Simple Education System
INSTRUCTION MANUAL

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

- This manual explains the Simple Education System (SES). Read this manual carefully and be sure to understand its contents before operation.
- For detailed instructions on additional equipment, including the Programming Pendant, NX100 Controller, and I/O box, refer to the specific equipment manuals included with your documentation package.

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.
- Software described in this manual is supplied against licensee only, with permission to use or copy under the conditions stated in the license. No part of this manual may be copied or reproduced in any form without written consent of YASKAWA.
Notes for Safe Operation

Before using this product, read this manual and all other related documents carefully to ensure knowledge about the product and safety, including all cautions.

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 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. 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."

CAUTION Before operating the SES, read and understand the following:

• The Explanation of Warning Labels on Page vii of the NX100 Controller Manual.
• Section 2, “Safety,” of the NX100 Controller Manual, which provides information on the safe use and operation of the NX100 Controller.
## Simple Education System

### Contents

1. **Introduction** ..................................................................................................................................... 1-1
   1.1 About This Document ........................................................................................................ 1-1
   1.2 Overview .......................................................................................................................... 1-1
   1.3 Reference Documentation ................................................................................................. 1-2
   1.4 Customer Service Information ........................................................................................... 1-3

2. **SES Equipment** ............................................................................................................................... 2-1
   2.1 NX100 Controller CPU ..................................................................................................... 2-1
   2.2 Programming Pendant ...................................................................................................... 2-1
   2.3 I/O Box ............................................................................................................................ 2-3
   2.4 Computer .......................................................................................................................... 2-3
   2.5 MotoSim® EG Lite Software .............................................................................................. 2-3

3. **SES Setup** ...................................................................................................................................... 3-1
   3.1 Setting Up the SES ............................................................................................................ 3-2
       3.1.1 Changing Cell Scenes .......................................................................................... 3-5
   3.2 Programming Virtual Work-cell Scenes ............................................................................. 3-5
   3.3 Shutting Down the SES ...................................................................................................... 3-5
1 Introduction

1.1 About This Document

This manual is delivered with the Simple Education System (SES) to provide instructions on the setup and operation of the complete Motoman Simple Education System. It is intended to help users set up the SES for programming of ladder logic and jobs, self-training, or teaching others. To perform these tasks, the SES software is used in conjunction with an actual NX100 Controller, a Programming Pendant, and a computer installed with MotoSim EG Lite software.

You should read and understand this manual before moving on to the more detailed documentation that is included with your Simple Education System. Although basic in content, this instruction manual is intended for personnel who have received operator training from Motoman and who are familiar with the operation of Motoman robotic systems.

For more detailed information on any specific component or peripheral of the Simple Education System, please review the full documentation package that is included with your Simple Education System (refer to Section 1.3).

This instruction manual contains the following sections:

Section 1 – Introduction

This section provides general information about the Simple Education System, a list of reference documents, and customer service contact information.

Section 2 – SES Equipment

This section provides information about the major components of the SES.

Section 3 – SES Setup

This section provides detailed setup procedures for the Motoman SES.

1.2 Overview

The Motoman Simple Education System for the NX Controller is part of the Motoman family of standardized solutions. The SES is a PC-based robot simulator that helps customers learn to operate and program Motoman robots in a virtual environment. This eliminates robot downtime during training and helps with off-line programming of complex work cells.

The Motoman SES package, which comes with or without a computer depending on the customer’s preference, includes the following features (see Figure 1-1):

- Compact, robust, self-contained NX100 Controller CPU
- MotoSim® EG Lite software
- Standard NX100 robot Programming Pendant and cable
- Input/output (I/O) box
- 2.0 GHz laptop computer (optional), with Windows® XP platform, 2 GB SDRAM, and 512 MB video card

If you purchased the Motoman SES without the computer, Motoman recommends using a computer that has the aforementioned specifications.
Because of the SES’s small, self-contained size, the unit can be moved to wherever training is needed. See Section 2 for more information on the equipment provided with the SES.

Figure 1-1: Motoman Simple Education System

1.3 Reference Documentation

For additional information on individual components of the Simple Education System, refer to the following documentation that is included with your delivered system:

- Motoman MotoSim EG Instructions (P/N 152002-1CD)
- Motoman NX100 Controller Manual (P/N 149201-1CD)
- Motoman Maintenance Manual for NX100 (P/N 150133-1CD)
- Motoman NX100 Operator's Manual for Arc Welding (P/N 149235-1CD)
- Motoman NX100 Concurrent I/O Manual (P/N 149230-1CD)
- Motoman INFORM (programming language) User’s Manual (P/N 150078-1CD)
- Vendor manuals for system components not manufactured by Motoman
1.4 Customer Service Information

For professional training assistance on the use of the SES product, please contact the Training Coordinator at (937) 847-3307 during normal business hours (8 a.m. to 5 p.m. EST, Monday through Friday).

If you need other assistance with any aspect of your Simple Education System, please call Motoman Customer Service’s 24-hour support number: (937) 847-3200. For routine technical inquiries, you can also contact Motoman Customer Service at the following e-mail address:

techsupport@motoman.com

When using e-mail to contact Motoman Customer Service, 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, please call the Customer Service telephone number shown above.

Please have the following information ready before you call:

- System: Simple Education System
- Primary Application: Training
- Controller: NX100 CPU
- Software Version: Access this information on the Programming Pendant LCD display screen by selecting {MAIN MENU} - {SYSTEM INFO} - {VERSION}
- Serial Number: Located on the label on top of the NX100 Controller CPU
2 SES Equipment

2.1 NX100 Controller CPU

The Simple Education System includes an NX100 Controller central processing unit (CPU; see Figure 2-1). The NX100 Controller CPU represents state-of-the-art technology in robotics today. It processes input and output signals, maintains variable data, and performs numeric processing to convert to and from different coordinate systems. It also provides main logic functions, program and constant data memory, and power distribution. The NX100 Controller CPU features a real-time operating system (RTOS) and is programmed with the Motoman INFORM programming language.

For more detailed information on the NX100 Controller CPU, refer to the NX100 Controller Manual that is included with your Simple Education System (see Section 1.3).

CAUTION

Do not re-initialize the NX100 Controller CPU after setup or the SES will not function. Re-initialization should be performed only by Motoman personnel.

Figure 2-1: NX100 Controller CPU

2.2 Programming Pendant

The Programming Pendant (see Figure 2-2) provides the primary means of programmer/operator interaction with the Simple Education System. The pendant features the Windows® CE operating system and displays...
information on a 6½-inch, color LCD, touch-screen display (640 X 480 VGA). The pendant also incorporates a Compact Flash card slot for program backups. The pendant provides icon-driven system programming. By using the pendant, the operator can teach the virtual robot motion and perform programming, editing, and diagnostic functions.

For detailed information on the pendant’s programming keys, programming functions, and display functions, please refer to the *NX100 Operator’s Manual for Arc Welding* that is included with your Simple Education System (see Section 1.3).

*Figure 2-2: NX100 Programming Pendant*

The Programming Pendant’s LCD display goes dark after a few minutes of inactivity. Press any key to restore the screen.
2.3 I/O Box

The input/output (I/O) box (see Figure 2-3) allows the user to interact with the SES in order to configure the inputs and outputs of its virtual I/O devices, such as proximity switches, conveyor relays, motors, safety devices, and programmable logic controllers (PLC). The SES is configured for the use of up to 8 inputs and 8 outputs [IG#(1) and OG#(1)] on the I/O box. For more information on the I/O box, refer to the NX100 Concurrent I/O Manual that is part of your SES documentation package (see Section 1.3).

Figure 2-3: I/O Box

2.4 Computer

An optional 2.0 GHz laptop computer with a Windows® XP platform, 2 GB of SDRAM, and 512 MB video card is available with the SES. If you purchased the Motoman SES without the computer, Motoman recommends using a computer that has these specifications.

The computer is installed with the MotoSim® EG Lite software, which was developed as an offline teaching tool for Motoman robots. See Section 2.5 for more information on this software. For more information about the computer, refer to the vendor manual that is included as part of your SES documentation package (see Section 1.3).

2.5 MotoSim® EG Lite Software

The MotoSim® EG Lite software provides the following:

- Collision detection through the use of sensors on the virtual robot,
- Cycle time calculations, which help to ascertain how long it takes to complete a virtual robotic job, and
- Reach analysis, which enables users to determine how to lay out the virtual work cell, where to position the robot relative to the part being built, and whether or not the correct size of the robot has been specified for the job.

Refer to the MotoSim EG Instructions manual for detailed information about this software (see Section 1.3).
This section provides detailed procedures for setting up, operating, and shutting down the SES. These procedures should be performed only by personnel familiar with computer setup. Read this section thoroughly before beginning setup.

**CAUTION**

The SES weighs approximately 36.3 kg. Handle the system with care. Do not drop it. Use proper lifting techniques to prevent injury to personnel.

When unpacking the SES, remove the protective plastic covering and other packaging material and put aside. Then carefully inspect the components of the SES for shipping damage.

- Do not discard or recycle any parts or material until setup of the SES is complete.
- Notify your shipping contractor if you notice any shipping damage.

**CAUTION**

The customer is responsible for providing trained operators to run the equipment. The customer is also responsible for making sure that the equipment is operated in accordance with the ANSI/RIA R15.06-1999 Robot Safety standard, as well as any other local or state standards.
3.1 Setting Up the SES

Perform the following steps to set up the Motoman SES and ensure its proper functioning:

1. Connect the Programming Pendant cable to the NX100 Controller CPU by connecting the cable to the connector on the left side of the CPU's enclosure (see Figure 3-4).

   ![Fig. 3-4: Programming Pendant Cable to NX100 Controller CPU](image)

2. Connect the other end of the Programming Pendant cable to the pendant (see Figure 3-5).

   ![Fig. 3-5: Connection of Programming Pendant Cable to Pendant](image)

3. Locate the gray Ethernet cable that is attached to the NX100 Controller CPU and connect its other end to the computer (see Figure 3-6 and Figure 3-7).

   ![Fig. 3-6 and 3-7](image)
3. SES Setup

3.1 Setting Up the SES

4. Plug the SES power cord into a grounded wall outlet.

CAUTION

Do not use an adaptor that converts a three-prong plug into a two-prong.

5. Unlatch the door of the CPU’s enclosure and locate the power ON/OFF switch on its upper left-hand side (see Figure 3-8).
3. SES Setup

3.1 Setting Up the SES

6. Turn the CPU ON, then close and latch the door of the enclosure.

7. Turn ON the computer to start up Windows®.

8. Connect the MotoSim EG Lite hardware key to the USB port on the computer (see Figure 3-9).

9. On the Programming Pendant, use the Mode Select Switch to select the TEACH mode (see Figure 2-2).

10. Verify that the EMERGENCY STOP (E-STOP) button on the pendant is released by turning it clockwise (see Figure 2-2).

11. On the computer, select [Start] > [All Programs] > [Motoman] > [MotoSim EG].

12. When the MotoSimEG dialog box appears, select [OK].

NOTE: Your MotoSim EG Lite hardware key may differ from the one shown in the picture.
3. Select [File] > [Open].

14. Select a virtual work-cell scene file that you have already programmed, or begin creating a work-cell scene file. (Refer to Section 3.2 for information on programming virtual work-cell scenes.)

15. Select [Open] or double-click on the file to open it.

16. From the menu, select [RemoteMonitor] then [Connect].

17. Press the SERVO ON READY button on the Programming Pendant (see Figure 2-2).

18. Press COORD on the Programming Pendant until the desired coordinate system is displayed in the Status Display Area (see Figure 2-2). For detailed information on coordinate systems, refer to the *NX100 Operator’s Manual for Arc Welding* that is included with your Simple Education System (see Section 1.3).

19. Press the MANUAL SPEED Fast key on the Programming Pendant to set the SES to high manual speed (see Figure 2-2).

20. Press the coordinate Axis Keys on the Programming Pendant to verify that the robot moves and thus simulates operation from the pendant (see Figure 2-2).

3.1.1 Changing Cell Scenes

To go to another cell scene, proceed as follows:

1. Select [Disconnect] from the Remote Monitoring dialog box.
2. Select [File] > (Close) to close only the scene, not MotoSim EG.
3. Continue from Step 13 in Section 3.1 above.

3.2 Programming Virtual Work-cell Scenes

For detailed instructions on how to program the SES with work-cell scenes pertinent to your job applications, refer to the *MotoSim EG Instructions* manual that is included as part of your SES documentation package (see Section 1.3).

3.3 Shutting Down the SES

Perform the following steps to shut down the SES:

1. On the Remote Monitoring dialog box, select [Disconnect].
2. Select [File] > [Close].
3. Close the MotoSimEG window and, if desired, shut down the computer.
4. Unlatch the door of the CPU’s enclosure and press OFF on the ON/OFF switch to shut down the SES.
5. Close and latch the door of the enclosure.