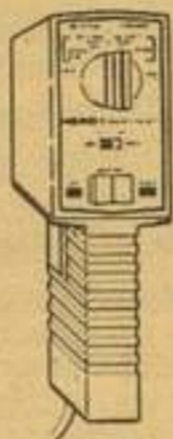


HERO 1 is completely equipped to demonstrate every major robotic concept



Hexadecimal keypad and LED display



Teaching Pendant controller



NEW optional RF Remote Control Accessory enables direct and computer control of HERO 1 from up to 100 feet away

Move into the world of robotics with HERO® 1

1 HERO 1 is the ideal robotics training tool

Bring the concepts of high-technology robotics to life with practical hands-on training using the teaching robot, HERO 1. This computer-controlled, electro-mechanical device allows you to explore and work with all the fundamental components and circuitry associated with robot technology. Completely self-contained, HERO 1 is capable of interacting with you and its environment. It detects light, sound, motion and obstacles in its path; and it can travel over a predetermined course. When using its optional arm, the robot can be programmed to pick up small objects with its manipulator. And with its optional voice synthesizer, HERO 1 can even speak in complete sentences.

An intelligent robot, HERO 1 has a computer brain consisting of an on-board 8-bit 6808 microprocessor. Following programmed instructions, the microprocessor can guide HERO 1 through complex maneuvers, activate and monitor sensors, and modify the robot's actions as a result of sensor or real-time clock inputs. Memory consists of 8K of ROM and 4K bytes of RAM. This can be increased up to 56K with the addition of an optional memory expansion board. Preprogrammed ROMs are also available for installation on this board that allow HERO 1 to demonstrate its many capabilities.

Program HERO 1 using any one of several methods. From the top-mounted 17-key keyboard you can easily enter, verify and modify programs as well as select any of the seven operating modes. Also access any of the microprocessor's registers through the keyboard. An attachable Teaching Pendant lets you manually control all motor and arm movements or store them in memory for later duplication. A rear-panel serial port allows programs stored in memory to be transferred to a cassette tape for later reloading and use.

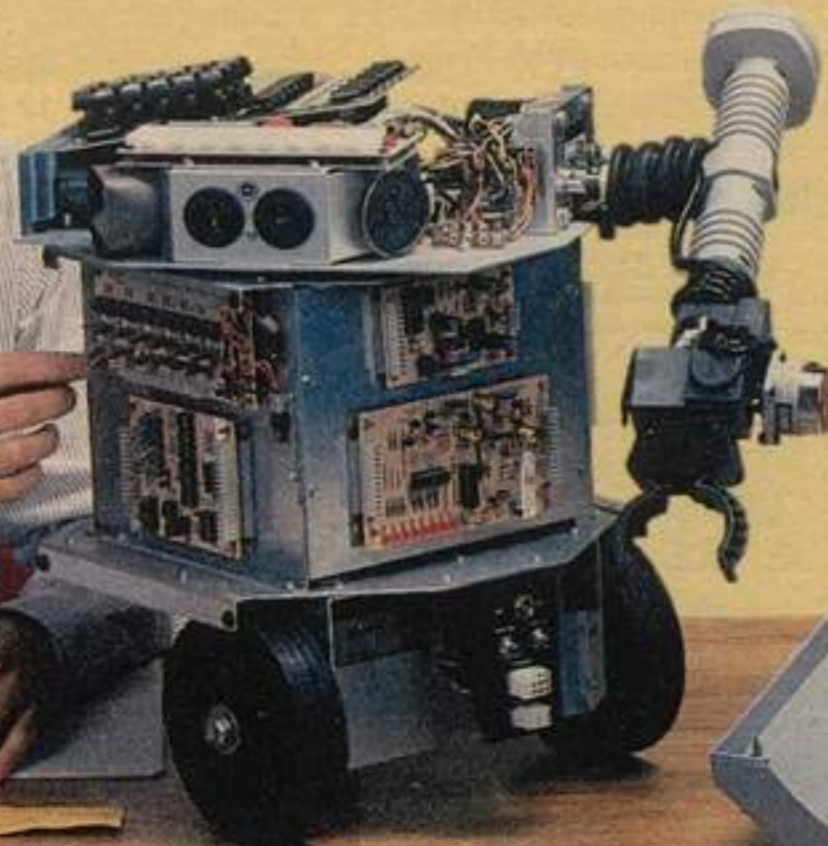
Two totally new methods to control HERO 1 are now available. One is a remote, radio frequency-controlled transmitter available in 3 models, each operating at a different frequency. It controls all keyboard and Teaching Pendant operations from up to 100 feet away. An RS-232 connector on this accessory also permits a computer to remotely operate the robot. The Remote has a self-contained rechargeable battery that provides operating power for up to five hours. Control is also provided through an optional RS-232 Interface that plugs onto the top breadboard providing a direct link between a host computer and HERO 1.

Light, sound and motion detectors plus a sonar ranging system gives HERO 1 the ability to see and hear. The sound detector hears over a 300 to 5000 Hz frequency range while the light detector sees over the entire visible spectrum and into the Infrared spectrum. The motion detector senses movement up to a distance of 15 feet and the sonar system determines the range between objects and the robot.

An experimental breadboard, mounted on the top of HERO 1, provides a means of experimenting with and interfacing user-designed circuits to the robot's CPU. Direct access is available to an I/O port, a user-defined interrupt, CPU control lines, and +12 and +5 VDC power terminals.

2

3



Learn high-tech robotics with the HERO[®] 1 Robot and its complete training system



An ideal teaching tool, HERO 1 is a completely self-contained robot that interacts with you and its environment. HERO 1 detects sound, light, motion and obstacles and travels over a course that you predetermine. The robot can see and hear through on-board light, sound and motion detectors plus a sonar ranging system. The sound detector hears over a 300 to 5000 Hz frequency range while the light detector sees over the entire visible spectrum and into the infrared range. HERO 1's motion detector senses movement up to a distance of 15 feet while a sonar system determines ranges between objects and the robot.

HERO 1's abilities are limited only by your imagination. For example, you can get an optional Arm with Gripper and program it to pick up small objects with its manipulator. The arm moves through five axes and can lift 16 ounces when retracted. You can also purchase the optional voice synthesizer. It not only lets HERO 1 simulate the sound of human speech, but it can also speak in complete sentences. You can see a

demonstration of HERO's sensors, voice and movements as soon as you get your robot by purchasing our special HERO 1 Demo Cassette.

On-board HERO 1 is an 8-bit 6808 microprocessor that can guide the robot through complex maneuvers, activate and monitor sensors, and modify actions as a result of sensor or real-time clock inputs. HERO 1 also has 8K of ROM as well as 4K of RAM which can be increased up to 56K with the addition of an optional memory expansion board.

Commanding HERO 1 is easy with three different methods available to you. A top-mounted 17-key hexadecimal keyboard lets you easily enter, verify and modify programs, and select any of seven separate operating modes. You can also access any of the microprocessor's registers through the keypad. An attachable Teaching Pendant lets you manually control all motor and arm movements, or store them for later duplication. Or you can control HERO 1 with a remote, radio frequency-controlled transmitter available in two models, each operating at a different frequency. The Remote controls all keyboard and Teaching Pendant operations from up to 100 feet away. You can also guide HERO 1 by directly linking a host computer with the help of the Memory Expansion Board and an optional RS-232 Interface that plugs into the top experimental HERO 1 breadboard.

Configurations:

- Kit **ET-18-A** Basic HERO 1 Robot less arm and voice ship wt 66 lbs.
- Assembled **ETW-18-WA** HERO 1 without arm assembly ship wt 65 lbs.
- Kit **ETS-18-37** HERO 1 with Arm and Remote Control operating at 75.43 MHz and with voice 89 lbs.
- Kit **ETS-18-38** HERO 1 with Arm and Remote Control operating at 75.67 MHz and with voice 89 lbs.
- Assembled **EWS-18-35** HERO 1 with Arm and Remote Control operating at 75.43 MHz ship wt 95 lbs.
- Assembled **EWS-18-36** HERO 1 with Arm and Remote Control operating at 75.67 MHz ship wt 95 lbs.

Accessories:

- Kit **ET-18-1** HERO 1 Arm with gripper mechanism ship wt 6 lbs.
- Assembled **ETW-18-1** HERO 1 Arm ship wt 5 lbs.
- Kit **ET-18-2** HERO 1 Voice ship wt 1 lb.
- Kit **ET-18-35** Remote Control Accessory for HERO 1 that operates at 75.43 MHz ship wt 5 lbs.
- Assembled **ETW-18-35** Remote Control Accessory that operates at 75.43 MHz ship wt 5 lbs.
- Kit **ET-18-36** Remote Control Accessory for HERO 1 that operates at 75.67 MHz ship wt 5 lbs.
- Assembled **ETW-18-36** Remote Control Accessory for HERO 1 that operates at 75.67 MHz ship wt 5 lbs.
- ET-18-4** A plug-in Demo ROM containing several routines demonstrating all of HERO 1's motor and sense circuits and voice ship wt 1 lb.
- ET-18-5** Monitor ROM listing ship wt 1 lb.
- Assembled **ET-18-6** Memory Expansion Board allows the addition of over 40K of memory 2 lbs.
- ETA-18-6** Memory Expansion RAM (8K x 8) chip that installs onto the ET-18-6 memory board ship wt 1 lb.



Learn high-tech robotics with the HERO® 1 Robot and its complete training system

Configurations:

Kit **ET-18-A** Basic HERO 1 Robot less arm and voice \$799.95, ship wt 66 lbs.

Assembled **ETW-18-WA** HERO 1 without arm assembly \$1699.95, ship wt 65 lbs.

Kit **ETS-18-35** HERO 1 with Arm and Remote Control operating at 75.43 MHz and without voice *Regularly* \$1399.85 *Now Only* \$1299.95, ship wt 78 lbs.

Kit **ETS-18-36** HERO 1 with Arm and Remote Control operating at 75.67 MHz and without voice *Regularly* \$1399.95 *Now Only* \$1299.95, ship wt 78 lbs.

Assembled **EWS-18-35** HERO 1 with Arm and Remote Control operating at 75.43 MHz *Regularly* \$2669.80 *Now Only* \$2149.90, ship wt 95 lbs.

Assembled **EWS-18-36** HERO 1 with Arm and Remote Control operating at 75.67 MHz *Regularly* \$2669.80 *Now Only* \$2149.90, ship wt 95 lbs.

Accessories:

Kit **ET-18-1** HERO 1 Arm with gripper mechanism \$349.95, ship wt 6 lbs.

Assembled **ETW-18-1** HERO 1 Arm \$549.95, ship wt 5 lbs.

Kit **ET-18-2** HERO 1 Voice \$99.95, ship wt 1 lb.

Kit **ET-18-35** Remote Control Accessory for HERO 1 that operates at 75.43 MHz \$249.95, ship wt 5 lbs.

Assembled **ETW-18-35** Remote Control Accessory that operates at 75.43 MHz \$399.95, ship wt 5 lbs.

Kit **ET-18-36** Remote Control Accessory for HERO 1 that operates at 75.67 MHz \$249.95, ship wt 5 lbs.

Assembled **ETW-18-36** Remote Control Accessory for HERO 1 that operates at 75.67 MHz \$399.95, ship wt 5 lbs.

ET-18-4 a plug-in Demo ROM containing several routines demonstrating all of HERO 1's motor and sense circuits and voice \$49.95, ship wt 1 lb.

ET-18-5 Monitor ROM listing \$39.95, ship wt 1 lb.

Assembled **ET-18-6** Memory Expansion Board allows the addition of over 40K of memory \$49.95, 2 lbs.

ETA-18-6 Memory Expansion RAM (8K x 8) chip that installs onto the ET-18-6 memory board \$24.95, ship wt 1 lb.

ET-18-7 Automatic Mode ROM that plugs into HERO 1 and enables the robot to move independently around a room while avoiding obstacles \$29.95, ship wt 1 lb.

ET-18-9 HERO 1 BASIC is a plug-in ROM that allows you to program HERO 1 in a simple integer BASIC with modifications to use the robot's voice synthesizer and its various motors and sensors. Requires an ET/ETW HERO 1, an ET-18-6 Memory Expansion Accessory, one or more ETA-18-6 Memory Expansion RAM, an ETW-18-10 RS-232 Interface Accessory, a terminal or computer with a terminal emulation program, and a serial interface cable such as the HCA-10 or HCA-11 on page 101 \$49.95, ship wt 1 lb.

SAVER! ETS-18-9 Expansion System. Everything needed to let you program your robot and includes: BASIC ROM, RS-232 Interface, Memory Expansion Board, and one Memory Expansion RAM \$179.80, ship wt 6 lbs.

ET-18-11 HERO 1 Demo Cassette contains programs on cassette tape demonstrating the robot's sensors and voice along with a variety of arm and body movements \$14.95, ship wt 1 lb.

Assembled **ETW-18-10** RS-232 Interface allows serial communication between the robot and a terminal or computer, requires ET-18-6 Memory Expansion Board \$59.95, 1 lb.

An ideal teaching tool, HERO 1 is a completely self-contained robot that interacts with you and its environment. HERO 1 detects sound, light, motion, and obstacles and travels over a course that you predetermine. The robot can see and hear through on-board light, sound and motion detectors plus a sonar ranging system. The sound detector hears over a 300 to 5000 Hz frequency range while the light detector sees over the entire visible spectrum and into the infrared range. HERO 1's motion detector senses movement up to a distance of 15 feet while a sonar system determines ranges between objects and the robot.

HERO 1's abilities are limited only by your imagination. For example, you can get an optional Arm with Gripper and program it to pick up small objects with its manipulator. The arm moves through five axes and can lift 16 ounces when retracted. You can also purchase the optional voice synthesizer. It not only lets HERO 1 speak in complete sentences, but it can also simulate the sound of human speech. You can see a demonstration of HERO's sensors, voice and movements as soon as you get your robot by purchasing our special HERO 1 Demo Cassette.

And HERO's smart. On-board is an 8-bit 6808 microprocessor that can guide the robot through complex maneuvers, activate and monitor sensors, and modify actions as a result of sensor or real-time clock inputs. HERO 1 also has 8K of ROM as well as 4K of RAM which can be increased up to 56K with the addition of an optional memory expansion board.

Commanding HERO 1 is easy with three different methods available to you. A top-mounted 17-key hexadecimal keyboard lets you easily enter, verify and modify programs, and select any of seven separate operating modes. You can also access any of the microprocessor's registers through the keypad. An attachable Teaching Pendant lets you manually control all motor and arm movements, or store them for later duplication. Or you can control HERO 1 with a remote, radio frequency-controlled transmitter available in two models, each operating at a different frequency. The remote controls all keyboard and Teaching Pendant operations from up to 100 feet away. You can also guide HERO 1 by directly linking a host computer with the help of the Memory Expansion Board and an optional RS-232 Interface that plugs into the top experimental HERO 1 breadboard.



Learn all about robotics and industrial electronics

Our Robotics and Industrial Electronics Course

teaches you how robots work. After a review of elementary electronic principles, you'll be introduced to robot mechanics, computer control and low, medium and high-technology robots. From there, you'll master different power systems and familiarize yourself with the operation of various AC and DC motors and generators, industrial hydraulic and pneumatic systems, and DC stepper motors.

You'll get an over-all understanding of the robotics system as we link computer applications with mechanical principles. You'll also learn how to write robot control programs and see how sensing systems and voice synthesis work.

Do the optional experiments and let your HERO 1 guide you to a practical understanding of the principles of industrial electronics, computers, automated equipment, sensors, servos, stepper motors, controllers and more.

We recommend that, before you start, you complete EE-3101-A DC Electronics (page 67), EE-3102-A AC Electronics (page 67), EE-3201-A Digital Techniques (page 70), and EE-3401-A Basic Microprocessors (page 71). 8 CEU's. **EE-1800** \$99.95, 12 lbs.

\$100 OFF! ROBOTICS TRAINING SAVERS

Our special offer includes: EE-1800 Robotics and Industrial Electronics Course, EE-1812 Robot Applications Course, EB-1802 Advanced Programming Experiments, ET-18-A Basic HERO 1 Robot, ET-18-1 Robot Arm with Gripper, and ET-18-2 Voice Synthesizer. **EES-1800** \$1374.70, ship wt 111 lbs.



Study real-world applications and design of industrial robots

Learn about the driving technologies behind advanced industrial robots, why robots are important, and where they go from here with our Robot Applications Course.

You'll start with a review of robotics basics. Next, you'll plug into an in-depth study of how corporations use tasks, payback reliability, quality and other factors in deciding the need for and kind of industrial robot to buy. You'll learn about the process of signal conditioning that gets a signal from sensor to microprocessor controller. Plus, you'll gain a thorough knowledge of the different types of vision, tactile and environmental feedback sensor systems. This comprehensive coverage is designed to give you a solid understanding of the capabilities, present uses and limitations of industrial and domestic robots.

We then take you to the future manufacturing plant, where we explore "computer-aided" production and the possible future applications of industrial robots.

We reinforce your learning with nine experiments that you can perform on HERO 1. All components for the experiments are included. You'll even get an audio cassette tape containing the experiment programs for this course.

Pass the optional final exam and you'll earn 4.0 Continuing Education Units. **EE-1812** \$99.95, ship wt 6 lbs.

Advanced programming experiments for HERO 1

Master the operation of your HERO 1 and unlock the power of the Robot Language Interpreter. Our sixty-one programming experiments show you how with a wide range of examples that teach general programming principles, including subroutines in HERO 1's monitor ROM. **EB-1802** \$24.95, ship wt 1 lb.



Credit card orders call TOLL-FREE:

1-800-253-0570

Alaska and Michigan residents call: 616-982-3411.



Move into the world of robotics with the first sophisticated teaching robot—HERO 1

While teaching your robot to move, sense, see, hear, and speak, you can be learning robotics from HERO and its companion Heathkit/Zenith educational course. And it's so inexpensive, with the HERO 1 Robot Kit available from \$999.95 and the assembled Robot, with both arm and voice options, for \$2499.95.



On-board computer provides intelligence

Includes rechargeable batteries and charger

Programmed from keyboard, teaching pendant, or cassette port

Senses light, sound, motion and distance

Speaks with optional phoneme synthesized voice

Three-wheeled base drives and steers HERO

Programmable robot: Completely self-contained, HERO 1 is capable of interacting with its environment. It detects light, sound, motion and objects in its path. It can travel over a set course and repeat specific functions on a predetermined schedule. With an optional arm and voice, HERO 1 can grasp items and speak.

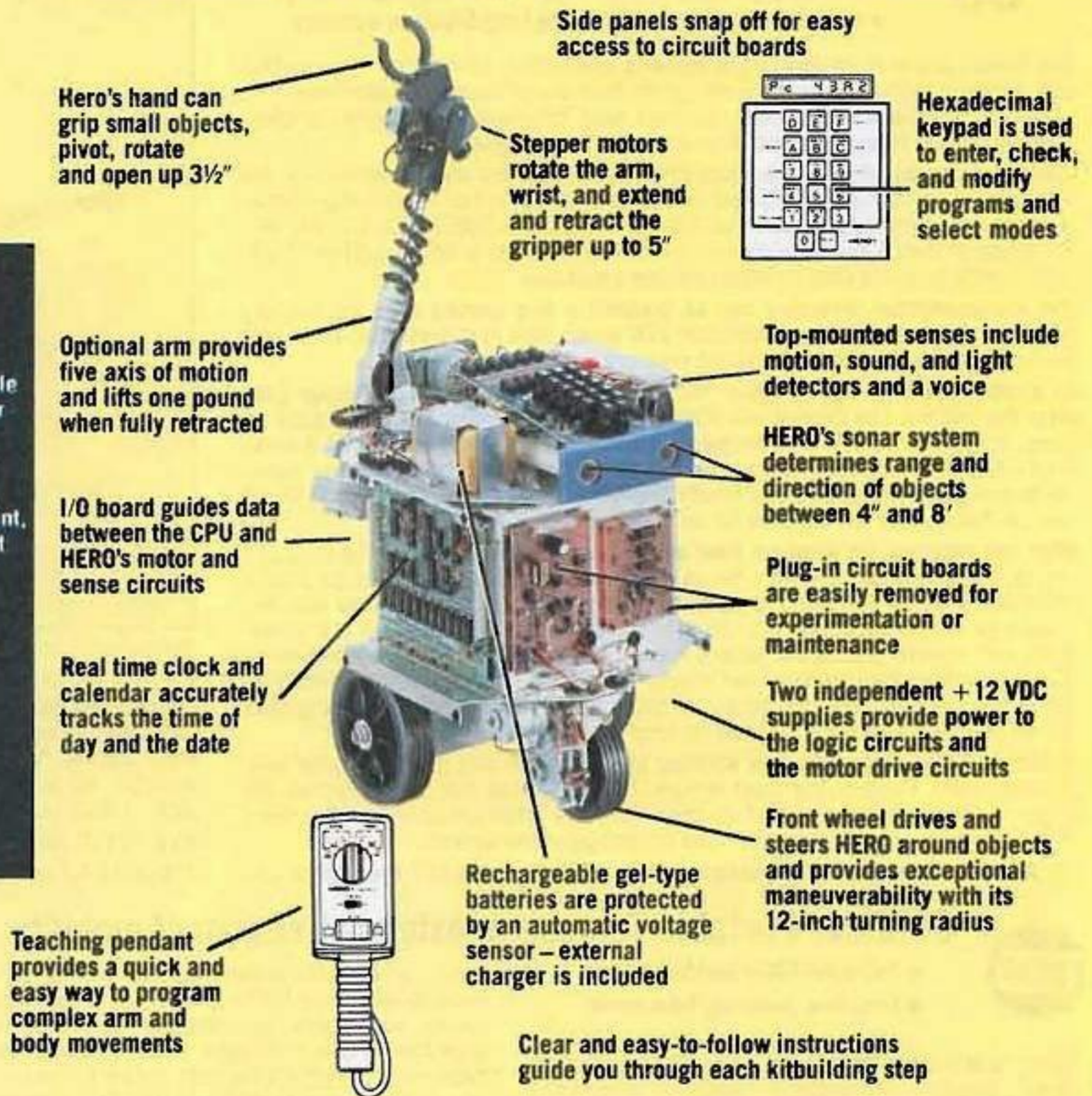
A computer on wheels: HERO 1 is controlled by an on-board 8-bit 6808 microprocessor. Following programmed instructions, the microprocessor can guide HERO 1 through complex maneuvers, activate and monitor its sensors, and modify the robot's actions as a result of sensor or real-time clock inputs. To store user-programmed instructions, Hero comes equipped with 4K of RAM memory. An 8K ROM stores a number of built-in commands and speeches.

Three programming methods: HERO 1 can be programmed by entering instructions through the hexadecimal keyboard mounted on top of its head. By using a hand-held remote control teaching pendant, manually-controlled motor and arm movements can be programmed into memory. This pendant can be used to select individual motors and their directions of rotation. Another method of programming HERO 1 is through a rear-panel serial cassette port. By connecting an ordinary audio cassette recorder here, programs can be saved on a cassette tape and then reloaded into the robot.

Four sensor circuits: Within HERO 1's head are four sensors which act as its eyes and ears. A sound detector hears sound from 300 to 5000 Hz while a light detector sees light over the visible spectrum. A motion detector senses movement up to 15 feet away and a sonar system determines range.

Learn by doing: HERO 1 provides a hands-on knowledge of industrial electronics, mechanics, computer theory and programming as applied to robots by putting them into action. An experimental breadboard is also included for experiments and interfacing user-designed circuits to the on-board microprocessor. The top-mounted breadboard has direct access to a user I/O port, a user defined interrupt, CPU control lines, and +12 VDC and +5 VDC. For a more extensive background in robotics and its associated technology, a companion Robotics Education Course (see opposite page) is available.

HERO contains all the basic systems of today's industrial robots



Hero's hand can grip small objects, pivot, rotate and open up 3½"

Side panels snap off for easy access to circuit boards

Stepper motors rotate the arm, wrist, and extend and retract the gripper up to 5"



Hexadecimal keypad is used to enter, check, and modify programs and select modes

Optional arm provides five axis of motion and lifts one pound when fully retracted

Top-mounted senses include motion, sound, and light detectors and a voice

I/O board guides data between the CPU and HERO's motor and sense circuits

HERO's sonar system determines range and direction of objects between 4" and 8'

Real time clock and calendar accurately tracks the time of day and the date

Plug-in circuit boards are easily removed for experimentation or maintenance

Two independent +12 VDC supplies provide power to the logic circuits and the motor drive circuits

Rechargeable gel-type batteries are protected by an automatic voltage sensor—external charger is included

Front wheel drives and steers HERO around objects and provides exceptional maneuverability with its 12-inch turning radius

Teaching pendant provides a quick and easy way to program complex arm and body movements

Clear and easy-to-follow instructions guide you through each kitbuilding step

Rechargeable batteries with charger: When HERO 1 tells you that its voltage is low, use the external battery charger even while it is operating.

Grasps small objects With the optional ET-18-1 Arm and Gripper Mechanism, HERO 1 can be programmed to pick up small items. Using five stepper motors, the ET-18-1 is capable of five axis of motion and can perform precision mechanical tasks. On command, the gripper can open up to 3½" and close, the wrist rotates 350 degrees and pivots 180 degrees, the arm pivots 150 degrees, and the arm extends up to 5 inches.

Speech Synthesizer: The ET-18-2 Speech Synthesizer gives HERO 1 a voice. It uses a phoneme-based synthesizer system that generates 64 phonemes (speech sounds). The phonemes are then linked together by your computer program to simulate human speech or various sound effects. Using this system, HERO 1 has access to an unlimited vocabulary.

Kit ET-18, Basic HERO 1 Robot (less arm, voice), 69 lbs. 999.95

ET-18-1, HERO 1's Arm (Arm and Gripper Mechanism), 6 lbs. 399.95

ET-18-2, HERO 1's Voice (Phoneme Speech Synthesizer), 1 lb. 149.95

NEW! ET-18-4, Demo ROM, plug in ROM containing several routines demonstrating all HERO 1's motor and sense circuits, including voice, Shpg. wt. 1 lb. 49.95

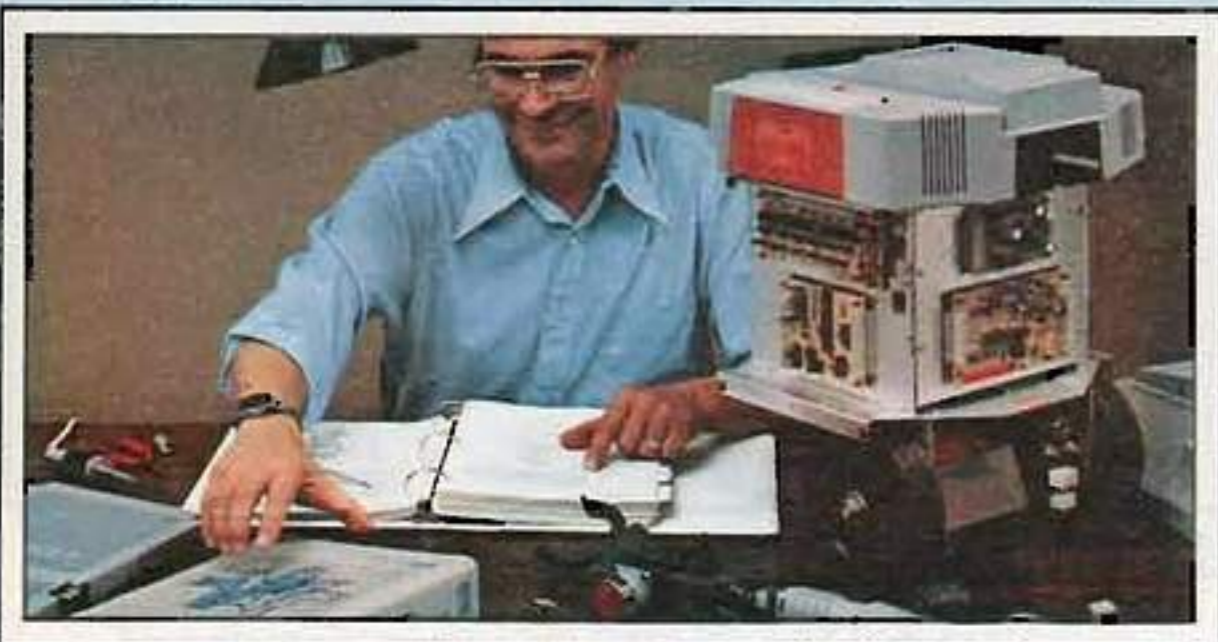
ET-18-5, Monitor ROM Listing, Shpg. wt. 1 lb. 39.95

ETW-18, Complete Assembled Robot (with arm, voice), 70 lbs. ... 2499.95

SAVE \$50.00! Kit ETS-18, complete HERO 1 Robot (with arm and voice), Shpg. wt. 91 lbs. \$1549.85 separately, NOW ONLY 1499.85



Learn all the fundamentals of robotics with this comprehensive course in robot technology



\$99⁹⁵

- Step-by-step self-study approach covers the entire field of robotics
- Two volumes filled with illustrations, charts and diagrams to enhance your learning
- Hands-on experience is provided by optional experiments performed on the teaching robot — HERO 1
- Receive credit by passing final exam

Comprehensive course: The Robotics and Industrial Electronics course is an A to Z look at how robots work. It reviews elementary electronic principles used in robotics and introduces new concepts associated with robots.

Course objectives: In this self-study course, you master each concept before proceeding to the next. You start with the terminology used with low, medium, and high-technology robots. Progressing at your own speed, you become acquainted with the operation of various AC and DC motors and generators, industrial hydraulic and pneumatic systems, and DC stepper motors. Microprocessors are introduced and how to write robot control programs. Then sensing systems are covered along with voice synthesis, which allows a robot to talk, and the skills required to make a robot perform tasks.

These subjects are covered in the Heathkit/Zenith Robotics Course:

- | | |
|--------------------------------|---|
| 1. Robot Fundamentals | 6. Heathkit/Zenith Robot Microprocessor |
| 2. AC and Fluidic Power | 7. Data Acquisition (Sensors) |
| 3. DC Power and Positioning | 8. Data Handling and Conversion |
| 4. Microprocessor Fundamentals | 9. Voice Synthesis |
| 5. Robot Programming | 10. Interfacing |
| | 11. Industrial Robots at Work |

Programmed reviews: During your studies, you'll find many self-test reviews. Each review is designed to reinforce the material presented. You use these short quizzes to test your understanding of the material. Also, these quizzes can be used as a guide to determine what areas may require further study.

Hands-on experiments: Accompanying this course are optional experiments which are performed on the unique robotics and industrial electronics trainer, HERO 1 (opposite page). Together, the Robot and course provides you with a tremendous learning opportunity. A chance to learn, practice, and apply the basic principles of industrial electronics, computers, automated equipment, sensors, servos, stepper motors, controllers, and other basic elements of industrial robots. While working with HERO 1, you gain practical and hands-on experience with the basic elements of robotics: programming, electronically-controlled movement and positioning, interfacing and data acquisition.

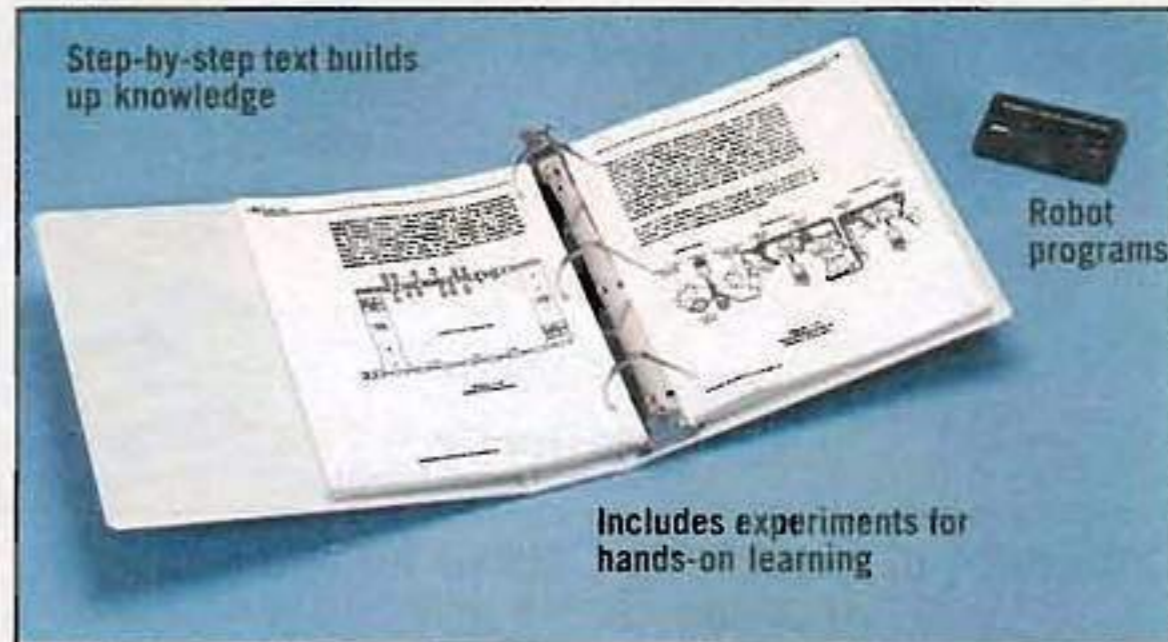
Recognition and credit: Pass the optional final examination with a 70 percent or better score and receive a handsome Certificate of Achievement that's suitable for framing from Heathkit/Zenith Educational Systems. Also, you'll earn 8 Continuing Education Units (CEUs) which is a nationally-used method of recognizing achievement in non-credit adult education.

Prerequisites: To better understand the material covered in the Robotics and Industrial Electronics Course, you should complete the following subjects or have a basic knowledge about them: EE-3101A DC Electronics (p. 70), EE-3102A AC Electronics (p. 71), EE-3201A Digital Techniques (p. 73), and EE-3401 Basic Microprocessors (p. 74).

EE-1800, Robotics Course, Shpg. wt. 12 lbs. **99.95**



Continue your education in robot technology with a course in Robot Applications



Step-by-step text builds up knowledge

Robot programs

Includes experiments for hands-on learning



\$99⁹⁵

- Course briefly reviews basics of robotics and introduces new concepts
- Provides a knowledge base to keep you abreast of changing robotics field
- Uses HERO 1 to perform experiments including the construction and use of an EPROM burner
- Gain recognition and earn credit

Course objectives: In the Robot Applications Course, you'll learn the concepts and technologies that make advanced industrial robots a reality. You'll learn many of the factors that govern the selection of an industrial robot based on management and workplace environment conditions. Signal conditioning, the process of getting the signal from the sensor to the microprocessor controller, is covered in depth. A detailed study of sensor systems is reinforced by a number of experiments designed to give you hands-on experience with sensor systems. You'll construct vision, tactile, and environmental feedback types of sensors. With the programs provided with this course, you'll be able to produce a variety of sensor systems. When you have finished this course, you'll be able to understand both the capabilities as well as the limitations of today's robots.

These subjects are covered in the Robot Applications Course:

- | | |
|------------------------------|---------------------------------------|
| 1. Management Considerations | 4. Tactile Sensing |
| 2. Environmental Feedback | 5. Computer Aided Manufacturing (CAM) |
| 3. Vision Systems | 6. Robot Applications |

Programmed reviews: As with other Heathkit/Zenith courses, you'll find many self-test reviews during your studies. They are there to reinforce the material in the lessons. Use these short quizzes to test your understanding of the material you've covered and as a guide to determine what areas, if any, in which you may need further study.

Hands-on experiments: Along with the Robot Applications Course are ten experiments that are conducted on the versatile robotics and industrial electronics trainer, HERO 1 (opposite page). An audio tape supplied with the course contains several programs for HERO 1 which are used in doing the experiments. These experiments are a hands-on opportunity to become acquainted with the concepts and technologies you have studied in the text. Experiments covered in the course include: a smoke detection/vocal warning system, a heat sensor, color discrimination, object identification, vision-aided positioning, array tactile sensor, a controller memories/EPROM burner, stationary home security robot, mobile intrusion alarm, and a mobile home security robot. All components needed to successfully complete the experiments (including a programmable ROM) are included with the course.

Recognition and credit: Upon completion of the optional final examination and with a passing grade of 70% or better, you receive from Heathkit/Zenith Educational Systems a Certificate of Achievement that's suitable for framing. You'll also earn 4 Continuing Education Units (CEUs). This is a nationally recognized method of awarding achievement in non-credit adult education.

Prerequisites: For a fuller understanding of the material in this course, the completion of the EE-1800 at the left is highly recommended.

EE-1812, Robot Applications Course, Shpg. wt. 6 lbs. **99.95**

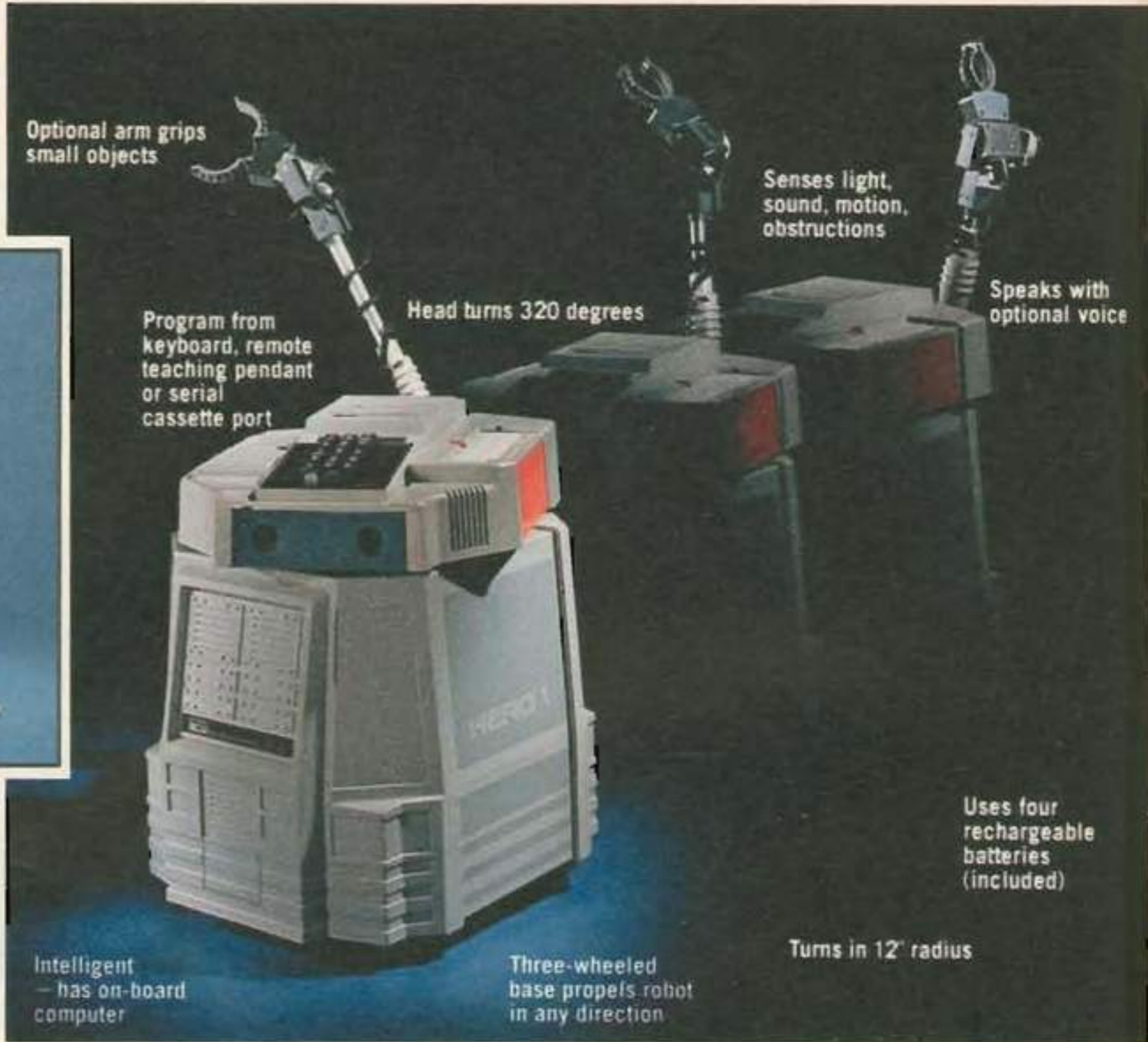


Discover the fun of kitbuilding at your Heathkit Electronic Center.



Introducing the world's first sophisticated teaching robot, HERO 1 — one of the most

Your new robot will move. See. Hear. Speak. And learn whatever you teach it — while it teaches you robotics with help from the companion Heathkit/Zenith educational course. It's also remarkably inexpensive, with the HERO 1 Robot Kit available for only \$999.95 — and the assembled Robot, complete with arm and voice, priced at \$2499.95.



HERO 1 is a full-featured robot:

- Controlled by on-board computer
- Exceptional maneuverability — goes in any direction, turns in 12" radius
- Senses light, sound, motion and obstructions in its path
- Can pick up small objects, speak with optional Arm and Voice
- Includes rechargeable batteries, external battery charger and experimental circuit board

One of the most important microprocessor-controlled devices since the introduction of the microcomputer: HERO 1 is a completely self-contained, electro-mechanical robot capable of interacting with its environment.

Functions free of any external control: Controlled by a programmable on-board computer, the robot has electronic sensors to detect light, sound, motion and obstructions in its path. It can travel over pre-determined courses and repeat specific functions on a pre-determined schedule.

It can also be programmed to pick up small objects with the optional ET-18-1 Arm and Gripper Mechanism (below, right), and speak with the optional ET-18-2 Phoneme Voice Synthesizer (also below, right).

Highly maneuverable: Using a three-wheeled base with both drive and steering on one wheel, the robot travels any direction and turns in a 12" radius.

A computer on wheels: Program HERO 1's on-board 6808 microprocessor to guide the robot through various complex maneuvers, activate the robot's sensors and modify the robot's behavior in response to inputs from its on-board sensors and real-time clock. The straightforward programming process allows step-by-step debugging and other corrections, as needed.

HERO 1 can be programmed in three different ways: Through the keyboard mounted on the robot's head, with its hand-held remote-control teaching pendant, or through its serial cassette port (using programming previously stored on a conventional audio cassette tape recorder). The computer can store programs with over 1,000 individual steps.

Program HERO 1 to guard your home, plant: It automatically detects intruders in its range and warns them away verbally. And HERO 1 can remain on guard for extended periods of time, using its power-conserving "sleep" mode.

Grabs and speaks with optional accessories: Capable of seven axes of motion, the optional ET-18-1 Arm and Gripper Mechanism lets you program HERO 1

to pick up small objects. The arm extends, retracts and turns — performing mechanical tasks with precision. The robot can also be programmed to speak complete sentences with the optional ET-18-2 Speech Synthesizer.

Experimental circuit board included: Expand HERO 1's capabilities to the very limits of the user's skills and imagination. This board allows the user to design circuits for interfacing with the robot's computer.

Includes on-board rechargeable batteries and charger: When HERO 1 tells you that its batteries need charging, use the robot's external battery charger. HERO 1 can be operated while its batteries are charging.

An even more significant "first": Remarkable though the robot is, its companion Robotics Education Course (see opposite page) provides an even more thorough grounding for you or those working with you in robot technology.

HERO 1 and the Robotics Course bring the learning process to life: You quickly get a hands-on grasp of industrial electronics, mechanics, computer theory and programming as applied to robots by putting them into action.

You teach it — it teaches you: HERO 1's only limitations are your imagination and ingenuity in programming, as you challenge its capabilities.

The list of capabilities goes on almost indefinitely: With the appearance of HERO 1, in production now and ready for you, the learning age of robotics has arrived. Now you can work with your own robot to develop your electronics, mechanics and programming skills — at a highly affordable price.

Kit ET-18, Basic HERO 1 Robot (less arm, voice), 69 lbs. 999.95

ET-18-1, HERO 1's Arm (Arm and Gripper Mechanism), 6 lbs. 399.95

ET-18-2, HERO 1's Voice (Phoneme Speech Synthesizer), 1 lb. 149.95

SAVE \$50.00! Kit ETS-18, Complete HERO 1 Robot (with arm, voice), Shpg. wt. 91 lbs. \$1549.85 separately, NOW ONLY 1499.85

ETW-18, Complete Assembled Robot (with arm, voice), 70 lbs. 2499.95



Use your Visa or MasterCard credit cards to purchase your kit!

important microprocessor-controlled devices ever conceived

Convenient Control Panel: Control HERO 1 from the keyboard on his head. You can also use the remote teaching pendant, or a program written on cassette tape.

Exceptional capabilities

HERO 1 can talk (with optional accessory): With the optional ET-18-2 Phoneme Speech Synthesizer, the robot can simulate human speech – with four levels of inflection.

HERO 1 can see: The robot's light sensor beam can detect ambient light over the entire visible spectrum, with excellent resolution – down to one part in 256.

HERO 1 can hear: The robot's omnidirectional sound sensor can hear ambient sound from 200 to 5000 Hz, with the same one-part-in-256 resolution.

Detects still and moving objects: HERO 1's twin ultrasonic beams can "see" movement up to 15 feet away, and can determine the range of an object up to eight feet away.

Experimental Circuit Board included: HERO 1's breadboarding area provides direct access to an I/O port, user-defined interrupt, CPU control lines and power.

Highly maneuverable: HERO 1's three-wheel drive system, with one wheel both driving and steering, allows the robot to move anywhere – and to turn in a 12-inch radius.

HERO 1's Hand, part of its optional Arm, grips small objects: The gripper can hold up to a pound when fully retracted and horizontal – pivots up to 350 degrees.

Optional ET-18-1 Arm available: Rotates up to 250 degrees, pivots wrist up to 180 degrees, extends or retracts gripper over a five-inch track.

"Learn" mode lets you teach HERO 1: Just switch to "Learn" mode and take the robot through your task. It remembers – and repeats the steps at your command.

"Sleep" mode conserves power: This makes HERO 1 ideal for home and plant security duty – when it sees intruders, it "wakes up," and warns them away verbally.

Self-contained rechargeable batteries: Two separate power systems – one for the logic circuits and a second for the drive system. External recharger included.

World-famous Heathkit manual: Easy-to-follow instructions from the world's largest builder of electronic kits guide you through each kitbuilding step.



\$99⁹⁵

Course provides a complete, comprehensive education in robot technology

- The 1200-page self-instruction text – Heathkit/Zenith's most extensive to date – has 11 chapters covering robot fundamentals
- Progress at your own pace – self-test exams in each unit help you check your progress
- Optional experiments give you hands-on experience with our HERO 1 Teaching Robot
- Earn 8 CEUs and a Certificate of Achievement

The most extensive course ever developed by Heathkit/Zenith Educational Systems: The 1,200-page text, which fills two three-ring binders, consists of 11 separate units covering the basics of robotics – each unit fully illustrated with charts and diagrams.

These subject areas are covered in the Heathkit/Zenith Robotics Course:

- | | |
|--------------------------------|---|
| 1. Robot Fundamentals | 6. Heathkit/Zenith Robot Microprocessor |
| 2. AC and Fluidic Power | 7. Data Acquisition (Sensors) |
| 3. DC Power and Positioning | 8. Data Handling and Conversion |
| 4. Microprocessor Fundamentals | 9. Voice Synthesis |
| 5. Robot Programming | 10. Interfacing |
| | 11. Industrial Robots at Work |

Progress at your own pace: The programmed self-study materials guide the student, step-by-step, until important concepts are mastered. Self-test reviews at the end of each unit make sure you understand what you've studied, before moving on to the next unit.

Use the ideal learning aid for robotics: Use the HERO 1 Robot on the opposite page to bring the learning process to life. By letting you apply what you've just learned, you get the type of reinforcement that makes 'learning-by-doing' one



of the most effective education methods ever devised. The course is also fully functional without the robot.

Prerequisites: You should complete EE-3101 DC Electronics (p. 32), EE-3102 AC Electronics (p. 33), EE-3201 Digital Techniques (p. 35) and EE-3401 Basic Microprocessors (pgs. 36-37) – or have a basic knowledge of those subjects – before starting the Robotics Course.

Earn 8 Continuing Education Units (CEUs) and a Certificate of Achievement from Heathkit/Zenith Educational Systems: Pass the optional final examination with a 70 percent or better score.

EE-1800, Robotics Course, Shpg. wt. 12 lbs. 99.95

Discover the fun of kitbuilding at your Heathkit Electronic Center.