SIA/SDA Supplement:
Robot Duty Cycle Information

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

MOTOMAN INSTRUCTIONS
MOTOMAN-SIA/SDA INSTRUCTIONS

DX200 INSTRUCTIONS
DX200 OPERATOR’S MANUAL
DX200 MAINTENANCE MANUAL

DX100 INSTRUCTIONS
DX100 OPERATOR’S MANUAL
DX100 MAINTENACE MANUAL

FS100 INSTRUCTIONS
FS100 OPERATOR’S MANUAL
FS100 MAINTENANCE MANUAL

The DX200, DX100 and FS100 Operator Manuals above corresponds to specific usage. Be sure to use the appropriate manual.

Part Number: 166749-1CD
Revision: 1
MANDATORY

• This addendum is intended to supply the SIA/SDA Robot Duty Cycle Information for SIA/SDA. Be sure to read and understand this addendum thoroughly before installing and operating.

• To ensure correct and safe operation, carefully read the DX200/DX100/FS100 Instructions before reading this manual.

CAUTION

• Some drawings 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 drawings 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.
We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems (ANSI/RIA R15.06-2012). You can obtain this document from the Robotic Industries Association (RIA) at the following address:

Robotic Industries Association
900 Victors Way
P.O. Box 3724
Ann Arbor, Michigan 48106
TEL: (734) 994-6088
FAX: (734) 994-3338
www.roboticsonline.com

Ultimately, well-trained personnel are the best safeguard against accidents and damage that can result from improper operation of the equipment. The customer is responsible for providing adequately trained personnel to operate, program, and maintain the equipment. NEVER ALLOW UNTRAINED PERSONNEL TO OPERATE, PROGRAM, OR REPAIR THE EQUIPMENT!

We recommend approved YASKAWA training courses for all personnel involved with the operation, programming, or repair of the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the SIA/SDA Robot.

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

DANGER
Indicates an imminent hazardous situation which, if not avoided, could result in death or serious injury to personnel.

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 to alert against unsafe practices.

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 “DANGER”, “CAUTION” and “WARNING”.


Before operating the manipulator, check that servo power is turned OFF pressing the emergency stop buttons on the front door of the controller 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.

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.

Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
- Be sure to use a lockout device to the safeguarding when going inside. Also, display the sign that the operation is being performed inside the safeguarding and make sure no one closes the safeguarding.
- 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 controller.
- 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 controller and the programming pendant.
<FS100>

**WARNING**

- Before operating the manipulator, check that servo power is OFF when the emergency stop button on the programming pendant is pressed. When servo power is OFF, the SERVO ON LED on the programming pendant is OFF. Injury or damage to machinery may result if the emergency stop circuit cannot stop the manipulator during an emergency.

**Fig. : Emergency Stop Button**

- In the case of not using the programming pendant, be sure to supply an emergency stop button on the equipment. Then before operating the manipulator, check to be sure that the servo power is turned OFF by pressing the emergency stop button. Connect the external emergency stop button to the 5-6 pin and 16-17 pin of the robot system signal connector (CN2).
- Upon shipment of the FS100, this signal is connected by a jumper cable in the dummy connector. To use the signal, make sure to supply a new connector, and then input it. If the signal input with a jumper cable connected and does not function, this may result in personal injury or equipment damage.
- 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.

**Fig. : Release of Emergency Stop**

- Observe the following precautions when performing teaching operations within the manipulator’s operating range:
  - Be sure to use a lockout device for safeguarding when going inside. Also, display a sign that operations are being performed inside the safeguarding and make sure no one closes the safeguarding.
  - 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 their is 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 manipulator’s operating range and that you are in a safe location before:
  - Turning ON the FS100 power.
  - Moving the manipulator with the programming pendant.
  - Running the system in the check mode.
  - Performing automatic operations. Injury may result if anyone enters the manipulator’s operating range during operation. Always press the emergency stop button immediately if there is a problem.

The emergency stop button is located on the right of the programming pendant.
Definition of Terms Used Often in This Manual (DX200)

The MOTOMAN is the YASKAWA industrial robot product. The MOTOMAN usually consists of the manipulator, the controller, the programming pendant, and supply cables.

In this manual, the equipment is designated as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DX200 controller</td>
<td>DX200</td>
</tr>
<tr>
<td>DX200 programming pendant</td>
<td>Programming pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator cable</td>
</tr>
</tbody>
</table>

Definition of Terms Used Often in This Manual (DX100)

The MOTOMAN is the YASKAWA industrial robot product. The MOTOMAN usually consists of the manipulator, the controller, the programming pendant, and supply cables.

In this manual, the equipment is designated as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DX100 controller</td>
<td>DX100</td>
</tr>
<tr>
<td>DX100 programming pendant</td>
<td>Programming pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator cable</td>
</tr>
</tbody>
</table>
Definition of Terms Used Often in This Manual (FS100)

The MOTOMAN is the YASKAWA industrial robot product.

The MOTOMAN usually consists of the manipulator, the FS100 controller, manipulator cables, the FS100 programming pendant (optional), and the FS100 programming pendant dummy connector (optional).

In this manual, the equipment is designated as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS100 controller</td>
<td>FS100</td>
</tr>
<tr>
<td>FS100 programming pendant</td>
<td>Programming pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator Cable</td>
</tr>
<tr>
<td>FS100 programming pendant dummy connector</td>
<td>Programming pendant</td>
</tr>
</tbody>
</table>

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 bland names for each company or corporation. The indications of (R) and TM are omitted.

Safeguarding Tips

All operators, programmers, maintenance personnel, supervisors, and anyone working near the system must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. General safeguarding tips are as follows:

- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation of this equipment, the operator's manuals, the system equipment, and options and accessories should be permitted to operate this equipment.
- Improper connections can damage the equipment. All connections must be made within the standard voltage and current ratings of the equipment.
- The system must be placed in Emergency Stop (E-Stop) mode whenever it is not in use.
- In accordance with ANSI/RIA R15.06-2012, section 4.2.5, Sources of Energy, use lockout/tagout procedures during equipment maintenance. Refer also to Section 1910.147 (29CFR, Part 1910), Occupational Safety and Health Standards for General Industry (OSHA).
Mechanical Safety Devices

The safe operation of this equipment is ultimately the user's responsibility. The conditions under which the equipment will be operated safely should be reviewed by the user. The user must be aware of the various national codes, ANSI/RIA R15.06-2012 safety standards, and other local codes that may pertain to the installation and use of this equipment.

Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. The following safety equipment is provided as standard:

- Safety barriers
- Door interlocks
- Emergency stop palm buttons located on operator station

Check all safety equipment frequently for proper operation. Repair or replace any non-functioning safety equipment immediately.
Programming, Operation, and Maintenance Safety

All operators, programmers, maintenance personnel, supervisors, and anyone working near the system must become familiar with the operation of this equipment. Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this equipment should be permitted to program, or maintain the system. All personnel involved with the operation of the equipment must understand potential dangers of operation.

- Inspect the equipment to be sure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.
- Be sure that all safeguards are in place. Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Check the E-Stop button on the operator station for proper operation before programming. The equipment must be placed in Emergency Stop (E-Stop) mode whenever it is not in use.
- Back up all programs and jobs onto suitable media before program changes are made. To avoid loss of information, programs, or jobs, a backup must always be made before any service procedures are done and before any changes are made to options, accessories, or equipment.
- Any modifications to the controller unit can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to the controller unit. Making any changes without the written permission from YASKAWA will void the warranty.
- Some operations require a standard passwords and some require special passwords.
- The equipment allows modifications of the software for maximum performance. Care must be taken when making these modifications. All modifications made to the software will change the way the equipment operates and can cause severe personal injury or death, as well as damage parts of the system. Double check all modifications under every mode of operation to ensure that the changes have not created hazards or dangerous situations.
- This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.
- Do not perform any maintenance procedures before reading and understanding the proper procedures in the appropriate manual.
- Use proper replacement parts.
- Improper connections can damage the equipment. All connections must be made within the standard voltage and current ratings of the equipment.
Maintenance Safety

Turn the power OFF and disconnect and lockout/tagout all electrical circuits before making any modifications or connections.

Perform only the maintenance described in this manual. Maintenance other than specified in this manual should be performed only by YASKAWA-trained, qualified personnel.

Summary of Warning Information

This manual is provided to help users establish safe conditions for operating the equipment. Specific considerations and precautions are also described in the manual, but appear in the form of Dangers, Warnings, Cautions, and Notes.

It is important that users operate the equipment in accordance with this instruction manual and any additional information which may be provided by YASKAWA. Address any questions regarding the safe and proper operation of the equipment to YASKAWA Customer Support.
Customer Support Information

If you need assistance with any aspect of your SIA/SDA Robot system, please contact YASKAWA Customer Support at the following 24-hour telephone number:

(937) 847-3200

For routine technical inquiries, you can also contact YASKAWA Customer Support at the following e-mail address:

technical.support@motoman.com

When using e-mail to contact YASKAWA Customer Support, please provide a detailed description of your issue, along with complete contact information. Please allow approximately 24 to 36 hours for a response to your inquiry.

Please use e-mail for routine inquiries only. If you have an urgent or emergency need for service, replacement parts, or information, you must contact YASKAWA Customer Support at the telephone number shown above.

Please have the following information ready before you call Customer Support:

- System: SIA/SDA
- Primary Application: ________________
- Controller: DX200/DX100/FS100
- Software Version: Access this information on the Programming Pendant’s LCD display screen by selecting {MAIN MENU} - {SYSTEM INFO} - {VERSION}
- Robot Serial Number: Located on the robot data plate
- Robot Sales Order Number: Located on the DX200/DX100/FS100 controller data plate
1 Introduction

This addresses duty cycle limitations for SDA and SIA robots under DX and FS control. To apply information the average torque and motor speed must be known or be able to model/simulate accurately.

**NOTE** Throughout this manual SIA20 will represent SIA20 and SIA20 II.

2 Duty Cycle / Application Charts

Reference the charts/figures on the following pages for information relating to each robot and axis with YASKAWA actuators. This chart shows exact cross reference for each robot and the appropriate Figures to look at for the axis to be evaluated:

**Table 1: Decoding the Robots Axes and Charts**

<table>
<thead>
<tr>
<th>Robot</th>
<th>S-Axis</th>
<th>L-Axis</th>
<th>E-Axis</th>
<th>U-Axis</th>
<th>R-Axis</th>
<th>B-Axis</th>
<th>T-Axis</th>
<th>S1/Base Axis</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDA5</td>
<td>Fig. 17</td>
<td>Fig. 18</td>
<td>Fig. 19</td>
<td>Fig. 20</td>
<td>Fig. 21</td>
<td>Fig. 22</td>
<td>Fig. 23</td>
<td>Fig. 24</td>
</tr>
<tr>
<td>SDA10</td>
<td>Fig. 9</td>
<td>Fig. 10</td>
<td>Fig. 11</td>
<td>Fig. 12</td>
<td>Fig. 13</td>
<td>Fig. 14</td>
<td>Fig. 15</td>
<td>Fig. 16</td>
</tr>
<tr>
<td>SDA20</td>
<td>Fig. 2</td>
<td>Fig. 3</td>
<td>Fig. 4</td>
<td>Fig. 5</td>
<td>Fig. 6</td>
<td>Fig. 7</td>
<td>Fig. 8</td>
<td>n/a</td>
</tr>
<tr>
<td>SIA5</td>
<td>Fig. 17</td>
<td>Fig. 18</td>
<td>Fig. 19</td>
<td>Fig. 20</td>
<td>Fig. 21</td>
<td>Fig. 22</td>
<td>Fig. 23</td>
<td>n/a</td>
</tr>
<tr>
<td>SIA10</td>
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<td>Fig. 10</td>
<td>Fig. 11</td>
<td>Fig. 12</td>
<td>Fig. 13</td>
<td>Fig. 14</td>
<td>Fig. 15</td>
<td>n/a</td>
</tr>
<tr>
<td>SIA20</td>
<td>Fig. 2</td>
<td>Fig. 3</td>
<td>Fig. 4</td>
<td>Fig. 5</td>
<td>Fig. 6</td>
<td>Fig. 7</td>
<td>Fig. 8</td>
<td>n/a</td>
</tr>
</tbody>
</table>

1. This axis is out of this manuals coverage. This axis is not an actuator drive.

**Fig.1: Weight Capacity and Cycle Time Relations**
Fig. 2: Continuous Use Domain: SIA20(D,F), SDA20(D,F) S-axis

The domain which overheats if continuous use is carried out

The domain in which continuous use is possible

Fig. 3: Continuous Use Domain: SIA20(D,F), SDA20(D,F) L-axis

The domain which overheats if continuous use is carried out

The domain in which continuous use is possible
Fig. 4: Continuous Use Domain: SIA20(D,F), SDA20(D,F) E-axis

Fig. 5: Continuous Use Domain: SIA20(D,F), SDA20(D,F) U-axis
**Duty Cycle / Application Charts**

Fig. 6: Continuous Use Domain: SIA20(D,F), SDA20(D,F) R-axis

![Graph showing the continuous use domain for R-axis with torque duty percentage and motor average speed in rpm.]

The domain which overheats if continuous use is carried out.

The domain in which continuous use is possible.

Fig. 7: Continuous Use Domain: SIA20(D,F), SDA20(D,F) B-axis

![Graph showing the continuous use domain for B-axis with torque duty percentage and motor average speed in rpm.]

The domain which overheats if continuous use is carried out.

The domain in which continuous use is possible.
**SIA/SDA Robot Duty Cycle Information**

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**Fig. 8:** Continuous Use Domain: SIA20(D,F), SDA20(D,F) T-axis

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**Fig. 9:** Continuous Use Domain: SIA10(D,F), SDA10(D,F) S-axis
**Fig. 10: Continuous Use Domain: SIA10(D,F), SDA10(D,F) L-axis**

![Graph showing continuous use domain for L-axis.](image)

- The domain in which continuous use is possible.
- The domain which overheats if continuous use is carried out.

**Fig. 11: Continuous Use Domain: SIA10(D,F), SDA10(D,F) E-axis**

![Graph showing continuous use domain for E-axis.](image)

- The domain in which continuous use is possible.
- The domain which overheats if continuous use is carried out.
Fig. 12: Continuous Use Domain: SIA10(D,F), SDA10(D,F) U-axis

Fig. 13: Continuous Use Domain: SIA10(D,F), SDA10(D,F) R-axis
**Fig. 14: Continuous Use Domain: SIA10(D,F), SDA10(D,F) B-axis**

- The domain which overheats if continuous use is carried out.
- The domain in which continuous use is possible.

**Fig. 15: Continuous Use Domain: SIA10(D,F), SDA10(D,F) T-axis**

- The domain which overheats if continuous use is carried out.
- The domain in which continuous use is possible.
Fig. 16: Continuous Use Domain: SDA10(D,F) S1-axis

The domain which overheats if continuous use is carried out.

The domain in which continuous use is possible.

Fig. 17: Continuous Use Domain: SIA5(D,F), SDA5(D,F) S-axis

The domain which overheats if continuous use is carried out.

The domain in which continuous use is possible.
**Fig. 18:** Continuous Use Domain: SIA5(D,F), SDA5(D,F) L-axis

The domain which overheats if continuous use is carried out

The domain in which continuous use is possible

**Fig. 19:** Continuous Use Domain: SIA5(D,F), SDA5(D,F) E-axis

The domain which overheats if continuous use is carried out

The domain in which continuous use is possible
Fig. 20: Continuous Use Domain: SIA5(D,F), SDA5(D,F) U-axis

The domain which overheats if continuous use is carried out

The domain in which continuous use is possible

Fig. 21: Continuous Use Domain: SIA5(D,F), SDA5(D,F) R-axis

The domain which overheats if continuous use is carried out

The domain in which continuous use is possible
**Fig. 22: Continuous use domain: SIA5(D,F), SDA5(D,F) B-axis**

![Graph showing continuous use domain for SIA5(D,F), SDA5(D,F) B-axis.]

**Fig. 23: Continuous Use Domain: SIA5(D,F), SDA5(D,F) T-axis**

![Graph showing continuous use domain for SIA5(D,F), SDA5(D,F) T-axis.]

The domain in which continuous use is possible.

The domain which overheats if continuous use is carried out.
Fig. 24: Continuous Use Domain: SDA5(D,F) S1-axis

The domain which overheats if continuous use is carried out

The domain in which continuous use is possible
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Specifications are subject to change without notice
for ongoing product modifications and improvements.