Mechatronics
Modern industry relies on highly complex production systems to produce high-quality, economical products for an ever demanding world. Mechatronics teaches systems thinking that is required to effectively operate, program, and problem solve in this complex environment. With the rapid proliferation of automation technology, mechatronics has become one of the fastest growing technical education programs in the world. Many technologies are integrated to make these sophisticated production systems:

- Mechanical
- Electrical
- Electronics
- Software

Amatrol’s 870 Mechatronics Learning System teaches students a broad array of job-ready skills in integrating technologies utilizing 7 learning stations. Students work together in a team environment to make the whole process work. Seven stations make up a complete flexible manufacturing system. Each station is a small mechatronics system in itself with multiple, integrated technologies that can be used stand-alone or in various combinations, creating unlimited project capability. The 870 Learning System is compact, enabling it to fit into almost any teaching facility. Whether using one station or many, Amatrol’s Mechatronics Learning System is the ultimate team project!

Amatrol’s Mechatronics Program will quickly bring your Mechatronics program online with the teaching tools you need to get the job done: extensive curriculum in both print-based and CD-ROM formats, high quality industrial hands-on training equipment, teacher guides, computerized classroom assessment system, installation, on-going service and support, and teacher training. Amatrol’s Mechatronics Program is also unique because it offers:

Industrial Components and Safety
Amatrol’s Mechatronics Learning System uses off-the-shelf industry standard components typical of what learners will see in industry. Recreating the industrial environment in the classroom helps make students job-ready by building skills using the equipment they will find in the workplace. Industrial methods and components combine so that students learn to do tasks they will perform on the job.

Safety in an industrial setting is critical. The 870 Mechatronics System teaches students standard industrial practices and methods that support a safe workplace. Emergency stop circuits meet industrial standards as does the real world operator panel. Students learn the importance of lockout / tagout and procedures for correct machine start-up, shut-down, and emergency stop operation.

Wide Array of Advanced Technology
Amatrol’s Mechatronics System covers a broad array of applications across a balance of mechanical, electrical, electronics, fluid power and software to enable students to work effectively in virtually any industrial setting. The 870 Mechatronics system includes eight types of electronic sensors, three types of electrical motors, four types of pneumatic actuators and 20 different mechanical power transmission components.

Real Product Production
The 870 Mechatronics Learning System teaches students how to manufacture industrial quality working directional control valves. They develop skills needed to enable processes to work
together such as making precision physical adjustments. Modern industry leverages technology so that one set of equipment can make many products. Amatrol's Mechatronics System brings industrial realism to the classroom by allowing students to program it to assemble a minimum of four different variations of the valve.

**Individualized and Group Learning Formats**
Amatrol’s learning activity packet (LAP) design gives instructors the flexibility to teach students using either a self-directed or traditional lecture-lab format. The LAP design allows labs to be implemented with a minimum of preparation.

**Multimedia and Printed Curriculum Formats**
Amatrol curriculum is well known for its breadth and depth of industry-relevant skills. Amatrol's unique curriculum approach uses a task-based design where theory and hands-on activities are structured around industry-relevant tasks that enable students to develop job-ready skills. The curriculum easily supports either traditional lecture-lab format or individualized learning so students can learn at their own pace.

The 870 Mechatronics Learning System boasts a robust ten Learning Activity Packets (LAPs). The first two LAPs concentrate on skills core to all stations: an introduction to mechatronics, systems concepts, safety, machine operation, sensors, pneumatic pick & place, and electrical pick & place. Integration skills across multiple stations as well as skills specific to an individual station are covered in the balance. Overall system skills include discrete I/O handshaking, system start-up / halt, system stop / reset, and FMS programming.

All stations teach operation, sequencing and programming skills. Stations can be easily moved apart to function as individual workstations by releasing two quick connects and one plug-in cable. Stations can also be mixed and matched, enabling instructors to build and change the system as budgets allow or needs change. Many station combination’s are available to support your needs.

**Automated Lab Results**
Amatrol’s SkillACE software makes documentation of lab results an easy task for teachers with a computerized data collection system and powerful reporting tools.

**Amatrol’s Mechatronics Program Contents**
- **Learning Systems** - These systems include hands-on stations with industrial quality software and equipment to provide learning in mechatronics topics.
- **Printed Curriculum** – Each learning system includes a printed curriculum in an individualized, layered, task-based format.
- **Interactive Multimedia Curriculum** – Various learning systems are available with an optional interactive multimedia version of the printed curriculum to enhance student learning and motivation.
- **Electronic Assessment System** – The optional Amatrol SkillACE software automatically collects student assessment results and organizes them in useful reporting formats.
- **Teacher Training Services** – Amatrol provides tuition-free teacher training for initial and on-going professional development of teachers involved in the Mechatronics Program.
- **Service and Support Services** – Amatrol offers superior service and support, including free hot-line support and knowledgeable local service technicians.
Learning System Topics
- Mechanical Drives
- Fluid Power
- Servo Control
- Electrical Motor Control
- Electronic Drives
- Programmable Controllers
- Process Control
- Robotics
- Computer Integrated Manufacturing (CIM)

Individual Station Detail:
- Station 1 – Pick and Place Feeding
- Station 2 – Gauging
- Station 3 – Orientation Processing
- Station 4 – Sorting / Buffering
- Station 5 – Servo Robotic Assembly
- Station 6 – Torque Assembly
- Station 7 – Inventory Storage
Station 1
Mechatronics Pick and Place Feeding Station – 87-MS1

Amatrol’s 87-MS1, Pick and Place Feeding, is station 1 of the 870 Mechatronics Learning System. The 87-MS1 station is a small mechatronics system in itself with multiple, integrated technologies that can be used stand-alone or in combination with other stations. Industrial safety and operation are emphasized on all Amatrol mechatronic stations.

The Pick and Place Feeding station teaches interfacing, problem solving, programming, sequencing and operation for pneumatic robots, material feeding systems, powered parts feeders, vacuum grippers, hall-effect sensors, and magnetic sensors. This station starts the process of assembling a working industrial directional control valve.

The 87-MS1 is a mobile workstation with slotted work surface that contains an operator station, powered feed module, pneumatic pick and place manipulator, finished parts storage module, parts set, a pneumatic distribution module as well as an electrical distribution module, an electro-pneumatic valve manifold, and a digital I/O interface module.

### Key Features
- Hall-effect sensor
- Vacuum gripper
- Powered parts feeder
- Pneumatic robot
- Material feeding system
- Magnetic sensor
- Photoelectric sensor

### Learning Topics
- Powered Parts Feeder Operation
- Shock Absorber Adjustment
- Vacuum Switch Adjustment
- Vacuum Gripper Adjustment
- Material Feeding Systems
- Station Operation
- Electrical Sensors
- Electrical Pick and Place
- Pneumatic Pick and Place
- Mechatronics Safety
- Control Systems Concepts
- Mechatronics Introduction
- Pneumatic Manipulator Operation
- Powered Parts Feeder Sequencing
- Pneumatic Manipulator Sequencing
- PLC Program Design for Station Sequencing
Station 2
Mechatronics Gauging Station – 87-MS2

Amatrol’s 87-MS2, Gauging, is station 2 of the 870 Mechatronics Learning System. The 87-MS2 station is a small mechatronics system in itself with multiple, integrated technologies that can be used stand-alone or in combination with other stations. Industrial safety and operation are emphasized on all Amatrol mechatronic stations.

The Gauging station teaches interfacing, problem solving, programming, sequencing and operation for go/no-go gauging, analog sensor adjustment, non-servo electric traverse axis, synchronous belt drive, ball screw drives and part rejection/transfer. The 87-MS2 performs a number of quality inspections in the process of assembling a working industrial directional control valve.

The 87-MS2 is a mobile workstation with slotted work surface that contains an operator station, ultrasonic measurement module, proximity gauging module, part transfer module, part reject module, finished parts storage module, parts set, a pneumatic distribution module as well as an electrical distribution module, an electro-pneumatic valve manifold, and a digital I/O interface module.

### Key Features
- Non-servo Electric Traverse Axis
- Magnetic Reed Switches
- Limit Switches
- Photoelectric Sensor
- Inductive Sensor
- Ultrasonic Sensor
- Analog Sensor Adjustment
- Go/No-Go Gauging
- Synchronous Belt Drive
- Ball Screw Drives
- Part Rejection/Transfer

### Learning Topics
- Ball Screw Drive Adjustment
- Synchronous Belt Adjustment
- Non-Servo Electric Traverse Axis Travel Adjustment
- Station Operation
- Electrical Sensors
- Electrical Pick and Place
- Pneumatic Pick and Place
- Mechatronics Safety
- Control Systems Concepts
- Mechatronics Introduction
- Non-Servo Electric Traverse Axis Sequencing
- Part Reject Module Sequencing
- Go/No-Go Station Sequencing
- PLC Program Design for Station Sequencing
Station 3
Mechatronics Orientation-Processing Station – 87-MS3

Amatrol’s 87-MS3, Orientation-Processing, is station 3 of the 870 Mechatronics Learning System. The 87-MS3 station is a small mechatronics system in itself with multiple, integrated technologies that can be used stand-alone or in combination with other stations. Industrial safety and operation are emphasized on all Amatrol mechatronic stations.

The Orientation-Processing station teaches interfacing, problem solving, programming, sequencing and operation for index tables, stepper motors, homing sensors, fiber optic sensors, part transfer, parts orientation, and capacitor sensors. This station performs the role of parts orientation and an optional simulated machine operation in the process of assembling a working industrial directional control valve.

The 87-MS3 is a mobile workstation with slotted work surface that contains an operator station, 8-station rotary index table, pick and place pneumatic robot, fiber optic gauging module, part transfer module, finished parts storage module, parts set, a pneumatic distribution module as well as an electrical distribution module, an electro-pneumatic valve manifold, and a digital I/O interface module.

### Key Features
- Stepper Motors
- Homing Sensors
- GMR (Giant Magnetoresistive) Sensors
- Inductive Sensors
- Capacitive Sensors
- Parts Orientation
- Part Transfer
- Index Tables

### Learning Topics
- Part Transfer Module Sequencing
- Homing Sensor Adjustment
- Stepper Motor Controller Programming
- Capacitive Sensor Adjustment
- Fiber Optic Sensor Adjustment
- Station Operation
- Electrical Sensors
- Electrical Pick and Place
- Pneumatic Pick and Place
- Mechatronics Safety
- Control Systems Concepts
- Mechatronics Introduction
- Stepper Motor Index Table Sequencing
- Parts Orientation Sequencing
- Station Sequencing
Station 4
Mechatronics Sorting-Buffering Station – 87-MS4

Amatrol’s 87-MS4, Sorting-Buffering, is station 4 of the 870 Mechatronics Learning System. The 87-MS4 station is a small mechatronics system in itself with multiple, integrated technologies that can be used stand-alone or in combination with other stations. Industrial safety and operation are emphasized on all Amatrol mechatronic stations.

The Sorting-Buffering station teaches interfacing, problem solving, programming, sequencing and operation for sorting, queuing, flat belt conveyors, photoelectric sensors, and inductive sensors. This station performs the role of sorting parts by material type in the process of assembling a working industrial control valve.

The 87-MS4 is a mobile workstation with slotted work surface that contains an operator station, belt conveyor module, part sorting module, buffer module, proximity sensing module, parts set, a pneumatic distribution module as well as an electrical distribution module, an electro-pneumatic valve manifold, and a digital I/O interface module.

- **Key Features**
  - Photoelectric Sensors
  - Flat Belt Conveyors
  - Queuing
  - Sorting
  - Inductive Sensors

- **Learning Topics**
  - Photoelectric Sensor Adjustment
  - Flat Belt Conveyor Adjustment
  - Station Operation
  - Electrical Sensors
  - Electrical Pick and Place
  - Pneumatic Pick and Place
  - Manual Operation
  - Machine Operator Functions
  - Mechatronics Safety
  - Control Systems Concepts
  - Mechatronics Introduction
  - Sorting Module Sequencing
  - Parts Queuing Module Sequencing
  - PLC Program Design for Station Sequencing
Station 5
Mechatronics Servo Robotic Assembly Station – Pegasus II – 87-MS5-P2

Amatrol's 87-MS5-P2, Servo Robotic Assembly – Pegasus II, is station 5 of the 870 Mechatronics Learning System. The 87-MS5-P2 station is a small mechatronics system in itself with multiple, integrated technologies that can be used stand-alone or in combination with other stations. Industrial safety and operation are emphasized on all Amatrol mechatronic stations.

The Servo Robotic Assembly station teaches interfacing, problem solving, programming, sequencing and operation for servo robotics, gravity feeders, pick and place assembly, pneumatic screw feeders, and part insertion. This station performs the role of assembling a working industrial directional control valve using a combination of servo robotic and pick and place technologies.

The 87-MS5-P2 has two mobile workstations with slotted work surfaces that contain an operator station, Pegasus II servo robot with teach pendant, spool insertion module, screw feed module, spring/knob feed module, screw/knob engagement module, assembly shuttle module, parts presentation module, finished parts storage module, parts set, a pneumatic distribution module as well as an electrical distribution module, an electro-pneumatic valve manifold, and a digital I/O interface module.

- **Key Features**
  - Pneumatic Screw Feeders
  - Pick and Place Assembly
  - Gravity Feeders
  - Servo Robotics
  - Part Insertion

- **Learning Topics**
  - Electrical Sensors
  - Mechatronics Introduction
  - Station Sequencing
  - Screw Thread Engagement Module Sequencing
  - Screw Feed Module Sequencing
  - Part Insertion Module Sequencing
  - Automatic Screw Feeder Adjustment
  - Parts Feeder with Escapement Adjustment
  - Station Operation
  - Electrical Pick and Place
  - Pneumatic Pick and Place
  - Mechatronics Safety
  - Control Systems Concepts
Station 6

Mechatronics Torque Assembly Station – 87-MS6

Amatrol’s 87-MS6, Torque Assembly, is station 6 of the 870 Mechatronics Learning System. The 87-MS6 station is a small mechatronics system in itself with multiple, integrated technologies that can be used stand-alone or in combination with other stations. Industrial safety and operation are emphasized on all Amatrol mechatronic stations.

The Torque Assembly station teaches interfacing, problem solving, programming, sequencing and operation for an automated torque system, electric traverse slide, DC motor torque, variable speed motors and clutches. This station assures that the assembly components are properly tightened in the process of assembling a working industrial directional control valve.

The 87-MS6 is a mobile workstation with slotted work surface that contains an operator station, screw torque module, part clamp module, electric traverse module, a pneumatic distribution module as well as an electrical distribution module, an electro-pneumatic valve manifold, and a digital I/O interface module.

- Key Features
  - Variable Speed Motors
  - Clutches
  - Electric Traverse Slide
  - Inductive Sensor
  - Magnetic Reed Switches
  - Variable Speed PWM (Pulse Width Modulator)
  - Pneumatic Gripper
  - DC Motor Torque
  - Automated Torque System

Learning Topics
- Motor Starter Overload Adjustment
- Motor Torque Adjustment
- Non-Servo Electric Slide Adjustment
- DC Motor Speed Adjustment
- Station Operation
- Electrical Sensors
- Electrical Pick and Place
- Pneumatic Pick and Place
- Mechatronics Safety
- Control Systems Concepts
- Mechatronics Introduction
- Non-Servo Electric Slide Sequencing
- Torque Clamp Module Sequencing
- Station Sequencing
Station 7
Mechatronics Inventory Storage Station – 87-MS7

Amatrol's 87-MS7, Inventory Storage, is station 7 of the 870 Mechatronics Learning System. The 87-MS7 station is a small mechatronics system in itself with multiple, integrated technologies that can be used stand-alone or in combination with other stations. Industrial safety and operation are emphasized on all Amatrol mechatronic stations.

The Inventory Storage station teaches interfacing, problem solving, programming, sequencing and operation for pick and place storage, pneumatic grippers and brakes, infrared sensors, and a programmable pneumatic traverse module. This station sorts the completed assemblies of working industrial directional control valves.

The 87-MS7 is a mobile workstation with slotted work surface that contains an operator station, a programmable position pneumatic robot, 4-channel parts storage module, a parts presentation module, a pneumatic distribution module as well as an electrical distribution module, an electro-pneumatic valve manifold, and a digital I/O interface module.

- **Key Features**
  - Programmable Pneumatic Traverse Module
  - Infrared Sensors
  - Pneumatic Grippers and Brakes
  - Pick and Place Storage
  - Magnetic Reed Switches
  - Inductive Sensors

- **Learning Topics**
  - Infrared Sensor Adjustment
  - Pneumatic Brake Adjustment
  - Pneumatic Gripper Adjustment
  - Station Operation
  - Electrical Sensors
  - Electrical Pick and Place
  - Pneumatic Pick and Place
  - Mechatronics Safety
  - Control Systems Concepts
  - Mechatronics Introduction
  - Non-Servo Electric Slide Sequencing
  - Torque Clamp Module Sequencing
  - Station Sequencing