

HERO1

ROBOT and COURSE

The perfect robotics training system for industry and schools



<https://classic.technology>

Heathkit

Heathkit/Zenith

Educational Systems

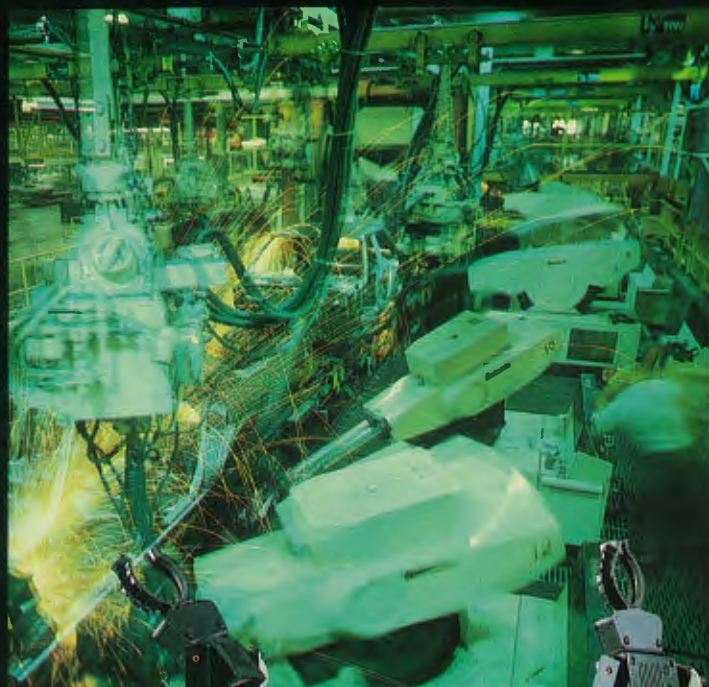
The key to success in the new robotics revolution will be knowledge

There's no escaping it. **The worldwide direction for industry today is robotics.** All across North America, Europe and the Far East, industry is turning to robots to perform a multitude of manufacturing activities in order to remain competitive. It is estimated there will be one-quarter million industrial robots in the United States by 1990. Projections for other countries are even higher.

We are at the start of a robotics revolution and there is a tremendous shortfall in educated, trained personnel to design, specify, sell, program, operate, install and service these robots.

The Heath robot makes it possible for nearly anyone to obtain a comprehensive background in robotics.

If your firm or school is considering entering robotics, the HERO 1 Robot and course will be the first, affordable step in developing a training system for your application.



HERO 1 demonstrates every major principle of Industrial Robotics and Electronics



Trainer is a mobile, programmable robot with arm, gripper, voice, and sensors

HERO 1 (an acronym for Heath Educational Robot), is the most advanced and versatile product for teaching robotics available on the market today. It is an intelligent, mobile robot with features and capabilities not found in industrial robots costing many thousands of dollars more.

It is a completely self-contained, electromechanical robot capable of interacting with its environment. It is controlled by its own on-board, programmable computer and carries electronic sensors to detect light, sound, motion and obstructions in its path. It can be programmed to pick up small objects with its arm, speak complete words and sentences with its voice synthesizer, travel over predetermined courses, and repeat specific functions on a predetermined schedule. It carries its own rechargeable power supply and can function totally free of any external control.



Teaching system design permits hands-on learning and experimentation

Designed as a robotics and industrial electronics trainer, HERO 1 permits easy access to all interior boards and components. The robot and course provide practical experience in a long list of disciplines that have broad application to the modern industrial setting. The individual

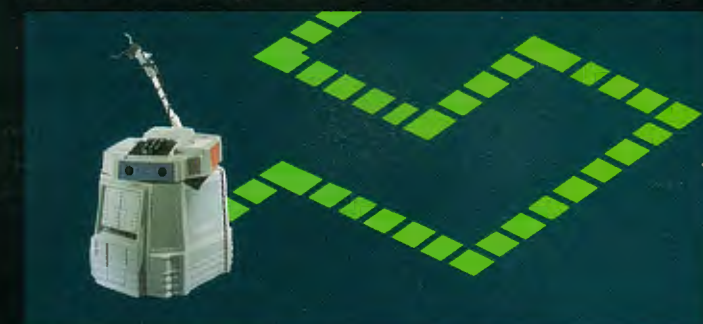
will learn, practice and apply basic principles of industrial electronics, computers, automated equipment, sensors, servos, steppers, relays, controllers, artificial intelligence and more.

In the process of working with HERO 1 the individual gains practical, hands-on experience with the basic elements of robotics, including programming, electronically-controlled movement and positioning, interfacing and data acquisition.

Low cost, highly effective training system for robotics

HERO 1 was specifically designed to teach robotics in the industrial and classroom settings. Used with the Robotics and Industrial Electronics course the Heath robot brings the learning process to life. The complete HERO 1 Robot can be purchased factory assembled and tested for \$2495. See back page for ordering information.

Extensive design features make HERO 1 unique



SENSES — detect sound, light and motion. Can also "sight" and range objects in its path with ultrasonic ranger.

VOICE — phoneme-based system generates 64 sounds to simulate human speech and sound effects. Has variable pitch and four levels of inflection.

HEAD — stepper motor rotates the head 350 degrees. The head contains sensors for the motion detector, light detector, ultrasonic ranging system, and sound detector. It also contains the bread-boarding area (experimental circuit board), the LED display and hexadecimal keyboard, the abort button, and the mounting point for the arm.

Breadboarding area (experimental circuit board) provides direct access to a user I/O port, a user defined interrupt, CPU control lines, and +12 and +5 volts.

ARM — rotates 350 degrees in the horizontal plane with the head. The shoulder motor raises and lowers the arm 150 degrees in the vertical plane. Extender motor extends and retracts the gripper 5 inches (12.7 centimeters). Wrist pivot motor pivots gripper 180 degrees total (90 degrees above or below axis of arm). Wrist rotate motor rotates gripper through 350 degrees. Gripper motor opens gripper 3½ inches (8.9 centimeters). Wrist assembly may rotate 90 degrees at extreme end of arm extension (user option).

Arm maximum payload (with arm horizontal and fully retracted) is 16 oz (450 grams). With arm fully extended, 8 oz (225 grams). Gripper force at the tip of the gripper is 5 oz (140 grams) max.

MICROPROCESSOR — 6808 microprocessor interfaces with all sensors, on-board real-time clock, experimental circuit board, and drive motors. Programmable through keyboard, external teaching pendant, or standard cassette tape recorder. Microprocessor has seven operating modes: 1) Executive; 2) Utility; 3) Program; 4) Repeat; 5) Manual; 6) Learn; 7) Sleep.

HERO 1 and the Robotics Course...a complete robotics education system for schools and industry

The Heath HERO 1 teaching robot and companion Robotics Education Course provide the most complete system for robotics education ever developed.

Until the HERO 1 introduction, there were no comprehensive, affordable training systems available for teaching robotics.

Now, HERO 1 and the Robotics Course make it possible for nearly any school or company to buy the equipment and materials necessary for thorough robotics training.

The fully illustrated course features hands-on experimentation with the HERO 1 robot, unit review tests and a final examination.

The two-volume, 1200 page course is divided into eleven teaching units:

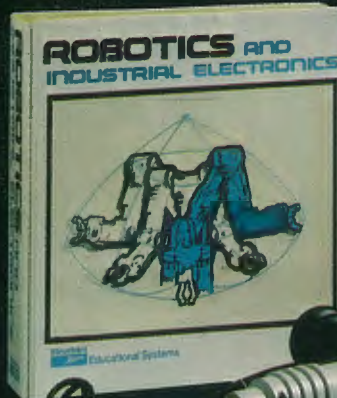
- Robot Fundamentals
- Industrial Robots at Work

- Alternating Current and Fluidic Power
- Direct Current Power and Positioning
- Microprocessor Fundamentals
- The Heath Robot Microprocessor

- Programming
- Data Acquisition (sensors)
- Data Handling and Conversion
- Voice Synthesis • Interfacing

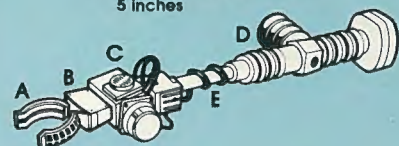
This course is built on the foundation of Heathkit/Zenith Educational Systems' experience in technical education. It's available for the surprising low cost of \$99.95.

Take a leadership position in the Robotics revolution. See the back page of this brochure for ordering information.

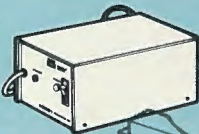


HERO 1 demonstrates every major concept in robotics

- 1 ARM provides five axes of motion:
- Gripper opens and closes 3 1/2"
 - Wrist rotates 350°
 - Wrist pivots 180°
 - Arm pivots 150°
 - Arm extends and retracts 5 inches



- 19 HERO 1 comes complete with its own battery charger. Robot can operate while being recharged.



- 18 ROBOT is powered by four 4-amp hour rechargeable gel cell batteries. HERO 1 automatically indicates low-voltage.



- 17 CASSETTE INTERFACE provides a means of saving and reloading programs on cassette tape.



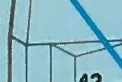
- 16 REAL TIME CLOCK/CALENDAR adds additional programming capabilities including sleep function which enables robot to "wake" at designated times.



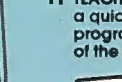
- 15 PLUG-IN CIRCUIT BOARDS may be snapped off for experimentation or maintenance.



- 14 POWERFUL DC GEAR MOTOR for drive torque. Robot is powered by 8 motors including 7 stepper motors.



- 12 SIDE PANELS snap off for easy access to all side mounted circuit boards.



- 13 FRONT WHEEL drives and steers for exceptional maneuverability. Optical encoder on front wheel provides precise measurement of distance traveled.



- 11 TEACHING PENDANT provides a quick and easy way to program complex movements of the arm and body.

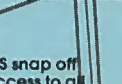


- 8 SEVEN SEGMENT LED DISPLAY for viewing memory addresses, data, program steps and more.

- 9 HEXADECIMAL KEYPAD for entering, verifying, modifying programs and selecting any one of seven operating modes.



- 10 ULTRASONIC SONAR SYSTEM for determining range and direction of objects from 4 inches to 8 feet with 0.4 inch resolution.



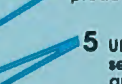
- 7 A LIGHT DETECTOR measures ambient light through 256 levels in the visible spectrum.



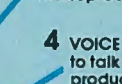
- 6 SOUND DETECTOR senses and quantifies sounds in the 300 to 5000 Hz range over 256 levels.



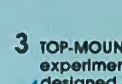
- 5 ULTRASONIC MOTION DETECTOR senses the slightest motion around the robot.



- 4 VOICE SYNTHESIZER allows the robot to talk in unlimited vocabulary and produce various sound effects.



- 3 TOP-MOUNTED BREADBOARD for experiments and interfacing user-designed circuits to the on-board microprocessor.



- 2 HEAD rotates 350° to position sensors and arm.



ROBOTICS AND INDUSTRIAL ELECTRONICS COURSE TOPIC OUTLINE

UNIT 1: ROBOT FUNDAMENTALS

- Robot Evolution
- Terminology
- Low-Technology Robots
- Medium and High Technology Robots

UNIT 2: AC AND FLUIDIC POWER

- AC Power Generation
- AC Motors
- Basic Hydraulic System
- Pneumatic Systems

UNIT 3: DC POWER AND POSITIONING

- Batteries (Overview)
- Nickel-Cadmium Batteries
- Gelled-Electrolyte Batteries
- DC Motors
- DC Brushless Motors
- Stepper Motors

UNIT 4: MICROPROCESSOR FUNDAMENTALS

- Terms and Conventions
- An Elementary Microcomputer
- Executing a Program
- Addressing Modes
- Binary Arithmetic
- Two's Complement Arithmetic
- Boolean Algebra

UNIT 5: INTRODUCTION TO PROGRAMMING

- Branching
- Conditional Branching
- Algorithms
- Additional Instructions

UNIT 6: A TYPICAL MICROPROCESSOR CONTROLLER

- Architecture of the 6808 MPU
- Instruction Set of the 6808 MPU
- New Addressing Modes
- Stack Operations
- Subroutines
- Input/Output Operations
- Interrupts

UNIT 7: DATA ACQUISITION

- Optoelectric Sensors
- Temperature Sensing
- Ultrasonic Sensors

UNIT 8: DATA HANDLING AND CONVERSION

- Synchro and Servomechanisms (Overview)
- Synchro System
- Servomechanisms
- Digital-to-Analog Converters
- Analog-to-Digital Converters

UNIT 9: VOICE SYNTHESIS

- How Do We Speak
- Fundamentals of Speech
- Looking at Waveforms
- Producing a Phoneme Electronically
- Using a Phoneme Synthesizer
- Programming the PSS
- Inflection Enhancement
- Naturalness and Phoneme Phrases

UNIT 10: ET-18 INTERFACING

- Interfacing Fundamentals
- Interfacing with Random Access Memory
- Interfacing With Read Only Memory
- Interfacing With Control Circuits

UNIT 11: INDUSTRIAL ROBOTS AT WORK

- Industrial Robot Classification
- Application Considerations

UNIT 12: EXPERIMENTS

- Introduction
- Experiment 1 – Robot Familiarization – Platform Mobility
- Experiment 2 – Robot Familiarization – Manipulator Axes of Motion
- Experiment 3 – On-Board Logic Probe
- Experiment 4 – Manual Control of a DC Motor
- Experiment 5 – Straight Line Programs

- Experiment 6 – Arithmetic and Logic Instructions
- Experiment 7 – Program Branches
- Experiment 8 – Additional Instructions
- Experiment 9 – New Addressing Modes
- Experiment 10 – Arithmetic Operations
- Experiment 11 – Stack Operations
- Experiment 12 – Subroutines
- Experiment 13 – Sensors
- Experiment 14 – "Open-Loop" Control of a DC Stepping Motor
- Experiment 15 – Robot Voice Routine

- Experiment 16 – Robot Language – Motors
- Experiment 17 – Robot Language – Sensors and Sound
- Experiment 18 – Cassette and Teaching Pendant Interfacing
- Experiment 19 – Modifying a Taught Program

ALSO INCLUDED IN THE COURSE

- Appendices
 - Number Systems and Codes
 - 6808 Data Sheets
 - Definition of the Executable Instructions
 - The Phoneme Dictionary
- Final Examination





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