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AUTHOR Weaver, Dave
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ABSTRACT

Science interfacing packages (also known as microcomputer-based laboratories or probeware) generally consist of a set of programs on disks, a user's manual, and hardware which includes one or more sensory devices. Together with a microcomputer they combine to make a powerful data acquisition and analysis tool. Packages are available for accurately measuring and monitoring one or more of the following: temperature; light intensity; sound intensity; frequency; pH; resistance; voltage; amperage; heart rate; respiration rate; wind speed; and others. This report: (1) provides an overview of science interfacing packages; (2) discusses how they are used in classrooms; (3) briefly considers related instructional issues; (4) lists available products, noting hardware requirements, grade level(s), and connection (circuit board or game paddles); (5) provides an evaluation summary for 16 packages; and (6) provides either a detailed description or a description and evaluation of 29 packages under these headings: temperature interfaces; light and timer interfaces; sound interfaces; health interfacing; multi-drive systems; and others. Information provided includes: title; cost; producer; hardware/software needed; grade level(s); required background of user; package components; system functions and data analysis features; and others. List of producers and information for building interface systems are provided in appendices. (JN)

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COMPUTER LAB TOOLS FOR SCIENCE:
An Analysis of Commercially Available Science Interfacing Software for Microcomputers.

microSIFT

A Quarterly Report

March 1986

Dave Weaver
Technology Program
Northwest Regional Educational Laboratory
300 S.W. 6th Avenue
Portland, Oregon 97204
503/248-6800

Northwest Regional Educational Laboratory

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TABLE OF CONTENTS

1. What are Science Interfacing Packages?

Scientists, engineers and medical laboratory technicians have been using computers as a tool for acquiring, storing, manipulating and analyzing data since the first computers were invented. Sparked by the proliferation of microcomputers in schools and the availability of low cost science laboratory applications software and hardware, the potential of the computer as a laboratory tool is being realized by science teachers across the nation.

These science laboratory applications have become known by several names: microcomputer-based laboratories (MBLs), science interfacing packages, and even probeware. They generally consist of a set of programs on disk, a user's manual and additional hardware which includes one or more sensory devices. These together with a microcomputer combine to make a powerful data acquisition and analysis tool. Products are available for accurately measuring and monitoring one or more of the following: temperature, time, light intensity, sound intensity, frequency, pH, EMF, resistance, voltage, amperage, heart rate, respiration rate, GSR, EMG, pressure, wind speed, humidity, and many others.

The software typically enables the computer to collect data over a designated period of time at one or more sensors, store the data on the disk, display or print the data in a variety of graph and tabular formats, sometimes perform statistical calculations and calibrate the sensory devices.

There are two different ways the sensors can be connected to the computer. One way is to use the game paddle connection which is available on most microcomputers. The game paddle converts a measurement of resistance to a numeric value. By connecting a device which converts sensor input such as temperature or light intensity to resistance, the computer can be programmed to read the resistance at the game paddle and convert the reading back to the appropriate measurement (temperature, light intensity, etc.). The other common method involves additional circuitry which enables the computer to convert inputs other than resistance (generally voltage) into a numeric value. The principle is basically the same as with the game paddle connection but uses a different input. The software reads the input and converts to the appropriate units.

Those packages using the game paddle connection tend to be considerably less expensive than those requiring additional circuitry. On the other hand, using the game paddle connection limits the software developer to the type of signal to be read (resistance only), and the number of readings per second. In cases where the game paddle port is connected to other devices, particularly voltage, there is a chance that an inappropriate input could cause damage to the host computer. The additional circuitry is more expensive but provides capabilities not possible using the game paddle connection. The additional circuitry enables the computer to read a wide variety of input at a rate hundreds of times faster. These boards can also provide protection against inappropriate input which could cause damage to the host computer.

Generally, the packages come completely assembled ready to install into your computer. However, in order to reduce costs to the end user, several producers make the software and manual available without the additional hardware devices. The manuals contain detailed instructions for building your own devices either from components purchased at an electronics store or using low-cost kits provided separately by the producer. In addition to reducing the cost of the interfacing package, building your own provides an excellent learning opportunity for both the teacher and the student.

For teachers with programming skills and some knowledge of electronics, it is possible to program and build your own interfacing system. Several organizations support workshops in which the participants learn to build their own interfacing devices as well as write the programs to monitor the sensory devices. In many cases public domain routines are provided. Appendix C contains the contact information for several such organizations.

For the purposes of this report, only commercially available products were included. Public domain software which required the construction of your own hardware was omitted.

2. How They are Used in the Classroom

Although most schools have microcomputers, their presence in the science classroom is not widespread. This is particularly true at the elementary and junior high school levels. At best, the science teacher may have access to one computer which is shared with several other teachers. In cases where multiple machines are available, multiple sets of interfacing packages for use on each machine are seldom found. This limited access greatly restricts the types of uses science interfacing packages are currently receiving.

The most common use of interfacing packages is the teacher-directed class demonstration. This requires the use of a large screen monitor which enables a classroom of students to see the computer screen. The teacher performs the experiment and operates the computer while the students observe the results. This "electronic blackboard" approach enables the teacher to effectively take advantage of the computer's ability to automate the data gathering and graphing process while directing a class discussion about the meaning of the results.

The designated lab station is another use of the science interfacing packages which is commonly found. In this case the interfacing package and the computer is one of several lab stations. Each station involves different activities which either focus on a central topic or are sequenced to lead the students toward some objective. Students rotate from station to station performing the designated task at each.

The lab interfacing system can also be used as a central data collection point for the data generated at several lab stations all doing the same experiment. The students do most of the work away from the computer and come to the computer only when they are ready to have the computer make a measurement or to enter their results. In this way the computer can be used to analyze the results of a number of repetitions of the same experiment performed during one class or during several class periods.

Outside the science laboratory these packages are useful for providing an environment where students can explore various concepts of science while being actively involved in the processes of science. These packages are particularly useful at the elementary level with small groups of students working separately on some assigned task or exploration.

3. A Discussion of the Related Issues

Student use of science interfacing packages is not universally endorsed without some reservation. These packages are laboratory tools which automate various aspects of the laboratory procedures. They were never intended to replace the functions which they automate. Students must still acquire the data gathering and analysis skills in order to fully understand the processes automated by the laboratory interfacing package.

To the teacher, the issue is a matter of determining the most appropriate time to introduce the use of lab interfacing packages. The consensus seems to be that the students should perform the process manually at least once. When the students thoroughly understand the process, the interfacing package can then be used to automate portions of it allowing more time for analysis of the data and a discussion of the meaning of the results.

Another issue influencing the use of science interfacing packages is the preferred teaching methodology. Science interfacing packages are best used in a discovery learning environment where small groups of students work together at various directed activities. This often involves noise and movement about the room. Lab oriented teachers who are comfortable in this environment are more likely to utilize interfacing packages as they were intended.

4. List of Available Products

The table below gives a list of the commercially available products which were identified at the time of this report. The contact information for each producer may be found in Appendix B.

KEY:			
	HARDWARE:	AP	Apple
		AT	Atari
		CO	Commodore
		IB	IBM
		RS	Radio Shack TRS-80
	LEVEL:	E	Grades 4-6
		M	Grades 7-9
		H	Grades 10-12
	CONNECTION:	G	Game Paddle
		B	Circuit Board

PRODUCT LIST

TITLE	PRODUCER	COST	HARDWARE	LEVEL	CONNECTION
ALAB	Interactive	1760.00	IB AP	H	B
Atari Lab	Creative	99.95	AT	EMH	G
Bank Street Laboratory	Holt	350.00	AP	EM	B
Biofeedback Microlab	HRM	350.00	AP CO	H	B
Cardiovascular Fitness	HRM	75.00	AP CO IB	EMH	B
CHAMP Interfacing Ser.	Merlan	Varies	CO	H	B
Chempac	E&L Inst.	2200.00	CO	H	B
CompTrol Lab: Mechanics	EduTech	275.00	AP	H	G
CompTrol Lab: Temperatu	EduTech	195.00	AP	H	G
Exp.In Chemistry	HRM	349.00	AP IB	H	G
Exp.In Human Physiology	HRM	259.00	AP IB	MH	G
Exp.In Science	HRM	259.00	AP IB	MH	G
Experiment Interface	CDL	1728.70	AP RS AT	H	B
Frequency Meter	Vernier	39.95	AP	H	G
FutureLab	FutureMind	300.00	AP	H	B
LEAP Advanced System	Quantum	1275.00	AP	H	B
LEAP Standard System	Quantum	895.00	AP	H	B
Light Lab	Creative	49.95	AP CO	EM	G
Physics Lab: Heat	Cross	60.00	AP	H	G
Physics Lab: Light	Cross	60.00	AP	H	G
Physics Lab: Sound	Cross	60.00	AP	H	G
Precision Timer II	Vernier	39.95	AP CO	H	G
Sci-Lab	Narco	3195.00	AP	H	B
Science Toolkit	Broderbund	59.95	AP	EMH	G
Temperature Experiments	Hartley	69.95	AP	EM	G
Temperature Grapher	HRM	79.00	AP	MH	G
Temperature Interface	EME	98.00	AP	EMh	G
Temperature Lab	Hayden	99.95	AP CO	EM	G
Temperature Plotter	Vernier	39.95	AP	MH	G
Voltage Plotter	Vernier	39.95	AP	H	G

The table below briefly identifies the measurement capabilities of each software package listed in the table above.

KEY:

A	Amperage
C	Calorimeter
EKG	Electrocardiograph
EMF	Electromagnetic Force
EMG	Muscle Tension
GSR	Galvanic Skin Response
HR	Heart Rate
pH	pH
Pre	Pressure
R	Resistance
V	Voltage

PRODUCT CAPABILITIES

TITLE	PRODUCER	TEMP	TIME	LIGHT	FREQ	SOUND	OTHERS
ADALAB	Interactive						V
Atari Lab	Atari	Y					
Bank Street Laboratory	Holt	Y		Y	Y	Y	
Biofeedback Microlab	HRM	Y		Y			EMG GSR HR
Cardiovascular Fitness	HRM						HR
CHAMP Interface Ser.	Merlan	Y	Y	Y	Y	Y	See Description
Chempac	E&L Inst.	Y		Y			C EMF pH Pre
CompTrol Lab: Mechanic	EduTech		Y				
CompTrol Lab: Temperat	EduTech	Y					
Exp.In Chemistry	HRM	Y					pH
Exp.In Human Physiolog	HRM	Y	Y	Y			HR
Exp.In Science	HRM	Y		Y			
Experiment Interface	CDL	Y	Y	Y			V pH
Frequency Meter	Vernier				Y		
FutureLab	FutureMind				Y	Y	
LEAP Advanced System	Quantum	Y	Y	Y			V A R
LEAP Standard System	Quantum	Y	Y				V A R
Light Lab	Hayden		Y	Y			
Physics Lab: Heat	Cross	Y					
Physics Lab: Light	Cross		Y	Y			
Physics Lab: Sound	Cross				Y	Y	
Precision Timer II	Vernier		Y				
Sci-Lab	Narco	Y	Y	Y			pH EKG EMF
Science Toolkit	Broderbund	Y	Y	Y			
Temperature Experiment	Hartley	Y					
Temperature Grapher	HRM	Y					
Temperature Interface	EME	Y					
Temperature Lab	Hayden	Y					
Temperature Plotter	Vernier	Y					
Voltage Plotter	Vernier						V

5. Summary of Analysis Results

Of the thirty science interfacing packages identified in this project, sixteen were evaluated. The table below gives a summary of the results. We encourage the reader to consult the complete evaluation report in the following chapter for all products of interest. Each package was rated on a scale from 1 (low) to 5 (high) in each of the following categories: hardware provided with the package (HRD), supplementary printed materials (PRI), suggested experiments (EXP), data displays and analysis features (DIS), and ease of use and technical characteristics (GEN). Copies of the forms used to evaluate these packages can be found in Appendix A. These forms may be reproduced for your own use.

The overall package rating is the average of these five categories. Packages meeting the evaluation criteria were given a rating of 3. A rating of 5 is only given for exemplary applications. It is important to note that the highest rated package in this report is not necessarily the most appropriate package for your use. First, not all packages identified were evaluated, and secondly, each packages contains features making it very useful in a particular classroom situation. We recommend previewing any package prior to purchase whenever possible.

EVALUATION SUMMARY

TITLE	PRODUCER	COST	HRD	PRI	EXP	DIS	GEN	OVERALL
CompTrol Lab: Temperat	EduTech	195.00	4	2	1	2	2	2.2
Physics Lab: Heat	Cross	60.00	3	2	2	2	1	2.0
Temperature Experiment	Hartley	69.95	3	3	2	2	4	2.8
Temperature Interface	EME	98.00	3	2	4	4	4	3.4
Temperature Grapher	HRM	79.00	4	3	2	2	3	2.8
Temperature Plotter	Vernier	59.95	4	3	2	4	3	3.2
CompTrol Lab: Mechanic	EduTech	275.00	3	2	3	3	2	2.6
Physics Lab: Light	Cross	60.00	3	3	3	3	3	3.0
Precision Timer II	Vernier	39.95	3	4	2	4	3	3.2
Frequency Meter	Vernier	39.95	4	4	2	4	3	3.4
Physics Lab: Sound	Cross	60.00	2	1	1	1	2	1.4
Cardiovascular Fitness	HRM	175.00	3	3	2	5	3	3.2
Exp.In Human Physiolog	HRM	259.00	2	3	4	3	3	3.0
Bank Street Laboratory	Holt	350.00	4	3	3	5	4	3.8
Exp.In Science	HRM	259.00	3	4	4	2	2	3.0
LEAP Standard System	Quantum	895.00	4	4	4	4	2	3.6
AVERAGE:			3.3	2.9	2.6	3.2	2.8	2.9

Several general observations can be made regarding the state of science interfacing packages.

- The producers tend to concentrate on the development of the hardware and the software. The printed materials and suggested experiments were consistently rated lower than the hardware and data displays.

- The suggested experiments are generally the weakest portion of these packages. A general criticism of almost all packages is the lack of enough classroom applications. In many cases this is by design. These packages are intended to be tools. In discussions with the developers of these packages, many feel that it is up to the user to define how the tool is used.

- The packages are designed for use on a single machine. At this point, only the packages which come in kit form can easily be expanded to multiple machine usage. None of the already assembled systems has a lab pack option which included enough equipment and disks for use on several systems.

- A major factor determining the cost of a package is whether it connects to the computer through the game paddle port or requires additional circuit bourds. Those using the game paddle connector are considerably less expensive. However, the tradeoffs are in flexibility, accuracy and the degree to which the host computer is protected from damage by inappropriate input.

- The cost vs instructional benefit was a very difficult criterion to judge. There is almost no consistency or consensus among reviewers on this point, reinforcing the importance of teachers previewing software prior to purchase.

6. Descriptions and Evaluations of Individual Products

The following pages contain either a detailed description or a description and an evaluation of each package identified. Evaluations were performed on those packages MicroSIFT was able to obtain from the producer. Therefore, the information given in the evaluation reports is based on first-hand experience with the package. The descriptive reports are based on the information provided by the producer.

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: CompTrol Lab: Temperature

PRODUCER: EduTech
Dept. C
P.O. Box 1715
303 Lamartine St.
Jamaica Plain, MA 02130
617/524-1774

COST: $195.00

REQUIRED HARDWARE: Apple II+ or IIe, one disk drive, monitor, printer with graphics interface.
REQUIRED SOFTWARE: DOS 3.3, Applesoft
BACK-UP POLICY: Back-up is provided

GRADE LEVEL: 9 through postsecondary
PACKAGE OBJECTIVES: To provide a means for accurately measuring temperature and plot temperature against time.

REQUIRED BACKGROUND OF USER: The student should have an understanding of the concept of temperature and be familiar with the processes of measuring temperature and constructing a graph of temperature against time.

PACKAGE COMPONENTS: Additional hardware provided with the package includes an interface box for easy connection of devices to the Apple game paddle port and two temperature probes.

The software includes one disk and a back-up disk. The disk contains programs for measuring temperatures at a maximum of three probes and plotting the results on a graph of temperature against time, calibrating the probes, and reviewing the data collected. The data can be stored on a disk and/or printed on the printer (if a graphics interface is used).

The printed materials provided include a 16-page CompTrol Lab Manual. Information provided in the print materials--program operating instructions, technical information about the temperature probes, instructions for installing the interface box and sample program output.

SYSTEM FUNCTIONS and DATA ANALYSIS FEATURES: All temperatures are measured in Celsius. The user selects the temperature range from a minimum of -20 to a maximum of 120 degrees Celsius, the time duration of the measurements from 1 to 1000 minutes, and the number of temperature probes used. The data collected is immediately displayed on a graph of time vs. temperature. The data can also be displayed or printed in tabular form. This table divides the given time period into forty equal intervals and displays the temperature of each probe at each time interval.

SUGGESTED EXPERIMENTS: None provided

SCIENCE INTERFACING COURSEWARE EVALUATION

SA	A	D	SD	NA	
	●				Additional hardware is easy to install.
	●				Calibration of the sensory devices is easily accomplished.
	●				External devices are durable.
	●				Sensory devices are accurate and sensitive enough for classroom use.
●					External devices are easy to use.
	●				The hardware is reliable in normal use.
		●			Print materials are comprehensive.
		●			Print materials are effective.

SA	A	D	SD	NA	
			●		Package includes an appropriate range of suggested experiments.
				●	Objectives of the suggested experiments are clearly stated.
				●	Experiments achieve the intended objectives.
		●			Data displays are effective.
	●				Data displays are flexible.
				●	Data analysis information is useful.
	●				Intended user can easily employ the package.
		●			Cost of the package is reasonable compared to its instructional value.

KEY: SA – Strongly Agree A – Agree D – Disagree SD – Strongly Disagree NA – Not Applicable

COMMENTS SUPPORTING THE ABOVE:

- The package includes an interface box which can be connected to the game paddle port inside of the computer. The temperature probes plug into the interface box to simplify setup.
- There have been some minor changes to the program and not to the documentation. The document does not correlate exactly with the program but doesn't present any major problems.
- There are no suggested experiments provided.
- There is a key provided but it is still difficult to determine which line on the graph corresponds to which temperature probe. This is especially true if the temperature is rapidly changing.
- If a color monitor is used, the color must be turned off to make the text on the graphic screen readable.
- The package begins monitoring the temperature probes within a few seconds after the initial graphing parameters have been entered. Once the monitoring has begun, the user cannot stop and restart the monitoring process. The data must be collected in one uninterrupted session.
- The program has good error trapping. For example, if you indicate you wish to monitor two temperature probes and only one is connected to the interface box, a corrective message appears on the screen.
- The package requires a special graphics interface in order to print the graphic displays.

POTENTIAL USES: This package is appropriate for use in any science class in which temperatures are measured. It would make an excellent teacher directed demonstration if used with a large screen monitor. It could also be used by small groups of students in a lab setting.

EVALUATION SUMMARY: Rating scale from 1 (low) to 5 (high)

Hardware Components - 4
Print Materials - 2
Suggested Experiments - 1
Data Displays & Analysis - 2
General/Technical - 2
Overall - 2.2

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: Physics Lab: Heat

PRODUCER: Cross Educational Software
1802 N. Trenton Street
P.O. Box 1536
Ruston, LA 71270

COST: $60.00

REQUIRED HARDWARE: 48k Apple II plus or IIe, one disk drive and monitor. A printer and graphics interface is optional. Tools and supplies for assembling the interface device: soldering iron, solder, wire cutters, wire strippers, silicone sealer.
REQUIRED SOFTWARE: Applesoft, DOS 3.3

GRADE LEVEL: 9 through postsecondary
PACKAGE OBJECTIVES: To provide a means whereby the Apple computer can be used to measure temperature and plot a graph of temperature against time.

REQUIRED BACKGROUND OF USER: The teacher should be able to assemble the thermistor from the kit provided. The teacher should also have some knowledge of BASIC programming in order to enable graphs to be saved to the disk and/or printed on the printer. The student should have an understanding of the concept of temperature and be familiar with the processes of measuring temperature and constructing a graph of temperature against time.

PACKAGE COMPONENTS: The additional hardware provided with the package is a kit for assembling a thermistor for connection to the Apple game paddle socket. This kit includes: four thermistors (thermal resistors), a cable, and a plug for the game paddle.

The software includes one disk with programs for calibrating the thermistors for continuously displaying the absolute temperature at each of four thermistors, and for graphing temperature against time.

The 16 pages of printed materials include instructions for assembling and calibrating the thermistors, program operating instructions, suggested lab experiments, and a listing of the program code in BASIC.

SYSTEM FUNCTIONS and DATA ANALYSIS FEATURES: All temperatures are given in Celsius with a precision of .1 after calibration. In the graph of temperature versus time, the user selects the number of temperature probes to be monitored, maximum and minimum temperatures displayed and the number of seconds between readings (from 1 to 1000 seconds). The maximum and minimum temperatures allowable are limited only by the thermistor's ability to withstand extreme heat and cold.

SUGGESTED EXPERIMENTS: The manual outlines a thermal radiation experiment to measure the Stefan-Boltzmann constant. The manual also suggests experiments in cooling curve, specific heat, relative humidity, and solar heat gain.

EVALUATION REPORT

SCIENCE INTERFACING COURSEWARE EVALUATION

SA	A	D	SD	NA	
		●			Additional hardware is easy to install.
	●				Calibration of the sensory devices is easily accomplished.
				●	External devices are durable.
		●			Sensory devices are accurate and sensitive enough for classroom use.
	●				External devices are easy to use.
				●	The hardware is reliable in normal use.
		●			Print materials are comprehensive.
	●				Print materials are effective.

SA	A	D	SD	NA	
		●			Package includes an appropriate range of suggested experiments.
		●			Objectives of the suggested experiments are clearly stated.
	●				Experiments achieve the intended objectives.
	●				Data displays are effective.
		●			Data displays are flexible.
				●	Data analysis information is useful.
		●			Intended user can easily employ the package.
		●			Cost of the package is reasonable compared to its instructional value.

KEY: SA–Strongly Agree A–Agree D–Disagree SD–Strongly Disagree NA–Not Applicable

COMMENTS SUPPORTING THE ABOVE:

- The teacher building the kit must be careful not to coat the thermistors with too much or too little silicone sealer. Too much decreased the sensitivity of the probes and too little allowed liquids to destroy the thermistors.
- The package needs many more suggested experiments.
- When the program is plotting the temperature against time and the graph has reached the end of the screen, the program exits to the Applesoft basic prompt. The user must then enter the BASIC commands to restart the program, save the graph to disk or screen dump to printer (only if a graphics interface is used). The program does not contain any routines for performing these functions.
- The program does not have the capability to display a table of the data collected, pause during the collection of the data or to merge data from one experiment with another.
- The program is not well error-trapped. The program will crash if incorrect parameters are entered.

POTENTIAL USES: This package would be useful as a teacher-directed demonstration in a physics class or any other class which involves the constant monitoring of temperature over time. Because the program is not user friendly, it would not be appropriate for student use unless the student is familiar with Applesoft BASIC.

ESTIMATED STUDENT TIME REQUIRED FOR SUGGESTED EXPERIMENTS: Varies

EVALUATION SUMMARY: Rating scale from 1 (low) to 5 (high)

Hardware Components - 3
Print Materials - 2
Suggested Experiments - 2
Data Displays & Analysis - 2
General/Technical - 1
Overall - 2.0

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: Temperature Experiments

PRODUCER: Hartley Courseware, Inc.
Dimondale, MI 48821
800-247-1380

COST: $69.95

REQUIRED HARDWARE: 48k Apple II plus, IIe or IIc, one disk drive and monitor.
REQUIRED SOFTWARE: DOS 3.3 and Applesoft
BACK-UP POLICY: Backup disk provided.
PREVIEW POLICY: 30-day preview to school systems upon written request.

GRADE LEVEL: 2 through 8
PACKAGE OBJECTIVES: To provide a tool for monitoring temperature with the Apple computer. To actively involve students in research. To foster interest in science.

REQUIRED BACKGROUND OF USER: The student should have an understanding of the concept of temperature and the process of measuring temperature.

PACKAGE COMPONENTS: Additional hardware provided with the package includes two thermistors connected by a cable to a jack which can plug into the Apple game paddle socket.

The software includes one disk with programs for measuring the absolute temperature at one or two temperature probes and for plotting a real time graph of temperature against time. Options are also available for saving and recalling data on the disk.

The disk also contains a program which gives the student ten multiple choice questions which require the reading of a thermometer. Two levels of difficulty are available. The program provides corrective feedback when a wrong answer is given.

The 24-page user's manual includes program objectives, setup instructions, program operation instructions, sample program output and suggested program usage.

SYSTEM FUNCTIONS and DATA ANALYSIS FEATURES: Temperatures can be measured in either degrees Fahrenheit or Celsius within a range from -40 to 115 degrees Celsius. When measuring the absolute temperature the program displays an animated thermometer indicating the current temperature at each probe as well as a digital readout. The real time graphing program allows the user to select the maximum and minimum temperature expected and choose the duration of the experiment from 2 min., 10 min., 1 hr., 10 hrs., and 72 hrs. If two graphs are stored on the disk each using one temperature probe, it is possible to superimpose one over the other.

SUGGESTED EXPERIMENTS: There is a list of seven elementary and three junior high school ideas outlined for the teacher which describes how the package could be used.

EVALUATION REPORT

SCIENCE INTERFACING COURSEWARE EVALUATION

SA	A	D	SD	NA	
●					Additional hardware is easy to install.
	●				Calibration of the sensory devices is easily accomplished.
	●				External devices are durable.
	●				Sensory devices are accurate and sensitive enough for classroom use.
	●				External devices are easy to use.
	●				The hardware is reliable in normal use.
		●			Print materials are comprehensive.
	●				Print materials are effective.

SA	A	D	SD	NA	
		●			Package includes an appropriate range of suggested experiments.
		●			Objectives of the suggested experiments are clearly stated.
				●	Experiments achieve the intended objectives.
	●				Data displays are effective.
		●			Data displays are flexible.
				●	Data analysis information is useful.
	●				Intended user can easily employ the package.
	●				Cost of the package is reasonable compared to its instructional value.

KEY: SA – Strongly Agree A – Agree D – Disagree SD – Strongly Disagree NA – Not Applicable

COMMENTS SUPPORTING THE ABOVE:

- The optional information of experimenter's name, date, time, title and description of experiment is a nice feature. It makes it easy for a student to do an experiment and then turn in their work.
- The screen displays are attractive and are easy to read.
- The package does not provide any student-ready activities. The ideas for use are very good ones but the teacher must develop the support materials to make it work in the classroom.
- The package is limited in the number of ways the data can be portrayed. It is not possible to examine or edit a table of the data.
- The practice program makes a nice introduction to reading a thermometer.
- The software supports a wide variety of printers and printer interface cards.
- It is possible to have the scale of one thermometer be fahrenheit and the other cecsius. This enables students to explore the relationship between the two scales.

POTENTIAL USES: This package can be used as part of the regular elementary science curriculum to teach the concept of temperature and reading a thermometer. It can be used as a teacher directed demonstration or by small groups of students in a lab setting. Special education students could also benefit.

ESTIMATED STUDENT TIME REQUIRED FOR SUGGESTED EXPERIMENTS: Varies.

EVALUATION SUMMARY: Rating scale from 1 (low) to 5 (high)

- Hardware Components - 3
- Print Materials - 3
- Suggested Experiments - 2
- Data Displays & Analysis - 2
- General/Technical - 4
- Overall - 2.8

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: Temperature Interface

PRODUCER: Educational Materials and Equipment
P.O. Box 17
Pelham, NY 10803

COST: $98.00

REQUIRED HARDWARE: Apple II+ or IIe, one disk drive, monitor, printer
REQUIRED SOFTWARE: Applesoft, DOS 3.3
BACK-UP POLICY: Back-up disk included
PREVIEW POLICY: 14-day preview available upon written request

GRADE LEVEL: 4 through postsecondary
PACKAGE OBJECTIVES: To provide a means whereby the Apple computer can be used to measure temperature and plot a graph of temperature against time. The manual indicates the objectives to help the student to: recognize the capabilities of the computer as a laboratory tool, set up an automatic procedure to acquire and store experimental data, and improve data interpretation and graphing skills.

REQUIRED BACKGROUND OF USER: The student should have an understanding of the concept of temperature and be familiar with the processes of measuring temperature and constructing a graph of temperature against time.

PACKAGE COMPONENTS: Additional hardware provided with the package includes two temperature probes and cables for connecting the probes to the Apple game paddle port.

The software includes one disk and a back-up disk. The disk contains programs for calibrating the temperature probes of monitoring the temperature at one or two temperature probes.

The printed materials provided include a five-page instruction sheet which gives an overview, package objectives, hardware installation instructions, program operating instructions, and suggested activities.

SYSTEM FUNCTION and DATA ANALYSIS FEATURES: All temperatures are measured in degrees Celsius and are accurate to the nearest tenth of a degree after calibration. Prior to the acquisition of the data, the user may select the time interval between readings from 1 to 600 seconds. During the acquisition of data, the program builds and displays a data table which gives the time and the temperature at one or both probes. After the data has been collected the user may review, print or save the data table on the disk. The data table can be displayed as a graph of temperature vs. time. In this mode the user may select time interval to be displayed and the temperature range from a minimum of -10 degrees to a maximum of 110 degrees Celsius. A data analysis option gives the time and temperature of the maximum and minimum readings, the average temperature and the standard deviation. Options are also available to load previously saved data sets and cataloging the disk.

SUGGESTED ACTIVITIES: The manual gives a short one-paragraph description of the following activities: response time, "hot ears," friction, weather temperature, greenhouse effect, and evaporation.

EVALUATION REPORT

SCIENCE INTERFACING COURSEWARE EVALUATION

SA	A	D	SD	NA	
	●				Additional hardware is easy to install.
	●				Calibration of the sensory devices is easily accomplished.
●					External devices are durable.
	●				Sensory devices are accurate and sensitive enough for classroom use.
	●				External devices are easy to use.
	●				The hardware is reliable in normal use.
		●			Print materials are comprehensive.
	●				Print materials are effective.

SA	A	D	SD	NA	
		●			Package includes an appropriate range of suggested experiments.
			●		Objectives of the suggested experiments are clearly stated.
		●			Experiments achieve the intended objectives.
	●				Data displays are effective.
	●				Data displays are flexible.
●					Data analysis information is useful.
●					Intended user can easily employ the package.
	●				Cost of the package is reasonable compared to its instructional value.

KEY: SA–Strongly Agree A–Agree D–Disagree SD–Strongly Disagree NA–Not Applicable

COMMENTS SUPPORTING THE ABOVE:

- The temperature probes are protected by a shroud making them less subject to breakdown than others. However, the shroud makes the probes slower to respond to changes in temperature. When one probe was heated in hot water and the other cooled in cold water, it took between a minute to a minute and a half for their temperature to stabilize when placed in the same container of water at room temperature. The response time can be increased by sliding the shroud along the shaft exposing the thermistor. Because of the way the probes are designed, they are most appropriate for measuring the temperature of liquids.

- The print materials are minimal. The suggested activities mostly describe activities which can be done better using a thermometer. They do not take advantage of the system's capability to analyze changes of temperature over time.

- The screen displays are attractive and easy to read. The program makes good use of color to indicate the temperature of the two different probes when plotting the graph of temperature against time.

- A special graphics interface card must be used to print the graphs.

- When the program displays the files which have been saved on the disk, it gives the Apple DOS catalog which includes the system programs. The student needs to know that the experimental data files are the text indicated by the letter 'T.'

POTENTIAL USES: Judging by the tone of the suggested activities, this package is intended for use with upper elementary through high school science classes. This package would be useful as a teacher directed demonstration in any class which involves the constant monitoring of temperature over time.

ESTIMATED STUDENT TIME REQUIRED FOR SUGGESTED EXPERIMENTS: Varies

EVALUATION SUMMARY: Rating scale from 1 (low) to 5 (high)

Hardware Components - 3
Print Materials - 2
Suggested Experiments - 4
Data Displays & Analysis - 4
General/Technical - 4
Overall - 3.4

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: Temperature Grapher

PRODUCER: HRM Software
175 Tompkins Avenue
Pleasantville, NY 10570
914/769-7496
800/431-2050

COST: $79.00

REQUIRED HARDWARE: 48k Apple II plus or IIe, or IIc (with game paddle adapter), one disk drive, monitor.
REQUIRED SOFTWARE: DOS 3.3 and Applesoft
BACK-UP POLICY: Make your own back-up
PREVIEW POLICY: Demonstration disks available for free 30-day preview.

GRADE LEVEL: 7 through postsecondary
PACKAGE OBJECTIVES: To provide teachers and students with: (1) a laboratory tool that displays temperature in real time on the computer, (2) a flexible computer program that facilitates maximum use in the laboratory, and (3) an introduction to the wide uses of computers in scientific instrumentation.

REQUIRED BACKGROUND OF USER: The student should have an understanding of the concept of temperature and be familiar with the processes of measuring temperature and constructing a graph of temperature against time.

PACKAGE COMPONENTS: Additional hardware provided with the package includes two temperature probes and a cable for connecting the probes to the Apple game paddle port.

The software includes one disk with programs for measuring temperatures at one or two probes and displaying the results in the form of a graph of temperature vs. time. The software also includes a program for calibrating the probes.

The 60-page manual includes suggested grade and ability level, instructions for installing the probes, program operating instructions, teacher's information, suggested lab experiments, resource and reference information, and programming notes.

SYSTEM FUNCTIONS and DATA ANALYSIS FEATURES: All temperatures are measured in degrees Celsius. The user may select the temperature range which appears on the graph from -10 to 110 degrees Celsius (intervals of 5 degrees). The user may select the time duration to be 2, 4, 8, 16 or 32 minutes. A continuous function plot is available so that when the graph reaches the right side of the screen, the screen is erased and a new graph begins. Options are available for plotting a reference arrow on the Y axis at any time, temporarily stopping and restarting the graph, and displaying the temperature at each probe on the screen. The graphs can be displayed with or without scales or labels. Help screens are available from each menu.

SUGGESTED EXPERIMENTS: Exploration of heat flow, thermal conductivity measurements, studies of evaporation, state changes and energy, heat capacity measurements, and insulation measurements.

EVALUATION REPORT

SCIENCE INTERFACING COURSEWARE EVALUATION

SA	A	D	SD	NA	
	●				Additional hardware is easy to install.
	●				Calibration of the sensory devices is easily accomplished.
	●				External devices are durable.
●					Sensory devices are accurate and sensitive enough for classroom use.
	●				External devices are easy to use.
	●				The hardware is reliable in normal use.
	●				Print materials are comprehensive.
	●				Print materials are effective.

SA	A	D	SD	NA	
	●				Package includes an appropriate range of suggested experiments.
		●			Objectives of the suggested experiments are clearly stated.
	●				Experiments achieve the intended objectives.
		●			Data displays are effective.
	●				Data displays are flexible.
				●	Data analysis information is needed.
	●				Intended user can easily employ the package.
	●				Cost of the package is reasonable compared to its instructional value.

KEY: SA – Strongly Agree A – Agree D – Disagree SD – Strongly Disagree NA – Not Applicable

COMMENTS SUPPORTING THE ABOVE:

- The program lacks the ability to save, review or print the data set or to save or print the graphs. Graphs can be saved on the disk and loaded again manually using the Apple DOS and BASIC commands. The procedures for doing this are given in the manual.

- The calibration program cannot be accessed from any of the main program menus. The user must exit the Temperature Grapher program and enter calibration program using the Apple DOS commands. This is a minor inconvenience for the teacher but serves to keep the calibration routine secure from the students.

- When one temperature probe was heated in hot water and the other cooled in hot water and then immersed in water at room temperature, the probes reached equilibrum in around twelve seconds.

- The suggested experiments are not in student-ready form. They are general suggestions and descriptions to the teacher about how these experiments can be done and what students could learn. The producer indicates that lab manuals for both middle school and high school are curreently under development and will be available by May 1986.

- When two probes are used and the temperatures are relatively close, it is difficult to determine which graph corresponds to which probe. Some form of a key would be helpful.

- The label of the Y-axis is printed on the inside of the graph which clutters the first portion of the graph.

- The program is well error-trapped and easy to use. The help screens are a nice feature although they use all Apple text and seem cluttered.

POTENTIAL USES: This package would be useful as a teacher directed demonstration in any class which involves the constant monitoring of temperature over time. It would also be a very useful for students in a laboratory setting during a number of experiments in most all science classes (see suggested experiments).

ESTIMATED STUDENT TIME REQUIRED FOR SUGGESTED EXPERIMENTS: Varies

EVALUATION SUMMARY: Rating scale from 1 (low) to 5 (high)

Hardware Components - 4
Print Materials - 3
Suggested Experiments - 2
Data Displays & Analysis - 2
General/Technical - 3
Overall - 2.8

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: Temperature Lab/AtariLab: Starter System

PRODUCER: Creative Technologies Inc.
PO Box 1009
Carlisle, PA 17013
717/245-2988

ALSO AVAILABLE FROM: Hayden Book Company Warehouse
1 Chris Court
Dayton, NJ 08810
201/329-9150
(for Commodore and Apple versions)

Atari, Inc.
P.O. Box 3427
Sunnyvale, CA 94088
(for Atari version)

COST: $99.95
With Light Lab from Creative Teachnologies $135.00

REQUIRED HARDWARE: 64k Apple IIe or IIc, one disk drive, monitor. Commodore 64, one disk drive and monitor. Atari 800 or 800 XL, monitor, disk drive or printer is optional.
REQUIRED SOFTWARE: Apple: DOS 3.3 and Applesoft
BACK-UP POLICY: Make your own back-up disk
PREVIEW POLICY: 30-day preview upon written request from a school system.

GRADE LEVEL: 5 through 9
PACKAGE OBJECTIVES: To introduce proper laboratory procedures. To provide a tool for accurately measuring temeprature.

PACKAGE COMPONENTS: Additional hardware provided with the package includes aninterface box which connects to the game paddle port, one temperature probe and an alcohol bulb thermometer. Additional probes are available for $10.00.

The software includes one disk (ROM cartridge for Atari version) containing programs for measuring absolute temperature and monitoring temperatures over a designated time period. The temperature measurement programs display an animated thermometer whose level changes according to the temperature at the sensor. The graphing program displays a real time graph of temperature against time.

The printed materials included a 140-page manual which contains installation instructions, program operating instructions, an overview of proper experimental procedures, background information on temperature, suggested experiments, reproducible worksheets, programming notes and calibration instructions.

SYSTEM FUNCTIONS and DATA ANALYSIS FEATURES: Temperatures may be measured from -5 to 45 degrees Celsius. Duration of the experiment may range from 10 seconds to 24 hours.

SUGGESTED EXPERIMENTS: Evaporation-condensation and dewpoint, How temperatures change over time, How quickly can the sensors change temperature, Keeping your soda cold, Kitchen chemistry I - salt and ice, Kitchen chemistry II - soda and vinegar, and measuring daily changes in air temperature.

POTENTIAL USES: This package could be used as a teacher directed demonstration or with small groups of students at a lab station.

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: Temperature Plotter

PRODUCER: Vernier Software
2920 S.W. 89th Street
Portland, OR 97225
503/297-5317

COST: Software and manual: $39.95
2 probe system for Apple IIe or IIc, parts only: $20.00
assembled: $40.00
4 probe system for Apple II+ or IIe, parts only: $30.00
assembled: $60.00

REQUIRED HARDWARE: Apple II+ or IIe, one disk drive, and monitor. An Image writer printer or graphics printer with Grappler interface is optional. If you purchase the interface parts kit or purchase your own components, tools are needed for assembling the interfacing devices. This includes soldering iron, solder, wire cutters, and wire.
REQUIRED SOFTWARE: DOS 3.3, Applesoft
BACK UP POLICY: Make your own back-up
PREVIEW POLICY: Available for 30-day preview

GRADE LEVEL: 7 through postsecondary
PACKAGE OBJECTIVES: To provide an accurate, inexpensive method of monitoring temperature with the Apple II+, IIe or IIc computer.

REQUIRED BACKGROUND OF USER: The teacher should be able to assemble the temperature probes from the parts kit. The student should have an understanding of the concept of temperature and be familiar with the processes of measuring temperature and constructing a graph of temperature against time.

PACKAGE COMPONENTS: Temperature probes are available in kit form or already assembled. The assembled version includes a connector box which plugs into the Apple game paddle socket and 2 or 4 temperature probes. The kit contains most of the components necessary to build the probes except for wire and solder. The parts kits include a one-page set of instructions for assembling the probes.

The software includes a disk which contains programs for: calibration of the temperature probes, monitoring the temperatures for a maximum of four probes, displaying the absolute temperature in regular or large print, displaying, editing and printing data tables, saving or loading data files, plotting graph of data tables or in real time, and printing the graph.

The print materials provided include a 59-page user's guide which provides program operating instructions, teacher's information, sample program output, suggested experiments and demonstrations, program design notes and modifications, a table of variables used in the program and technical information on the temperature transducers.

SYSTEM FUNCTIONS and DATA ANALYSIS FEATURES: Temperatures can be measured in Celsius, Kelvin or Fahrenheit scales. Time can be measured in relative time or clock time using a software clock, Thunderclock or Mountain Hardware clock. Temperature probes can be used from -55 to 150 degrees Celsius. Prior to collecting the data, the user selects the length of time between readings and the total number of readings taken. The graph of temperature against time includes options for automatic scaling with variable or zero origin, or manual scaling. Graphs can be shown as dots at points or point to point line graphs. The scale of any graph can be changed and a new graph constructed of the same data using the new scale. The data analysis provides the mean, standard deviation, maximum and minimum temperatures for the data at each probe as well as the entire data set.

SUGGESTED EXPERIMENTS and DEMONSTRATIONS: Latent heat of fusion of ice, specific heat of metal, cooling curves and latent heat, specific heat of a liquid, rate of cooling, heat of reaction, radiant energy absorption, freezing of ice, electrical energy, flame efficiency, insulation properties, weather studies, and furnace studies.

EVALUATION REPORT

SCIENCE INTERFACING COURSEWARE EVALUATION

SA	A	D	SD	NA	
●		●			Additional hardware is easy to install.
	●				Calibration of the sensory devices is easily accomplished.
	●				External devices are durable.
	●				Sensory devices are accurate and sensitive enough for classroom use.
●					External devices are easy to use.
	●				The hardware is reliable in normal use.
	●				Print materials are comprehensive.
	●				Print materials are effective.

SA	A	D	SD	NA	
	●				Package includes an appropriate range of suggested experiments.
		●			Objectives of the suggested experiments are clearly stated.
	●				Experiments achieve the intended objectives.
	●				Data displays are effective.
●					Data displays are flexible.
●					Data analysis information is useful.
	●				Intended user can easily employ the package.
●					Cost of the package is reasonable compared to its instructional value.

KEY: SA – Strongly Agree A – Agree D – Disagree SD – Strongly Disagree NA – Not Applicable

COMMENTS SUPPORTING THE ABOVE:

- When one temperature probe was heated in hot water and the other cooled in cold water and then immersed in water at room temperature, the probes reached equilibrum in around thirty to forty seconds.
- The suggested experiments are not in student-ready form. They are general suggestions and descriptions to the teacher about how these experiments can be done and what students could learn.

- If the preassembled temperature probes are used, the initial set-up is very easy. The kit makes the initial set-up of the package considerably more difficult. Teachers have commented that assembling the kit is a good extra credit project for students.

- The text screens use all Apple text and appear cluttered.

- The ability to change scale and redraw the graph is a powerful feature.

- The package allows for a great deal of data manipulation.

POTENTIAL USES: This package would be useful as a teacher directed demonstration in any class which involves the constant monitoring of temperature over time. It would also be very useful for students in a laboratory setting during a number of experiments in most science classes (see suggested experiments).

ESTIMATED STUDENT TIME REQUIRED FOR SUGGESTED EXPERIMENTS: Approximately 30 to 50 minutes.

EVALUATION SUMMARY: Rating scale from 1 (low) to 5 (high)

Hardware Components - 4
Print Materials - 3
Suggested Experiments - 2
Data Displays & Analysis - 4
General/Technical - 3
Overall - 3.2

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: CompTrol Lab: Mechanics

PRODUCER: EduTech
Dept. C
P.O. Box 1715
303 Lamartine St.
Jamaica Plain, MA 02130
617/524-1774

COST: $275.00

REQUIRED HARDWARE: Apple II+ or IIe, one disk drive, monitor, printer with graphics interface (optional), and air track (optic al).
REQUIRED SOFTWARE: DOS 3.3, Applesoft
BACK-UP POLICY: Back-up is provided

GRADE LEVEL: 9 through postsecondary
PACKAGE OBJECTIVES: To provide a means for accurately measuring time in order to conduct acceleration, momentum and pendulum experiments. Specific instructional objectives are given with each suggested experiment.

REQUIRED BACKGROUND OF USER: The student shcuild be able to define velocity, acceleration, momentum, period, and amplitude. The student must have a good background in mathematics (algebra) to understand the calculations which are explained in the documentation.

PACKAGE COMPONENTS: Additional hardware provided with the package inlcudes an interface box for easy connection of devices to the Apple game paddle port, a Pasco Scientific photogate, an electric start gate, a transparent flag with ten evenly spaced black stripes and two transparent flags with two black strips.

The software includes two disks and two back-up disks. One disk, "Acceleration & Momentum," contains three programs: Aceleration 1 is used to measure acceleration and instantaneous velocities of the 10-stripe flag as it passes through the photogate. The data can be displayed as a graph of distance vs. time or velocity vs. time.

Acceleration 2 is used to measure the time it takes the two-stripe flag to traverse a given distance and the instantaneous velocity of the flag as it passes through the photogate. The data can be displayed as a graph of the distance vs. time, velocity vs. time, and velocity vs. distance.

Momentum is used to measure the velocity, kinetic energy, and momentum of one or two moving objects using the two striped flags and one or two photogates. The program can measure up to four separate events at a time.

The other disk, "Pendulum," contains a program which measures the period of a pendulum. Data can be collected for 5 to 50 swings of the pendulum. The program contains one mode for studying the relationship between the amplitude and period, and another mode for studying the relationship between the length and period.

The print materials provided include a 16-page CompTrol Lab Manual, a 23-page booklet containing pendulum experiments, and an 18-page booklet containing acceleration experiments. Information provided in the print materials--program operating instructions, technical information about the photogates, instructions for installing the interface box, suggested lab experiments, student record sheets, and sample program output.

SYSTEM FUNCTIONS and DATA ANALYSIS FEATURES: All distances must be measurements in centimeters. Timings are measured to the nearest ten-thousandth of a second. During the experiments, the programs construct a data table which can be stored on the disk, merged with other data on the disk or printed on the printer. Data sets can also be added to and deleted from the table. In the data analysis, the program automatically calculates the values of important variables, constructs a graph of the data, fits a curve or line to the points on the graph, and displays the error for the data.

SUGGESTED EXPERIMENTS: Free fall, constant acceleration, pendulum-period and amplitude, and pendulum-period and length.

EVALUATION REPORT

SCIENCE INTERFACING COURSEWARE EVALUATION

SA	A	D	SD	NA	
	●				Additional hardware is easy to install.
		●			Calibration of the sensory devices is easily accomplished.
	●				External devices are durable.
●					Sensory devices are accurate and sensitive enough for classroom use.
	●				External devices are easy to use.
	●				The hardware is reliable in normal use.
		●			Print materials are comprehensive.
	●				Print materials are effective.

SA	A	D	SD	NA	
		●			Package includes an appropriate range of suggested experiments.
●					Objectives of the suggested experiments are clearly stated.
	●				Experiments achieve the intended objectives.
	●				Data displays are effective.
	●				Data displays are flexible.
	●				Data analysis information is useful.
	●				Intended user can easily employ the package.
		●			Cost of the package is reasonable compared to its instructional value.

KEY: SA—Strongly Agree A—Agree D—Disagree SD—Strongly Disagree NA—Not Applicable

COMMENTS SUPPORTING THE ABOVE:

- When using the Acceleration 2 program, the use of the start gate was a bit difficult and required some practice.
- The instructions for calibrating the timer were inadequate and took several tries before successful completion.

- There should be more ready-made experiments provided. For example, there are no experiments provided which make use of the momentum program.

- If a color monitor is used, the color must be turned off to make the text on the graphic screen readable.

- If the interfacing devices are left connected to the computer, other software packages may not operate properly.

- The package requires a special graphics interface in order to print the graphic displays.

POTENTIAL USES: This package is appropriate for use in a physics or physical science class in a unit on motion. It would make an excellent teacher directed demonstration if used with a large screen monitor. It could also be used by small groups of students in a lab setting.

ESTIMATED STUDENT TIME REQUIRED FOR SUGGESTED EXPERIMENTS: Approximately 50 minutes each experiment.

EVALUATION SUMMARY: Rating scale from 1 (low) to 5 (high)

Hardware Components - 3
Print Materials - 2
Suggested Experiments - 3
Data Displays & Analysis - 3
General/Technical - 2
Overall - 2.6

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: Light Lab/AtariLab: Light Module

PRODUCER: Creative Technologies Inc.
PO Box 1009
Carlisle, PA 17013
717/245-2988

ALSO AVAILABLE FROM: Hayden Book Company Warehouse
1 Chris Court
Dayton, NJ 08810
201/329-9150
(for Commodore and Apple versions)

Atari, Inc.
P.O. Box 3427
Sunnyvale, CA 94088
(for Atari version)

COST: $49.95
With Temperature Lab from Creative Technologies $135.00

REQUIRED HARDWARE: 48k Apple II computer, one disk drive, monitor. Commodore 64, one disk drive and monitor. Interface box from Temperature lab required.
REQUIRED SOFTWARE: Apple: DOS 3.3 and Applesoft
BACK-UP POLICY: Make your own back-up
PREVIEW POLICY: 30-day preview upon written request from a school system.

GRADE LEVEL: 5 through 9
PACKAGE OBJECTIVES: To provide a laboratory tool for monitoring light intensity.

REQUIRED BACKGROUND OF USER: The student should have an understanding of the concept of light, light intensity and units of measurement of light intensity.

PACKAGE COMPONENTS: Additional hardware provided with the package includes a light sensor, light assembly and stand, light stick, red and blue filters, glow panel, and test tube.

The software includes 1 disk containing programs for data acquistion and analysis of light intensity data.

The printed materials include installation instructions, program operating instructions, objectives, suggested experiments and a glossary.

SYSTEM FUNCTIONS and DATA ANALYSIS FEATURES: Light intensities are measured in foot candles or relative light intensity depending upon the experiment. The user controls the duration of the experiment from 1/2 second to 44 hours. Options are available for saving the data to the disk, editing the data tables and comparing the results of successive experiments.

SUGGESTED EXPERIMENTS: Color experiment, light assembly, hot light, levels of light, laboratory light, calibration of sensors, response time to change in light, filters and how they let light through, light through different materials, direct light vs. reflected light, light spectrum, using light as a tool, glows, yeast growing, eclipse, and solar energy.

POTENTIAL USES: As a small group lab station at the upper elementary and junior high level. As a teacher directed demonstration.

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: Physics Lab: Light

PRODUCER: Cross Educational Software
1802 N. Trenton Street
P.O. Box 1536
Ruston, LA 71270

COST: $60.00

REQUIRED HARDWARE: 48k Apple II plus or IIe, one disk drive, monitor. Tools and supplies for assembling the interface device: soldering iron, solder, wire cutters, and wire strippers.
REQUIRED SOFTWARE: Applesoft, DOS 3.3

GRADE LEVEL: 9 through postsecondary
PACKAGE OBJECTIVES: To provide a means whereby the Apple computer can be used to measure light intensity and time intervals.

REQUIRED BACKGROUND OF USER: The teacher should be able to assemble the phototransistors from the kit provided. The teacher should also have some knowledge of BASIC programming in order to make full use of the programs. The student must have prior instruction on how to interpret the graph and calculate the time interval between events.

PACKAGE COMPONENTS: The additional hardware provided with the package is a kit for assembling a phototransistor for connection to the Apple game paddle socket. This kit includes: four phototransistors, twelve feet of four-conductor cable, a metric ruler, and a plug for the game paddle socket.

The software includes one disk with programs for measuring the relative light intensity with a maximum of four light sensors and for plotting the light intensity against time with up to four light sensors.

The 37 pages of printed materials provided includes instructions for assembling the phototransistors, program operating instructions, suggested lab experiments, technical data about the phototransistors, programmer's notes, and a listing of the program code in BASIC.

SYSTEM FUNCTIONS and DATA ANALYSIS FEATURES: In the graph of light intensity versus time, the user selects the number of light sensors and the duration of the time measurements. Timings are accurate to .001 of a second and may last from 5 to 50 seconds depending upon the number of sensors used. The results are displayed in the form of a multiple screen graph of light intensity against time which may be scrolled left or right. A vertical axis indicates the time which is displayed at the bottom of the screen. The axis may be moved left or right on the graph in order to measure the time at which a fluctuation in the light intensity occurred. Timings can be made by calculating the time interval between events.

The light intensity program continuously displays a number which corresponds to the intensity of light at each phototransistor connected.

SUGGESTED EXPERIMENTS: The manual outlines the following experiments which can be performed or demonstrated using the package: the acceleration of gravity, measuring gravity from the rate of change of velocity, period and amplitude of pendulum, light intensity versus distance, and efficiency of a light bulb.

EVALUATION REPORT

SCIENCE INTERFACING COURSEWARE EVALUATION

SA	A	D	SD	NA	
		●			Additional hardware is easy to install.
				●	Calibration of the sensory devices is easily accomplished.
				●	External devices are durable.
	●				Sensory devices are accurate and sensitive enough for classroom use.
	●				External devices are easy to use.
	●				The hardware is reliable in normal use.
	●				Print materials are comprehensive.
	●				Print materials are effective.

SA	A	D	SD	NA	
	●				Package includes an appropriate range of suggested experiments.
	●				Objectives of the suggested experiments are clearly stated.
	●				Experiments achieve the intended objectives.
	●				Data displays are effective.
●					Data displays are flexible.
				●	Data analysis information is useful.
	●				Intended user can easily employ the package.
	●				Cost of the package is reasonable compared to its instructional value.

KEY: SA – Strongly Agree A – Agree D – Disagree SD – Strongly Disagree NA – Not Applicable

COMMENTS SUPPORTING THE ABOVE:

- The package is extremely flexible and can be used for a number of different types of timing.
- The phototransistors are sensitive enough to record changes in light intensity which are very short in duration.
- The timings are limited in duration. With one phototransistor connected the maximum duration is around 20 seconds. With two phototransistors, the maximum is under 13 seconds.
- The light intensity must be fairly bright to produce the best timing results.
- The number which is displayed on the screen in the light intensity program changes constantly and is very difficult to read. The value which appears is the decimal fraction of the ration 1/x where x is an integer. As the light intensity increases the value which appears follows the sequence: ..., .125, .1428571, .16666667, .2, .25, .33333333, .5, and finally 1.
- The program ends with the Apple system prompt. The user must know the BASIC command to restart the system or restart the appropriate program.

POTENTIAL USES: This package would be most useful as a teacher directed demonstration in a physics class in conjunction with a unit on motion and/or light. Because it is not user friendly, it would be difficult to use with students unless they are familiar with Applesoft BASIC.

ESTIMATED STUDENT TIME REQUIRED FOR SUGGESTED EXPERIMENTS: Approximately 50 minutes each.

EVALUATION SUMMARY: Rating scale from 1 (low) to 5 (high)

Hardware Components - 3
Print Materials - 3
Suggested Experiments - 3
Data Displays & Analysis - 3
General/Technical - 3
Overall - 3.0

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: Precision Timer II

PRODUCER: Vernier Software
2920 S.W. 89th Street
Portland, OR 97225
503/297-5317

COST: Software and manual: $39.95

3 photogate system for Apple II+, IIe:	$40.00
2 photogate system for Apple IIc:	$35.00
3 photogate system for Commodore 64:	$30.00

REQUIRED HARDWARE: Apple II+ or IIe, one disk drive, and monitor. An Image writer printer or graphics printer with Grappler interface is optional. Pasco photogate system, photogate parts kit or purchase your own components. If you choose to assemble your own photogates, tools are needed which include: soldering iron, solder, wire cutters, and wire.
REQUIRED SOFTWARE: DOS 3.3, Applesoft
BACK-UP POLICY: Make your own back-up
PREVIEW POLICY: Available for 30-day preview

GRADE LEVEL: 9 through postsecondary
PACKAGE OBJECTIVES: To provide an accurate, versatile and inexpensive laboratory timer.

REQUIRED BACKGROUND OF USER: The teacher should be able to assemble the photogates from the parts kit. The students must have prior instruction on the relations between time, distance, velocity and acceleration.

PACKAGE COMPONENTS: Additional hardware kits are available separately for building the photogates. Each kit contains most of the components necessary to construct the photogates except for wire and solder. The photogate parts kits include a one-page set of instructions for assembling the converter. The system may also be used with the Pasco Model 6575, 6575A and 6576 photogate systems.

The software includes a disk which contains programs for measuring the following times: time difference at two or three photogates, pendulum timings, bounce timings, duration of break at one or between two photogates, various collision timings, stopwatch, and duration of flash. Erroneous data can be deleted and the tables can be stored on the disk.

The printed materials include a 41-page user's guide which provides program operating instructions, teacher's information, sample program output, suggested experiments and demonstrations, program design notes and modifications, table of variables used in the program, and program listing.

SYSTEM FUNCTIONS and DATA ANALYSIS FEATURES: Timings are made to the nearest ten-thousandth of a second. The program constructs a data table for each experiment performed. This data table may be displayed on the screen in regular or large print or may be printed on the printer. Invalid entries to the data table can be deleted. The data table can be saved to and retrieved from the disk. The number of data points, the mean and the standard deviation for each set of data is automatically calculated.

Once the data table has been constructed, the results may be graphed as a scatter plot, line graph or bar graph. Scaling of the axes can be done automatically or manually. Options are available for graphing a linear regression line and for displaying the slope, y-intercept, and coefficient of correlation the data has to the regression line. The graph can be printed on an Imagewriter printer or other graphics printers with a Grappler interface.

SUGGESTED EXPERIMENTS and DEMONSTRATIONS: Timing of free falling objects, timing of rolling objects, pendulum studies, bounce study, duration of flash, studying collisions on an air track, and measuring speed of an air track glider.

EVALUATION REPORT

SCIENCE INTERFACING COURSEWARE EVALUATION

SA	A	D	SD	NA	
	●	●			Additional hardware is easy to install.
	●				Calibration of the sensory devices is easily accomplished.
	●	●			External devices are durable.
●					Sensory devices are accurate and sensitive enough for classroom use.
	●				External devices are easy to use.
	●				The hardware is reliable in normal use.
●					Print materials are comprehensive.
	●				Print materials are effective.

SA	A	D	SD	NA	
	●				Package includes an appropriate range of suggested experiments.
		●			Objectives of the suggested experiments are clearly stated.
	●				Experiments achieve the intended objectives.
	●				Data displays are effective.
●					Data displays are flexible.
	●				Data analysis information is useful.
	●				Intended user can easily employ the package.
	●				Cost of the package is reasonable compared to its instructional value.

KEY: SA—Strongly Agree A—Agree D—Disagree SD—Strongly Disagree NA—Not Applicable

COMMENTS SUPPORTING THE ABOVE:

- If the Pasco photogate is used, the equipment is easy to use and install. The kits make the initial setup of the package considerably more difficult. Teachers have commented that assembling the kit is a good extra credit project for students.
- The suggested experiments are not in student ready form. They are general suggestions and descriptions to the teacher about how these experiments can be done and what students could learn.

- The text screens use all Apple text and appear cluttered.
- The ability to change scale and redraw the graph is a powerful feature.
- The package allows for a great deal of data manipulation.
- The package provides for a wide variety of different timing. Used in high school physics.

POTENTIAL USES: This package is most appropriate for use in a high school physics class during a unit on motion. The package would make an excellent teacher directed demonstration. It could also be used by small groups in a lab setting.

ESTIMATED STUDENT TIME REQUIRED FOR SUGGESTED EXPERIMENTS: Varies

EVALUATION SUMMARY: Rating scale from 1 (low) to 5 (high)
Hardware Components - 3
Print Materials - 4
Suggested Experiments - 2
Data Displays & Analysis - 4
General/Technical - 3
Overall - 3.2

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: Frequency Meter

PRODUCER: Vernier Software
2920 S.W. 89th Street
Portland, OR 97225
503/297-5317

COST: Software and manual: $39.95
Microphone - Amplifier Parts kit: $12.00
Voltage to Frequency Converter kit: $15.00
Temperature to Frequency Converter kit: $18.00

REQUIRED HARDWARE: Apple II+ or IIe, one disk drive, and monitor. An Image writer printer or graphics printer with Grappler interface is optional. A cassette tape recorder or interface parts kit. If you purchase the interface parts kit or purchase your own components, tools are needed for assembling the interfacing devices. This includes soldering iron, solder, wire cutters, and wire.
REQUIRED SOFTWARE: DOS 3.3, Applesoft
BACK-UP POLICY: Make your own back-up
PREVIEW POLICY: Available for 30-day preview

GRADE LEVEL: 9 through postsecondary
PACKAGE OBJECTIVES: To provide an accurate, inexpensive frequency meter and sound generator covering the audio frequency range.

REQUIRED BACKGROUND OF USER: If a cassette is not used, the teacher should be able to assemble the interfacing devices from the parts kit. The student should have prior instruction on the nature of sound and the meaning of frequency.

PACKAGE COMPONENTS: The package can be used with a cassette tape recorder connected to the cassette port of the Apple computer. Additional hardware kits are available separately for building a Microphone--Amplifier, Voltage to Frequency Converter and a Temperature to Frequency Converter which are connected to the Apple game paddle port. Each kit contains most of the components necessary to construct the converter except for wire and solder. The parts kits include a one-page set of instructions for assembling the converter. The assembly of the interface devices from the parts kit takes an hour to an hour and a half.

The software includes a disk which contains programs for: displaying the frequency of sound in both large and regular size print, collecting and storing data, displaying or printing data tables, deleting, loading and saving data files on the disk, plotting data from memory or in real time, printing the graph, generating one or two tones, generating tones, generating chromatic or tempered scales, calculating the ratio of two tones, and calibrating the frequency meter.

The printed materials provided include a 46-page user's guide which provides program operating instructions, teacher's information, sample program output, suggested experiments and demonstrations, program design notes and modifications, and a table of variables used in the program.

A "Dixie Fife" flute-a-phone is also provided with the package for generating clear tones.

SYSTEM FUNCTIONS and DATA ANALYSIS FEATURES: Tones can be generated or displayed within the audible sound range (0 to 20,000 Hz). The data table format gives the number of data pairs, the time interval between readings, the mean and the standard deviation. The plot program for displaying a graph of the frequency vs. time provides options for either automatic or manual scaling, dots at points or point to point line drawing, and regression analysis. If regression analysis is performed, the statistics on the slope of the line, y-intercept, and correlation coefficient are available.

SUGGESTED EXPERIMENTS and DEMONSTRATIONS: The relationship between pitch and frequency, the relationship between the frequencies of the musical scale, the difference between the chromatic and the equally tempered scale, frequency discrimination of the human ear, the Doppler effect, resonance tubes, and sonometer.

EVALUATION REPORT

SCIENCE INTERFACING COURSEWARE EVALUATION

SA	A	D	SD	NA	
	●	●			Additional hardware is easy to install.
	●				Calibration of the sensory devices is easily accomplished.
●		●			External devices are durable.
		●			Sensory devices are accurate and sensitive enough for classroom use.
	●				External devices are easy to use.
	●				The hardware is reliable in normal use.
●					Print materials are comprehensive.
	●				Print materials are effective.

SA	A	D	SD	NA	
	●				Package includes an appropriate range of suggested experiments.
		●			Objectives of the suggested experiments are clearly stated.
				●	Experiments achieve the intended objectives.
	●				Data displays are effective.
●					Data displays are flexible.
	●				Data analysis information is useful.
	●				Intended user can easily employ the package.
	●				Cost of the package is reasonable compared to its instructional value.

KEY: SA – Strongly Agree A – Agree D – Disagree SD – Strongly Disagree NA – Not Applicable

COMMENTS SUPPORTING THE ABOVE:

- If the cassette is used the equipment is easy to use and install. The kits make the initial set-up of the package considerably more difficult. Teachers have commented that assembling the kit is a good extra credit projects for students.
- The program is generally slow to respond to changes in the frequency. This is especially true if using the large number display mode.

- The suggested experiments are not in student ready form. They are general suggestions and descriptions to the teacher about how these experiments can be done and what students could learn.

- The text screens use all Apple text and appear cluttered.

- The ability to change scale and redraw the graph is a powerful feature.

- The package allows for a great deal of data manipulation.

- The package is extremely flexible allowing for measurement of time, voltage, temperature, light intensity and pressure by using different input devices available from Vernier Software.

POTENTIAL USES: This package is most appropriate for use in a high school physics class during a unit on sound. The package would make an excellent teacher directed demonstration. It could also be used by small groups in a lab setting. If the additional devices are added the package can also be used in conjunction with many other physics topics. The teacher must be willing to build their own interfacing devices.

EVALUATION SUMMARY: Rating scale from 1 (low) to 5 (high)

Hardware Components - 4
Print Materials - 4
Suggested Experiments - 2
Data Displays & Analysis - 4
General/Technical - 3
Overall - 3.4

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: Physics Lab: Sound

PRODUCER: Cross Educational Software
1802 N. Trenton Street
P.O. Box 1536
Ruston, LA 71270

COST: $60.00

REQUIRED HARDWARE: 48k Apple II plus or IIe, one disk drive, monitor. Tools and supplies for assembling the interface device: soldering iron, solder, wire cutters, and wire strippers.
REQUIRED SOFTWARE: Applesoft, DOS 3.3

GRADE LEVEL: 9 through postsecondary
PACKAGE OBJECTIVES: To provide a means whereby the Apple computer can be used to measure sound intensity, display sound waves, and as an audio oscillator to generate tones.

REQUIRED BACKGROUND OF USER: The teacher should be able to assemble the speakers and microphone from the kits provided. The teacher should also have some knowledge of BASIC programming in order to make full use of the programs. The student must have prior instruction on the nature of sound, the relationship between pitch and frequency, and interference between two waves. The Spectrum Analyzer requires an understanding of the meaning of a Fornier transformation.

PACKAGE COMPONENETS: The additional hardware provided with the package is a kit for assembling a speaker and a microphone for connection to the Apple game paddle socket. This kit includes: one speaker, one microphone, three transistors, two 16 pin 'DIP' header connectors, one 2 megohm potentiometer, a 110k resistor, one .22 microfarad capacitor, and two cables.

The software includes one disk which contains the following programs: Speaker Tones, Sound Intensity, Spectrum Analyzer, See Your Voice, and Doppler Effect. The first four programs use the interface devices and the last program is a tutorial on the Doppler effect.

The 29 pages of printed materials provided include instructions for assembling the speaker and microphone, program operating instructions, suggested lab experiments, a copy of a magazine article which gives technical information about the Apple Audio Processing, programmer's notes, and a listing of the program code.

SYSTEM FUNCTIONS and DATA ANALYSIS FEATURES: The Speaker Tone Program can be used to generate audible tones (20hz to 19231hz) using the Apple built-in speaker and/or the additional external speaker. The frequency heard is displayed on the screen and can be controlled by the user. The error in the frequency is approximately 1% to 5%. The sound intensity program continually displays a number which corresponds to the intensity of the sound received by the microphone. The Spectrum Analyzer will display a Fornier plot of a sound wave 0.1 seconds in duration. It may also generate Fornier plots of square waves, triangle waves, sine waves and complex sine waves. The See Your Voice program will display a sine wave up to 10 seconds in duration on a multiple screen graph.

SUGGESTED EXPERIMENTS: The manual briefly outlines a demonstration of the interference between two sound waves and a resonance tube experiment for measuring the speed of sound.

EVALUATION REPORT

SCIENCE INTERFACING COURSEWARE EVALUATION

SA	A	D	SD	NA	
			●		Additional hardware is easy to install.
				●	Calibration of the sensory devices is easily accomplished.
				●	External devices are durable.
		●			Sensory devices are accurate and sensitive enough for classroom use.
	●				External devices are easy to use.
		●			The hardware is reliable in normal use.
			●		Print materials are comprehensive.
			●		Print materials are effective.

SA	A	D	SD	NA	
			●		Package includes an appropriate range of suggested experiments.
		●			Objectives of the suggested experiments are clearly stated.
		●			Experiments achieve the intended objectives.
		●			Data displays are effective.
		●			Data displays are flexible.
				●	Data analysis information is useful.
	●				Intended user can easily employ the package.
		●			Cost of the package is reasonable compared to its instructional value.

KEY: SA – Strongly Agree A – Agree D – Disagree SD – Strongly Disagree NA – Not Applicable

COMMENTS SUPPORTING THE ABOVE:

- The Speaker Tones program is one of the best features of this program. The user can easily control the frequency. It makes a fairly good demonstration of the beats caused by the interference of two waves.
- The sound intensity program is very slow to respond. Short sounds frequently do not register a reading. Longer sounds must be fairly loud to register at all.
- The printed materials are more of a technical manual which explains the details of the programming.

- The See Your Voice program was only able to show the wave pattern of about three to five seconds of sound. The sound must be very consistent in order to produce a clear picture of the wave form. Most sounds are displayed as a splattering on points where the wave pattern is difficult to see.

- The Spectrum Analyzer program is only capable of analyzing sounds which are very short in duration.

- The tutorial on the Doppler effect would only be appropriate for college students or highly motivated high school physics students. Although the demonstrations are fairly clear, the amount of student interaction is minimal requiring mostly reading. The explanation of the derivation of the formulas requires a good mathematics background.

POTENTIAL USES: This package is most appropriate for use as a classroom demonstration in high school or college physics. Because it is not very user friendly, it would be difficult to use with students unless they are familiar with Applesoft BASIC.

EVALUATION SUMMARY: Rating scale from 1 (low) to 5 (high)

Hardware Components - 2
Print Materials - 1
Suggested Experiments - 1
Data Displays & Analysis - 1
General/Technical - 2
Overall - 1.4

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: Cardiovascular Fitness Lab

PRODUCER: HRM Software
175 Tompkins Avenue
Pleasantville, NY 10570
914/769-7496
800/431-2050

COST: $175.00

REQUIRED HARDWARE: 48k Apple II plus or IIe, one disk drive, and monitor. A graphics printer with Grappler interface card is optional. Also available for Commodore 64 and IBM PC.
REQUIRED SOFTWARE: DOS 3.3 and Applesoft (available in May 1986)
BACK-UP POLICY: Make your own back-up
PREVIEW POLICY: Demonstration disk available for free 30-day preview.

GRADE LEVEL: 4 through adult
PACKAGE OBJECTIVES: To provide a tool which will allow the computer to monitor heart rate.

REQUIRED BACKGROUND OF USER: The user must be aware of the effects of aerobic training on the body functions. The student should have prior experience with the process of gathering heart rate data and plotting the rate against time.

PACKAGE COMPONENTS: Additional hardware provided with the package includes a circuit board to be installed into one of the slots in the Apple, a sensor and an extender cord.

The software includes one disk which contains three programs for monitoring heart rate: Plotting, Histogram, and Training.

The 34-page manual includes suggested grade and ability level, instructions for installing the equipment, program operating instructions, teacher's information, suggested lab experiments, and information regarding aerobic training and cardiovascular fitness.

SYSTEM FUNCTIONS and DATA ANALYSIS FEATURES: The Plot program collects heart rate data in beats per minute from the sensor and displays the information in table form or as a graph of heart rate versus time. The user selects the plot interval (from 1 to 60 seconds), the experiment length (from 1 to 120 minutes), the heart rate range (maximum and minimum).

The Histogram program is similar to the plot program except the data is displayed in a histogram or table format. The user selects the number of histogram divisions, the experiment length (from 1 to 120 minutes), the heart rate range (maximum and minimum).

The training program is designed for monitoring the heart rate during physical activity. The user selects the upper and lower limits of the desired heart rate during training, the length of the training session (1 to 120 minutes), and the total range of heart rate measurement. Data display gives the elapsed time, current heart rate, and a graph of the current heart rate in relation to the desired training zone. During the use of the training program, arrows and a "beep" are used to indicate if your heart rate is higher or lower than your intended target range. When the designated training period has been completed, the program displays the percentage of time the user's heart rate was within the target range.

Each program provides options for cataloging, loading, saving and deleting data files on the disk. Data files may be displayed on the screen or printed on the printer. If a printer with Grappler interface is used, the graph can also be printed. The audio "beep" at each heart beep can be turned on or off at any time. An option is also available for marking an event on the screen as it occurs.

SUGGESTED EXPERIMENTS: Respiration and heart rate, exercise and heart rate, blood pressure and heart rate, psycho-physiology and heart rate, and biofeedback.

EVALUATION REPORT

SCIENCE INTERFACING COURSEWARE EVALUATION

SA	A	D	SD	NA	
	●				Additional hardware is easy to install.
				●	Calibration of the sensory devices is easily accomplished.
	●				External devices are durable.
	●				Sensory devices are accurate and sensitive enough for classroom use.
	●				External devices are easy to use.
	●				The hardware is reliable in normal use.
		●			Print materials are comprehensive.
	●				Print materials are effective.

SA	A	D	SD	NA	
		●			Package includes an appropriate range of suggested experiments.
			●		Objectives of the suggested experiments are clearly stated.
				●	Experiments achieve the intended objectives.
●					Data displays are effective.
●					Data displays are flexible.
				●	Data analysis information is useful.
●					Intended user can easily employ the package.
		●			Cost of the package is reasonable compared to its instructional value.

KEY: SA – Strongly Agree A – Agree D – Disagree SD – Strongly Disagree NA – Not Applicable

COMMENTS SUPPORTING THE ABOVE:

- Since use of the package requires physical activity, the reviewers expressed some concern over the connection of the ear lobe probe to the computer interface card. The cable connection should be more securely fastened to the body of the computer to avoid pulling the wires out of the interface card.
- The package is very easy to use and does an excellent job of portraying the data in a variety of forms (tabular, graph of heart rate vs time, or histogram).

- Additional extender cords and replacement ear lobe probes are available separately from HRM.

- The instructional objectives of the entire package as well as the suggested experiments are not made clear in the documentation.

- The suggested experiments are not in student-ready form. They are general suggestions and descriptions to the teacher about how these experiments can be done and what students could learn. The package should include more suggested experiments in a student-ready form. The producer indicates that lab manuals are under development for both middle and high school which will be available June 1986.

POTENTIAL USES: The program has been designed for use in biology, health or physical education classes at the junior high school through college levels. It could best be used as a teacher directed demonstration or as an individual lab station. The program could also be used to monitor aerobic training at home, or at physical fitness centers.

ESTIMATED STUDENT TIME REQUIRED FOR SUGGESTED EXPERIMENTS: Approximately 5 to 15 minutes depending on the duration of the aerobic exercise.

EVALUATION SUMMARY: Rating scale from 1 (low) to 5 (high)

Hardware Components - 3
Print Materials - 3
Suggested Experiments - 2
Data Displays & Analysis - 5
General/Technical - 3
Overall - 3.2

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: Biofeedback Microlab

PRODUCER: HRM Software
175 Tompkins Avenue
Pleasantville, NY 10570
914/769-7496
800/431-2050

COST: $350.00

REQUIRED HARDWARE: 64k Apple II plus or IIe, one disk drive, monitor, printer (optional). Also available for Commodore 64.
REQUIRED SOFTWARE: DOS 3.3 and Applesoft
BACK-UP POLICY: Make your own back-up
PREVIEW POLICY: Demonstration disk available for free 30-day preview.

GRADE LEVEL: 9 through adult
PACKAGE OBJECTIVES: To provide a tool which will allow the student to explore the relationship between the psychological and physiological functions of the body.

REQUIRED BACKGROUND OF USER: The student should have some knowledge of what is being measured (i.e., heartrate, muscle tension, skin temperature, and GSR), the units of measurement and how the various readings relate to body functions and health.

PACKAGE COMPONENTS: Additional hardware provided with the package includes: a circuit board for connecting the sensors to the computer, a pulse rate sensor which clips to the earlobe or finger, an electrodermal activity (GSR) sensor, a thermistor probe, and a muscle tension (EMG) sensor.

The software includes one disk with programs for measuring and monitoring muscle tension, heart rate, skin temperature and electrodermal activity (GSR).

The manual includes a 71-page user's manual which includes program operating instructions, installation instructions, background information about biofeedback, teacher's information, and suggested experiments.

SYSTEM FUNCTIONS and DATA ANALYSIS FEATURES: The programs operate in either the continuous or trial mode. In the continuous mode the program generates a realtime stripchart of the data collected. In the trial mode the user first establishes a base line measurement and then the computer sets a goal. The student employs biobeedback techniques in subsequent trials in an attempt to achieve the goal. The computer sets new goals for each successive trial.

The package enables the user to save and retrieve data sets on the disk, and examine or print the data in tabular, bar graph or line graph form. The graphs provide options for setting event markers and automatic range adjustments setting at any time. Average between event markers, average for each trial, overall average and average for a defined portion of the data are available.

SUGGESTED EXPERIMENTS: Your body's reaction to noise, Your body's reaction to mental tasks, Observing muscle tension during rest and active relaxation, Exploring muscle tension biofeedback, Exploring heart rate biofeedback, Exploring skintemperature biofeedback, and Exploring electrodermal biofeedback.

POTENTIAL USES: This package is appropriate for use in biology, physiology, health, psychology, physical education and premedicine.

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: Experiments In Human Physiology

PRODUCER: HRM Software
175 Tompkins Avenue
Pleasantville, NY 10570
914/769-7496
800/431-2050

COST: $259.00

REQUIRED HARDWARE: 48k Apple II plus or IIe, one disk drive, monitor. Also available for IBM PC with Quadlink board.
REQUIRED SOFTWARE: DOS 3.3 and Applesoft
BACK-UP POLICY: Make your own back-up
PREVIEW POLICY: Demonstration disks available for free 30-day preview.

GRADE LEVEL: 7 through postsecondary
PACKAGE OBJECTIVES: To provide a tool which will allow the computer to assist in experiments involving measurement of temperature and light intensity.

REQUIRED BACKGROUND OF USER: Minimal teacher preparation is necessary.

PACKAGE COMPONENTS: Additional hardware provided with the package includes an interfacing box and ribbon cable for easy connection of devices to the Apple game paddle port, four extender cables, two temperature probes, a light sensor, a light, and a timer plug.

The software includes one disk containing programs for measuring response time, calibrating the temperature probes, monitoring skin temperature, respiration rate and heart rate. The disk also contains a polygraph program which involves the simultaneous monitoring of skin temperature, respiration rate and heart rate. Options are available for cataloging the disk, and displaying, printing, saving, retrieving and deleting data files.

The 75-page manual includes suggested grade and ability level, instructions for setting up and trouble-shooting the equipment, program operating instructions, teacher's information, suggested lab experiments, technical information and programmer's notes.

SYSTEM FUNCTIONS and DATA ANALYSIS FEATURES: The Response time program measures the user's response time in milliseconds for up to two hundred trials. The results are displayed in real time as a scatter plot and as a histogram simultaneously. A digital readout of the time for each response is also displayed. When the set of trials has been completed, the program displays the minimum, maximum and mean time. The stimulus may be a 'beep' of variable volume from the speaker, a light on the scope box of variable intensity or a character which appears on the screen at

fixed or variable locations. The user has the option of responding to the stimulus by pressing the space bar or using the light detector. The number of histogram divisions may be changed within a range from 5 to 50. The number of trials may be changed to any number up to 200.

The skin temperature program measures the temperature at one probe and displays the results in real time on a graph. All temperatures are measured in degrees Celsius or Fahrenheit. The user may select the duration of the experiment and the maximum and minimum temperatures displayed on the graph. The user may also change the axes and redraw the graph.

The respiration rate program uses a temperature probe to measure the respiration rate of the user. During the running of the experiment the program displays a graph of the breathing pattern for a 14-second period in real time. The program at the same time displays a scatter plot graph of the user's respiration rate for each 14-second interval. The user selects the duration of the experiment and the maximum and minimum number of breaths per minute displayed on the graph.

The heart rate program uses a light source and light sensor to monitor heart rate. It operates similar to the respiration rate program but for 7 second intervals.

Generally, all of the programs allow the user to superimpose the results of one experiment over another. Event markers may also be placed on the graph at any time while measurements are being taken.

SUGGESTED EXPERIMENTS: Response time measurement, skin temperature measurements, respiration rate experiment, heart rate experiment, response time investigations, homeostasis--thermoregulation, psychological stress (lie detector), exercise experiments, and biofeedback.

EVALUATION REPORT

SCIENCE INTERFACING COURSEWARE EVALUATION

SA	A	D	SD	NA	
	●				Additional hardware is easy to install.
	●				Calibration of the sensory devices is easily accomplished.
	●				External devices are durable.
		●			Sensory devices are accurate and sensitive enough for classroom use.
	●				External devices are easy to use.
		●			The hardware is reliable in normal use.
	●				Print materials are comprehensive.
	●				Print materials are effective.

SA	A	D	SD	NA	
	●				Package includes an appropriate range of suggested experiments.
●					Objectives of the suggested experiments are clearly stated.
	●				Experiments achieve the intended objectives.
	●				Data displays are effective.
	●				Data displays are flexible.
	●				Data analysis information is useful.
	●				Intended user can easily employ the package.
	●				Cost of the package is reasonable compared to its instructional value.

KEY: SA – Strongly Agree A – Agree D – Disagree SD – Strongly Disagree NA – Not Applicable

COMMENTS SUPPORTING THE ABOVE:

- The light sensor used in the heart rate program is temperamental and difficult to get working with some individuals. HRM is developing a new interface box which will improve the performance in this area.

- The polygraph program requires the simultaneous monitoring of skin temperature, respiration rate and heart rate. It is extremely difficult to get reliable readings on all three at any one time. The user must remain very still.

- The suggested experiments include background information, clearly stated goals, material lists, setup procedures, step-by-step directions, student data sheet masters and extension activities and questions.

- The response time program does not account for uninitiated responses. Students learn very quickly that they can fool the machine by repeatedly giving responses.

POTENTIAL USES: This package is most appropriate for use in a health or life science class at the secondary level. It would best be used as a lab station where students rotate through performing the various experiments. It would also make an excellent teacher directed demonstration.

ESTIMATED STUDENT TIME REQUIRED FOR SUGGESTED EXPERIMENTS: Each experiment would take approximately 15 minutes per student. The polygraph program could take considerably longer.

EVALUATION SUMMARY: Rating scale from 1 (low) to 5 (high)

Hardware Components - 2
Print Materials - 3
Suggested Experiments - 4
Data Displays & Analysis - 3
General/Technical - 3
Overall - 3.0

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: ADALAB

PRODUCER: Interactive Microware, Inc.
P.O. Box 139
State College, PA 16804-0139
814/238-8294

COST:

	IBM PC	APPLE
ADALAB-PC Interface board:	$655.00	$545.00
Labtech Notebook	$895.00	N/A
Curve Fitter	$105.00	$39.00
Scientific Plotter	$105.00	$28.00

REQUIRED HARDWARE: IBM PC, XT and AT computers with 256K RAM, IBM Color/Graphics adapter card, Epson LX-80 Printer, IBM parallel adapter and cable, and monitor. 48k Apple II+ or IIe, one disk drive, monitor, Grappler interface card and printer.
REQUIRED SOFTWARE: IBM: DOS 2.1 or greater. Apple: DOS 3.3
BACK-UP POLICY: Make your own back-up disk (except LabTech Notebook--back-up disk available for a fee)
PREVIEW POLICY: 30-day trial purchase period.

GRADE LEVEL: 9 through postsecondary
PACKAGE OBJECTIVES: To provide a laboratory data acquisition and analysis for use in conjunction with other laboratory equipment.

REQUIRED BACKGROUND OF USER: The user should have a fairly sophisticated knowledge of computer operations and use of laboratory equipment.

PACKAGE COMPONENTS: The ADALAB circuit board enables the computer to read data from any laboratory device with an analog voltage output.

The LabTech Notebook (IBM PC only) allows the data acquistion process to run in background enabling the computer to be used for other applications during the data gathering process.

The Curve Fitter program allows the user to fit a wide variety of curves to a given set of experimental data.

The Scientific Plotter program enables the user to display and print line graphs, bar graph and pie graphs from a set of experimental data.

SUGGESTED EXPERIMENTS: None

POTENTIAL USES: This package is most appropriate for use at the college level or with very sophisticated science students at the high school level.

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: The Voyage of the Mimi:
Whales and Their Environment with the Bank Street Laboratory

PRODUCER: Holt, Rinehart and Winston
Attn.: Order Fulfillment Dept.
CBS, Inc.
383 Madison Avenue
New York, NY 10017
212/872-2213

COST: $350.00
With 25 student workbooks: $412.25

REQUIRED HARDWARE: 64k Apple II, one disk drive, monitor (color recommended).
REQUIRED SOFTWARE: DOS 3.3 and Applesoft.
BACK-UP POLICY: Make your own back-up disks
PREVIEW POLICY: 30-day preview with purchase order.

GRADE LEVEL: 4 through 12
PACKAGE OBJECTIVES: To provide a tool for measuring light, temperature, and sound which will enable the student to perform scientific explorations.

REQUIRED BACKGROUND OF THE USER: This package is designed to be used in conjunction with the 13 half-hour episode television series and video cassette series entitled "The Voyage Of the Mimi." However, the learning modules can be used separately.

PACKAGE COMPONENTS: This package is the fourth in The Voyage of the Mimi series of learning modules. The other packages in the series are: Introduction to Computing, Maps and Navigation, and Ecosystems.

Additional hardware provided with the package includes an electronic circuit board that plugs into one of the slots inside the Apple computer, two temperature sensors, a light sensor, a small lamp, a microphone, a speaker, three connectors, a slit slide and a diffraction grating slide.

The software includes a boot disk, and a lab disk which enables the computer to be used to measure temperature, light, and sound.

The printed materials include 25 student workbooks, a 70-page Teacher's Edition, and a User's Manual, which provides the following information: suggested grade/ability level, sample program output, program operating instructions, teacher's information, student's instructions, student worksheets, textbook correlation, follow-up activities and suggested lab experiments.

The Student Guide introduces the student to whales and their environments which sets the stage for a study of light temperature and sound. The Guide provides instructions for conducting 15 experiments relating to the environment.

SYSTEM FUNCTIONS and DATA ANALYSIS FEATURES: Temperature Module--Temperatures can be measured to the nearest tenth of a degree in Fahrenheit and/or Celsius degrees within a range of -50 to 150 degrees Celsius. Temperatures are displayed in real time using a graphic of a thermometer as well as a digital readout. The module provides functions for: calibrating the temperature probes, measuring the absolute temperature at one or two probes, comparing up to five successive temperature measurements using one probe, and real time graphing of temperature (up to 1000 hours).

Light Module--Light intensity is measured in foot-candles within a range or 0 to 200 fc. Light intensity is displayed in real time on a thermometer-like scale as well as a digital read-out. The module provides functions for: calibrating the light sensor, measuring the absolute light intensity at one sensor, comparing up to five successive measurements of light intensity using one sensor, and real time graphing light intensity. The light source connected to the system can be turned on and off at any time with one key stroke.

Sound Module--This module provides functions for exploring the loudness of sound, the frequency of sound and examining sound wave forms.

Loudness--Loudness is measured in decibels within a range from 20 to 100 dB. This module provides functions for: calibrating the sound sensor, measuring the absolute loudness at one sensor, comparing up to five successive measurements of loudness using one sensor, and real time graphing of the loudness of sounds. The user can easily turn an external speaker on and off and control the volume and pitch with a single key stroke.

Frequency--Frequency is measured in Hertz within a range from 250 to 4000 Hz. This module provides functions for: measuring the frequency of sound at the microphone, comparing up to five successive measurements of the frequency of sounds using one microphone, generating a sound print of one second of sound at the microphone and generating the sounds from a user constructed graph of frequency against time. The user can easily turn an external speaker on and off and control the volume and pitch with a single key stroke.

Sound Scope--This module displays the sound wave pattern of a single sound wave or can compare two separate sound waves. It will also construct a sound print of one second of sound and allow the user to magnify any 30 millisecond segment of the wave pattern.

The package contains several other options including a timer which uses the computer like a stopwatch to measure time to the nearest tenth of a second, a program for measuring the speed of sound, an audiometer to test hearing, and an audio oscillator for generating speaker tones.

All modules provide options for saving and retrieving the data from the disk and printing the graphics screen. During the real time graphing of various measurements, the user may at any time stop and restart the graphing, change the scale and redraw, or mark an event. Graphs can also be superimposed one over another.

SUGGESTED EXPERIMENTS: Is Your Body a Good Thermometer?, Comparing Fahrenheit and Celsius, Hottest Hands, Testing Insulators, Measuring Heat Loss from the Surface, Louder and Softer, Humming a Graph of Loudness, Changing the Frequency of Sound, Looking at Frequency, Frequency and Loudness, Measuring the Speed of Sound, Intensity and Distance from the Source, Scattering of Light by Dust in the Air, and Measuring Reflection.

EVALUATION REPORT

SCIENCE INTERFACING COURSEWARE EVALUATION

SA	A	D	SD	NA	
●					Additional hardware is easy to install.
	●				Calibration of the sensory devices is easily accomplished.
	●				External devices are durable.
	●				Sensory devices are accurate and sensitive enough for classroom use.
●					External devices are easy to use.
●					The hardware is reliable in normal use.
		●			Print materials are comprehensive.
	●				Print materials are effective.

SA	A	D	SD	NA	
		●			Package includes an appropriate range of suggested experiments.
		●			Objectives of the suggested experiments are clearly stated.
	●				Experiments achieve the intended objectives.
●					Data displays are effective.
●					Data displays are flexible.
				●	Data analysis information is useful.
●					Intended user can easily employ the package.
	●				Cost of the package is reasonable compared to its instructional value.

KEY: SA – Strongly Agree A – Agree D – Disagree SD – Strongly Disagree NA – Not Applicable

COMMENTS SUPPORTING THE ABOVE:

- The package is very easy to use and is completely self-documented. All selections from menus are made with the space bar and the RETURN key. An on screen prompt briefly explains each menu function prior to selection. However, at various times during the use of the package, the program is a bit slow to respond.

- The program uses icons which indicate which sensory device is currently connected to the computer.

- The package is very well error-trapped. If the wrong device is attached, the program will give the appropriate corrective message. The computer only responds to appropriate keyboard input.

- The external devices are very easy to connect to the system using the modular jacks.

- The temperature and light sensors are a bit slow to respond. The light sensor in particular has a reaction time too slow to respond to the shadow of a moving object.

- The program does not allow the user to review and edit the data gathered in tabular form.

- The sound module of this package is absolutely excellent.
- The relationship between "Whales and Their Environment" and the activities in the "Bank Street Laboratory" is very vague.
- The objectives of the suggested experiments are not given.
- The producer indicates that they are developing a physical science lab experiment book for both junior high and high school.

POTENTIAL USES: This package is most appropriate for use with upper elementary and junior high school students. It could be used by small groups in a science lab setting or in a teacher directed large group demonstration. It would also be good for independent study such as a research project or a science project. Music teachers can use the sound module to demonstrate concepts in music.

ESTIMATED STUDENT TIME REQUIRED FOR SUGGESTED EXPERIMENTS: The experiments can take from 10 to 40 minutes.

EVALUATION SUMMARY: Rating scale from 1 (low) to 5 (high)

Hardware Components - 4
Print Materials - 3
Suggested Experiments - 3
Data Displays & Analysis - 5
General/Technical - 4
Overall - 3.8

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: CHAMP Interface Series

PRODUCER: Merlan Scientific, LTD
247 Armstrong Avenue
Georgetown, Ontario, Canada L7G 4X6
416/877-0171

REQUIRED HARDWARE: Commodore 64, one disk drive, monitor, and printer.

GRADE LEVEL: 9 through postsecondary

PACKAGE COMPONENTS: This package is made up of a variety of hardware and software components sold separately and described below.

CHAMP Interface $250.00
An A/D converter board with four input chanels and a sampling rate as fast a 0.2 milliseconds. This board is required for all other applications for the CHAMP series.

Scope Chart Software $149.00
This software enables the Champ interface to be used as a storage oscilloscope.

SigPro Software $149.00
This software enables the Champ Interface to perform complete Fournier analysis of any input from a microphone, frequency generator, etc.

Harris Sensor Package Software $149.00**
This software enables the computer and CHAMP Interface to be used as a data acquisition and analysis tool with any four of the sensor kits described below. The data may be measured or gathered for a designated period of time, edited, saved to the disk, and displayed or printed in tabular or graph forms. Statistical analysis includes the sample mean, maximum, minimum, and standard deviation. Graph can be generated displaying the data collected in a variety forms. The program will also perform curve fitting operations as well as integration.
**Note: Price subject to change.

The following are sensor kits which are available for use with the CHAMP Interface board and the Harris Sensor Package Software.

Position Sensor	$112.00	Light Sensor	$ 76.00
Temperature Sensor	$111.00	Oxygen Sensor	$ 81.00
Humidity Sensor	$154.00	pH Sensor	$ 74.00
Pressure Sensor	$211.00	Monometer Control	$ 78.00
Electronic Barometer	$205.00	Strain Gauge	$183.00
Magnetic Sensor	$121.00	Voltmeter	$ 95.00
Ammeter	$ 99.00	Ratementer	$130.00

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: Chempac

PRODUCER: E & L Instruments
70 Fulton Terrace
New Haven, CT 06509
800/225-0125

COST: 2200.00 (Available May 1986)

REQUIRED HARDWARE: None--Price includes a complete Commodore-64 system
BACK-UP POLICY: Make your own back-up
PREVIEW POLICY: A video tape is available from regional sales representatives. Contact E & L Instruments for more information.

GRADE LEVEL: 9 through postsecondary
PACKAGE OBJECTIVES: To provide a laboratory tool for conducting quantitative chemistry experiments.

REQUIRED BACKGROUND OF USER: The student should have the appropriate chemistry instruction which corresponds to the lab experiments.

PACKAGE COMPONENTS: Additional hardware provided with the package includes a Commodore 64 microcomputer, monitor, one disk drive, printer, interface module, two thermal couplers, two thermistors, a pressure sensor and vessel, a colorimeter, a calorimeter, a pH meter, and an EMF cell.

The software includes two student disks and one teacher's disk containing data adquisition and analysis software corresponding to the experiments.

The printed materials include two student laboratory manuals and one teacher's guide. The student manuals contain detailed outlines the students can follow for each of 51 experiments. Approximately 30 of the experiments make use of the computer and accompanying interfacing devices.

SUGGESTED EXPERIMENTS: Observation of a burning candle, Mass-volume-density measurements, Temperature measurements, Measurement and accuracy, Pressure-volume relationship for gasses, Pressure-temperature relationship for gasses, Mass of volume of gas, Water content of copper sulfate, Mass relationships in a chemical change, Replacement of hydrogen by a metal (Mg), Percentage of lead in lead iodide, Thermistor calibration, Specific heat of materials, Melting and freezing points, Crystal transitions, Vaporization of Methanol, Heat of solution, Heat of reaction, Colorimeter calibration, Two reaction rates experiments, Chemical equilibrium, Chemical equilibrium-solubility products, Chemical analysis, Properties of acids and bases, Hydrogen ion concentration, Acid-base titration, Standardization of HCl solution, Hydrolysis of salts, Freezing points and freezing point depression,

Miscible and immiscible liquids, Vapor pressure of methanol, Solubility of CO2 in water, Solubility and temperature dependence, Introduction to Redox systems, EMF of typical Redox systems, Redox titration, Electrolytic cells, Preparation and properties of carbon dioxide, Preparation and properties of hydrogen, Types of chemical reactions, Ionic precipitation reactions, Transition metal ions, Reaction of hydrocarbons, Yeast--rate and energetics, Qualitative analysis, Esterification of an alcohol, Absorption and chromatography, Halogens, and Le Chatelier's Principle.

POTENTIAL USES: The experiments are designed to support a full year high school chemistry course.

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: Experiment Interface

PRODUCER: Cambridge Development Laboratory, Inc.
1696 Massachusetts Avenue
Cambridge, MA 02138
617/491-0377

COST:

Interface Box	$694.95	Temperature Module	$268.95
Light Module	$149.95	pH Module	$194.95
Angular Motion Mod	$224.95	Voltage Module	$194.95

(10% discount if total order is over $1000.00)

REQUIRED HARDWARE: Either an Apple, TRS-80 or Atari computer with an RS-232-C serial port and cable.
BACK-UP POLICY: Make your own back-up disk
PREVIEW POLICY: Currently none--Call for information regarding a loaner system.

GRADE LEVEL: 7 through postsecondary
PACKAGE OBJECTIVES: To provide an accurate laboratory data acquisition and analysis tool.

REQUIRED BACKGROUND OF USER: The teacher should have some knowledge of basic programming and computer interfacing configurations.

PACKAGE COMPONENTS: Additional hardware provided with the package includes an interface box which contains 4 analog input connections and one RS-232-C digital output port. The temperature module includes one 6-inch stainless steel temperature probe. The Light module includes one phototransistor mounted in a 3-inch tube. The pH module has a BNC connector which will fit any pH electrode with BNC connector. The angular motion module includes potentiometer, housing clamp for mounting on a ring stand and two rigid pendula. The voltage module includes three binding posts for connection to the analog output of instruments.

The Apple version includes one disk containing programs for calibrating the sensors, performing data acquisition and constructing graphs. The TRS-80 and Atari versions provide program listings which must be keyed into the system.

The printed materials include a parts list, other materials lists, installation instructions, operating instructions, trouble-shooting suggestions, programming tips and program listings (TRS-80 and Atari).

SYSTEM FUNCTIONS and DATA ANALYSIS FEATURES: RS-232-C baud rates may be selected from 300, 1200, 9600 and 19,200 baud.

SUGGESTED EXPERIMENTS: None

POTENITAL USES: As a teacher directed demonstration at the high school level. By individual students or groups of students during a science project.

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: Experiments In Chemistry

PRODUCER: HRM Software
175 Tompkins Avenue
Pleasantville, NY 10570
914/769-7496
800/431-2050

COST: $349.00

REQUIRED HARDWARE: 48k Apple II plus or IIe, one disk drive, monitor, printer (optional), calomel reference electrodes with pin connection, and combination electrode with gel-filled polymer body and BNC connectors. The package is compatible for Apple IIc with game paddle adapter. Also available for IBM PC with Quadlink board.
REQUIRED SOFTWARE: DOS 3.3 and Applesoft
BACK-UP POLICY: Make your own back-up
PREVIEW POLICY: Demonstration disk available for free 30-day preview.

PACKAGE OBJECTIVES: To provide a tool which will allow the computer to assist in experiments involving measurement of temperature, EMF and pH/mV.

REQUIRED BACKGROUND OF USER: The student should have the appropriate background in chemistry to perform the selected experiment. The student should have some knowledge of what is being measured (i.e., pH, EMF) and the units of measurement.

PACKAGE COMPONENTS: Additional hardware provided with the package includes: an interfacing box and ribbon cable for easy connection of devices to the Apple game paddle port, extender cables, alligator clip cables, two temperature probes, pH/mV meter that requires a combination of electrodes (not included but available from HRM).

The software includes one disk with programs for conducting fifteen chemistry experiments chemistry. An option is available for the teacher to define the experiment parameters and save them on the disk for later use.

The manual includes suggested grade and ability level, instructions for setting up and trouble-shooting the equipment, program operating instructions, teacher's information, suggested lab experiments, technical information and programmer's notes.

SYSTEM FUNCTIONS and DATA ANALYSIS FEATURES: The programs guide the student by requesting specific data to be entered and describing the steps necessary to perform the experiment. The data displays and analysis features are specific to each experiment.

SUGGESTED EXPERIMENTS: Cooling curve, simple calorimetry--specific heat of metals, molecular mass of a solid by freezing-point depression, heat of neutralization, basic pH measurements, standardization of NaOH--a strong base titration, standardization of HCl--a strong acid titration, titration of a weak acid, analysis of antacids, determination of the acetic content of vinegar, titration of carbonate, basic EMF measurements--fundamentals of electrochemistry, titration of halides with silver nitrate, standard potential of the Ag°/Ag^{+} electrode, and potentiometric titration.

POTENTIAL USES: As a laboratory activity in high school chemistry or as a teacher directed demonstration.

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: Experiments In Science

PRODUCER: HRM Software
175 Tompkins Avenue
Pleasantville, NY 10570
914/769-7496
800/431-2050

COST: $259.00

REQUIRED HARDWARE: 48k Apple II plus or IIe, one disk drive, monitor. Also available for IBM PC with Quadlink board.
REQUIRED SOFTWARE: DOS 3.3 and Applesoft
BACK-UP POLICY: Make your own back-up
PREVIEW POLICY: Demonstration disks available for free 30-day preview.

GRADE LEVEL: 7 through postsecondary
PACKAGE OBJECTIVES: To provide a tool which allows the computer to assist in experiments involving measurement of temperature and light intensity.

PACKAGE COMPONENTS: Additional hardware provided with the package includes an interfacing box and ribbon cable for easy connection of devices to the Apple game paddle port, four extender cables, two temperature probes, a light sensor, a light, a green LED light, and a test-tube holder.

The software includes one disk containing twelve programs for conducting specific experiments in chemistry, physics, biology, and earth/planetary science.

The 60-page manual includes suggested grade and ability level, instructions for setting up and trouble-shooting the equipment, program operating instructions, teacher's information, suggested lab experiments, technical information and programmer's notes.

SYSTEM FUNCTIONS and DATA ANALYSIS FEATURES: When an experiment is selected from the menu, a message appears indicating how the sensory devices are to be connected. The program then guides the user through the experiment by requesting specific data to be entered and describing the actions necessary. The data displays and analysis features are specific to each experiment. Generally, all temperatures are measured in degrees Celsius. Light intensity is measured relative to an initial setting.

SUGGESTED EXPERIMENTS: Cooling curves, heat and neutralization, chemical reaction rates, light intensity, kinematics, light-energy equivalence, heart rate, response time, flicker fusion, insulation, evaporation and humidity, and weather station.

SCIENCE INTERFACING COURSEWARE EVALUATION

SA	A	D	SD	NA	
	●				Additional hardware is easy to install.
	●				Calibration of the sensory devices is easily accomplished.
	●				External devices are durable.
	●				Sensory devices are accurate and sensitive enough for classroom use.
	●				External devices are easy to use.
	●				The hardware is reliable in normal use.
●					Print materials are comprehensive.
	●				Print materials are effective.

SA	A	D	SD	NA	
	●				Package includes an appropriate range of suggested experiments.
●					Objectives of the suggested experiments are clearly stated.
	●				Experiments achieve the intended objectives.
	●				Data displays are effective.
		●			Data displays are flexible.
		●			Data analysis information is useful.
	●				Intended user can easily employ the package.
		●			Cost of the package is reasonable compared to its instructional value.

KEY: SA – Strongly Agree A – Agree D – Disagree SD – Strongly Disagree NA – Not Applicable

COMMENTS SUPPORTING THE ABOVE:

- The experiments are very structured and the user must follow each as outlined in the guide. According to the producer, the experiments in this package were intended to be examples of the kinds of experiments which could be performed using the additional hardware. Teachers are encouraged to write their own programs to perform other experiments not provided here.
- The program does not provide any means of printing out the results of an experiment.
- Most of the programs are only appropriate for use with the specific experiment for which they were designed.
- For each experiment, the manual gives the objective, a description, a materials list, a procedure outline and extension questions.

POTENTIAL USES: This package contains three experiments appropriate for each of the following courses: chemistry, physics, biology and earth science. Some of the experiments would be appropriate for use at the junior high school level. They were designed for use with small groups working at a lab station. Some could be used as a teacher directed demonstration.

ESTIMATED STUDENT TIME REQUIRED FOR SUGGESTED EXPERIMENTS: The experiments range from 15 to 50 minutes. Student designed experiments could be done over a period of several days. No one course of study would make use of all of the experiments provided.

EVALUATION SUMMARY: Rating scale from 1 (low) to 5 (high)

Hardware Components - 3
Print Materials - 4
Suggested Experiments - 4
Data Displays & Analysis - 2
General/Technical - 2
Overall - 3.0

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: FutureLab

PRODUCER: FutureMind
1745 21st Street
Santa Monica, CA 90404
213/829-3641

COST: (Available June 1986)

Starter system with Sound Module:	$300.00
Ultrasonic Module	$150.00
Chemistry Module	$100.00

REQUIRED HARDWARE: 64k Apple II+ or IIe, one disk drive, monitor, printer (optional)
REQUIRED SOFTWARE: DOS 3.3
BACK-UP POLICY: Make your own back-up disk

GRADE LEVEL: 4 through postsecondary
PACKAGE OBJECTIVES: To stimulate scientific curiosity and appreciation of the scientific method. To provide a tool which will open new areas of study in the science curriculum.

PACKAGE COMPONENTS: Additional hardware provided with the package includes a circuit board which plugs into an expansion slot, an interface box, and the sound analysis module which contains software, a textbook, a workbook, a teacher's guide, a microphone, various sound absorbing and funneling materials. The Ultrasonic module contains software, a textbook, a workbook, a teacher's guide, an ulatrasonic transducer and miscellaneous experimental apparatus. The Chemistry module contains software, a textbook, a workbook, a teacher's guide, a temperature probe, a pH meter, a light sensor, a conductivity meter and selected chemicals.

The background information pertaining to each experiment is given in the student textbook. The text provides a series of experiments at a variety of levels for each topic. The software and interfacing equipment serves as data acquisition and analysis.

POTENTIAL USES: The experiments in the text progress in difficulty and sophistication. Consequently, each module conatins several experiments appropriate for each grade level 4 through 12. The package could be used as an independent study lab station or as a teacher directed demonstration.

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: LEAP Standard System

PRODUCER: Quantum Technologies, Inc.
P.O. Box 1396
Englewood, CO 80150
303/674-9651

COST: $895.00

REQUIRED HARDWARE: 64k Apple II+ or IIe, one disk drive, monitor, printer (optional)
REQUIRED SOFTWARE: Applesoft, DOS 3.3
BACK-UP POLICY: Make your own back-up disks

GRADE LEVEL: 9 through postsecondary
PACKAGE OBJECTIVES: To provide a laboratory tool for accurately measuring and monitoring temperature, resistance, voltage and amperage.

REQUIRED BACKGROUND OF USER: The student should have an understanding of what is being measured and the units used.

PACKAGE COMPONENTS: Additional hardware provided with the package includes a LEAP-Mate interface box, a LEAP-Card (analog to digital converter) and a LEAP-Aratus Kit which contains the following items: two sets of input clip leads, two 10k thermistors, a photovoltaic cell, a photoresistive cell, cotton wick, universal probe, collimeter, battery holder, 400mV DC electric motor, propeller, 1 Ohm resistor, 10 Ohm resistor, 1000 Ohm resistor, 1 microfarad capacitor, a diode, and three wire nuts.

The software includes one disk which contains programs for performing temperature experiments, light experiments, dc electrical experiments, or setting up your own experiments. The LEAP Standard System allows for two inputs. The software also contains the system configurations for twenty-five prepared experiments which are outlined in the Interdisciplinary Lab Pac booklet.

The printed materials include a Teacher's Guide, a Interdisciplinary Lab Pac and a Standard User's Manual. The User's Manual gives a system overview, hardware installation instructions, program operating instructions, and trouble-shooting information. The Teacher's Guide gives teaching and learning strategies, a system overview, curriculum components for the LEAP-System, student recordkeeping forms, and a glossary of terms and formulas. The Interdisciplinary Lab Pac gives student instructions for conducting twenty-five different experiments.

SYSTEM FUNCTIONS and DATA ANALYSIS FEATURES: The system is capable of measuring temperature, resistance, volts, millivolts, amps, and milliamps. Temperatures can be measured in either Celsius or Fahrenheit degrees with a range from a -40 to 120 degrees Celsius. Light experiments can be performed with either a photocell or photoresistor with an output range from 0 to 100. Electrical measurements include volts and millivolts in both AC and DC, amps and milliamp in both AC and DC, and resistance in ohms.

SUGGESTED EXPERIMENTS: Temperature Measurement, Heat Flow by Convection, Heat Flow by Conduction, Heat Flow by Radiation, Density Relationahips, Generation of Heat from Electricity, Effects of Evaporation, Melting Point, Specific Heat of Fluids, Measurement of Light, Using Solar Energy, Waves and Reflection, Measuring Work through Voltage and Current, Motor Efficiency, Coefficient of Friction, Torque, Conductivity of Solutions, Electro-Plating, Electrolysis of Water, Makinga Battery, Operating Principle of a Capacitor, Operating Principle of Diode, Operating Principle of a Thermistor, Operating Principle of a Photoresistor, and Operating Principle of a Photovoltaic Cell.

EVALUATION REPORT

SCIENCE INTERFACING COURSEWARE EVALUATION

SA	A	D	SD	NA	
	●				Additional hardware is easy to install.
				●	Calibration of the sensory devices is easily accomplished.
	●				External devices are durable.
●					Sensory devices are accurate and sensitive enough for classroom use.
	●				External devices are easy to use.
	●				The hardware is reliable in normal use.
●					Print materials are comprehensive.
	●				Print materials are effective.

SA	A	D	SD	NA	
●					Package includes an appropriate range of suggested experiments.
●					Objectives of the suggested experiments are clearly stated.
	●				Experiments achieve the intended objectives.
	●				Data displays are effective.
	●				Data displays are flexible.
	●				Data analysis information is useful.
	●				Intended user can easily employ the package.
		●			Cost of the package is reasonable compared to its instructional value.

KEY: SA – Strongly Agree A – Agree D – Disagree SD – Strongly Disagree NA – Not Applicable

COMMENTS SUPPORTING THE ABOVE:

- The sensory devices and other apparatus are basically a collection of electronic components which must be wired together for each experiment. The electrical components are readily available in electronics parts stores and will need to be replaced after several uses.
- Beside the set of 25 experiments provided, the system enables the user to define experiments and save the parameters on the disk for later use.
- The package is extremely flexible and can be used for a wide variety of measurements.

- Depending upon the scale used, the graphs sometimes appear step-like rather than a smooth line. The system uses a look-up table to make the conversions from the value read at the sensor to the appropriate units. The step effect appears when the value changes from one unit on the table to the next. The look-up tables can be changed but this is not recommended.

- The interface box provides protection to the host computer from inappropriate input.

POTENITAL USES: This package could be used as a teacher directed demonstration or with pairs of students in a lab setting at the high school level. The experiments cover topics in chemistry, biology, and earth science but mostly in physics.

ESTIMATED STUDENT TIME REQUIRED FOR SUGGESTED EXPERIMENTS: Each suggested experiment would take one class period.

EVALUATION SUMMARY: Rating scale from 1 (low) to 5 (high)

Hardware Components - 4
Print Materials - 4
Suggested Experiments - 4
Data Displays & Analysis - 4
General/Technical - 2
Overall - 3.6

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: LEAP Advanced System

PRODUCER: Quantum Technologies, Inc.
P.O. Box 1396
Englewood, CO 80150
303/674-9651

COST: $1275.00

REQUIRED HARDWARE: 64k Apple II+ or IIe, two disk drive and monitor. Printer and clock card are optional.
REQUIRED SOFTWARE: Pascal
BACK-UP POLICY: Make your own back-up disks

GRADE LEVEL: 9 through postsecondary
PACKAGE OBJECTIVES: To provide a laboratory tool for accurately measuring and monitoring temperature, resistance, voltage and amperage.

REQUIRED BACKGROUND OF USER: The teacher should be very familiar with science laboratory equipment and the processes for interfacing this equipment with the computer.

PACKAGE COMPONENTS: The LEAP Advanced System includes the LEAP Standard System plus the LEAP-Plex Input Switching Center, a 62-page user's manual and three disks. The LEAP-Plex used in conjunction with the LEAP-Mate allows for a maximum of nine inputs and two outputs.

The first disk, LEAP1, contains the programs for maintaining the operating system. The second disk, LEAP2, stores specification sets, tables, and data files. It also contains the Pascal Formatter code, so the user can prepare blank disks to copy any of the LEAP-Volumes. The third disk, LEAP1S, contains special programs for high speed reading of the sensor (up to 16 times per second), and stripcharting data and calculation results. All programs are fully menu driven.

The User's Manual gives a system overview, hardware installation instructions, and program operating instructions.

SYSTEM FUNCTIONS and DATA ANALYSIS FEATURES: The system has the following capabilities:

-- Read real time physical variables directly from sensors supplied, or parameters from instruments with digital or analog output (e.g., strip chart recorder jack).

-- Read voltage or resistance as temperature, pressure, solar radiation, dissolved oxygen, mass, turbidity, density, pH, and others.

-- Sample sensors or instruments at preset intervals.

-- Display the user-selected data on a graph and in a detailed table (if a printer is available strip charts can be made).

-- Record the data onto a diskette for review or subsequent analysis.

-- Operate switch-controlled devices within pre-selected time, data, or calculation limits.

-- Perform user defined calculations on data for parameter conversion or analysis.

POTENTIAL USES: This package could be used by more advanced high school students for special science projects. The package is most appropriate for use at the college level. It could be used in a programming class in conjunction with a unit on robotics.

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: Science Toolkit - Master Module

PRODUCER: Broderbund Software
17 Paul Drive
San Rafael, CA 94903-2101
415/479-1170

COST: $59.95

REQUIRED HARDWARE: 64k Apple II+, IIe or IIc, one disk drive, monitor and printer (optional). Joystick port adapter required for Apple II+.
BACK-UP POLICY: Free with proof of purchase

GRADE LEVEL: 5 through postsecondary
PACKAGE OBJECTIVES: To stimulate interest and excitement in scientific discovery. To provide a tool for making accurate measurements of temperature, light intensity and time.

REQUIRED BACKGROUND OF USER: The student should have a concept of temperature, light intensity, and time and be familiar with the units of measure.

PACKAGE COMPONENTS: Additional hardware provided with the package includes one light probe and stand, one temperature probe and interface box which plugs into the game paddle connection.

The software gives the user the option of selecting the measurement tool (TOOL), performing disk operations (DISK), reviewing and printing the data (LOG) and setting up the system (SETUP). If the TOOL option is selected the user may choose between a thermometer, light meter, a timer or a strip chart. If DISK option allows the user to load, save and delete files, initialize a disk or catalog a disk. The LOG option allows the user to review or print the data. The SETUP option contains programs for defining the printer specifications and calibrating the sensors.

The printed materials include a 125-page manual which includes installation instructions, program operating instructions, suggested experiments, information describing good laboratory procedures, and background information regarding related science content.

SYSTEM FUNCTIONS and DATA ANALYSIS FEATURES: Time interval measurements may range from 0.01 seconds to 99 hours. Temperature measurements may be in either degrees Fahrenheit or Celsius within a range from -12 to 60 degrees Celsius. Light intensity ranges from 0 to 500 foot candles.

SUGGESTED EXPERIMENTS: Radiators and elephant ears, Sweating it out, Is bigger better?, The well dressed glass of water, Where did all the light go?, Stellar measuring tape, What stardust and a dirty window have in common, Showdown at the leaning tower, The calibrated paper wad, Nature's parachutes, Nature's helicopters, Hot and cold plaster, Multiple evaporative coolers, Black and white, Handy dandy detecting device, Temperature and seed germination, Light and seed germination, The lighter side of plant growth, Chemical refrigerators, Better chemical refrigerators, Chemical ovens, Reflection of light, Absorption of light, Transmission of light, The perfect slope, An accelerating constant, and Building a better ski jump.

POTENTIAL USES: This package can be used by small groups of students in a laboratory setting or as a teacher directed demonstration. It is appropriate for use at the upper elementary and junior high school.

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: Sci-Lab Educational Courseware Series

PRODUCER: Narco Bio-Systems
7651 Airport Blvd.
Houston, TX 77061
713/644-7521

COST:

Biology Kit:	$1750.00
Chemistry Kit:	$1450.00
Physics Kit:	$1695.00
Master Science System (all three):	$3195.00

REQUIRED HARDWARE: 64k Apple II+ or IIe, one disk drive, monitor (color recommended), printer with Grappler interface.
BACK-UP POLICY: Back-up disks are provided.
PREVIEW POLICY: Contact your local Sargent Welch Scientific laboratory supply distributor.

GRADE LEVEL: 9 through 12
PACKAGE OBJECTIVES: To provide a comprehensive laboratory tutorial and interfacing tool for high school science.

PACKAGE COMPONENTS: Each kit includes an A/D converter board, the Sci-Lab programmable signal conditioner and the Sci-Key course simulation interface.

The Biology kit includes an EKG kit, Dynamometer kit, bubble detector kit, and the following course modules: rate of photosynthesis, rate of yeast fermentation, electrical activity of the heart, skeletal muscle activity, evaluation of physical conditioning, and the mechanics of respiration.

The Chemistry kit includes a ph electrode, a temperature probe and the following course modules: measuring temperature and heat, energy and phase change, heat of fusion, hydronium ion concentration and pH, indicator colors and pH, and titration of a strong acid.

The Physics kit includes a force transducer kit, a gravity transducer kit, a motion transducer kit and the following course modules: metric system, average and instantaneous velocity, acceleration, acceleration due to gravity, and force of friction.

Each course module contains software which states the objective, gives an interactive tutorial which introduces the background and basic principles of the experiment, outlines the procedures, lists the required materials, guides the student through the data collection, assists with the data analysis with questions and provides a summary of the expected results. A system operating manual is also included.

SYSTEM FUNCTIONS and DATA ANALYSIS FEATURES: System utilities are available for storing and retrieving the data from the disk, and editing the data.

NOTE: The software can be run independently of the interfacing device using sample data stored on the disk. The only hardware necessary to simulate the experiments is the Sci-Key simulation interface. Contact Narco Bio-Systems for more information regarding these other options.

POTENTIAL USES: As an independent study lab station in the appropriate high school science course.

SCIENCE INTERFACING PACKAGE DESCRIPTION

TITLE: Voltage Plotter

PRODUCER: Vernier Software
2920 S.W. 89th Street
Portland, OR 97225
503/297-5317

COST: Software and manual: $39.95
Voltage input unit - Parts kit: $25.00
Assembled: $35.00
OR
Advanced Interfacing Bourd: $225.00

REQUIRED HARDWARE: Apple II+, IIe or IIc, one disk drive, and monitor. An Imagewriter printer or graphics printer with Grappler interface is optional. The system will require either the Advanced Interfacing Board or the Voltage Input Unit. If you purchase the interface parts kit or purchase your own components, tools are needed for assembling the interfacing devices. This includes soldering iron, solder, wire cutters, and wire.
REQUIRED SOFTWARE: DOS 3.3, Applesoft
BACK-UP POLICY: Make your own back-up
PREVIEW POLICY: Available for 30-day preview

GRADE LEVEL: 9 through postsecondary
PACKAGE OBJECTIVES: To allow the Apple computer to serve as a voltmeter.

REQUIRED BACKGROUND OF USER: If the parts kit is purchased, the teacher should be able to assemble the Voltage Input Unit. The student should have prior instruction on the definition of voltage.

PACKAGE COMPONENTS: The software includes a disk which contains programs for displaying the voltages in both large and regular size print; collecting and storing data; displaying or printing data tables; deleting, loading and saving datafiles on the disk; plotting data from memory or in real time; printing the graph; and calibrating the input devices.

The software enables the user to set up "parameter files" which will allow the measurement of other quantities indirectly. The file calibrates and sets the proper labels and units of input. In doing so, the system can be connected to any other laboratory equipment which produces a voltage output.

The printed materials include a 86-page user's guide which provides program operating instructions, teacher's information, sample program output, suggested experiments and demonstrations, program design notes and modifications, and a table of variables used in the program.

SYSTEM FUNCTIONS and DATA ANALYSIS FEATURES: If the Voltage Input Device is used the system can measure voltages between 0 and 3.5 VDC up to three times a second at one input. If the Advanced Interfacing Board is used, the system can measure voltages from -10V to +10V, up to 5000 times a second at up to 8 inputs. The data table format gives the number of data pairs, the time interval between readings, the mean and the standard deviation. The plot program for displaying a graph of the voltage vs. time provides options for either automatic or manual scaling, dots at points or point to point line drawing, regression analysis. If regression analysis is performed, the statistics on the slope of the line, y-intercept, and correlation coefficient are available.

POTENTIAL USES: This package is most appropriate for use as a data acquisition and analysis tool connected to other laboratory equipment.

APPENDICES

SCIENCE INTERFACING COURSEWARE EVALUATION

microSIFT

NORTHWEST REGIONAL EDUCATIONAL LABORATORY

Package Title _____ Producer _____

Evaluator's Level and Subject Taught _____

Evaluator Name _____ Organization _____

Date _____ ☐ Check this box if this evaluation is based partly on your observation of student use of this package.

Please circle one and include comments on individual items below.

KEY: SA - Strongly Agree A - Agree D - Disagree SD - Strongly Disagree NA - Not applicable

HARDWARE COMPONENTS

SA A D SD NA Additional hardware is easy to install.

SA A D SD NA Calibration of the sensory devices is easily accomplished.

SA A D SD NA External devices are durable.

SA A D SD NA Sensory devices are accurate and sensitive enough for classroom use.

SA A D SD NA External devices are easy to use.

SA A D SD NA The hardware is reliable in normal use.

COMMENTS relating to the hardware which support the above -

PRINT MATERIALS

SA A D SD NA Print materials are comprehensive.

SA A D SD NA Print materials are effective.

COMMENTS relating to the print material which support the above -

SUGGESTED EXPERIMENTS

SA A D SD NA Package includes an appropriate range of suggested experiments which take advantage of the capabilities of the system.

SA A D SD NA Objectives of the suggested experiments are clearly stated.

SA A D SD NA Experiments achieve the intended objectives.

COMMENTS relating to the suggested lab experiments which support the above -

(Additional items on back)

DATA DISPLAYS AND ANALYSIS

SA A D SD NA Data displays are effective.

SA A D SD NA Data displays are flexible.

SA A D SD NA Data analysis information is useful.

COMMENTS relating to the data displays and analysis which support the above -

GENERAL

SA A D SD NA Intended user can easily employ the package.

SA A D SD NA Cost of the package is reasonable compared to its instructional value.

OTHER COMMENTS relating to the package -

POTENTIAL USES - Target user: ... Teacher ... Student

Required background of user:

Describe the classroom technique which would make best use of the package.

List potential areas of study:

ESTIMATED STUDENT TIME REQUIRED FOR SUGGESTED EXPERIMENTS:

RECOMMENDATIONS

- ☐ I highly recommend this package.
- ☐ I would use or recommend use of this package with little or no change. (Note suggestions for effective use below.)
- ☐ I would use or recommend use of this package only if certain changes were made. (Note changes under Weaknesses or Other Comments.)
- ☐ I would not use or recommend this package. (Note reasons under Weaknesses.)

APPENDIX B: PRODUCER CONTACT INFORMATION

Atari

Atari, Inc.
P.O. Box 3427
Sunnyvale, CA 94088

Broderbund

Broderbund Software
17 Paul Drive
San Rafael, CA 94903-2101
415/479-1170

CDL

Cambridge Development Laboratory, Inc.
1696 Massachusetts Avenue
Cambridge, MA 02138
617/491-0377

Creative

Creative Technologies Inc.
PO Box 1009
Carlisle, PA 17013
717/245-2988

Cross

Cross Educational Software
1802 N. Trenton Street
P.O. Box 1536
Ruston, LA 71270

EduTech

EduTech
Dept. C
P.O. Box 1715
303 Lamartine St.
Jamaica Plain, MA 02130
617/524-1774

E&L Inst

E & L Instruments
70 Fulton Terrace
New Haven, CT 06509
800/225-0125

EME

Educational Materials and Equipment
P.O. Box 17
Pelham, NY 10803

FutureMind

FutureMind
1745 21st Street
Santa Monica, CA 90404
213/829-3641

Hartley

Hartley Courseware, Inc.
Dimondale, MI 48821
800-247-1380

Hayden

Hayden Book Company Warehouse
1 Chris Court
Dayton, NJ 08810
201/329-9150

Holt

Holt, Rinehart and Winston
Attn.: Order Fulfillment Dept.
CBS, Inc.
383 Madison Avenue
New York, NY 10017

HRM

HRM Software
175 Tompkins Avenue
Pleasantville, NY 10570
914/769-7496
800/431-2050

Interactive

Interactive Microware, Inc.
P.O. Box 139
State College, PA 16804-0139
814/238-8294

Merlan

Merlan Scientific, LTD
247 Armstrong Avenue
Georgetown, Ontario, Canada L7G 4X6
416/877-0171

Narco

Narco Bio-Systems
7651 Airport Blvd.
Houston, TX 77061
713/644-7521

Quantum

Quantum Technologies, Inc.
P.O. Box 1396
Englewood, CO 80150
303/674-9651

Vernier

Vernier Software
2920 S.W. 89th Street
Portland, OR 97225
503/297-5317

APPENDIX C: INFORMATION ABOUT BUILDING YOUR OWN

The following organizations conduct workshops on building your own interfacing packages and/or distribute low-cost software routines.

Technical Education Research Center Inc.
1996 Massachusetts Avenue
Cambridge, MA 02138
617/547-3890

American Association of Physics Teachers
5110 Roanoke Place
College Park, MD 20740
301/345-4200

National Science Teachers Association
1742 Connecticut Avenue NW
Washington, DC 20009
202/328-5840

Project Seraphim
Dr. John W. Moore, Director
Department of Chemistry
Eastern Michigan University
Ypsilanti, MI 48197
313/487-0368