PRINTOUT

JOSEPH B. SIDOWSKI

Products

Pneumograph

The Model DP-1A Dynamic Pneumograph consists of a nonstretching nylon belt designed to attach around the S's chest to monitor expansion of the chest during inspiration and expiration. A solid-state sensor is sewn inside the belt and is completely isolated from the S. The electrical circuit is sewn into the belt lining and insulated. Electrical power comes from a standard-size battery contained in its own holder. Change in resistance of the solid-state sensor is proportionate to chest expansion, and signal change can be read out on a recorder or other oscillographic device. The electrical signal is linear with expansion and the accuracy is $\pm 5\%$. The DP-1A is designed for use with any dc preamplifier. Price: \$120.

Sensotec Division
1400 Holly Avenue
Columbus, Ohio 43212
(614) 294-5436

Solder Remover

The Oryx desoldering tool is operated by depressing a plunger to create a sucking-pump type of action. Molten solder is drawn into a Teflon tip, at the end of a plastic barrel containing the spring-loaded suction pump, by releasing the trigger. Thus, solder is sucked up into the barrel after having been heated with a regular soldering tool. The usual desoldering tool has its own separate soldering iron with a bulb-activated suction pump. With the Oryx there is no wait for the separate tool to heat up. Price: \$18.

Continental Products Co.
P.O. Box 129
Bronxville, New York 10708

Digital Printer

The Systron-Donner Model 5103 Digital Printer is a medium-speed low-cost (\$995) unit able to accept dual source operation with A and B or with A or B source control. Each source can have a different BCD code and each can have either negative or positive logic. The Model 5103 has programmable zero suppression, up to 21 columns with 16 characters per column, an ability to print any input channel in any column, a digital clock interface option

with programmable dual line operation, an automatic paper alarm which inhibits printing when paper supply is depleted, a DVM counter translator option for printing measurement units, $\pm$ sign or floating decimal point, and red or black color printing with remote selection. Transfer time is 300 msec and printing rate is three lines/second. Spacing is five lines/inch; column spacing is 0.1375 in., center to center. Weight is 25 lbs, and the dimensions are 7 in. high x 8½ in. wide x 17 in. deep.

Systron Donner
888 Galindo Street
Concord, California 94520
(415) 682-6161

Photometer

The SLI Type 80 Photometer employs a photosensitive cell that is linear with respect to light energy. The meter accepts a wide variety of light reading probes and is compact (weight, 3 lbs; dimensions, 8 in wide x 6 in. high x 5 in. deep). Spectral response depends on the head chosen: without adapter 350-1,100 millimicrons, visible range 350-850 millimicrons, infrared range 700-1,100 millimicrons. Intensity range is 0.2-3,000 fc (ratio of 1,500:1). Power requirements: two "C" size flashlight batteries. Price of the SLI Type 80 Exposure Photometer is \$275. A complete kit with various probes and adapter heads costs \$475.

SLI
139 Nevada Street
El Segundo, California 90245
(213) 322-6324

Solid-State Electronic Kits

All kits described here include an etched and drilled circuit board plus necessary components and instructions. Kits operate on 6-12 V and can be interchanged or interconnected to comparable kits.

The No. 370 Variable Power Supply costs \$11.55 and consists of a full-wave silicon rectifier bridge followed by a transistorized regulator and electronic ripple filter. Also featured is a built-in limiting circuit which protects the unit if there is a short circuit on the output. The power supply requires an input of 12 V ac, obtainable from a small filament transformer. The dc output is adjustable from 0 to 12 V at currents up to 500 mA.

The No. 350 dc power supply kit requires an ac input voltage up to 12 V to get a well-filtered 1-A dc output. The dc output voltage will be approximately equal to 1.5 times the ac voltage input. For example, a 6-V ac filament transformer will net 9 V at the dc output. Price: \$5.55.

The No. 150 Delay-on-Timer 1- to 100-sec unit can handle load currents up to ¼ A. For larger loads, the timer output can be used with slave relays. Applying power to the unit initiates the time delay. After a period of time determined by the setting of the adjustment potentiometer, an output voltage essentially equal to the supply voltage will be applied to the load. Interrupting power to the unit resets the timer. Price: \$5.65.

The No. 340 Signal Flasher Lamp is adjustable and can be operated over a wide range of flash rates. It can operate on standard batteries or it can be used with the No. 350 or No. 370 power supply. Price: \$5.65.

The No. 210 High-Gain Pre-Amplifier kit is a two-stage transistor unit for use ahead of a power amplifier to enlarge very low-level signals. A 6- to 12-V dc power source is required. Price: \$6.45.

The No. 120 Electronic Metronome has an adjustable rate of approximately 20-300 beats/minute. Any 8-ohm speaker can be used with the unit, which is priced at \$5.05.

Other kits are available also. Orders of \$15-\$25 are discounted by 20%.

Houle Manufacturing Company
P.O. Box 276
Santa Susana, California 93063

Visible Solid-State Light Source

The MV50 is a diffused gallium arsenide phosphide diode with the following characteristics: brightness, 750 fL produced by 20 mA; current required to produce 50 fL, 2-10 mA; peak emission wavelength, 6,300-6,500 Å; spectral line halfwidth, 400 Å; forward voltage, 1.60 V; capacitance, 200 pF; reverse current, 0.3 microamperes; and light turn on and turn off, 1.0 nsec. The dimensions of the epoxy lens are 0.100 in. diam and 0.100 in. high.

Monsanto
Electronic Special Products
10131 Bubb Road

Cupertino, California 95014
(408) 257-2140

Pulse Generator

The Model PG-11 Pulse Generator has a range of 10 Hz to 20 MHz and is priced at \$375. The instrument has a rise time of 3 nsec at full amplitude, ± 15 V at maximum or any other rep rate, synchronous or asynchronous gating, triggering dc to 20 MHz, and continuously variable rep rate, width, delay, and amplitude. The unit is guaranteed a year.

Chronetics, Inc.
500 Nuber Avenue
Mt. Vernon, New York 10500
(914) 699-4400

Waveform Generator

The Exact Model 126 is a main generator for sine, square, triangle, pulse, and sync, plus a ramp generator for sweeping or triggering the main generator or for use as an independent generator. The frequency range is 0.1 Hz to 3 MHz, with a ramp time of 10 microseconds to 100 sec. The ramp generator can sweep the main generator over a range of 1,000:1. Both generators can be triggered and gated independently, and the main generator can be swept manually over three decades (search mode). Ramp is available at the main output and via its own connector, a ramp gate output connector on the rear panel convenient for x-y and Bode plots. The unit weighs 9 lbs and stands 3½ in. high x 12½ in. wide x 10½ in. deep. Price: \$495.

Exact Electronics, Inc.
Box 160
Hillsboro, Oregon 97123
(503) 648-6661

Automatic Deprivation

Environmental Sciences Corporation is advertising a completely programmable rat and pigeon deprivation system which allows 24-h control and care. Food and/or water is available for time periods selected by E and at any intervals. The company also sells an integrated self-cleaning and automatic water system.

Environmental Sciences Corporation
405 Howell Way
Edmonds, Washington 98020
(206) 774-9822

Paper-Tape Perforator

The Dijitpunch 400 is a portable paper-tape perforator that accepts low-level BCD inputs and records data in computer-compatible code. Models are available with either four or eight channels

of variable data. Operating speed is variable from 0 to 10 characters/second. Code Channels 1-4 are variable, 5-8 are fixed for data (eight channels of variable data are available). The feed-out causes all eight channels to be punched. Price: \$895.

PIVAN Data Systems
6955 North Hamlin Avenue
Chicago (Lincolnwood), Illinois 60645
(312) 676-0790

Heat by the Yard

Heat by the Yard is a flexible heating tape that provides uniform heat to 450°C (842°F) with the use of a voltage controller. It can be used on practically any vessel, valve, or column and reused on different setups. The tape consists of a continuous network of resistance wires enclosed in knitted flexible sleeves of glass-fiber yarn. To install, a suitable length of tape is cut from the dispensing carton and the insulated terminations are fixed with the connectors supplied. A nomogram is supplied which serves as a guide in determining required tape length for specific temperatures and voltages. The ½-in. width comes in 25-ft (\$87) and 50-ft (\$154) lengths supplied with 6 and 12 connectors, respectively. The 1-in. width costs \$109 for 25 ft, and \$201 for 50 ft.

Cole-Parmer Instrument Company
7425 North Oak Park Avenue
Chicago, Illinois 60648
(312) 647-0272

Digital Data System

Esterline Angus has introduced a compact 5- to 20-channel digital data acquisition system. The system has low-level signal conditioning of 1 mV full scale with 200% overrange. Programmable gain of individual channels (1, 10, and 100 mV) can be selected from front panels. Each channel can be assigned a different gain, which allows various levels of full-scale input from different types of transducers. Input impedance is 100 megohms on all ranges. Noise rejection is accomplished by using an integrating type of digital voltmeter and guard-shield techniques. The three inputs per channel (high, low, and guard) are switched, an important feature in relation to common mode rejection ratios for both ac and dc voltage.

The system has an internally mounted real-time clock to provide visual and printed records of hour and minute codes. The D-2020 Digital Data Acquisition System has a self-contained digital printer which prints channel number, date, time, and data frame identification as entered. Its decimal point is floating, so it can be

assigned to any of the four digits. Frame scan rates can vary from two channels/second to one frame/hour to permit wide-range data sampling. An optional interval circuit is available which allows interface with incremental magnetic tape or punched paper-tape recorders. Data is available in ASCII-coded format. The digital data system is priced at \$3,540 for 5 channels; additional 15 channels are available at \$250 per 5-channel plug-in board.

Esterline Angus
Box 2400
Indianapolis, Indiana 46224
(317) 244-7611

Printout Device

The M-120 is a serial-entry numeric printer with direct BCD input which functions as a printout instrument at 15 digits/second (bit parallel). Print time is 330 msec, and the data are printed on 3-in.-wide tape with from 1 to 16 columns of digits. Price: \$190.

SMC Corporation
Industrial Products Department
3210 Porter Drive
Palo Alto, California 94304
(415) 326-9500

Strip Printer

The CTS 444 is a 35-characters/second strip printer which can operate as a stand-alone unit or may be incorporated into OEM equipment. The instrument prints 64 alphanumeric characters and is priced at \$580.

Computer Terminals Systems, Inc.
52 Newton Plaza
Plainview, New York 11803
(516) 293-6611

Decade Counter Kit

The Numitron Readout Decade Counter Kit costs \$19 and includes a circuit board, socket, and two integrated circuits. The DR-2010 or DR-2020 RCA Numitron tubes cost \$5.95 each. The 2010 displays 0 through 9 with decimal point; the 2020 displays plus-minus sign and numeral 1. Counting speed is up to 20 MHz, with viewing angle up to 150 deg. Input levels are 2.2 V for logic "1" and 0.6 V for logic "0." Outputs are 2.4 V minimum for logic "1" and .4 V maximum for logic "0." Power input for the display is 3.5 to 5 V at 120 mA maximum; for the circuits it is 5.0 V $\pm 5\%$ at 50 mA.

Southwest Technical Products
Corporation
219 W. Rhapsody

Telemetry

Datel, Inc. is marketing telemetry equipment suitable for use with animal and human Ss. The Model 1100 transmitter without conditioners costs \$1,430 and has the following specifications: input sensitivity, 100 microvolts full scale; noise level, <1 microvolt rms; frequency response, within ± 3 dB, 0.5 to 100 Hz for eight channels; input impedance > 2 megohms; number of data channels, two to eight; modulation, pulse interval modulated subcarrier, frequency modulated RF carrier; sampling rate, 9,000 samples/second; transmitting range, 100 ft (other ranges available); transmitting frequency, 88 to 108 MHz (adjustable). The weight is approximately 5 oz and the size is 1 x 3-7/8 x 4 in.

The conditioners are priced as follows: EEG (ac), \$198; EKG, \$155; EOG, \$198; pressure, \$179; temperature, \$117; and EEG (dc), \$320. The receiver system without demodulators is listed at \$1,531, with demodulators costing \$158 per channel.

The Datel 2100 is a single-channel wide-band telemetry transmitter specifically designed for transmitting high-frequency biopotential data from a free-moving S. FM/FM techniques are utilized. Transmission distance is 25 ft. The unit weighs approximately 1 oz and measures 0.6 x 1.2 x 1.8 in.

Datel, Inc.
1161 15th Street
Holly Hill, Florida 32017
(904) 252-8798

Solid-State Panel Timer

The PT-100 series panel timers have timing ranges from 100 msec to 1,600 sec, depending on the model. Operating ranges for different models are 12 to 110 V, and the units operate on ac or dc. Reset is less than 50 msec, and the timers are protected against ac and dc transients. The timers measure 3 x 3 x 1 1/2 in. Cost per unit: \$28.50.

Chronologics, Inc.
24 Martin Street
Webster, New York 14580
(716) 872-1470

Universal Timer

LVE recently introduced a useful laboratory timer which integrates circuitry with a 5-Range Tenor Clock Unit. The Universal Timer (LVE 253-21) has two functions of particular interest, a hold and a reset. A signal applied to hold will stop

the timing pointer wherever it is and hold it there. When the signal is removed, the timing pointer will continue to finish timing the interval. This hold feature permits saving or holding time on concurrent interval schedules which have changeover "lockouts."

Unlike the stop function (a pulse at stop while the timer is running aborts the timing and causes it to go to the rest state), reset does not abort timing of the interval. It simply returns the timing pointer to zero without disrupting the timing contacts and starts retiming the interval automatically. This feature permits the programming of a DRL with no other unit but the timer. A response passed through a timing contact to the reset input operationally defines the DRL.

Price of the Universal Timer is \$145.

Lehigh Valley Electronics
Box 125
Fogelsville, Pennsylvania 18051
(215) 285-4211

Briefs

Student Lab T-Scope

An earlier issue of this journal reported an inexpensive tachistoscope for use in student laboratories (Rouse, R. O., & Tarpy, R. M. A simple tachistoscope for student labs. *Behavior Research Methods & Instrumentation*, 1969, 1, 156-157). As originally constructed, the interior lighting of the unit was provided by three 3-V flashlight bulbs powered by two flashlight batteries. Although the unit operates very well, during continuous student laboratory use the battery power arrangement sometimes proves inadequate. To provide a more flexible piece of inexpensive equipment, two minor changes are suggested. The batteries can be replaced with a 115- to 6-V step-down transformer (Allied Electronics, 54 A 2351, \$3.70) mounted inside the front left corner of the box and the 3-V bulbs replaced with 6.3-V lamps. The potentiometer can be permanently installed on the side of the box with a 2-in. precision control vernier dial (Micronta, 274-615, \$1.59) mounted on the outside.

The use of a transformer instead of the batteries provides a constant source of power for interior lighting and eliminates problems such as intrasession dimming of the lights due to power drain on the batteries. The addition of the vernier dial to the potentiometer, in conjunction with a light meter, allows for a fairly accurate calculation of light intensity at various settings.

(This information was submitted by S. F. Davis and F. E. Mayo, Jr., of King College, Bristol, Tennessee 37620.)

BCD to 7-Segment Decoder/Drivers

For a limited time, Fabri-Tek is allowing new customers to purchase evaluation quantities (1-10 units) of their decoder-drivers at volume prices (1,000-2,499 quantity price). The FTD-1001 (120 mA/segment, 40 V) contains one decoder/driver plus seven transistors at \$9.55 per unit. The FTD-1002 contains an additional quad latch for \$12.35; the FTD-1003 contains one decade counter, one decoder/driver, and seven transistors at \$12.35 per unit. The package for all three is a 16-pin DIP.

If more complexity is desired, you can buy the FTD-1005 for hexadecimal readout (0-9 and A-F, using 9-segment or 16-segment displays with 20-pin DIP) at \$20.50 per unit. The FTD-1007 is a full alphanumeric (64 ASCII characters) decoder/driver for 16-segment incandescent or LED displays at \$63 per unit.

Fabri-Tek
Micro-Systems, Inc.
1150 N.W. 70th Street
Fort Lauderdale, Florida 33309
(305) 933-9351

New Computer Department

The Hagan/Computer Systems Division of Westinghouse Electric has been renamed the Computer and Instrumentation Division and has been restructured. The hardware side of the Westinghouse computer business has been moved to Orlando, Florida, and renamed the Computer Department. The new department is slating development programs for new versions of the Prodac 2000 minicomputer.

Universal Interface

EG&G Inc. recently formed a Data Products Group to market Data Interface. The latter is a universal interface and device controller designed to mate all types of peripherals to mini- through medium-sized computers. Data Products has now been discontinued, and the universal interface concept temporarily withdrawn from active marketing. It will be reconsidered in 12-18 months. Evidently, present marketing inputs were not adequate to assure a worthwhile venture.

Fiber Optic Kits

Rank Precision Industries is selling two fiber optic kits that could prove useful as research tools. Kit No. 1 is priced at \$45

and contains a fiber optic flashlight as the light source, a rigid Y guide for proximity switch or positioning sensing applications, a flexible fiber optic light pipe (one end divided into twin bundles), robust light pipes of 1/6 in. diam x 24 in. long, 1/8 in. diam x 18 in. long, and 1/4 in. diam x 12 in. long, and two plastic connectors for coupling fiber optic components together.

Kit No. 2 contains some of the same material plus a 12-element reader, a flexible Y guide, 12 in. long, for double illumination from a single lamp, sample pieces of plastic fiber optic for decorative lighting, an image conduit, 1/4 in. diam by 12 in. long, for transmitting pictures (not just light), an image inverter, 1 in. diam, which rotates the image 180 deg, and a 1-in.-diam field flattener (a disk of fiber optic, flat on one side, curved on the other, for photographic image flattening). Price of Kit No. 2 is \$84.

Rank Precision Industries, Inc.
260 North Route 303
West Nyack, New York 10994
(914) 358-4450

Poly-Optics also markets a fiber optic experimenter's kit. Their kit contains a total fiber footage of 49,710 and includes 10 ft each of .0717, .1917, and .3717 poly fibers, and 1/4 in. diam x 6 ft bundles of bulk fiber in five sizes, ranging from 3 to 30 mil. Also included are a light source, a transformer, a line switch, a reflector housing, 24 ft of jacketing, epoxy and treatment compound, and assorted eyelets. Price: \$50.

Poly-Optics, Inc.
1815 East Carnegie
Santa Ana, California 92705
(714) 546-2250

TV Camera for Darkness

The Newell TV camera can be used in daylight or darkness without adjustment. The unit consists of an infrared source, a GE TE-33 camera, and a tube on the front of the camera that converts infrared to visible light. The camera has no image-intensifier tubes, thus reducing cost.

Newell Industries
A/V Equipment Division
795 Kifer Road
Sunnyvale, California 94086

Darlington Devices

The MJ900 and the MJ901 are pnp units; the MJ1000 and MJ1001 are npn-type numbers for a new series of silicon-power Darlington devices made by Motorola. Minimum dc beta is 1,000 at V_{ce0} ratings of 60 and 80 V. The

configuration consists of both transistors and their compensating emitter resistors on a single chip.

Motorola Semiconductor Products, Inc.
Box 20924
Phoenix, Arizona 85036

Infant Sentry

The AEL Model 1500 Infant Sentry is a telemetric device which does not require the attachment of wires to the infant. A small transensor, weighing less than one-third of an ounce, may be laid on, or taped to, the infant's stomach. A receiver alarm unit is attached to the side of the container or bassinet and a pickup antenna is placed under the infant. During breathing, a blinking light provides a visual display of operation. When the infant's respiration stops, an audible alarm is sounded and the light stays on. A delay is built in so that the alarm sounds at a preset interval (3-15 sec) after respiration has stopped. If breathing resumes, the alarm is silenced.

American Electronics Laboratory, Inc.
P.O. Box 552
Landsdale, Pennsylvania 19446
(215) 822-2929

Russian Computers

The Soviet third-generation type of computers are not expected to be generally introduced until 1975. According to reports, five machines are proposed as the base of the series which will range from a small machine similar to the IBM 360/20 to something like the 360/50. If the Russians go to a larger machine, it is not clear as yet whether it will be of a type equivalent to the 360/65 or of another design based on the currently powerful Russian machine, the BESM-6.

A Rand Corporation report indicates that the Soviets are about at the stage that the U.S. was in 1962-1964. The Nairi-3 computer, believed to be the first Russian IC machine, was announced approximately a year ago. It is comparable (although less sophisticated) to the first American IC processors of 6 or 7 years ago—the IBM System/360 (hybrid circuitry), the monolithic circuit Honeywell 4200, and other systems. It is felt that Soviet expertise in computer-related technologies, such as switching theory, design of integrated circuits, and logic design, is almost as good as ours, but that applications are minimal.

Plasma Scalpel

Work is being done on the testing of a plasma scalpel that cuts surgical

hemorrhaging. A team of Purdue researchers is building prototypes.

The plasma scalpel has a positive copper electrode and a negative tungsten electrode. The former functions as a nozzle; the latter is shaped like a bullet. An electric arc is struck between the electrodes and, as the gas passes through the arc, free electrons are stripped from the gas atoms and the temperature rises as high as 15,000°C. This jet vaporizes water in body tissue. It also disintegrates solid matter. The plasma scalpel makes a fine incision and, at the same time, cauterizes the sides. The exit diameter of the Purdue plasma jet is 0.25 mm.

Gas and water cooling are being used on separate prototypes. Electrical lines and gas and coolant tubes are housed in an umbilical connection.

Radio-Shack-Allied Merger

Radio Shack and Allied Radio have merged, combining the facilities of 700 Radio Shack Company owned and franchised stores and 41 Allied Radio stores. Radio Shack products will be made available through Allied Radio outlets and Allied catalog order booths will be located in each Radio Shack store. No mention has been made of price changes, a matter of importance to experimenters. For example, a pint of ferric chloride for etching printed circuits costs nearly twice as much in the Radio Shack catalog as it does in the Allied listing. There are other price comparisons which are similar.

The new 1971 Allied Radio Shack catalog costs \$1 for mailing and handling charges, refundable with the first purchase of \$1 or more.

Three-Dimensional Displays

The Stereotronics TV Company is introducing a kit which enables one to see depth in two-dimensional displays. The Stereotronics System is an optical kit with an advertised capability of converting any closed-circuit TV equipment to 3D in minutes. The kit includes a 10-min specially recorded video tape, stereo screen, and stereo glasses, along with instructions covering details, theory, and how to make your own stereo photos, film, or video tapes. Applications to computer readout are described also. Since the kit is optical, no electronic modification is required. Introductory kits range in price from \$85 to \$225. Advertising is directed toward industrial uses.

Stereotronics Television Company
13720 Riverside Drive
Sherman Oaks, California 91403
(213) 783-7770

Solid-State Items

Poly Paks is advertising a number of reasonably priced solid-state items. In the integrated circuits line, the Philco Dual 50-Bit Shift Register (No. PL5R100P) is listed at \$9.99. A TTL Texas/National Decade Counter costs \$5.50 (SN7490T) and a 4-bit binary counter by the same company is priced at \$4.95 (SN7493T). A Fairchild 16-Bit Memory is \$3.95 (9033F), a Fairchild TTL 4-Bit Universal Shift Register costs \$2.49, and a TTL BCD Up/Down Counter is listed at \$9.99. Buffers, dual buffers, gates of various sorts, and flip-flops are \$1.29, or three for \$3.19.

For a listing of items, write to Poly Paks, P.O. Box 942, South Lynfield, Mass. 01940.

Drug Analyzer

A 3-min analysis of seven barbiturates is being advertised for a gas chromatographic method developed by Supelco, Inc. A high-temperature column packing method is used to separate completely barbital, amobarbital, pentobarbital, secobarbital, mephobarbital, cyclopentylmethyl barbituric acid, and phenobarbital.

An Inexpensive Multipurpose Sensor

In the last issue of this journal, Spears and I described a versatile apparatus for measuring the frequencies and durations of animal and human responses (Sidowski, J. B., & Spears, C. A versatile apparatus for measuring the frequencies and durations of animal and human responses. *Behavior Research Methods & Instrumentation*, 1970, 2, 235-238). A number of sensing circuits were included to illustrate the various techniques that might be used for activating the sensitive relay. Four of the diagrams covered touchplates and moisture sensors, the manufacture of which is the topic of this brief report.

Figure 1 shows two sensors, differing in shape, which we have used with great success for moisture or touchplate operations in research with human and subhuman primates. Both are very easy to make, and they are inexpensive.

The transducers can be manufactured in any size or shape, but the grids must be close together, as shown in Fig. 1. Leads are soldered to each set of grids at Points A and B.

Six or eight sensing units can be made from a single unpunched Vector 2-oz copper-clad terminal board, No. CU65/45-1, measuring $6\frac{1}{2} \times 4\frac{1}{2}$ in. These are etched as illustrated with ferric

Fig. 1. Moisture or touchplate sensors. A and B indicate lead connections.

chloride etching solution, Type E-1PT. The board (\$.62) and solution (\$.85/pint) are available from Allied Electronics, Stock Nos. 47 D 6208 and 47 D 1159, respectively.

Electronics

EDI is having a sale on electronic and other items that is worth looking into. For a listing, write to Electronic Distributors, Inc., 4900 N. Elston, Chicago, Illinois 60630. The sale expires January 30, 1971.

Calculator Sale

BF Enterprises is advertising the Monroe Calculator Model 8N-213 at about one-fifth original cost. The machines are advertised as fully checked and reconditioned at a price of \$137.50. Write BF Enterprises, P.O. Box 44, Hathorne, Massachusetts 01937.

The same company is advertising a tape-punch/tape-reader panel from the Remington Synchro-Tape Unit containing an eight-level punch, eight-level reader, and supply and take-up spools, and some electronics. The punch solenoids operate from 50 V dc; no other technical information is available. Price of the TPTRP is \$75.

Photodetectors

Photodetectors are circuit elements activated by light. As light changes in intensity, these sensors either generate voltages or currents, or change resistance in such a way as to provide signals for initiating various functions. Four general classes of photodetectors are: the photoconductors, photovoltaics, photo-emissive detectors, and junction photodetectors.

The most common *photoconductors* are of cadmium selenide (CdSe), cadmium sulfide (CdS), and lead sulfide (PbS), although there are also lead arsenide and indium arsenide types. CdS and CdSe

respond at about the visible spectral region, PbS at I.R. (Photoconductors are known also as photoresistors since they are light-sensitive resistors.) Their long-term stability can be rated poor to good since photovoltaic properties change with temperature, aging, and previous light exposure. The cell sensitivity of photoresistors is the current output for a given light level.

With *photovoltaic cells*, incident light generates electricity, so they need no applied voltage. Response time of silicon cells is faster than selenium, but silicon is not as subject to fatigue. The peak spectral response of silicon cells is about .85 microns; for the selenium it is at about .60 microns. The range of spectral response is from visible to near I.R. Temperature influences the outputs of both. Internal resistance of the photovoltaic cell varies with light intensity, with outputs being fairly linear for low resistance loads. Photovoltaics as well as photoconductors can be used in bridge circuits.

Photo-emissive detectors are electron tube types, either vacuum or gas filled, which are generally out of sorts with modern solid-state and IC applications. External voltages are applied for operation. As light intensity on the cathode varies, anode current changes.

The *junction photodetectors* include photodiodes, phototransistors, and photoswitches. With *photodiodes*, both germanium and silicon types are available. Except for the fact that a lens is used to focus light on the pn junction, these devices are similar to ordinary solid-state diodes, and they are affected by temperature. Faster than photoconductors, photodiodes have lower sensitivity and are the smallest of the photodetectors; amplification is generally necessary. The *phototransistors* (silicon or germanium) are more sensitive than photodiodes but response times are longer. Their responses to different light spectra are similar. The phototransistor uses a lens to collect light on the junction, otherwise it is similar to ordinary transistors. Field-effect transistors have better sensitivity and very fast response times. Now the *photoswitches* are essentially optical silicon-controlled rectifiers (SCR), "on" in the light and "off" in the dark. These are pnpn devices that can be used as high-speed power switches. As such, they can activate motors, lamps, solenoids, and other components. Long-term stability is good, and the spectral response is from visible to near I.R. The light-activated SCR is valuable in logic circuitry because the latching properties in dc circuits give the LASCR a built-in memory.

Remanufactured Ampex Recorder/Reproducer

Ampex has remanufactured a limited number of the Ampex FR-1400 Recorder/Reproducer systems. Price of the system is under \$10,000, depending on the configuration (slightly higher for FM-type electronics). The FR-1400 sold new for an average of \$45,000 each. Each carries the standard new-product guarantee of 90 days. The systems record and reproduce direct from 400 Hz to 1.5 MHz, in the FM mode from dc to 720 kHz. Four speeds are provided; 7- or 14-channel operation is offered. Contact your nearest Ampex Instrumentation field engineer or Ampex Corporation, 401 Broadway, Redwood City, California 94063. Phone: (415) 367-2011.

Notes

An inexpensive photosensor using a light-activated SCR

DAVID S. MALCOLM, HUNTER COLLEGE OF THE CITY UNIVERSITY OF NEW YORK, New York, New York 10021

The interruption of a light beam is frequently used to define a response in behavioral research. The typical photosensor employs a photocell which responds to changes in light intensity with a change in resistance. Additional circuitry is required to obtain an on-off output for

Fig. 1. Photosensor circuit and LASC base diagram. All resistance values are in ohms and are $\frac{1}{2}$ W: $R_1 = 4.7\text{M}$; $R_2 = 100\text{K}$ potentiometer, linear taper; $R_3 = 100\text{K}$. The LASC is a GE L8F. D1 is RCA 1N537, or equivalent. K1 is an Allied Control T154 relay. LL is a lamp-lens assembly, such as Sawyers 371-504, 375-105. The base diagram of the LASC is viewed from the bottom: K = cathode, G = gate, A = anode.

Fig. 2. Circuit for 2-A power supply. T1 = Stancor P8357; primary 117 V ac, secondary 25.2 V ac, 2 A. BR1 = International Rectifier 18DB2A, 2-A bridge rectifier.

program control. A new device, the light-activated semiconductor-controlled rectifier (LASC), responds to changes in light intensity with an on-off switching action allowing direct control of certain devices such as relays. The LASC is similar in appearance to a transistor but has a clear window in the top of the case. After switching to the on or conducting state, a LASC will not turn off until current flow through it reaches zero. For this reason, the LASC circuit is powered by a supply giving full-wave rectified, unfiltered dc.

Figure 1 shows the circuit for the LASC photosensor. The turn-on threshold is controlled by the biasing voltage on the gate which is adjusted by R2. K1 may be any 24-V dc relay requiring 1 A or less. The power supply shown in Fig. 2 is adequate for several photosensors. The maximum number is determined by the sum of the current requirements of the K1 in each circuit, for this supply a maximum of 2 A. If this is inadequate, several power supplies or one with a larger amperage rating may be constructed.

As the peak sensitivity of the LASC is in the infrared region, filters may be used on the light source to reduce the visible component of the light with little loss of sensitivity.

The LASC photosensor is inexpensive, approximately \$8, excluding the relay. The 2-A power supply also costs about \$8.

A photoelectrically automated shuttlebox¹

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The shuttlebox, or stabilimeter cage, has long been used in studies of behavior maintained by aversive stimulation and in the measurement of spontaneous activity. Recent data suggest that this device may

Fig. 1. Apparatus schematic; parts from Allied Catalog.

also provide information on the motivational properties of rewarding electrical stimulation of the brain that may not be obtainable in a conventional leverpress situation (Atrens, in press).

One of the disadvantages of this device is that it is rather difficult to automate. The tilting-floor arrangement that is typically used is often difficult to balance and is prone to counting spurious responses if the S jumps or straddles the balance point. This moving-floor arrangement also introduces a substantial and irreducible amount of response-produced stimulation and complicates electrifying the grid.

These difficulties have been reduced in some commercially available units and could be virtually eliminated by using stress gauges to detect the presence of the animal. Unfortunately, both of these solutions are very expensive and have yet to be incorporated in a single unit.

The apparatus schematized in Fig. 1 circumvents the problems inherent in tilting-floor shuttleboxes by the use of a simple photoelectric circuit that can be constructed from readily available components at a total cost of under \$10 (less relay). While essentially the same result can be achieved with commercially available photoelectric devices, the circuit described here represents an optimum solution in several respects. It is very inexpensive, compact, reliable, sensitive, and can operate under virtually any ambient light conditions.

Basically, the photocell and the 47K resistor form a voltage dividing circuit which becomes unbalanced when the photobeam is interrupted. This causes the 1.0-microfarad capacitor to discharge a positive voltage into the gate of the silicon-controlled rectifier, which actuates a relay. The two circuits interact in such a way that once one is activated it cannot be reactivated until the other photobeam is