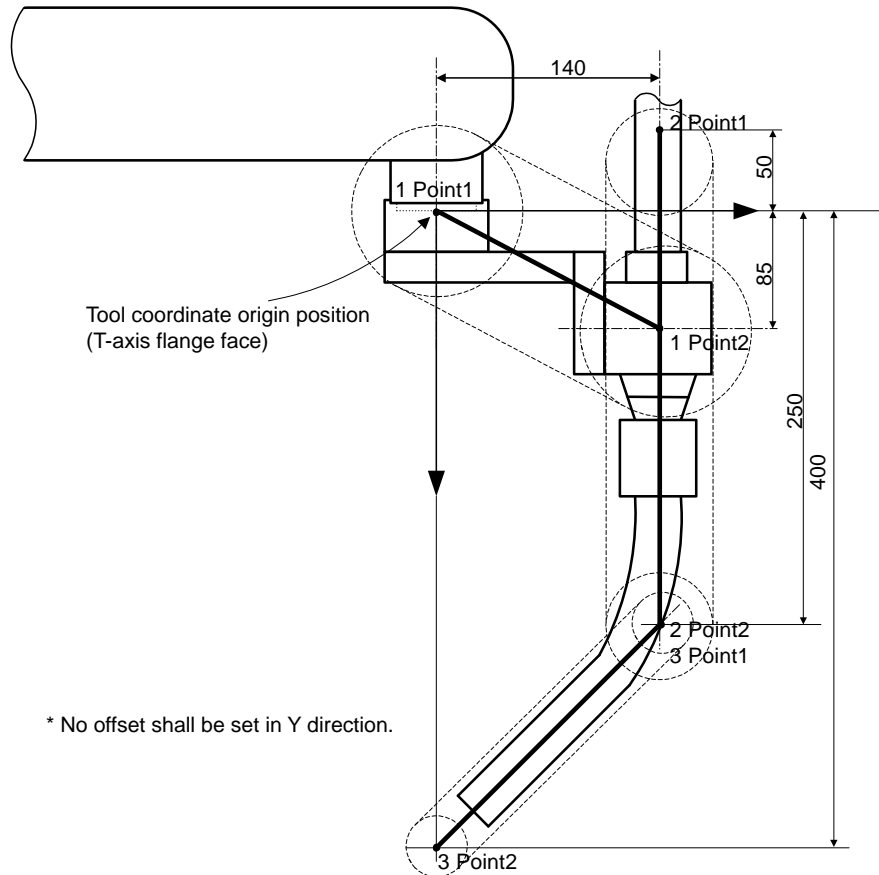
Press {Main Menu} → {ROBOT} → {TOOL INTERFERENCE} to display the TOOL INTERFERE file.

TOOL INTERFERE			
TOOL NO.: 0			
	POINT1 (mm)	POINT2 (mm)	RADIUS (mm)
1. X	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
Y	<input type="text" value="0"/>	<input type="text" value="0"/>	
Z	<input type="text" value="0"/>	<input type="text" value="0"/>	
2. X	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
Y	<input type="text" value="0"/>	<input type="text" value="0"/>	
Z	<input type="text" value="0"/>	<input type="text" value="0"/>	
3. X	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
Y	<input type="text" value="0"/>	<input type="text" value="0"/>	
Z	<input type="text" value="0"/>	<input type="text" value="0"/>	
4. X	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
Y	<input type="text" value="0"/>	<input type="text" value="0"/>	
Z	<input type="text" value="0"/>	<input type="text" value="0"/>	
5. X	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>

Main Menu Simple Menu

- A maximum of 64 tool interfere files, which is the same numbers as the tool files, can be set.
The same numbered tool number and tool interference number are allocated one-on-one.
In accordance with the tool number specified in the operation, a file is selected out of 64 files.
- A maximum of 5 cylinders and spheres can be specified for registering the shape of the tool.
- Values for cylinders and spheres can be input to No.1 to No.5 by moving the cursor key downward.
- Values input to Point 1 and 2 specify the either ends position of the cylinder.
Like the setting of the tool dimensions, the setting values are set with the center of T-axis flange regarded as the starting point (X=0, Y=0, Z=0).
- The values input to "RADIUS" set the radius of the cylinders specified by Point 1 and 2. Also, the spheres with their center points at Point 1 and 2 are set with their radius specified by the values input to "RADIUS".

1.2.3 Example of Setting Tool Interfere File



TOOL INTERFERE			
TOOL NO. : 0 / 64			
	POINT1 (mm)	POINT2 (mm)	RADIUS (mm)
1. X	0	140	70
Y	0	0	
Z	0	85	
2. X	140	140	30
Y	0	0	
Z	-50	250	
3. X	140	0	20
Y	0	0	
Z	250	400	
4. X	0	0	0
Y	0	0	
Z	0	0	
5. X	0	0	0
Y	0	0	
Z	0	0	

1.3 Recovery from Interference

When {ALARM OUTPUT} is set to "ON" and {CHECK MEASURE} is set to "FEED BACK", still the alarm occurs if the manipulator interferes with the interference area. Despite this alarm, the manipulator may not be put outside of the interference area. It is because that the manipulator is still inside of the area even after resetting the alarm and, furthermore, the alarm occurs again. Then, it becomes impossible to reset the alarm any more.

To put the manipulator outside of the interference area, refer to the following procedures.

1.3.1 Releasing Limit

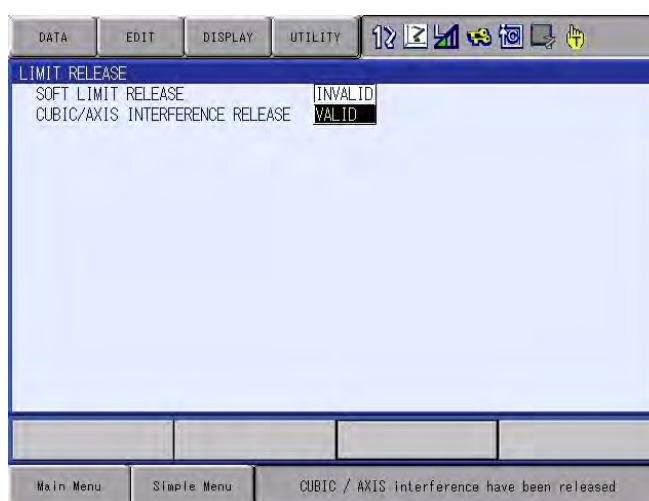
The alarm status mentioned above can be released on LIMIT RELEASE window.

To display LIMIT RELEASE window, select {Main Menu} → {ROBOT} → {LIMIT RELEASE}.

Move the cursor key to {CUBIC/AXIS INTERFERENCE RELEASE} and press [SELECT] to alternate "VALID" and "INVALID".

Monitoring of the interference can be released temporarily by setting "VALID" to {CUBIC/AXIS INTERFERENCE RELEASE} only when the mode is in teach mode.

However, {CUBIC/AXIS INTERFERENCE RELEASE} is set to "INVALID" again automatically when the mode is changed to play mode or to remote mode.



The user can release the alarm occurrence by following the procedures below.

1. Select {Main Menu} → {ROBOT} → {LIMIT RELEASE}.
2. Change the setting of {CUBIC/AXIS INTERFERENCE RELEASE} from "INVALID" to "VALID".
3. Select {Main Menu} → {SYSTEM INFORMATION} → {ALARM}.
4. Press {ALARM RESET} button on the window.
5. Move the manipulator to outside of the interference area by JOG operation.
6. Select {Main Menu} → {ROBOT} → {LIMIT RELEASE}.

7. Change the setting of {CUBIC/AXIS INTERFERENCE RELEASE} from "VALID" to "INVALID".

1.3.2 Editing Interference Area Setting While Alarming

On the CUBIC/AXIS INTERFERENCE setting window, the interference area can be edited even when the alarm is occurring.

The user can recover the manipulator from the alarm status by following the procedure below.

1. Select {Main Menu} → {ROBOT} → {INTERFERENCE AREA}.
2. Display the interference area specified by the alarm number.
3. Change the setting of {ALARM OUTPUT} from "ON" to "OFF".
4. Select {Main Menu} → {SYSTEM INFORMATION} → {ALARM}.
5. Press down "ALARM RESET" button.
6. Move the manipulator to outside of the interference area by JOG operation.
7. Select {Main Menu} → {ROBOT} → {INTERFERENCE AREA}.
8. Change the setting of {ALARM OUTPUT} from "OFF" to "ON".

1.4 Notes

①

When using the check function of arm interference with specified cubic areas, to avoid any interferences with the manipulator including its tool, set "COMMAND POSITION" to {CHECK MEASURE} on INTERFERENCE AREA window. Set the radius of the tool interfere file with allowances because there are position errors between the command position and the feed back position for the moving manipulator.

②

Determine the setting value of the TOOL INTERFERE file in accordance with the drawing.

DX200 OPTIONS INSTRUCTIONS

FOR ARM INTERFERENCE WITH SPECIFIED CUBIC AREA CHECK FUNCTION

HEAD OFFICE

2-1 Kurosakishiroishi, Yahatanishi-ku, Kitakyushu 806-0004, Japan
Phone +81-93-645-7745 Fax +81-93-645-7746

YASKAWA America Inc. M Robotics Division
100 Automation Way, Miamisburg, OH 45342, U.S.A.
Phone +1-937-847-6200 Fax +1-937-847-6277

YASKAWA Nordic AB
Box 504 Verkstadsgatan 2, PO Box 504 SE-385 25 Torsås, Sweden
Phone +46-480-417-800 Fax +46-486-414-10

YASKAWA Europe GmbH Robotics Div.
Yaskawastrasse 1, 85391 Allershausen, Germany
Phone +49-8166-90-0 Fax +49-8166-90-103

YASKAWA Electric Korea Co., Ltd
9F, KYOBO Securities Bldg., 26-4, Yeoido-Dong Yeounggeungpo-ku, Seoul, Korea
Phone +82-2-784-7844 Fax +82-2-784-8495

YASKAWA Electric (Singapore) PTE Ltd.
151 Lorong Chuan, #04-02A, New Tech Park, Singapore 556741
Phone +65-6282-3003 Fax +65-6289-3003

YASKAWA Electric (Thailand) Co., Ltd.
252/246, 4th Floor. Muang Thai-Phatra Office Tower II Rachadaphisek Road,
Huaykwang Bangkok, 10320, Thailand
Phone +66-2-693-2200 Fax +66-2-693-4200

YASKAWA Shougang Robot Co. Ltd.
1015, Boxuenan Rd. Maluzhen, Jiading District, Shanghai, China
Phone +86-21-5950-3521 Fax +86-20-3878-0651

YASKAWA ELECTRIC CHINA Co., Ltd.
12F Carlton Building, No. 21-42 Huanghe Road, Shanghai 200003, China
Phone +86-21-5385-2200 Fax +86-21-5385-3299

YASKAWA Robotics India Ltd.
#426, Udyog Vihar, Phase- IV, Gurgaon, Haryana, India
Phone +91-124-475-8500 Fax +91-124-475-8542

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