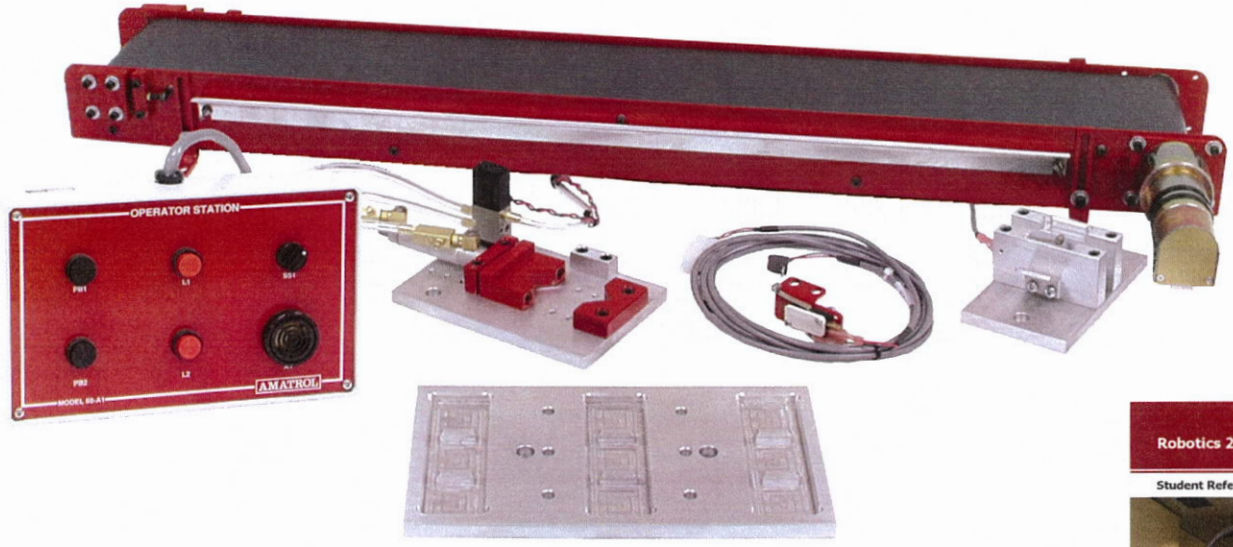
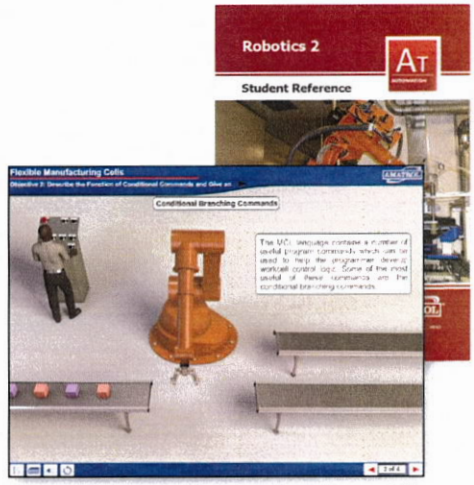
Robotics 2 Learning System

96-ROB2A

AT AUTOMATION



96-ROB2A



Interactive Multimedia and Student Reference Guide

Learning Topics:

- Application Development
- CNC Machine Loading
- Robot Workcell Envelope
- Flexible Manufacturing Cells
- Servo Conveyor Operation
- Quality Control
- Robot Operation Interface
- Production Control
- Operator Input Interface
- Relational and Arithmetic Operators

Amatrol's Robotics 2 Learning System (96-ROB2A) covers a variety of topics and skills related to the Pegasus robot, including application development, flexible manufacturing cells, quality control, and production control. More specifically, learners will begin the course by learning how to connect a conveyor to the Pegasus robot, how to control the conveyor, and how to develop a robot program. Learners will then develop programs to make a robot load and unload multiple automated machines, learn commands that can be used in quality control applications, and use variables with mathematic functions, input instructions, and relational operators.

Robotics 2 includes a variety of heavy-duty components that add onto the Robotics 1 Learning System (96-ROB1A), vastly expanding the scope of industrial applications and skills offered to learners. These Robotics Learning Systems are part of Amatrol's Project Based Learning program, which introduces high school students to knowledge and skills directly applicable to careers in engineering, manufacturing, and industrial maintenance. With the ever increasing use of automation and robots in advanced manufacturing, these Robotics Learning Systems are absolutely vital to training future members of the workforce.

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Technical Data

Complete technical specifications available upon request.

Operator Station (88-A1-A)
Inspection Station (88-A2)
Assembly Station (88-A3)
Palletizing Module (88-A4)
Feeder (88-F1)
Sensor (88-A9)
Linear Servo Conveyor (88-LC1-A)
Multimedia Curriculum (MB762)
Instructor's Guide (CB762)
Student Reference Guide (HB762)
Additional Requirements:
Robotics 1 Learning System (96-ROB1)
Computer: See requirements: http://www.amatrol.com/support/computer-requirements
Utilities:
Electricity (120 VAC/60 Hz/1 phase)
Air Supply: 5 CFM @ 100 PSIG

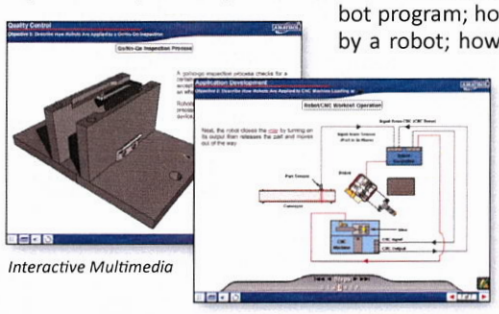
Design a Robot Program that uses a Servo Conveyor

The Robotics 2 Learning System includes an operator station, inspection station, assembly station, palletizing module, feeder with sensor, and a linear servo conveyor. When integrated with the 96-ROB1A, these heavy-duty components allow learners to practice skills like programming teach points on a double-jointed robot arm using the full range of its work envelope; designing a robot program that uses a servo conveyor; entering a robot program that uses a variable name; and designing a robot program that stops a production process if a quality standard is not met.

96-ROB2A with the 96-ROB1A

Learn How to Vary the Speed of a Conveyor Controlled by a Robot

In addition to components, this system includes stunning interactive multimedia curriculum that covers topics in application development, manufacturing cells, and production and quality control. Specifically, learners study learning objectives like: the steps used to develop a robot program; how to vary the speed of a conveyor controlled by a robot; how robots are used to measure parts; and the function and operation of loop commands. This curriculum offers the depth and detail of knowledge for which Amatrol's curriculum is well known, but adds 3D graphics, videos, interactive quizzes and exercises, and voiceovers of the text. Amatrol's multimedia curriculum is designed for both self-paced and classroom learning and can be used anywhere with a computer.



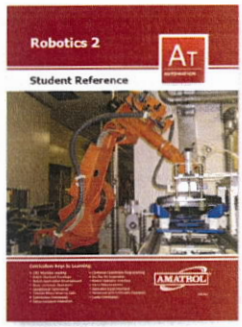
Interactive Multimedia

Amatrol's Project Based Learning: Building Problem-Solving, Teamwork, and STEM Skills

Robotics 2 is only one learning system within Amatrol's expansive Project Based Learning program. Project Based Learning offers real-world industrial concepts and industry-applicable hands-on skills for high school students. Designed to teach valuable problem-solving, teamwork, and STEM skills and provide a strong base to build toward advanced manufacturing careers, Project Based Learning features systems in areas like electrical, electronics, fluid power, thermal, and more in addition to automation.

Student Reference Guide

A sample copy of the Robotics 2 Student Reference Guide is also included with the system for your evaluation. Sourced from the system's curriculum, the Student Reference Guide takes the entire series' technical content contained in the learning objectives and combines them into one perfectly-bound book. Student Reference Guides supplement this course by providing a condensed, inexpensive reference tool that learners will find invaluable once they finish their training making it the perfect course takeaway.



AMATROL®

2400 Centennial Blvd. Jeffersonville, IN 47130 USA 800.264.8285 812.288.8285 www.amatrol.com

ROBOTICS 2 LEARNING SYSTEM
This system shall include a robotic conveyor, operator system, inspection station, assembly station, palletizing station, and feeder sensor.

Robotic Conveyor
This component is used in advanced applications further reinforcing the robotics material. It shall include mounting hardware, conveyor motor, drive pulley, sensor rail, etc.

Operator Station
To consist of the below components:

- Hand-held console with silk-screened panel
- Pushbuttons (2)
- Selector switch
- Alarm sensor
- Indicator lights (2)
- Robot interface cable with plug-in terminal strip

Inspection Station
To consist of the below components

- Mounting panel
- Rectangular parts fixture
- Electro-mechanical sensor with interface cable to robot
- Flexible mounting wings for electronic sensors (2)

Palletizing Module
To consist of 9-station aluminum pallet, sized to mount 1.25-inch blocks

Assembly Station
This system shall perform work holding on 1.25 inch min. square parts and .75 inch min. round parts. To consist of the below components

- Aluminum mounting pad 0.375-in X 4-in X 6-in drilled and tapped with a grid pattern of mounting holes
- Assembly V-clamp fixture
- Pneumatic cylinder
- 24 VDC solenoid-operated pneumatic valve
- Robot interface cable with terminal strip
- Mounting for sensors, fittings and hose

Feeder Sensor
DPST limit switch bracket and cable to attach to the robot feeder to sense when the parts feeder is empty

Robotic Conveyor Module
Shall include bi-directional linear conveyor of 32 inches in length and 4 inches wide. The drive system shall be a D.C. servomotor with optical encoder with resolution of 512 counts per complete revolution. The speed of the conveyor shall be 0-3.14 ins/sec (0-80 mm/sec) with a linear resolution of ±0.005 inches. The conveyor shall be capable of being operated in either the velocity or position mode.

Multimedia Curriculum Robotics 2
This system shall include four (4) modules of multimedia curriculum with at least thirty-two (32) industry-relevant skills within interactive computer-based instruction consisting of text, digital video, voice, online self-review tests, interactive simulations, color diagrams and color photos. Topics shall include: robot program commands and applications, servo point array programming, quality control, conveyors, production operations, and operator interface. Each multimedia based topic shall follow a series of objectives and skills. Students shall be able to navigate to a specific page by using a pull down table of contents and by selecting specific sections via a button-based table of contents. The software shall

include a glossary with definitions of technical words and terms that shall be accessible from a tool bar and from hot text imbedded in the computer-based instruction. The software shall be able to access certain related software directly from buttons within the instruction so students can open other software without leaving the computer-based instruction. The curriculum shall be designed in a skill-based format that focuses on teaching industry relevant tasks. This curriculum shall be designed for use in a self-directed student learning environment. Each Learning No external text sources shall be required. The specific cognitive skills taught by each text passage shall be identified next to the passage. Each lab activity shall be identified by the industrial task taught. A self-review of five to ten questions shall be provided after each segment.

Teacher's Assessment/ Portfolio Guide
A teacher's assessment guide shall be provided. It shall contain student data sheets, data sheet solutions, self-review answers, quizzes, quiz answers, student skill record sheets, and authentic assessment. The teacher's assessment guide shall include directions for authentic skill assessment.

Amatrol Model No. 96-ROB2A or equal

96-ROB2A
ROBOTICS 2 LEARNING SYSTEM

LAP 1 APPLICATION DEVELOPMENT

SEGMENT 1	**CNC MACHINE LOADING**
OBJECTIVE 1	Describe three classifications of robot applications
SKILL 1	Connect a solenoid-operated pneumatic valve to the output of the robot controller
SKILL 2	Connect a robot operator station to the robot controller
OBJECTIVE 2	Describe how robots are applied to CNC machine loading and give an advantage
SKILL 3	Design a robot program that will load and unload an automatic machine
SEGMENT 2	**ROBOT WORKCELL ENVELOPE**
OBJECTIVE 3	Define the work envelope of a robot
OBJECTIVE 4	Describe the work envelope of a double-jointed robot and give an advantage
SKILL 4	Teach points with a double-jointed robot arm using the full range of its work envelope
SKILL 5	Design a robot program that uses a robot's double-jointed design
OBJECTIVE 5	Describe the four types of robot geometry and give an advantage of each
SEGMENT 3	**ROBOT APPLICATION DEVELOPMENT**
OBJECTIVE 6	Describe six steps used to develop a robot program for a given application
SKILL 6	Design a robot program given a general description of the application
SEGMENT 4	**BASIC CONVEYOR OPERATION**
OBJECTIVE 7	Define material transfer and describe five methods
OBJECTIVE 8	Describe three conveyor applications
SKILL 7	Connect and configure a servo conveyor to a servo robot
OBJECTIVE 9	Describe two types of conveyors and give an application of each
OBJECTIVE 10	Describe the operation of the external motor commands Mon and Moff
SKILL 8	Enter a robot program that has Mon and Moff commands
SKILL 9	Design a robot program that uses a conveyor

LAP 2 FLEXIBLE MANUFACTURING CELLS

SEGMENT 1	**CONDITIONAL COMMANDS**
OBJECTIVE 1	Describe the function of a flow chart and how to construct one
SKILL 1	Construct a flow chart given a general sequence of operations
OBJECTIVE 2	Describe the function of conditional commands and give an advantage
OBJECTIVE 3	Describe the operation of the conditional commands: If-Then, Else, Endif, and Inp
SKILL 2	Enter a robot program that has conditional commands: If-Then, Else, Endif, and Inp
SKILL 3	Design a robot program that sorts parts
SEGMENT 2	**FLEXIBLE MANUFACTURING CELLS**
OBJECTIVE 4	Describe how robots are applied to multiple machine loading cells and give an advantage
SKILL 4	Design a robot program that will unload two or more automatic machines

SEGMENT 3	**SUBROUTINE COMMANDS**
OBJECTIVE 5	Describe the function of a subroutine and give an advantage
OBJECTIVE 6	Describe the operation of the subroutine commands: Call, Return, and Sub
SKILL 5	Enter a robot program that has subroutine commands: Call, Return, and Sub
SKILL 6	Design a robot application using a subroutine
SEGMENT 4	**SERVO CONVEYOR OPERATION**
OBJECTIVE 7	Describe two methods of controlling conveyors and give an advantage of each
OBJECTIVE 8	Describe the operation of the robot command Ddmove
OBJECTIVE 9	Describe how to vary the speed of a conveyor controlled by a robot
SKILL 7	Enter a robot program that has a Ddmove command
SKILL 8	Design a robot program that uses a servo conveyor

LAP 3 QUALITY CONTROL

SEGMENT 1	**CARTESIAN COORDINATE PROGRAMMING**
OBJECTIVE 1	Explain how the Cartesian coordinate system is used with robots
SKILL 1	View the current location of a robot in Cartesian coordinates
OBJECTIVE 2	Describe how a move command is specified using Cartesian coordinates
SKILL 2	Use the Pmove function with Cartesian coordinates to move a robot to a position
SKILL 3	Enter a robot program that uses points stored in Cartesian coordinates
SEGMENT 2	**GO/NO-GO INSPECTION**
OBJECTIVE 3	Describe how robots are applied to a go/no-go inspection
OBJECTIVE 4	Describe the operation of the command: Testi
SKILL 4	Enter a robot program that has the Testi Command
SKILL 5	Design a robot program to perform a go/no-go inspection
SEGMENT 3	**ROBOT OPERATOR INTERFACE**
OBJECTIVE 5	Explain how robots and operators communicate with each other and give an application
OBJECTIVE 6	Describe the function of two types of variables
OBJECTIVE 7	Explain five rules for naming variables
OBJECTIVE 8	Describe two ways variable names can be used with move commands
SKILL 6	Enter a robot program that uses a variable name
OBJECTIVE 9	Describe the operation of the operator interface commands: Print and Println
SKILL 7	Enter a robot program that uses the Print and Println commands
SKILL 8	Design a program that provides an operator interface on a computer screen
SEGMENT 4	**PARTS MEASUREMENT**
OBJECTIVE 10	Explain how robots are used to measure parts
OBJECTIVE 11	Describe the operation of the measuring command: Measure
SKILL 9	Enter a robot program that has a Measure command
SKILL 10	Design a robot program to inspect parts by measuring them in the robot's gripper

LAP 4 PRODUCTION CONTROL

SEGMENT 1	**OPERATOR INPUT INTERFACE**

OBJECTIVE 1	Describe the operation of the input command
SKILL 1	Enter a robot program that uses an input command
SEGMENT 2	**RELATIONAL AND ARITHMETIC OPERATORS**
OBJECTIVE 2	List and describe the function and operation of four basic arithmetic operators
OBJECTIVE 3	List and describe the function and operation of six relational operators
SKILL 2	Enter a robot program that uses arithmetic and relational operators
SKILL 3	Design a robot program that stops a production process if a quality standard is not met
SEGMENT 3	**LOOP COMMANDS**
OBJECTIVE 4	Describe the function of a loop command
OBJECTIVE 5	Describe the operation of the loop commands: For, Next, and Step
SKILL 4	Enter a robot program that has loop commands
SKILL 5	Design a robot application using For-Next commands