

CANADA'S OWN ELECTRONICS MAGAZINE

\$1.25

electronics today

SEPTEMBER 1978

**Huge
Scope
Survey**

FREE
Dominion
Catalogue

**Electronics in
Model Railways**
Camera Shutter Timer

Digital-Display
Audio Oscillator
Electronic
Rain Alarm

Specifications

HM 412

Modes of operation

Channel I, channel I and II

Channel switching alt. or chop.

(chopper frequency approx. 1MHz)

Summation channel I + II,

Difference with channel I inverted

X-Y operation, ratio 1 : 1

(X signal via channel II)

Vertical Amplifier Y

Frequency range of both channels

0 - 15MHz (-3dB), 0 - 20MHz (-6dB)

Risetime: approx. 23ns

Overshoot maximum 1%

Deflection coefficients: 12 calibr. pos.

5mVpp/cm - 20Vpp/cm (sequence 1-2-5)

with fine control uncal. 2mVpp/cm

Accuracy of calibr. positions $\pm 3\%$

Input impedance 1M Ω //25pF

Input selectable. DC-AC-GD

Max. admissible input voltage 500V DC

Error of linearity: maximum 2%

Timebase

Deflection coefficients: 21 calibr. pos.

2s/cm - 0,5 μ s/cm (sequence 1-2-5)

with expansion x5 down to 100ns/cm

with fine control uncalibr. 40ns/cm

Calibrated time accuracy $\pm 3\%$

Sweep delay time: 7 positions

from 100ns to 1s, with fine control 1:10

Modes: normal, search, delayed

Triggering autom. or with adjustable level

of channel I, II, I/II, line or ext., pos. or neg.

Trigger coupling AC, DC and TV

Trigger sensitivity: 3mm

in the frequency range DC - 30MHz

Output for sweep voltage approx. 5Vpp

Horizontal Amplifier X

Frequency range 0 - 2MHz (-3dB)

Deflection coefficients: 12 calibr. pos.

5mVpp/cm - 20Vpp/cm (sequence 1-2-5)

with fine control uncal. to 2mVpp/cm

Input impedance 1M Ω //25pF

(input via channel II)

Miscellaneous

Cathode-ray tube 131 BXB 31, 13cm \emptyset

Built-in square-wave generator 1kHz

for probe adjustment (0,2Vpp $\pm 1\%$)

Input for Z modulation (5Vpp TTL level)

Electronic stabilization incl. high voltage

Power supply for 110, 127, 220, 237V

Permissible line voltage fluctuations $\pm 10\%$

Mains frequency range 50 - 60Hz

Power consumption approx. 34W

Weight approx. 8,1kg

Case 212 x 237 x 380mm, anthracite,

with handle and tilt stirrup.



- Bandwidth 0-15MHz
- Screen 8 x 10 cm
- Delayed Sweep
- Triggering 0-30MHz

The HM 412 particularly illustrates which standard of performance HAMEG oscilloscopes have reached today in this price class. In spite of its large-scale equipment it comes up to the requirements for simple operations. The engineering of the HM 412 is mainly based on integrated circuits and module technology. All supply voltages are electronically stabilized. Therefore the operation is very stable even under higher mains fluctuations. The timebase operates with the new LPS triggering technique developed by HAMEG, by which even signals up to 30MHz are stably triggered. By the installed Sweep Delay – such as with oscilloscopes with second timebase – even smallest details can be well displayed and made visible by cut-out magnification.

Because of the relatively large bandwidth and numerous modes of operation the HM 412 may be used in all technical fields.

Available Accessories

10: 1 probe, demodulating probe, various test leads, viewing hood, dual-trace unit, registration camera, instrument cart, carrying case, components tester.

Distributed by

Specifications

HM 312

Modes of operation

Channel I, channel II and II

Channel switching alt. or chop.

(chopper frequency approx. 120kHz)

X-Y operation, ratio 1:1

(X signal via channel II)

Vertical Amplifier Y

Frequency range of both channels

0-10MHz (-3dB), 0-15MHz (-6dB)

Risetime: approx. 35ns

Overshoot maximum 1%

Deflection coefficients: 12 calibr. pos.

5mVpp/cm - 20Vpp/cm (sequence 1-2-5)

Accuracy of calibr. positions $\pm 3\%$

Input impedance 1M Ω //25pF

Input selectable DC-AC-GD

Max. admissible input voltage 500V DC

Error of linearity: maximum 2%

Timebase

Deflection coefficients: 18 positions

0,2s/cm - 0,5 μ s/cm (sequence 1-2-5)

with fine control 1.3 down to 0,15 μ s/cm

Accuracy of calibr. positions $\pm 5\%$

Triggering autom. or with adjustable level

pos. or neg. of channel I, II or external

Trigger sensitivity: 3mm

in the frequency range 3Hz - 30MHz

TV push button for frame frequency

Output for sweep voltage approx. 5Vpp

Horizontal Amplifier X

Frequency range 0-1MHz (-3dB)

Deflection coefficients: 12 calibr. pos.

5mVpp/cm - 20Vpp/cm (sequence 1-2-5)

Input impedance 1M Ω //25pF

(input via channel II)

Miscellaneous

Cathode-ray tube 131BxB 31, 13cm \varnothing

Built-in square-wave generator 1kHz

for probe adjustment (0,2Vpp $\pm 1\%$)

Electronic stabilization of all important

voltages incl. high voltage (2kV)

Power supply for 110, 127, 220, 237V

Permissible line voltage fluctuations $\pm 10\%$

Mains frequency range 50-60Hz

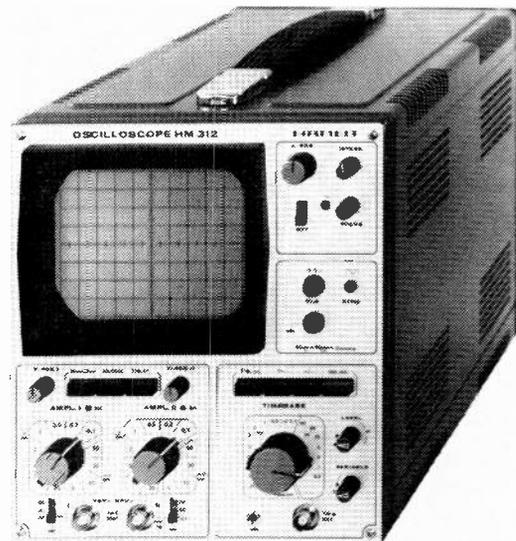
Power consumption approx. 26W

Weight approx. 7,5kg

Case 212x237x380mm, anthracite,

with handle and tilt stirrup.

Distributed by



- Bandwidth 0-10MHz
- Triggering up to 30MHz
- Dual-channel device
- Screen 8x10 cm

The latest model of the HM312 Universal Oscilloscope is the result of many years experience in this field. Thousands of its predecessors have already been distributed throughout the world. The measuring amplifier now has two channels with electronic switching. In addition, XY-display in the ratio 1:1 is possible. The controls and connectors on front panel have been given a clearly and neatly arranged layout. Particularly impressive are the stable triggering and the relatively good measuring accuracy. The effective screen area within the square frame measures 8 x 10 cm. All main supply voltages are electronically stabilized. For the display of low-speed phenomena, the HM 312 can also be supplied with a tube with long persistence characteristic. The instrument is applicable in all areas of technology, but more particularly in electronics including television.

Available Accessories

10: 1 probe, demodulating probe, various test leads, viewing hood, dual-trace unit, registration camera, instrument cart, carrying case, components tester.

SP 100 Oscilloscope Probe Kit



Part No. 900-95-522

This passive probe incorporates a three-position slide switch in the head and has a cable length of 1.5 metres. The specification is as follows.

Position x1

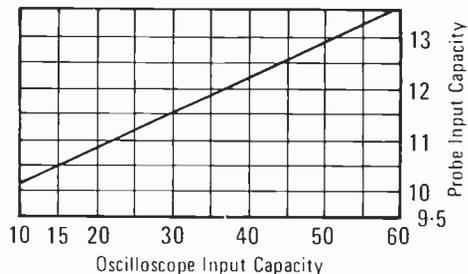
Bandwidth: D.C. to 10 MHz
 Input Resistance: $1M\Omega$ (oscilloscope input)
 Input Capacity: 40pF. Plus oscilloscope capacity
 Working Voltage: 600 Volts D.C. (including Peak A.C.)
 Cable Length: 1.5 Metres

Position Ref.

Probe tip grounded via $9M\Omega$ resistor, oscilloscope input grounded

Position x10

Bandwidth: D.C. to 100 MHz
 Rise time: 3.5 nanoseconds
 Input Resistance: $10M\Omega$ when used with oscilloscopes which have $1M\Omega$ input.
 (Probe resistance $9M\Omega \pm 1\%$)
 Input Capacity: 11.5pF when used with oscilloscopes which have a 30pF input capacity.
 For other values see graph.
 Compensation Range: 10 - 60pF
 Working Voltage: 600 Volts D.C. (including Peak A.C.)



Accessories Supplied

Insulating Tip	Pt. No. 113016
Sprung Hook	Pt. No. 120079
Trimmer Tool	Pt. No. 113012
BNC Adaptor	Pt. No. 100017
I.C. Tip	Pt. No. 113091



SP250 Oscilloscope Probe Kit



Part No. 900-91-546

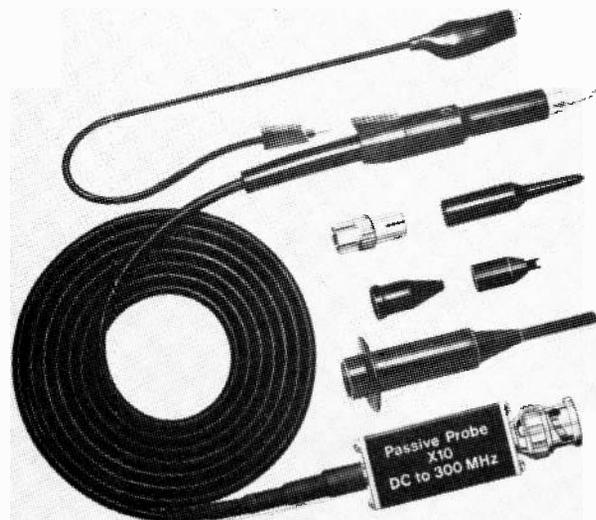
Probe Specification

Bandwidth x 10 Greater than 250 MHz
 Rise Time x 10 Less than 1.4 n.S
 Input Resistance 10M when connected to a C.R.O.
 Having 1M input resistance
 Input Capacity 12.5 PF when connected and compensated to C.R.O. with 15PF input.
 Compensation Range 10-61PF
 Working Voltage 660V D.C. (including peak A.C.)

Accessories Supplied

Trimmer Tool	Pt. No. 113012
Insulating Tip	Pt. No. 113016
Sprung Hook	Pt. No. 120079
I.C. Tip	Pt. No. 120091
BNC Adaptor	Pt. No. 100017

Bandwidth x 10 Greater than 250 MHz



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Toronto, Ontario, M4H 1B1
Telephone (416) 423-3262

Second Class Mail registration number 3955.
Return postage guaranteed. Post Office returns
to Unit 6, 25 Overlea Boulevard, Toronto,
Ontario, M4H 1B1.

Published by Electronics Today
International (Canada) Ltd.

Printed by Livingstone Printing Ltd.

News Stand Distribution Gordon &
Gotch, Toronto.

Subscription Rates \$12.00 per year,
\$20.00 for two years.

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INTERNATIONAL EDITIONS

Electronics Today International
25-27 Oxford St., London W1R 1RF, UK.
Editor Halvor Moorshead.

Electronics Today International,
Ryrie House, 15 Boundary St.,
Rushcutters Bay, Sydney, Australia.
Editor Collyn Rivers.

Electronica Top Internationaal,
Postbus 260, Emmen, Holland.
Editor Anton Kriegsman

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Kommanditgesellschaft, Bissendorfer
Strasse 8, 3000 Hannover 61, Germany.
Editor Udo Wittig.

electronics today

international

incorporating electronic workshop

CANADA'S ELECTRONICS MAGAZINE

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This month's cover shows a detail of a model railroader's dream, kindly lent to us by George's Trains of Toronto.

NEWS DIGEST



Sweep Function Generator

A new AC or battery Lin Log sweep function generator has been introduced by Exact Electronics and is available in Canada from Webster Instruments Ltd. The model 117 offers sine, square, triangle, ramp and pulse outputs with the main output variable up to 15 V p-p open circuit or 7.5 V p-p into 600 ohms. Independent auxiliary triangle, pulse, ramp and low sine outputs are also available simultaneously with an independent amplitude control on the low sine. The 117 can be

swept internally or externally with battery as well as AC operation.

Three frequency ranges cover 2 Hz to 200 KHz. Frequency control may be internal, with a frequency dial, or automatically swept over a thousand to one range either linearly or logarithmically.

For more information contact Mr. Roger Webster, Webster Instruments Ltd. PO Box 427 Port Credit PS, Mississauga, Ontario L5G 4M1. (416) 275-2270.

The Latest Craze: Home Sphygmomanometry

The consumer is saved. Christmas was coming and it looked like there wouldn't be a new electronic necessity invented in time for the fall season of consumer manipulation. We were worrying that we'd just get revamps of previous years' products — video games, smoke detectors, computers, or even video recorders.

But electronic fashion-followers have been rescued by a company called Lumiscope. And Marketron in Toronto (the centre of the New Wave in electronic fashion) is specially importing a couple of the new products: the Lumi-Tronic II and the Ultima IV.

The deluxe model is the Lumi-Tronic,

which sells for \$89.95. Featuring 'No Stethoscope Required', 'Electronic Gauge', 'Auto Valve', 'Easy-On Gabardine Cuff' and 'Colored Leatherette Case', this unit has synchronised flashing lights and "audible beep", it is self-bleeding and preset to assure exact deflation rate.

The Ultima is only \$42 and features 'The Lumi-Gauge', 'The Lumi-Valve', 'The Lumi-Cuff', and free 'Nurse's Stethoscope'. There's no mention of it glowing in the dark, but the Lumi-Gauge has a 'beautiful color-hued dial face, color coordinated with the rest of the unit'.

All you could want in a blood-pressure meter.

Another Great Catalogue Surfaces

Funny how things happen. You announce you are going to do Catalogue Survey and you get maybe one or two companies responding. But print the survey and out they come — the catalogues you've managed without (amazingly) for years. This month we have one from Edmonton:

The Cardinal Industrial Electronics Catalogue is another one in the Electro Sonic class. It has 868 pages (pages about 80% ETI-size) covering the whole "industrial" range with generous data. The catalogue also relates to products stocked by Cardinal's affiliated company in Vancouver, RAE Industrial Electronics. There are some prices in the catalogue but they're likely to be out of date. We don't know when the catalogue was published. The price of the book is \$5.

From RAE Industrial Electronics Ltd., 1629 Main Street, Vancouver, BC, V6A 2W5; (604) 687-2621.

Or from Cardinal Industrial Electronics Ltd., 11619 145 St. Edmonton, Alberta, T5M 1V9; (403) 455-4122.

Data On Wedgebase Lamps And LEDs

Chicago Miniature Lamp Works has recently published a new data sheet on the company's miniature and subminiature all-glass wedge-base lamps.

Designed principally for avionic, electronic, appliance and automotive applications these lamps are easily loaded into their sockets by a simple push.

A new 20-page catalog (#7900) featuring their complete line of solid state LED lamps has also been published by Chicago Miniature Lamp Works.

The catalog includes standard and high-brightness LEDs as well as wide-angle, short and tapered lens, low current and rectangular devices. Each product category is accompanied by tables and charts of optical, electrical and dimensional characteristics.

For more information on either publication, contact Doug Pettifer, Lenbrook Industries Limited, 1145 Bellamy Road N, Scarborough, Ontario M1H 1H5; telephone (416) 438-4610.

Multimeter Survey Update

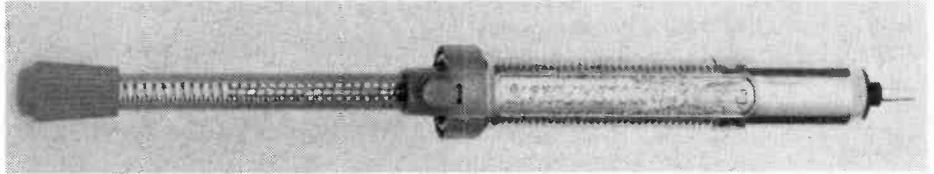
Here are the correct prices for Philips Multimeters: PM2522A \$760, PM2523 \$610, PM2524 \$1245, PM2527 \$2590, PM2517 \$431. The prices include duty and FST. We do not have details on the PM2526 and PM2513.

Canadian Phone System For Jeddah

One of the largest private digital telecommunications systems in the world has been shipped from Canada to Jeddah, Saudi Arabia. A 3,000-line SL-1 digital EPABX (electronic private automatic branch exchange) manufactured for export by Northern Telecom will replace three existing telecommunications systems and serve all administrative and shipping facilities in Jeddah harbour. It is the largest SL-1 system so far produced by Northern Telecom and will eventually be expanded to 5,000 lines. Jeddah is the major port on the Red Sea for outbound Arab oil.

One-Inch Video On Location

CFTO-TV Limited (Toronto) recently purchased one-inch video equipment from Sony of Canada. Sony say this is the first time a major Canadian broadcaster will use one inch VTR equipment for on-location shooting and editing of major television productions.



Anti-Static Desoldering

Silverstat Soldapull anti-static desoldering tool protects sensitive FET and MOSFET semiconductor devices from failure due to static electricity. Its conductive plastic tip and barrel housing allows any built-up static

Scope Theft

The following items were stolen on June 30, 1978 from the premises of BCS Electronics Ltd. 980 Alness St., Unit 35, Downsview, Ontario. Loss has been reported to the Police of No. 32 Division, Downsview, Ont.

- Items stolen are as follows:
- a) 2 Models HM307 Oscilloscopes, serial numbers 2552 and 2558.
 - b) 1 Model HM812 Storage Oscilloscope, serial number 43327.

charge to drain off harmlessly through the hand to ground. There are no conductive straps attached to the tool.

For further information contact Len Finkler Limited, 25 Toro Road, Downsview, Ontario, M3J 2A6.



WHEN WILL YOUR SUBSCRIPTION START?

March ETI is mailed to subscribers in February and we have to tell our computer to make up labels in late January. So if you want your subscription to start with the March issue we have to receive your order by mid-January. For the September issue we have to know by mid-July; you typically have to wait six weeks between sending in your order and receiving your first subscription copy.

To: ELECTRONICS TODAY INTERNATIONAL, Unit 6, 25 Overlea Blvd., Toronto, Ont. M4H 1B1

- Send me ETI for one year (12 issues) for \$12.00 Send me ETI for two years (24 issues) for \$20.00
For U.S. add \$3.00 per year for postage, outside North America add \$5.00 per year.

9/78 NAME _____

PLEASE PRINT ADDRESS _____

TOWN/CITY _____ PROVINCE/STATE _____

CODE _____ DATE _____

Cheque enclosed. DO NOT send cash.

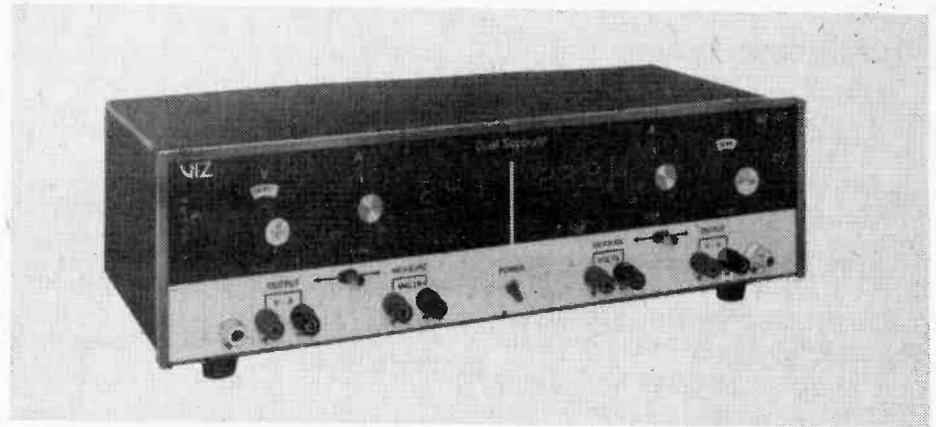
Bill Mastercharge A/C No. _____ Signature _____

Bill Chargex A/C No. _____ Expiry Date _____

Power Supply With Circuit Testing

A new line of power supplies from VIZ Test Instruments incorporates circuit-testing capabilities into fully regulated laboratory-type power supplies. In addition to providing power regulated at better than 0.075%, VIZ "Supplysts" will indicate two independent external dc voltages from 0-99.9V on twin 3-digit LED displays. The LEDs also indicate supply output voltage and current at the flip of a switch.

The VIZ Dual Supplyst, Model WP-707, provides two outputs independently adjustable to 0.1 V in five ranges from 0-25 V. The full-load output current is 0-2 A over the entire output range. Load regulation is better than 0.075% over the full operating range; line regulation is better than 0.05% at full output voltage and current when the input voltage is 105-130 Vac. Ripple is 5 mV max. peak-to-peak, and there is no overshoot on turn-on, turn-off, or reset. Output impedance is 1 ohm, dc to 10 kHz, and output-vs-temperature derating is 0.01%/°C above 25°C.



The unit has current-limiting overload and short-circuit protection; each output has its own LED to indicate an overload, and its own reset button.

Single-output voltage and current can be monitored simultaneously on the two digital displays, or the displays can show voltage and/or current of either or both outputs. The two outputs can be connected in series for 0.50 V at up to 2A.

Separate input terminals on the front

panel permit independent external voltage measurements, with two sets of test leads supplied. Input impedance for the voltmeters is 5 megohms.

The press release sent to ETI from the US quotes a "dealer-optional" price of \$299. If you want to know what that means to an ETI reader in Canada, contact Robert Liska, VIZ Test Instruments Group, VIZ Mfg Co, 335 E Price Street, Philadelphia, PA 19124, USA; telephone (215) 844-2626.

Power Engineering Scope

The BWD 880 Powerscope, produced in Australia, is claimed to be the first instrument of its kind dedicated to measurement of voltage, current, phase angles and time in the field of power engineering. World patent rights have been lodged for this innovative instrument, which should have an immediate appeal to power engineers needing a safe means of measuring high voltages and displaying them for visual evaluation.

Industries, utilities and educational establishments using thyristors, triacs, ignitrons, magnetic amplifiers, etc. to control 1, 2 or 3 phase power for motors, lights, heaters or welders can employ Powerscope for design, monitoring, field service and teaching.

Operator safety is provided by a fully insulated panel, controls and probes, fitted with shrouded high voltage connectors and closed conformity to IEC 348 safety requirements.

The high CMR of each amplifier enables signals down to 100mV p-p to be measured across components operating in 600V RMS 3 phase or 350V RMS single phase supplies.

Phase measurement is by a 1° wide

intensified marker pulse with digital readout, selectable by an up/down counter from 0° to 359°. Zero reference is also selectable in 60° steps from 0° to 300°. Phase circuit operates automatically over the range 25Hz to 2KHz and may also be used to provide digital trigger delay in 1° steps for the time base.

More information in this issue's Oscilloscope Survey.

Micronta DMM

In compiling our DMM survey we checked the Radio Shack catalogue for possible equipment and found none. However Radio Shack do have a DMM, as explained below by Dave Walton of Radio Shack 5257:

I just finished reading your article on digital multimeters in the July issue. You mention that the Micronta meter is being marketed by Radio Shack in England and may be available in Canada shortly. The Micronta DMM is available for over the counter delivery at most of the over 600 Radio Shack stores and dealers in Canada. Dealers in smaller centres may not stock the meter but can obtain them for their customers. The current retail price of the meter is \$79.95 and its stock number is 22-199.

Analog Device Literature

The latest 20-page issue of Analog Dialogue (Vol. 12, No. 1) includes application notes and new product descriptions, including applications for multiplying DACs, a semiconductor temperature sensor, a complete monolithic 10-bit A/D converter, offset voltage effects with glass-encapsulated diodes, a low-drift superbeta op-amp, fast 6-decade logarithmic amplifiers, analog I/O boards, a low-cost 12-bit multiplying D/A converter, and five new product descriptions.

The new 600-page Data Acquisition Products Catalog contains tutorial sections and full data sheet information on Analog Devices' complete product line of precision data acquisition components, data converters, signal conditioning components, temperature transducers, digital panel meters and instruments, computer interface products, and microcomputer-compatible analog I/O subsystems. Pricing for several different quantities is included for the products.

For a free copy of either publication, write: Analog Devices, Inc, PO Box 280, Route 1 Industrial Park, Norwood, Massachusetts 02062, USA; telephone: (617) 329-4700.

Canadian Inventor's Video Ideas

Donald L. Orr, of Edmonton, has sent us details of his inventions. He invites approaches from interested manufacturers. Mr. Orr doesn't say whether he has working prototypes of his inventions, or whether his inventions are just theoretical.

The inventions are a 'flying hole' video camera, a 'flying hole' display (flatscreen or projected), and a 'holographic' TV display.

The 3D TV combines storage CRT, LCD, and laser technology.

The 'flying hole' devices are based on

a matrix of addressable ECOTS (electrically-controlled optical transmission switches). Mr. Orr has details of the addressing method and of the construction of the individual ECOTS cells (which utilise polarizers and electrical sandwiches of a nematic liquid).

Contact D. L. Orr, Box 1632, Edmonton, Alberta, T5J 2N9. Business: (403) 478-6784.

microfile

are encouraged to have copies for sale at \$1.00 a copy.

Featured in the June issue (Vol. 1 No. 2) are articles about the new Fortran IV software, a description of what's in the MPU-B Board, and an explanation of a few of the enhancements available in Imdos, Imsai's multi floppy disk operating system. In future issues, look for articles on new products, such as the Imsai VDP-40 (Video Data Processing System), software applications programs, and other articles.

IMSAI Manufacturing Corporation, 14860 Wicks Blvd., San Leandro, Ca. 94577. (415) 483-2093.

Cheaper VIP

The US price on the RCA VIP (Video Interface Processor) home computer has been reduced to \$249.00 from \$299.95. The reduction is possible because of increasing production volume and declining costs of 4K static RAMs.

The VIP is a microcomputer based on the RCA Cosmac (CDP1802) microprocessor, and is designed to interface directly with a video monitor or modified TV set. It contains a sixteen-key keypad for entering programs and has a built-in audio cassette interface.

Digital Output Boards

Plug-compatible 16 or 32 channel isolated digital output systems are now available for Intel SBC 80 and Intellec MDS microcomputers. The new units, Burr-Brown models MP801 and MP802, are available in Canada from Allan Crawford Associates Ltd. The isolation provided by these units eliminates ground loop problems and protects the microcomputer from real world transients and malfunctions.

Memory mapped MP801 (16 channel) or MP802 (32 channel)

Semiconductors For Fiber Optics

A specially characterized series of photodetectors and photoemitters signifies Motorola's entry into the growing market for fiber optic interface devices.

Offered in selected glass lensed metal packages compatible with AMP fiber optic connectors, the initial devices are suited to low frequency transmission of digital pulse signals through the insulating fiber medium for applications in medical electronics, industrial controls, microprocessor systems and security systems.

systems are contained on a single PCB and provide all control and timing circuitry. Channels are implemented by dry reed relays protected by metal-oxide varistors and can handle up to 10 watts. Relays, with a life of 10⁶ operations, provide low "on impedance", high output current and isolate output channels from the computer bus (to 600 VDC) and from channel-to-channel (300 VDC).

MP801 and MP802 are mechanically and electrically compatible with the Intel units and operate from their +5 VDC supply. They are treated as memory by the CPU — eight output channels occupying one memory location. A logic 1 will close an output; a logic 0 will open the output. Outputs can switch inductive loads.

For more information contact Mr. Malcolm Mercer Allan Crawford Associates Ltd., 6503 Northam Drive, Mississauga, Ontario L4V 1J2 (416) 678-1500.

Cesco Microcomputer Catalogue

A 32-page catalogue from Cesco contains 7 pages of Motorola products, 2 of RCA products, 2 on Signetics, 2 on AMI, and one each on TI and Intersil. There's a two-page cross-reference guide, an eleven-page availability guide, plus an intro to microcomputers, a page on Hammond Power Supplies and details of Cesco's PROM programming service. In the words of Cesco's Arnold Goodman: "You will note that this deals with the more sophisticated equipment from major electronics manufacturers, rather than the rock-bottom 'Toys' that are on the market".

Cesco Electronics Ltd., 4050 Jean Talon St. W., Montreal, H4P 1W1. Phone (514) 735-5511.

Single Chip Micro with On-Board NMOS A/D

Intel Corporation's first low-cost, general-purpose single-chip microcomputer ever to contain a full analog-to-digital converter has been announced. Aimed at high-volume control applications, the microcomputer is ideal for applications in home appliances, test and measurement instruments, automotive, process control, environmental control, sensing/recording instruments and other control applications. The 8022 is software compatible with other single-chip microcomputers in the MCS-48 family.

Features are: • 2-channel, • 8-bit NMOS A/D converter • three input ports, one of which can detect digital states. This, in conjunction with the A/D converter, permits the 8022 to interface up to 8 analog signals. • zero-cross detection capability (which facilitates creating a real-time clock or timing synchronized with AC). • interrupt capability to permit the 8022 to react and handle randomly occurring events. • the ability to operate on a broad range of power supply voltage.

Intel Corporation, 3065 Bowers Avenue, Santa Udna, California 95051.

Imsaider

The Imsaider, a customer newsletter from Imsai Manufacturing Corporation, is now a bimonthly publication in a glossy magazine format. Its purpose is "To establish communication with all the people who purchased Imsai equipment, and as the capabilities, the usefulness and the performance of our products are improved or expanded, to make that information available." To customers it is available by subscription at \$4.00 per year. Dealers



Audio Today

Developments in audio reviewed by Wally Parsons

ONCE UPON A TIME there was a phenomenon known as "High Fidelity". This had nothing to do with grounds for divorce, (although many wives at the time wished it could be cited as grounds for same) but was a development of what happened when professional workers in audio took their super-powered (all of ten watts, some of those brutes) amplifiers and theatre speakers home to listen to records and break leases. Quickly, a rather small, specialized industry developed, with a pretty high level of fraternity and of engineering. Pretty soon we had high-fidelity lingerie, high-fidelity desk-lamps, even high-fidelity lipstick. Manufacturers often made optimistic claims for their own products, but, on the whole, equipment advertising tended to be a "just the facts, ma'am" approach, and most of the better stuff delivered what it promised.

Then, as the '50's drew to a close, and music seemed destined for oblivion, stereo was introduced, and at the same time, a lot of marketing people, ever on the alert for a way to make a buck, realized that they had struck oil. Suddenly, stereo became a "consumer" (whatever a consumer is) commodity, ready to be exploited with all the hype, exaggeration, half-truths, and lies that the advertising man is so good at, using tools honed to a fine edge in Detroit.

Consequently, last year's "break-through" is suddenly obsolete, eclipsed by this year's "dramatic new developments". Many of Japan's wunderkinden have only recently discovered how to build an OFL amplifier and hail it as a second coming.

Mitsubishi proudly proclaims its "DM Factor". This great achievement stands

for "Dual Monaural" — which, presumably, refers to two persons, each with one ear). Just imagine: two, count 'em, two separate amplifiers in one chassis, for the ultimate in stereo separations, indeed "more than stereo". And it's exclusive with Matsubishi, they say, a revelation which would undoubtedly be of interest to all its competitors, were it not for the fact that they too indulge in the same kind of nonsense.

Like Sansui's revolutionary new "rear driven tweeter", which bears a suspicious resemblance to one of J B Lansing's trustworthy work-horses.

A few years ago Phase Linear introduced a rather complex expander circuit which they dubbed a "Downward Expander" and "Peak Unlimiter", which performed a function previously available only on professional studio equipment. And a useful device it is, too. Above a certain level it provides expansion, intended to counteract the effects of limiting in the programme source, and below another level adds additional expansion to counter the compression often introduced in the programme. We are now asked to believe that this circuit actually reads the mind of some recording engineer who, months, or even years, ago decided that the recording level was too low, and nudged the pot up a little. The implication is that it knows when the musicians were simply playing softer and so makes no changes.

But such is the advertising mentality and the functional illiteracy which it nurtures. And such is public apathy and mental laziness that we swallow more and more of this garbage and even reward the pointy-headed fraternity by

buying their products rather than those of more substantial minds.

But now, it seems, even the last bastion of honesty is beginning to crack, namely the learned magazine paper. There used to be a time when audio magazine articles were written by serious workers, working either independently, or with a research team of a manufacturer and, to be sure, a paper might describe the results of a research project which would shortly produce some product or other for the audio market-place. This is a perfectly proper and respectable practice.

HYPE '78

However, two examples from one of the most prestigious of U.S. publications show an alarming trend in the direction of hype. One was entitled "Phone Reproduction 1978" and was by-lined by six different authors, all described as having one official capacity or another with some unnamed manufacturer. As it turned out, it proved to be an excellent article, informative, well organized, and quite detailed. But it certainly did **not** deal with phonograph reproduction in 1978 — unless you believe that phonograph reproduction begins and ends with the Shure Model V-15, Type IV. Because that was the real subject of the article. Now, don't misunderstand; I, and surely many others, am very interested in the research and design philosophy which went into this product, even though I have not yet had the opportunity to sample this alleged marvel. But I don't have to be enticed, and I resent being conned. But then, Shure claims to have "invented" the moving magnet pickup, so maybe one shouldn't be surprised.

RECORDING REVOLUTION

The second example, from the same publication, was entitled "A New Recording System". Wow! This I gotta see. The reader should understand that your old professor has a certain wide-eyed streak in his make-up. That means that I'll look at almost any proposition, eagerly. But that's about as far as the wide-eyed streak goes.

Now, this fantastic revolutionary development was described by a senior engineer of Tandbergs Radiofabrikk, of Norway, manufacturers of tape recorders of that name, and can be summed up in Fig. 1. This is the "new recording system" — a push-pull amplifier with current feedback, which, because of its high output impedance they have chosen to call a "transconductance amplifier", mainly because a voltage change at the input produces a current change in the output. That's reaching a bit, but it's close enough, I guess, for the consumer hi-fi.

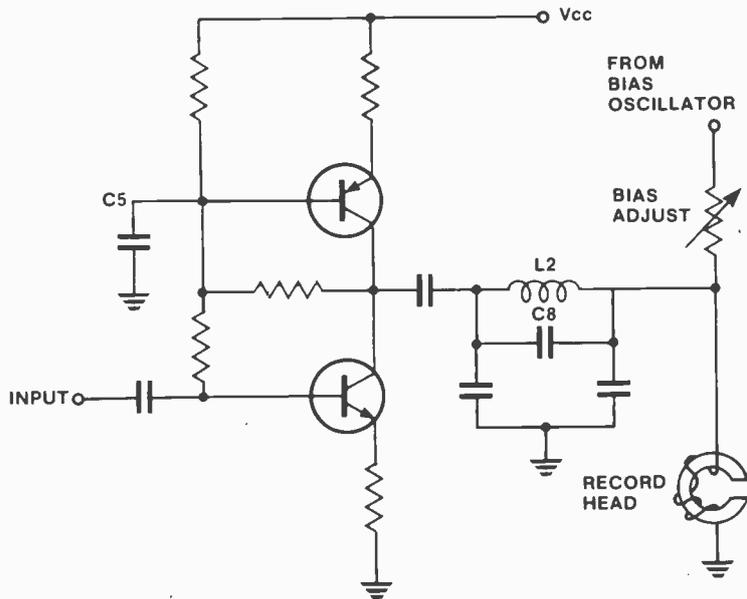


Fig. 1. Tape head driver circuit.

One of the criticisms of "conventional" old fashioned "systems" made was that they use passive summing of signal and bias current, and this circuit eliminates the resulting problems. How? Well, it looks to these eyes like a very simple summing circuit, and the only reason that bias current is isolated from the signal amplifier is that L2 and C8 form a trap, and it still requires C5 to remove residual bias. C'mon, guys.

The pity of this is that it really is an excellent circuit, even if it isn't very sophisticated. The prime virtue is the large amount of headroom, due in part to the push-pull circuitry, and in part to the fact that current feedback raises the output impedance without affecting the

power output (What's that, you say, you didn't know recording amplifiers were power amplifiers?). More common systems use a series resistance in the output, but since this is considerably higher than the record head impedance, most of the power is dissipated in it, reducing the headroom. However, it does provide **greater** isolation of the bias signal.

Readers who are interested in another sophisticated recording amplifier circuit should dig out the November ETI and read part 2 of "V-Fets for Everyone". Still, I like the circuit. In fact, some aspects of it might even be worth stealing. Serves them right!



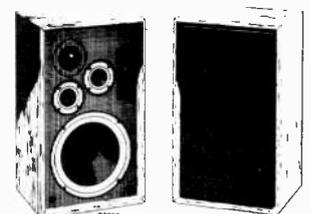
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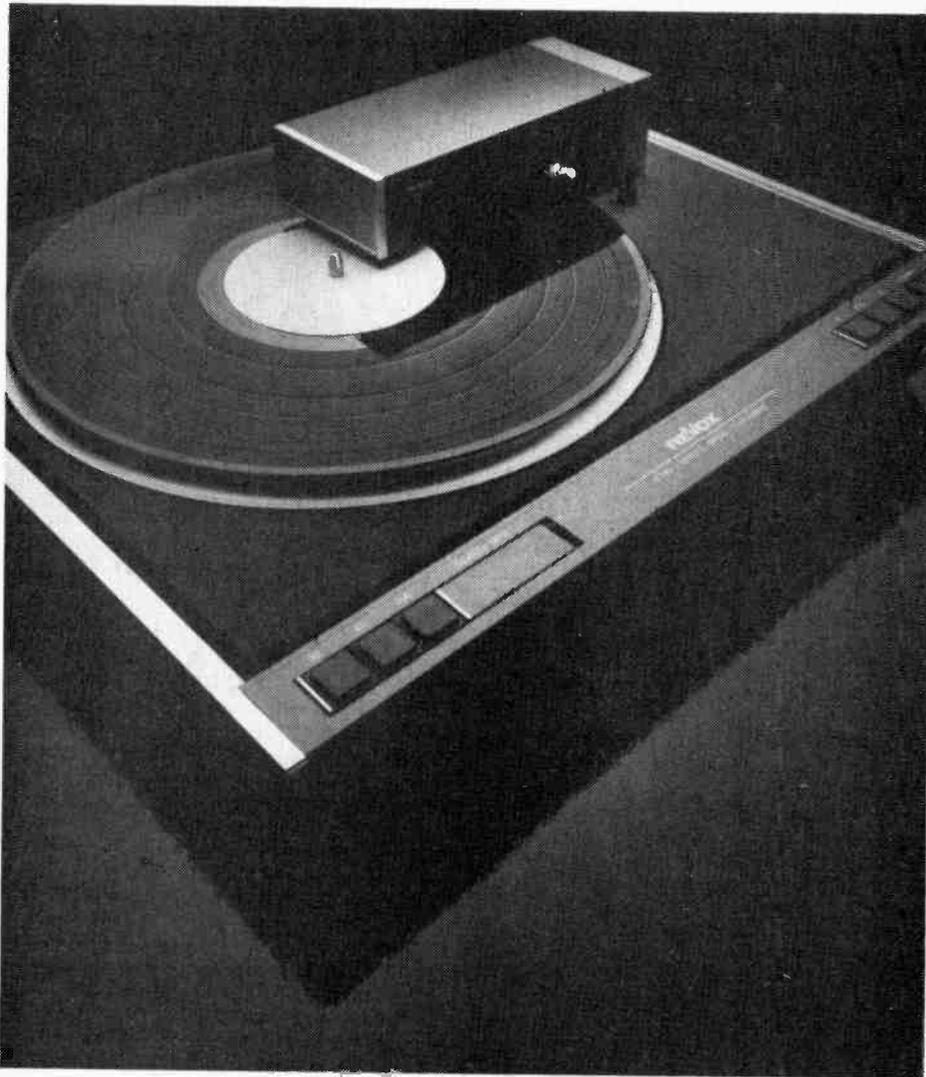
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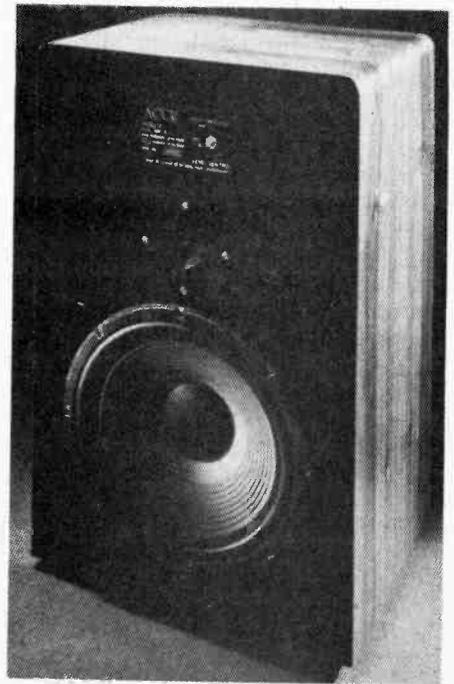
Audio developments reviewed by ETI's Contributing Audio Editor Wally Parsons



REVOX B790 TURNTABLE

Available from Studer Revox Canada Ltd., 14 Banigan Dr., Toronto, Ont. M4H 1E9, this is surely one of the sexiest looking tables on the market. Revox' first turntable, it features a magnetic suspension of the tangential arm, controlled by the push-buttons, so that the pickup is never touched.

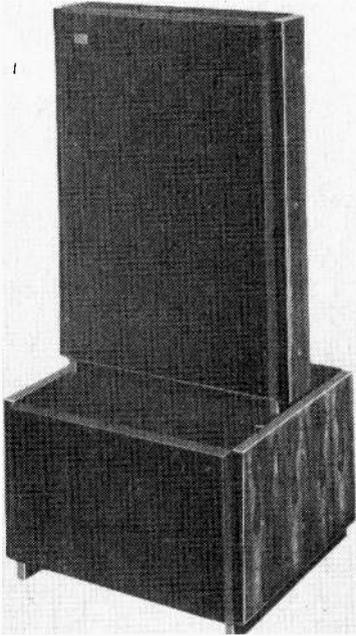
The turntable itself is a quartz crystal controlled direct drive machine with digital LED readout of actual speed. Initially the B790 will come with a factory installed Ortofon VMS20E pickup (although other pickups can be installed) at a list price of \$899.00. That's not a bad price, really.



ACCU PULSE SPEAKERS

ACCU12 and ACCU10 loudspeakers are two-way units manufactured by ACCU Pulse Loudspeaker Co., 150 Cathcart St., Hamilton, Ont., L8L 5A4.

Both models are described by the manufacturers as possessing high efficiency, but no specifications are actually given. Both are said to use 4 lb woofer magnets which **could** give a combination of high sensitivity and high damping, even with 1.5 inch voice coils. They are described as being phase inversion types, which implies bass reflex, but the literature description reads more like either a short labyrinth or acoustical resistance. Basically, though, the designs seem fairly conventional except for the claimed extensive internal bracing, the absence of which is a common cause of resonance colourations in many speakers, the use of a 6 dB/oct crossover, which, if properly designed is inherently phase coherent, and the butyl surround of the woofer, a more expensive, but superior material to the more common plastic foam. Although, why anyone would use an electrolytic capacitor in the crossover, with the resulting distortion, and cross-over inaccuracies, is beyond me. As yet, I've had no opportunity to audition this unit, but I will try. Price unknown.

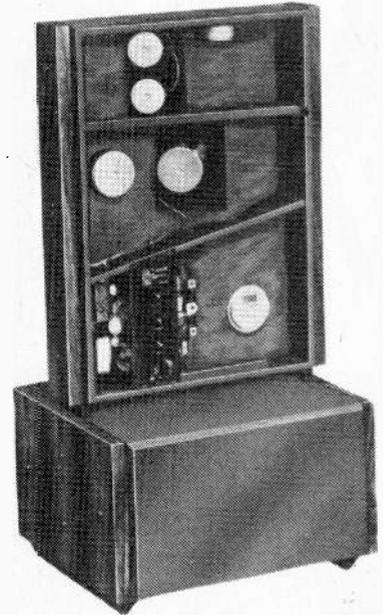


WATSON MODEL 10

From Watson Laboratories, 2711 Rena Rd., Mississauga, Ont. L4T 3K1, this is a product of the fertile mind of William Dayton-Wright, of Electrostatic fame, and represents the more exotic extreme of Canadian Loudspeaker manufacturing. The woofers system (the



large box on the bottom) is described as a "Gas Linearised Compliance System", and one might be tempted to dub it, irreverently, as "the Gas Bag", however, anyone who has heard the Dayton-Wright Electrostatics would be well advised to restrain his wit. Actually, the enclosure is filled with little bags containing SF₆, an inert gas whose thermal characteristics and sound



propagation rate is said to lower system resonance and distortion.

Similarly, the rather strange looking arrangement for the rest of the system is based on theories developed by Mr. Wright as a result of his own research. Again, I have yet to hear them. Anyway, write to Watson Labs for a brochure with some meat in it. No hype, honest. But expensive.

Audio Today Letters

If you want to express your views or report on news write to Audio Today, ETI Magazine, Unit Six, 25 Overlea Blvd, Toronto. Ont. M4H 1B1.

OLD RECORDER & NEW TAPE

I have an open reel tape machine, and wish to use some of the recent high performance tapes with it. Most attempts have been unsatisfactory, and I understand that I must adjust the recorder to suit the tape. Any dealers I've spoken to advise me to get a new machine. Although mine is about ten years old, it was quite expensive in its day, and I'd like to get several more years use out of it. Any suggestions?
D. W. Calgary

I sure do. First of all, dealers make money by selling equipment, not modifying it, and a dealer has to be pretty dedicated to his customer's happiness to advise this route. From the dealer's standpoint there is some justification in that it isn't always easy to predict the effectiveness of such a procedure. He may have learned the hard way that sometimes customers have ethics which are even lower than those they attribute to dealers, and that all he'll get for his pains is a lot of abuse.

But if it really is a good machine, there should be some provision for adjusting bias, equalization, and record meter calibration.

These three are essential, and if they do not have the range required, the circuits will have to be modified. I don't want to throw any wet blankets around, but this is not a simple little job, and without adequate test equipment you could end up creating a lot of trouble for yourself.

In many large cities it is possible to find a few service persons who specialize in quality custom work, but it will take some looking. Remember too, that before undertaking such a project the machine will have to be put in top condition to provide a reasonable point of departure. This may include head replacement. At this point I'm sure you can see the dollar sign sprouting, and you may be wondering what the local pawn broker will give you for the family jewels. Unfortunately, I can't tell you whether it's worth it or not.

While we're on the subject, and realizing that a high percentage of ETI's readers are employed in service, this is as good a time as any to invite anyone who is involved in such specialty services to drop me a line, so I can add your name to my files. That would make it easier to add a referral to my reply to the above letter.

Electronics In Model Railways

A profile of how electronics is applied to a hobby which is essentially scale modelling. By Peter J. Thorne.

"PLAYING WITH TRAINS" is probably how most readers would describe Model Railroading, the latter being the much preferred expression for something over 200,000 hobbyists in North America alone. Of course, there's a heck of a lot more who do just "play with trains". Names such as Hornby Dublo, Triang or Wrenn bring back memories of bygone youth to many an expatriate Briton, and likewise with American Flyer, Lionel or Mantua for many Canadians.

However, the hobby is not just one of running a train around a circle of track under the Christmas tree; the mature model railroader invests a great deal of effort into scale realism of operating models, structures, scenery and track. And if you tie that need for realism into the extensive growth of electronics as a hobby in the last ten years or so, you'll see why the expert on precision scale operation is keenly interested in how electronics can help this hobby.

Or, to look at it another way, there are so many variables possible in controlling several trains on a model railroad — as indeed there is in a real one — that it's not surprising that several companies have used model railroads at trade shows to demonstrate microprocessor versatility. A recent example was discussed in Byte magazine for July 1977.

Apart from computer control, which is really outside the scope of this short article, there are several uses for both digital and analog electronics in the model train empire. Let's discuss them in stages — control, signalling, lighting and sound.

CONTROL

Most model locomotives use 3, 5 or 7 pole D C permanent magnet motors. A few use brushless, ironless rotor motors and a very few A C motors. Power is picked up directly from the two rails, and reversal of track polarity reverses the locomotive direction except in the case of the A C motors, where an extra "kick" of A C triggers a reversing contact in the locomotive.

The Christmas train set power pack is nothing but a full wave rectifier delivering pulsating unfiltered D C to the track via a 100 ohm variable resistor as speed control. This gives very poor control at low speeds for the simple reason that stall current on a permag motor is much higher than its low speed current. Consequently there's a tendency for jackrabbit starts. Now the dyed-in-the wool hobbyists want precise control of low speeds because nearly all layouts have miniature freight yards: box-cars and cabooses have couplers operated by magnet remote control so the operator can make up



and break down his trains. The more or less ideal speed control — or one approach thereto anyway — looks like the circuit of Fig. 1. A simpler version shows on the lead photo. This type of control has several features; the variable D C output has a pulse ripple added at lower speeds to vibrate the motor armature and reduce motor

cogging and "stiction", secondly it has a low source impedance for the motor, thirdly a delayed action can be switched in and out so that the controlled inertia of a heavy train can be simulated together with brake levers; and lastly it's short-circuit proof by virtue of heavy duty transistors and an overload trip. The last is indeed

essential because short-circuits abound on the model railroad!

Though the circuit I've shown uses two darlington transistors, commercial versions are available, particularly from the U.S.A., using op amps, SCR control or pulse width modulation. Even the renowned Heathkit has introduced a version. The

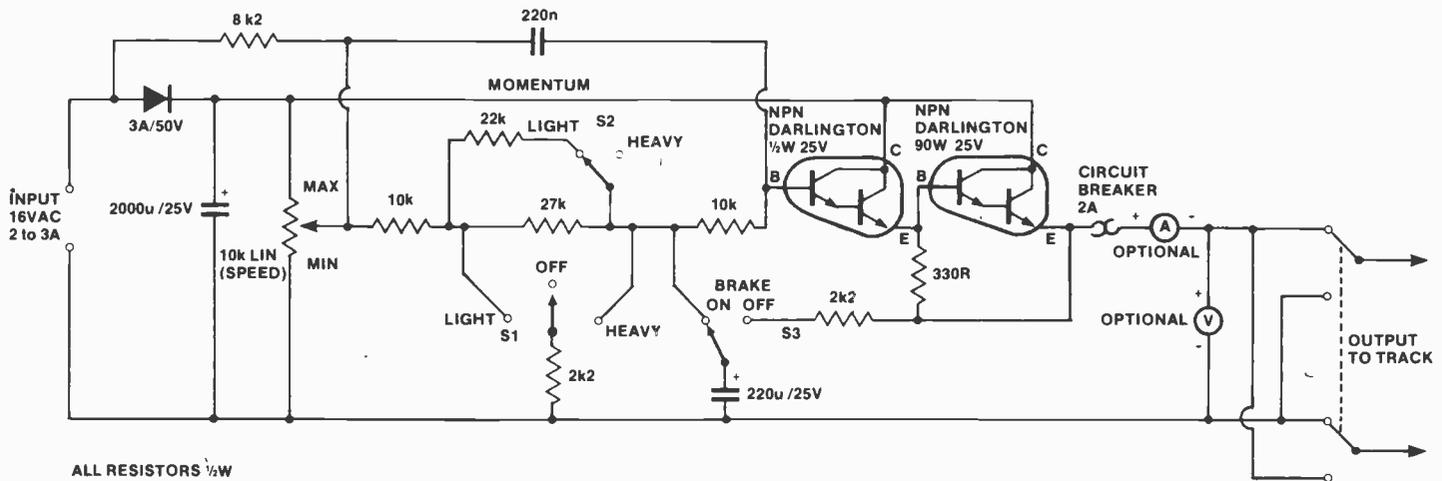
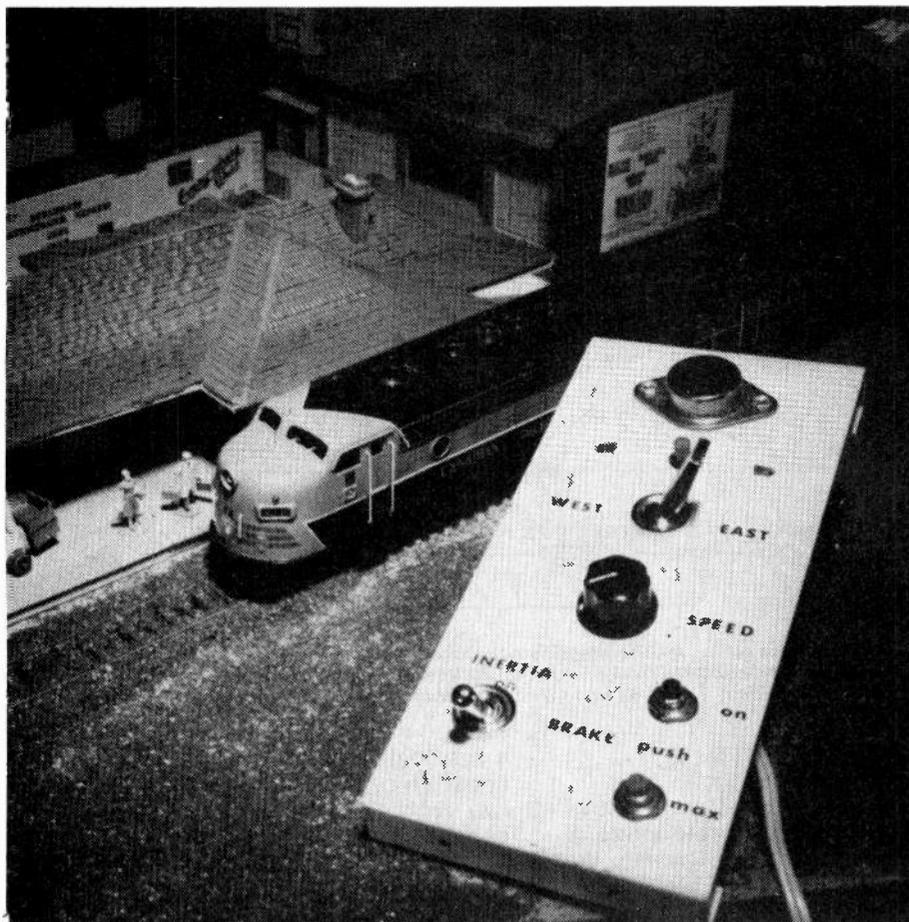


Fig. 1. An electronic speed control for model trains.



most important feature is probably that superimposed pulse, for if it's too small in amplitude or too high in frequency, it is not effective; but if it goes too far in the opposite direction, the resulting buzz or rattle from the motor becomes objectionable. Anyway, you electronic fans with a dusty train set in your attic, dig it out, build a momentum-pulse-throttle and you just might pick-up an extra hobby!

In terms of current rating, the power pack shown should be capable of about 2.5 A at 12 V. This is adequate for any HO scale models, which scale 1:87, even with doubleheading locomotives. As you'd anticipate, the current requirements decrease with scale size — the second most popular scale is 1:160 (n for Nine mm, which is the track width) scale. Going up a size to 0 scale (1:48) many motors will need the full 2.5 A. By the way, in case you home computer builders are thinking "why waste money on electronics for toys", some of these "toy" locomotives retail for over \$1,000 apiece and lately have been appreciating in value at well over 20% yearly.

SIGNALS

A natural for digital IC application is signaling. Model signals in two (red and green) or three aspect (red, yellow, green) with operating miniature 12 V 60

mA lamps are available. Until recently, relays were widely used by modelers to operate these lamps in controlled sequence and often automatically disconnected a section of track ahead of a red signal for automatic train control. The relays used were typically low resistance coils in series with the power supply to the track. When the locomotive entered a particular track section, the relay contacts closed. All model railroads use track sections from 2 to 20 feet long insulated from each other and switchable to alternate power packs. This facilitates the operation of multiple trains.

Complete model railroads still exist using these series relays for automatic control and signaling; but they're a maintenance nightmare for their intermittently proud owners. Up to date techniques use TTL gates driving red, yellow and green LED's for signals.

Relay driver ICs can be added to drive the small 12 V signal lamps if preferred and also to operate good solid 12 V relays for automatic stops and starts.

The interface between train and TTL is a little more tricky: you've noticed, of course, that the track has only two rails which are required to conduct power (in either direction) to the locomotive. The requirement to detect locomotive presence led a few years back to a widely used detector circuit known as a "Twin-T". This was introduced by Lynn Westcott, editor emeritus of Kalmbach Publications "Model Railroader" magazine. The simple circuit is shown in Fig. 2. The circuit detects resistance between the rails as high as 50k, but is insensitive to the connection of the power supply in the circuit, so it will respond only to the presence of a locomotive motor or any rolling stock with a 10k to 47k resistor wired between its wheels. Other less subtle interfaces are magnetic reed switches between the track, triggered by disc magnets under rolling stock — ideal for JK flip-flop operations, or opto-electronics, where ambient light can be interrupted by the movement of rolling stock to trigger or detrigger a light activated SCR., for example.

With a light activated system, the light source and the opto detector must be angled to the track to avoid gaps between moving rolling stock causing light modulation.

All three track detection systems are, of course, suitable input interface for microprocessor control of signals . . . and track voltage, polarity, etc.

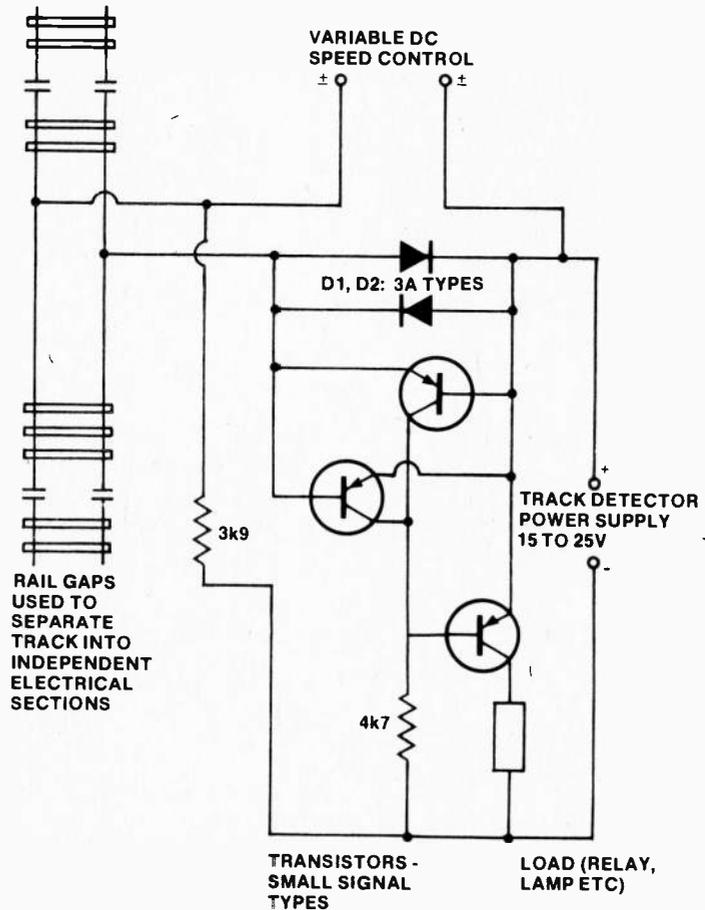


Fig. 2. Widely used "Twin T" track detector circuit. Q3's load de-energises whenever a resistance appears across track in the section being detected, regardless of whether power is connected to that track section. Consequently presence of any train or item of rolling stock can be sensed remotely.

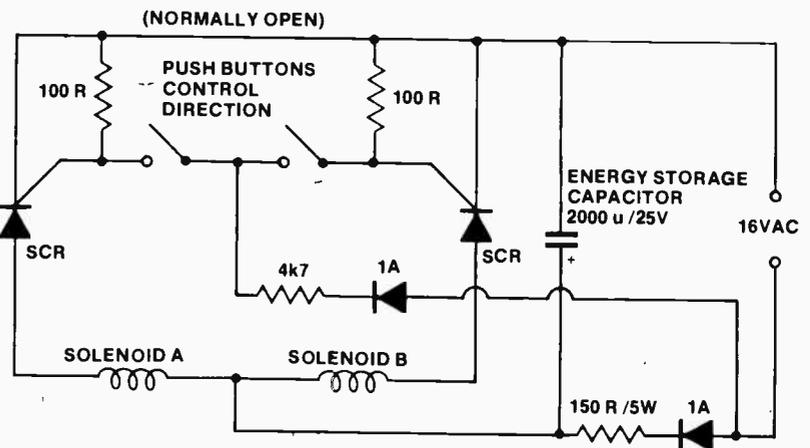


Fig. 3. Capacitor discharge system enables solenoids to be thrown with small average energy. System also prevents solenoid burnup if accidentally left powered-up. SCR switch control enables small current push buttons to switch heavy current. The SCR's automatically switch off when capacitor stored charge zeroes.

TURNOUT CONTROL

Turnouts, (switches, or points) control train routing. Remote control of these, on the models as on the prototype has nearly always been electric. The usual method is the use of

a solenoid motor (Fig. 3). A soft iron armature can be moved into either of two high flux copper wound coils, depending on which is energised — using 16 volt AC or DC. The armature is linked mechanically to the movable track section to control the train's

alternate paths. These coils, of necessity are about 2 to 4 ohms resistance and hence can draw a 4 A: if left connected to the supply for more than a second or so, the 50 W of heat show — rapidly! So recently the electronically minded modeller adopted capacitor discharge.

Typically a 220 uF capacitor charged to 25V stores enough energy to operate a couple of the low resistance coils and as you can see from the Fig. 3 circuit, there's no fire hazard if the power is left on. Also a small transformer can be used. Also shown is a method of discharging the capacitor into the coil via an SCR, which permits the controlling push button to carry only the low SCR gate current, instead of a contact-blowing multi-ampere current.

Again, this basic control circuit is adoptable to TTL control.

SOUND

Now you hi-fi fans know it's impossible to reproduce the sound of a gigantic steam locomotive without a 100 W amp and a 4 cubic foot bass reflex enclosure. Except those model railroad nuts don't believe you! Quite expensive, at about US \$350, is a Pacific Fast Mail sound unit that transmits sound and motor power through just those two rails. The sound is synchronized to the piston position, that is for a two cylinder steam engine there are four "chuffs" per driver wheel revolution. Plus bell sound and the required wailing steam chime can also be sent from the trackside to be nicely reproduced in a miniature speaker located in the locomotive tender.

The P.F.M. unit synchronizes the "chuff" sounds by transmitting a 2V 38 kHz (approx.) signal superimposed on the DC motor voltage going to the track. The DC voltage source (a transistorized circuit, which is a simplified version of the circuit shown in Fig. 1) has a low resistance choke in series with its output: this prevents the 38 kHz and the audio tones from disappearing into the speed circuitry. When the 38 kHz reaches the locomotive, it is intermittently shorted out in a capacitor (see Fig. 4). The capacitor is grounded four times per drive wheel revolution via a phosphor — bronze contact, which rubs on the inside of a drive wheel equipped with insulated quarter sections. As the 38 kHz signal shorts out, a relay operates in the track-side unit, sending out transistorized hiss to the locomotive-borne speaker. Being highly inductive, the locomotive motor bypasses neither the 38 kHz nor hiss —

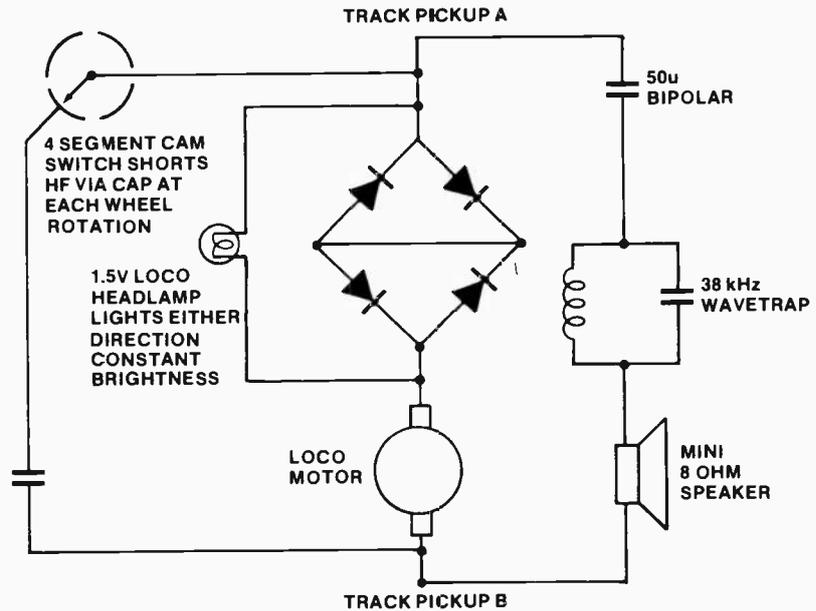


Fig. 4. These components, mounted in locomotive tender reproduces audio signals superimposed on d.c. motor voltage. Cam switch signals synchronization of "chuff" sound to trackside audio generator.

nor bell nor steam chime sounds, all of which are solid-state generated in the P.F.M. box with full operator control. And even though the speaker is less than 2 inches in diameter, the sound is very effective.

Another electronic gimmick in the P.F.M. system is the bridge rectifier of Fig. 4. There's a constant voltage drop of 1.4 V across the bridge, since it's in series with the motor — regardless of the motor voltage polarity. Connect a miniature 1.5 V headlamp across the bridge and presto — constant brightness, regardless of motor speed.

A California based firm — Modeltronics, produces sound systems that are completely contained in the model — also synchronized for "chuff". The supply voltage for the noise generator and miniature amplifier is derived from the track voltage much as the P.F.M. "constant lighting section". Of course, the Modeltronics system does not offer bell or chime — yet.

The P.F.M. unit is also available with built-in reverberation for that illusion of sound through the model mountains. Apart from the relatively complex systems above, many modellers rig a cassette deck to the track and play either a pre-recorded run through the locomotive speaker, or use an 8-track in endless loop fashion, with four different sounds available for keying into the speaker.

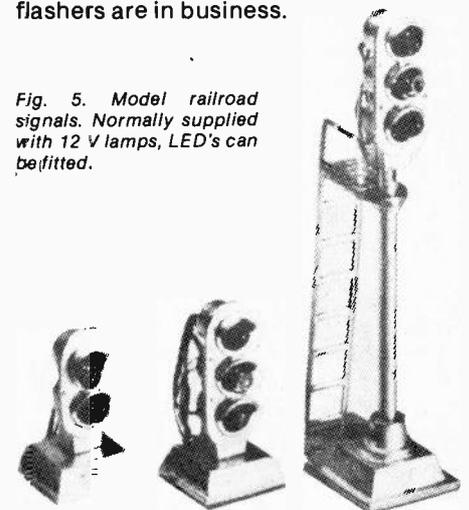
Miscellaneous Effects

LED HAZARD FLASHERS

Pop a 3 m red or yellow LED into the cabin roof of a model diesel, drive it from an internal LM3909 flasher integrated circuit, oscillating at 0.3 Hz, powered up from 1.5 - 3 V, and you've duplicated real life on the "Atcheson Topeka and the Santa Fe".

Grade crossing flashers in model form are available ready made, with miniature 12 V lamps, just like signals. To flash, take one 555 IC timer, put one pair of lamps from I C output to + rail, another pair from output to - rail, apply 12 V, time at 20/minute and grade flashers are in business.

Fig. 5. Model railroad signals. Normally supplied with 12 V lamps, LED's can be fitted.



CANADIAN PROJECTS BOOK NO. 1



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HEART-RATE MONITOR

By clipping an illuminated bulb to one side of your ear-lobe and clipping an LDR to the other side, you can monitor the changing translucency of the tissue as blood spurts through the blood vessels. The signal from the ear-lobe detector is cleaned up and squared off and then fed to a frequency-to-voltage convertor which, after buffering, drives an analogue meter. This project is not meant for use as a serious diagnostic instrument. It can be used by those experimenting in biofeedback or by sportsmen in training.

DOUBLE DICE

A project to get you started in CMOS digital electronics. A decade counter is made to divide the output from an oscillator by six. The dice rolls while a button is pressed and continues to roll (now slowly) for a short while after release. Consumption from the battery is so low that we use no on-off switch. The results are truly random.

TOUCH ORGAN

What's so neat about this project is that it is all on one PCB. Twenty-seven touch-switches are laid out on the copper side of the board to give a full two-octave keyboard and tremolo switch. There are two voices available, and a volume control. The project is easy to build, uses 12 ICs and runs from a 9V battery.

PHASER

The effect of the phaser or phlanger will be well-known to readers who are interested in popular music. The ETI phaser achieves the desired effect by splitting an audio signal into two paths and re-mixing the components after one has undergone a phase change. This change takes place in six RC networks, each capable of 180° shift at high frequencies. This gives a comb-shaped response (3 minima) for the unit as a whole. The characteristic whooshing sound occurs when we change the resistive elements of each RC section (using a 4049 as six sets of complementary FETs) under voltage control from a triangle-wave oscillator.

AUDIO LIMITER

This stereo device uses a 4049 CMOS hex-inverter IC to provide enhancement-mode FETs for use in a voltage-controlled attenuator circuit. The project can be used to limit audio peaks to prevent amplifier clipping, to reduce the dynamic range of a signal for recording, or as a voltage-controlled volume control for remote or automatic operation.

SOUND-LIGHT FLASH

This project senses a change in light or sound and, after a predetermined delay, operates a photographic flash unit. You can photograph glass shattering, any violent impact, splash, explosion, etc.

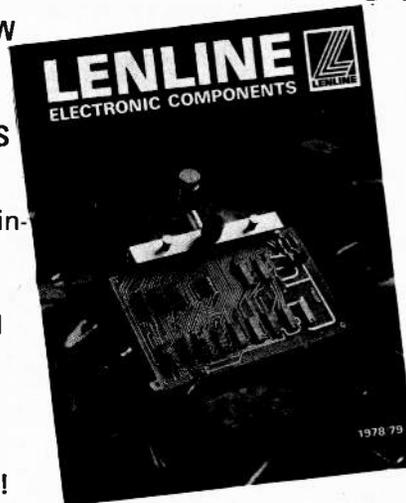
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Available from ETI for \$2 (includes postage). Just order our May 1977 issue from ETI Back Issues Dept, Unit Six, 25 Overlea Blvd, Toronto, M4H 1B1.

LIGHTING

Whole passenger trains can be lit up using a supersonic generator at around 25 - 40 kHz. This can be fairly easily constructed using a 10 W audio power amplifier with the conventional negative feedback rephased to positive. Connected in parallel with the train motor power, with a blocking choke between the two, constant lighting can give a superb visual effect with artificial twilight on a layout. Switch off the generator — and the lights go out. Each train group of lights uses a 0.22 uF capacitor in series to block the otherwise additive lighting power from the DC motor voltage.

RADIO CONTROL AND CARRIER CONTROL

Coming back to the mystery of operating several trains simultaneously on one ribbon of track, and at different speeds and directions brings me to the surprising revelation that mighty General Electric was once (1963 — 64) in the model train electronic business with their "Astrac" carrier control system. "Astrac" used separate little frequency-gated SCR receivers in each of up to five locomotives. Twenty volts AC was on the track at all times, and depending which part of the AC cycle was switched on in each high frequency selective receiver, gave varying speed and direction, by either gating on only the negative or only the positive half cycles. An analog system if ever there was one! The control frequencies used were spaced 5 kHz apart around 250 kHz. December 1963 prices are shown in the advertisement reproduction in Fig. 5.

Much more recently a "Digitronic 1600" system appeared, also in the USA, using digital proportional control of up to 16 trains simultaneously, also from a continuous AC track voltage. The system is too costly for most individuals; but a few clubs would opt for it. Incidentally there are at least three large model railroad clubs with very large permanent layouts in the Toronto area alone. One of the several train hobby shops can always direct you to a club.

As a purely personal observation, I feel the next and imminent step in electronics with model railroads is radio control. At least one experimental, but practical circuit has already been published. Taken to the ultimate, needed are very low current motors powered by rechargeable Ni Cd

batteries together with the radio receiver, variable speed and direction controls, and sound generator circuit plus amplifier. Of necessity the concept requires extreme miniaturization because for HO scale, (the most widely used size), the space available for everything is hardly more than 5 or 6 cubic inches. The entire receiver and motor drive circuit can easily be derived from model aircraft R. C. designs, particularly if the new Signetics NE544 motor/servo driver chip is employed. On-board sound — for example a diesel horn sound, can use a 556 IC in the self-oscillating mode generating two tones, each around 250 Hz, amplified by an LM380 audio chip.

Individual function control is practical using 555 tone generators in

the transmitter with phase lock loop decoders in the receiver. The advantage of this type of control is that the modeller has become free of the power-to-the-rails restriction.

In summary, I hope this overview shows how another hobby can adapt techniques of electronics in order to add to the fun. Maybe I've tempted you to pop round to your nearest Model Railroad emporium. Take money!

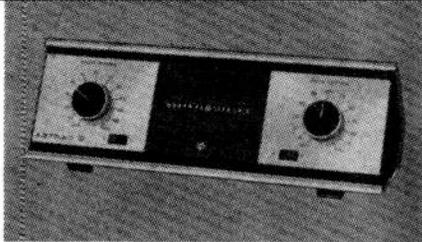
Peter J. Thorne has authored audio books for Philips Technical Library, and is also the author of "Practical Electronic Projects for Model Railroads", published by Kalmbach Publications, Milwaukee.

Fig. 5. Example of frequency multiplexed control system, available in the early '60s. Note the use of rubber rectifiers in the receiver. From an advertisement for General Electric.

Model No. K-2 (Channels 1 and 5)
Model No. K-4 (Channels 2 and 4)

DUAL CONTROL UNIT

Controls two trains on the same track both independently and simultaneously. Model K-2 pre-set for channels 1 and 5. Model K-4 pre-set for channels 2 and 4. Separate speed controls and separate forward/reverse switches provided for each train. All electronic control unit contains 4 transistors, 6 diodes, and printed circuit board. Indicator light tells when system is on. Heavy gauge all metal housing. Brushed aluminum finish. Not affected by track shorts. Complete with two pre-set micro-receivers, power cord, connecting wire, and installation instructions. 90 day warranty on all parts and labor. Sockets on back for future equipment.

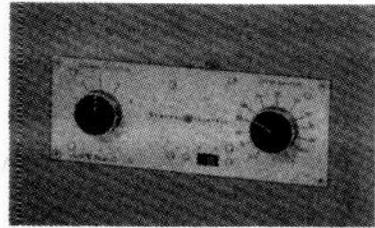


These Dual Control Units operate from 110-125 volts AC, 50-60 cycles, 11 watts.
Transmitter size: 12 1/2" x 4 1/2" x 3 1/2"
Carton size: 14" x 8" x 4". Packed one set per carton (includes 2 Micro-Receiver)
Approx. Ship. Wt. 3 lbs. Retail price about \$64.95.

Model No. K-5

5-CHANNEL CONTROL UNIT

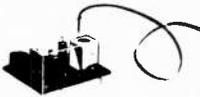
Completely assembled and ready to mount in your control panel. Controls one train at a time. Select any train on the track with the channel selector switch. All electronic, completely transistorized, with printed circuit board. Complete with mounting hardware, wire, hole template, power cord, and installation instructions. Warranty. Socket in back for future equipment. Operates from 110-125 volts AC, 50-60 cycles, 4 watts. Transmitter size 8 1/2" x 3 1/2" x 3".



Carton size: 10" x 5" x 5". Packed one per carton.
Approx. Ship. Wt. 2 lbs. Retail price about \$34.95.

Models K-10, 20, 30, 40, 50

MICRO-RECEIVERS



Encased in clear General Electric silicone rubber, G-E Micro-Receiver are shock-proof, moisture proof, and heat resistant. Not affected by track shorts. All electronic, no mechanical contacts. Uses two G-E Silicone Controlled Rectifiers. Adaptable to most gauges. Each receiver can handle up to 2.6 amperes, 15 amperes

one cycle surge, and a 48 watt load at 30 volts. They operate from 6 to 30 volts AC, 25-60 cycles. Only three connections need be made to install the receivers. One wire to the motor, one wire to each pickup wheel. Rubber can be trimmed to custom fit your equipment. Two receivers can be paralleled for double heading. Complete instructions included. Warranty.

Receiver size: 1 1/2" x 1 1/4" x 3/4".

Models and channels are as follows:

K-10	Channel 1	100KC
K-20	Channel 2	140KC
K-30	Channel 3	180KC
K-40	Channel 4	220KC
K-50	Channel 5	255KC

Carton size: 3" x 2" x 1 1/2". Packed 5 per carton (K-10 thru K-50).
Approx. Ship. Wt. 1 1/2 lbs. Retail price about \$9.95 per receiver. Also available in single units.

ETI CANADA — SEPTEMBER 1978

19

Oscilloscope Survey

A huge selection of scopes is available . . . if you know where to look.

LITTLE DID WE REALISE the immensity of the task of surveying oscilloscopes available in Canada. There are obviously less scopes for sale than meters, right? Forget it! A formidable (to the world-be reviewer) battery of oscilloscopes greets the eye(s) upon opening most of the brochures procured for this task.

CHOOSING

Last month we looked at the features of a couple of typical general purpose scopes, and their importance to the user. With this survey we hope to be completing the picture by providing basic information on all oscilloscopes that are offered.

The most useful specifications have been listed in our survey, but of necessity they have been kept brief. They should be enough however to get you started on looking for the instruments that fit your needs. For some of the more sophisticated scopes from Hewlett-Packard, Philips and Tektronix we felt our basic analysis didn't do full justice, so we settled for a more descriptive approach.

In any event, you will need more information, so contact the appropriate manufacturers or representatives for their literature, and if nothing more you'll have hours of fascinating reading in store.

PRICES

The prices in our survey are (unless otherwise mentioned) in Canadian dollars and include duty and federal sales tax where applicable.

WHO'S INCLUDED

We have tried to include every scope company we could, but there are probably one or two who we've missed. If this is the case we will try to find a space in News Digest

in future issues for information we receive after the survey deadline.

ADDRESSES

The addresses below are those to contact to find out where to get the scopes listed. In some cases these are the addresses where the scopes themselves may be obtained, in other cases you may be advised where to get their scopes in your area. In any case literature should be obtainable from these sources.

Allan Crawford Associates, 6503 Northam Drive, Mississauga, Ontario L4V 1J2.

Associated Test Equipment, 3530 Pharmacy Avenue, Scarborough, Ontario.

Atlas Electronics, 50 Wingold Ave., Toronto, Ontario M6B 1P7.

Baytronix Ltee., 4006 Cote Vertu, Montreal H4R 1V4

BCS Electronics Ltd., 980 AIness St., Unit 31, Downsview, Ontario.

L. G. Blunt Limited, 33 Heritage Rd., Markham, Ontario L3P 1M3.

Duncan Instruments, 122 Milwick Dr., Weston, Ontario M9L 1Y6.

EICO Canada Limited, P.O. Box 268, Richmond Hill, Ontario, L4C 4Y6.

Heathkit, 1480 Dundas St. E., Mississauga, Ontario L4X 2R7.

Hewlett-Packard (Canada) Ltd., 6877 Goreway Dr., Mississauga, Ontario L4V 1L9.

Melermaster Div. of R. H. Nichols Co. Ltd., 214 Dolomite Dr., Downsview, Ontario M3J 2P8.

Nicolet Instruments Canada Limited, 1616 Matheson Blvd., Mississauga, Ontario L4W 1R9.

Omnitronix Ltd., 2056 South Service Road, Trans Canada Hwy., Dorval, Quebec H9P 2N4.

Philips Test and Measuring Instruments Inc., 6 Leswyn Road, Toronto, Ontario M6A 1K2.

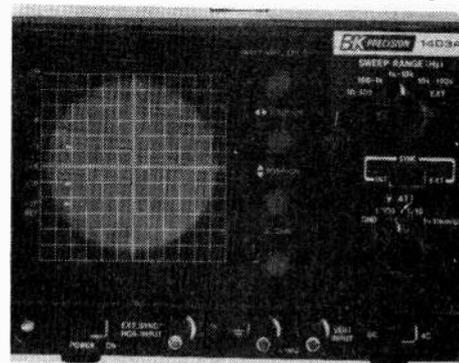
H. Rogers Electronic Instruments, Ltd., P.O. Box 310, Ajax, Ontario L1S 3C5.

Superior Electronics, 1330 Trans Canada Hwy. S., Montreal, Quebec H9P 1H8.

Tektronix Canada Ltd., P.O. Box 6500, Barrie, Ontario L4M 4V3.

VIZ, 335 E Price Street, Philadelphia, PA 19144.

B&K PRECISION



B & K 1403A

Features: Single trace, DC to 5MHz, 12 by 12 div graticule.

Horizontal Ranges: 10Hz to 100kHz continuously adjustable, also X-Y mode.

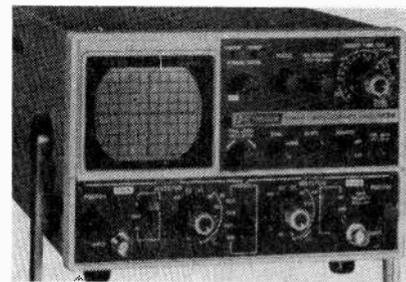
Vertical Ranges:

10mV/div to 1V/div continuously adjustable.

Synchronization: Internal or separate input.

Price: \$240.

Contact: Atlas



B & K 1432P

Features: Dual trace, DC to 15 MHz, 8 by 10 div graticule.

Horizontal Ranges: .5s/div to .5us/div continuously adjustable, plus 5 times expansion, also X-Y mode.

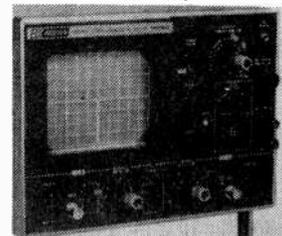
Vertical Ranges:

2mV/div to 10V/div continuously adjustable.

Trigger: Automatic, adjustable, with separate input. TV setting.

Price: \$825.

Contact: Atlas



25 million reasons why you should look into NRI training in CB and Communications Servicing.

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NRI Schools
McGraw Hill Center for
Continuing Education
330 Progress Avenue
Scarborough, Ontario M1P 2Z5

Oscilloscope Survey

B & K 1461P

Features: Single trace, DC to 10 MHz, 8 by 10 cm graticule.

Horizontal Ranges: .5s/cm to 1us/cm continuously adjustable, plus 5 times expansion, also X-Y mode.

Vertical Ranges:

10mV/cm to 20V/cm continuously adjustable.

Trigger: Automatic, adjustable, with separate input, TV setting.

Price: \$560.

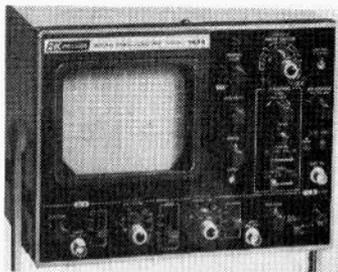
Contact: Atlas

B & K 1471 BP

Similar to model 1461P but has dual trace display and controls. **Price:** \$660.

B & K 1472C

Similar to model 1471BP but has 15MHz bandwidth. **Price:** \$870.



B & K 1474

Features: Dual trace, DC to 30 MHz, 8 by 10 cm graticule.

Horizontal Ranges: .5s/cm to .2us/cm continuously adjustable, plus 5 times expansion, also X-Y mode.

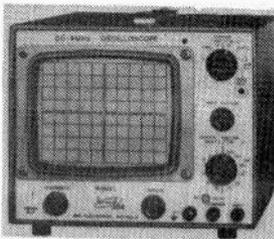
Vertical Ranges: 5V/cm to .5mV/cm continuously adjustable.

Trigger: Automatic, adjustable, with separate input, incorporates delay circuitry.

Price: \$1140.

Contact: Atlas

BWD



BWD 504

Features: Single trace, DC to 6 MHz, 8 by 10 cm graticule.

Horizontal Ranges: 10ms/cm to 1us/cm continuously adjustable, also X-Y mode.

Vertical Ranges:

50V/cm to 10mV/cm continuously adjustable.

Trigger: Automatic

Price: \$440

Contact: Duncan

BWD 509B

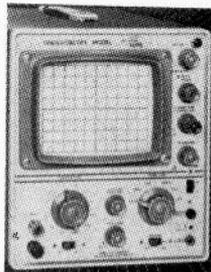
Features: Single trace, DC to 10 MHz, 8 by 10 cm graticule.

Horizontal Ranges: .1 s/cm to 1us/cm continuously adjustable also X-Y mode.

Vertical Ranges: 50V/cm to 10mV/cm

Trigger: Automatic, adjustable, with separate input.

Price: \$560.



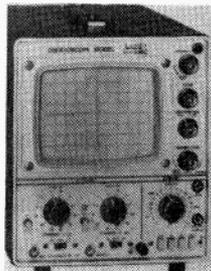
Contact: Duncan

BWD 539C/D

Features: Dual trace, DC to 25 MHz, 8 by 10 cm graticule.

Horizontal Ranges: .5s/cm to .5us/cm continuously adjustable, plus 5 times expansion, also X-Y mode.

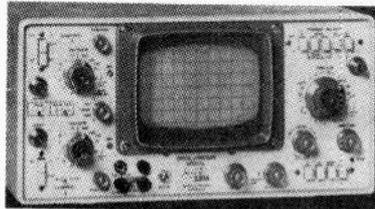
Vertical Ranges: .50/20V/cm to 10/5mV/cm



Trigger: Automatic, adjustable, with separate input, TV setting

Price: \$950 for 539D

Contact: Duncan



BWD 530A

Features: Dual trace, DC to 30 MHz, 6 by 10 cm graticule.

Horizontal Ranges: 2s/cm to 200ns/cm continuously adjustable, plus 5 times expansion, also X-Y mode.

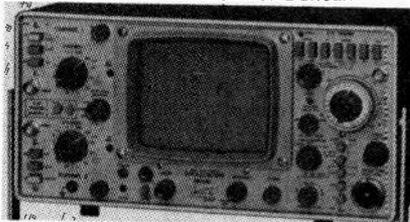
Vertical Ranges:

20V/cm to 5mV/cm continuously adjustable, plus .4 to 5 times expansion.

Trigger: Automatic, adjustable, with separate input, TV setting, incorporates delay circuitry.

Price: \$1500

Contact: Duncan



BWD 540

Features: Dual trace, DC to 100 MHz, 8 by 10 cm graticule.

Horizontal Ranges: 1s/cm to 50ns/cm, dual time base continuously adjustable, plus 10 times expansion also X-Y mode.

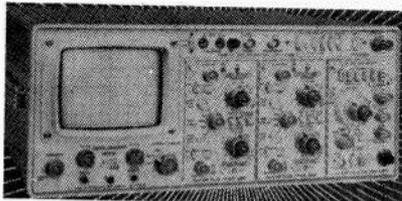
Vertical Ranges: 20V/cm to 5mV/cm

continuously adjustable, plus 5 times expansion.

Trigger: Automatic, adjustable, with separate input, TV setting, incorporates adjustable delay circuitry.

Price: \$3125

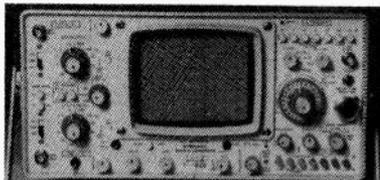
Contact: Duncan



BWD 525 Plug-in scope and Series 6 modules.

The 525 mainframe enables the use of a choice of input and timebase modules such as sweep speeds to 10ns/div and sensitivity to 10uV/div, and up to 4 trace operation.

Price: \$1480 for mainframe only.



BWD 845

Features: Dual trace, DC to 30 MHz, 8 by 10 cm graticule. Variable persistence storage scope.

Horizontal Ranges: 2s/cm to 100ns/cm, dual time base, continuously adjustable, plus .4 to 5 times

expansion, also X-Y mode.

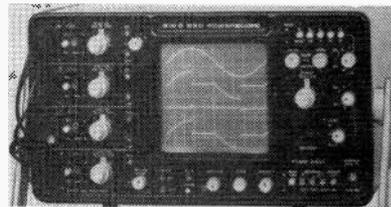
Vertical Ranges: 20V/cm to 5mV/cm continuously adjustable, plus 5 times expansion.

Trigger: Automatic, adjustable, with separate input, incorporates adjustable

delay circuitry.

Price: \$4310

Contact: Duncan



BWD 880 POWER-SCOPE

Features: 4 trace, DC to 7.5 MHz, 10 by 10 cm graticule. Intended for power applications.

Horizontal Ranges: 2s/cm to .5us/cm continuously adjustable, plus .2 to 5 times expansion, also X-Y mode.

Vertical Ranges:

200V/cm to 100mV/cm.

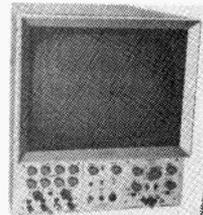
Trigger: Automatic, adjustable, with separate input, incorporates adjustable delay circuitry for measuring phase angles, and positionable marker.

Price: \$5265

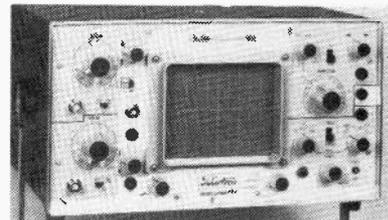
Contact: Duncan

BWD 1722 Display Oscilloscope

This unit features a 17" screen and chassis which accepts a variety of plug in modules. **Price:** \$1990 for mainframe only.



DARTRON



DARTRON D12

Features: Dual trace, DC to 17 MHz, 8 by 10 cm graticule.

Horizontal Ranges: .5s/cm to 1us/cm continuously adjustable, plus 10 times expansion, also X-Y mode.

Vertical Ranges:

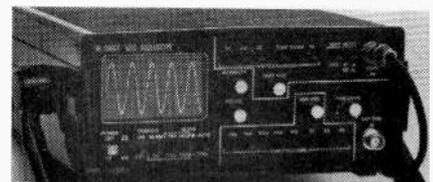
50V/cm to 10mV/cm continuously adjustable, 1mV by cascading amps.

Trigger: Adjustable, with separate input, TV setting.

Price: \$900 approx.

Contact: Baytronix

DEFORST



DEFORST 6010

Features: Single trace, DC to 10 MHz, 3.6 by 6 cm graticule.

Horizontal Ranges: 1ms/cm to .1us/cm plus 2.5 times expansion.

Vertical Ranges:

10mV/cm to 1V/cm plus 2.5 times expansion.

Trigger: Automatic, adjustable, with separate input, TV setting.

Price: \$900 approx.

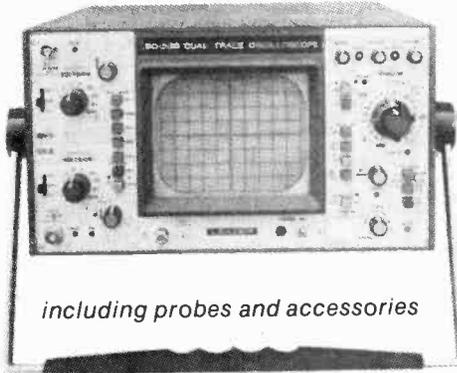
Contact: Baytronix

BAYTRONIX also have a line of monitor oscilloscopes in 5,9 and 16 inch CRT sizes with facilities to display up to 10 channels.

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- Sweep/Marker Generators
- Accessories

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LBO 520 30MHz DUAL TRACE OSCILLOSCOPE with signal delay line and post deflection acceleration C.R.T.

The newest addition to a growing family of Leader Oscilloscopes. This 30MHz dual trace oscilloscope has good bandwidth without sacrificing the high sensitivity — 5mV/cm. It is specially suited for display of wave forms generated in "high speed" digital circuits such as those used in computer equipment. The cathode ray tube is the high brilliancy type using the post deflection acceleration voltage. The vertical amplifier includes a delay line — a convenience in observation of the pulse leading edge. Other features are provided for a wide range of applications.

- Wide band—High Sensitivity
- Possible to observe the high speed pulse
- Large clear display with high brightness
- Equipped with various functions
- Portable compact type and improved facility

LBO 508 20MHz DUAL TRACE OSCILLOSCOPE

A brand new addition to a growing family of Leader oscilloscopes. This 20 MHz dual trace oscilloscope is small in size and light in weight. Front panel controls are logically grouped and located for fast and easy operation. The LBO 508 is a 20 MHz oscilloscope with a 10 mV/cm — 20 V/cm sensitivity in 11 calibrated steps. The high intensity CRT delivers excellent contrast while the regulated high voltage supply provides stable brightness.

The applications for this new outstanding oscilloscope are limitless. The LBO 508 is ideally suited for research and development, production, quality control, education and servicing.

- Compact, lightweight, horizontal package
- Add and subtract mode
- Front panel x-y one touch operation
- Automatic and T.V. sync. triggering



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LBO 507 20MHz SINGLE CHANNEL OSCILLOSCOPE

Yet another brand new addition to the growing family of Leader oscilloscopes. This single channel 20MHz is small in size and light in weight. Front panel controls are logically grouped and located for fast and easy operation. The LBO 507 is a 20MHz oscilloscope with a 10 mV/cm — 20V/cm sensitivity in 11 calibrated steps. A 200mV/cm horizontal amplifier is incorporated to permit front panel x-y operation. The high intensity CRT delivers excellent contrast while the regulated high voltage supply provides stable brightness. This general purpose oscilloscope is ideally suited for research and development, production, quality control, education and general service applications.

- Compact, lightweight, horizontal package
- DC to 20 MHz bandwidth
- Front panel x-y operation
- Automatic and T.V. sync. triggering
- Unique trigger circuit for maximum display stability

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Oscilloscope Survey

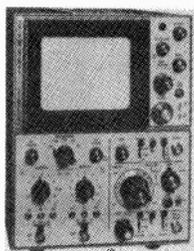
DUMONT

DUMONT 1050
Features: Dual trace, DC to 50 MHz, 8 by 10 cm graticule.

Horizontal Ranges: 1 s/cm to .1us/cm plus 10 times expansion, also X-Y mode.

Vertical Ranges: 20V/cm to 10mV/cm continuously adjustable, plus 10 times expansion.

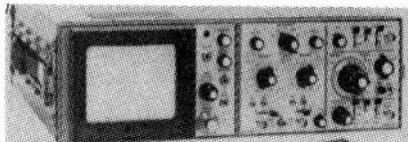
Trigger: Automatic, adjustable, with separate input, incorporates adjustable delay circuitry.
Price: Not received



DUMONT 1064
Similar to model 1050 but 60MHz bandwidth.

DUMONT 1075
Similar to model 1050 but 75MHz bandwidth.

Contact: Baytronix



DUMONT R1950
Similar to model 1050 but rack mounting, and

"ruggedized" construction.

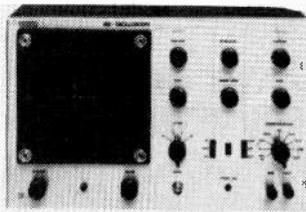
DUMONT 1100P
Features: Dual trace, DC to 100 MHz, 8 by 10 cm graticule.

Horizontal Ranges: 1s/cm to 50ns/cm continuously adjustable, plus 10 times expansion, also X-Y mode.

Vertical Ranges: 10V/cm to 5mV/cm continuously adjustable.

Trigger: Automatic, adjustable, with separate input, incorporates adjustable delay circuitry.
Price: US \$2000.
Contact: Baytronix

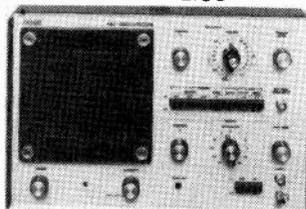
EICO



EICO 462

Features: Single trace, DC to 10 MHz, 6 by 10 cm graticule.
Horizontal Ranges: 10Hz to 1MHz continuously adjustable, also X-Y mode.

Vertical Ranges: 1V/cm to 1mV/cm continuously adjustable.
Synchronization: Adjustable, with separate input, TV setting
Price: Not received. Kit or Assembled
Contact: EICO



EICO 480
Features: Single trace, DC to 10 MHz, 6 by 10 cm graticule.

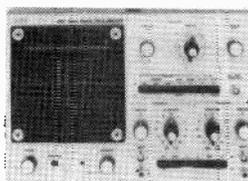
Horizontal Ranges: .5s/cm to .1us/cm continuously adjustable, also X-Y mode.
Vertical Ranges:

20V/cm to 10mV/cm continuously adjustable

Trigger: Automatic, adjustable, with separate input, TV setting,
Price: \$680 Assembled
Contact: EICO

EICO 482

Similar to model 480 but dual trace
Price: Not received. Assembled only.



EICO 435

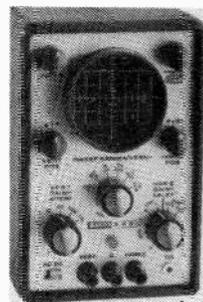
Features: Single trace, DC to 10MHz, 4 by 6 cm graticule.

Horizontal Ranges: 10Hz to 100kHz continuously adjustable, also X-Y mode, TV settings.

Vertical Ranges: continuously adjustable.

Synchronization: Automatic, with separate input.

Price: \$415 Ass./\$330 kit.



Contact: EICO

EICO 460

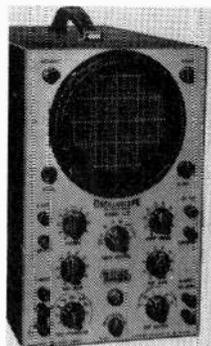
Features: Single trace, DC to 4.5MHz, 4 by 4 in graticule.

Horizontal Ranges: 10Hz to 100kHz continuously adjustable, also X-Y mode, TV settings.

Vertical Ranges: 80V/in to 80mV/in approx., continuously adjustable.

Synchronization: Automatic, with separate input.

Price: \$415 Ass./\$300 kit.



Contact: EICO

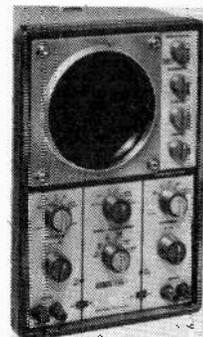
EICO 465

Features: Single trace, DC to 8 MHz, 6 by 10 cm graticule. Vector-scope features

Horizontal Ranges: 10Hz to 100kHz continuously adjustable, also X-Y mode. (Has identical horizontal amplifier for X-Y)

Vertical Ranges: 50V/cm to .05V/cm continuously adjustable

Synchronization: Automatic, with separate input



Price: \$540 Ass./\$420 kit
Contact: EICO

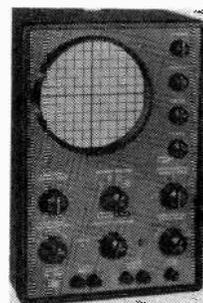
EICO 427

Features: Single trace, DC to 500 kHz 12 by 12 cm graticule.

Horizontal Ranges: 10Hz to 100kHz continuously adjustable, up to 3 times expansion approx. also X-Y mode.

Vertical Ranges: 10V/cm to 10mV/cm continuously adjustable

Synchronization: Automatic, with separate input



Price: \$370 Ass./\$250 kit
Contact: EICO

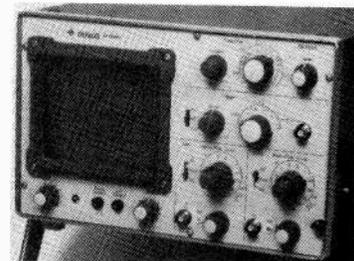
GOULD - ADVANCE



GOULD ADVANCE OS245A
Features: Dual trace, DC to 10 MHz, 8 by 10 cm graticule.
Horizontal Ranges: .5 s/cm to 1 us/cm continuously adjustable, plus 5, 10 times

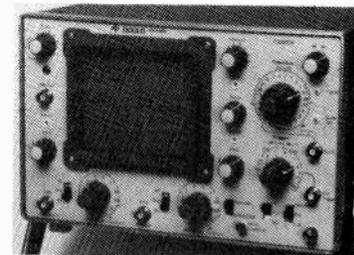
expansion, also X-Y mode.

Vertical Ranges: 5mV/cm to 20V/cm
Trigger: Adjustable, with separate input, TV setting.
Price: \$500.
Contact: A.C.A.



GOULD ADVANCE OS250B
Features: Dual trace, DC to 15 MHz, 8 by 10 cm graticule.
Horizontal Ranges: .5 s/cm to 1 us/cm continuously adjustable, plus 10 times expansion, also X-Y mode.

Vertical Ranges: 5mV/cm to 20V/cm continuously adjustable, plus 2.5 times expansion.
Trigger: Adjustable, with separate input, TV setting.
Price: \$700.
Contact: A.C.A.



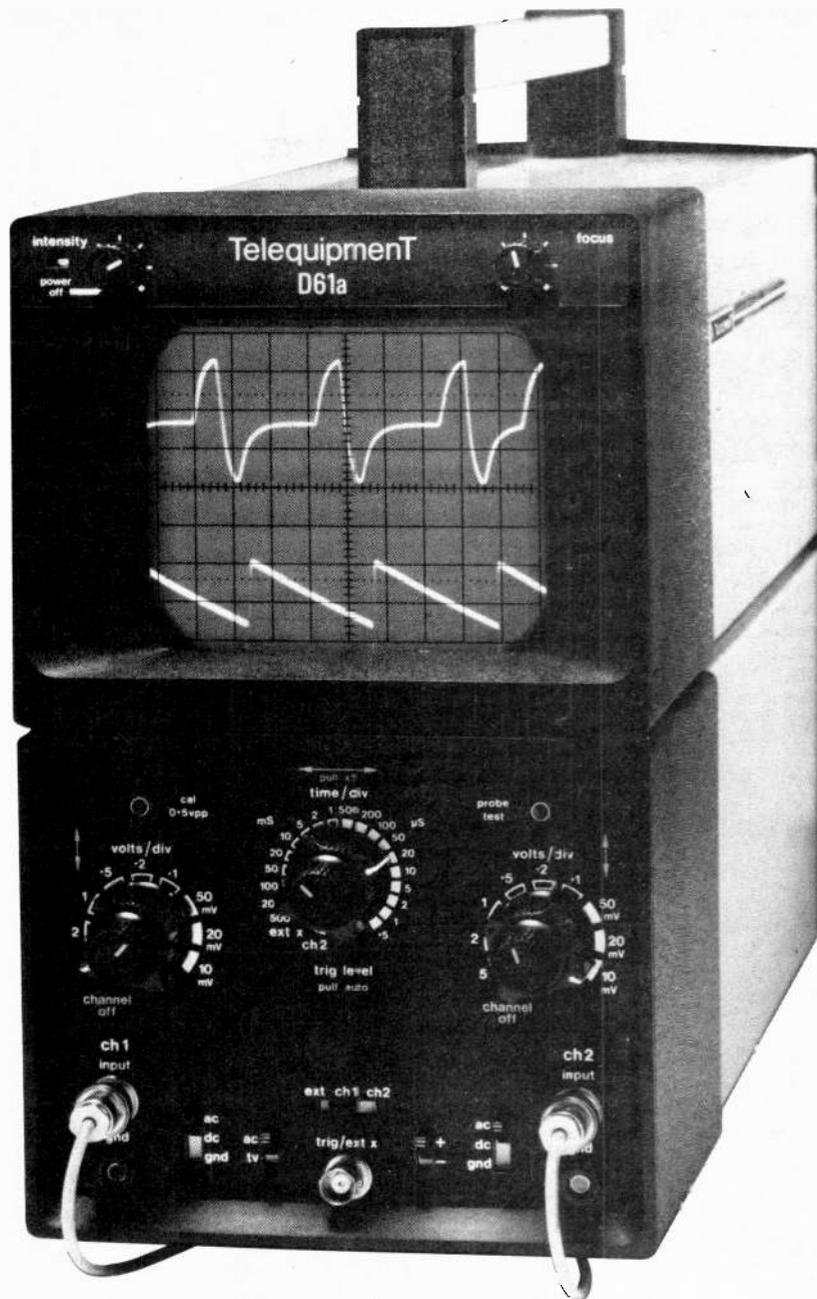
GOULD ADVANCE OS1000B
Features: Dual trace, DC to 20 MHz, 8 by 10 cm graticule.
Horizontal Ranges: 1 s/cm to .5 us/cm continuously adjustable, plus 10 times expansion, also X-Y mode.

Vertical Ranges: 5mV/cm to 20V/cm continuously adjustable, 1mV/cm with amps cascaded.
Trigger: Automatic, adjustable, with separate input, TV setting, incorporates delay circuitry.
Price: \$1175.
Contact: A.C.A.



GOULD ADVANCE OS260
Features: Dual beam, DC to 15 MHz, 8 by 10 cm graticule.

Horizontal Ranges: .2 s/cm to .5 us/cm continuously adjustable, plus 10 times expansion, also X-Y mode.



A NEW LOW-COST, DUAL-TRACE SERVICE OSCILLOSCOPE FULLY BACKED BY TEKTRONIX

Now for only \$535 you can get a portable, 10 MHz dual-trace service oscilloscope. The 18 lb. TELEQUIPMENT D61a has front-panel controls that are easy to understand, easy to use. Full-sensitivity X-Y gives you vector displays that are in true phase relationship—displays that you can rely on. And automatic selection of alternate or chopped mode and automatic selection of tv line or frame triggering make this os-

cilloscope ideal for classroom use as well as the service shop.

D61a features a bright 8 x 10 cm display, and 10 mV sensitivity in dual-trace and X-Y operation. It is fully backed by a standard Tektronix one-year warranty and may be serviced at any of 3 Tektronix Service Centres nationwide. Call your nearest field representative for specifications and ordering information on the

new D61a and other low cost TELEQUIPMENT Oscilloscopes or contact Tektronix Canada Ltd.

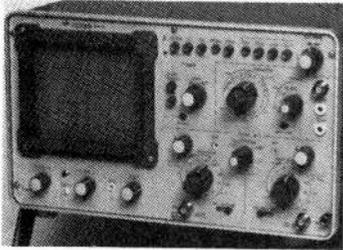
CDN Sales Price FOB Destination. FST extra.

TELEQUIPMENT 

Tektronix Canada Ltd.
P.O. Box 6500,
Barrie, Ontario L4M 4V3

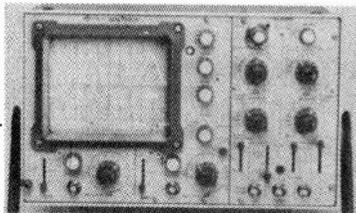
Oscilloscope Survey

Vertical Ranges: 10 mV/cm to 20 V/cm continuously adjustable, plus 2.5 times expansion.



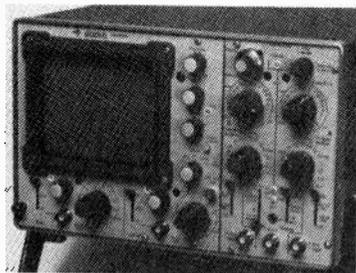
Trigger: Adjustable, with separate input.
Price: \$1235.
Contact: A.C.A.

GOULD ADVANCE OS1100
Features: Dual trace, DC to 30 MHz, 8 by 10 cm graticule.
Horizontal Ranges: 2 s/cm to .2 us/cm continuously adjustable, plus 10 times expansion, also X-Y mode.



Vertical Ranges: 2mV/cm to 10V/cm continuously adjustable, plus 1/2 to 2 times expansion.
Trigger: Automatic, adjustable, with separate input, incorporates adjustable delay circuitry.
Contact: A.C.A.

GOULD ADVANCE OS3000A
Features: Dual trace, DC to 40 MHz, 8 by 10 cm graticule.
Horizontal Ranges: 2 s/cm to .2 us/cm continuously adjustable, plus 10 times expansion, also X-Y mode. Individual time base for each channel.



Vertical Ranges: 5mV/cm to 20V/cm continuously adjustable, plus 5 times expansion.
Trigger: Automatic, adjustable, with separate input, TV setting, incorporates adjustable delay circuitry.
Contact: A.C.A.

GOULD ADVANCE OS3300B
Features: Dual trace, DC to 50 MHz, 8 by 10 cm graticule.
Horizontal Ranges: 1 s/cm to 100 ns/cm continuously adjustable, plus 10 times expansion, also X-Y mode.

Vertical Ranges: 5mV/cm to 20V/cm continuously adjustable, plus 5 times expansion.
Trigger: Automatic, adjustable, with separate input, incorporates adjustable delay circuitry.
Contact: A.C.A.

GOULD ADVANCE OS4000
Features: Dual trace, DC to 10 MHz, 8 by 10 cm graticule. Digital storage in 1K byte memory gives resolu-

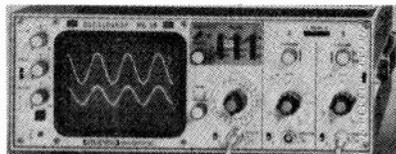
tion on the order of 0.2%.
Horizontal Ranges: 20s/cm to 1us/cm continuously adjustable, plus 10 times expansion, also X-Y

mode.
Vertical Ranges: 5mV/cm to 20V/cm continuously adjustable.

GRUNDIG

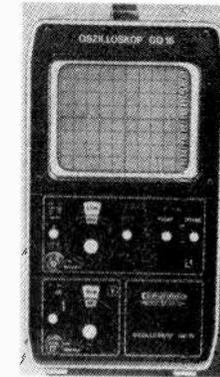
GRUNDIG GO15
Features: Single trace, DC to 15MHz, 8 by 10 cm graticule.
Horizontal Ranges: 100ms/cm to 0.3us/cm plus 3 times expansion.
Vertical Ranges: 5mV/cm to 20V/cm
Trigger: Adjustable, with separate input, TV setting.
Contact: L. G. Blunt Limited

GRUNDIG GO10
Features: Dual trace, DC to 10MHz, 8 by 10 cm graticule.
Horizontal Ranges: 0.5s/cm to 0.1us/cm plus 5 times expansion.
Vertical Ranges: 2mV/cm to 50V/cm
Trigger: Adjustable, with separate input, TV setting.
Contact: L. G. Blunt Limited



GRUNDIG MO50
Features: Dual trace, DC to 50MHz, 8 by 10 cm graticule.
Horizontal Ranges: 1s/cm to 20ns/cm continuously adjustable, plus 5 times expansion.

Trigger: Automatic, adjustable, with separate input.
Contact: A.C.A.



GRUNDIG G10/13Z
Features: Dual trace, DC to 10MHz, 8 by 10 cm graticule.
Horizontal Ranges: 0.5s/cm to 0.1us/cm
Vertical Ranges: 2mV/cm to 50V/cm
Trigger: Automatic, adjustable, with separate input, TV setting.
Contact: L. G. Blunt Limited

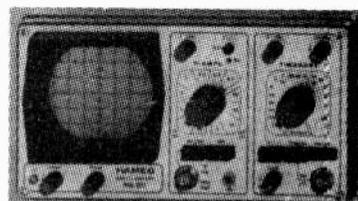
Vertical Ranges: 5mV/cm to 10V/cm continuously adjustable.
Trigger: Automatic, adjustable, with separate input.
Contact: L. G. Blunt Limited



GRUNDIG MO52
Features: Dual trace, DC to 50MHz, 8 by 10 cm graticule.
Horizontal Ranges: 1s/cm to 0.1us/cm continuously adjustable, plus 5 times expansion.

Vertical Ranges: to 5mV/cm continuously adjustable.
Trigger: Automatic, adjustable, with separate input, incorporates adjustable delay circuitry.
Contact: L. G. Blunt Limited

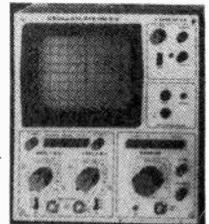
HAMEG



HAMEG HM307
Features: Single trace, DC to 10 MHz.
Horizontal Ranges: .2s/cm to .5us/cm continuously adjustable, also X-Y mode.
Vertical Ranges:

HAMEG HM312
Features: Dual trace, DC to 10 MHz, 8 by 10 cm graticule.
Horizontal Ranges: .2s/cm to .5us/cm continuously adjustable, plus 3 times expansion, also X-Y mode.
Vertical Ranges: 20V/cm to 5mV/cm (p-p)
Trigger: Automatic, adjustable, with

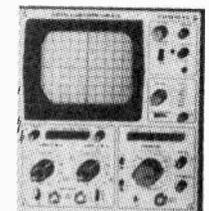
20V/cm to 5mV/cm (p-p) continuously adjustable.
Trigger: Automatic, adjustable, with separate input.
Price: \$450.
Contact: BCS



HAMEG HM412
Features: Dual trace, DC to 20 MHz, 8 by 10 cm graticule.
Horizontal Ranges: 2s/cm to .5us/cm continuously adjustable, plus 5 to 12 times expansion, also X-Y mode.

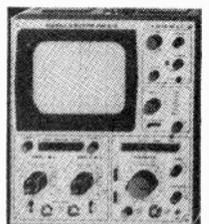
Vertical Ranges: 20V/cm to 5mV/cm (p-p) continuously adjustable, plus 2.5 times expansion.
Trigger: Automatic, adjustable, with

separate input, TV setting.
Price: \$825.
Contact: BCS



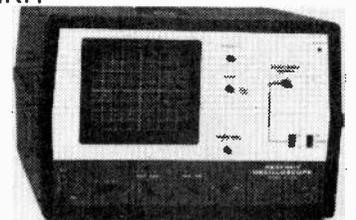
HAMEG HM512
Features: Dual trace, DC to 50 MHz, 8 by 10 cm graticule.
Horizontal Ranges: 2s/cm to 100ns/cm continuously adjustable, plus 5 to 15 times expansion, also X-Y mode.
Vertical Ranges: 20V/cm to 5mV/cm (p-p) continuously adjustable.
Trigger: Automatic, adjustable, with

separate input, TV setting, incorporates adjustable delay circuitry.
Price: \$1225.
Contact: BCS



separate input, incorporates adjustable delay circuitry.
Price: \$1880.
Contact: BCS

HEATHKIT



HEATHKIT IO4560
Features: Single trace, DC to 5 MHz, 8 by 10 cm graticule.
Horizontal Ranges: 20ms/cm to 20 us/cm (uncalibrated), continuously adjustable, also X-Y mode.

Vertical Ranges: 10V/cm to 100 mV/cm continuously adjustable.
Trigger: Automatic, with separate input
Price: \$200
Contact: Heathkit

HEATHKIT IO/S04541
Features: Single trace, DC to 5 MHz, 8 by 10 cm graticule.

Horizontal Ranges: 200ms/cm to .2us/cm continuously adjustable, also X-Y mode.

Accuracy made easy . . .
Push Button Triggered Scopes
from



HICKOK
the value innovator

Model 517
Dual-Trace
15 MHz
Triggered
Oscilloscope

A value loaded medium bandwidth scope useable to 27 MHz

The Hickok Model 517 Dual Trace Oscilloscope is the perfect signal tracing instrument for all servicing jobs. The Model 517 has all the necessary features for professional analysis and results.

Dual trace lets you simultaneously view two waveforms that are frequency or phase related or that have a common sync voltage.

This unit is also available in single trace Model 515 and Model 532 30 MHz Dual trace.

ROGERS electronic instruments Ltd.

P.O. Box 310, 595 Mackenzie Avenue Units 1 & 2.
Ajax, Ontario L1S 3C5. Tel. (416) 683-4211

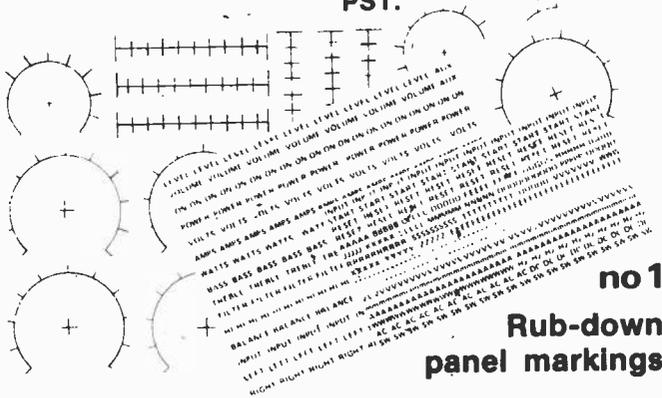
eti PANEL TRANSFERS

A really high quality system for finishing off your projects. The sheets include a mass of lettering and control scales for both rotary and linear pots.

The lettering is transferred simply by laying on to the panel and rubbing down — it's strong and permanent.

The markings are on two sheets (a full-sized one cut in half for easy postage) and contain sufficient lettering for dozens of projects.

Send \$3.50 (including postage) to ETI PANEL TRANSFERS, Unit Six, 25 Overlea Blvd., Toronto, Ontario, M4H 1B1. Ontario Residents add 4% PST.



no 1

Rub-down
panel markings



A SCOPE FOR ALL REASONS --

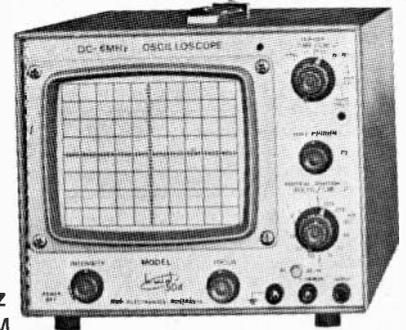
Audio, TV, CB/GRS servicing — Experimental and hobby uses — Professional and amateur radio measurements — Education — Production line testing.

LOW
COST



504

DC to 6 MHz
SINGLE BEAM

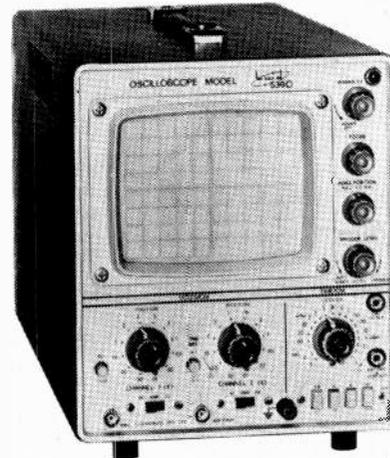


A CALIBRATED TRIGGERED OSCILLOSCOPE

Vertical bandwidth DC to 6 MHz (3 dB), sensitivity 10 mV to 50V/cm. Frequency response to beyond 40 MHz — Time base 0.5 μ Sec to 1 Sec/cm, with auto lock — Isolated ground — DC-coupled X-Y amplifiers with low X-Y phase shift — Input protected to 400 V AC/DC — 8x10 cm graticule — 12 months warranty.

BWD Model 504
including 1:1 probes **\$395**

-- Or even more versatile



The
Dual
Trace



539D

DC to
25 MHz

\$840

probes extra

Where signal comparisons are essential to ensure correct operation, e.g., check the phase shift of stereo outputs; measure pulse delays in digital circuits; separate line and frame lock in TV servicing.

Vertical DC to 25 MHz (3 dB), 5 mV to 20 V/cm — Time base 0.1 μ Sec to 10 Sec/cm, 3 Hz to 30 MHz trigger plus line and frame video — Built-in calibrator — 8x10 cm graticule — 12 months warranty.

Probes (two required):
Model 88100, 1:1 and 10:1 switched, \$36
Model 88000, 10:1, \$26

Above probes also usable with Model 504 scope

All prices are Sales Taxes Extra, FOB Weston, and subject to change without notice.

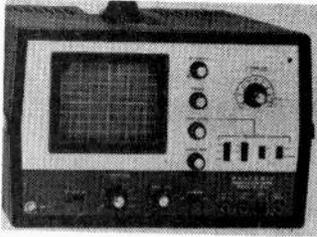
DUNCAN INSTRUMENTS LTD.

ELECTRICAL MEASURING INSTRUMENT SPECIALISTS

122 MILLWICK DRIVE, WESTON, ONTARIO. M9L 1Y6

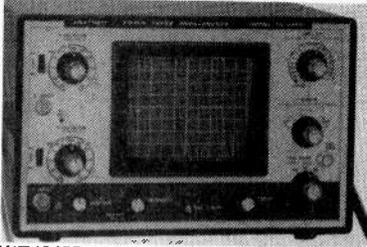
TELEPHONE (416) 742-4448 • TELEX 06-969636

Oscilloscope Survey



Vertical Ranges:
10V/cm to 20mV/cm
continuously adjust-
able,
Trigger: Automatic,
adjustable, with

separate input, TV
setting
Price: \$290 kit/\$500
Assembled
Contact: Heathkit



HEATHKIT 104555
Features: Single trace,
DC to 10 MHz, 8 by 10
cm graticule.

Horizontal Ranges:
.2s/cm to .2us/cm
continuously adjust-
able, plus 5 times
expansion, also X-Y
mode.

Vertical Ranges:

20V/cm to 10mV/cm
continuously adjust-
able. (Identical channel,
for X, except 1MHz
response)

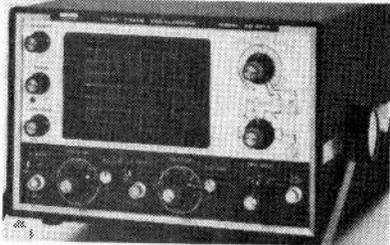
Trigger: Automatic,
adjustable, with
separate input, TV
setting

Price: \$530

Contact: Heathkit

HEATHKIT 10/S0 4550
Similar to model 4555
but dual trace.

Price: \$590 kit/\$800
assembled.



HEATHKIT 10/S0 4510
Features: Dual trace,
DC to 15 MHz, 6 by 10
cm graticule.

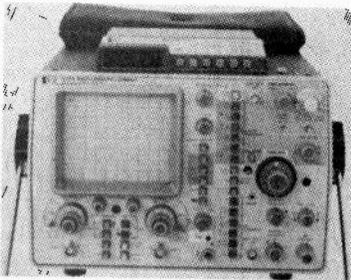
Horizontal Ranges:
.2s/cm to .1us/cm
continuously adjust-
able, plus 5 times
expansion, also X-Y
mode.

Vertical Ranges: 5V/cm
to 1mV/cm contin-
uously adjustable.

Trigger: Automatic,
adjustable, with
separate input, incor-
porates delay circuitry.

Price: \$1000 kit/\$1330
Assembled
Contact: Heathkit

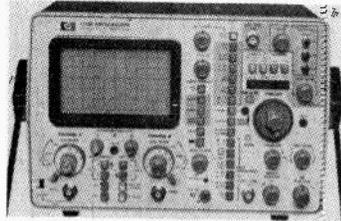
HEWLETT-PACKARD



HEWLETT-PACKARD 1715A & 1725A

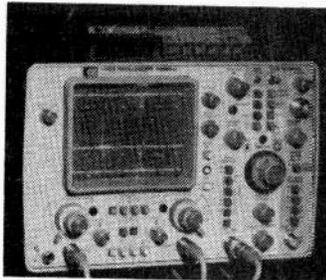
Features: Frequency response up to 275MHz,
down to 5mV/div sensitivity, sweep speeds to
1ns/div, dual trace. Calibrated delay and marker,
or "Delta Time" system using two markers for
making various time measurements, useful in
high speed digital applications.

Optional 3½ digit auto-ranging DMM may be
included, which also allows direct display of delta
time value. Also available is the "state display
option" giving binary readout (1s and 0s) of
digital data on the scope screen.



HEWLETT-PACKARD 1720A, 1722A, 1722B

Features: 275MHz response, sweep rates to
1ns/div, dual trace. The 1722A&B incorporate a
microprocessor system and numeric readout for
direct display of time interval, calculated
frequency, and voltage measurements.



HEWLETT-PACKARD 1740, 41, 42, 43, 44

This series of 100MHz scopes based on the same
mechanical chassis afford a selection of
sophisticated features. All are dual channel with
sweep speeds to 10ns/div, sweep delay and
mixed time bases, with vertical sensitivity to
1mV/div

Of the individual models, 1741 provides variable
persistence storage and has optional binary logic
state readout feature, 1742 allows easy delta time
measurements and may be ordered with
DMM/time readout option. 1743 has a built in
100MHz crystal time reference, and digital time
interval readout. Finally, 1744 is again a storage
scope, but incorporates a new CRT design
allowing up to 1800cm/sec writing speed, as
compared to 100cm/sec for the 1741.

As an example the 1744 is priced at
approximately \$8500.

HICKOK

HICKOK 511

Features: Single trace,
DC to 10 MHz, 8 by 10
cm graticule.

Horizontal Ranges:
.2s/cm to .5us/cm
continuously adjust-
able.

Vertical Ranges:
50V/cm to 10mV/cm
continuously adjust-
able.

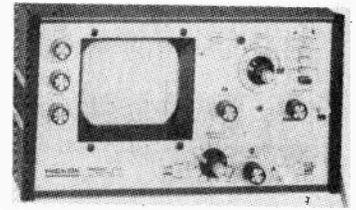
Trigger: Automatic,
adjustable, with
separate input.

Price: \$570

Contact: H. Rogers



HICKOK 512
Similar to model 511
but dual trace.
Price: \$860



HICKOK 515

Features: Single trace,
DC to 15 MHz, 8 by 10
cm graticule.

Horizontal Ranges:
.2s/cm to .5us/cm
continuously adjust-
able, plus 5 times
expansion, also X-Y
mode.

HICKOK 517

Similar to model 515

Vertical Ranges:
50V/cm to 10mV/cm
continuously adjust-
able.

Trigger: Automatic,
adjustable, with
separate input, TV
setting.

Price: \$710

Contact: H. Rogers

but dual trace.

Price: \$995



HICKOK 532

Features: Dual trace,
DC to 30 MHz, 6 by 10
cm graticule.

Horizontal Ranges:
2s/cm to 50ns/cm
continuously adjust-
able, also X-Y mode.

Vertical Ranges:

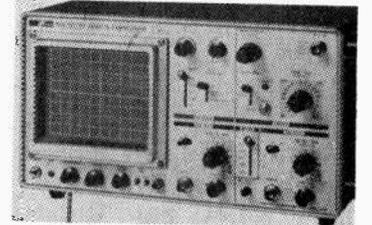
20V/cm to 10mV/cm
continuously adjust-
able.

Trigger: Automatic,
adjustable, with
separate input, incor-
porates delay circuitry.

Price: \$1425

Contact: H. Rogers

IWATSU



IWATSU SS-5212

Features: Dual trace,
DC to 15 MHz, 8 by 10
cm graticule.

Horizontal Ranges:
.5s/cm to .5us/cm
continuously adjust-
able, plus 10 times
expansion, also X-Y
mode.

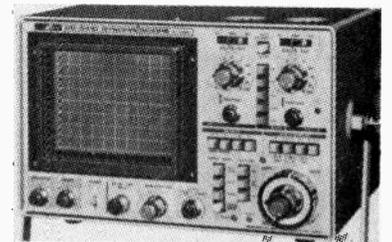
Vertical Ranges:

20V/cm to 10mV/cm
continuously adjust-
able, plus 10 times
expansion.

Trigger: Automatic,
adjustable, with
separate input, TV
setting.

Price: \$920.

Contact: A. T. E.



IWATSU SS-5410

Features: Dual trace,
DC to 35MHz, 8 by 10
cm graticule.

Horizontal Ranges:

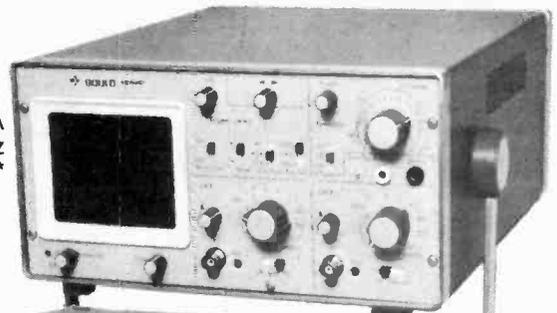
.2s/cm to .1us/cm, dual
(delayed) timebase,
continuously adjust-
able, also X-Y mode.

Vertical Ranges:

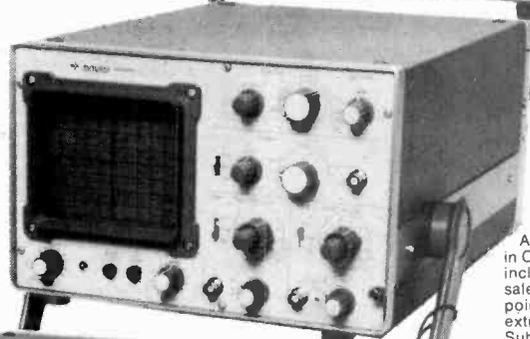
How much are you ~~paying~~ ~~saving~~ by building your own 'scope?

Some people still believe that it is less expensive to buy an oscilloscope in kit form and assemble it themselves. Spec for spec we believe that Gould/Advance scopes offer more performance at lower cost than any other scopes available in Canada, including kits. If you are one of those who still thinks that kits are cheaper then take a few minutes to compare prices and specifications. Then buy Gould/Advance and save yourself some money and time.

OS245A
10 MHz
\$535*



OS250B
15 MHz
\$699*



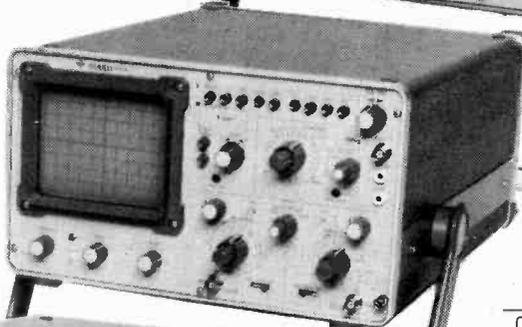
*Canadian Prices
All prices shown are in Canadian funds and include duty and federal sales tax. FOB shipping point. Provincial taxes are extra where applicable. Subject to change without notice.



OS1000B
20 MHz
\$1195*



OS1100
30 MHz
\$1535*



MODEL	DUAL TRACE	SWITCHED X-Y	TV TRIGGERING	TRIGGER DELAY LINE	DIFFERENTIAL	VAR TRIGGER DELAY	DUAL TRIGGER DELAY	SWEEPSPEED (DIV/IV)	BANDWIDTH (MHz)	MAX SENSITIVITY (mV/DIV)	PRICE*
OS245A	•	•	•				200	10	5	\$ 535	
OS250B	•	•	•				100	15	2	\$ 699	
OS1000B	•	•	•	•			50	20	1	\$1195	
OS1100	•	•	•	•			20	30	1	\$1535	
OS3300B	•	•	•	•			10	50	1	\$2105	

OS3300B
50 MHz
\$2105*



We challenge you to compare specifications, warranty and price!

We challenge you to compare Gould/Advance dual-trace general purpose oscilloscopes against any other makes offering similar performance specifications. You will be amazed at just how economical Gould/Advance scopes are. Plus with Gould/Advance you get an exclusive two-year warranty on parts and labour; a wide choice of models; ACA service facilities across Canada; and immediate availability from stock at ACA Electronic Centres in Toronto, Montreal, Calgary, and Vancouver. Shop in person or by mail. Write for free catalog. Master Charge and Chargex-Visa accepted.

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10V/cm to 5mV/cm continuously adjustable.

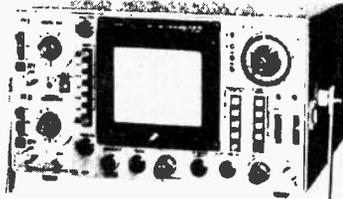
Trigger: Automatic, adjustable, with

separate input, incorporates delay circuitry.
Price: \$2660.
Contact: A.T.E.



IWATSU SS-4511
Similar to model SS-5410 but 50MHz bandwidth and 5 times

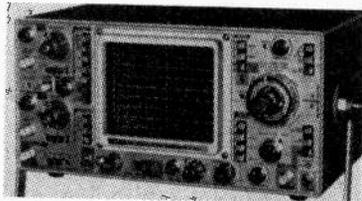
expansion in vertical, and 10 times in the horizontal directions.
Price: \$2785.



IWATSU SS-4121A
Features: Dual trace, DC to 100 MHz, 6.4 by 8 cm graticule.

Horizontal Ranges: to 5 ns/div, delayed sweep, continuously adjustable, also X-Y mode.

Vertical Ranges: to 1 mV/div, continuously adjustable.
Trigger: Automatic, adjustable, with separate input, incorporates delay circuitry.
Price: \$3750.
Contact: A.T.E.



IWATSU SS-5321
Features: Dual trace "Ch3" displays trigger, DC to 250 MHz, 8 by 10 cm graticule.

Horizontal Ranges: 50ms/cm to 10ns/cm, delayed sweep, continuously adjustable, plus 10 times expansion, also X-Y mode.

Vertical Ranges: 5V/cm to 5mV/cm continuously adjustable, 1mV/cm if amps cascaded.
Trigger: Automatic, adjustable, with separate input, incorporates delay circuitry.
Price: \$6555.
Contact: A.T.E.

LEADER

LEADER LBO-310A/HAM
Features: Single trace, DC to 4MHz, (450 MHz by direct connection to plates)

Horizontal Ranges: 10Hz to 100kHz continuously adjustable, also X-Y mode.

Vertical Ranges: 20mV/cm to 2V/cm continuously adjustable.

Synchronization: Automatic

Notes: The 310 is available in a HAM model which includes circuitry for monitoring



transmitter output, and RTTY signals.
Price: \$265/\$295
Contact: Omnitronix

LEADER LBO-510
Similar to model 310 but larger CRT, allows external synch signal.
Price: \$430



LEADER LBO-552 "STEREOSCOPE"

Features: Single trace split into left and right halves, DC to 1.5 MHz, 8 by 10 cm graticule. Intended for stereo servicing.

LEADER LBO/512A
Features: Single trace, DC to 10 MHz, 8 by 10 cm graticule.

Horizontal Ranges: 1ms/cm to 1us/cm continuously adjustable, also X-Y mode.

Vertical Ranges: 10V/cm to 10mV/cm continuously adjustable

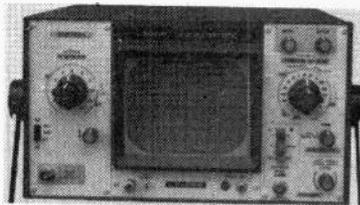
Trigger: Automatic, adjustable, with separate input
Price: \$580

LEADER LBO/506A
Features: Dual trace, DC to 10 MHz, 8 by 10 cm graticule.

Horizontal Ranges: .2s/cm to .5us/cm continuously adjustable, plus 5 times expansion, also X-Y mode.

Vertical Ranges: 20V/cm to 10mV/cm continuously adjustable,

Trigger Synchronization: Automatic, adjustable, with separate input,



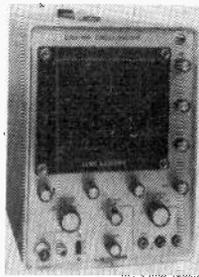
LEADER LBO-507
Features: Single trace, DC to 20MHz, 8 by 10 cm graticule.

Horizontal Ranges: .2s/cm to .5us/cm continuously adjustable, plus 5 times expansion, also X-Y mode.

Vertical Ranges: 20V/cm to 10mV/cm continuously adjustable

Trigger: Automatic, adjustable, with separate input, TV setting
Price: \$805

Contact: Omnitronix



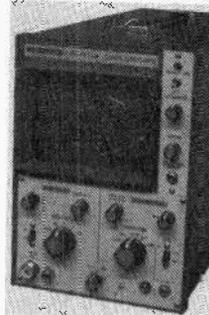
Horizontal Ranges: 10Hz to 100kHz continuously adjustable, also X-Y mode.

Vertical Ranges: 20V/cm to 20mV/cm continuously adjustable

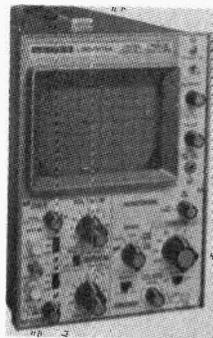
Synchronization: Automatic with separate input.

Notes: Has two input channels, displays signals side by side.
Price: \$615

Contact: Omnitronix

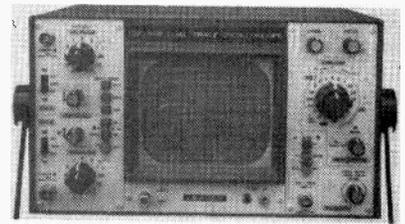


Contact: Omnitronix



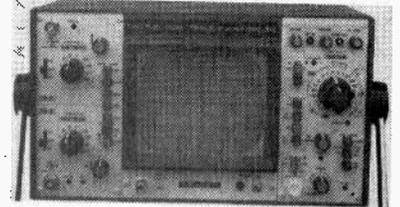
Price: \$765.

Contact: Omnitronix



LEADER LBO-508
Similar to model LBO-

507 but dual trace.
Price: \$935



LEADER LBO-520
Features: Dual trace, DC to 30MHz, 8 by 10 cm graticule.

Horizontal Ranges: .5s/cm to .2us/cm continuously adjustable, plus 10 times expansion, also X-Y mode.

Vertical Ranges: 5V/cm to 5mV/cm continuously adjustable.

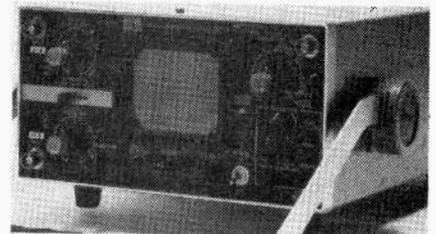
Trigger: Automatic, adjustable, with separate input, TV setting
Price: \$1400

Contact: Omnitronix

LEADER LBO-515
Similar to model LBO-520 but includes variable delayed sweep

and mixed time bases, response is only 25 MHz.
Price: \$2370

METERMASTER



METERMASTER 66303
Features: Dual trace, DC to 15 MHz, 8 by 10 cm graticule.

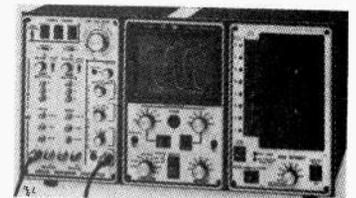
Horizontal Ranges: .5s/cm to 1us/cm continuously adjustable, plus 5 times expansion, also X-Y mode.

Vertical Ranges: 10V/cm to 5 mV/cm continuously adjustable

Trigger: Automatic, adjustable, with separate input, TV setting
Price: \$770

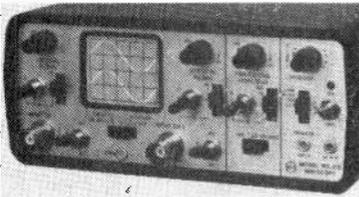
Contact: R.H. Nichols

NICOLET INSTRUMENTS



NICOLET INSTRUMENTS Explorer II and III
These are series' of digital storage oscilloscopes, providing comprehensive control over data acquisition and display. Long term storage of traces may be accomplished using the model III's floppy disk unit. The screen provides for digital readout of information.

NON-LINEAR SYSTEMS INC.



NON-LINEAR SYSTEMS MS 15
Features: Single trace, DC to 15 MHz, 4 by 5 cm graticule.

Horizontal Ranges: .5s/cm to .1us/cm continuously adjustable, also X-Y mode.

Vertical Ranges: 50V/cm to 10mV/cm continuously adjustable.
Trigger: Automatic, adjustable, with separate input.
Notes: Includes rechargeable batteries.
Price: \$410
Contact: R. H. Nichols

50V/cm to 10mV/cm continuously adjustable.

Trigger: Automatic, adjustable, with separate input.

Notes: Includes rechargeable batteries.
 Price: \$410
 Contact: R. H. Nichols

PHILIPS



PHILIPS PM3211/3225/3226
Features: Single (3225)/ Dual trace, DC to 15 MHz, 8 by 10 div graticule.
Horizontal Ranges: .2s/div to .5us/div continuously adjustable, plus 5 times expansion on 25 and

26, also X-Y mode.
Vertical Ranges: 10V/div to 2 mV/div
Trigger: Automatic, adjustable, with separate input, TV setting
Price: \$1315/\$915/\$1175
Contact: Philips



PHILIPS PM 3010 MINISCOPE
Features: Single trace, DC to 5 MHz, 1.8 by 2.7 cm graticule.
Horizontal Ranges: .1s/cm to 1us/cm plus 10 times expansion

Vertical Ranges: 1V/cm to 30mV/cm
Trigger: Automatic, adjustable, with separate input
Price: Not received
Contact: Philips

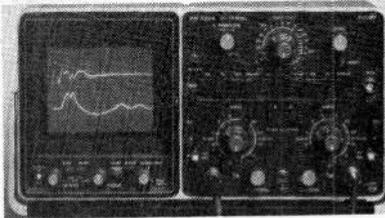


PHILIPS 3232/3233
Features: Dual beam, DC to 10 MHz, 8 by 10 cm graticule.
Horizontal Ranges: .5s/cm to 200ns/cm

continuously adjustable, plus 5 times expansion.
Vertical Ranges: 10V/cm to 2mV/cm continuously adjustable.

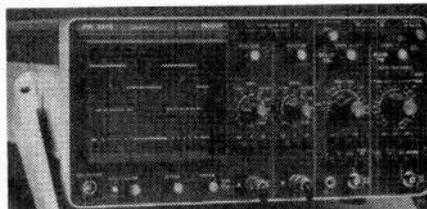
Trigger: Automatic, adjustable, with separate input.

Price: \$1680/\$1770
Contact: Philips

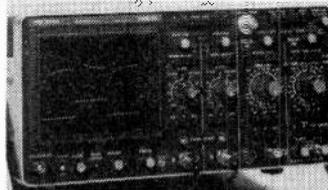


PHILIPS 3234 but has storage facility.
Price: \$3880

PHILIPS has an extensive line of oscilloscopes with bandwidths over 25MHz. The following list covers the most important specifications. Most operate from AC line or battery supply.
 PM3213/14: 25MHz dual trace, 2mV/div, 20ns/div, delay line. 3214 also has delayed timebase. \$1755/\$2110.



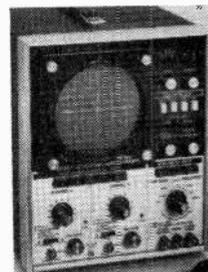
PM3240 (X)/44/43: 50MHz dual trace (4 on 44), 5mV/div, 5ns/div, delay line. All have delayed timebase. 3240X is especially suited to TV studio work. 3243 is a storage scope with capability to multiply the two input channels.
PM3260E/3261: 120MHz dual trace 5mV/div, 5ns/div, delay line and delayed timebase. 3261 provides digital delay, and readout of same. \$4930 for 3261.



PM3265 (E): 150MHz dual trace, 5mV/div, 2ns/div, delay line and delayed timebase. 3265 model has multiplier. \$6485/\$4815.
PM3262: 100MHz dual trace, 5mV/div (2mV/div to 35MHz), 5ns/div, delay line and delayed timebase. Trigger input displayed on 3rd channel. \$3470.

SENCORE

SENCORE 163
Features: Dual trace, DC to 8 MHz, 10 by 10 cm graticule.
Horizontal Ranges: .1s/cm to .1us/cm continuously adjustable, also X-Y mode.
Vertical Ranges: 50V/cm to 5mV/cm continuously adjustable.
Trigger: Automatic, adjustable, with separate input, TV setting



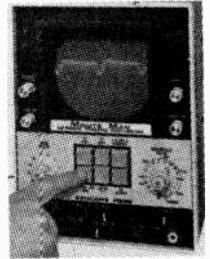
Notes: 5000V AC protection
Price: \$1385
Contact: Superior

SENCORE PS29
Features: Single trace, DC to 8 MHz, 10 by 10 cm graticule.
Horizontal Ranges: .1s/cm to .2us/cm

continuously adjustable, also X-Y mode.
Vertical Ranges: 50V/cm to 10mV/cm continuously adjustable.

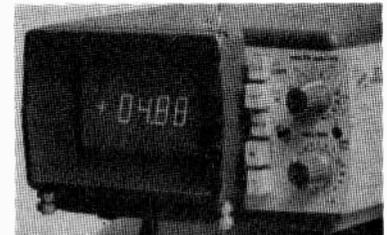
Trigger: Automatic, adjustable, with separate input, TV settings

Notes: 5000V AC protection. Push button display set-up for colour TV and video signals.
Price: \$910
Contact: Superior



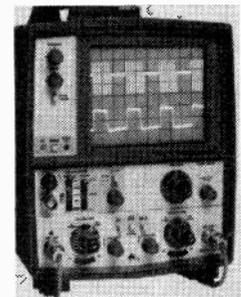
TEKTRONIX

TEKTRONIX makes a very large range of oscilloscopes, so only a brief description can be given. Tektronix also owns TELEQUIPMENT, whose scopes are listed separately. The Tektronix line may basically be considered as comprised of the following lines or series: 200 Miniscopes, T900 Series portables, 300 Series portables (Sony/Tektronix), 400 Series portables, and 5000 and 7000 series no-quite-so-portables. We will take a look at each series separately.



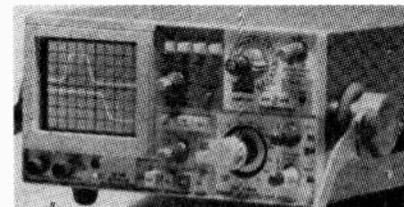
TEKTRONIX 200 Series Miniscopes.

There are four models in this range, all in very compact cases around 7.6 X 13.3 X 24.1 cm. They are the: 221 single trace 5MHz, 5mV to 100V/div; the 213 combination 1MHz, 5mV to 100V/div and digital multimeter with on-screen readout of AC and DC voltage and current, and resistance. The 212 and 214 offer dual trace and 500kHz response, 1mV to 50V/div, with the 214 also providing storage facility. Prices are (in numerical order of models) \$1570, \$2210, \$2210, \$1490



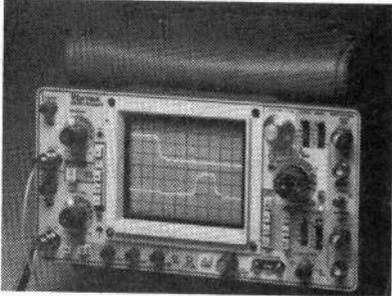
TEKTRONIX T900 Series

All similar in appearance, size about 25 X 18 X 48 cm.
 T921: DC to 15MHz, maximum 20ns/cm (including expansion), 2mV/cm. \$990
 T922: Similar but dual trace. \$1210
 T932A: Similar to T922 but 35MHz, 10ns/cm \$1640
 T935A: Similar to T932A but has delayed timebase feature \$2040
 T912: Storage scope, similar to T922 but 10MHz, 50ns/cm, \$1920



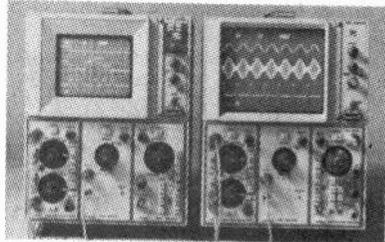
TEKTRONIX/SONY 300 Series

- Size about 11 X 22 X 30cm
 323: 4MHz, single trace, 1mV to 20V/div, sweep to .5us/div. \$1575
 326: 10MHz, dual trace, 1mV to 10V/div, sweep to 100ns/div. \$2520
 314: Storage scope, otherwise similar to 326, \$2610
 335: 35MHz dual trace, 1mV to 10V/div, sweep to 20ns/div, delayed sweep \$2340



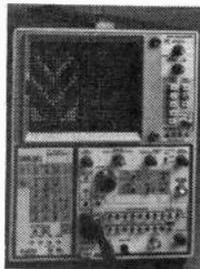
TEKTRONIX Series 400

- All models in this series have dual trace, and all but the 434 also have delayed sweep. Size is typically about 18 X 35 X 55 cm, weight 10 to 12 kg.
 434: Storage scope 25MHz, at 5mV/div, sweep speed to 20ns/div. \$4485
 455: 50MHz at 5mV/div, 5ns/div. \$2560
 464: Storage scope 100MHz at 5mV/div, 5ns/div. \$5690
 465: 100MHz at 5mV/div, 5ns/div. \$3170
 465M: Military version. \$3240
 466: Storage scope 100MHz at 5mV/div, 5ns/div, 3000div/us writing speed. \$6760
 475: 200MHz at 2mV/div, 1ns/div. \$4415
 475A: 250MHz at 5mV/div, 1ns/div. \$4910
 485: 350MHz at 5mV/div, 1ns/div. \$7215



TEKTRONIX 5000 Series

Seven oscilloscope models are offered, with various combinations of storage, multiple trace, wide bandwidth, high sensitivity, delayed sweep etc. A large number of plug-ins may be used in these frames, having such exotic functions as curve tracer, spectrum analyzer, dual trace sampler along with the various horizontal and vertical systems available. Units may be rack mounted or self standing.



TEKTRONIX 7000 Series

This is Tektronix' most exotic line of oscilloscope products. The series is made up of individual sub-series' of mainframes, which may employ any of a wide variety of plug in modules.
 The series' are: 7300 25MHz storage, 7600 100MHz storage and non-storage, 7700 250MHz non-storage, 7800 400MHz storage and non-storage and finally the 7900 non-storage 500MHz

series. Needless to say prices are into 4 and 5 figures. (Not counting the cents!)

Some of the more exciting plug-ins enable digital measurements of trace characteristics, delta time measurements, data sampling, and logic analysis with screen display of binary information.

TELEQUIPMENT



TELEQUIPMENT S22
Features: Single trace, DC to 5 MHz, 3.6 by 6 cm graticule.
Horizontal Ranges: .3s/cm to 1us/cm continuously adjustable, plus 10 times expansion, also X-Y mode.

Vertical Ranges: 5V/cm to 10mV/cm continuously adjustable, plus 10 times expansion.
Trigger: Automatic, adjustable, with separate input, TV setting.
Price: \$800.
Contact: Tektronix

TELEQUIPMENT D32
Similar to model S22 but 10MHz response, dual trace, sweep to

.5us/div plus times 5 expansion.
Price: \$1165.

TELEQUIPMENT D34
Similar to model D32

but 15MHz.
Price: \$1470.

TELEQUIPMENT S61
Features: Single trace, DC to 5MHz, 8 by 10 cm graticule.

Horizontal Ranges: .5s/cm to 1us/cm continuously adjustable, also X-Y mode.

Vertical Ranges: 20V/cm to 5mV/cm
Trigger: Automatic, adjustable, with separate input.

Price: Not Received.
Contact: Tektronix

TELEQUIPMENT D61a
Similar to model S61 but 10MHz response, maximum sensitivity 10mV/cm, continuous-

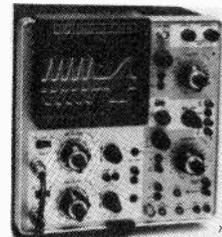


ly variable, sweep rate to .5us/cm.
Price: \$600.

TELEQUIPMENT D65/66
Features: Dual trace, DC to 15/25MHz, 8 by 10 cm graticule.

Horizontal Ranges: 2s/cm to .1us/cm continuously adjustable, plus 5 times expansion, also X-Y mode.

Vertical Ranges: 50V/cm to 10mV/cm continuously adjustable, plus 10 times expansion.
Trigger: Automatic,



adjustable, with separate input, TV setting.
Price: \$1065/\$1180
Contact: Tektronix

TELEQUIPMENT DM64
Similar to model D65

but 10MHz, provides storage facility.

TELEQUIPMENT D67A
Similar to model D66 but max sweep speed is

.2us/div (plus 5 times). Dual timebase with delay facility.

TELEQUIPMENT D63/DM63

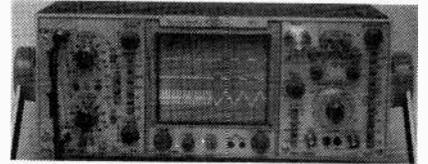
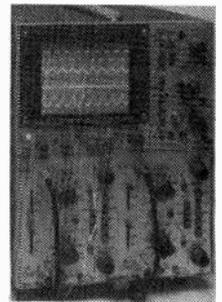
Features: Multitrace, DC to 15MHz, 8 by 10 cm graticule. Storage facility on DM63.

Horizontal Ranges: 1s/cm to .2us/cm continuously adjustable, plus 5 times expansion, also X-Y mode.

Vertical Ranges: Various vertical amplifier modules available.

Trigger: Automatic, adjustable, with

separate input.
Price: \$2400
 (Mainframe only)
Contact: Tektronix



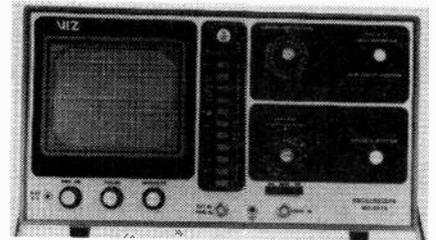
TELEQUIPMENT D75

Portable 50MHz mainframe, plug-in horizontal and vertical systems.

TELEQUIPMENT D83

Similar to D75 but vertical panel format.

VIZ

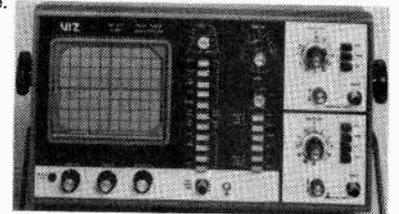


VIZ WO-527A

Features: Single trace, DC to 15 MHz, 8 by 10 cm graticule.

Horizontal Ranges: .5s/cm to .5us/cm continuously adjustable, plus 10 times expansion, also X-Y mode.

Vertical Range: 20V/cm to 10mV/cm continuously adjustable.
Trigger: Automatic, adjustable, with separate input, TV setting
Price: US \$525
Contact: VIZ

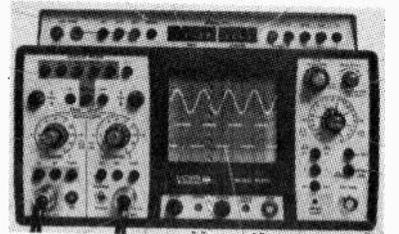


VIZ WO-555

Similar to model WO527 but dual trace.

Price: US \$750.
Contact: VIZ

VU-DATA CORP



VU-DATA PS935

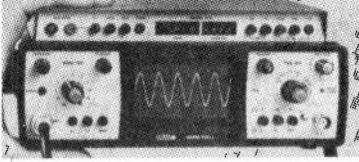
Features: Dual trace, DC to 35MHz, 2 by 2.5

inch graticule.
Horizontal Ranges: .1us/div to .5s/div

continuously adjustable, plus 10, times expansion, also X-Y mode.

Vertical Ranges: 5mV/div to 10V/div continuously adjustable, plus 5 times expansion.

Trigger: Automatic, adjustable, with separate input.
Notes: Also available with built in DMM and Counter #975
Price: \$2330/\$2935 with DMM-Counter #975
Contact: ACA



VU-DATA PS941B
Features: Dual trace, DC to 20MHz, 2 by 2.5 inch graticule.
Horizontal Ranges: 1us/cm to .5s/cm continuously adjustable, also X-Y mode.

Vertical Ranges: 10mV/cm to 20V/cm continuously adjustable.
Trigger: Automatic, adjustable, with separate input.
Price: \$1880.
Contact: ACA



DATA SERIES 1200
Notes: The series 1200 monitor oscilloscopes are very versatile allowing for up to seven plug-in DC to 5MHz oscilloscopes on one chassis.
Contact: ACA

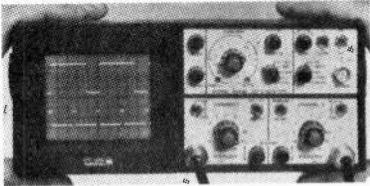
VU-DATA PS915A
Features: Single trace, DC to 20MHz, 1.5 by 2.5 inch graticule.

Horizontal Ranges: .1us/div to 10ms/div continuously adjustable, plus 5 times expansion, also X-Y mode.

Vertical Ranges: 10mV/cm to 20V/cm

continuously adjustable

Trigger: Automatic, adjustable, with separate input.
Notes: Also available with DMM-Counter #975A
Price: \$2040.
Contact: ACA



VU-DATA PS943B
Similar to model PS941B but different

sweep speeds.
Price: \$1968.



VU-DATA PS910B
Features: Single trace, DC to 20MHz, 1 by 2.5 inch graticule.

Horizontal Ranges: 1us/cm to 100ms/cm continuously adjustable, plus 1000 times expansion, also X-Y mode.

Vertical Ranges: 10mV/cm to 50mV/cm continuously adjustable

Trigger: Automatic, adjustable, with separate input
Price: \$1055
Contact: ACA

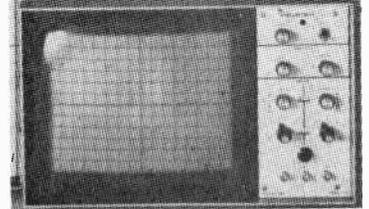


DATA SERIES MS700
Notes: The series MS700 is a line of monitor oscilloscopes having dual DC to 10MHz oscilloscope

displays with + internal, and external, trigger and are only 1 3/4 inches high.
Contact: ACA

WAVETEK 1901C
Features: Single trace, DC to 15KHz, 18 by 24 cm graticule.
Horizontal Ranges: .1V/div to 10V/div continuously adjust-

able, also X-Y mode.
Vertical Ranges: 1mV/div to 1V/div continuously adjustable.
Price: \$980.
Contact: ACA



WAVETEK 1910
Similar to model 1901C

but with dual trace.
Price: \$1210.

WAVETEK 1951
Features: Single Dual trace, DC to 1.5KHz, 18 by 24 cm graticule.
Notes: Standard

display scope but with extra large CRT useful for medical electronics.
Price: \$815.
Contact: ACA



Win a Million dollars!

ETI has a project that might help you solve the UFO riddle and win fame and fortune. For instance, National Enquirer are offering a million dollars (US\$, too) for proof that UFOs are an unnatural phenomena emanating from outer space. But even if you prove they're something else you're bound to find a buyer for your story.

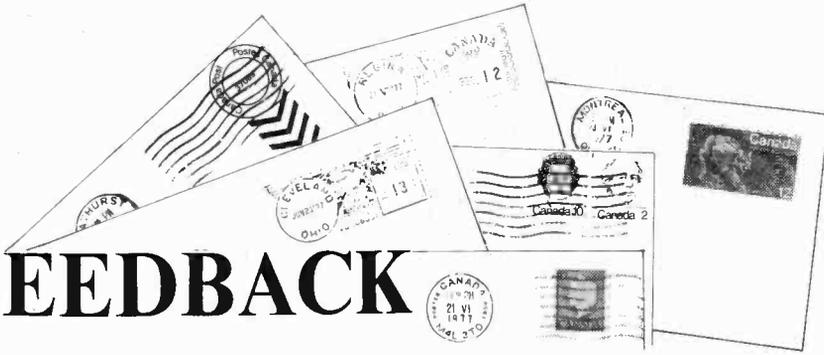
To help you with your research we have the design for a magnetic-disturbance detector; that there is a coincidence between UFO sightings and these disturbances is accepted by most ufologists.

The design of the ETI UFO-detector will appear in next month's magazine. Also in that issue will be an exciting project for audio experimenters and musicians: a phaser based on a CCD delay line. Other projects are designed and scheduled, but we can't tell you anything definite until we sort out some component-supply problems.

In addition to these projects there will be the usual assortment of features, columns, news, . . .



FEEDBACK



State Of Emergency

Help! I haven't received the February issue of ETI. Quickly, alert the Armed Forces and the RCMP. Declare a state of emergency. In a civilized country (more or less) this just can't happen. I've been subscribing since you started publishing your magazine in Canada and so haven't missed an issue. And I don't feel this is any time to start.

Enclosed is a cheque for \$2.00 (and a prayer, which I bet you can't find in the envelope, that you still have some leftover Feb./78 issues) and a copy of my subscription label. Please send me my missing copy as soon as possible. PS: Do you suppose that ETI has been elevated to the ranks of PLAYBOY as a prime rip-off target by Postal employees?

L. H. Higgins Jr. Cocagne, NB.

Notch Above

While I'm writing please let me say how much I enjoy your magazine. I've been collecting electronic magazines since my teens, and so I have many hundreds now. Your magazine is, however, a notch above most of the American editions and I've found them far more useful in terms of current phases of the art and simple-to-complex projects. You have contributed greatly to the field in Canada and I hope you keep it up and grow prosperous.

R. Burkett, London

No Need For Any Other

I would just like to say that I have been subscribing to from the States for many years now. The subscription runs out in September and I'm not renewing it. Since being a subscriber to Electronics Today for the past year I have no need for any other magazine in electronics. I have renewed my subscription to ETI. Keep the good work up. — Hooray for a Canadian magazine!

A. J. Bundy, New Westminster

LOOK

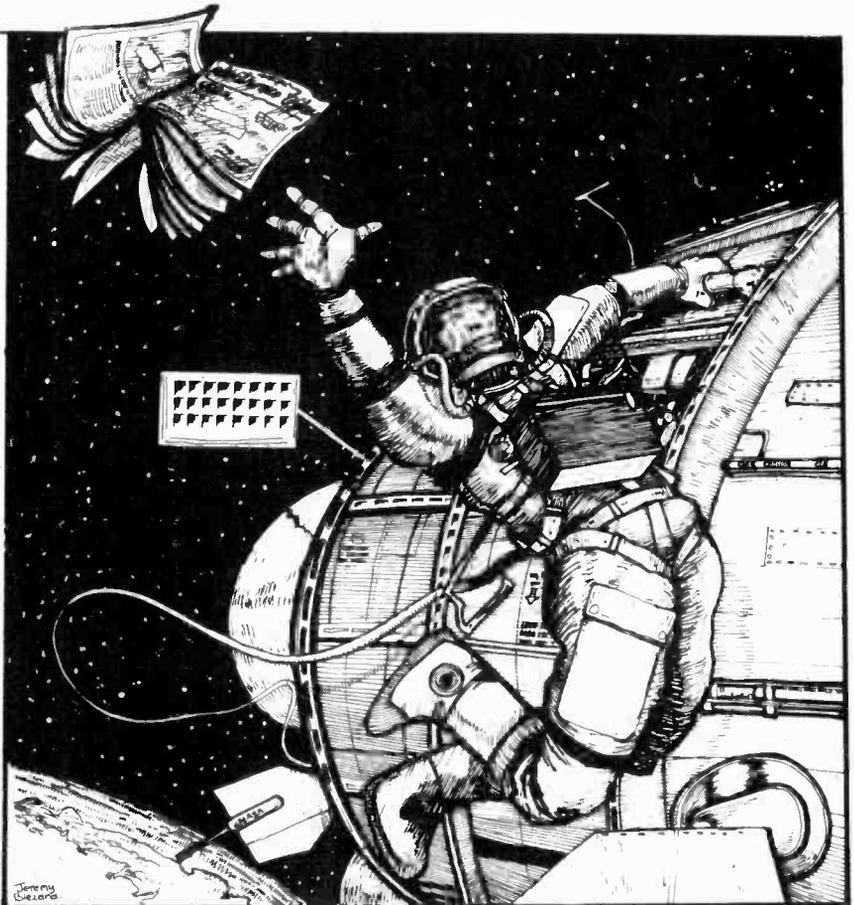
ETI Rescue Service is fully operational. Many back issues are available and important information can be supplied from those which are not. So if you lose a copy send us details and \$2 (not cash) for each issue you require, to ETI BACK-NUMBERS, Unit 6, 25 Overlea Blvd., Toronto, Ontario M4H 1B1.

1977

February
May
June
July
September
November
December

1978

January
February
March
April
May
June
July
August



Shutter Speed Timer

A project from the amateur photographer from ETI's project team to enable accurate checking of the mechanical bits!

THE NUCLEUS of good photography is correct exposure. This is a combination of shutter speed and lens aperture as determined by an exposure meter. If either speed or aperture is not as indicated on the camera the results will be less than perfect.

While the lens aperture is a simple mechanical operation and unlikely to be in error the same cannot be said about the shutter with its springs and things. *(Typical electronic engineer's attitude!—Ed.)* Not only may the speed not be exactly as indicated on the dial, it may (probably) change as the camera gets older. Therefore it is desirable that a simple method of determining the actual speed should be available.

This project describes the design and construction of a unit which is capable of measuring times from 1/10000 sec. to 10 sec. This allows the actual speed to be measured and then used to calculate the correct aperture when taking those important photos.

SPECIFICATIONS

Timing range	0.1 ms to 9.99sec.
Sensor	Photo transistor
Display	3 digit LED
Power supply	9 volt batteries 65 – 160mA LEDs on 20mA LEDs off
Battery life	≈6 hours – normal ≈20 hours – alkaline



It is suitable for checking cameras with a hinged or removable back so that the sensor can be placed in the film plane. For cameras where the film fits into a slot this unit cannot be used.

CONSTRUCTION

Commence construction with the PCB adding initially the nine links

required. Next add the resistors and capacitors in the appropriate locations as shown in the component overlay. Note that capacitor C5 is polarised and must be inserted the correct way round.

The transistors and the displays can now be soldered in place taking care with orientation of the transistors.

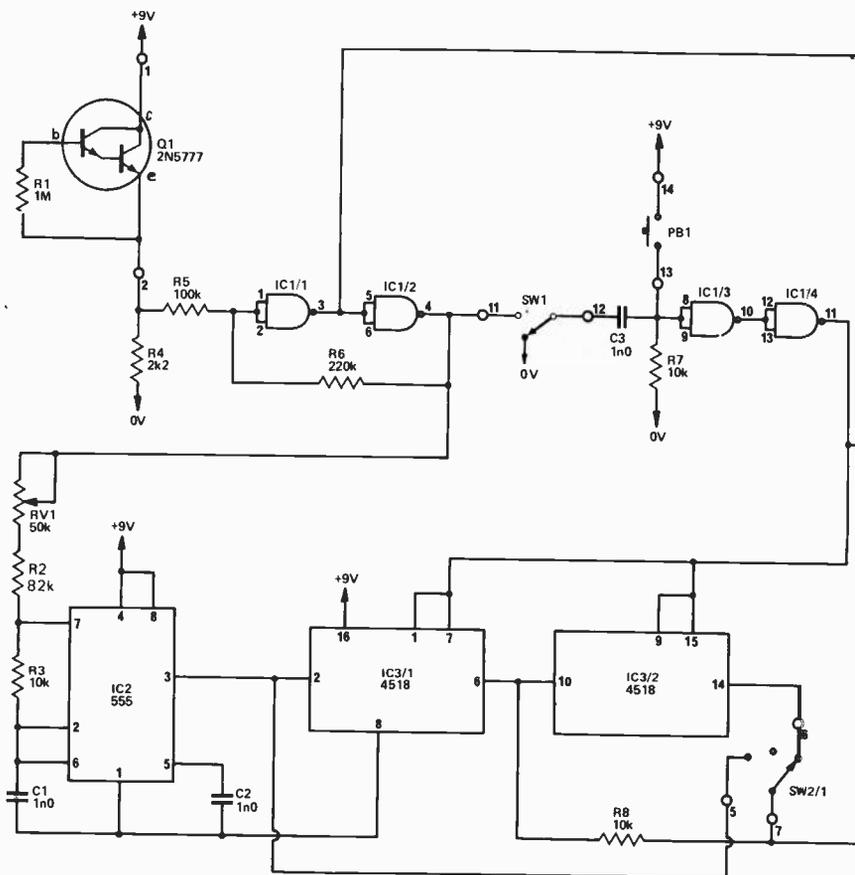
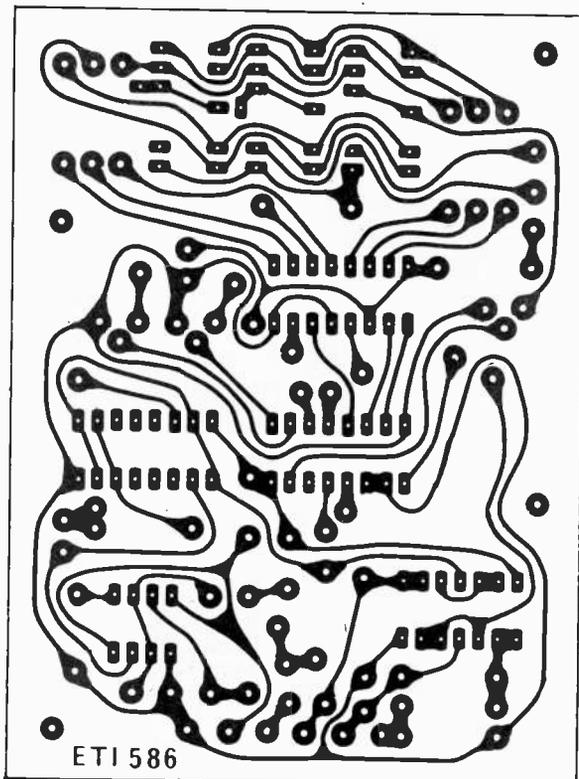


Fig. 1. Circuit diagram of the timer.

The ICs are the last components to be installed and these must be in the correct location and orientation. When soldering them in, solder the corner pins (the power supplies), pins 7 and 14 or 8 and 16 first as this allows the internal protection diodes to work while you solder the other pins.

The front panel can now be drilled and cut. A piece of polarised plastic helps as a display window. The switches, pushbutton and phone jack can now be fitted and connected to the PCB as shown in the component overlay. The only point which could cause problems here is that the phone jack connections sometimes vary, and you should check yours before connection.

The PCB can now be mounted onto the support bracket with 6 mm spacers and the bracket into the box with two screws. When positioned correctly, the display will be visible through the window and the battery holders will be held in position at the other end.

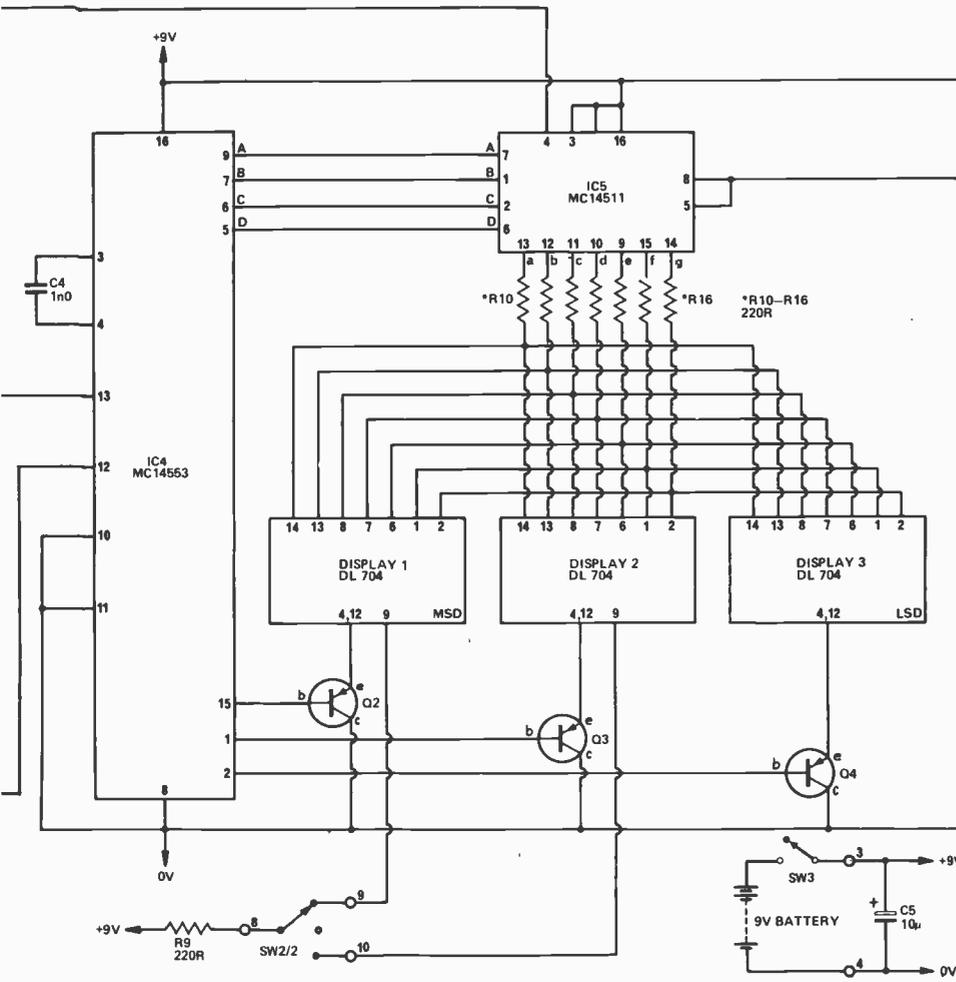
HOW IT WORKS

To measure the time the shutter is open we use a phototransistor, Q1, positioned in the film plane in the camera. When the shutter is operated and if the camera is focusing a bright light on to the transistor, the voltage across R4 will rise to about 7 V for the duration of the shutter being open. The transistor used is a Darlington type and is normally too slow for measuring times shorter than 1 ms. The addition of R1 increases the speed at the expense of sensitivity — hence the need for a bright light.

The output across R4 is squared up by the Schmitt trigger formed by IC1/1,2. The output of this controls the input to the 10 kHz oscillator IC2. This is an ordinary 555 oscillator where the frequency is set by C1, R2, R3 and RV1. The output of IC2 is divided by 10 in IC3/1 and again by 10 in IC3/2. We use the enable inputs of IC3 as they give clocking on the negative edges, which is what we need. We now have three outputs of 10 kHz, 1 kHz and 100 Hz. One of these outputs is selected by SW2/1 which is a centre off toggle switch. When it is in the off position, 1 kHz is selected via R8, while in the other positions the 1 kHz signal is swamped by the low output impedance of the other dividers.

Whichever frequency is selected clocks IC4 which is a 3 decade counter-latch-multiplexer. We are not using the latch in this application. This IC simply counts the number of pulses it receives and with the help of IC5 (7 segment decoder-driver) and Q2 — Q4 displays the result on the LED displays. During the counting period the display is blanked to prevent ripple on the supply rail upsetting the 555 timer. The ripple would occur as the current changes with different digits displayed. The decimal point is controlled by SW2/2.

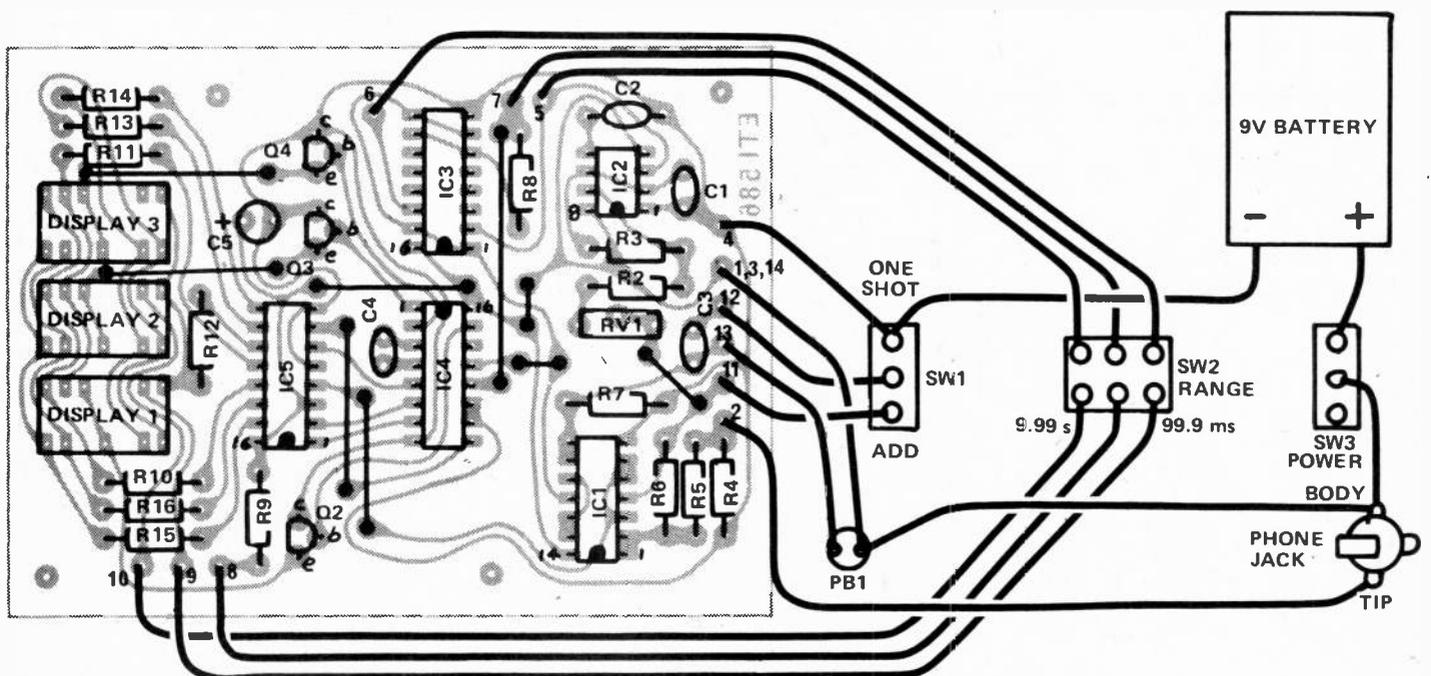
Two modes, single-shot and add, are provided. In the single-shot mode when light hits Q1 operating the Schmitt trigger the monostable formed by IC1/3 gives a pulse about 50 μs long which resets the main counter IC4 and the /10 dividers, IC3. Pins 1 and 9 on IC3 which have to be low to allow clocking are taken high during the reset pulse only because it made the PCB easier and does not affect the operation. In the 'add' mode the reset pulse does not occur and unless the reset button is pressed the second and successive counts will simply add on to the previous count. This allows say ten tests to be made and the total divided by ten to find the average.



PARTS LIST

RESISTORS all 1/2 W 5%	
R1	1M
R2	82k
R3	10k
R4	2k2
R5	100k
R6	220k
R7,8	10k
R9-R16	220R
POTENTIOMETER	
RV1	50k
CAPACITORS	
C1-C4	1n0 polyester
C5	10u 16 V electrolytic
SEMICONDUCTORS	
IC1	4011
IC2	555
IC3	4518
IC4	14553
IC5	4511
DISPLAY 1-3	DL704
Q1	2N5777
Q2-Q4	Photo-Darlington 2N3905
SWITCHES	
SW1,3	toggle switch SPDT
SW2	toggle switch DPDT centre off
MISCELLANEOUS	
PC8 ETI 586, plastic box, push button, phone jack and plug, battery holder, battery clip, support bracket, spacers, nuts, bolts, wire etc.	

Fig. 2. Component overlay and wiring diagram.



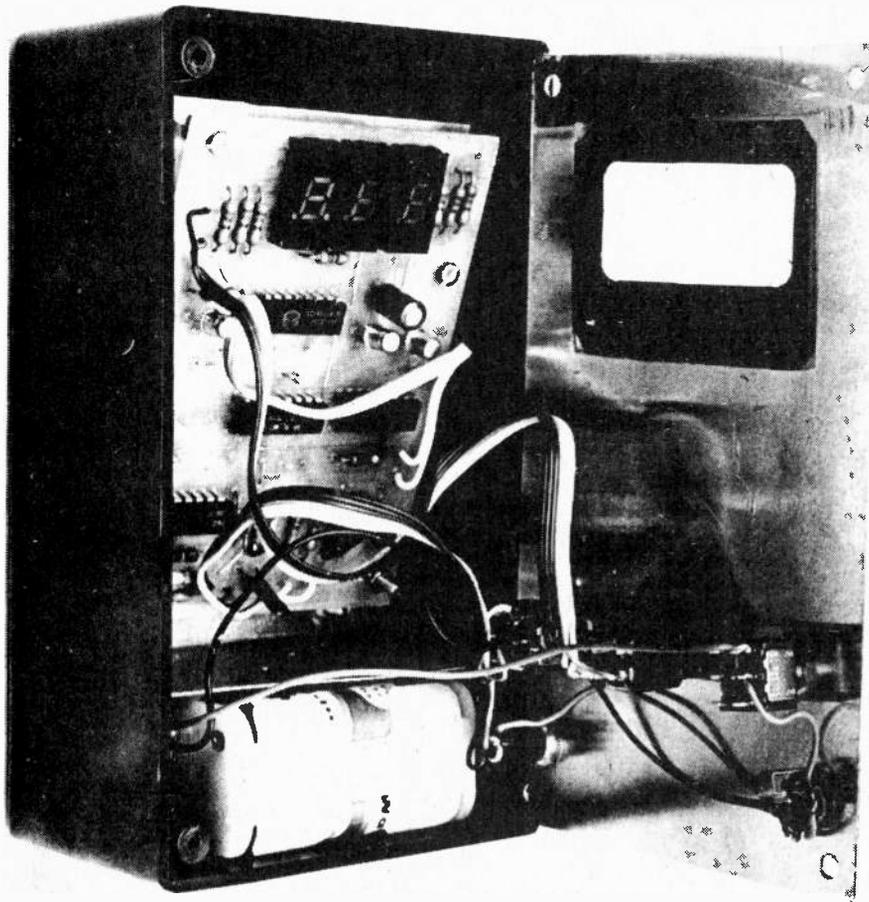
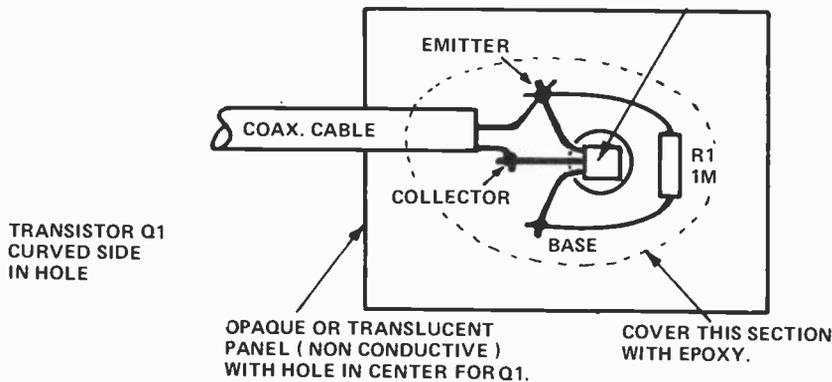


Fig. 3. Connection of the transistor on the sensor plate.



SENSORTIVE

The sensor plate which contains Q1 and R1 can now be made. We used a piece of PCB material, although any non-conductive material which is opaque or translucent may be used. Start by cutting the plate to size and drilling a 6 mm hole in the centre. The photo-transistor Q1 should be mounted with the curved surface (which is the active side) into the hole and R1 soldered to the leads, the whole assembly then being glued onto the plate with quick dry epoxy. Ensure that all conductive parts are covered with epoxy to prevent touching when in use.

CALIBRATION

The unit can be calibrated accurately enough with the aid of a stopwatch with a second hand. Set the camera up as detailed in the operational notes and using the single-shot mode, open the lens for five seconds. By adjusting RV1 get the reading close to 5s.

Now use a longer time, say 20 s, noting that the first digit will be missing. (i.e. a reading of 8.52 represents 18.52 s while 2.31 would be 22.31 s) and finally adjust RV1.

To aid setting up a push button can be substituted for the phototransistor but the 'add' position should be used and the timer manually reset as contact bounce can cause the display to reset on release of the button.

OPERATION

While the camera can be hand-held it is recommended that a tripod be used. Mount the camera on the tripod pointing at a light of 100 – 500 Watts about 2 – 3 feet away. Open the back of the camera and position the sensor plate so that the light is focused on the sensor. Initially, have the lens wide open; if enough light is hitting the sensor, the display will be blanked. Stop the lens down until the display comes on then go back one stop.

This sets the sensitivity and by selecting the appropriate range the shutter speed can be checked.

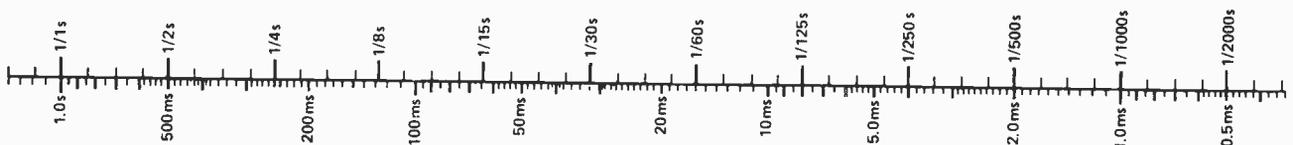


Fig. 4. Graph showing the relationship between time and shutter speed. Each of the small divisions on the right hand side corresponds with a $\frac{1}{4}$ stop.



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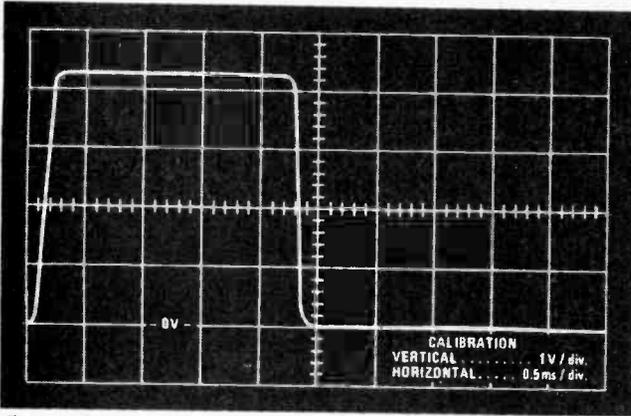


Fig. 5. Waveform on the input (point 2) with the camera on 1/500 sec. The actual time was 2.1ms.

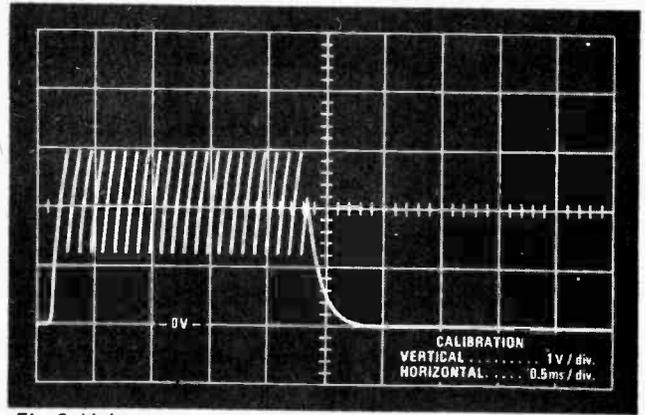


Fig. 6. Voltage across C1 during operation.

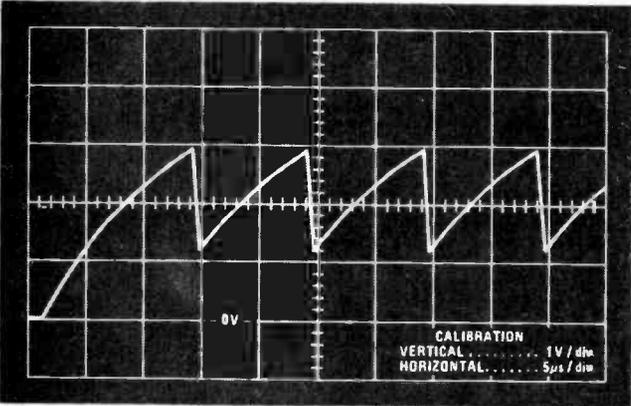


Fig. 7. Expanded view of the start of the above waveform.

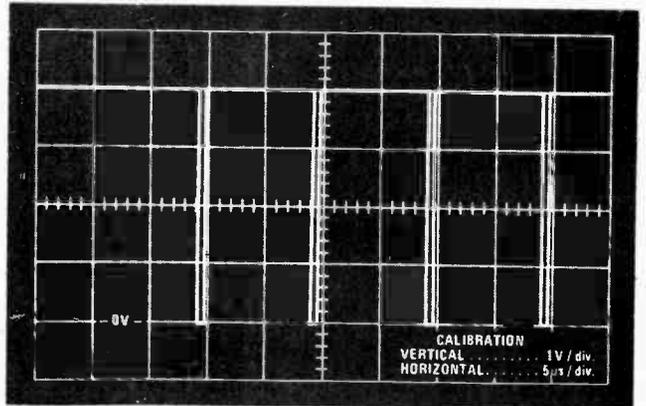


Fig. 8. The output of the 555 showing the first four pulses.

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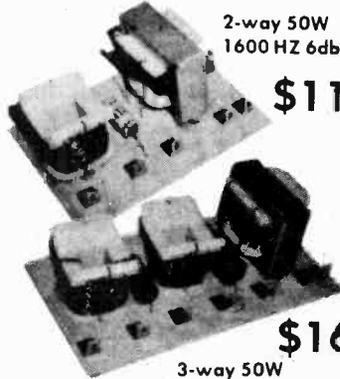
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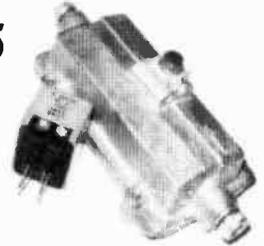


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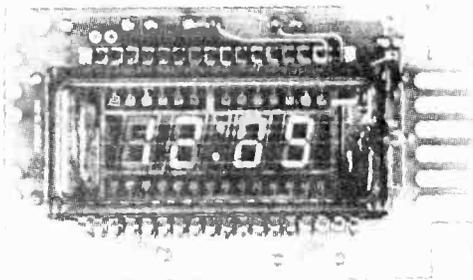
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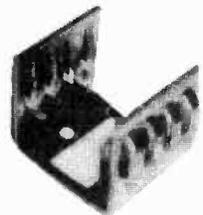
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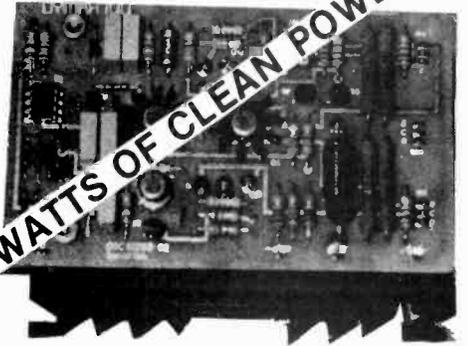


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*500ohm

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SPECIFICATIONS

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Frequency Response	+ 0db -1db 8Kz - 40KHz
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Total Harmonic Distortion	< 0.04% (100 W, 1Khz)
Intermodulation Distortion	< 0.03% (SMPTE at 100 W)
Hum and Noise	-85db (Power Input Shorted)
Damping Factor	> 240 at 1Khz, 8 ohms
Input Sensitivity	0db (0.775v) for Full Output
Input Impedance	47K
Power Requirements	+ / - 48 Volts at 1.7A
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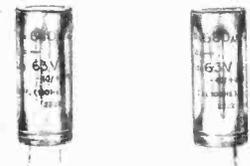
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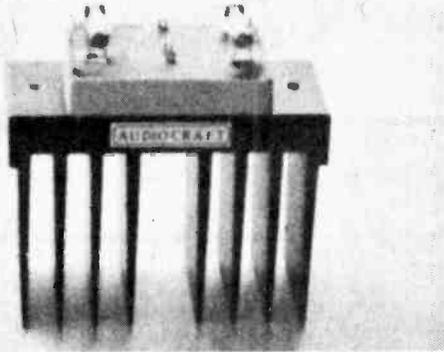


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 HARMONIC DISTORTION — .05% at 1 KHz at 65 watts
 IM DISTORTION — Less than .1%
 HUM AND NOISE — 90 db Below full output
 INPUT IMPEDANCE — 100K ohms
 SENSITIVITY — 500 mv for 65 watts
 MODULE DIMENSIONS — 110 mm x 115 mm x 50mm
 WEIGHT — .6 Kg (1.3 lbs.)
 POWER SUPPLY — \pm 35 V.D.C. at 2 amps

AC100

\$79⁰⁰

POWER OUTPUT — 100 watts RMS into 8 ohms
 FREQUENCY RESPONSE — 20 Hz - 20 KHz \pm 1db
 HARMONIC DISTORTION — .05% at 1 KHz at 100 watts
 IM DISTORTION — Less than .1%
 HUM AND NOISE — 90 db Below full output
 INPUT IMPEDANCE — 100K ohms
 SENSITIVITY — 500 mv for 100 watts
 MODULE DIMENSIONS — 110 mm x 115 mm x 50mm
 WEIGHT — .6 Kg (1.3 lbs.)
 POWER SUPPLY — \pm 45 V.D.C. at 2.5 amps

AC200

\$99⁵⁰

POWER OUTPUT — 200 watts RMS into 4 ohms
 FREQUENCY RESPONSE — 20 Hz - 20 KHz \pm 1db
 HARMONIC DISTORTION — .05% at 1 KHz at 200 watts
 IM DISTORTION — Less than .1%
 HUM AND NOISE — 90 db Below full output
 INPUT IMPEDANCE — 100K ohms
 SENSITIVITY — 500 mv for 200 watts
 MODULE DIMENSIONS — 110 mm x 115 mm x 100 mm
 WEIGHT — 1.15 Kg (2.5 lbs.)
 POWER SUPPLY — \pm 45 V.D.C. at 5 amps



AC1

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SPECIFICATIONS:

\$28⁵⁰

Input Sensitivity and Impedance

Mag. Phone	-	1mv, 50K ohms
Tuner	-	120mv, 50K ohms
Microphone	-	8mv, 50K ohms
Auxiliary	-	3-120mv, 50K ohms

Distortion

- .05% at 1 KHz

Frequency Response

- 20Hz to 20 KHz \pm 3db

Phono Overload

- 40db

Tone Controls

Bass	-	\pm 12db at 100Hz
Treble	-	\pm 12db at 10KHz

Output Voltage

- 1.2 volts

Tape Output Voltage

- 100mv

Signal to Noise Ratio

- 70db on phono input

Input Voltage

- \pm 16 to \pm 30 volts

Input Current

- 15MA

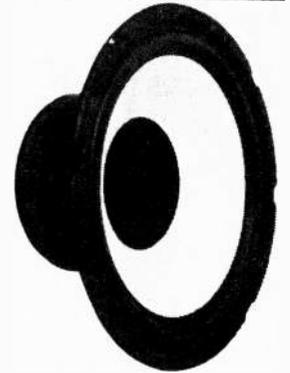
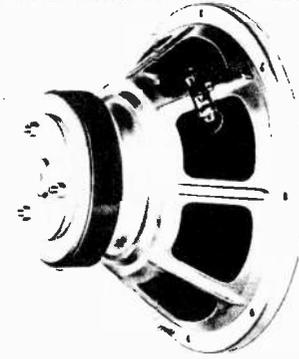
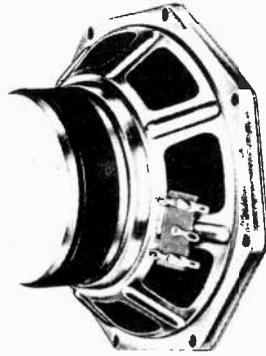
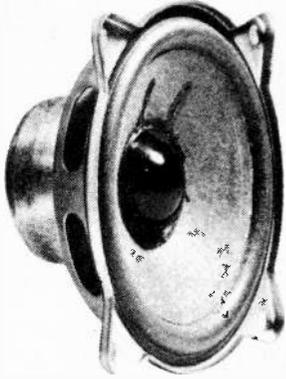
Controls Required:

Balance	-	5K ohms Linear
Bass	-	100K ohms Linear
Treble	-	100K ohms Linear
Volume	-	100K ohms logarithmic
Selector	-	4 position, Double pole



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5" WOOFER

Type Number	Impedance Availability (Ω)	Resonant Frequency (Hz)	Voice Dia. (mm)	Coil System Material Type	Magnet System Weight (oz/kg)	Magnet System Material Type	Max. PHC	Cone Rim	White Cone Avail.	Overall Weight (lbs/kg)	
AD5060/W	4/8	60	25	Copper	10/.25	FXD 300	10	Buytl Rubber	NA	1.5/.7	\$13.65

7" WOOFER

Type Number	Impedance Availability (Ω)	Resonant Frequency (Hz)	Voice Dia. (mm)	Coil System Material Type	Magnet System Weight (oz/kg)	Magnet System Material Type	Max. PHC	Cone Rim	White Cone Avail.	Overall Weight (lbs/kg)	
AD7066/W	4/8	45	25	Alum/Copper	16/.42	FXD 300	40	Buytl Rubber	NA	2.5/1.15	\$15.75

8" WOOFERS

Type Number	Impedance Availability (Ω)	Resonant Frequency (Hz)	Voice Dia. (mm)	Coil System Material Type	Magnet System Weight (oz/kg)	Magnet System Material Type	Max. PHC	Cone Rim	White Cone Avail.	Overall Weight (lbs/kg)	
AD081020/W	8	45	25	Copper	10/.25	FXD 300	20	Treated Fabric	Yes	2.0/.9	\$9.75

8" WOOFERS

Type Number	Impedance Availability (Ω)	Resonant Frequency (Hz)	Voice Dia. (mm)	Coil System Material Type	Magnet System Weight (oz/kg)	Magnet System Material Type	Max. PHC	Cone Rim	White Cone Avail.	Overall Weight (lbs/kg)	
AD8067/W	4/8	32	35	Alum.	16/.42	FXD 300	40	Buytl Rubber	NA	2.9/1.3	\$31.50

Type Number	Impedance Availability (Ω)	Resonant Frequency (Hz)	Voice Dia. (mm)	Coil System Material Type	Magnet System Weight (oz/kg)	Magnet System Material Type	Max. PHC	Cone Rim	White Cone Avail.	Overall Weight (lbs/kg)	
AD80100/W	8	30	37.9	Alum/Copper	20/.566	FXD 300	40	Foam	Yes	5/2.25	\$28.35

10" WOOFERS

Type Number	Impedance Availability (Ω)	Resonant Frequency (Hz)	Voice Dia. (mm)	Coil System Material Type	Magnet System Weight (oz/kg)	Magnet System Material Type	Max. PHC	Cone Rim	White Cone Avail.	Overall Weight (lbs/kg)	
AD10100/W	4/8	25	50	Copper	37/1.05	FXD 300	40	Buytl Rubber	NA	6.6/3.0	\$52.50

Type Number	Impedance Availability (Ω)	Resonant Frequency (Hz)	Voice Dia. (mm)	Coil System Material Type	Magnet System Weight (oz/kg)	Magnet System Material Type	Max. PHC	Cone Rim	White Cone Avail.	Overall Weight (lbs/kg)	
AD102050/W	8	25	35	Copper	20/.566	FXD 300	50	Foam	Yes	5/2.3	\$33.60

Type Number	Impedance Availability (Ω)	Resonant Frequency (Hz)	Voice Dia. (mm)	Coil System Material Type	Magnet System Weight (oz/kg)	Magnet System Material Type	Max. PHC	Cone Rim	White Cone Avail.	Overall Weight (lbs/kg)	
AD10240/W	8	25	50	Alum/Copper	40/1.13	FXD 300	70	Foam	Yes	7.9/3.6	\$52.50

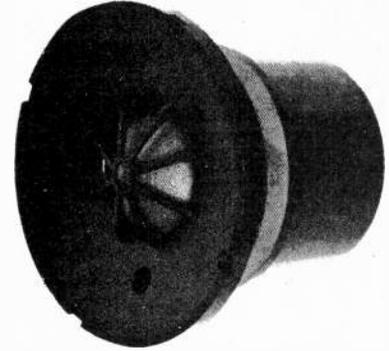
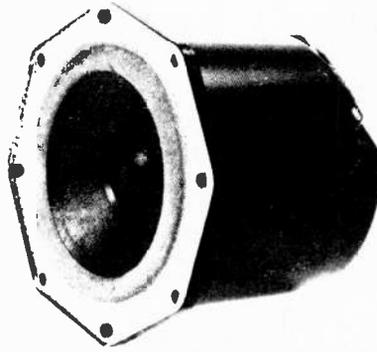
12" WOOFERS

Type Number	Impedance Availability (Ω)	Resonant Frequency (Hz)	Voice Dia. (mm)	Coil System Material Type	Magnet System Weight (oz/kg)	Magnet System Material Type	Max. PHC	Cone Rim	White Cone Avail.	Overall Weight (lbs/kg)	
AD12100/W	4/8	19	50	Copper	37/1.05	FXD 300	40	Buytl Rubber	NA	7.0/3.2	\$54.60

Type Number	Impedance Availability (Ω)	Resonant Frequency (Hz)	Voice Dia. (mm)	Coil System Material Type	Magnet System Weight (oz/kg)	Magnet System Material Type	Max. PHC	Cone Rim	White Cone Avail.	Overall Weight (lbs/kg)	
AD122050/W	8	19	35	Copper	20/.566	FXD 300	50	Foam	Yes	4.0/1.8	\$38.85

PHILIPS DeForest

QUALITY LOUDSPEAKERS



Type Number	Impedance Availability (Ω)	Resonant Frequency (Hz)	Voice Coil System Dia. (mm)	Material Type	Magnet System Weight (oz/kg)	Material Type	Max. PHC	Cone Rim	White Cone Avail.	Overall Weight (lbs/kg)	
AD12240/W	8	20	50	Alum/Copper	40/1.13	FXD 300	70	Foam	Yes	8/3.62	\$54.60

15" WOOFER

Type Number	Impedance Availability (Ω)	Resonant Frequency (Hz)	Voice Coil System Dia. (mm)	Material Type	Magnet System Weight (oz/kg)	Material Type	Max. PHC	Cone Rim	White Cone Avail.	Overall Weight (lbs/kg)	
AD15240/W	8	19	50	Alum/Copper	40/1.13	FXD 300	80	Foam	Yes	90/4.08	\$63.00

DOMe TWEETERS

Type Number	Impedance Availability (Ω)	Resonant Frequency (Hz)	Voice Coil System Dia. (mm)	Material Type	Magnet System Weight (oz/kg)	Material Type	Max. PHC	Dome Material	Overall Weight (lbs/kg)	
AD0140/T	4/8	1200	25	Alum/Copper	5/1	FXD 300	10W 20W* 40W†	Polycarbonate	.6/ .25	\$10.50

DOMe TWEETER

Type Number	Impedance Availability (Ω)	Resonant Frequency (Hz)	Voice Coil System Dia. (mm)	Material Type	Magnet System Weight (oz/kg)	Material Type	Max. PHC	Dome Material	Overall Weight (lbs/kg)	
AD0163/T	8/15	1000	25	Alum/Copper	10/ .25	FXD 300	10 20* 50†	Textile	1.1/ .5	\$15.50

DOMe MID RANGE

Type Number	Impedance Availability (Ω)	Resonant Frequency (Hz)	Voice Coil System Dia. (mm)	Material Type	Magnet System Weight (oz/kg)	Material Type	Max. PHC	Cone Rim	White Cone Avail.	Overall Weight (lbs/kg)	
AD0211SQ	4/8	370	35	Alum/Copper Vented Form	16/ .42	FXD 300	60W*	Textile Rim Textile Dome	NA	2 2/1 0	\$31.50

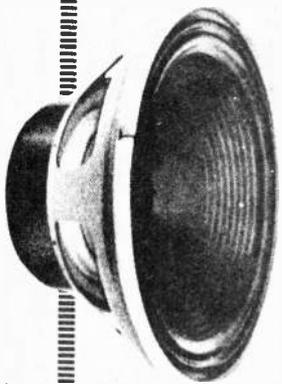
Type Number	Impedance Availability (Ω)	Resonant Frequency (Hz)	Voice Coil System Dia. (mm)	Material Type	Magnet System Weight (oz/kg)	Material Type	Max. PHC	Cone Rim	White Cone Avail.	Overall Weight (lbs/kg)	
AD5060/SQ	4/8	210Hz	25	Copper	10/ .25	FXD 300	40*	Textile	NA	1.8/ .8	\$17.35

CROSSOVER FILTERS

Type Number	Crossover Frequencies	Impedance (Ohms)	Slope/Octave			Overall Weight (lbs/kg)
			Lo	Med.	High	
TWO WAY						
AD2WXA also ADF2400/8	2400Hz	8	6dB		6dB	\$7.50
AD2WXB also ADF1600/8	1600Hz	8	6dB		12dB	\$9.75
THREE WAY						
AD3WXA also ADF500/4500/8	500/4500Hz	8 (also in 4)	6dB	6dB	12dB	\$18.00
AD3WXSP	700/3600Hz	8	12dB	12dB	12dB	\$45.00

Goodmans

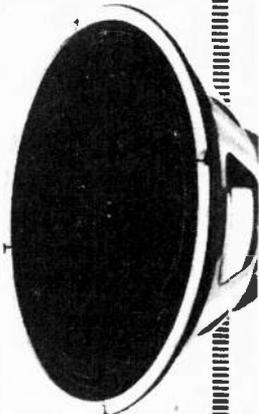
POWER RANGE LOUDSPEAKERS



Audiom 12P
12"
WOOFER
\$59.⁹⁵

Nominal impedance: 8 or 15 Ohms
Nominal power handling: 50 Watts
Fundamental resonance: 85 Herz
Sensitivity (96dB at 1m): 1.6 Watts
Recommended enclosure volume for single unit: 50 Litres
Depth, overall: 152 mm
Diameter, overall: 311 mm
Baffle hole diameter: 278 mm
Fixing hole diameter: 4 off 8 mm
Fixing hole centres: 298 mm (PCD)

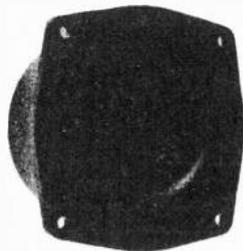
Nominal impedance: 8 or 15 Ohms
Nominal Power handling: 60 Watts
Fundamental resonance: 55 Herz
Sensitivity (96dB at 1m): 0.6 Watts
Recommended enclosure volume for single unit: 40 Litres
Depth, overall: 142 mm
Diameter, overall: 311 mm
Baffle hole diameter: 278 mm
Fixing hole diameter: 4 off 8 mm
Fixing hole centres: 298 mm (PCD)



Audiom 12P-D
12"
WOOFER
\$69.⁹⁵

DOM TWEETER

\$29.95



Axent 100

Frequency range: typically 2,000–22,000 Hz ±2dB
Maximum RMS input: 3 Watts
Recommended amplifier music power: for use in systems rated not inore than 40 Watts
Impedance: 8 ohms
Maximum dimensions across corners: 112mm
Baffle hole diameter: 70mm rear mounted

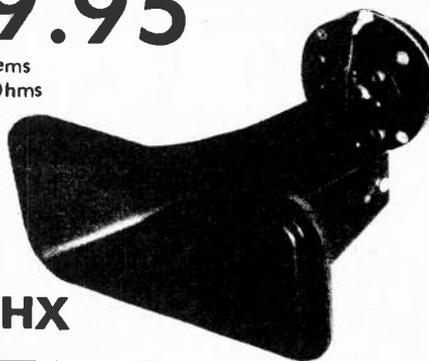
FOR COMPLETE CATALOGUE AND PRICE SHEET ON THE FULL RANGE OF GOODMAN SPEAKERS PLEASE MAKE NOTE ON THE ORDER FORM

HORN MID RANGE

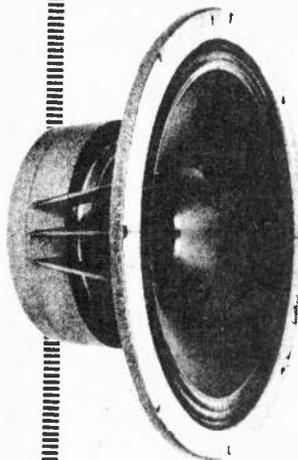
\$79.95

Impedance: For use with systems rated at 8 or 15 Ohms
Nominal power handling: systems rated at 50 Watts
Sensitivity: (96 dB at 1m) 0.11 Watts
Depth Overall: 250mm
Baffle hole: 163 x 81mm
Fixing hole diam: 6 off 5mm

Hifax 50HX



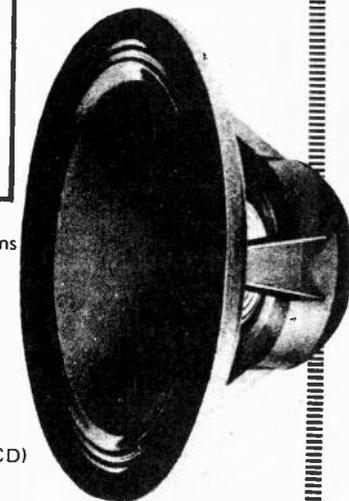
18"
WOOFER
\$149.⁹⁵



Audiom 15P

Nominal impedance: 8 or 15 Ohms
Nominal power handling: 50 Watts
Fundamental resonance: 56 Herz
Sensitivity (96dB at 1m): 0.9 Watts
Recommended enclosure volume for single unit: 80 Litres
Depth, overall: 163mm
Diameter, overall: 383mm
Baffle hole diameter: 330mm
Fixing hole diameter: 8 off 7mm
Fixing hole centres: 370mm (PCD)

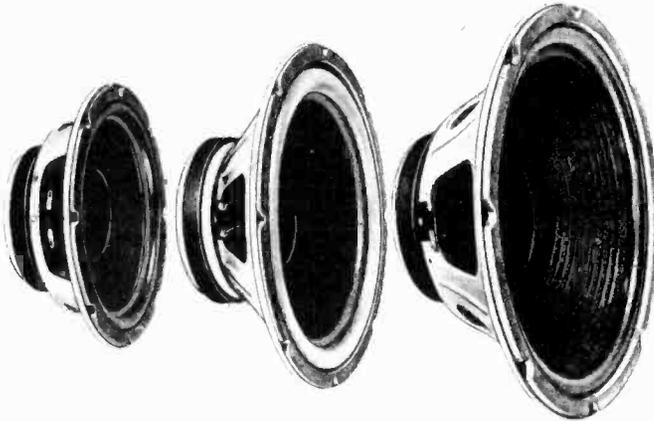
Nominal impedance: 8 or 15 Ohms
Nominal power handling: 100 Watts
Fundamental resonance: 45 Herz
Sensitivity (96dB at 1m): 0.6 Watts
Recommended enclosure volume for single unit: 120 Litres
Depth, overall: 222 mm
Diameter, overall: 459 mm
Baffle hole diameter: 413 mm
Fixing hole diameter: 8 off 8 mm
Fixing hole centres: 438 mm (PCD)



Audiom 18P

ULTRAFLEX LOUDSPEAKERS

**RSC
AUDIO**



hi-compliance woofers

These driver units by RSC have been designed for use in sealed enclosures in order to achieve optimum response and power handling. To take full advantage of the five years of research designing these speakers, you are advised **not** to mix these components with any others. Specifications should not be changed. Your cabinet must have no air leaks . . . caulk all seams and speaker frames. Speakers are to be mounted from the front and flush with the face of the baffle. The grille cloth should be an open weave material that you can breathe through easily . . . make sure the grille clears the speakers by at least $\frac{3}{8}$ ". Follow these specifications . . . and you'll have speakers offering you acoustical excellence.

800W8

1000W8

1200W8

NUMBER	TYPE	SIZE	RMS POWER	RES.	PRICE
800W8	WOOFER	8"	35W	55Hz	25.95
1000W8	WOOFER	10"	40W	47Hz	39.95
1200W8	WOOFER	12"	45W	42Hz	42.95

MID RANGE



400 - 7000 Hz
40 Watts

\$11⁹⁵

5"

DOM TWEETER

3000 - 20000 Hz
40 Watts



4"

\$8⁹⁵



FULL RANGE

These driver units by RSC have been designed for use in reflex enclosures for optimum response and power handling. Specifications should not be changed. Your cabinet must have no air leaks other than the vent . . . caulk all seams and speaker frames. Speakers are to be mounted from the front and flush with the face of the baffle. The grille cloth should be an open weave material that you can breathe through easily . . . make sure the grille clears the speaker by at least $\frac{3}{8}$ ". We suggest you line the cabinet with two inches of damping material making sure the front and vent are clear. Follow these specifications . . . and you'll have speakers delivering you acoustical excellence.

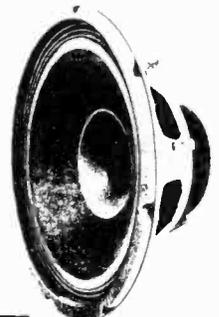


8"
\$15⁹⁵

20
WATTS
RMS

8
OHM

12"
\$24⁹⁵



DRE DC8

DRE DC12



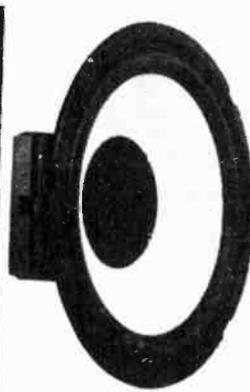
Marsland Speakers



VHP
VERY HIGH POWER

VHP — 1200
\$79⁹⁵

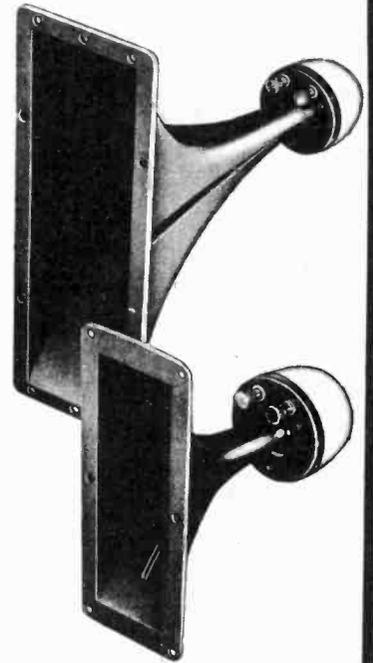
18 Hz — 4 KHz
100 Watts RMS



15" WOOFER

59⁹⁵

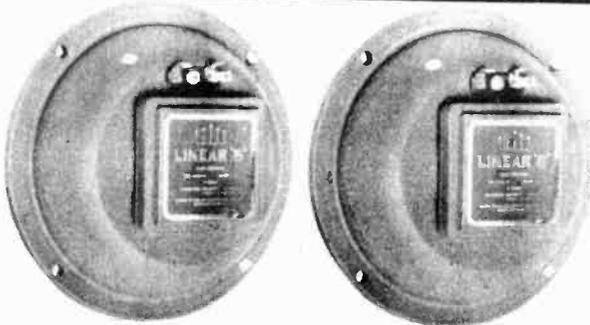
15 Hz — 4 KHz
100 Watts RMS



HORN TWEETERS

2" x 6"
\$24⁹⁵
3 — 20 KHz
25 Watts RMS

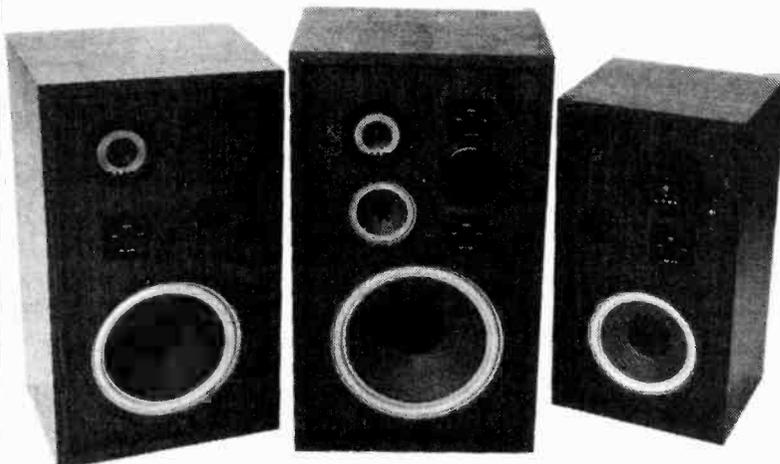
4" x 10"
29⁹⁵
1 — 20 KHz
25 Watts RMS



Linear 'B' MID DRIVER

\$19⁹⁵
600 Hz — 8 KHz
60 Watts RMS

6"



SPECIFICATIONS

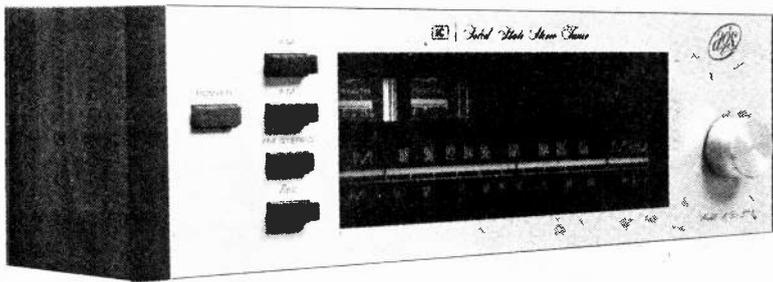
Speaker Complement	LTC 8 MK IV	LTC 10 MK IV	LTC 12 MK IV
	<ul style="list-style-type: none"> • One 8" Hi-Compliance Bass Driver • One 1 1/2" Phenolic Ring Flare Dome Hi-Driver 	<ul style="list-style-type: none"> • One 10" Hi-Compliance Bass Driver • One 1 1/2" Phenolic Ring Flare Dome Hi-Driver 	<ul style="list-style-type: none"> • One 12" Hi-Compliance Bass Driver • One 5" Hi-Compliance Closed back Mid-Driver • One 1 1/2" Phenolic Ring Flare Dome Hi-Driver
Cross-Over Type	LC 2-way 2500 Hz	LC 2-way 2500 Hz	LC 3-way 1000 and 5000 Hz
Frequency Response	35 — 22,000 Hz	30 — 22,000 Hz	25 — 22,000 Hz
Resonance	65 Hz	50 Hz	50 Hz
Power Handling	Watts Rms 35 Watts Music 50	50 70	75 100
Efficiency — Power required to produce 90 DB SPL @ 6 feet	2.5 Watts	2.5 Watts	2.5 Watts
Impedance	8 Ohms	8 Ohms	8 Ohms
Dimensions and Weight	21" - 11 1/2" x 9 1/2" 21 lbs	24" - 13 3/4" x 11 1/2" 30 lbs	26 1/2" x 15 1/2" x 12 37 lbs

\$99⁹⁵ \$129⁹⁵ \$188¹⁰

LTC enclosures are warranted for five years against manufacturing defects.

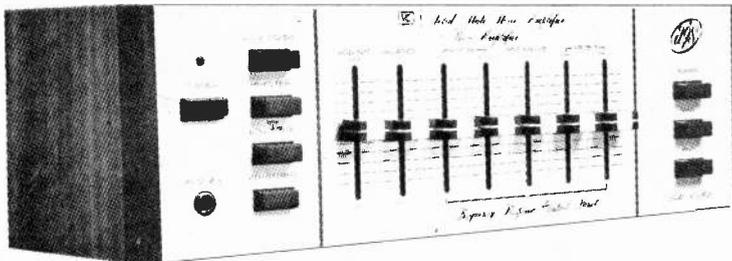
STEREO

SPECIALS



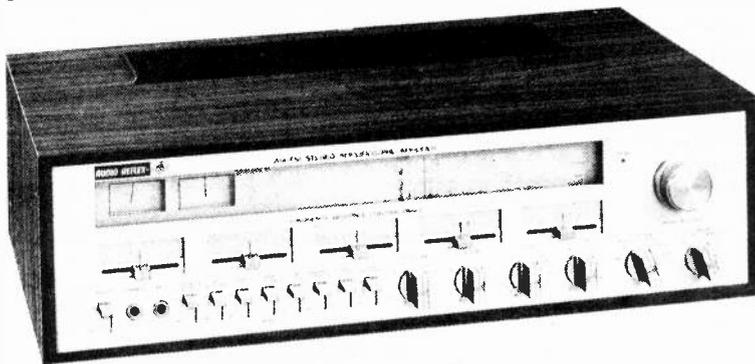
**STEREO TUNER
FEATURING LOW
DISTORTION AND
HIGH SENSITIVITY**

\$ 79.95



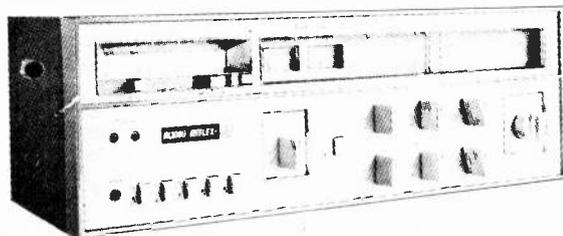
**STEREO AMPLIFIER
WITH FREQUENCY
CONTROL PANEL**

\$ 99.95



**50 WATTS x 2 RMS
SOLID STATE
FM-AM RECEIVER**

\$ 269.95



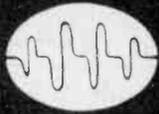
**STEREO AM-FM RECEIVER
WITH RECORD-PLAYBACK
CASSETTE**

\$ 239.95

DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES



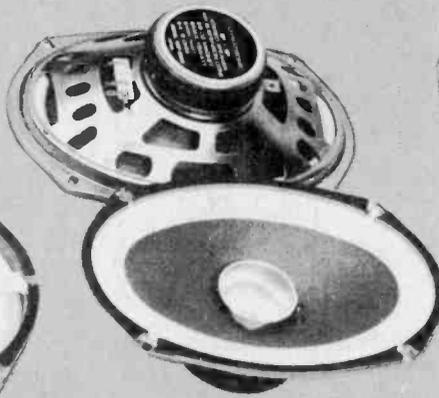


DYNATRONIC®

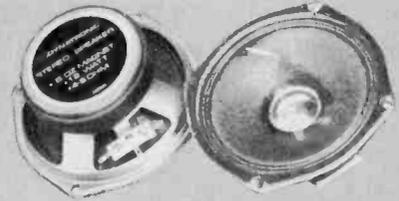
Replacement Speakers



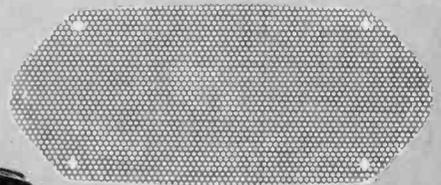
BS 6912CX
BS 6920CX
BS 6930CX



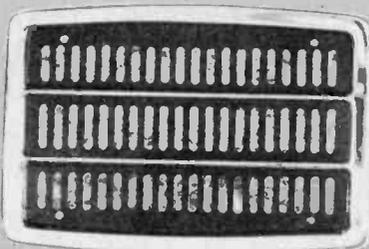
NRS 6903A
NRS 6908



BS 503
BS 506
BS 506
BS 512



SG 410
metal \$1.29



SG 69S
metal \$2.79

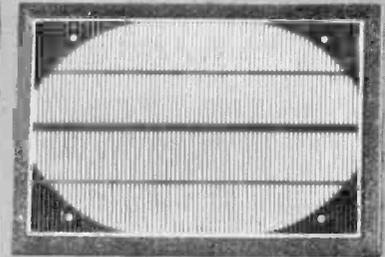
NEW

\$39.95



NEW

6" x 9" THREE WAY SUPER DELUXE speaker (woofer, midrange, tweeter) with 20 oz. ceramic magnet. Floating AIR SUSPENSION multi-colour cone with urethane foam rolled edge. Separate 3" midrange and 2" tweeter. Available in bulk pack and in multi-colour display package kit with super deluxe grille, wire and mounting hardware. Display package kit Model No. RSP-69TRX



SG 69P
plastic \$2.29

MODEL NO. MODÈLE NO.	DESCRIPTION	SPEAKER HAUT-PARLEURS	CERAMIC MAGNET AIMANT EN CÉRAMIQUE	SORTIE MAXIMUM OUTPUT (WATTS)	IMP. (OHMS)	PRICE
BS-503		5" with dustcover / avec couvercle	3 oz	5	8	\$ 3.95
BS 506	Pin Cushion / Épingle de coussin Replacement / Remplacement	5"	6 oz	10	4-8	\$ 5.95
		5"			4-8	
BS-512		5" AIR SUSPENSION / SUSPENSION ACCOUSTIQUE	12 oz	15	4-8	\$ 9.95
NRS-6903A	Standard replacement / Remplacement	6" x 9"	3 oz	8	8	\$ 5.95
NRS-6908	Replacement / Remplacement	6" x 9" AIR SUSPENSION SUSPENSION ACCOUSTIQUE	8 oz	15	4-8	\$10.95
BS-6912CX	Deluxe	6" x 9" CO-AXIAL AIR SUSPENSION SUSPENSION ACCOUSTIQUE 2 way / deux manières (6" x 9" woofer & 3" tweeter)	12 oz CO-AXIAL	25	4-8	\$15.95
BS-6920CX	Super Deluxe		20 oz CO-AXIAL	35	4-8	\$18.95
BS-6930CX	Grande Deluxe		30 oz CO-AXIAL	50	4-8	\$24.95



DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES



AUTOMOTIVE SOUND

FEATURING RELIABLE 100% SOLID STATE **VERSATILE SHORT DEPTH CHASSIS**

Front panel plate kit included with all models



\$39.95

MK4 JIL AM PUSHBUTTON CAR RADIO

Universal In-dash or Under-dash mounting.
12V DC Negative ground 4.5W Output.
5 Station Pre-set pushbuttons.
On/Off Volume, Widerange Tone & Manual Tuning Controls.

Speakers Extra

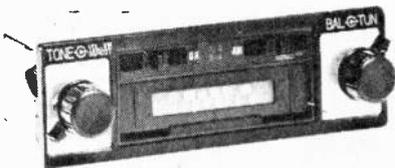


\$55.95

MK55 JIL CAR STEREO 8-TRACK PLAYER WITH AM RADIO

In-dash mounting. 12V DC Negative ground.
4W + 4W Output.
Right Volume, On/Off-Left Volume, Tone, Tuning & Program Select controls.

Speakers Extra



\$89.95

MK95 JIL CAR STEREO 8-TRACK PLAYER WITH AM/FM-MPX RADIO

In-dash mounting with 5 position adjustable shaft.
12V DC Negative ground.
4.5 + 4.5W Output.
Controls: On/Off-Volume-Channel Select, Widerange Tone, Local-Distant switch, AM-FM select switch, Tuning, Balance.
FM Stereo light, Program indicator lights.

Speakers Extra

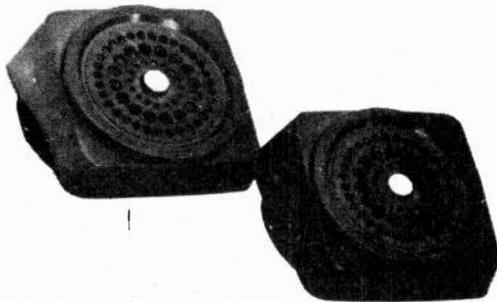


\$99.95

MK63 JIL CAR STEREO CASSETTE PLAYER WITH AM/FM-MPX RADIO

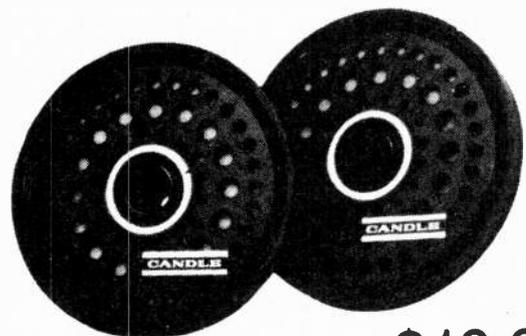
In-dash mounting with 6 position adjustable shaft.
12V DC Negative ground.
5W + 5W Output.
Widerange Tone & Volume controls. Tuning & Balance FF/Eject/Rew Button

Speakers Extra



\$8.95 PR.

CRV3 — Deck Mount. 5W.5". 2 oz. magnet. 4-8 ohms.



\$19.95 PR.

CR737 — Flush Mount. 5 1/2". 8 oz. magnet. 10 Watts. 4-8 ohms.

VISTA DC POWER SUPPLIES



CSA approved
Homologation ACNOR

VISTA IV

\$29⁹⁵

- * SUPPLIES 2 AMPS @ 12 VDC - 4 AMP SURGE
- * AUTOMATIC CIRCUIT BREAKER
- * CSA APPROVED

Converts home 115 VAC to 12 VDC. Now you can enjoy car tape players in you home by using this, our most popular power supply. The unit is overload protected, includes automatic circuit breaker, neon indicator light, on/off switch. Size: 3 1/4" H x 5" W x 5" D. CSA approved.

- * 3 AMP REGULATED POWER SUPPLY
- * FULL POWER OUTPUT FOR CB
- * SOLID STATE OVERLOAD PROTECTION

VISTA CB-III R

\$44⁹⁵



CSA approved
Homologation ACNOR

Integrated circuit regulated.
Converts 115 VAC to 13.8 VDC ±.5 volts.
This power supply is regulated and will deliver maximum power from your CB rig, with a surge of 5 amps. Also can be used to trickle-charge 12 volt batteries.
Special features: Neon indicator light, on/off switch, circuit breakers. Canadian made, CSA approved.
Size: 3 1/4" H x 5" W x 5" D.

FULL CB POWER!



CSA approved
Homologation ACNOR

VISTA CB-IVR

\$79⁹⁵

- * 4 AMP REGULATED POWER SUPPLY - 6 AMP SURGE
- * SOLID STATE DUAL OVERLOAD PROTECTION
- * CROWBAR OVERVOLTAGE PROTECTED

Converts 115 VAC to 13.8 VDC ±.5 volts.
A heavy duty power supply for use with all types of transistor equipment requiring 4 amps or less. Will operate radios, intercoms, recorders, car stereo tape players, CB transceivers, etc. Features neon indicator light, on/off switch. Size: 4" H x 6 1/2" W x 8" D. CSA approved.

FULL CB POWER!

- * 10 AMP REGULATED POWER SUPPLY - 12 AMP CPR*
- * DUAL OVERLOAD PROTECTED
- * CROWBAR OVERVOLTAGE PROTECTED

VISTA X-R

\$119⁹⁵



Converts 115 VAC to 13.8 VDC +.5V.
A heavy duty regulated power supply designed for use with Ham, CB and marine mobile radio stations. Also for linear amplifiers up to 200 watts P.E.P. Size: 4 1/4" H x 6 1/2" W x 8" D.

* CPR: Continuous Periodic Rating -
Duty Cycle 3 min. on, 1 min. off.



ZENON STROBE

\$39⁹⁵

The longest lasting, most dependable strobe ever developed.

We unconditionally guarantee everything including flash-tube for 6 months. (And we're the only ones to do so!).

No-drift feature controls flash-rate up to 10 flashes per second.

5" Indoor-Outdoor Paging Speaker

\$11⁹⁵

- Frequency Response: 400-7,000 Hz
Power Rating: 5 Watts
Air Column Length: 3 1/4"
Bell Diameter: 5"
Horn Length: 5 3/8"
Driver: Permanent Magnet
Weight: 1 lb.
-8-Ohm



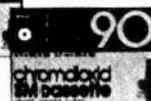
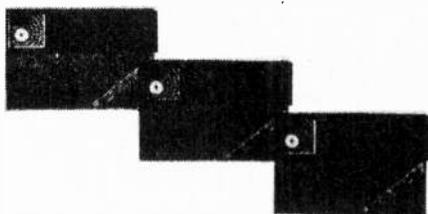
DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES



TRY THE RED ONES

Jamproof
Special
Mechanics



FERROCHROM MULTI-LAYER CASSETTE — HIGHEST QUALITY CASSETTE

DESCRIPTION	TYPE	RECORDING TIME	STANDARD CARTON	SUGGESTED LIST PRICE	OUR PRICE	SAVE
Fe/CrO ₂ SP SM	C 60	30 minutes each side/chaque côté	12	\$5.99	5.39	10%
Fe/CrO ₂ SP SM	C 90	45 minutes each side/chaque côté	12	7.49	5.07	

CrO₂ — CHROMDIOXID FORMULATION — FOR THE DISCRIMINATING AUDIOPHILE

DESCRIPTION	TYPE	RECORDING TIME	STANDARD CARTON	SUGGESTED LIST PRICE	OUR PRICE	SAVE
CrO ₂ SP SM	C 60	30 minutes each side/chaque côté	12	\$5.49	4.95	10%
CrO ₂ SP SM	C 90	45 minutes each side/chaque côté	12	6.49	5.84	
CrO ₂ SP SM	C 120	60 minutes each side/chaque côté	12	7.49	6.75	

LH super — LOW NOISE/HIGH OUTPUT — SUPER EFFECT CASSETTE WITH SPECIAL 'MAGHEMITE' OXIDE FORMULATION

DESCRIPTION	TYPE	RECORDING TIME	STANDARD CARTON	SUGGESTED LIST PRICE	OUR PRICE	SAVE
LHS SP SM	C 60	30 minutes each side/chaque côté	12	\$4.49	3.95	12%
LHS SP SM	C 90	45 minutes each side/chaque côté	12	5.49	4.84	
LHS SP SM	C 120	60 minutes each side/chaque côté	12	6.49	5.70	

LH CASSETTES LOW NOISE/HIGH OUTPUT

DESCRIPTION	TYPE	RECORDING TIME	STANDARD CARTON	SUGGESTED LIST PRICE	OUR PRICE	SAVE
LH SP SM	C 60	30 minutes each side/chaque côté	12	\$5.47	2.44	30%
LH SP SM	C 90	45 minutes each side/chaque côté	12	4.49	3.15	
LH SP SM	C 120	60 minutes each side/chaque côté	12	5.49	3.84	

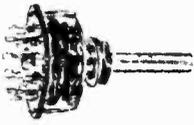


BASF REEL-TO-REEL TAPES — POLYESTER BACKED



LP 35 LH SUPER — HIGH DENSITY OXIDE — "MAGHEMITE" — 1.0 MIL			OUR PRICE	SAVE
5" 900'	20	8.97	6.72	25%
7" 1800'	20	14.99	11.24	
5" 1200'	20	11.99	8.99	
7" 2400'	20	18.49	13.88	

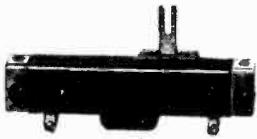
HOME & TV ACCESSORIES



Useful for many audio, stereo and hi-fi applications. Spring loaded, shorting type. positive detent action. 1-1/4" diameter with 1-1/4" shaft length, plated lugs.

- 5201. 11 position, single pole.
- 5202. 12 position, single pole.
- 5203. 5 position, 2-pole.
- 5204. 6 position, 2-pole.
- 5205. 3 position, 3-pole.
- 5206. 4 position, 3-pole.
- 5207. 2 position, 4-pole.
- 5208. 3 position, 4-pole.
- 5209. 2 position, 6-pole.

\$ 169



79¢

TS302. Ruggedly designed slide controls for a wide variety of general replacement and OEM applications. Solder lugs on all terminals, threaded end flanges for panel mounting. Available in 10K, 50K, 100K ohms — please specify when ordering. 2-1/4" L x 7/16" D x 5/16" W.



Custom replacement knobs for above controls and other standard types.

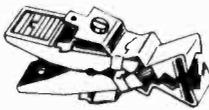
- GP10. BLACK, with marker.
- GP16. Silver/chrome finish, r.

49¢
59¢



\$159

N-9065. CATV MATCHING TRANSFORMER. Now you can match the impedance of any CATV co-axial line to the impedance of your TV or FM receiver. Converts 75 ohms CATV output to 300 ohms FM/TV input. Hardware and F-59 connector included.
N-9066. Same as above but with slim-line 1/2" casing.



25¢

N-1015. TV ANTENNA CLIP. Strong plated springs with screw terminals and coloured plastic handles. Quick way to connect or disconnect antenna lead-in wires to TV set, FM radio etc.



Q4807

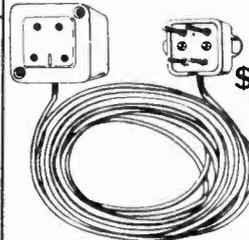
CATV/MATV HARDWARE



\$3.95

N-9067. 75 OHM SPLITTER. Splits incoming 75 ohm line to dual 75 ohm outputs, for use with TV-FM combination, etc. Standard F-61 connectors, all-metal casing.

N-9068. As above, 3 outputs. **4.95**
N-9069. As above, 4 outputs. **5.95**



\$4.95

N-4939. Plugs into standard telephone equipment, or for use with jacks and plugs shown below. White vinyl covered cable is 30 feet long with four colour coded conductors.

\$ 1.98



25¢

N-F59.

N-F59. MALE CONNECTOR. For use with RG-59/U cable. Fits F-61, F-61A, F-81 and F-81B Connectors. Ferrule supplied.

49¢



N-F61A.

N-F61A. FEMALE CONNECTOR. Fits F-59, F-59A and F-56 connectors. Complete with nut and washer.



69¢

N-F81.

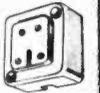
N-F81. FEMALE ADAPTOR. Mates with F-59, F-59A and F-56 connectors.



89¢

N-4936. Fits all single and 2-line phones. Easy to attach without soldering.

89¢

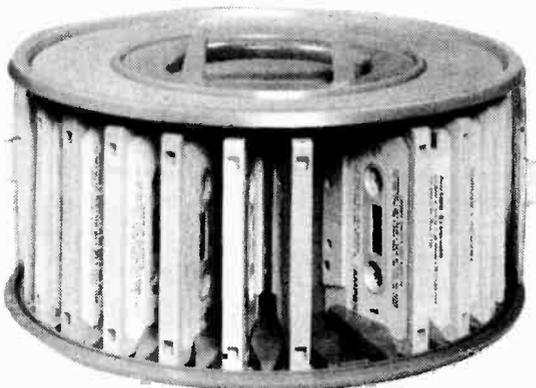


N-4937. Mounts to wall with 2 wood-screws, included. Screw-type terminals.

Q4807. TELEPHONE PICKUP. Suction cup attaches to phone handle behind earpiece and picks up both sides of telephone conversation. Miniature phone plug connects to amplifier or tape recorder.

TAPE STORAGE UNITS

CASSETTE CAROUSEL



CAROUSEL

\$ 9.95

WITH 6 X C-60 Tapes

13.95

WITH 25 X C-60 Tapes

29.95

CARRYING CASE



CASSETTE

\$5.95

WITH 4 X C-60 TAPES

7.95

8-TRACK

5.50

WITH 2 X 90 MIN TAPES

7.50

DOMINION RADIO & ELECTRONICS COMPANY

A MONO 8 OHM L PAD

\$2⁹⁵ ea.

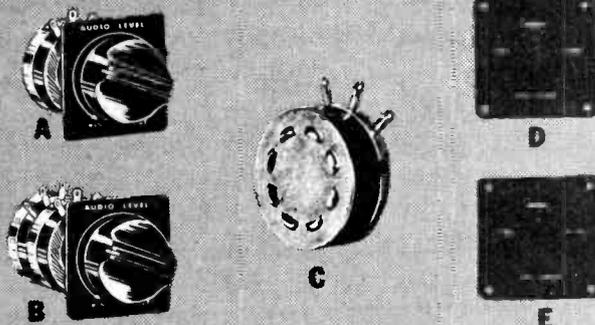
10 WATTS

B STEREO 8 OHM L PAD

\$3⁹⁵ ea.

10 WATTS

8 OHM AUDIO PADS



C HEAVY DUTY MONO 8 OHM L PAD **\$7⁹⁵** ea.
100 WATTS

D TWEETER CONTROL

\$4⁹⁵ ea.

20 WATTS

E MID RANGE CONTROL

\$4⁹⁵ ea.

20 WATTS

SWITCHES
Miniature

Cat. No.	Type	PRICE
DJ-4030	SPST	\$1 ²⁹
DJ-4031	SPDT	\$1 ⁴⁹
DJ-4034	DPDT	\$1 ⁶⁹
DJ-4032	SPDT Center Off	\$1 ⁸⁹
DJ-4033	DPDT Center Off	\$2 ⁰⁹



SLIDER CONTROLS



Available in
10 K ohms
50 K ohms
100 K ohms
log or linear taper
Matching Knob

60mm Travel

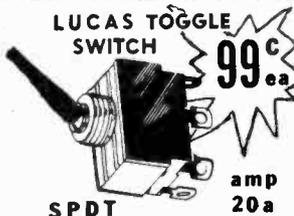
\$2⁹⁵ ea.

79^c ea

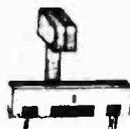
PANEL LIGHTS

120V PANEL LAMP
JJ-10027R — Red
JJ-10027A — Amber
Built in resistor for 120VAC
Head diameter 1/2"

\$1¹⁹



LUCAS TOGGLE SWITCH
99^c ea.
amp 20a
SPDT



jana
CONTROLS



\$1⁴⁹ EA
PANEL LAMP FOR BAYONET BASE LAMPS
JJ-10018 — Red Dome
JJ-10019 — Green Dome
JJ-10020 — Amber Dome

TOGGLE SWITCH 99^c S.P.S.T.



\$1²⁹ D. P. D. T.
\$1⁵⁹ D. P. D. T. CENTER OFF

MODEL	TRAVEL	
JJ-10006 - 10K	30mm	\$1⁴⁹ EA
JJ-10006B - 100K	30mm	
JJ-10006C - 500K	30mm	
JJ-10006D - 1 MEG	30mm	

PUSH SWITCH



S. P. S. T. **\$1²⁹**
S. P. D. T. **\$1⁴⁹**
D. P. D. T. **\$1⁶⁹**

JJ-10007	10K	45mm	\$1⁸⁹ EA
JJ-10007A	50K	45mm	
JJ-10007B	100K	45mm	
JJ-10007C	500K	45mm	
JJ-10007D	1 MEG	45mm	

Available in log taper only
Knob included

MINIATURE DELAY RELAY

\$1⁹⁸



6 VOLT
60 SECONDS

DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES



	1. AUTOMATIC HEADLIGHT REMINDER Novel circuit to remind you to turn your headlights off if they are left on when the ignition is off.	\$ 4.25	
	2. BATTERY OPERATED FLORESCENT LIGHT KIT Useful circuit that can be built into small (20 W max) fluorescent fixture in mobile vans & campers for 12 VDC	\$14.25	 
	3. BUG SHOO Produces a sound to keep annoying bugs away.	\$ 5.25	LAMP
PHONO PICKUP	4. CODE OSCILLATOR Practice up your "Morse Code" with this simple project.	\$ 5.55	
	5. CRYSTAL RADIO Crystal radio receiver picks up local AM radio stations.	\$ 4.95	RELAY
LOUD SPEAKER	7. CURIOSITY BOX II Great for parties — a novelty electronic item.	\$ 7.25	
	8. DALLY LIGHTER Time delay circuit for turning a light circuit off after a predetermined length of time.	\$ 5.75	
HEADPHONE	9. DECISION MAKER Novelty item — great for the junior electronic enthusiast.	\$ 4.25	A—Ammeter V—Voltmeter METER
	10. FISH CALLER A real fisherman's lure — not guaranteed to catch the big one but only to make it more interesting.	\$ 4.25	
GROUND	11. HI POWER 12 V DC FLASHER Electronic signal flasher circuit for warning lights, etc.	\$ 7.25	MOTOR
	12. PHOTO ELECTRIC NIGHT LIGHT Night watchman — turns lights on at dusk and off at dawn.	\$ 5.50	
GENERATOR	13. 6V POWER SUPPLY Regulated & filtered 6V DC power supply 1/2 amp.	\$ 9.95	MICROPHONE
	14. 9V POWER SUPPLY Regulated & filtered 9V DC power supply 1/2 amp.	\$ 9.95	
FUUSE	15. 0-24 V POWER SUPPLY Variable regulated & filtered power supply @ 1 amp.	\$18.69	SCR
	16. SINGLE CHANNEL COLOR ORGAN Dancing lights are possible by connecting this to your HiFi and adding a light bulb	\$ 5.75	
PIEZOELECTRIC	17. ELECTRONIC SIREN Police siren simulator.	\$ 4.59	RESISTOR
	18. SHIMMER STROBE LIGHT Shimmer light is great for special lighting effects.	\$ 6.25	
CRYSTAL	19. TONE GENERATOR Audio tone generator produces different tones by "waving your hand".	\$ 5.59	PNP
	20. 5 TRANSISTOR 1 WATT AMPLIFIER HiFi quality amplifier — great for many uses.	\$ 7.25	
ELECTROLYTIC	21. TUBE CONTINUITY CHECKER Tube filament tester for 7, 8 and 9 pin tubes.	\$ 3.69	Iron Core
	22. XENON STROBE Super strobe effects are possible with this Xenon strobe.	\$10.95	
KEY	23. LJ 12016A COLOR ORGAN 3 Channel color organ complete with PC board & instructions. 300W per channel.	\$19.95	
	24. LOUDMOUTH SIREN Various siren like tones are produced with an ear shattering noise level. NEW	\$11.25	
	25. ROULETTE WHEEL Great party item — duplicates the real Vegas game, electronically. NEW	\$ 9.95	

Jana projects have been developed and refined over the past few years with the help and assistance of teachers in the school system. Many of our projects are part of the electronics teaching programs in many provinces. Each of the projects illustrate a principle of electronics. These principles may be covered in depth or they may be just accepted as is.



DOMINION RADIO & ELECTRONICS COMPANY

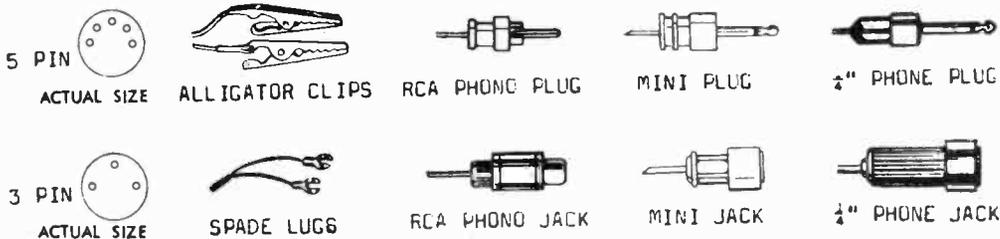
THE HOME OF RADIO & ELECTRONIC SUPPLIES



Canada's Most Popular Audio and General Purpose Connectors

Here are the latest additions to our line of Hi-Fi and P.A. cable assemblies :

- RCA plug - Bare Wires
 - W1 36" \$.89
 - W2 72" 1.20
 - W3 120" 1.49
- RCA plug - Spade lugs
 - W4 36" .79
 - W5 72" 1.20
- RCA plug - Alligator clips
 - W7 72" 1.20
- RCA plug - RCA plug
 - W8 36" .89
 - W9 72" 1.20
 - W10 120" 1.49
- RCA plug - 90 RCA plug
 - W11 72" 1.20
 - W12 120" 1.49
- RCA plug - RCA jack
 - W15 36" .89
 - W16 72" 1.20
- 2 RCA plugs - 2 RCA plugs
 - W17 72" 2.19
- RCA plug - 1/4" phone plug
 - W18 36" .89
 - W19 72" 1.20
- RCA plug - 1/4" phone jack
 - W22 72" 1.50
- MINI plug - Bare wires
 - W23 72" 1.20
- MINI plug - Alligator clips
 - W24 72" 1.20
- MINI plug - RCA plug
 - W25 72" 1.20
- MINI plug - RCA jack
 - W26 72" 1.20
- MINI plug - Mini plug
 - W27 72" 1.20
- MINI plug - Mini jack
 - W28 72" 1.20
- MINI plug - 1/4" Phone plug
 - W29 72" 1.20
- MINI plug - Phone jack
 - W30 72" 1.20
- 1/4" Phone plug-RCA Jack
 - W31 72" 1.20



Complete Cable Assemblies for Hi-Fi with European connectors

NO.	CONNECTOR	CABLE	CONNECTORS	PRICE
W40	3 PIN DIN PLUG	6' 2 COND & SHIELD	2 PHONO PLUGS	3.25
W41	3 PIN DIN PLUG	6' 2 COND & SHIELD	2 PHONO JACKS	3.25
W42	3 PIN DIN PLUG	6' 2 COND & SHIELD	2 MINI PLUGS	3.25
W43	3 PIN DIN PLUG	6' 2 COND & SHIELD	3 PIN DIN PLUG	3.25
W44	3 PIN DIN PLUG	6' 2 COND & SHIELD	3 PIN DIN JACK	3.25
W45	5 PIN DIN PLUG	6' 2 COND & SHIELD	2 PHONO PLUGS	3.25
W46	5 PIN DIN PLUG	6' 4 COND & SHIELD	4 PHONO PLUGS	3.95
W47	5 PIN DIN PLUG	6' 4 COND & SHIELD	4 MINI PLUGS	3.95
W48	5 PIN DIN PLUG	6' 4 COND & SHIELD	5 PIN DIN PLUG	3.95
W49	5 PIN DIN PLUG	6' 4 COND & SHIELD	5 PIN DIN JACK	3.95
W50	4 RCA PLUGS	6' 4 COND & SHIELD	4 RCA PLUGS	3.95

FLEXIBLE "Y" CONNECTORS

W51	1 RCA PLUG	-	2 RCA JACKS	\$1.10
W52	1 RCA JACK	-	2 RCA PLUGS	1.10
W53	1 RCA PLUG	-	2 RCA PLUGS	1.10
W54	1 MINI PLUG	-	2 RCA PLUGS	1.10
W55	1 MINI PLUG	-	2 MINI JACKS	1.10



3 WAY "Y" ADAPTERS

SHIELDED "Y" ADAPTOR SHIELDED "Y" ADAPTOR SHIELDED "Y" ADAPTOR

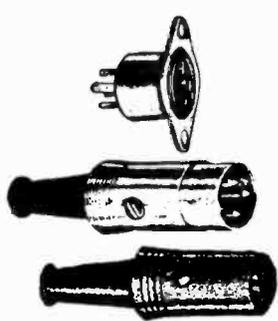
70¢ **70¢** **70¢**

2 RCA jacks parallel connected to one RCA plug. 3 RCA jacks parallel connected 2 RCA jacks parallel connected to one 1/4" phone plug.

DOMINION RADIO & ELECTRONICS CO



NEW
CONTINENTAL CONNECTORS



PINS	MALE	INLINE FEMALE	CHASSIS MOUNT
2	129 72M Metal	149 73F Metal	
2	59 56M Plastic		59 57C Plastic
3	79 58M Plastic	79 59F Plastic	59 66C Plastic
5	89 60M Plastic	99 61F Plastic	59 67C Plastic
5	189 76M Metal	189 77F Metal	
6	199 70M Metal		69 71C Metal

SWITCHES

2 POSITION - 2 POLE
ROTARY
SWITCH

25¢



3 POSITION

ROTARY
SWITCH

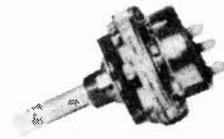
25¢



3 POSITION - 2 POLE

ROTARY
SWITCH

35¢



LIGHTED
RESET SWITCH

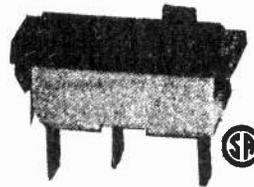
\$1.50



DPST
BULB NOT INCLUDED

ILLUMINATED
LIGHT SWITCH

\$1.79



THUMBWHEEL SWITCH

\$1.95

ea.
10 POSITION



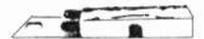
SPDT LEVER
SWITCH

.99



145° THERMAL SWITCH

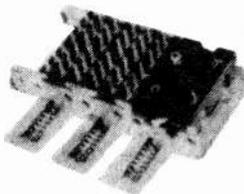
.99



3 SECTION

PUSH
SWITCH

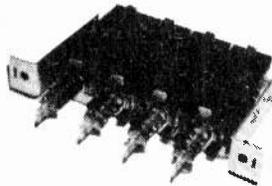
75¢



4 SECTION

PUSH SWITCH

95¢

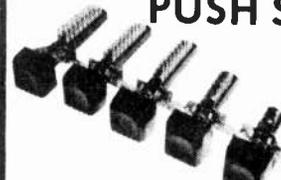


5 SECTION

PUSH SWITCH

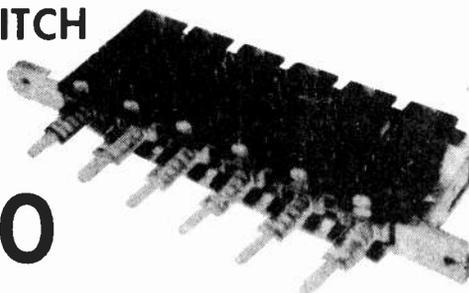
WITH
KNOBS

\$1.95



6 SECTION
PUSH SWITCH

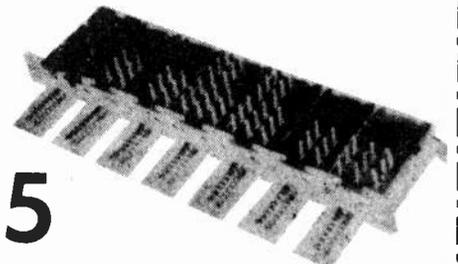
\$1.50



7 SECTION

PUSH SWITCH

\$1.75



DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES



Wire & Cable



RIBBON WIRE

10 COND.	.20/ft
20 COND.	.40/ft
30 COND.	.60/ft
40 COND.	.80/ft
50 COND.	1.00/ft
60 COND.	1.20/ft

COLOR CODED

ANTENNA ROTOR CABLE



4 COND **4¢/FT.**
5 COND **5¢/FT.**

TV LEAD-IN WIRE



REG **2 1/2¢/FT.**
HEAVY **5¢/FT.**

STANDARD SPEAKER WIRE

2 1/2¢ PER Ft.



SPECIAL SALE

500 foot roll



\$1.95

HOOK UP WIRE



65¢ 100'

Pot Wire

PARALLEL LAMP CORD
Colors: Black, Brown, White.



6¢ PER FT.

Coaxial Cables



RG 58
RG 59 **10¢/FT**
RG 62

RG 8 **30¢/FT**

VINYL MICROPHONE SHIELDED CABLES

Hi-Fi Connecting Cable



1 COND + SHIELD **8¢/FT**
2 COND + SHIELD **10¢/FT**



Dual Channel Audio Cable for head set, stereo and language labs

15¢/FT



79¢ ea

Panel Mount Fuse Holder
Bayonet type Knob
1/2" (12.7 mm) panel hole. Accommodates all 1/4" (6.3 mm) x 1/4" (31.7 mm) Fuses.

UNIVERSAL CASSETTE 8-TRACK DRIVE BELTS



SQUARE CASSETTE DRIVE BELT
GJ7070
280 mm (11 in.) dia. - 1/8" (1.6 mm) square
GJ7071
150 mm (6 in.) dia.
GJ7072
240 mm (9.4 in.) dia.
GJ7073
230 mm (9.0 in.) dia.
GJ7074
255 mm (10 in.) dia.
GJ7076
220 mm (8.8 in.) dia.



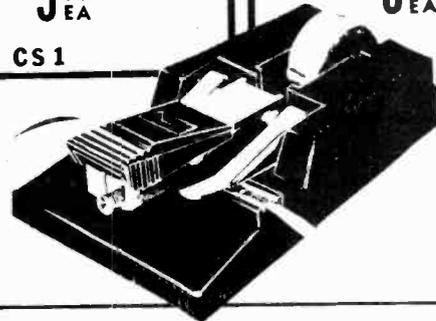
ROUND CASSETTE DRIVE BELT
GJ7075
150 mm (5.9 in.) dia. - 3/32" (2.4 mm) round



FLAT 8 TRACK BELTS
GJ7080
330 mm, (13 in.) dia. - 1/4" wide (6.4 mm)
GJ7081
280 mm, (11 in.) dia. - 3/16" wide (4.8 mm)
GJ7082
280 mm, (11 in.) dia. - 1/4" wide (6.4 mm)

PROFESSIONAL TAPE SPLICER

<p>NEW! CASSETTE SPLICER</p> <p>\$5.95 EA</p> <p>CS 1</p>	<p>1/4" TAPE SPLICER</p> <p>\$5.95 EA</p> <p>TS 1</p>
---	--



30 ft. rolls.
PVC insulating tape.

Tape



YOUR CHOICE:
Black Green
Brown Blue
Red Grey
Yellow White

29¢ ROLL

FAST ACTING

FUSES

1/2 AMP 3 AMP
1 AMP 4 AMP
2 AMP 5 AMP

\$1.09

PACK OF 5

250 Volt or Less
1/4 x 1 1/4 Inch Glass Tube Formerly 3AG



DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES



99¢

PARTS

99¢

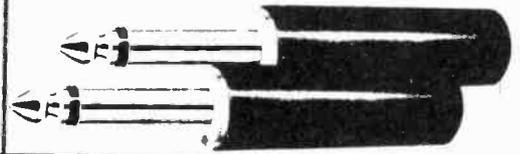
TWO INLINE
STEREO PHONE JACKS



THREE 2 PIN DIN PLUGS



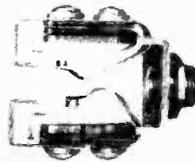
THREE 1/4" PHONE PLUGS



TWO INLINE
SHIELDED 1/4" JACKS



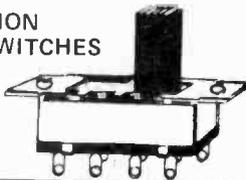
TWO CHASSIS
STEREO HEADPHONE JACKS



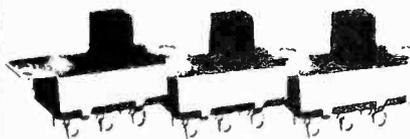
TWO FEMALE
MIKE CONNECTORS



FOUR
2 POLE
3 POSITION
SLIDE SWITCHES

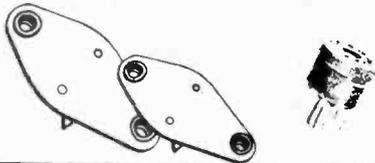


FIVE DPDT SLIDE SWITCHES



SURPRISE
OVER \$30 VALUE

TWENTY-FIVE ASSORTED
TRANSISTOR SOCKETS



TWENTY
ASSORTED TUBE SOCKETS



GUARANTEED
DRE
VALUE

RESISTOR
CAPACITOR
TRANSISTOR
CIRCUIT BOARD
HARDWARE
COILS
IC'S ETC.

THIRTY ASSORTED KNOBS



FIFTEEN RCA PLUGS



TWO 1/8" MINIATURE JACK
TO PHONO PLUG ADAPTORS



THREE MIKE JACKS



TEN ASSORTED RF COILS



TEN ASSORTED VARIABLE
CAPACITORS



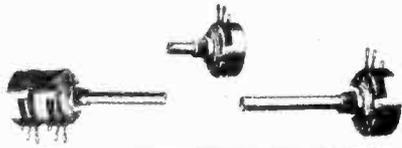
DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES



BARGAINS 99¢

FIVE ASSORTED VOLUME CONTROLS



TEN ASSORTED INTEGRATED CIRCUITS



2 - 300 WATT BULBS
(Standard base)
or
2 - 500 WATT BULBS
(Standard base)
or
2 - 1000 WATT BULBS
(Mogul base)

TWENTY ASSORTED ELECTROLYTICS



FIFTEEN ASSORTED MINIATURE BULBS

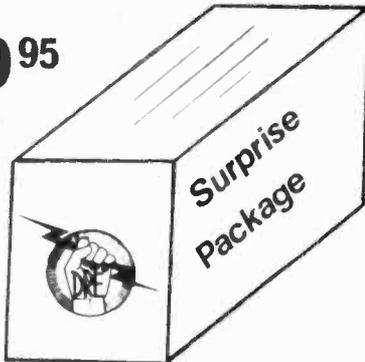


ONE POUND ASSORTED HARDWARE

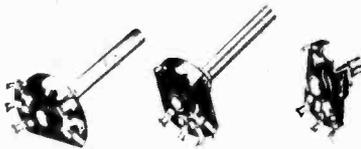


PACKAGE

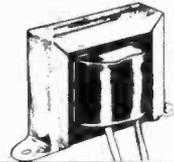
\$9.95



EIGHT ASSORTED ROTARY SWITCHES



THREE ASSORTED FILTER CHOKES



TWENTY ASSORTED SEMICONDUCTORS



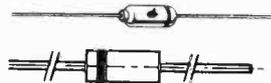
TWO NE 555 TIMERS



FOUR SN7402 IC'S



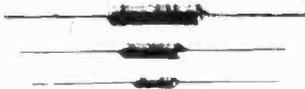
TEN ZENER DIODES



TWO LM 741 OP AMP



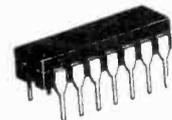
ONE HUNDRED ASSORTED RESISTORS



THIRTY ASSORTED SPADE LUGS



TEN RESISTOR CHIPS



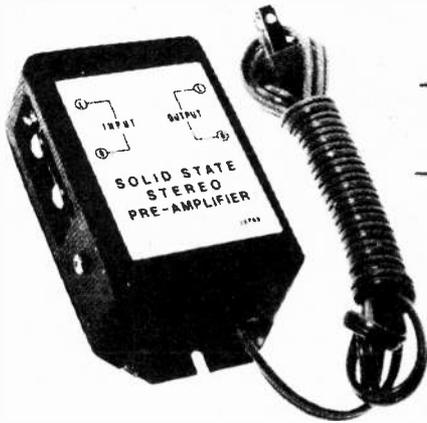
DOMINION RADIO & ELECTRONICS COMPANY

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Jana

POPULAR ACCESSORIES



\$ 13⁹⁵

STEREO PHONO PREAMP AJ 1306

Jana Stereo Phono Pre-amplifiers enable the Hi Fi enthusiast to use his magnetic cartridge with an amplifier that has only crystal or ceramic phono inputs.

SPECIFICATIONS

- | | |
|--------------------|--|
| Frequency Response | — 30HZ to 20KHZ (RIAA) |
| Input Impedance | — 50K ohms |
| Max Input | — 30mv |
| Max Output | — 1.8V (at 1% H.D.) |
| Gain | — 10mv at .5V output |
| S/N Ratio | — better than 60db |
| Transistors | — 2SB175B x 4 |
| Power Input | — 117VAC |
| Dimensions | — 4 3/4 in. (12cm) H x 2 3/4 in. (6.6cm) W x 1 1/2 in. (3.8cm) |

CB CONNECTORS and ADAPTERS



\$ 129

2 CONDUCTOR INLINE
MICROPHONE CONNECTOR
CJ 3154



\$ 139

3 CONDUCTOR INLINE
MICROPHONE CONNECTOR
CJ 3152



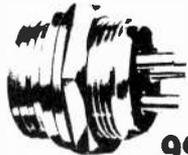
\$ 149

4 CONDUCTOR INLINE
MICROPHONE CONNECTOR
CJ 3150



99¢

2 CONDUCTOR CHASSIS
MICROPHONE CONNECTOR
CJ 3155



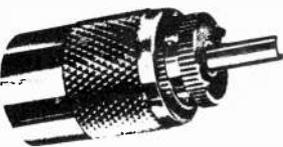
99¢

3 CONDUCTOR CHASSIS
MICROPHONE CONNECTOR
CJ 3153



99¢

4 CONDUCTOR CHASSIS
MICROPHONE CONNECTOR
CJ 3151



99¢

CABLE CONNECTOR
CJ 3800 (PL-259)



99¢

CHASSIS CONNECTOR
CJ 3804 (SO-239)



29¢

ADAPTER FOR (RG-58/U)
CJ 3801
ADAPTER FOR (RG-59/U)
CJ 3802



195

REPLACEMENT CASSETTE POWER CORD AJ 1530

6 foot long, black line cord is the exact replacement for the most popular type. These cords are used in millions of portable tape recorders and phonos which are both battery and electric operated. Hard to find, but always needed.

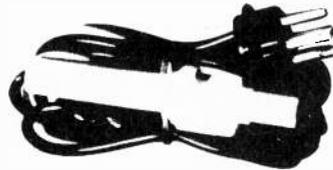


79¢

POWER SOCKET AJ 1529

Chassis Jack to mate with AJ 1530. Ideal for replacement in cassette recorders and for new installations in projects. Simply strip the insulation from the wire ends, insert into the hollow pins on the AJ 1529 and apply solder.

TAPE PLAYER WIRING HARNESS



NEW
4
MODELS

CJ 3402



\$ 225

CJ 3404



CJ 3401



CJ 3403



STEREO HARNESS CABLE

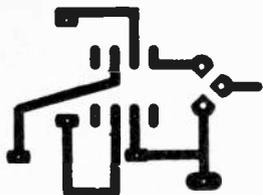
Stereo harness cables for use with your auto tape player, when connected to external power supply.



DOMINION RADIO & ELECTRONICS COMPANY

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CERESIST

3-WAY TRANSFERS

NEW

CERESIST is the sensational new 3-way material which takes the frustrations out of making PCB layouts.

1 - only PCBs. Apply CERESIST directly to the PCB, buffing smoothly with ballpoint pen where you desire the pattern to be transferred. Lift the CERESIST sheet gently, and firm down work with fingerpad. Lines etc. can be broken, butted, overlaid to meet your requirements. The PCB can now be etched directly in ferric chloride bath.

Applied to paper, CERESIST renders excellent "artwork" originals for negative making. CERESIST also transfers well to clear films for positive transparencies & overlays.

There is no problem combining CERESIST with other media (tapes ink, lacquer etc.) if desired.

NEW

\$199

Per Package

QUANTITY DISCOUNT:

FOR EVERY 10 CERESIST PACKAGES YOU BUY, YOU GET 1 FREE

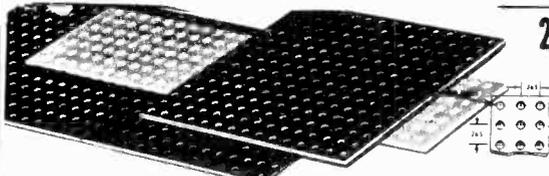
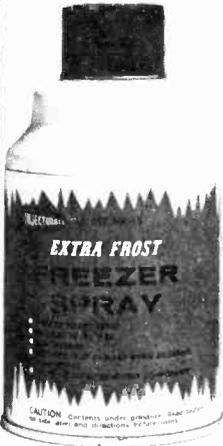
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535 YONGE STREET
TORONTO 5, ONTARIO

	94/1	IC PADS (dip)
	74/1	IC PADS 8-pin
	76/1	IC PADS 10-pin
	41	lines, fine
	44	lines, med
	46	lines, thick
	50/1	angles, thin
	50/2	angles, med
	76/2	medium pads (in circles)
	75/2	large pads (in circles)
	02/1	edge conn's
	64/1	transistor pads (small)
	60/1	transistor pads (medium)
	61/1	transistor pads (large)

 <h1 style="margin: 0;">INJECTORALL ELECTRONICS CORPORATION</h1> 			
<h2 style="margin: 0;">KIT 500</h2> <p style="margin: 0;">For Printed Circuits</p> <p style="margin: 0;">KIT 500 is a low cost kit that comes complete with all materials to make a printed circuit board. Consists of two copper clad boards, a resist ink pen, resist ink solvent, a 6 oz. bottle of etchant, a 1/16" drill bit and a 5 x 7 x 2" plastic case in which the boards are etched. Comes with complete directions. Packaged on a display card. Weight 2 lbs.</p> <div style="text-align: center;"> <p style="margin: 0;">\$ 12⁹⁸</p> </div>	<h2 style="margin: 0;">KIT 650</h2> <p style="margin: 0;">Photo-Etch Kit for Printed Circuits</p> <p style="margin: 0;">KIT 650 is a complete kit using a photographic method to produce professional quality printed circuits. No dark room is necessary. Contains 2 photo-sensitized 3 x 4" phenolic boards, a photographic test negative & an ultraviolet light source. Materials are included to make negatives of magazine layouts. Also contains exposure glass, clamps, developer, etchant, trays, resist remover, drill and complete instructions. Ideal for solid-state and integrated circuits. Packed in a display box. Weight 3 lbs.</p> <div style="text-align: center;"> <p style="margin: 0;">\$ 26⁹⁵</p> </div>		
<div style="text-align: center;"> <p style="margin: 0;">\$ 1⁴⁹</p> </div> <p style="margin: 0;">TAPE HEAD CLEANING STICKS</p> <p style="margin: 0;">TAPE HEAD CLEANING STICKS are 6 inch cotton-tipped wooden swabs. They are excellent to reach dirty recorder heads without taking the tape recorder apart. Packed 100 on a hanging package.</p> <p style="margin: 0;">No. 255 • 100 wooden swabs</p>	<p style="margin: 0;">"BREADBOARDING" AND PRINTED CIRCUIT DESIGN</p> <p style="margin: 0;">LJ-12006</p> <div style="text-align: center;">  <p style="margin: 0;">2 for \$ 2²⁵</p> </div> <p style="margin: 0;">PERFORATED PLASTIC CIRCUIT BOARDS</p> <p style="margin: 0;">Unexcelled for prototypes, breadboards, hobby or science projects. Made of tough mil-spec phenolic with clean punched holes.</p>	<div style="text-align: center;"> <p style="margin: 0;">\$ 2²⁵</p> </div> <p style="margin: 0;">TAPE HEAD CLEANER</p> <p style="margin: 0;">For Tape Recorder Heads</p>	
<p style="margin: 0;">Extra Frost FREEZER</p> <div style="text-align: center;">  <p style="margin: 0;">\$ 6⁰⁰</p> </div>	<p style="margin: 0;">PHONO GRIP-WELL</p> <div style="text-align: center;">  <p style="margin: 0;">\$ 2²⁵</p> </div>	<p style="margin: 0;">TUNER CLEANER</p> <p style="margin: 0;">Cleaner and Lubricant</p> <div style="text-align: center;">  <p style="margin: 0;">\$ 2²⁵</p> </div>	<p style="margin: 0;">DRIVE WHEEL CLEANER</p> <div style="text-align: center;">  <p style="margin: 0;">\$ 2²⁵</p> </div>

LENLINE 

JELLIED Moovit

MICRO - LUBRICANT

THE FINEST LUBRICANT KNOWN FOR T.V. TUNERS, TUNERS, CONTROLS, SWITCHES, RELAYS, CONTACTS, ELECTRIC MOTORS, ETC.

.99 PACK OF 20



DOMINION RADIO & ELECTRONICS COMPANY

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INJECTORALL ELECTRONICS CORPORATION

PRINTED CIRCUIT BOARDS

1 oz. COPPER-CLAD BAKELITE LAMINATES — one side copper

PC1	1/16"	XXXX bakelite	3"x4½"	1.15
PC2	1/16"	XXXX bakelite	4"x6"	1.45
PC3	1/16"	XXXX bakelite	6"x9"	3.20
PC4	1/16"	XXXX bakelite	12"x18"	8.80

1 oz. G-10 EPOXY GLASS BASE LAMINATES — one side copper

PC5	1/16"	G-10 epoxy glass	3"x4½"	1.60
PC6	1/16"	G-10 epoxy glass	4"x6"	2.98
PC7	1/16"	G-10 epoxy glass	6"x9"	5.50
PC8	1/16"	G-10 epoxy glass	12"x18"	6.25

2 oz. G-10 EPOXY GLASS BASE LAMINATES — one side copper

PC9	1/16"	G-10 epoxy glass	3"x4½"	1.65
PC10	1/16"	G-10 epoxy glass	4"x6"	3.25
PC11	1/16"	G-10 epoxy glass	6"x9"	6.50
PC12	1/16"	G-10 epoxy glass	12"x18"	21.65

1 oz. G-10 EPOXY GLASS BASE LAMINATES — two sides copper

PC40	1/16"	G-10 epoxy glass	3"x4½"	2.20
PC41	1/16"	G-10 epoxy glass	4"x6"	4.50
PC42	1/16"	G-10 epoxy glass	6"x9"	8.80
PC43	1/16"	G-10 epoxy glass	12"x18"	29.25
PC44	1/32"	G-10 epoxy glass	3"x4½"	1.60
PC45	1/32"	G-10 epoxy glass	4"x6"	2.98
PC46	1/32"	G-10 epoxy glass	6"x9"	5.50
PC47	1/32"	G-10 epoxy glass	12"x18"	14.45

PRINTED CIRCUIT BOARDS

Light Sensitized Coated Boards

1 oz. COPPER-CLAD BAKELITE LAMINATES — one side copper

PC13	1/16"	XXXX bakelite	3"x4½"	sensitized	1.65
PC14	1/16"	XXXX bakelite	4"x6"	sensitized	2.20
PC15	1/16"	XXXX bakelite	6"x9"	sensitized	5.15
PC16	1/16"	XXXX bakelite	12"x18"	sensitized	17.45

1 oz. G-10 EPOXY GLASS BASE LAMINATES — one side copper

PC17	1/16"	G-10 epoxy glass	3"x4½"	sensitized	2.20
PC18	1/16"	G-10 epoxy glass	4"x6"	sensitized	4.50
PC19	1/16"	G-10 epoxy glass	6"x9"	sensitized	8.70
PC200	1/16"	G-10 epoxy glass	12"x18"	sensitized	29.25

2 oz. G-10 EPOXY GLASS BASE LAMINATES — one side copper

PC25	1/16"	G-10 epoxy glass	3"x4½"	sensitized	2.60
PC10S	1/16"	G-10 epoxy glass	4"x6"	sensitized	4.80
PC11S	1/16"	G-10 epoxy glass	6"x9"	sensitized	11.65
PC12S	1/16"	G-10 epoxy glass	12"x18"	sensitized	32.55

1 oz. G-10 EPOXY GLASS BASE LAMINATES — two sides copper

PC40S	1/16"	G-10 epoxy glass	3"x4½"	sensitized	3.30
PC41S	1/16"	G-10 epoxy glass	4"x6"	sensitized	5.85
PC42S	1/16"	G-10 epoxy glass	6"x9"	sensitized	12.40
PC43S	1/16"	G-10 epoxy glass	12"x18"	sensitized	43.50
PC44S	1/32"	G-10 epoxy glass	3"x4½"	sensitized	2.20
PC45S	1/32"	G-10 epoxy glass	4"x6"	sensitized	4.50
PC46S	1/32"	G-10 epoxy glass	6"x9"	sensitized	8.80
PC47S	1/32"	G-10 epoxy glass	12"x18"	sensitized	29.25

ETCHANT

For Printed Circuit Boards

Injectorall's ETCHANT is a ferric chloride solution to remove excess copper from printed circuit boards. It is an electronic-grade solvent from which solvent impurities have been carefully removed to meet the most stringent requirements of the electronic industry. It is packaged in a plastic bottle.



ETCHANT •

No. 199-6 • 6 oz. plastic bottle	2.20
No. 199P • 1 pint plastic bottle	3.50
No. 199Q • 1 quart plastic bottle	5.40
No. 199G • 1 gallon plastic bottle	18.50

RESIST INK SOLVENT

For Printed Circuit Boards

RESIST INK SOLVENT is an excellent solvent for removing inks, markings and surplus flux. It is non-flammable, non-toxic and evaporates quickly after use.



RESIST INK SOLVENT •

No. 198 • 2 oz. glass bottle	2.48
No. 198G • 1 gallon can	24.15

PHOTO RESIST SPRAY

For Sensitizing Boards

For coating printed circuit boards. Photo Resist is a high quality resist which will cause less pin-holing and has less sensitivity to white light exposure than other resists.



PHOTO RESIST

No. PC194-3 • 3 oz. spray can	5.85
No. PC194-16 • 16 oz. spray can	16.30
No. PC194G • 1 gallon	244.20

RESIST INK PEN

For Printed Circuit Boards

Injectorall's felt-tip RESIST INK PEN makes resist circuits directly on printed circuit boards. Injectorall's pen enables the application of resist ink as easily as if using any felt marker pen. It is available in black only, in fine and medium widths. Dries instantly and remains until removed with any resist ink remover or fine steel wool. Blister-packed.



RESIST INK PEN •

No. 195 • Black-fine tip, blister-packed	2.25
No. 196 • Black-medium tip, blister-packed	2.25

PHOTO RESIST DEVELOPER

For Photo-Sensitized Boards

PHOTO RESIST DEVELOPER is a specially prepared solvent for developing photo resist images. It can be used for printed circuits, semiconductor parts and electroplating stopoff. Compatible with Kodak KPR resists.



PHOTO RESIST DEVELOPER

No. D2-8 8 oz. can	4.30
No. D2G 1 gallon can	26.70

BREADBOARDS

PERFORATED PLASTIC BOARDS

Made of 1/16" polyester glass with holes either regularly spaced or staggered for transistors.

HOLE SIZE				
No. B653	.062	alternate	3x4"	2.15
No. B655	.062	alternate	3x6"	2.98
No. B656	.062	alternate	4x8"	4.85
No. B657	.093	straight	3x4"	2.05
No. B658	.093	straight	3x6"	2.80
No. B659	.093	straight	4x8"	4.50
No. B663	.038	IC Breadboard	3x4"	2.05
No. B664	.038	IC Breadboard	3x6"	2.45
No. B665	.038	IC Breadboard	4x6"	2.98
No. B666	.038	IC Breadboard	4x8"	3.80

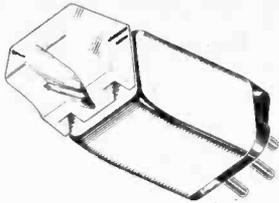


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EMPIRE
EMPIRE



66 E/X

**ELLIPTICAL
STYLUS
CARTRIDGE**

\$13⁹⁵

FREQ. RESPONSE 8-30,000HZ
SEPERATION 30db
STYLUS TYPE .3X.7mil ELLIPTICAL
DIAMOND



\$1⁹⁵

**CIGAR LIGHTER
MAP-LIGHT
AND POWER
ACCESSORY
ADAPTOR**

6335
Twin cigarette plug with lamp in vinyl bag. Ideal for reading maps. etc.



(Unpunched) BOARD

Copper-Clad Solid Board

\$1⁹⁹ lb

For Making Your Own Printed Circuits

- Expressly for Making Your Own Printed Circuits!
- Quality-Manufactured Boards Bonded with Copper!

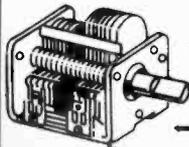
1 lb. Assortment

2 AMP CADMIUM SULPHIDE PHOTOCCELL

\$2.50



**2 GANG
SUPERHET VARIABLE
CONDENSER**



50^c

Antenna Section 350 PF
Oscillator Section 125 PF,
w/trimmer
Counter-Clockwise Rotation

**REPLACEMENT
SPEAKER**

3"x 5" PM **99^c** EA



4 ohm

AC Chassis Mount Receptacle

29^c EA



LED'S

MIL 30



MIL 50

DIFFUSED LENS

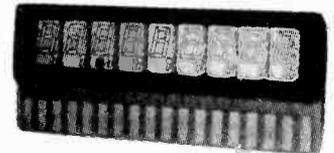
3 mm dia RED .29
YELLOW .39
GREEN .39
5 mm dia
.8 mcd at 20 ma.

HARDWARE

MIC 31 .10 MIC 51 .08

9 DIGIT READOUT

\$2.95
ea.



5 volt.

7 Segment 0.8 Displays

Common Anode 20 ma per segment **\$3⁵⁰**
Part No. MID 165A

9 Segment Alpha Numeric 0.8 Displays

Common Anode 20 ma per segment **\$3⁵⁰**
Part No. 162A

CMOS SPECIALS

- CD4000....\$.14
- CD4006....\$.90
- CD4007....\$.15
- CD4015....\$.65
- CD4016....\$.35
- CD4024....\$.65
- CD4027....\$.35
- CD4028....\$.65
- CD4030....\$.35
- CD4033....\$1.35
- CD4037....\$.30
- CD4043....\$.55

DISCOUNTS

50-100 -10%
Over 100 -15%

**RF Power
Transistor**
14 - 30 MHz

\$19⁹⁵



SD 1024

**50 Watts Output
12 Volt Supply
10 db Gain**

IC'S & DIODE'S

DIGITAL

- 7400 .24
- 7401 .24
- 7402 .21
- 7404 .25
- 7405 .29
- 7406 .59
- 7408 .27
- 7410 .24
- 7411 .36
- 7412 .21
- 7420 .24
- 7423 .36
- 7427 .38
- 7430 .24
- 7442 1.59
- 7447 1.09
- 7454 .24
- 7460 .24
- 7472 .34
- 7473 .42
- 7474 .42
- 7475 .59
- 7476 .45
- 7486 .43
- 7490 .59
- 7491 .87
- 7492 .59
- 7493 .59
- 7495 .87
- 74121 .49
- 74123 .87
- 74125 .58
- 74141-1.36
- 74150 1.89
- 74151 1.23
- 74153 1.09
- 74157 .87
- 74164 1.38
- 74191 1.66
- 74192 1.38



LINEAR

- LM301 .49
- LM311 1.24
- LM379 6.50
- LM380 2.35
- LM381 3.40
- LM382 3.60
- LM555 .49
- LM556 .99
- LM709 .46
- LM723 .63
- LM741 .55
- LM1458 .75
- LM3900 .87

DIODES

- 1N4001 .19
- 1N4002 .19
- 1N4003 .23
- 1N4004 .23
- 1N4005 .23
- 1N4148 .10
- 1N914 .10
- 1N5406 .37



ZENERS

- 5.1v .49
- 6.2v .49
- 6.8v .49
- 7.5v .49
- 8.2v .49
- 9.1v .49
- 12v .49
- 15v .49
- 22v .49
- 100v .49
- all 1 watt



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SEMICONDUCTORS

Power Transistors

15 Amp



60 Volts

Metal can

NPN
2N3055

PNP
MJ2955

\$149

\$159

BRIDGES

WO 2

69¢

1.5 Amp
200 PIV

FO 1

\$169

5 Amp
100 PIV

KO 1

\$450

25 Amp
100 PIV

OUTLINE



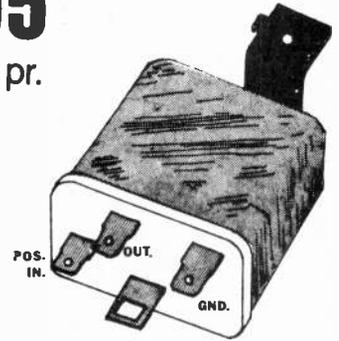
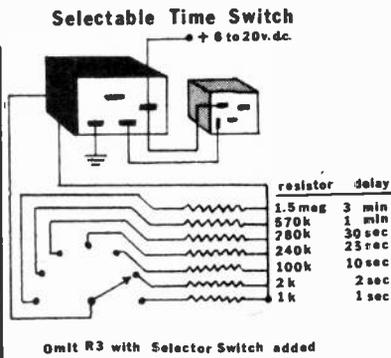
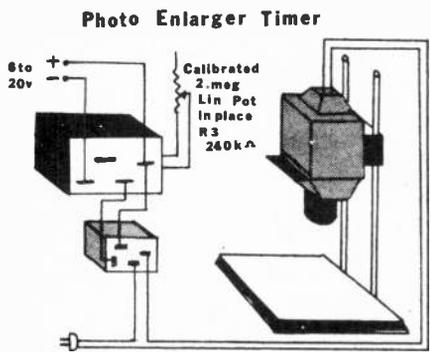
Bargain Transistors

- 2N2221 2N3708
- 2N2222 2N3900
- 2N3565 2N3904
- 2N3703 2N4058
- 2N3704 2N5172
- 2N3707 2N5526

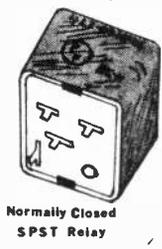
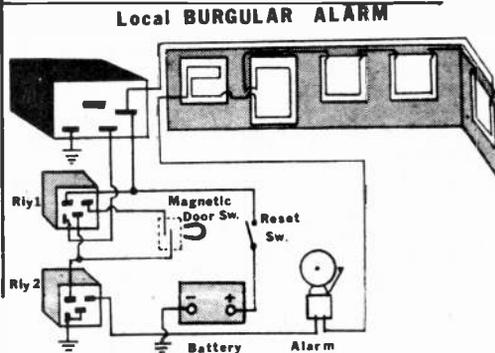
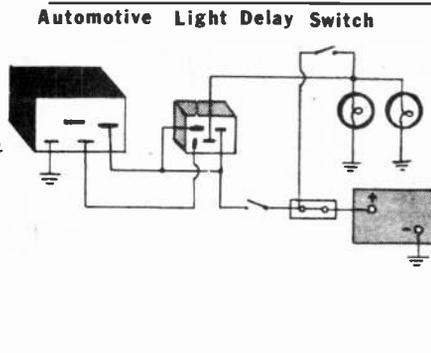


FOR THE HOBBYIST SOLID STATE TIMERS APPLICATIONS

\$ 3⁹⁵ pr.



25 Second Turn On SOLID STATE AUTO TIMER



DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES



Central Semiconductor

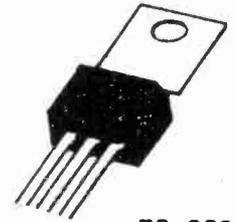
NEW

SCR's

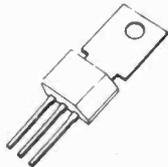
TYPE NO	V _{DRM} (VOLTS)	I _F (RMS) (AMPS)	I _{GT} (μ A)	V _{GT} (VOLTS)	PACKAGE	PRICE
2N5062	100	0.8	200	0.8	TO-92	.75
2N5064	200	0.8	200	0.8	TO-92	.85
C103B	200	0.8	200	0.8	TO-92	.69
C106B	200	4	200	0.8	TO-202	1.29
C106D	400	4	200	0.8	TO-202	1.39



TO-92



TO-202



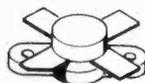
SOLID STATE SCIENTIFIC INC.

RF POWER TRANSISTORS



14-30 MHz, CB/AMATEUR TRANSISTORS

DEVICE TYPE	P _{out} OUTPUT POWER WATTS	G _{pe} POWER GAIN dB MIN	V _{cc} SUPPLY VOLTAGE VOLTS	PACKAGE	PRICE EACH
RF2146	1.0	10.0	6.0	TO202	\$ 3.50
RF2147	5.0	8.5	6.0	TO202	3.75
SD1289	50.0	10.0	12.5	500-4LFL	31.75



NEW

130-175 MHz, HIGH BAND VHF FM TRANSISTORS

SD1156	1.5	10.0	12.5	TO117SL	11.95
SD1256	3.0	8.5	12.5	TO117	13.95
SD1143	10.0	10.0	12.5	MT72	20.50
RF1004	30.0	5.7	12.5	380-4LFL	29.75



NEW

156-162 MHz, VHF MARINE RADIO FM TRANSISTORS

SD1012	6.0	5.0	12.5	MT72	13.75
SD1133	12.0	10.0	12.5	MT72	19.45
SD1229	30.0	6.0	12.5	MT72	29.00



DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES



ME MICRO ELECTRONICS LTD.

SEMICONDUCTOR PRODUCTS

HIGH SPEED SWITCHING TRANSISTORS

TYPE NO. NPN	Maximum Ratings			Electrical Characteristics @ TA=25°C				PRICE EA.	TYPE NO. PNP	Maximum Ratings			Electrical Characteristics @ TA=25°C				PRICE EA.
	PD @ TA=25°C	IC		hFE mm/max	ton toff max	CASE				PD @ TA=25°C	IC		hFE min/max	ton toff max	CASE		
2N2221A	500mW	500mA	40V	40/120	35ns 285ns	TO-18		\$.29	2N3905	310mW	200mA	40V	50/150	70ns 260ns	TO-92A		\$.33
2N2222A	500mW	500mA	40V	100/300	35ns 285ns	TO-18		.32	2N3906	310mW	200mA	40V	100/300	70ns 300ns	TO-92A		.36
2N3904	310mW	200mA	40V	100/300	70ns 250ns	TO-92A		.25	2N3136	400mW	600mA	35V	100/300	75ns 100ns	TO-18		.29
									2N4403	310mW	60mA	40V	100/300	35ns 255ns	TO-92A		.37

SMALL SIGNAL TRANSISTORS

TYPE NO. NPN	Maximum Ratings			Electrical Characteristics @ TA=25°C					PRICE EA.	TYPE NO. PNP	Maximum Ratings			Electrical Characteristics @ TA=25°C					PRICE EA.
	PD @ 25°C	IC	LV CEO	hFE min/max	fT min	NF max	CASE				PD @ 25°C	IC	LV CEO	hFE min/max	fT min	max	CASE		
2N2482	360mW	50mA	60V	100/150	60MHz	3dB	TO-18	\$.38	BC557B	500mW	200mA	45V	220/475	150MHz	4dB	TO-92F	\$.25		
2N3565	200mW	—	25V	150/600	40MHz	—	TO-106	.25	MA0462	—	40V	—	100/300	500MHz	—	TO-18	.32		
2N3707	250mW	30mA	30V	100/400	—	—	TO-92B	.25		300mQ	200mA	50V	200/400	200MHz	10dB	TO-92B	.32		
2N3825	250mW	100mA	15V	20/-	800MHz	—	TO-92B	.28	BC251	300mW	100mA	45V	125/900	130MHz	10dB	TO-92F	.25		
2N5172	200mW	—	25V	100/500	—	—	TO-106	.25											
BC107	300mW	200mA	45V	125/500	300MHz	10dB	TO-18	.29											
BC182LB	375mW	200mA	50V	200/450	150MHz	10dB	TO-92B	.32											

GENERAL PURPOSE TRANSISTORS

2N3019	800mW	1A	80V	100/300	100MHz	—	TO-39	\$.59	2N3703	300mW	500mA	30V	30/150	100MHz	—	TO-92B	\$.24
2N3706	350mW	800mA	20V	30/600	100MHz	—	TO-92B	.29	2N4033	800mW	1A	80V	100/300	150MHz	—	TO-39	.59
BC337-25	500mW	500mA	45V	160/400	70MHz	—	TO-92F	.29	BC327-25	625mW	500mA	45V	160/400	100MHz	—	TO-92F	.29
BC547B	500mW	100mA	45V	200/450	300MHz	10dB	TO-92F	.25									
BC548	500mW	100mA	20V	110/800	300MHz	10dB	TO-92F	.25									
MH8213	2.5W	2A	80V	100/240	50MHz	—	TO-220B	.75									

DARLINGTON AMPLIFIERS

2N5308	600mW	300mA	30V	30000/-	60MHz	—	TO-92F	.50	BC516	500mW	300mA	30V	30000/-	—	15dB	TO-92F	.46
MPSA13	500mW	300mA	30V	10000/-	125MHz	2dB	TO-92A	.33									
BC517	500mW	300mA	30V	30000/-	—	15dB	TO-92F	.45									

GENERAL PURPOSE FIELD EFFECT TRANSISTORS

TYPE NO.	BV GSS min	IDSS min/max	Y fs min/max	VGS (off) max	PRICE EA.	TYPE NO.	BV GSS min	IDSS min/max	rds (ON) max	ID (OFF) max	ton	t off	PRICE EA.
MEF 3819	25V	2.0/20.0mA	2000/6500	8.0V	\$.45	MEF 4391	40V	50/150mA	30 ohms	0.10nA	20ns	35ns	\$.65
HEF 4341	50V	3.0/9.0mA	2000/4000	6.0V	.52	HEF 4393	40V	5/30mA	100 ohms	0.1nA	20ns	80ns	.60

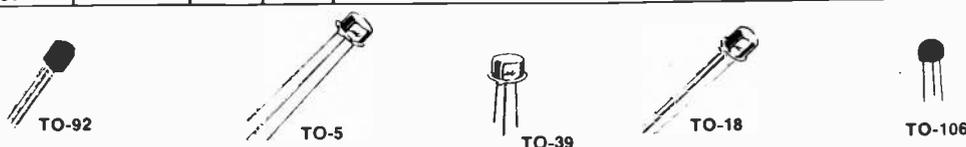
SWITCH AND CHOPPER

TYPE NO.	BV GSS min	IDSS min/max	Y fs min/max	VGS (off) max	PRICE EA.	TYPE NO.	BV GSS min	IDSS min/max	rds (ON) max	ID (OFF) max	ton	t off	PRICE EA.
MEF 3819	25V	2.0/20.0mA	2000/6500	8.0V	\$.45	MEF 4391	40V	50/150mA	30 ohms	0.10nA	20ns	35ns	\$.65
HEF 4341	50V	3.0/9.0mA	2000/4000	6.0V	.52	HEF 4393	40V	5/30mA	100 ohms	0.1nA	20ns	80ns	.60

PROGRAMMABLE UNIJUNCTIONAL TRANSISTORS

TYPE NO.	IA max	BV KAD min	VT max	IP max	IV max	PRICE EA.	RED LED	PRICE EA.
2N6027	20mA	40V	1.6V	200nA	70uA	\$.75		MIL50, 30 Hardware \$.29
2N6028	20mA	40V	0.6V	1500nA	25uA	.80		MIC 51 .08
								MIC 31 .10

PACKAGES

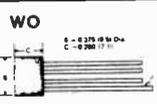
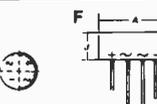
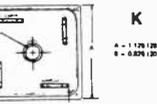
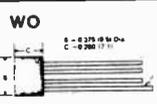
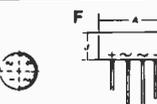


RECTIFIERS

1.0 AMP SILICON RECTIFIER DIODE

TYPE NO.	VRRM Volts	IFSM Amps	IO Amps	PACKAGE	PRICE EA.	TYPE NO.	VRRM Volts	IFSM Amps	IO Amps	PACKAGE	PRICE EA.
IN4002	100	35	1.0@75°C		\$.15	IN5401	100	200	3.0@50°C		\$.29
IN4003	200	35	1.0@75°C		.16	IN5402	200	200	3.0@50°C		.31
IN4004	400	35	1.0@75°C		.20	IN5404	400	200	3.0@50°C		.36

BRIDGE RECTIFIERS

TYPE NO.	V RRM Volts	V rms Volts	I FRM Amps	IO r Load Amps	PRICE EA.	OUTLINE
WO 02	200	140	15	1.5	\$.82	
WO 04	400	140	15	1.5	.95	
F 01	100	70	40	5.0	\$1.95	
F 02	200	140	40	5.0	2.15	
K 01	100	70	60	25	\$7.50	
K 02	200	140	60	25	8.95	

New Products From:



SGS-ATES SEMICONDUCTOR CORPORATION

LINEAR INTEGRATED CIRCUITS

Audio amplifiers

TYPE	$V_{S\ max}$ (V)	VOLTAGE GAIN (dB) (open loop)	P_o (W)	DISTORTION (%) and	R_L (Ω) and	V_S (V)	OUTPUT PEAK (A) CURRENT	PACKAGE	NOTE
TBA 800	30	74	5	10	16	24	1.5	DIP E	Thermal shut-down
TBA 810S/	20	80	7	10	4	16	2.5	DIP E	
TDA 2010	± 18	100	12	1	4	± 14	3.5	DIP C	Fully protected
TDA 2020	± 22	100	20	1	4	± 18	3.5	DIP C	Fully protected
TDA 2002	18	-	8	10	2	14.4	3	Pentawatt®	Thermal shut-down

Voltage regulators

TYPE	V_o (V)	REGULATED I_o (mA)	PACKAGE	PRICE EA.
L 129	5	850	TO-126 (1)	\$ 1.95
L 130	12	720	TO-126 (1)	1.95
L 131	15	600	TO-126 (1)	1.95

L200 ADJUSTABLE MONOLITHIC VOLTAGE & CURRENT REGULATOR
OUTPUT VOLTAGE 3-30 VOLTS
OUTPUT CURRENT 1.8 AMPS
PACKAGE Pentawatt® 4.95

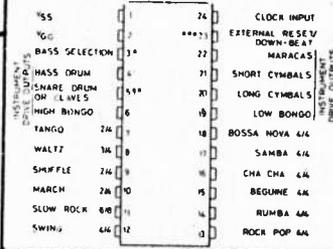
Special functions

TYPE	DESCRIPTION	TECHNOLOGY	CHANNELS (n°)	V_{DD} (V)	POWER CONS. (mW)	TEMP. RANGE (°C)	PACKAGE	PRICE EA.
L 120	Phase control for TRIAC and SCR triggering	CMOS	3	-17	400	0-70	DIP J	9.95
L 121	Burst control for TRIAC and SCR triggering							9.95
L 202	High-voltage, high-current darlington transistor array							2.95
TDA 1054	Preamplifier for tape recorder with ALC							3.95
TBA 231	Dual operational amplifier							2.95

TYPE	DESCRIPTION	TECHNOLOGY	CHANNELS (n°)	V_{DD} (V)	POWER CONS. (mW)	TEMP. RANGE (°C)	PACKAGE	PRICE EA.
M 1025*	TV remote control receiver	CMOS	30	-17	400	0-70	DIP J	19.00
M 1024*	TV remote control transmitter							16.50

M 253

29.75
RHYTHM GENERATOR
M 253 B1AA for standard music content



POWER TRANSISTORS

Epitaxial-base

Plastic



TO-126



TO-220 AB



TO-3

Metal can

TYPE	V_{CE0} (V)	h_{FE} min/max	V_{CE} (SAT) (V)	I_C max (A)	P_D (W) @ $T_C = 25^\circ C$	PACKAGE	PRICE EACH	TYPE	V_{CE0} (V)	h_{FE} min/max	V_{CE} (SAT) (V)	I_C max (A)	P_D (W) @ $T_C = 25^\circ C$	PACKAGE	PRICE EACH
BD437	45	40	0.6	4	36	TO-126	\$ 1.30	2N3055	60	20-70	1	15	117	TO-3	\$.95
MJE223	60	20	2.5	4	15	TO-126	1.30	2N3055U	70	20-70	0.5	15	150	TO-3	1.95
TIP31A	60	25	1.2	3	40	TO-220	.95	2N3442	140	20-70	1	10	117	TO-3	2.50
BD709	80	15-150	1	12	75	TO-220	1.50	BDW51C	45	20-150	3	15	125	TO-3	2.75

Epitaxial-base darlingtons - Plastic

Metal can

TYPE	V_{CE0} (V)	h_{FE} min/max	V_{CE} (SAT) (V)	I_C max (A)	P_D (W) @ $T_C = 25^\circ C$	PACKAGE	PRICE EACH	TYPE	V_{CE0} (V)	h_{FE} min/max	V_{CE} (SAT) (V)	I_C max (A)	P_D (W) @ $T_C = 25^\circ C$	PACKAGE	PRICE EACH
2N6037	40	750-15000	2	4	40	TO-126	\$ 1.59	2N6057	60	750-18000	2	12	150	TO-3	\$ 3.25
2N6038	40	750-15000	2	4	40	TO-126	1.79	2N6059	100	750-18000	2	12	150	TO-3	3.95
2N6039	80	750-15000	2	4	40	TO-126	2.25								
BDX53A	60	750	2	8	60	TO-220	2.95								
BDX53C	100	750	2	8	60	TO-220	3.25								

High voltage - Plastic

Metal can

TYPE	POLARITY	V_{CBO} (V)	h_{FE} min	V_{CE} (SAT) (V)	I_C max (A)	P_D (W) @ $T_C = 25^\circ C$	PACKAGE	PRICE EACH	TYPE	POLARITY	V_{CBO} (V)	h_{FE} min/max	V_{CE} (SAT) (V)	I_C max (A)	P_D (W) @ $T_C = 75^\circ C$	PACKAGE	PRICE EACH
BU407	NPN	330	10	1	7	60	TO-220	\$ 3.00	8UX97	NPN	350	10	5	6	90	TO-3	\$ 4.95

Resistors & Capacitors

1/4W			1/2W			1W			2W
9.1	18K	39	13K	3.3	16K	33	2.2K		
11	22K	56	15K	10	18K	39	2.7K		
12	27K	68	16K	33	20K	47	3.3K		
15	56K	75	18K	56	22K	82	4.7K		
16	82K	82	27K	82	27K	100	5.6K		
18	100K	91	30K	100	33K	180	6.2K		
20	130K	120	33K	220	39K	270	6.8K		
22	150K	130	36K	270	47K	330	8.2K		
27	160K	180	39K	330	56K	560	13K		
30	180K	220	43K	390	68K	680	15K		
33	220K	270	62K	470	150K	820	16K		
36	300K	330	82K	560	180K	1K	18K		
39	330K	390	150K	680	390K	1.5K	22K		
43	390K	510	160K	1.5K	820K	1.8K	33K		
68		620	180K	2.7K	1 meg		82K		
100	1 meg	750	300K	3.9K	1.2 meg		820K		
110	2 meg	820	330K	4.7K	1.5 meg	1.8 meg			
180	1/2W	910	360K	5.1K	1.8 meg	2.7 meg			
300	3.16	1K	390K	5.6K	2.2 meg	4.7 meg			
390	3.3	1.2K	620K	7.5K	2.7 meg				
430	3.9	1.5K	680K	8.2K	4.7 meg				
470	5.1	1.6K	1 meg	12K	5.6 meg				
680	5.6	1.8K	1.2 meg	15K	15 meg				
2.2K	7.5	2.2K	1.5 meg						
3.3K	12	2.4K	1.6 meg						
3.9K	13	2.7K	1.8 meg						
4.3K	15	3K	2.7 meg						
4.7K	18	3.3K	3.3 meg						
5.1K	22	3.6K	3.9 meg						
5.6K	24	5.1K	4.7 meg						
6.8K	28	5.6K	5.6 meg						
9.1K	30	6.8K	6.8 meg						
10K	33	8.2K	7.5 meg						
12K	35	9.1K	8.2 meg						
15K	36	12K	15 meg						



RESISTORS

1/4W 3 1/2¢

1/2W

1W 5¢

2W

5¢ EA.		DISC CERAMICS		5¢ EA.	
3	500v	39	5Kv	100	500v
3.3	500v	39	500v	100	1.4Kv
5.6	500v	39	2Kv	110	4Kv
6	500v	39	3Kv	110	6Kv
6.8	500v	40	6Kv	120	5Kv
6.8	3Kv	43	500v	120	6Kv
7	500v	47	500v	121	500v
8	500v	47	100v	127	500v
8.2	500v	47	500v	130	4Kv
9	500v	47	1Kv	135	500v
10	500v	47	2Kv	150	500v
12	500v	51	6Kv	160	500v
13	500v	56	500v	170	100v
13.5	500v	56	2.5Kv	180	200v
15	500v	58	200v	200	500v
17	500v	62	500v	210	500v
18	500v	68	500v	320	500v
18	2Kv	68	500v	330	2.5Kv
20	5Kv	68	500v	370	500v
22	500v	68	1Kv	390	1.5Kv
22	500v	68	3Kv	660	500v
24	1Kv	68	4Kv	680	500v
27	500v	70	500v	882	500v
27	200v	80	500v	1000	200v
27	500v	82	100v	1200	500v
29	5Kv	82	1Kv	2200	200v
30	500v	82	6Kv	2200	500v
33	500v	91	500v	2500	500v
33	500v	91	500v	3900	500v
33	1Kv	95	3Kv	.005	500v

POTENTIOMETERS	
10K w/sw	300K & 100K w/s
100K	50K & 500
300K	15K & 250K
470K Linear	800 & 100
500K w/sw	3 meg & 1.5 meg w/dpst
	5 meg & 1.5 meg w/sw
1.5 meg	1 meg & 400 w/sw
2 meg Linear	50K & 250K w/sw
3 meg	500K & 50K w/sw
4 meg Screw adjust	1 meg & 500
5 meg Screw adjust	1 meg & 300
	50K & 500K w/sw
	50K & 10K w/sw
	50K & 250K
500K & 500	Singles 20¢
50K & 2 meg log	Duals 35¢
150K with 4 pos. sw	Dual w/sw. 50¢
50K & 2 meg Linear	
1meg & 5 meg	
1 meg & 500K w/switch	

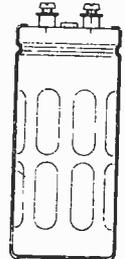
15¢		TRIMMER CAPACITORS		25¢	
SINGLES		20-130	Pfd.		
0-5	Pfd.	30-200	Pfd.	60-220	Pfd.
0-6	Pfd.	DUALS		60-220	Pfd.
0-85	Pfd.				
0-100	Pfd.	0-100	Pfd.	200-200	Pfd.
4.5-25	Pfd.	0-100	Pfd.	200-200	Pfd.
5-75	Pfd.				
5-80	Pfd.	15-120	Pfd.	350-500	Pfd.
7-85	Pfd.	15-120	Pfd.	75-110	Pfd.

COMPUTER GRADE CAPACITORS

SPECIAL

47,000uf	10V	5.95
15,000uf	25V	5.95
33,000uf	40V	7.95

LIMITED SUPPLY



ELNA

ELECTROLYTIC AND TANTALUM CAPACITORS

AXIAL LEAD



uf C \ vv (sv)	16 (20)	25 (32)	50 (63)	80 (100)
1			.20	
2.2			.20	
3.3			.20	
4.7			.20	
10	.20	.20	.25	.30
22	.25	.25	.30	.35
33	.25	.30	.30	.35
47	.30	.30	.30	.35
100	.30	.35	.45	.50
220	.30	.35	.50	.60
330	.35	.45	.60	
470	.40	.50	.70	.90
1000	.50	.60	.90	1.10
2200	.65	.90		
3300	.90	1.20		
4700	1.40	1.60		

RADIAL LEAD



uf C \ vv (sv)	16 (20)	25 (32)	50 (63)	80 (100)
1			.20	
2.2			.20	
3.3			.20	
4.7		.20	.20	
10	.20	.20	.20	.25
22	.20	.20	.20	.25
33	.20	.20	.25	.30
47	.20	.25	.30	.35
100	.25	.25	.30	.35
220	.25	.30	.40	.50
330	.30	.35	.50	
470	.35	.45	.75	
1000	.50	.65		
2200	.80			

POWER SUPPLY TYPE



uf C \ vv (sv)	16 (20)	25 (32)	50 (63)	100 (125)
2200		2.10	2.80	4.90
3300	2.10	2.70	3.50	6.50
4700	2.30	2.90	4.10	8.00
6800	2.90	3.50	5.20	12.00
10000	3.70	4.00	7.50	
15000	4.20	5.50	12.00	
22000	5.10	7.50		
33000	7.50			
47000	8.50			

PRICE INCLUDES MOUNTING CLAMPS



DIPPED SOLID TANTALUM

Capacitance Tolerance -20 +20%

Dc Leakage Current (uA) 0.02 or 1.0

uf C \ vv (sv)	16 (20)	25 (32)	35 (46)
0.22			.30
0.33			.30
0.47			.30
0.68			.30
1.0			.30
1.5			.30
2.2			.30
3.3			.30
4.7	.30		.35
6.8	.30		.35
10	.40	.45	.50
15	.45	.50	.80
22	.50	.60	1.30
33	.60	1.00	2.00
47	1.30	2.00	
68	2.00		
100	2.50		



ATTENTION !

SAVE MONEY ON VOLUME BUYS

RADIAL & AXIAL LEAD ELECTROLYTIC CAPACITORS

- 100 of each value - LESS 10%
- 1000 mixed values - LESS 15%
- 1000 of each value - LESS 20%

POWER SUPPLY CAPACITORS

- 25 of each value - LESS 10%
- 100 mixed values - LESS 15%
- 100 of each value - LESS 20%

TANTALUM CAPACITORS

- 50 of each value - LESS 10%
- 100 mixed values - LESS 15%
- 100 of each value - LESS 20%

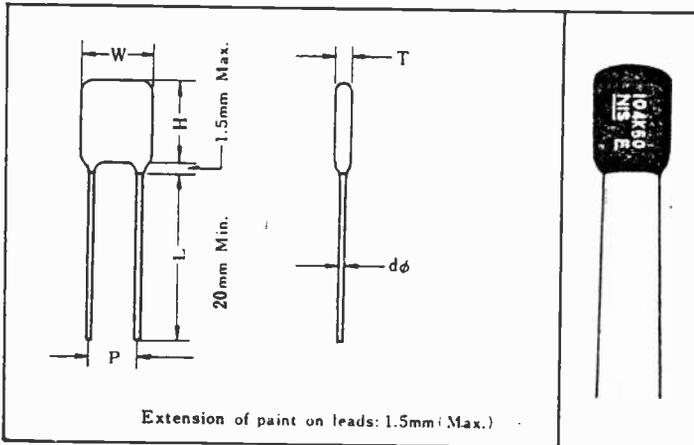
ALL ABOVE ARE PER UNIT PRICES

TYPE AMS

NISSEI

POLYESTER FILM CAPACITORS

Epoxy dipped
(GREEN)



Characteristics

Operating temperature range	-40° ~ +85°C
Rated voltage	100V.DC
Standard capacitance value	0.001μF ~ .22 μF
Standard capacitance tolerance	±10%
Insulation resistance	20,000MΩ Min.
Dissipation factor	1.0% Max.

- ★ Lead wire being electrically welded to the electrode, steady equal dissipation factor can be obtained.
- ★ Completely protected against moisture by thorough coating of epoxy resin, done by fully automatic vacuum dipping machine.
- ★ Highly reliable capacitors, produced by our special way and technique.
- ★ Very light miniature type.

Features

CAP uf	PRICE EA.	CAP uf	PRICE EA.	CAP uf	PRICE EA.
.0010	\$.15	.0068	\$.15	.047	\$.25
.0012	.15	.0082	.15	.056	.25
.0015	.15	.010	.15	.068	.25
.0018	.15	.012	.15	.082	.25
.0022	.15	.015	.15	.10	.25

CAP uf	PRICE EA.	CAP uf	PRICE EA.	CAP uf	PRICE EA.
.0027	.15	.018	.20	.12	.30
.0033	.15	.022	.20	.15	.35
.0039	.15	.027	.20	.18	.40
.0047	.15	.033	.20	.22	.45
.0056	.15	.039	.20		

NON-POLARIZED CAPACITORS

RADIAL LEAD



1 uf	63V	\$.39
2.2uf	63V	.49
3.3uf	63V	.49
4.7uf	63V	.59
6.8uf	63V	.59
10 uf	63V	.69
15 uf	63V	.79
22 uf	63V	.89

AXIAL LEAD



1uf	50V	\$.39
2.2uf	50V	.49
3.3uf	50V	.49
4.7uf	50V	.59
6uf	50V	.59
8uf	50V	.69
10uf	50V	.69
12uf	50V	.79
16uf	50V	.79
22uf	50V	.89
25uf	50V	.89
33uf	50V	.99



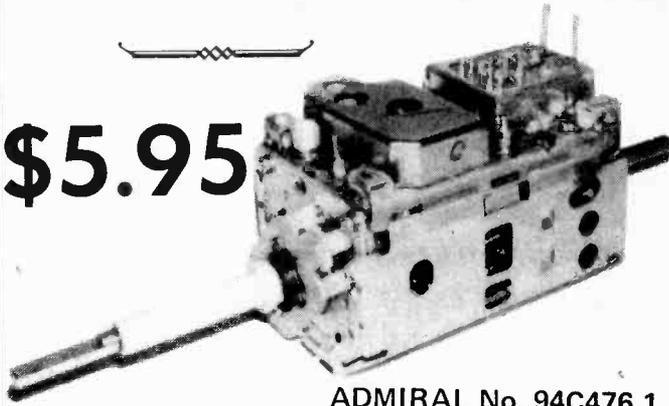
DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES



VHF TV TUNER

\$5.95



ADMIRAL No. 94C476 1

B & W YOKE

\$1.95

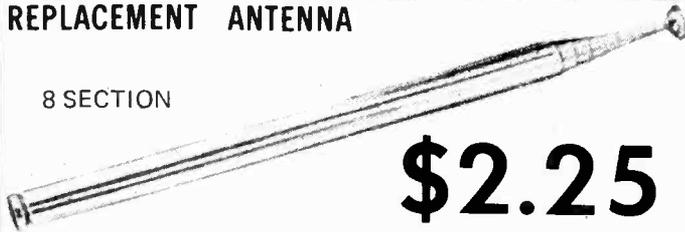
110 Degree



REPLACEMENT ANTENNA

8 SECTION

\$2.25



CONVERGENCE COIL

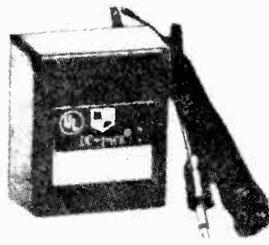
\$.99



UNIVERSAL AC ADAPTERS

\$2.95

YOUR CHOICE
4.5V 200ma
6V 100ma
9V 100ma



ASTATIC MICROPHONE

\$2.95

50Kohm DYNAMIC



MOTORIZED VOLUME CONTROL

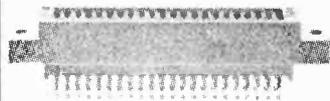
\$2.95

YOUR CHOICE

1Kohm
2Kohm
10Kohm



CARD-EDGE RECEPTACLES



30 PIN	\$2.95
80 PIN	\$3.95
84 PIN	\$4.95

A unique control with 2 motors, (forward and reverse). Motors operate on 110VAC.

4 SECTION CONTROLS

\$1.39 ea.

Your Choice
20 M π
25 k π
100 K π



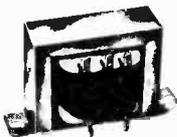
4" SHAFT EXTENSION

\$.49

COMPLETE WITH KNOB



**FILAMENT TRANSFORMERS
CENTER TAPPED**



MAX. CURRENT 1A	PRIMARY 117	VOLTAGE SECONDARY 6.3 CT	395
1A	117	12.6 CT	545

2.5 mh COIL

\$.79

*125 ma. *44ohms



MINIATURE REED RELAY

\$1.99



6 VOLT

DPST



DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES



COMPACTRON TRANSMITTING TUBE



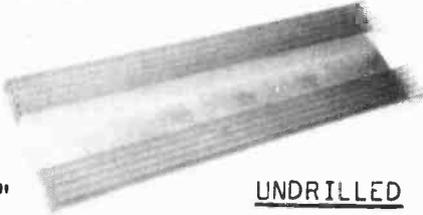
\$4.95

MATCHES WITH #88015
TRANSFORMER ON THIS PAGE

TYPE	DESCRIPTION	Base Connections	Dimensions in Inches		Cathode			Class and Type of Service	Plate Input Watts
			Length	Diameter	Volts	Current Amps.	Type		
7984	Beam Power Amplifier	12EU	2.875	1.562	13.5	0.58	CU	Class A Amplifier Class C Amplifier	25 81

HEAT SINK EXTRUSION

\$ 8.90



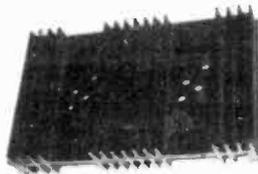
11½" X 3½" X 1"

UNDRILLED

DUAL HEAT SINK

\$3.95

7" X 4¼" X 1½"



PREDRILLED FOR 2 TO-3 TRANSISTORS

TAPE RECORDER CONTROL CENTRE



\$1.95

COMPLETE WITH 3 SHAFT EXTENDERS AND KNOBS

MICROPHONE HEADSET

\$3.95



MONO ONLY

USES COMBINATION SPEAKER/MICROPHONE

Power Transformers

\$8.95



#88015

Pri. 110V
Sec. 700V 150ma.
250V 50ma.
13.5V 1.5 A.

MATCHES WITH #7984 TRANSMITTING TUBE
ILLUSTRATED ON THIS PAGE.

#24-10182-1

Pri. 110V
Sec. 56VCT 8 A.
24V 2 A.
6.3V 4 A.

YOUR CHOICE

\$12.95

#24-10182-2

Pri. 110V
Sec. 58VCT 10 A.
24V 2 A.
6.3V 4 A.

#24-10182-3

Pri. 110V
Sec. 64VCT 10 A.
24V 2 A.
6.3V 4 A.

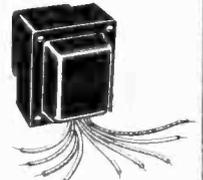


\$2.75
EA

#860-016

Pri. 110V
Sec. 80VCT 2 A.
6.3V 500ma.

\$2.75
EA

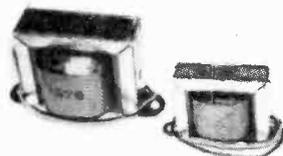


#025796

Pri. 110V
Sec. 125V 3 A.

FILTER CHOKES

\$.99

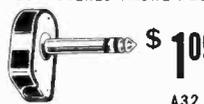
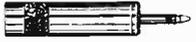


#157Q 3.5H 150ma.
#155H 5H 50ma.

DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES

PLUGS JACKS & ADAPTERS

<p>RCA PHONO PLUG</p>  <p>10¢ A1</p>	<p>INSULATED RCA PHONO PLUG</p>  <p>15¢ A2 Red or Black</p>	<p>FINGER GRIP RCA PHONO PLUG</p>  <p>15¢ A3</p>	<p>INSULATED RCA PHONO PLUG</p>  <p>25¢ A4</p>	<p>SHIELDED RCA PHONO PLUG</p>  <p>45¢ A5</p>
<p>RCA PHONO JACK</p>  <p>15¢ A6</p>	<p>CHASSIS MOUNT RCA PHONO JACK</p>  <p>25¢ A7</p>	<p>INLINE RCA PHONO JACK</p>  <p>25¢ A8</p>	<p>DUAL RCA PHONO JACKS</p>  <p>30¢ A9</p>	<p>SHIELDED INLINE RCA PHONO JACK</p>  <p>45¢ A10</p>
<p>ULTR MINIATURE PLUG</p>  <p>15¢ A11</p>	<p>ULTRA MINIATURE LONG BARREL PLUG</p>  <p>25¢ A12</p>	<p>MINIATURE PLUG</p>  <p>15¢ A13</p>	<p>MINIATURE PLUG</p>  <p>25¢ A14</p>	<p>CHROME MINIATURE PLUG</p>  <p>45¢ A15</p>
<p>ULTRA MINIATURE CHASSIS MOUNT JACK</p>  <p>10¢ A15</p>	<p>ULTRA MINIATURE INLINE LONG BARREL JACK</p>  <p>25¢ A17</p>	<p>CHASSIS MOUNT JACK</p>  <p>15¢ A18 #901 Closed Circuit #902 Open Circuit</p>	<p>MINIATURE INLINE JACK</p>  <p>25¢ A19</p>	<p>CHROME MINIATURE INLINE JACK</p>  <p>45¢ A20</p>
<p>STANDARD PHONE PLUG</p>  <p>45¢ A21 Black</p>	<p>SHIELDED PHONE PLUG</p>  <p>89¢ A22</p>	<p>90 STANDARD PHONE PLUG</p>  <p>99¢ A23</p>	<p>90 SHIELDED PHONE PLUG</p>  <p>99¢ A24</p>	<p>CHROMED BARREL PLUG</p>  <p>119¢ A25</p>
<p>INLINE PHONE JACK</p>  <p>45¢ A26</p>	<p>SHIELDED INLINE PHONE JACK</p>  <p>89¢ A27</p>	<p>CHASSIS MOUNT PHONE JACK</p>  <p>35¢ A28 Closed Circuit</p>	<p>CHASSIS MOUNT PHONE JACK</p>  <p>35¢ A29 Open Circuit</p>	<p>CHROMED BARREL INLINE JACK</p>  <p>\$ 119 A30</p>
<p>STEREO PHONE PLUG</p>  <p>69¢ A31</p>	<p>90 STEREO PHONE PLUG</p>  <p>\$ 109 A32</p>	<p>SHIELDED STEREO PHONE PLUG</p>  <p>99¢ A33</p>	<p>STEREO PHONE JACK CIRCUIT CLOSING</p>  <p>45¢ A34</p>	<p>36 STEREO Y ADAPTOR</p>  <p>\$ 219</p>
<p>INLINE stereo PHONE JACK</p>  <p>69¢ A35</p>	<p>STEREO PHONE JACK</p>  <p>45¢ A36</p>	<p>SHIELDED STEREO INLINE JACK</p>  <p>99¢ A37</p>	<p>EPOXY STEREO PHONE JACK</p>  <p>99¢ A38 CIRCUIT CLOSING</p>	<p>STEREO Y ADAPTOR</p>  <p>\$ 299</p>
<p>MINIATURE MALE INLINE MIKE CONNECTOR</p>  <p>79¢ A39</p>	<p>MALE INLINE MIKE CONNECTOR</p>  <p>79¢ A40</p>	<p>MIKE CONNECTOR TO PHONE PLUG ADAPTOR</p>  <p>79¢ A41</p>	<p>SHIELDED PHONO JACK TO PHONO JACK ADAPTOR</p>  <p>79¢ A42</p>	<p>PHONO JACK TO PHONO JACK ADAPTOR</p>  <p>69¢ A43</p>
<p>MINIATURE MALE CHASSIS MOUNT MIKE CONNECTOR</p>  <p>49¢ A44</p>	<p>MALE CHASSIS MOUNT MIKE CONNECTOR</p>  <p>49¢ A45 5/8 - 27 thread</p>	<p>MIKE CONNECTOR TO PHONE JACK ADAPTOR</p>  <p>89¢ A46</p>	<p>PHONO PLUG TO PHONE PLUG ADAPTOR</p>  <p>79¢ A47</p>	<p>PHONO JACK TO PHONO JACK ADAPTOR</p>  <p>79¢ A48</p>
<p>MINIATURE FEMALE INLINE MIKE CONNECTOR</p>  <p>69¢ A49</p>	<p>FEMALE INLINE MIKE CONNECTOR</p>  <p>69¢ A50 3/4 - 27 thread</p>	<p>MIKE CONNECTOR TO PHONE JACK ADAPTOR</p>  <p>79¢ A51</p>	<p>PHONO JACK TO MINIATURE PLUG ADAPTOR</p>  <p>79¢ A52</p>	<p>ULTRA MINIATURE JACK TO MINIATURE PLUG ADAPTOR</p>  <p>79¢ A53</p>
<p>MINIATURE JACK TO ULTRA MINIATURE PLUG</p>  <p>79¢ A54</p>	<p>MINIATURE JACK TO PHONE PLUG ADAPTOR</p>  <p>79¢ A55</p>	<p>1/2" MINIATURE JACK TO PHONO PLUG ADAPTOR</p>  <p>79¢ A56</p>	<p>PHONE JACK TO ULTRA MINIATURE PLUG ADAPTOR</p>  <p>79¢ A57</p>	<p>ULTRA MINIATURE JACK TO STANDARD PHONE PLUG</p>  <p>79¢ A58</p>
<p>PHONE JACK TO MINIATURE PHONE PLUG</p>  <p>79¢ A59</p>	<p>PHONE JACK TO PHONO PLUG ADAPTOR</p>  <p>79¢ A60</p>	<p>PHONE JACK TO PHONE JACK ADAPTOR</p>  <p>79¢ A61</p>	<p>PHONE PLUG TO PHONE PLUG ADAPTOR</p>  <p>79¢ A62</p>	<p>MIKE CONNECTOR TO PHONE JACK ADAPTOR</p>  <p>79¢ A63</p>

CASSETTE MOTORS

\$395

6VDC
#MTR 1



\$395

9VDC
#MTR 2



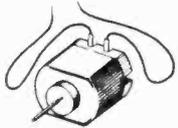
\$395

12VDC
#MTR 3



MINIATURE DC MOTOR

49¢



TAPE COUNTER

195



3 DIGIT

TOGGLE SWITCH

49¢



SPDT Spring Return

ROTARY SWITCH

99¢



SPDT

Terminal Strips



- 1 Terminal..... 2¢
- 2 Terminal..... 4¢
- 3 Terminal..... 6¢
- 4 Terminal..... 8¢
- 5 Terminal..... 10¢
- 6 Terminal..... 12¢
- 7 Terminal..... 14¢
- 8 Terminal..... 16¢
- 9 Terminal..... 18¢
- 10 Terminal..... 20¢
- 11 Terminal..... 22¢

SCREW TERMINAL STRIPS

TERMINAL BOARD.
High insulation bakelite with twin screw terminals. Standard replacement for most TV sets, and many other applications.



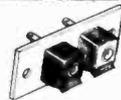
- 2 SCREW TERMINAL..... 15¢
- 3 SCREW TERMINAL..... 20¢
- 4 SCREW TERMINAL..... 25¢

FLEXIBLE TERMINAL BLOCKS

99¢



FLEXIBLE TERMINAL BLOCKS WILL CONFORM TO IRREGULAR SURFACE AND CAN BE EASILY CUT TO SIZE. LONG LEAKAGE PATHS ARE PROVIDED BY THE MOULDED POLYETHYLENE INSULATION. BOLTS AND SLEEVES ARE OF BRASS WHICH HAS BEEN NICKEL PLATED.



- 2 TERMINAL... \$.75
- 4 TERMINAL... \$ 1.50
- 8 TERMINAL... \$ 2.95

5136. **SPEAKER TERMINALS.** Spring loaded, push-button terminals mounted on bakelite strip for positive and instant connect/disconnect.

Tool Sets With Power Handle



\$199

J-4766. Includes 3 standard drivers in small, medium and large sizes; 3 Phillips drivers; one special tool with awl tip; and one special tool with 'corkscrew' tip. All tools measure 3 1/4" long and have colour coded hex handles. Torque amplifier handle is 3" long. Complete with unbreakable plastic carrying case.

LOOPSTICK ANTENNAE

49¢



Shop Tools

Tiny Tool Sets

CRIMP/STRIP TOOL



\$495

J-5085. **CRIMP/STRIP TOOL.** Tempered steel with insulated handles, this handy tool will cut and strip all popular wire sizes from 10 to 22, and will crimp on solderless lugs. 7 1/4" length, assortment of lugs included.

JEWELLERS SCREW DRIVERS



\$198

J-4735. **6-PIECE JEWELLER'S KIT.** Finely crafted drivers of tempered steel with free-turning barrels. Includes transparent vinyl carrying case.

PLIERS AND CUTTERS

Imported



\$395

4" **DIAGONAL SIDECUTTERS.** Quality drop-forged steel with insul-grip handles.



\$395

4" **LONGNOSE PLIERS,** with sidecutters. Drop-forged steel with tempered nose and cutting edges. Precision ground for close tolerance. Insul-grip handles.

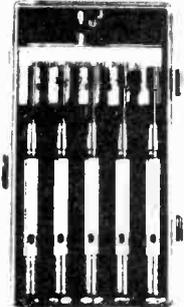


Offset Open End Wrench Set

\$395
#562

This Set #562 contains five precision wrenches with offset open end. Blades made of hardened steel. Sizes: 1/8", 5/32", 3/16", 1/4", and 5/16"

Socket Wrench Set



\$395
#563

This set #563 contains five precision Nut Drivers with torque hole and bar. Blades are made of hardened steel. Sizes: 5/64", 3/32", 7/64, 1/8", 5/32".

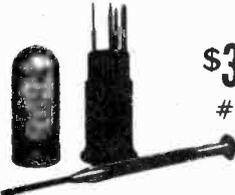
Phillips Driver & Allen Type Wrench Set



\$395
#564

This set #564 contains five drivers with torque hole and bar enabling you to set fastenings up tight. All blades are of hardened steel. Two cross recessed driver No. No. 1. Three allen type wrenches: No. 4 - No. 6 - No. 8.

Tiny Screw Driver & Awl Set



\$395
#565

This set #565 contains five interchangeable tools. Three steel screw driver blades: 1/16", 3/32", 1/8". One cross recessed driver No. 1. One awl. All heat treated. Chuck type handle.

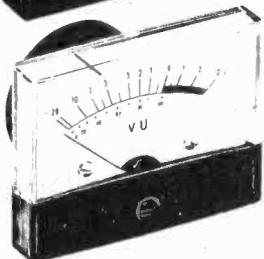
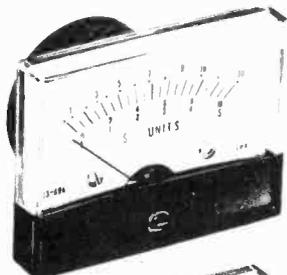
DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES



Jana

WIDE VIEW PANEL METERS



**Precision
WIDE-VIEW
Panel Meters**

**Highly Readable and
Accurate Design**

MODEL NUMBER TABLE				
RANGE	2"	PRICE	4"	PRICE
DC MICROAMMETERS				
O-30 uA			HJ-8801	9.95
O-50 uA	HJ-8202	10.95	HJ-8802	12.95
50-O-50 uA	HJ-8203	10.95	HJ-8803	12.95
O-100 uA	HJ-8204	10.95	HJ-8804	12.95
O-200 uA	HJ-8205	9.95	HJ-8805	9.95
O-300 uA	HJ-8207	9.95		
O-500 uA			HJ-8806	9.95
DC MILLIAMMETERS				
O-1 mA	HJ-8301	10.95	HJ-8811	10.95
O-5 mA			HJ-8812	10.95
O-10 mA			HJ-8813	11.95
O-100 mA	HJ-8303	10.95	HJ-8814	11.95
O-200 mA	HJ-8304	10.95	HJ-8815	11.95
O-300 mA			HJ-8816	12.95
O-500 mA	HJ-8306	10.95	HJ-8817	9.95
AC VOLT METERS				
O-15 V	HJ-8401	9.95	HJ-8821	12.95
O-150 V	HJ-8402	10.95	HJ-8822	10.95
O-250 V			HJ-8823	10.95
DC VOLT METERS				
O-10 V			HJ-8831	11.95
O-15 V	HJ-8502	9.95	HJ-8832	12.95
O-50 V	HJ-8503	9.95		
O-100 V	HJ-8504	6.95	HJ-8834	11.95
O-300 V	HJ-8505	6.95	HJ-8835	9.95
O-500 V	HJ-8506	10.95	HJ-8836	9.95
"S" METER				
	HJ-8701	9.95	HJ-8841	11.95
ILLUMINATED "S" METER				
	HJ-8703	9.95		
"VU" METER				
	HJ-8702	0.95		
ILLUMINATED "VU" METER				
	HJ-8704	11.95	HJ-8851	13.95
DC AMMETERS				
O-15 A	HJ-8601	10.95	HJ-8861	13.95
O-30 A	HJ-8602	10.95	HJ-8862	10.95

INDUSTRIAL MULTITESTER

- 10 AMP D.C. SCALE
- 20K OHM/VOLT D.C.
- 10K OHM/VOLT A.C.
- CARRYING CASE
- 40µA METER MOVEMENT
- STURDY BAKELITE CASE

\$29⁹⁵

20,000-ohm/V Multitester

Specification:
 DC Volt: 5-25-125-500-1000 (20K ohm/Volt)
 AC Volt: 10-50-250-1000 (10K ohm/Volt)
 DC Current: 50uA-2.5mA-250mA and 10A
 Resistance: Rx10, (30K) Rx100, (.3m) Rx1000 (3m) (Center Scale 30 ohms)
 Decibels: -20dB to +22 dB
 Dimensions: 3 3/4" x 4 3/4" x 1 3/8"



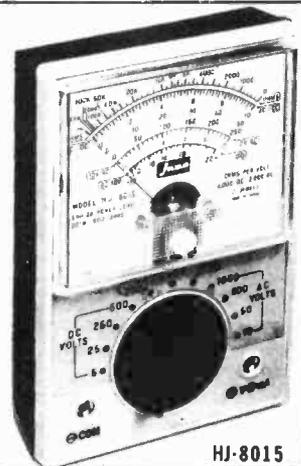
HJ-8010

POCKET MULTITESTER

- IDEAL FOR THE HOBBYIST
- 4K OHM/VOLT DC
- 2K OHM/VOLT AC
- 11 RANGES
- 2 JEWELS
- WHITE EASY TO READ FACE
- COMPLETE WITH TEST LEADS

\$19⁹⁵

SPECIFICATIONS:
 DC Volt: 0-5-25-250-500
 AC Volt: 0-10-50-500-1000
 DC Current: 0-250uA, 250mA
 Resistance: 0-600K (7000-ohm center)
 Decibels: -10 dB to +22dB
 Dimensions: 2 1/4" x 3 3/8" x 1 1/8"



HJ-8015



DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES

LEADER TEST INSTRUMENTS

LBO 508 20MHz DUAL TRACE OSCILLOSCOPE

\$ 961⁰⁰

NEW



including probes and accessories

A brand new addition to a growing family of Leader oscilloscopes. This 20 MHz dual trace oscilloscope is small in size and light in weight. Front panel controls are logically grouped and located for fast and easy operation. The LBO 508 is a 20 MHz oscilloscope with a 10 mV/cm — 20 V/cm sensitivity in 11 calibrated steps. The high intensity CRT delivers excellent contrast while the regulated high voltage supply provides stable brightness.

The applications for this new outstanding oscilloscope are limitless. The LBO 508 is ideally suited for research and development, production, quality control, education and servicing.

- Compact, lightweight, horizontal package
- Add and subtract mode
- Front panel x-y one touch operation
- Automatic and T.V. sync. triggering

LBO-310A 3" OSCILLOSCOPE

\$277⁰⁰

- Bandwidth, DC to 4 MHz, usable to 6MHz.
- Waveform monitoring up to 450MHz with direct connections.



LBO-506 5" DUAL TRACE OSCILLOSCOPE

\$ 795⁰⁰

- Automatic Vertical input gain & Automatic trigger.
- Compact, lightweight with low power consumption.
- Direct input for RF signals up to 100MHz.
- X-Y display, less than 3° phase shift.



LAG-26 AUDIO GENERATOR

\$171⁰⁰

The stable generator for testing all types of audio circuits, from the simple to hi-fi amplifiers. Operating controls are functionally laid out for ease in handling.



LSG-16 SIGNAL GENERATOR

\$129⁰⁰

Here is a compact solid-state RF signal generator designed for the hobbyist, service bench and technical instruction. The generator is most suited for checking and aligning the IF circuits and tuners in AM, FM and TV sets.



LPM-885 SWR WATTMETER

\$126⁰⁰

An inline SWR power meter that makes it easy to adjust transmitters and antenna systems for maximum efficiency.

- SWR and power output readings—1.8 to 54MHz.
- Feed-through power metering eliminates any power loss.
- Requires only 10W for SWR measurements.
- 1 to 1000W power output measurements.
- SWR/power detector circuit detachable for remote measurements.



LPM-880S RF POWER-METER

\$188¹⁰

Provides push-button Watt range selection and rapid measurements through use of an internal dummy load with minimal radiation.

- Minimizes TVI and BCI in transmitter output.
- Has broadband frequency range from 1.8 to 500MHz and a power range from 0.5 to 120W.
- Direct reading measurement eliminates necessity for frequency correction.
- Low SWR in the measuring range



DOMINION RADIO & ELECTRONICS COMPANY

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LEADER TEST INSTRUMENTS

LEADER TEST INSTRUMENTS

Audio Oscillator

Audio oscillator utilises new design in frequency meters, giving good accuracy and fast reading rates.

THE AUDIO OSCILLATOR is an almost essential piece of test equipment in any test lab be it professional or only the home workshop. Only the multimeter would rate more highly.

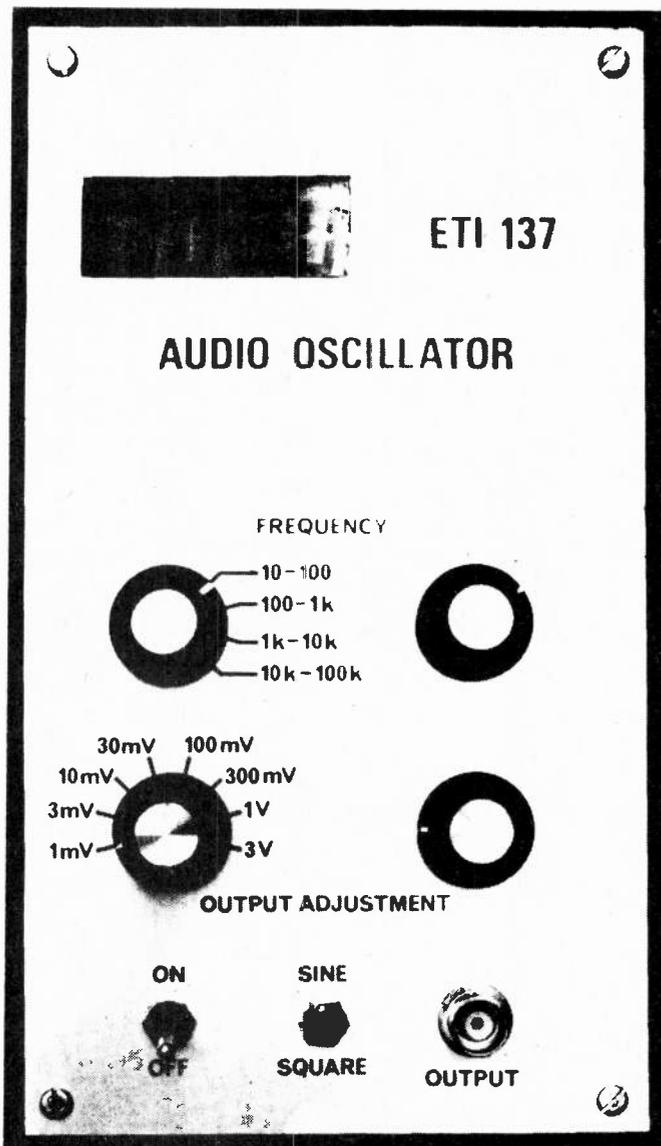
DESIGN FEATURES

This oscillator began as a redesign, mainly mechanical, of an earlier design. It then started to evolve as a voltage controlled sweep oscillator but when it became too complex we reverted to a simple Wein bridge oscillator.

One major problem with all home made oscillators is that of scaling the frequency dial. This is not just a problem of positioning the knob but since normally available potentiometers have a tolerance of +/- 20%, the scale length will also vary. In commercial units the use of an expensive wire wound potentiometer solves most of the problems giving reasonably accurate scaling.

We then decided to build in a frequency meter, basing it on an LED display module. However the high power consumption (we wanted to allow battery operation) and the poor resolution, especially at low frequency, prompted the design of a completely new frequency meter.

This uses what is literally an analogue computer to convert a period measurement into frequency with some digital electronics controlling it and displaying the results. We based this on the Intersil ICL7106 module which, due to its liquid



Front view of the audio oscillator. Note that this is an early prototype and the 3V range has been deleted.

crystal display, features low power consumption. Due to the method of conversion from period to frequency the range is limited from about 50 to 1999 counts and therefore automatic range selection is used. As the oscillator itself has less range than this, this limitation is no problem.

To simplify wiring we initially used CMOS analogue switches to select the range changing capacitors in the oscillator but this unfortunately increased the second harmonic distortion when the supply voltage dropped below 12 volts. This is due to the non-linearity of the "on" resistance when the input voltage changes. We therefore reverted to the good old mechanical switch!

CONSTRUCTION

Assemble the frequency counter board first, following the overlay provided. As this board is mounted very close to the front panel (only the height of the LCD) the capacitors should have leads long enough to allow them to be laid on their side on top of the resistors, etc. Also the CA3130 and the transistor will have to be mounted close to the board. While it is not essential that a socket be used (we didn't) for the LCD, one is recommended and although the Molex pins provided in the evaluation kit are not the best, they are available. Be very careful with the display as it is glass and therefore fairly fragile.

The oscillator board can now be assembled following its overlay diagram. The thermistor should be tied down using a loop of tinned copper wire and pc pins should be used on all external wire terminating points. Cut all leads short on the back of the pc boards as the two are mounted back-back with only 6 mm spacing.

We built the units into a large plastic box with all the components mounted on the front panel. The pc boards are secured by four 6BA c/s screws through the aluminium but hidden by the Scotchcal front panel used. The frequency meter board is spaced using 6BA nuts to give just enough clearance for the display and is held in place using 6.4mm long tapped spacers. Check that the spacers do not touch any tracks on the pc board and if so add pieces of insulation material under them.

The switches and potentiometers can now be mounted on the front panel and the wiring from the frequency counter board to the range switch done. Add wires from the two power connections and the input for later connection to the oscillator board.

SPECIFICATIONS

Oscillator section

Ranges	10.0 – 100.0Hz 100 – 1000Hz 1.00 – 10.00kHz 10.0 – 100.0kHz
Outputs available	sine or square
Output level	1V maximum continuously variable plus 10dB steps down to 1mV
Output impedance	nominally 600 ohms
Sine wave distortion	<0.1%
Square wave risetime	200ns
Frequency meter section	
Number of digits	3½
Display	LCD
Reading rate	5 per second
Resolution	0.1 Hz on lowest range
Mode	Period measurement computed to read frequency

General

Power consumption	26mA @ 12V dc
Battery life	
Ni Cads	20 hours
Pencells (red)	30 hours
Pencells (alkaline)	50 hours

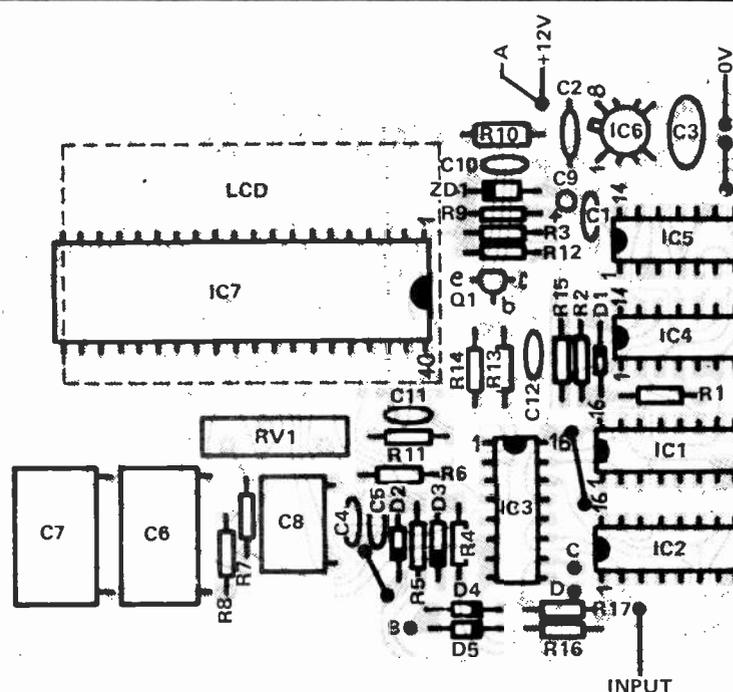


Fig. 3. Component overlay of the frequency meter board. Insert the LCD such that the +1 digit is on the left.

PARTS LIST

GENERAL

- Plastic box UB
- 1 One pole 12 position rotary switch
- 1 Three pole 4 position rotary switch
- 2 STDP toggle switches
- 4 knobs to suit
- 12V battery (8xdry cell or 10xNicads)
- External power socket
- Wire, screws etc.

Frequency Counter Board — ETI 137A

RESISTORS all 1/4W 5%

- R1 10k
- R2,3 1M
- R4,5 1k
- R6 10k
- R7 1k
- * R8 47k
- R9 1k
- R10 4M7
- * R11 100k
- R12 100k
- R13,14 4M7
- R15 1M
- R16,17 100k

POTENTIOMETER

- * RV1 1k ten turn trim

CAPACITORS

- C1 330p ceramic
- C2 56p ceramic
- C3 100n polyester
- C4,5 10n polyester
- * C6 470n polyester
- * C7 220n polyester
- * C8 100n polyester
- C9 1μ0 35V tantalum
- C10 10n polyester
- * C11 100p ceramic
- C12 10n polyester

SEMICONDUCTORS

- IC1,2 4518 (CMOS)
- IC3 4052 (CMOS)
- IC4 4001 (CMOS)
- IC5 4016 (CMOS)
- IC6 CA3130
- * IC7 ICL7106
- Q1 MPS 6515
- D1-D5 1N914
- ZD1 10V 300mW Zener

MISCELLANEOUS

- PCB ETI 137A
- * LCD display
- * These parts are provided in the Intersil ICL7106 Evaluation Kit.

Oscillator Board — ETI 137B

RESISTORS all 1/2W 5%

- R1,2 4k7
- R3,4 47k
- R5 4k7
- R6 680R
- R7 10k
- R8 220R
- R9,10 68R
- R11 1k
- R12 10k
- R13 100k
- R14 10k
- R15,16 47k
- R17 100R
- R18 10R
- R19-R23 1k2
- R24-R29 1k8
- R30 820R

THERMISTOR

- TH1 ITT Type RA53 (See Text)

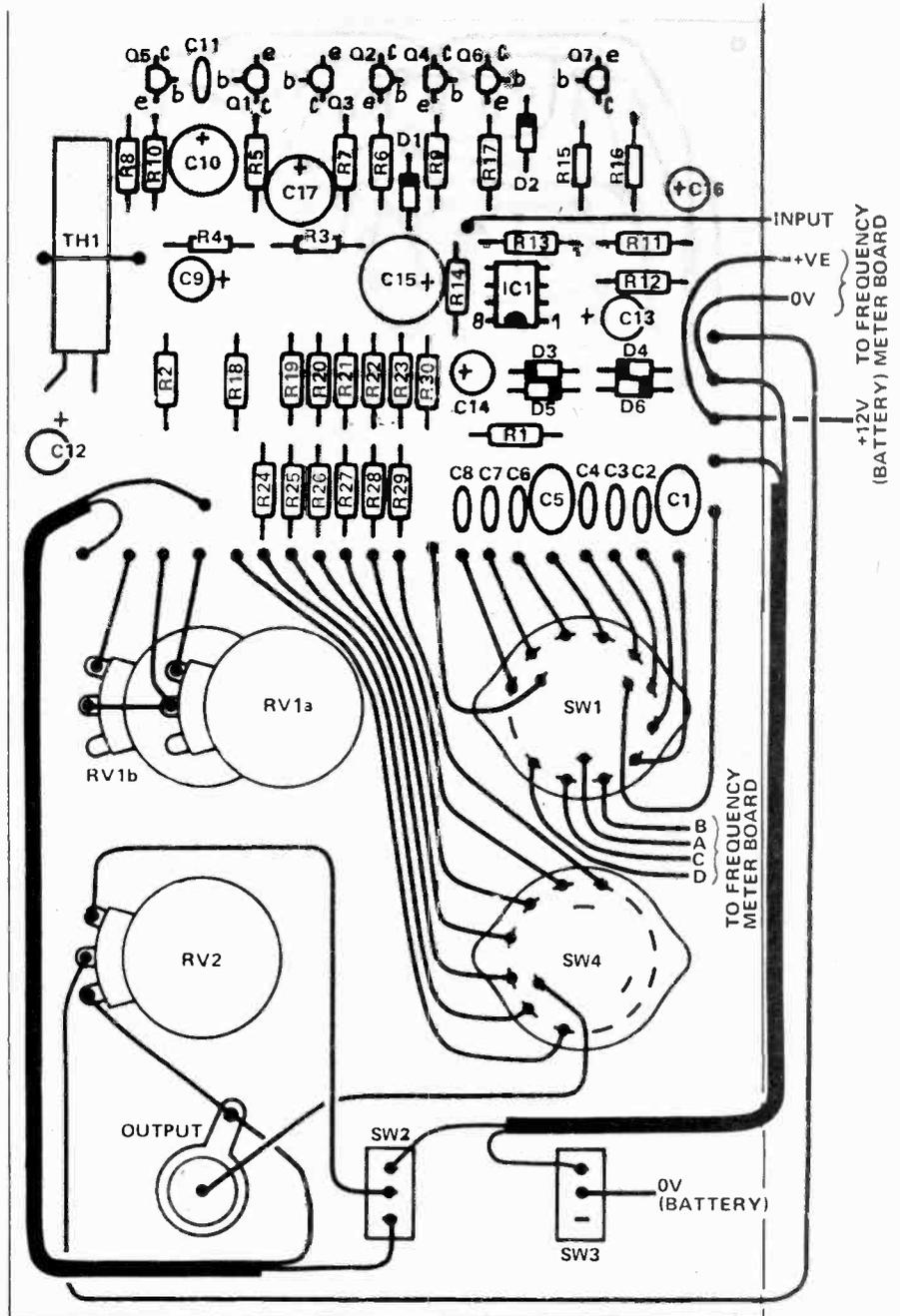


Fig. 4. The component overlay of the oscillator board and the wiring of the front panel.

POTENTIOMETERS

- * RV1 100k dual rotary
- RV2 10k lin rotary

CAPACITORS

- C1 220n polyester
- C2 22n polyester
- C3 2n2 polyester
- C4 220p ceramic
- C5 220n polyester
- C6 22n polyester
- C7 2n2 polyester
- C8 220p ceramic
- C9 10μ 25V electro
- C10 470μ 25V Electro
- C11 10p ceramic
- C12-C14 10μ 25V electro
- C15 1000μ 16V electro

- C16 10μ 25V electro
- C17 100μ 25V electro

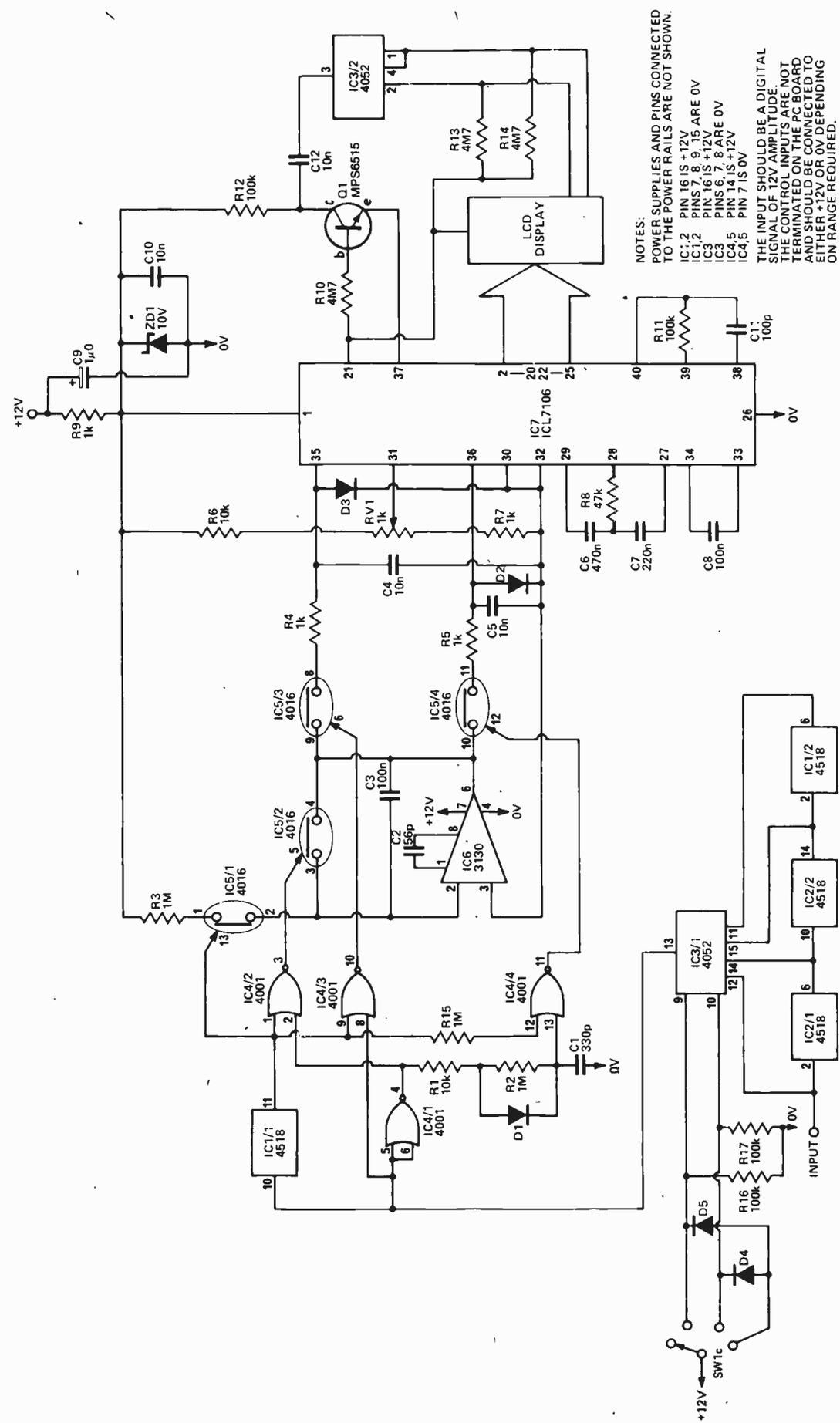
SEMICONDUCTORS

- IC1 301A
- Q1-Q4 MPS6518
- Q5 MPS6515
- Q6,7 MPS6518
- D1-D6 1N914

MISCELLANEOUS

- PCB ETI 137B

* RV1 — the preferred curve giving best resolution is antilog. If reverse rotation is acceptable log is as good. Otherwise use a linear curve.



NOTES:
 POWER SUPPLIES AND PINS CONNECTED TO THE POWER RAILS ARE NOT SHOWN.
 IC1,2 PIN 16 IS +12V
 IC1,2 PINS 7, 8, 9, 15 ARE 0V
 IC3 PIN 16 IS +12V
 IC3 PINS 6, 7, 8 ARE 0V
 IC4,5 PIN 14 IS +12V
 IC4,5 PIN 7 IS 0V
 THE INPUT SHOULD BE A DIGITAL SIGNAL OF 12V AMPLITUDE
 THE CONTROL INPUTS ARE NOT TERMINATED ON THE PC-BOARD AND SHOULD BE CONNECTED TO EITHER +12V OR 0V DEPENDING ON RANGE REQUIRED.

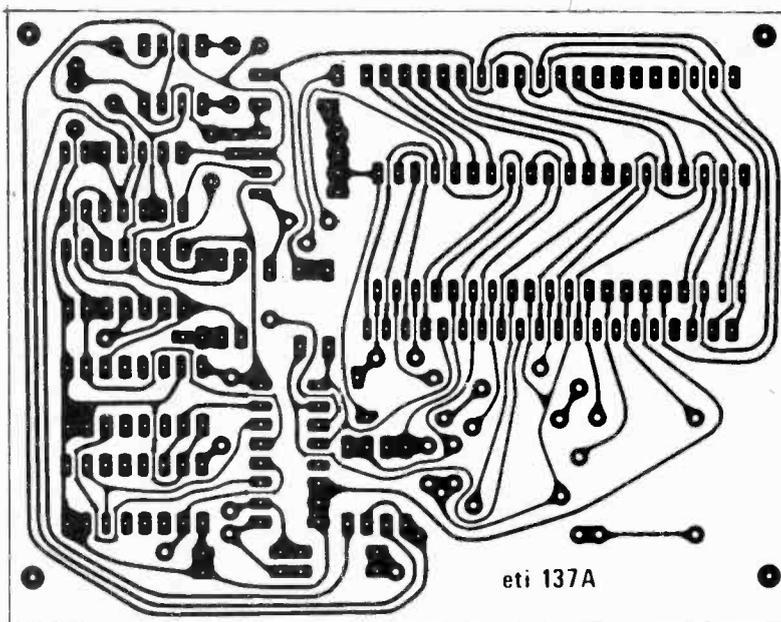
Fig. 1. The circuit diagram of the frequency meter section.

The oscillator board can now be mounted onto the back of the frequency meter board ensuring that no leads short between the two boards. Also check that the spacers do not touch any tracks on the oscillator board. The wiring of the front panel can now be completed.

CHECKING AND ADJUSTMENT

Switch on and check that the frequency meter and oscillator are working. Monitor the output of the oscillator with an accurate frequency counter and adjust the oscillator to the top end of one range. The frequency meter can now be calibrated by means of the 10 turn potentiometer on that board.

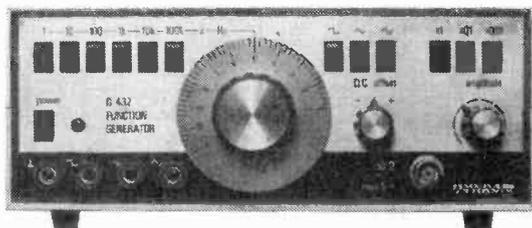
Check that the display range changes correctly and that the decimal point also moves. Each range while nominally having a 10-100 variation will be adjustable from about 7 to 150. Check the attenuator has 10 dB between steps.



THERMISTOR NOTES

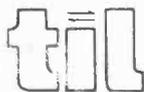
In the oscillator circuit we have what is basically an RC filter with feedback from output to input. In order to obtain an output of stable amplitude and low distortion the

MERATRONIK G432 FUNCTION GENERATOR \$165.00



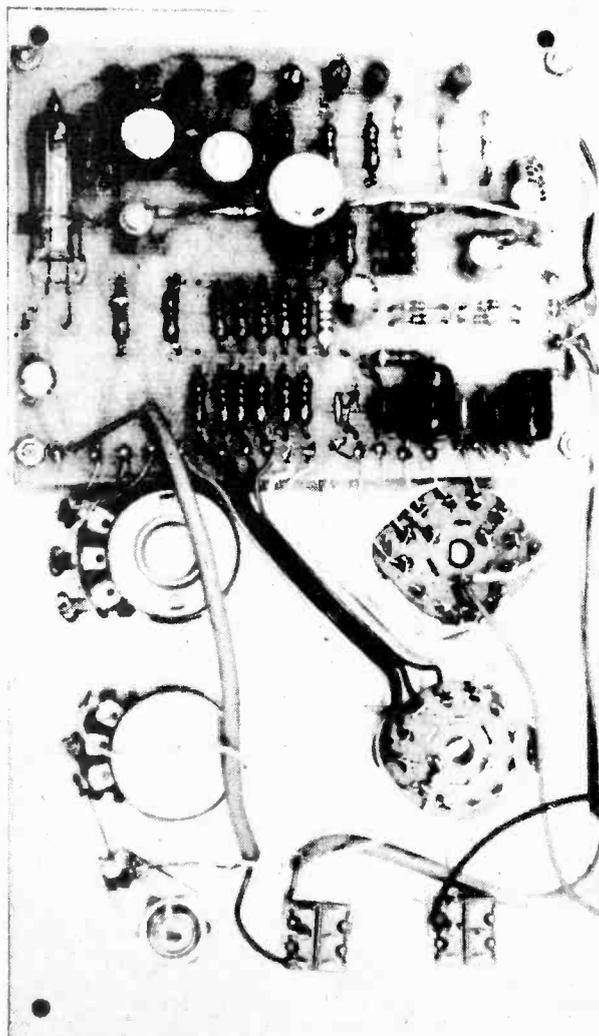
- Sine, Square, Triangle waveforms from 1 Hz to 1.1 MHz
- Both continuous and switched outputs
- DC offset control/three decade attenuator
- Controls are well grouped, easy to use
- Outstanding stability, excellent accuracy and waveform purity

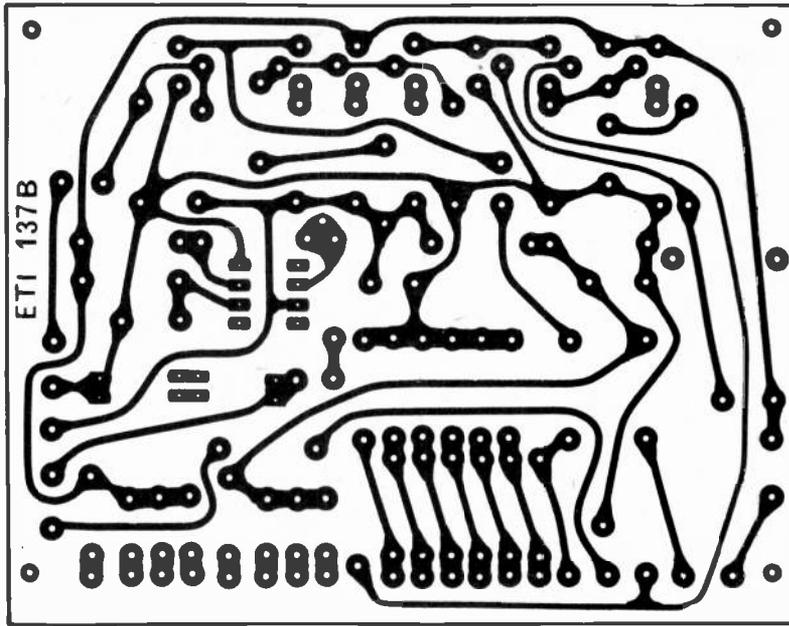
For specifications and test reports,
call, write or telex
Technex International Ltd.



technex international ltd

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Tel: (514) 331-4351 Telex: 05-827651
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feedback must not be too great (amplitude would increase to infinity . . . or the power supply voltage, whichever comes first) nor too little (output would decrease to zero). To adjust the feedback to exactly the right level by means of a trimpot would be impossible, and besides, the setting would vary at different room temperatures and with age.

Thus in this oscillator positive feedback is applied from the collectors of Q4, 5 through C1-4 etc., while negative feedback is applied through TH1 to Q3. It is this negative feedback that brings the overall amount of feedback to the right value. This is "adjusted" automatically by TH1, since if the amplitude of the output is too large, more current will flow through TH1,

heating it up, lowering its resistance, applying thereby more negative feedback, reducing the amplitude of the sine wave and so on.

Of particular note is the special design of the ITT RA53. The heat sensitive resistive element is a tiny bead mounted on thin wires, enclosed in an evacuated glass envelope looking much like an NE2 neon bulb. This design means that the thermistor is sensitive almost solely to heat generated electrically, and almost not at all to the outside environment. In fact this gives the device the characteristic that the element itself rises in temperature by 1C degree per 12.5uW! The device is thus very sensitive and able to keep close control over the oscillator amplitude. Other thermistors could be used, but will be less sensitive to oscillator amplitude, moreso to surrounding temperature. The RA53 has a resistance value of 5k at 20 degrees C, and negative temperature curve.

The RA53 may be obtained direct from: ITT Components, 4001 Chesswood Dr., Downsview, Ontario. Price is \$4.65; Ontario residents add sales tax, postage included in price.

We would like to acknowledge the assistance of Mr. Al Campbell at ITT in making this device available.

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Transistor Equivalents & Substitutes

The Second Book of Transistor Equivalents & Substitutes lists over two hundred pages of transistors and their equivalents from Britain, USA, Holland, Japan, Germany, Czechoslovakia and Poland. Bernard Babani compiled this book to update the information in his first book of Transistors Equivalents and Substitutes published in 1971. The book is a valuable guide to many recent transistors.

Calculator Users Handbook \$2.90

The Electronic Calculator Users Handbook by M. H. Babani presents formulae, conversion factors, etc, to aid users of electronic calculators. Using the book you can

calculate trigonometric (and hyperbolic) functions, logs and square roots using only a single four-function machine.

\$3.25

The prices shown include postage and packing. Send your order with a Cheque or Money Order, Mastercharge/Chargex number (include also date of expiry and signature) to ETI Books, Unit 6, 25 Overlea, Blvd., Toronto, Ontario, M4H 1B1.

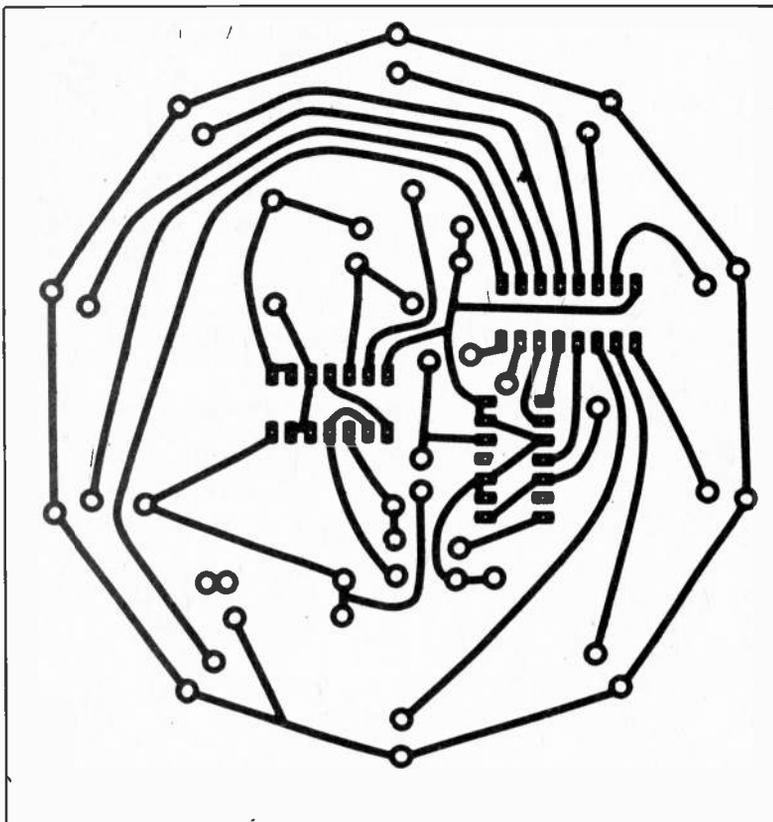
Roulette Wheel

Whip up this quick project contributed by Jana.

This project provides some fun experience with digital electronics using economical TTL integrated circuits. The circuit is an electronic version of the roulette wheel. When S2 is pushed, C1 charges. As long as C1 remains charged IC1 provides a train of clock pulses at its output. These clock pulses are fed into IC2 which is a decade counter. It counts to ten then

repeats, providing a binary coded output. This binary 1 to 10 output is decoded by IC3 which provides 10 outputs, each of which is connected to an LED. These 10 LED's repeatedly light in sequence as the clock pulses are counted, until C1 discharges and the counting sequence stops, leaving only one LED in the 'ON' state.

Printed circuit board pattern for roulette.



PARTS LIST

INTEGRATED CIRCUITS
 IC1 7400 Quad Nand Gate
 IC2 7490 Decade Counter
 IC3 7442 (or 7445) BCD to Decimal Decoder

DIODES
 D1 1N4001 (1A 50 PIV)

CAPACITORS
 C1 500 uF 15V Capacitor
 C2, C3 10uF 15V Capacitor

RESISTORS

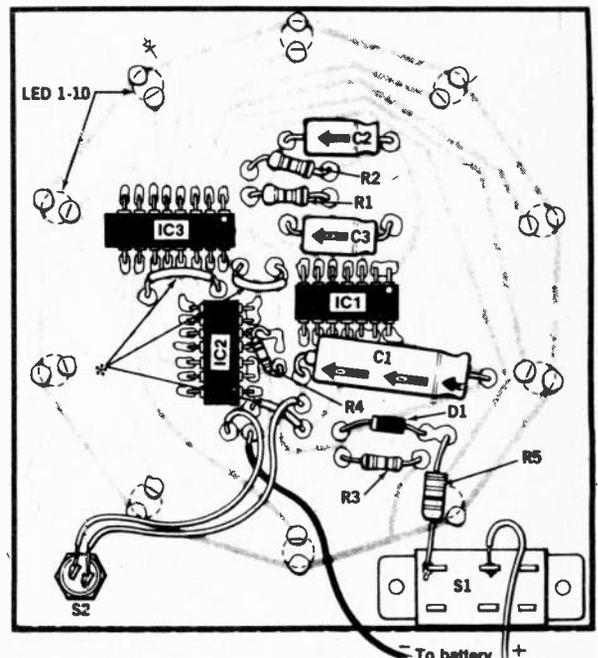
R1, R2 3k9
 R3 180R
 R4 18R
 R5 47R

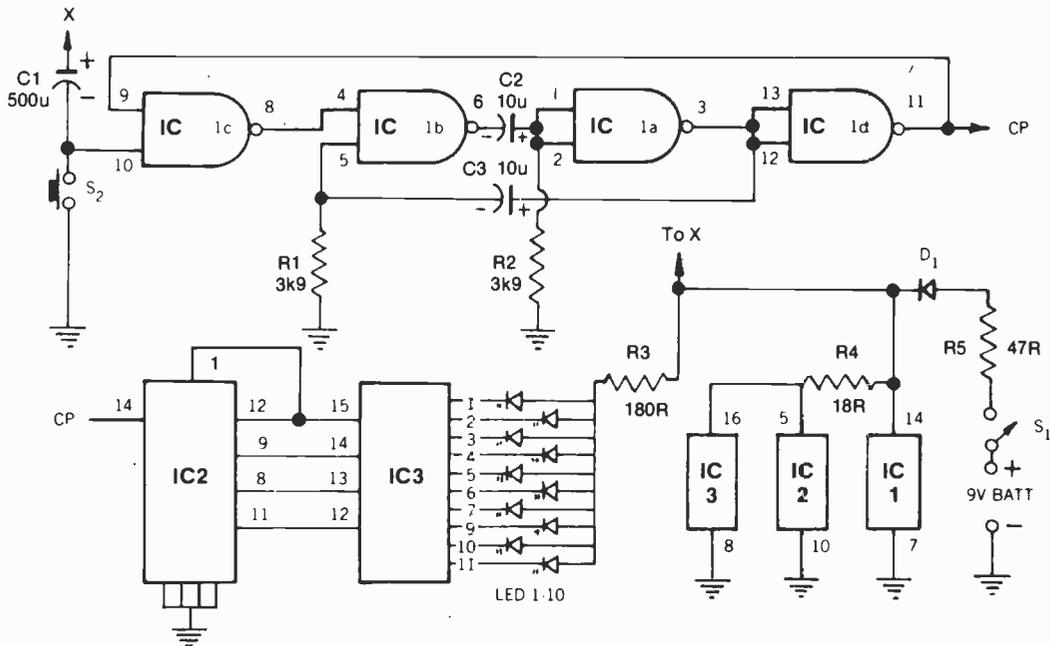
SWITCHES

S1 S.P.S.T. Slide Switch
 S2 N.O. Push Button Switch

LED 1-10 Light Emitting Diode
 MISC. Battery Clip, 9 Volt

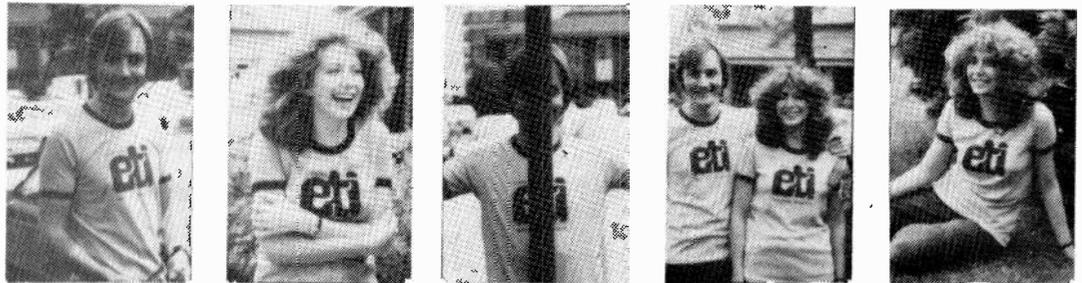
Component overlay.





Circuit diagram of roulette game.

ok



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Please send me _____ ETI T-Shirts, sizes as indicated. I enclose \$_____.

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Price	\$5.50	\$10.00	\$15.00	\$20.00	\$25.00	4% Provincial Sales Tax



LARGE (40")

Number required



MEDIUM (37")

Number required



SMALL (34")

Number required

Name _____

Address _____

Town _____ Prov. _____ Postal Code _____

DO NOT SEND CASH

Cheque enclosed. A/C No. _____

Bill Mastercharge. Signature _____

Bill Chargex. Expiry Date _____

Rain Alarm

Don't get washed away with this useful gadget.

THERE ARE MANY TIMES when you want to know whether (?) it's raining outside, without having to sit looking outside the window for hours on end. It may be the plants you're trying to shelter, or perhaps the washing that's supposed to be drying, but whatever the purpose this unit will alert you as soon as it gets wet.

IT MAY RAIN!

It's here that the good guys of the ETI project team come to the rescue with their Rain Alarm. This little fellow might well upstage any canine companion as a housewife's best friend, at least on washday, by giving a warning at the first sign of rain, giving plenty of time to get the washing in before it gets too wet.

The rain alarm should be placed out in the open and a length of two conductor wire run between it and an eight ohm speaker. We used an old intercom sub-station to provide a home for our speaker but a car

extension speaker or indeed any suitably boxed eight ohm device would be fine.

Any rain falling on the sensor track, formed as part of the PCB, will set off the alarm and produce a distinctive, intermittent bleep-bleep.

CONSTRUCTION

Construction is straightforward if the PCB layout shown is used and in the case of this project we would recommend that the PCB is used, as this adds to the attractiveness of the project.

Assemble the components according to the overlay, ensuring that the tantalum capacitor is connected the right way round. If you do not use a socket for IC1, solder pins seven and fourteen before the others (this allows the device's internal protection circuitry to function).

In our prototype we used a value of 4M7 for R1 which acts as a

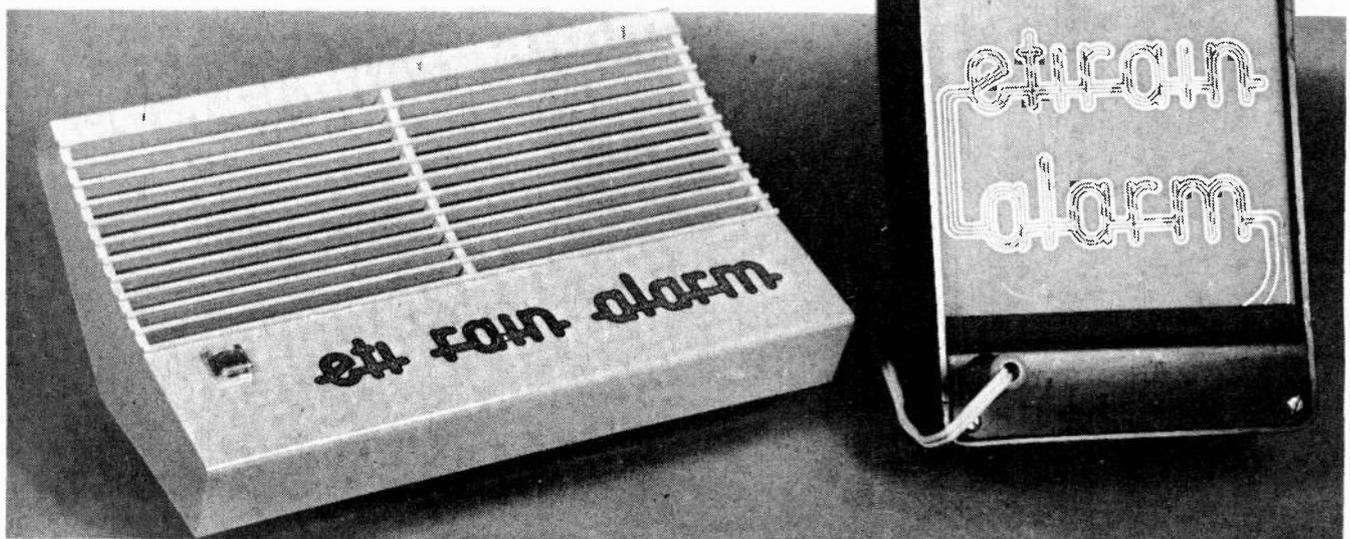
sensitivity adjustment. This value leads to a 'hair trigger' alarm and the value could well be reduced according to the level of sensitivity required.

When construction is complete and the alarm has been tested the area of the PCB that holds the components should be covered with some suitable non-conducting potting compound — epoxy resin should do — to render it waterproof.

POWER TO YOUR

Power consumption of the unit is so low when the alarm is not triggered that it was not thought necessary to provide an on/off switch.

While this unit is not as effective as a device to control the weather — still working on that one — it should at least prevent some of those washday blues.



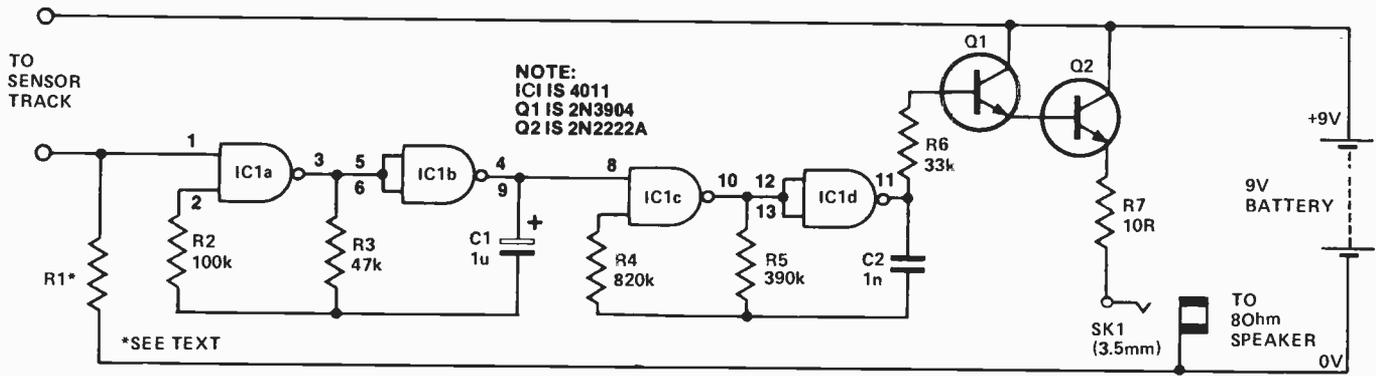


Fig. 1. Circuit diagram of Rain Alarm

HOW IT WORKS

THE rain alarm is formed by two gated CMOS oscillators and an audio output stage.

The basic CMOS oscillator is shown in Fig. 2. Upon switch on, with C discharged, the output of inverter B will be low, the input to A low and its output high. Capacitor C will now commence to charge towards supply, the voltage level at A's output, via resistor R

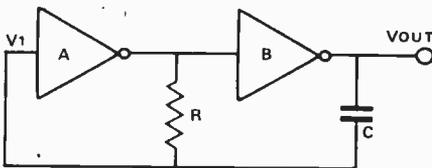


Fig. 2. Basic oscillator circuit

We can consider a CMOS gate to be a comparator that will change output state when the level of voltage at its input reaches a specified value, the transfer voltage (V_{tr}), usually about half supply. Thus as the voltage on C increases due to the charge current being supplied by R there will come a point when the voltage on the input of A will pass its transfer voltage and the output of B to go high.

At this point the charge on C corresponds to a voltage level of approximately half supply.

As the inverters A and B change states the end of C that was held at 0 volts is now at

supply and the end of C that was connected to supply via R is now returned to 0 volts via the same resistor.

These changes together with the charge stored on C mean that the potential across C is now supply plus the transfer voltage of gate A. This is shown in Fig. 3.

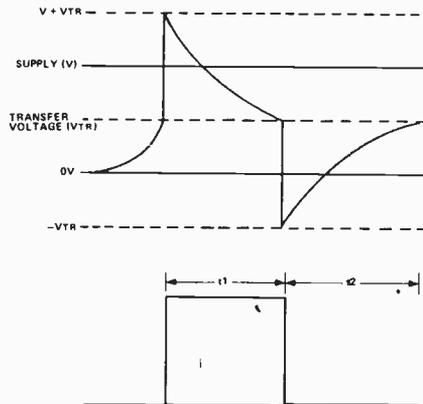


Fig. 3. Waveforms

Capacitor C will now discharge via R until once again the transfer voltage of A is reached whereupon the outputs of the inverters will assume their original states.

The conditions are not quite the same as at

switch on because, as can be seen in Fig. 3, the Potential across C is now a negative value equal to A's transfer voltage.

The final circuit diagram (Fig. 1) of the Rain Alarm shows that the inverters are in fact formed from the four NAND gates of a 4011 package. In each oscillator, while one gate is configured as a straightforward inverter, the other has one input that can act as a control input, oscillator action being inhibited if this input is held low.

From this point C charges via R again to repeat the cycle.

The output is shown in Fig. 3 where $t_1 = t_2 = 1.1 RC$ (the time taken for C to charge (discharge) via R to two-thirds of the maximum value of voltage across it).

In practice, due to the protection networks associated with modern CMOS devices, it is necessary to include a resistor in series with the input of A in order to ensure that the voltages across C are allowed to reach the values shown in Fig. 3.

The first oscillator (IC1a and IC1b) has this input tied low via a high value resistor (R1) that acts as a sensitivity control. Thus this oscillator will be disabled until the control input is taken high. Any moisture bridging the sensor track will so enable the output which is a square wave at about 10 Hz. This in turn will gate on and off the 500 Hz oscillator formed by IC1c and IC1d.

This latter oscillator drives the loudspeaker via R6, the Darlington pair formed by Q1 and Q2 and resistor R7.

PARTS LIST

RESISTORS (all 1/4W 5%)

R1	See text
R2	100k
R3	47k
R4	820k
R5	390k
R6	33k
R7	10R

CAPACITORS

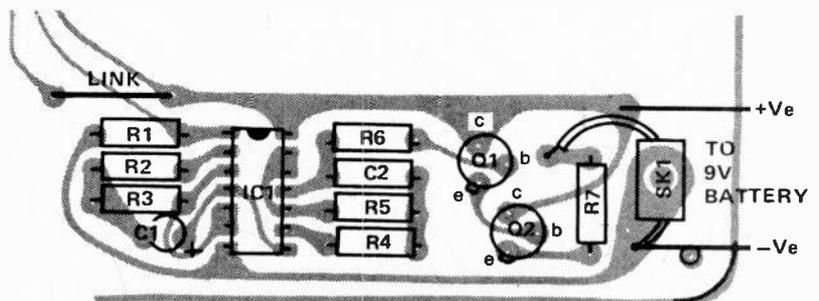
c1	1u0 16 V tantalum
c2	1n0 polyester

SEMICONDUCTORS

IC1	4011
Q1	2N3904
Q2	2N2222A

MISCELLANEOUS
PCB as pattern, 3.5mm jack socket, 8 ohm speaker, battery.

Fig. 4. Overlay of the section of the Rain Alarm PCB that holds the components.



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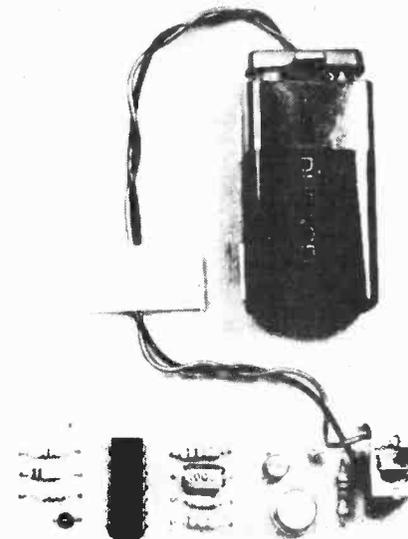
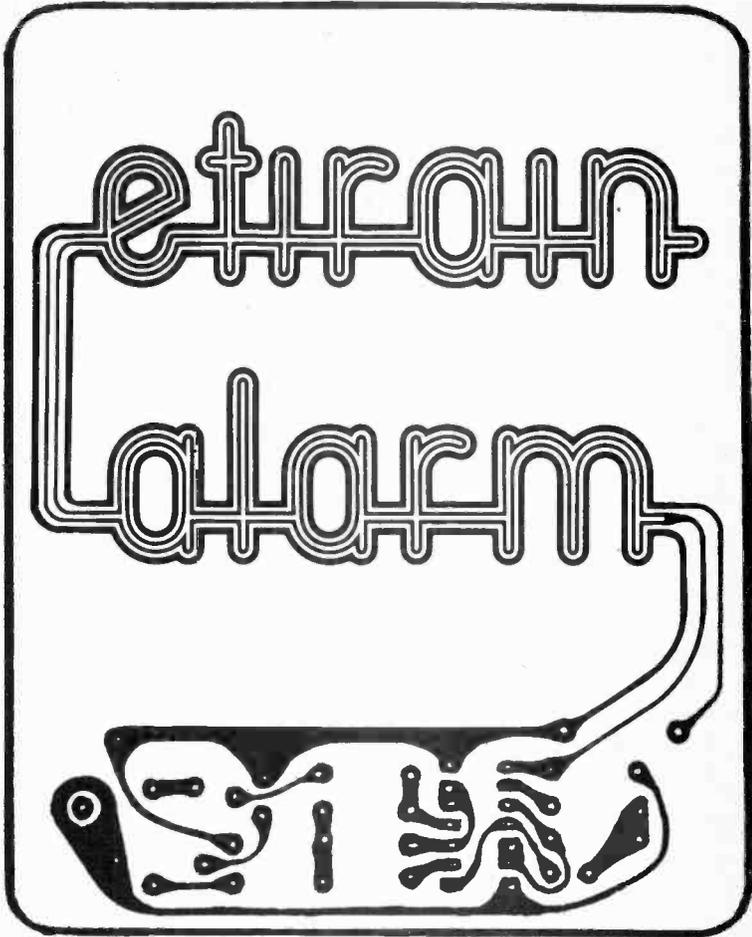
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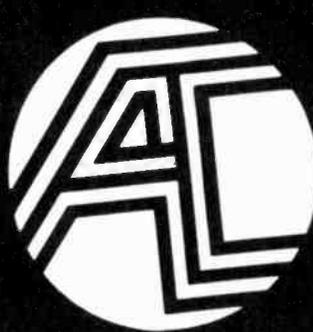
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CD4009BE	.39	CD4021BE	.69	CD4035BE	.64	CD4053BE	.54	CD4077BE	.25	CD4511BE	.99	CD4529BE	.69	400874PC	.69	40195PC	1.10
CD4010BE	.39	CD4022BE	.69	CD4040BE	.74	CD4060BE	.99	CD4078BE	.21	CD4512BE	.59	CD4532BE	1.19	400974PC	.60		
CD4011BE	.17	CD4023BE	.17	CD4041BE	.74	CD4066BE	4.45	CD4081BE	.21	CD4514BE	1.95	CD4539BE	.99	4009874PC	.60		
CD4012BE	.17	CD4024BE	.49	CD4042BE	.59	CD4067BE	.99	CD4082BE	.21	CD4515BE	1.95	CD4543BE	1.39	40160PC	.69		
CD4013BE	.32	CD4025BE	.17	CD4043BE	.57	CD4068BE	.21	CD4085BE	.69	CD4516BE	.69	CD4553BE	4.50	40161PC	.69		
CD4014BE	.73	CD4026BE	1.39	CD4044BE	.55	CD4069BE	.21	CD4086BE	.69	CD4518BE	.79	CD4555BE	.65	40162PC	.89		

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Service News

The introduction to our monthly service column — a Canadian service information centre. By R.C.

THIS NEW SECTION is intended to be of interest to the practising electronics technician. It is hoped that it will bring to you news items and information of special interest to the serviceman. A letter has been sent to the leading manufacturers explaining the purpose of this column and requesting any information on upcoming seminars, new developments, and in fact any items they feel would be beneficial to our readers. In view of the fact that the letter was only mailed in early July, it should be very apparent that they, the manufacturers, had little or no time to respond by press time. Any companies who have not been contacted are of course encouraged to contribute material they feel will be useful. However the Zenith Radio Corporation have done a pretty good job with their Fall agenda. (Fig. 1).

ZENITH

I have been invited to see the new computerized electronic games in approximately two weeks' time, and am in fact looking forward very much to pitting myself against their chess game. I should beat it. After all I have been

playing for nearly 45 years and this electronic wizard is very much a beginner. In any case I will let you know the result.

Zenith are also in the process of setting up a video cassette library, and by September they hope to be selling cassettes featuring children's, sports, educational and first-run movies. The cost will probably be in the \$40-\$90 range (per cassette) and advertising material and a cassette catalogue will be available to selected dealers. This seems to be a very convenient and economical way to service the consumer as no capital outlay is involved. The dealer can simply order from the catalogue and expect delivery within 24 hours.

This first column is not very technical, it is primarily a news release from the Zenith Corporation. However the conversations I have had with their technical reps have made it abundantly clear to me that to survive the TV technician must diversify. If we have not already reached, we are certainly very close to saturation in the colour TV market, and with the complexities of

solid state circuitry it has become more and more difficult to do other than the most rudimentary service in the home. The technical reps of several of the leading manufacturers have all expressed their opinion that unless the electronics technician is prepared to study and seek new fields he will not survive. Discussing the future of the domestic electronic technician, the general consensus of opinion was that he must be prepared to service not only colour TV, but burglar alarms, electronic door openers, electronic games, and even computers. This will require intensive study. We have for many years enjoyed a reasonably lucrative profession doing very little other than TV and stereo service, but with the reliability figures quoted to me by various manufacturers it would appear that this particular branch of domestic electronics is going to require considerably less maintenance than hitherto. When manufacturers quote an incidence of service of one service call in 3 years excluding nuisance calls, one must begin to wonder "What will I be doing in 5 years' time?" There will obviously be large numbers of tube sets

Fig. 1. ZENITH RADIO CORPORATION AGENDA — 1978

Date	Place	Subject
Sept 11-22	B.C. (Major Appliances, Vancouver)	The new chassis. (System 3)
Sept 25-29	Toronto	VCR (video cassette recorder)
Oct 1-6	Toronto	System 3
Oct 11	Sudbury	System 3
Oct 15-28	Saskatchewan and Manitoba	System 3
Oct 29-Nov 4	Alberta	System 3
Nov 6-10	Kitchener	System 3
Nov 13-14	Windsor	System 3
Nov 16-17	St. Catharines	System 3
Nov 20-21	Halifax	System 3
Nov 23-24	Moncton, N.B.	System 3
Nov 26-Dec 1	Toronto	System 3

Service News

and hybrid sets still in the field, but they will gradually phase themselves out, leaving the field service technician with no house calls to make. Prominent service technicians and owner/operators have expressed the opinion to me that the days of home service are numbered, stating that in the very near future the consumer will be expected to bring 20" and smaller colour TVs to the service centre for repair, and where a larger set is involved the companies are already planning to use relatively unskilled labour just to pick up the set for service by a bench technician.

The local Zenith office will be pleased to advise exact time and place.

These seminars will be presented by Mr. George Hess, well known to technicians across the country for his technical knowhow, his patience, and most important of all, his teaching ability.

In passing I would like to inform you that a 5-day seminar was held in Toronto in June on video cassette recorders. Eighteen selected technicians attended this course and Zenith report that it was one of the most

successful seminars ever presented by them. The technicians were most enthusiastic and I have been informed that by the end of the week the group was diagnosing the most elusive faults with ease, and in fact clamouring for more complex problems.

A further piece of late news: Zenith, in conjunction with Humber Collegiate, is setting up a VCR course. The date of commencement is indefinite at the time of writing, but providing suitable instruction is available it will commence in September. Failing that it will commence in January.

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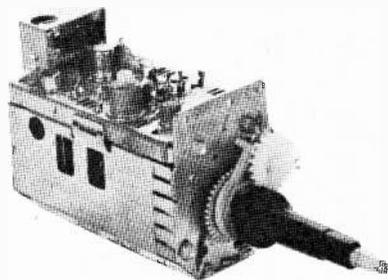


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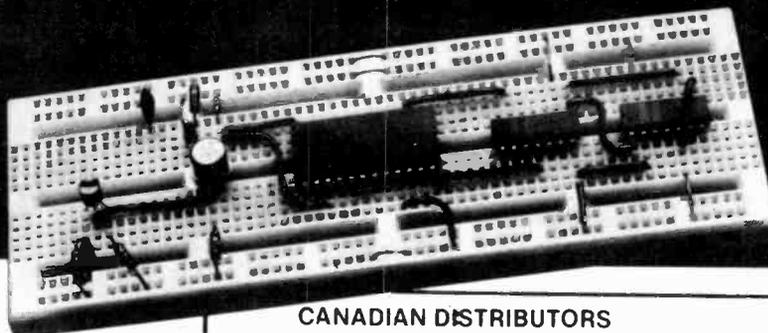
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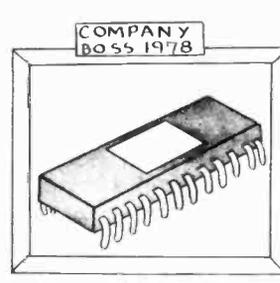


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Sprague ULN2232A Conversation Piece

Just becoming available from Sprague, this chip provides great entertainment value.

THE ULN2232A MOTION DETECTOR combines Integrated Injection Logic and more familiar bipolar technology in this part digital, part analog circuit designed for the advancement of toys, which will probably find use also in burglar alarms etc.

At the time of going to press, no proper data sheet was available so the information here is not absolutely complete. However, here's what we know.

NEAT LOOKING

Referring to the block diagram Fig. 1, we can see that there are two main sections of interest in the IC. First there's the "input" stage, the actual motion detector. This is composed of a photo diode actually on the chip, able to sense light due to a rather unique

transparent epoxy package. The photo diode only "looks" at a very small area directly facing the top of the IC (actually a narrow cone if you visualize it in three dimensions). A signal representing the amount of light from this area is amplified by A1, and if coupled through C1, then it is further amplified by A2 and A3.

DON'T MOVE

The detector senses changes in level, and outputs a digital trigger signal if the light level changes by more than 5% in the "cone of surveillance".

Since almost any movement in a room will affect the light falling elsewhere, this circuit will thus detect and signal the movement. Various optics options are planned including special lens and infrared filter. This

ability obviously is useful in burglar alarm applications, and makes the basis of a novel toy.

VOCAL CHIP

The second half of the IC complements this with a noise maker circuit. The digital generator and VCO are configured either to produce a burst of siren like output, or a pseudo (very) random sequence of 12 notes repeated in a burst reminiscent (if one can say that so soon afterwards) of Star Wars' R2D2. A4 and a transistor deliver an audio signal capable of directly driving a speaker, while a signal directly from the digital generator drives another transistor for powering flashing light bulbs of LEDs.

OPTIONS

Obviously a wide variety of

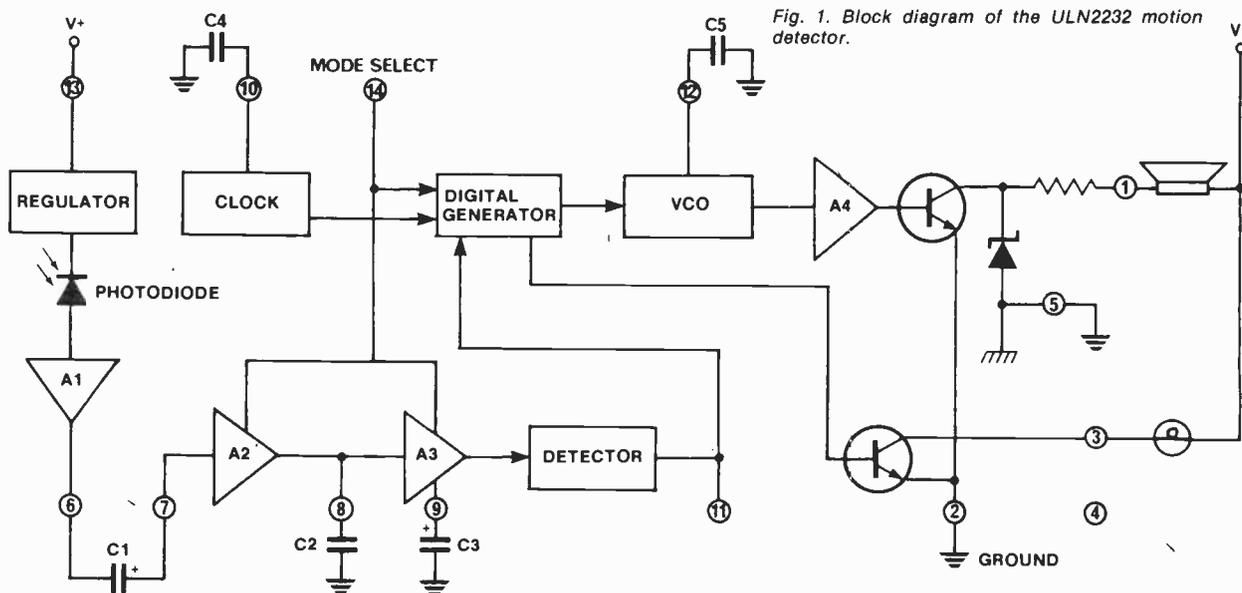


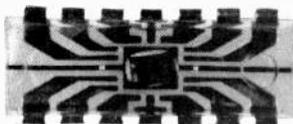
Fig. 1. Block diagram of the ULN2232 motion detector.

possibilities exist. A microphone can be used instead of the photo sensor. The gain of A2 and A3 may be varied (pin 14) and the trigger line may be permanently forced on through pin 11. Pin 14 also selects the sound options. The various capacitors adjust the frequency response or outputs. See Fig. 3 for details.

OTHER FEATURES

Of technical interest are a number of details about this device. High gain (40dB) linear amplifiers were fabricated for operation off power supplies as low as 2.5V. A logarithmic amplifier and linear detector are combined in order to detect a constant percentage light change. In addition, our "Applications Information" sheet says that the chip uses a "Class D"

Fig. 2. Photograph of the ULN2232A with transparent body. At last you can actually see how little there is in a DIP! Note the small black square in the centre of the chip itself — this is the photo diode.



amplifier for high efficiency. We suspect this means that the audio signal is a rectangular (Digital) wave rather than sine or triangle. This is not quite what Class D means, but it is the obvious way to dissipate less heat on the chip.

CONCLUSIONS

The 2232A is fascinating to play with and has many useful applications, other than toys. Speaking of which, here's a free tip. You can guess how many 2232A robots, R2D2's, animals, paper weights, Barbie dolls, cigarette

dispensers, hood ornaments etc there are going to be by Christmas time. If you want to keep your sanity make **sure** you don't buy any batteries.

Seriously though, it must say something about us if such amazing technology in this rather incredible little chip can so quickly receive a blasé reaction, but it's sure to happen. Familiarity breeds contempt. Better get yours now before the novelty wears off. Should be less than \$10.00 per piece at Sprague distributors.

Many thanks to Eric Hartwell for the material in this article.

Fig. 3. Connections and components options.

Supply voltage should be between 3V and 4.5V, current drain is 25mA. Maximum current sinkable by pin 1 is 80mA, and 500mA for pin 3.

- Pin 11 **No connection: triggering from photo detector**
High: Sound on.
- Pin 14 **High: Gain of A1 and A2 at maximum, trigger will cause a short burst of siren sound from speaker.**
Open: Reduced gain of A1 and A2, with slightly different frequency response.
Normal output is the pseudorandom sequence with light flashing slowly.
Trigger changes this to siren sound and increases flashing rate.
- C1 & 3: **Set amplifier low end cut off, 47u gives 0.7Hz.**
- C2: **Sets high cut off, 4u7 gives 9Hz**
- C4: **Sets length of sound burst (4 secs), the siren "yelp rate", the lamp flash rate (2.5 Hz in "Search" mode. (with 4u7)**
- C5: **Sets output frequency**

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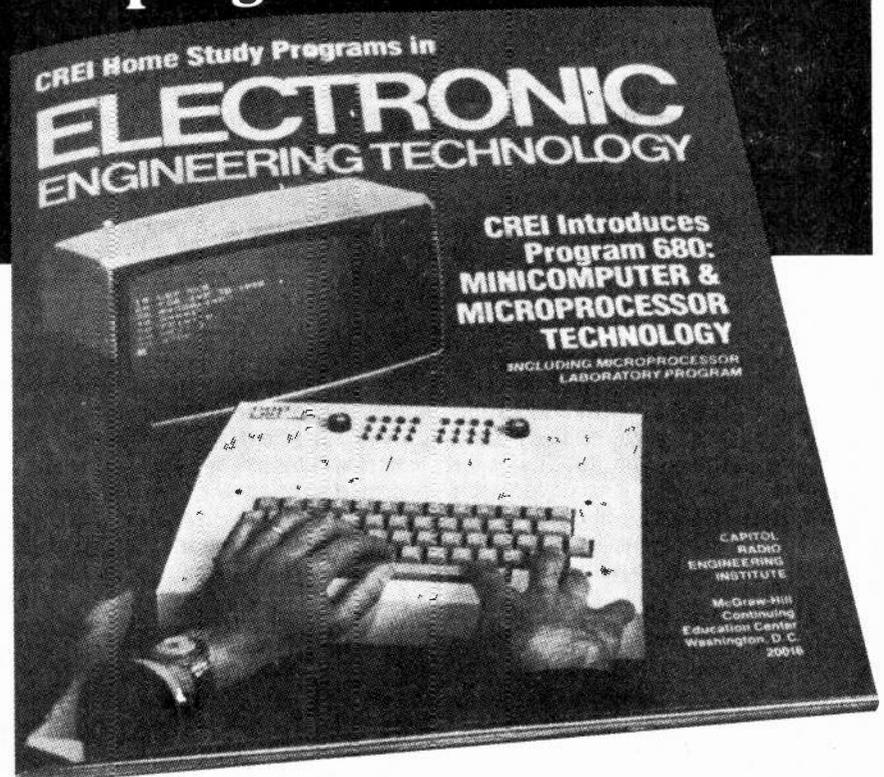
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John Garner's regular look at what's happening on short wave radio.

GENERALLY THE SHORT wave spectrum is considered to be the range of frequencies from 3,000 kHz up to 30,000 kHz (30,000,000 cycles per second). Below this, we have the long wave band and medium wave band, and above are the very high frequency and ultra high frequencies (which are not covered by most short wave receivers).

In the short wave range there are three main types of stations: (a) broadcast stations, (b) amateur radio operators, (c) utility stations.

Broadcast Stations. These are the stations which send their programs out over the airwaves to a general audience. These programs include news, music, commentaries, etc.

Amateur Radio Operators (Hams). These are radio hobbyists licensed for operating two-way communication with other amateurs around the world.

Utility Stations. These stations cover many aspects of radio and cover such stations as military, ship-to-shore, aero-nautical communications, standard time and frequency stations and much more.

All of the above stations, with few exceptions, operate within certain portions of the short wave spectrum as defined by the International Telecommunications Union (ITU). This is an international organization to which most countries belong and they are responsible for controlling international broadcasting. In 1979 a meeting will be held to discuss the various allocations of frequencies — so many of the bands now in use may be altered. This will likely relieve some of the crowded conditions around the SW bands.

Now for a breakdown of the various broadcast sections of the short wave bands. These are listed by metre bands. To convert from wavelength (in metres)

to frequency (in kHz) divide 300,000 by the wavelength. For example, 25.60 metres would be

$\frac{300,000}{25.60} = 11720 \text{ kHz}$ (in round figures).

Usually the bands are referred to the wavelengths in round figures such as the 25 metre band in this example:

120 metre band - 2300 to 2500 kHz: Very few stations operate in this band, and because they all use low power you rarely hear them. Nighttime reception only is possible in this band.

90 metre - 3200 to 3400 kHz: This is the first of the three tropical bands, so called because these bands are used mainly in the tropical areas of the world for domestic broadcasting. Since many of these countries have widely scattered populations this is usually the only form of radio available to them. Powers used by these stations are low, making reception difficult, but not impossible. Very little English is heard on these bands. Spanish and French are common as well as many lesser-known languages. Reception is only possible during darkness hours.

75 metre band - 3900 to 4000 kHz: Another tropical band, shared with amateur radio operators. A few major broadcasters operate in this band but like the 90 and 60 metre band, most of the stations are operated in domestic service for listeners in the station's country. Again night-time reception only.

60 metre band - 4750 to 5060 kHz: This is the last of the tropical bands with reception about the same as noted for the 75 and 90 metre bands. Many stations from the tropical areas operate this band for their home audiences. This is also a night-time band.

49 metre band - 5950 to 6200 kHz: A very crowded band, with major international broadcasters as well as local broadcasting stations from Asia, Africa and South America. Reception in this band is possible from late afternoon until quite late at night. Also from shortly before sunrise until shortly after sunrise, stations from Asia and the Pacific area may be heard.

41 metre band - 7100 to 7300 kHz: This is a segment of one of the exclusive North American amateur bands and therefore no broadcasters in the Americas use this band. However many broadcasters from Europe, Asia and Africa use the band direct programs our way. Reception on this band is possible from several hours before sunset until several hours after sunrise. There is usually interference from the amateurs.

31 metre band - 9500 to 9775 kHz: This is probably the best spot for listeners in Canada to hear English-language broadcasts from international

broadcasters. Many European stations, especially direct programs to North America in the evening hours, use this band. Reception on this band is best during the evening hours before your local midnight.

25 metre band - 11700 to 11975 kHz: The higher short wave frequencies provide reception in daylight hours while the lower frequencies are better during darkness. The 25 metre band is a transitional band with good reception over long distances during the daylight hours, but fading away late at night. This band is also well used by the major broadcasters. There is also some domestic programming especially from Latin America.

19 metre band - 15100 to 15450 kHz: This is a daytime band with stations from Europe in the morning, Africa in the afternoon, and very often stations from the Pacific are heard well into the late evening and even into the wee hours of the morning. Since most of the path from the Pacific is in daylight at night here in Canada reception of stations in Australia, New Zealand, Tahiti, etc are heard at this time.

16 metre band - 17700 to 17900 kHz: There are not so many stations operating in this band since reception is not too good during the low point in the eleven-year sunspot cycle. As conditions improve, this band will become more active. This is a daylight listening band.

13 metre band - 21450 to 21750 kHz: Even fewer stations operate in this band at the present time. Like the 16 metre band more stations will be moving to this band in the next year or so as conditions improve. Once again reception is only in daylight hours.

11 metre band - 25600 to 26100 kHz: I don't know of any broadcaster using this band at the present time because of the low sunspot count. Look for stations in this band next year or the following year as conditions improve. Daylight listening only.

I have mentioned the sunspot conditions a few times in the last few paragraphs. There will be more information on this and other propagation conditions in future issues of this column so that you will be able to know when and where to look for stations you wish to hear.

These bands listed above are the shortwave bands. However many stations operate outside these bands so don't be surprised to hear international broadcasters on frequencies other than these.

Next month I will continue with a look at the amateur band frequencies and utility stations. Until then 73 and good listening.

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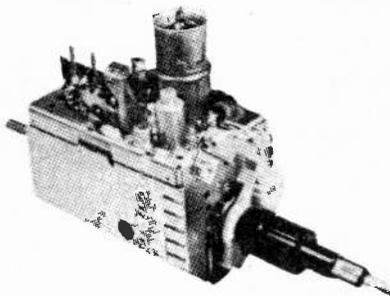
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Easy Mortgage Math

Mortgage management program lets you think you have more control over your money than the bank does. Contributed by Dick Wink of Peterborough, Ont.

Anyone who has attempted to use a regular annuities program to calculate house mortgages, may well have been disappointed to discover errors in the results. An error of even a few cents in the monthly payment can make a large difference over the time period of a normal mortgage. The normal annuity program assumes that the compounding period and payment period are the same, whereas a mortgage is usually compounded semi-annually, but paid monthly. Another difference that can occur arises because the "professional" computer print-out rounds all dollar and cent figures to two decimal places. The program outlined here, takes account of both factors and produces correctly the total interest, monthly payment and outstanding debt after n payments. It does not, of course, include property tax and insurance which are often included in the monthly payment. After using such a program you may well decide to renegotiate your mortgage. I did! Tables 1 and 2 show the status for the first four months of a \$23,000 mortgage at 10.5% per annum. By just over doubling the monthly payment, the time is reduced to one quarter and there is a saving of \$25,000 in interest.

The program was written for a Texas Instrument SR 52 and should easily "fit" into the more recent T.I. models as well as the Hewlett-Packard programmables. It can be split into two parts for calculators with smaller program memories. The formula for the true monthly interest rate (i^*) in decimal rather than percentage form is:

$$i^* = (1 + i/c)^{c/12} - 1$$

where i is the annual interest rate in decimal form and c is the number of compoundings per year. The installment payment that the home-owner makes each month (PMT) is given by the equation

$$PMT = P \cdot i^* / (1 - (1 + i^*)^{-12t})$$

where P is the initial dollar value of the mortgage, or principal, and t is the number of years over which the mortgage is amortised. The total interest that the home-owner pays over the full period of the mortgage (a truly horrifying sum) is given by:

$$TOT\ INT = PMT \cdot (12t) - P$$

These calculations are all performed in the first portion of the program. The second portion uses an iterative technique to generate the lines of the amortisation table so that the outstanding balance after the n th monthly payment can be calculated.

It is quite simple to derive an expression for outstanding balance but the results will disagree with those produced "professionally" because the calculator will perform the computation to a much greater degree of accuracy than the two decimal places appropriate to financial calculations. The iterative technique conforms to standard practice in mortgage computation. If $OP(n-1)$ denotes the outstanding principal just prior to the n th payment, then the interest payable at this time is:

$$I(n) = OP(n-1) \cdot i^*$$

The part of the payment which can be applied to reducing the debt (decrement of principal) is:

$$DP(n) = PMT - I(n)$$

The new principal - or debt after the n th payment has been made - is given by:

$$OP(n) = OP(n-1) - DP(n)$$

These three expressions are all calculated in the loop illustrated in the flowchart. Referring to the flowchart, it will be seen that the principal (P), annual interest rate per cent ($i\%$), number of compoundings (c) (Usually $c = 2$, semi-annual compounding) and time (t) years over which the mortgage is amortised are entered and stored. The number of payments made, (n), is then entered and the program is run. If $n=0$, only part A is run and the monthly payment and total interest are displayed. If n is non-zero the program enters the loop, initialising the counter and generating successive lines of the amortisation table until the n th payment is reached and the program halts. Outstanding principal, decrement of principal and interest portion of the payment are in memory and can be displayed. If a printer is available, a very minor modification can effect a printout of the entire amortisation table and not just the n th line. The total program uses 12 memories, 3 levels of parenthesis and one single level subroutine for rounding of the dollars and cents figures.

Table 1. For Principal $P = \$23000$, Rate $i = 10.5\%$ compounded semi-annually over 20 years. Monthly payment (PMT) = \$226.20

Payment #	Outstanding Principal Before Payment $OP(n-1)$	Interest $I(n)$	Reduction in Principal $DP(n)$	Outstanding Principal After Payment $OP(n)$
0				23000.00
1	23000.00	196.98	29.22	22970.78
2	22970.78	196.73	29.47	22941.31
3	22941.31	196.48	29.72	22911.59
4	22911.59	196.23	29.97	22881.62

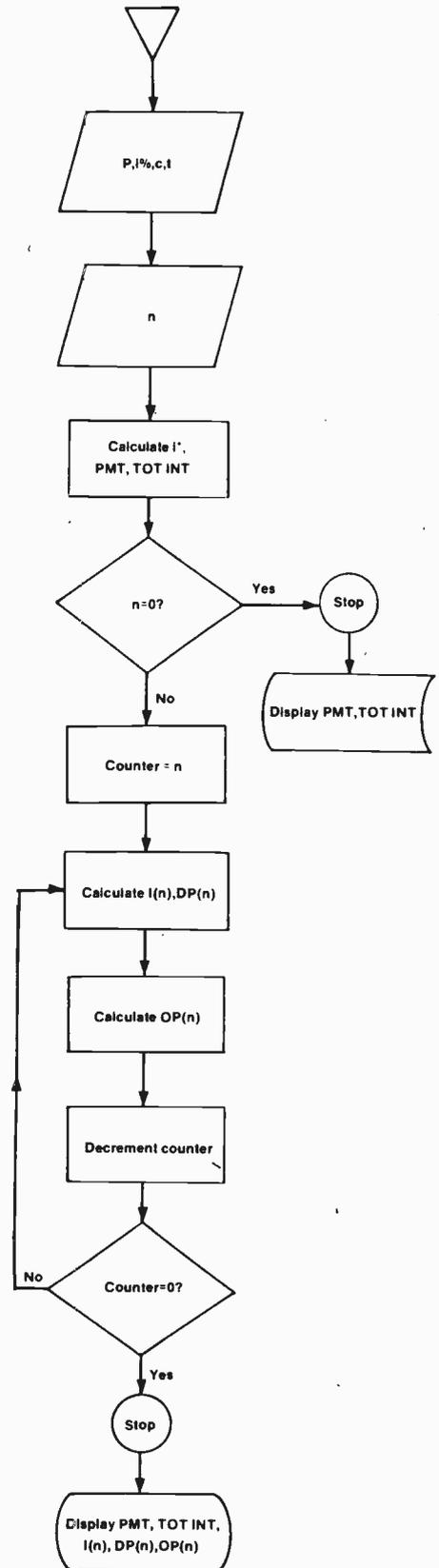
Total interest paid = \$31288.00

Table 2. For $P = \$23000$, $i = 10.5\%$ compounded semi-annually over 5 years. Monthly payment (PMT) = \$491.83

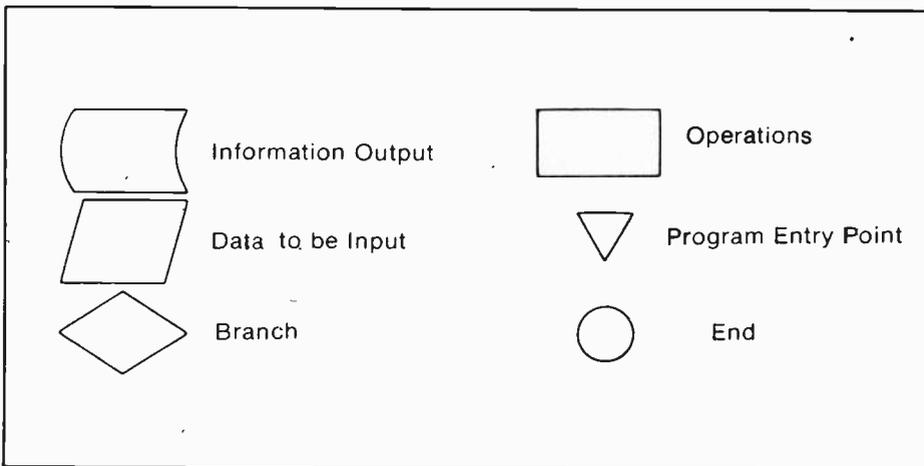
Payment #	Outstanding Principal Before Payment $OP(n-1)$	Interest $I(n)$	Reduction in Principal $DP(n)$	Outstanding Principal After Payment $OP(n)$
0				23000.00
1	23000.00	196.98	294.85	22705.15
2	22705.15	194.46	297.37	22107.86
3	22107.86	191.91	299.92	21805.37
4	21805.37	189.34	302.49	21502.88

total interest paid = \$6509.80

FLOW CHART

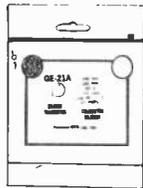


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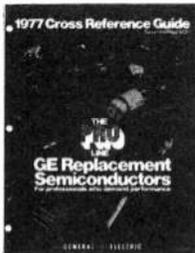
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PROGRAM

LOC CODE KEY

000	46	LBL	035	09	9	070	75	-	105	02	2	140	01	1	175	81	HLT
	11	A		42	STD		01	1		65	x		00	0		46	LBL
	42	STO		01	1		54	)		43	RCL		65	x		17	B'
	00	0		00	0		42	STO		00	0		43	RCL		43	RCL
	01	1		43	RCL		01	1		04	4		01	1		00	0
005	81	HLT	040	00	0	075	01	1	110	95	=	145	01	1	180	07	7
	46	LBL		01	.1		55	:		75	-		95	=		81	HLT
	12	B		65	x		53	(		43	RCL		51	SBR		46	LBL
	42	STO		53	(		53	(		00	0		87	1*		18	C'
	00	0		53	(		01	1		01	1		42	STO		43	RCL
010	02	2	045	53	(	080	75	-		95	=	150	00	0		01	1
	81	HLT		01	1		53	(		42	STO		08	8		00	0
	46	LBL		85	+		01	1		00	0		75	-	187	81	HLT
	13	C		43	RCL		85	+		07	7		43	RCL		46	LBL
	42	STO		00	0		43	RCL		43	RCL		00	0		19	D'
015	00	0	050	02	2	085	01	1	120	00	0	155	06	6	190	43	RCL
	03	3		55	:		01	1		05	5		95	=		00	0
	81	HLT		01	1		54	)		22	INV		42	STO		08	8
	46	LBL		00	0		45	y ^x		90	if zro		00	0		81	HLT
	14	D		00	0		53	(		01	1		09	9		46	LBL
020	42	STO	055	55	:	090	43	RCL	125	03	3	160	44	SUM	195	10	E'
	00	0		43	RCL		00	0		00	0		01	1		43	RCL
	04	4		00	0		04	4		57	FIX		00	0		00	0
	81	HLT		03	3		65	x		02	2		58	dsz		09	9
	46	LBL		54	)		01	1		81	HLT		01	1		81	HLT
025	15	E	060	45	y ^x	095	02	2	130	42	STO	165	03	3	200	46	LBL
	42	STO		53	(		94	+/-		00	0		09	9		87	1*
	00	0		43	RCL		95	=		00	0		57	FIX		57	FIX
	05	5		00	0		51	SBR		43	RCL		02	2		02	2
	00	0		03	3		87	1*		00	0		81	HLT		52	EE
030	42	STO	065	55	:	100	42	STO	135	01	1	170	46	LBL	205	22	INV
	00	0		01	1		00	0		42	STO		16	A'		52	EE
	08	8		02	2		06	6		01	1		43	RCL		22	INV
	42	STO		54	)		65	x		00	0		00	0		57	FIX
	00	0		54	)		01	1		43	RCL		06	6		56	RTN

EXECUTION

Procedure	Enter	Press	Display
1 Enter mortgage details	Principal	A	P
	Rate % P.A.	B	i%
	Compundings/Year	C	i
	Time-Years	D	t
	Number of payments	E	0.00
2 Recover results	2nd	A	PMT
	2nd	B	TOT INT
	2nd	C	OP.(n)
	2nd	D	I(n)
	2nd	E	DP(n)
3 For arbitrary payment*, time not specified follow step 1 entering P, i%, c. Enter 30 for t and 0 for n.	Arbitrary Payment:	STO 0 6	
		STO 0 5	
		GTO 130 RUN	
Then return to step 2			
*Unusual - but it can happen in some older private mortgages.			

SOFTSPOT is ETI's programmable calculator software department. We know there are many of you who have gone to a lot of effort to write routines for your machines — how about sharing the fun. Send us a copy of your pet program, preferably with flow chart. To make things interesting we will restrict our choices to only those programs making use of loops or conditionals.

All programs we publish will be paid for.

Mail to: ETI Softspot
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Don't forget to mention what kind of calculator you use — and we'd also be interested to know where you bought it.

Tech Tips

Tech-Tips is an ideas forum and is not aimed at the beginner.

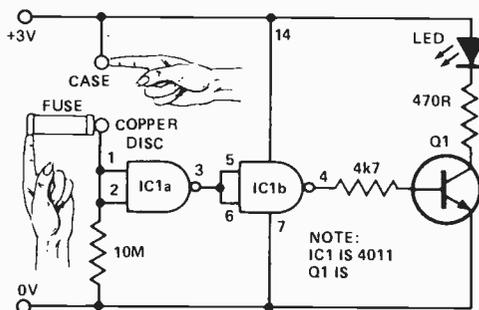
ETI is prepared to consider circuits or ideas submitted by readers for this page. All items used will be paid for. Drawings should be as clear as possible and the text should preferably be typed. Circuits must not be subject to copyright. Items for consideration should be sent to ETI TECH-TIPS, Electronics Today International, Unit 6, 25 Overlea Blvd., Toronto, Ontario, M4H 1B1.

FUSE TESTER

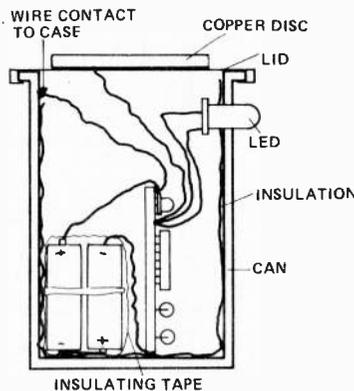
R. Heggie.

This circuit can be used for testing fuses, and has the advantage of being much smaller and easier to use than an ohm meter. The circuit is built into a 35mm aluminium film can, and is powered by two small mercury cells. An old penny glued to the plastic lid of the can forms one of the touch contacts, and the case forms another.

To test a fuse, the case is held on one hand and the fuse in the other, the end being touched onto the copper disc, if the fuse is OK a small current will flow through to the first gate of IC1a taking the input high and the output low. This is inverted by IC1b, which turns Q1 on, lighting the LED. As current consumption with the LED extinguished is almost negligible, a battery switch is not required.



IMPORTANT: All unused inputs on IC1 should be grounded.



CONSTANT CURRENT SOURCE

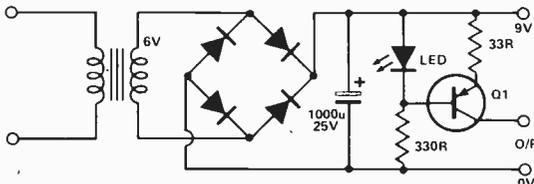
S. Callaghan

This circuit uses a standard panel mounting LED to provide a constant reference voltage for a transistor in a constant current generator.

The output current I , is given by

$$I = \frac{V_{LED} - V_{BE}}{R_E}$$

When the circuit is not connected to a load, the LED is extinguished, giving a visible indication of when the circuit is operating.



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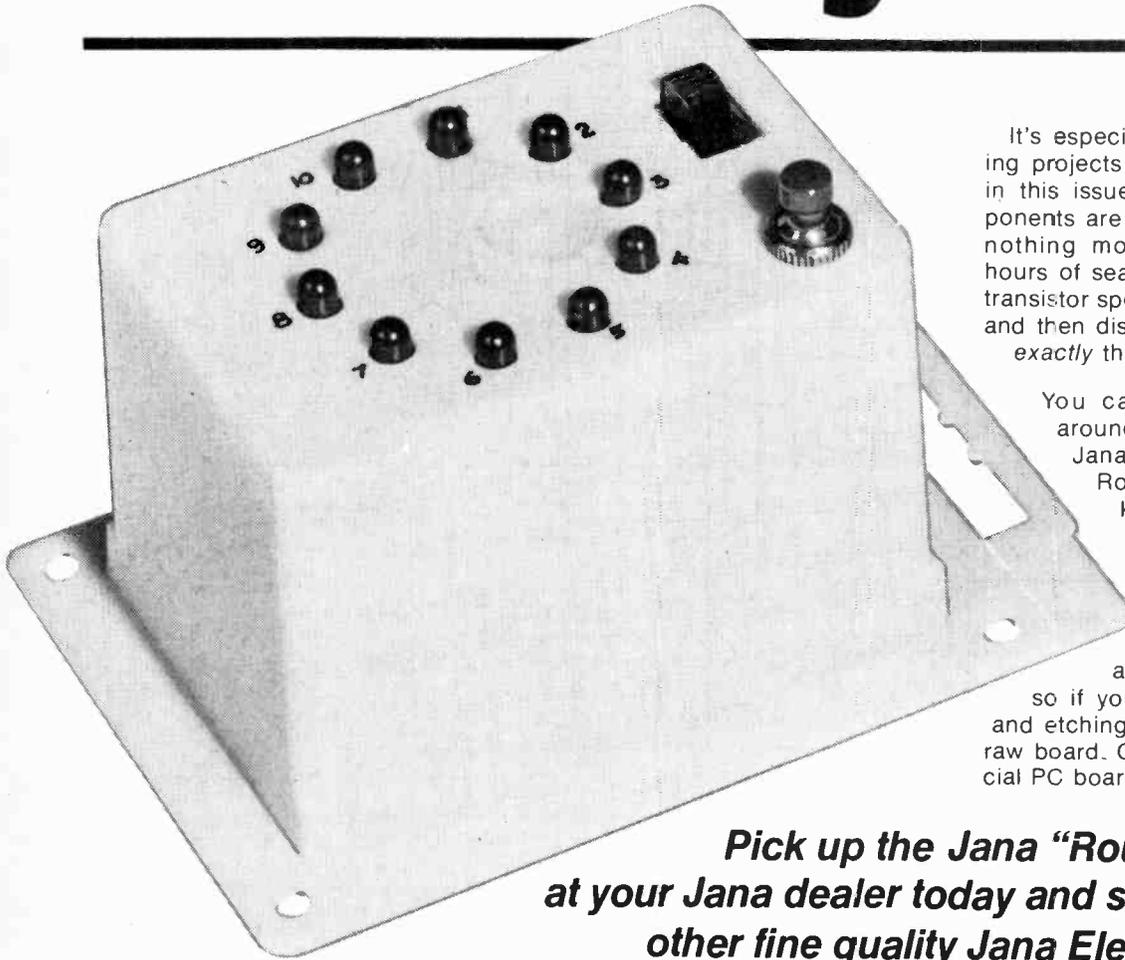
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Jana Quality Kits



It's especially important when building projects like the "Roulette Wheel" in this issue, to make sure the components are properly matched. There's nothing more frustrating than after hours of searching for the exact IC or transistor specified, having to substitute and then discover the kit doesn't work exactly the way it's supposed to.

You can avoid the parts run-around by going straight to your Jana Dealer and picking up the Roulette wheel parts kit. Jana kits are both economical and versatile. They come complete with a heavy duty mounting chassis and all the critical Components. Jana packages PC boards separately so if you decide to do the layout and etching yourself you can buy the raw board. Or if you prefer a commercial PC board, Jana has that too.

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| 4. Code Oscillator | 14. 9V Power Supply | 23. LJ 12016A Color Organ |
| 5. Crystal Radio | 15. 0-20V Power Supply | 24. Loudmouth Siren |
| 7. Curiosity Box II | 16. Single Channel Color Organ | 25. Roulette Wheel |
| 8. Dally Lighter | 17. Electronic Siren | 26. Electronic Sheet Game |
| 9. Decision Maker | 18. Shimmer Strobe Light | 27. Electronic Dice |
| 10. Fish Caller | 19. Tone Generator | 28. Super Roulette |
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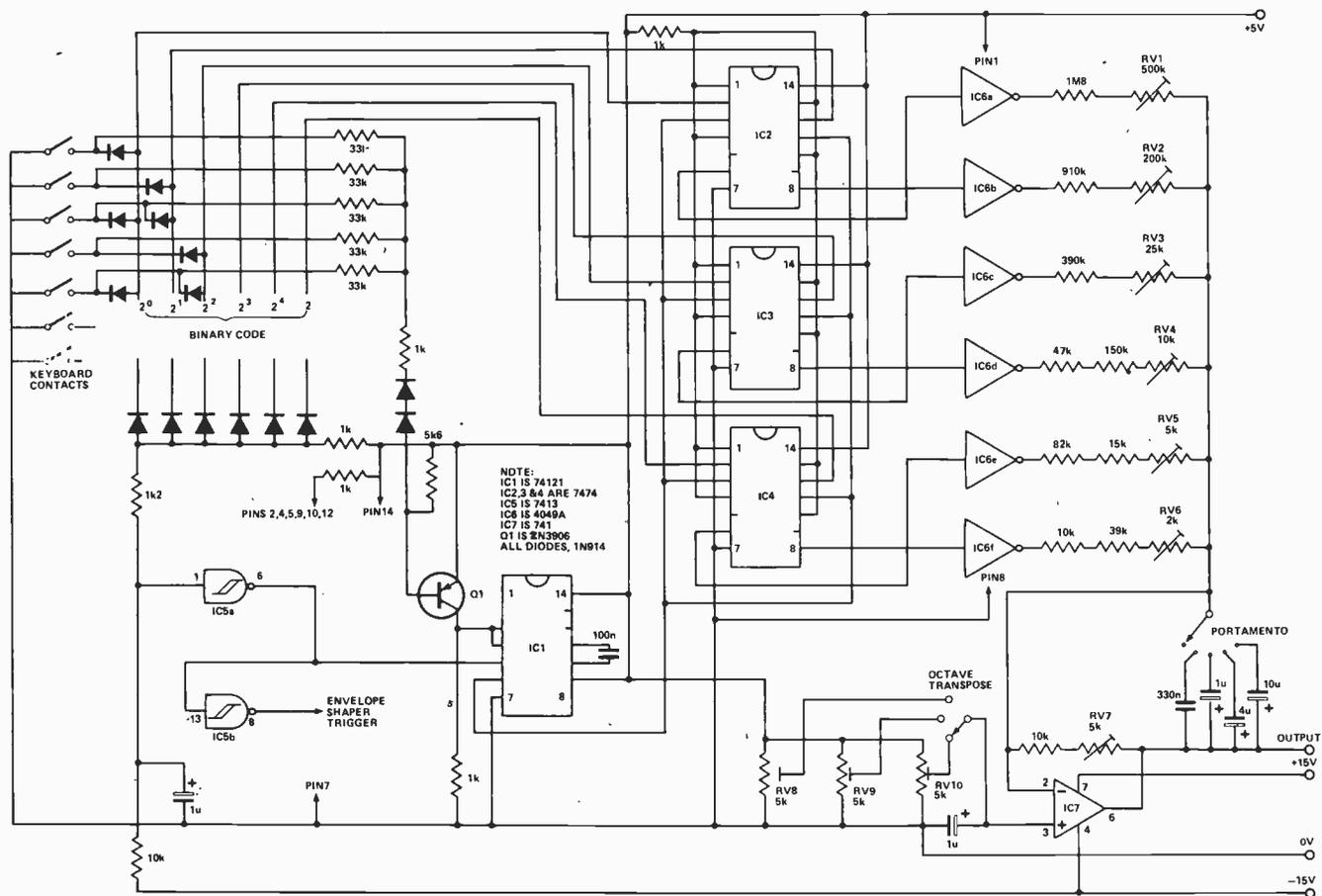
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Tech Tips

DIGITAL KEYBOARD CONTROLLER

P. Williams



This circuit was designed to overcome all the problems associated with resistor ladders and analogue memories normally found in synthesizers. The key depressions cause a diode matrix to set up binary patterns which are memorised on a bank of flip-flops.

The main advantages of this method are infinite memory hold; more accurate output since there are only six main tuning resistors (it is economical to make them variable). If more than one key is depressed at a time, no "out of tune" notes will be produced because of a multiple key depression detector. Only one set of single make contacts is required for the keyboard. Octave transpose and portamento is included.

When a key is depressed, the binary code set up by the diodes is

clocked into the flip-flop (IC2-IC4) by the monostable (IC6). IC7 along with its associated resistors forms a D/A converter. The 33k resistors along with Q1 form the circuit which inhibits further data being clocked into the flip-flops if more than one key edge to trigger envelope shapers.

Up to 63 semitones (over five octaves) can be catered for using six data bits as shown, although more bits can be added.

RV1 to RV6 should be adjusted so that each successive bit causes twice as much change in the output voltage. RV7 adjusts the voltage/frequency relationship. RV8-10 adjust the starting voltage; they should be set to give the required octave shifts on the transpose control.

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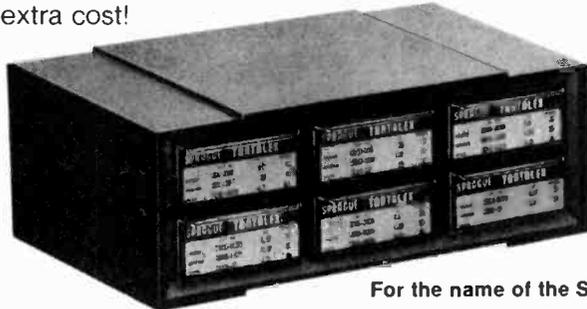
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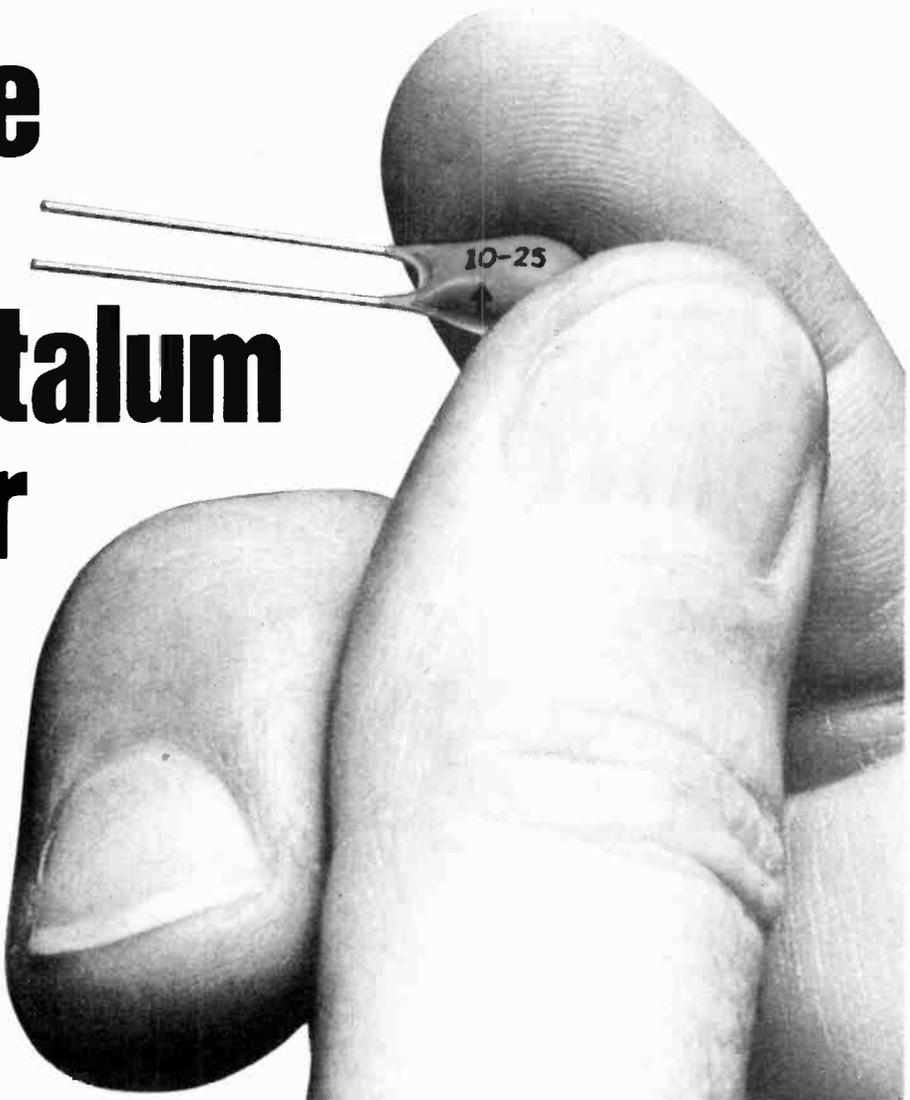
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4	SD35-R109	1	4	SD35-2R29	2.2
2	SD35-R159	15	1	SD35-3R39	3.3
2	SD35-R229	22	8	SD35-4R79	4.7
2	SD35-R339	33	8	SD35-6R89	6.8
5	SD35-R479	47	10	SD35-109	10
2	SD35-R689	68	2	SD35-159	15
8	SD35-19	1.0	8	SD35-229	22
2	SD35-1R59	1.5	2	SD35-339	33

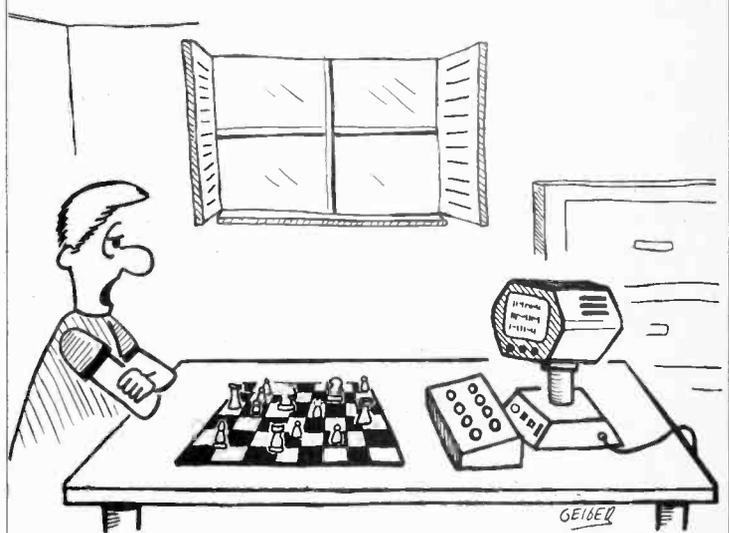
The Fun of Electronics



IF THE BOSS CALLS, TELL HIM I WON'T BE IN TODAY TO WORK ON THE COMPUTERS; TELL HIM I'M STAYING HOME TO... ER... CHECK OUT A NEW PROGRAM.



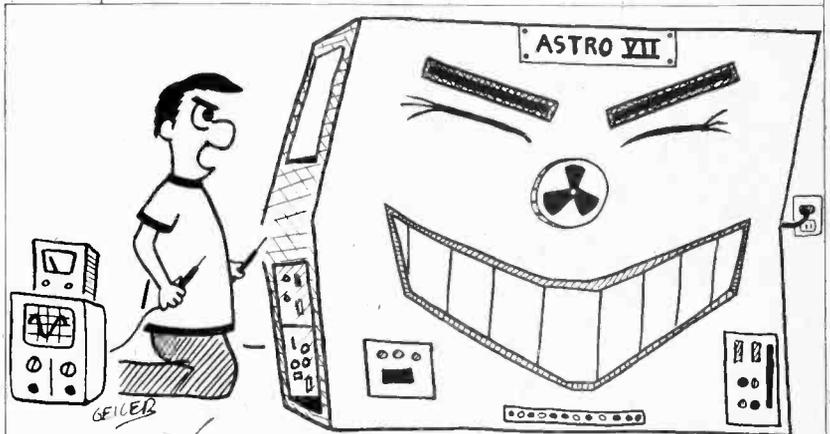
I DON'T UNDERSTAND IT, GEORGE. I INSTALLED THAT WAVE TRAP LIKE YOU SAID, BUT I'M STILL GETTING INTERFERENCE. DO YOU THINK MAYBE I'M USING THE WRONG KIND OF BAIT?



I DON'T WANT TO INFLUENCE YOUR NEXT MOVE, BUT LET ME REMIND YOU THAT THE LAST COMPUTER THAT BEAT ME AT CHESS IS NOW A COFFEE DISPENSING MACHINE IN THE LOBBY OF A FOUR ROOM MOTEL IN KAPUSKASING.



THAT CORRESPONDENCE COURSE ON HOW TO BECOME AN ELECTRONICS REPAIRMAN SURE IS COMPREHENSIVE; CHAPTER 14 IS TITLED, "HOW TO PAD A BILL, AND HOW MUCH TO CHARGE FOR FIXING SOMETHING THAT YOU BROKE YOURSELF."



LET'S GET ONE THING STRAIGHT: THERE'S NO WAY I CAN CONCENTRATE ON FIXING YOU IF YOU'RE GONNA GIGGLE EVERYTIME I TOUCH YOU WITH THE TEST PROBE.

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1N914	100v	10mA	.05	8-pin pcb	.20	ww	.35	2N2222	NPN (2N2222 Plastic .10)	.15			
1N4005	600v	1A	.08	14-pin pcb	.20	ww	.40	2N2907	PNP	.15			
1N4007	1000v	1A	.15	16-pin pcb	.20	ww	.40	2N3906	PNP (Plastic - Unmarked)	.10			
1N4148	75v	10mA	.05	18-pin pcb	.25	ww	.75	2N3904	NPN (Plastic - Unmarked)	.10			
1N4733	5.1v	1 W Zener	.25	22-pin pcb	.35	ww	.95	2N3054	NPN	.35			
1N753A	6.2v	500 mW Zener	.25	24-pin pcb	.35	ww	.95	2N3055	NPN 15A 60v	.50			
1N758A	10v	"	.25	28-pin pcb	.45	ww	1.25	T1P125	PNP Darlington	.35			
1N759A	12v	"	.25	40-pin pcb	.50	ww	1.25	LED Green, Red, Clear, Yellow		.15			
1N5243	13v	"	.25	Molex pins .01	To-3 Sockets	.25		D.L.747	7 seg 5/8" High com-anode	1.95			
1N5244B	14v	"	.25	2 Amp Bridge	100-prv	.95		MAN72	7 seg com-anode (Red)	1.25			
1N5245B	15v	"	.25	25 Amp Bridge	200-prv	1.95		MAN3610	7 seg com-anode (Orange)	1.25			
								MAN82A	7 seg com-anode (Yellow)	1.25			
								MAN74A	7 seg com-cathode (Red)	1.50			
								FND359	7 seg com-cathode (Red)	1.25			

C MOS		- T T L -									
4000	.15	7400	.10	7473	.25	74176	.85	74H72	.35	74S133	.40
4001	.15	7401	.15	7474	.30	74180	.55	74H101	.75	74S140	.55
4002	.20	7402	.15	7475	.35	74181	2.25	74H103	.55	74S151	.30
4004	3.95	7403	.15	7476	.40	74182	.75	74H106	.95	74S153	.35
4006	.95	7404	.10	7480	.55	74190	1.25			74S157	.75
4007	.20	7405	.25	7481	.75	74191	.95	74L00	.25	74S158	.30
4008	.75	7406	.25	7483	.75	74192	.75	74L02	.20	74S194	1.05
4009	.35	7407	.55	7485	.55	74193	.85	74L03	.25	74S257 (8123)	1.05
4010	.35	7408	.15	7486	.25	74194	.95	74L04	.30		
4011	.20	7409	.15	7489	1.05	74195	.95	74L10	.20	74LS00	.20
4012	.20	7410	.15	7490	.45	74196	.95	74L20	.35	74LS01	.20
4013	.40	7411	.25	7491	.70	74197	.95	74L30	.45	74LS02	.20
4014	.75	7412	.25	7492	.45	74198	1.45	74L47	1.95	74LS04	.20
4015	.75	7413	.25	7493	.35	74221	1.00	74L51	.45	74LS05	.25
4016	.35	7414	.75	7494	.75	74367	.75	74L55	.65	74LS08	.25
4017	.75	7416	.25	7495	.60			74L72	.45	74LS09	.25
4018	.75	7417	.40	7496	.80	75108A	.35	74L73	.40	74LS10	.25
4019	.35	7420	.15	74100	1.15	75491	.50	74L74	.45	74LS11	.25
4020	.85	7426	.25	74107	.25	75492	.50	74L75	.55	74LS20	.20
4021	.75	7427	.25	74121	.35			74L93	.55	74LS21	.25
4022	.75	7430	.15	74122	.55			74L123	.85	74LS22	.25
4023	.20	7432	.20	74123	.35	74H00	.15			74LS32	.25
4024	.75	7437	.20	74125	.45	74H01	.20	74S00	.35	74LS37	.25
4025	.20	7438	.20	74126	.35	74H04	.20	74S02	.35	74LS38	.35
4026	1.95	7440	.20	74132	.75	74H05	.20	74S03	.25	74LS40	.30
4027	.35	7441	1.15	74141	.90	74H08	.35	74S04	.25	74LS42	.65
4028	.75	7442	.45	74150	.85	74H10	.35	74S05	.35	74LS51	.35
4030	.35	7443	.45	74151	.65	74H11	.25	74S08	.35	74LS74	.35
4033	1.50	7444	.45	74153	.75	74H15	.45	74S10	.35	74LS86	.35
4034	2.45	7445	.65	74154	.95	74H20	.25	74S11	.35	74LS90	.55
4035	.75	7446	.70	74156	.70	74H21	.25	74S20	.25	74LS93	.55
4040	.75	7447	.70	74157	.65	74H22	.40	74S40	.20	74LS107	.40
4041	.69	7448	.50	74161	.55	74H30	.20	74S50	.20	74LS123	1.00
4042	.65	7450	.25	74163	.85	74H40	.25	74S51	.25	74LS151	.75
4043	.50	7451	.25	74164	.60	74H50	.25	74S64	.15	74LS153	.75
4044	.65	7453	.20	74165	1.10	74H51	.25	74S74	.35	74LS157	.75
4046	1.25	7454	.25	74166	1.25	74H52	.15	74S112	.60	74LS164	1.00
4049	.45	7460	.40	74175	.30	74H53J	.25	74S114	.65	74LS193	.95
4050	.45	7470	.45			74H55	.20			74LS367	.75
4066	.55	7472	.40							74LS368	.65

4069/74C04	.25
4071	.25
4081	.30
4082	.30
MC 14409	14.50
MC 14419	4.85
4511	.95
74C151	1.90

9000 SERIES			
9301	.85	95H03	1.10
9309	.35	9601	.20
9322	.65	9602	.45

MICRO'S, RAMS, CPU'S, E-PROMS			
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1702A	4.50	8224	3.25
MM5314	3.00	8228	6.00
MM5316	3.50	8251	8.50
2102-1	1.45	8255	10.50
2102L-1	1.75	8T13	1.50
2114	9.50	8T23	1.50
TR1602B	3.95	8T24	2.00
TMS 4044	9.95	8T97	1.00
		2107B-4	4.95
8080	8.95	2708	9.50
8212	2.95	Z80 PIO	8.50

LINEARS, REGULATORS, etc.			
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8038	3.95	LM320T12	1.65
LM201	.75	LM320T15	1.65
LM301	.45	LM324N	1.25
LM308 (Mini)	.95	LM339	.75
LM309H	.65	7805 (340T5)	.95
LM309K (340K-5)	.85	LM340T12	.95
LM310	.85	LM340T15	.95
LM311D (Mini)	.75	LM340T18	.95
LM318 (Mini)	1.75	LM340T24	.95
LM320K5 (7905)	1.65	LM340K12	1.25
LM320K12	1.65	LM340K15	1.25
		LM340K18	1.25
		LM340K24	1.25
		78L05	.75
		78L12	.75
		78L15	.75
		78M05	.75
		LM373	2.95
		LM380 (8-14 PIN)	.95
		LM709 (8, 14 PIN)	.25
		LM711	.45
		LM723	.40
		LM725N	2.50
		LM739	1.50
		LM741 (8-14)	.25
		LM747	1.10
		LM1307	1.25
		LM1458	.65
		LM3900	.50
		LM75451	.65
		NE555	.35
		NE556	.85
		NE565	.95
		NE566	1.25
		NE567	.95

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ETI Project File

Updates, news, information, ETI gives you project support

PARTS PARTS PARTS

We are continually besieged with letters from readers asking where they can get parts in their area. Since we can't take a country-wide tour to check where all the electronics parts-places are, how about sending us a note on any stores you have found useful, what they are good for (if you own the place you can contribute too!) and so on. At some time in the future we would like to help out the "lost" readers by publishing a rundown of where to get what.

PROJECT FILE is our department dealing with information regarding ETI Projects. Each month we will publish the Project Chart, any Project Notes which arise, general Project Constructor's Information, and some Reader's Letters and Questions relating to projects.

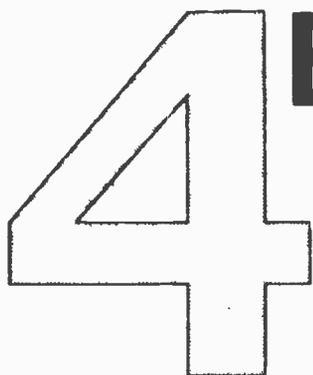
PROJECT NOTES

Since this magazine is largely put together by humans, the occasional error manages to slip by us into print. In addition variations in component characteristics and availability occur, and many readers write to us about their experiences in building our projects. This gives us information which could be helpful to other readers. Such information will be published in Project File under Project Notes. (Prior to May 78 it was to be found at the end of News Digest.)

Should you find that there are notes you wish to read for which you do not have the issue, you may obtain them in one of two ways. You can buy the back issue from us (refer to Project Chart for date of issue and see also Reader Service Information on ordering). Alternatively you may obtain a photocopy of the note free of charge, so long as your request includes a self addressed stamped envelope for us to mail it back to you. Requests without SASE will not be answered.

PROJECT CONSTRUCTOR'S INFORMATION

Useful information on the terminology and notation will be published each month in Project File.



ETI Publications

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(not cash), to

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Electronics Today International
Unit Six
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Toronto, Ontario
M4H 1B1

Please specify which publications
you require, and print your name
and address clearly.

Canadian Projects Book No. 1

\$3.00

Top projects from the early issues of ETI's Canadian edition, plus some of the projects from the UK edition's issues which were distributed in Canada in 1976. All projects use parts available in Canada. Those projects from UK edition have been completely re-worked in Canada for Canadian constructors. Includes a series of modular disco projects, plus games, biofeedback, metal locator, etc.

Circuits No. 1

\$5.00

A brand new concept from the house of ETI. More than 100 pages packed with a wide range of experimenters circuits. Based on the 'Tech Tips' section carried in the overseas editions of ETI, Circuits 1 is the first of a series of specials — produced for the enthusiasts who know what they want, but not where to get it! Circuits 1 will also act as a catalyst for further development of ideas, ideal for the experimenter. The collection of more than 200 circuits is complemented by a comprehensive index, making searches for a particular circuit quick and simple. Also, similar circuits can be compared easily, due to the logical layout and grouping used throughout. Last and by no means least, Circuits 1 has no distracting advertisements in the main section!

Electronics — it's easy Volume 1

\$3.50*

The best introductory series to electronics ever published in a magazine. Volume three completing the series, will be available in a few months. Volume One introduces electronics to the beginner by going through the systems approach, basic concepts, meters and measurements, frequency and wavelengths, electronics and communication, capacitance and inductance, capacitive and inductive reactance, resistance, capacitance and inductance in combination, detection and amplification, elements of transistor amplifiers, emitter followers and DC amplifiers, and basic operational amplifiers

Electronics — it's easy Volume 2

\$3.50*

Volume Two introduces the sources of power, simple power supplies, how regulated power supplies work, general purpose supplies, generating signal waveforms, generating non-sinusoidal waveforms, all about electronic filters, more about filters, introducing digital systems, the algebra of logic, integrated circuit forms of logic functions, digital sub-systems, counters and shift registers.

\$6.00 For Both*

ETI Project Chart Sept. 77 to Sept. 78

ISSUE DATE	ARTICLE	ISSUE DATE	ARTICLE
Sept 77	Audio Sweep Osc.	Apr 78	Neg.
Sept 77	Microamp	May 78	Note: N
Sept 77	Bongos	Feb 78	Freezer Alarm
Sept 77	Alarm Alarm	Apr 78	Neg.
Oct 77	Graphic Equaliser	Mar 78	Hammer Throw
Feb 78	Note: D	June 78	Neg.
Oct 77	Loud Hailer	Apr 78	Computer PSU & Neg.
Oct 77	Continuity Tester	Apr 78	Audio Delay Line & Neg.
Oct 77	Stereo Simulator	Mar 78	True RMS Meter
Nov 77	Digital Thermometer	Apr 78	Neg.
Jan 78	Note: C, T, S,	Mar 78	Home Burglar Alarm
Jan 78	Neg.	Apr 78	Gas Alarm & Neg.
Feb 78	Note: S	May 78	White Line Follower
Nov 77	3-Channel Tone Control	June 78	Neg.
Jan 78	Neg.	May 78	Acoustic Feedback Eliminator
Nov 77	Watchdog	June 78	Neg.
Jan 78	Neg.	May 78	Add-on FM Tuner
Aug 78	Note: D	June 78	Neg.
Dec 77	50D50 Amplifier	June 78	Audio Analyser
Jan 78	Neg.	June 78	Ultrasonic Switch & Neg.
Feb 78	Note: T	June 78	Phone Bell Extender & Neg.
Dec 77	Spirit Level	July 78	Proximity Switch
Jan 78	Neg.	Aug 78	Neg.
Dec 77	Egg Timer	July 78	Real Time Analyser MK II (LED)
Jan 78	Neg.	Aug 78	Neg.
Jan 78	Option Clock & Neg.	July 78	Acc. Beat Metronome.
July 78	Note: S	Aug 78	Neg.
Jan 78	LED Pendant	July 78	Race Track
May 78	Note: C	Aug 78	Neg.
Jan 78	Compander & Neg.	Aug 78	Sound Meter & Neg.
Feb 78	Tachomonitor	Aug 78	Porch Light & Neg.
Apr 78	Neg.	Aug 78	IB Metal Locator & Neg.
Feb 78	LCD Panel Meter	Aug 78	Two Chip Siren & Neg.
Apr 78	Note: C	Sept 78	Audio Oscillator
Apr 78	Neg.	Sept 78	Shutter Timer
Feb 78	CB Power Supply	Sept 78	Rain Alarm

PROJECT CHART

This chart is an index to all information available relating to each project we have published in the preceding year. It guides you to where you will find the article itself, and keeps you informed on any notes that come up on a particular project you are interested in. It also gives you an idea of the importance of the notes, in case you do not have the issue referred to on hand.

Every few months we print a pull out section in the magazine which may be used as a photographic negative for making printed circuit boards (as described in our January 78 issue). Each edition of this sheet contains projects from the preceding few issues. Information on where to find which negative is included in the chart.

Write to: Project File
Electronics Today International
Unit 6, 25 Overlea Blvd.,
TORONTO, Ontario
M4H 1B1

Component Notations and Units

We normally specify components using an international standard. Many readers will be unfamiliar with this but it's simple, less likely to lead to error and will be widely used sooner or later. ETI has opted for sooner!

Firstly decimal points are dropped and substituted with the multiplier, thus 4.7uF is written 4u7. Capacitors also use the multiplier nano (one nanofarad is 1000pF). Thus 0.1uF is 100n, 5600pF is 5n6. Other examples are 5.6pF = 5p6, 0.5pF = 0p5.

Resistors are treated similarly: 1.8M ohms is 1M8, 56k ohms is 56k, 4.7k ohms is 4k7, 100 ohms is 100F, 5.6 ohms is 5R6.

Kits, PCBs, and Parts

We do not supply parts for our projects, these must be obtained from component suppliers. However, in order to make things easier we co-operate with various companies to enable them to promptly supply kits, printed circuit boards and unusual or hard-to-find parts. Prospective builders should consult the advertisements in ETI for suppliers for current and past projects.

Any company interested in participating in the supply of kits, pcbs or parts should write to us on their letterhead for complete information.

READER'S LETTERS AND QUESTIONS

We obviously cannot troubleshoot the individual reader's projects, by letter or in person, so if you have a query we can only answer it to the extent of clearing up ambiguities, and providing Project Notes where appropriate. If you desire a reply to your letter it must be accompanied by a self addressed stamped envelope.

Canadian Projects Book

Audio Limiter	Metal Locator
5W Stereo	Heart-Rate Monitor
Overled	GSR Monitor
Bass Enhancer	Phaser
Modular Disco	Fuzz Box
G P Preamp	Touch Organ
Bal. Mic. Preamp	Mastermind
Ceramic Cartridge Preamp	Double Dice
Mixer & PSU	Reaction Tester
VU Meter Circuit	Sound-Light Flash
Headphone Amp	Burglar Alarm
50W-100W Amp	Injector-Tracer
Note: N Apr. 78	Digital Voltmeter

Key to Project Notes

C:- PCB or component layout
D:- Circuit diagram
N:- Parts Numbers, Specs
Neg:- Negative of PCB pattern printed
O:- Other
S:- Parts Supply
T:- Text
U:- Update, Improvement, Mods
***:- Notes for this project of complicated nature, write for details (enclose S.A.S.E., see text)

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Reader Service Information

Editorial Queries

Written queries can only be answered when accompanied by a self-addressed, stamped envelope, and the reply can take up to three weeks. These must relate to recent articles and not involve ETI staff in any research. Mark your letter ETI Query.

Projects, Components, Notation

For information on these subjects please see our Project File section.

Sell ETI

ETI is available for resale by component stores. We can offer a good discount and quite a big bonus, the chances are customers buying the magazine will come back to you to buy their components. Readers having trouble getting their copy of ETI could suggest to their component store manager that he should stock the magazine.

1977
 February
~~March~~
~~April~~
 May
 June
 July
~~August~~
 September
~~October~~
 November
 December

1978
 January
 February
 March
 April
 May
 June
 July
 August

Back Issues and Photocopies

Previous issues of ETI-Canada are available direct from our office for \$2.00 each. Please specify issue by the month, not by the features you require. The following back issues are still available for sale.

We can supply photocopies of any article published in ETI-Canada, for which the charge is \$1.00 per article, regardless of length. Please specify issue and article. (A special consideration applies to errata for projects, see Project File.)

LIABILITY: Whilst every effort has been made to ensure that all constructional projects referred to in this edition will operate as indicated efficiently and properly and that all necessary components to manufacture the same will be available, no responsibility whatsoever is accepted in respect of the failure for any reason at all of the project to operate effectively or at all whether due to any fault in design or otherwise and no responsibility is accepted for the failure to obtain any component parts in respect of any such project. Further no responsibility is accepted in respect of any injury or damage caused by any fault in the design of any such project as aforesaid.

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We will allow you up to twenty-five words to advertise items you want to buy or sell, or to publicise meetings of clubs, etc. Advertising will be accepted at our discretion — we will not accept commercial or any form of company advertising. For more insertions mail in again.

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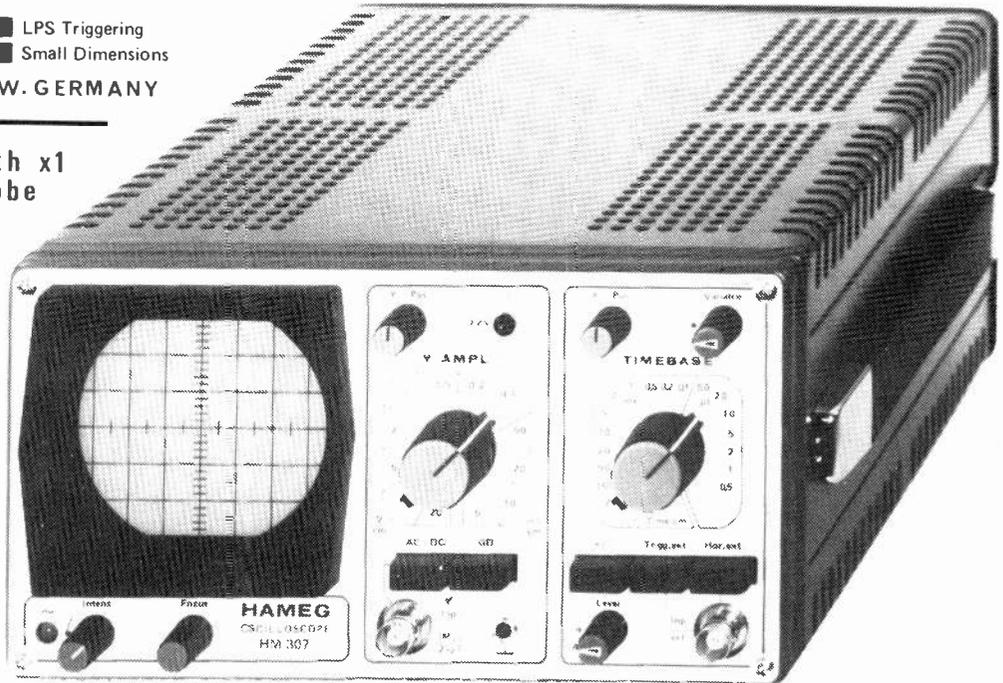
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OSCILLOSCOPE HM 307

- Bandwidth DC - 10MHz
- LPS Triggering
- Screen 7cm Ø
- Small Dimensions

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NEW with x1 probe



Specifications

Vertical Amplifier Y

Frequency range 0 - 10MHz (± 3dB)
 Risetime approx. 35ns
 Overshoot maximum 1%
 Sensitivity 5mVpp/cm (20Vpp/cm)
 Input attenuator with 12 positions (1 - 2.5 sequence)
 Deflection factor accuracy ± 5%
 Input impedance 1MΩ/25pF
 Input switchable DC AC GD
 Max. admissible input voltage 500V DC
 Linearity error max. 2%

Timebase

Sweep range 0.2s/cm - 0.5µs/cm
 with fine control 1 - 2.5 down to 0.2µs/cm
 (18 positions with 1 - 2.5 sequence)
 Sweep accuracy ± 5%
 Triggering: int or ext - pos or neg
 automatic or with adjustable level
 Trigger frequency range 1Hz - 25MHz
 Trigger threshold max. 3mV

Horizontal Amplifier X

Frequency range 3Hz - 1MHz (± 3dB)
 Sensitivity approx. 0.75Vpp/cm
 Input impedance approx. 1MΩ/25pF

Semiconductor Component Parts

6 IC, 30 transistors, 21 diodes,
 5 silicon rectifiers

Miscellaneous

Cathode-ray tube 3BP1A with 7cm Ø
 Built-in square wave generator 1kHz
 for probe adjustment (0.2Vpp)
Electronic stabilization
 for all supply voltages incl. high voltage
 Mains supply 110, 127, 220, 237V AC
 Admissible mains fluctuations
 ± 10%, 50 - 60Hz
Power consumption approx. 24W
 Weight approx. 4.5kg
 Case 212 x 114 x 265mm, anthracite
 with handle and tilt stirrup

Subject to change

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Purchase the model *HM 307* on a 14 day full money back guaranty. If for any reason you are dissatisfied or that it does not meet specifications; then return the unit along with proof of purchase and receive your full refund or credit. (Offer not valid where unit has been damaged or misused.)

\$449⁹⁵

LIST

Available Accessories

10:1 and 100:1 probe, demodulating probe, various test leads, pre-amplifier, dual-trace adapter, viewing hood, carrying case, recording camera and instrument cart.

This small trigger oscilloscope with 7cm screen is especially designed for electronic service and advanced amateurs. Despite its simplicity, it has many qualities of bigger oscilloscopes. The sensitivity of the measuring amplifier is sufficient to display also signals of a few mV without problems. The time deflection works with the new LPS trigger technique, developed by HAMEG. Signals of higher repetition frequency are also triggered absolutely jitter free. All supply voltages are stabilized. The operating elements are clearly arranged, just as is known from HAMEG instruments. A solid mechanical construction and optimum design of all technical details testify to the good value of this oscilloscope.

HAMEG

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Specifications

HM512

Modes of operation

Channel I, channel I and II

Channel switching alt. or chop.
(chopper frequency approx. 1MHz)

Summation channel I + II,

Difference with channel I inverted

X-Y operation, ratio 1 : 1

(X signal via channel II)

Vertical Amplifier Y

Frequency range of both channels

0 - 50MHz (+3dB), 0 - 65MHz (-6dB)

Risetime: approx. 7ns

Overshoot maximum 1%

Deflection coefficients: 12 calibr. pos.

5mVpp/cm - 20Vpp/cm (sequence 1-2-5)

with fine control uncal. up to 50Vss/cm

Accuracy of calibr. positions $\pm 3\%$

Input impedance 1M Ω //25pF

Input selectable: DC-AC-GD

Max. admissible input voltage 500V DC

Error of linearity: maximum 2%

Delay line (approx. 95ns)

Timebase

Deflection coefficients: 23 calibr. pos.

2s/cm - 100ns/cm (sequence 1-2-5)

with expansion x5 down to 20ns/cm

with fine control 3:1 uncal. up to 6s/cm

Accuracy of calibr. positions $\pm 3\%$

Sweep delay time: 7 positions

from 100ns to 1s, with fine control 1:10

Modes: normal, search, delayed

Triggering autom. or with adjustable level

of channel I, II, I/II and ext.: pos. and neg.

Trigger coupling AC, DC, HF or LF

Single sweep (with reset and LED)

Variable Holdoff time min. 10:1

Trigger sensitivity: < 5mm

in the frequency range DC - 70MHz

Horizontal Amplifier X

Frequency range 0 - 4MHz (-3dB)

Deflection coefficients: 12 calibr. pos.

5mVpp/cm - 20Vpp/cm (sequence 1-2-5)

with fine control uncal. up to 50Vpp/cm

Input impedance 1M Ω //25pF

(input via channel II)

Miscellaneous

Cathode-ray tube D 13-650, 13cm \emptyset

with total acceleration of 12kV

continuously adjustable raster illumination

Built-in square-wave generator 1kHz

for probe adjustment (0.2Vpp $\pm 1\%$)

Input for Z modulation (5Vpp TTL level)

Electronic stabilization incl. high voltage

Power supply for 110, 127, 220, 237V

Permissible line voltage fluctuations $\pm 10\%$

Mains frequency range 50 - 60Hz

Power consumption approx. 43W

Weight approx. 9,5kg

Case 212 x 237 x 380mm, anthracite,

with handle and tilt stirrup.



■ Bandwidth DC - 40MHz ■ Delayed Sweep

■ Delay Line ■ Single Sweep

The HM 512 is a universal oscilloscope with high accuracy. The max. error in both deflection directions is $\pm 3\%$. With the built-in delay line the trigger edge of the signal to be displayed is made visible, too. The new trigger technique developed by HAMEG permits jitter-free triggering up to at min. of 70MHz. Signals which are very hard to trigger can be represented always stable by suppression of unwished trigger signal parts by means of increased sweep holdoff time. The delayed sweep operates in a large range of time, it allows a magnification more than thousandfold of a small cut-out from the sweep period. The cathode-ray tube works with an acceleration of 12kV. The display is therefore especially bright and sharp.

Available Accessories

10: 1 probe, demodulating probe, various test leads, viewing hood, dual-trace unit, registration camera, instrument cart, carrying case, components tester.

Distributed by

Specifications **HM812**

Modes of Operation

Normal or storage operation for:
 Channel I, channel I and II,
Channel switching alt./chop.
 (chopper frequency approx. 800kHz)
 Summation channel I + II,
 Difference with channel I inverted
XY-display, ratio 1 : 1
 (X-signal via channel II)
 Single-sweep display

Vertical Amplifier Y

Frequency range of both channels
 0 - 40MHz (-3dB), 0 - 55MHz (-6dB)
 Risetime approx. 9ns
 Overshoot max. 1%
Sensitivity max. 5 mVpp/div.
 Input attenuator with 12 positions
 down to 20 Vpp/div. (sequence 1 - 2 - 5),
 with fine control 1 : 2.5 down to 50 Vpp/div.
 Calibrated Amplitude accuracy $\pm 3\%$
Input impedance 1 MOhm // 25pF
 Input switchable: DC-AC-GD
 Max. admissible input voltage 500V DC
 Max. vertical display 80mm
 Delay line (approx. 75ns)

Timebase

Sweep range 0,5s/div. - 0,1 μ s/div.
 (21 positions with sequence 1 - 2 - 5),
 with expansion x 5 down to 20ns/div.
 with fine control 1 : 3 up to 1,5s/div.
 Calibrated Time accuracy $\pm 3\%$
 Normal length of time trace 10 div.
Triggering automatical or with
 manually adjustable level of
 channel I, II or external: pos. or neg.
 Trigger coupling AC, DC or LF
 Individual display trigger action by Single
 and Reset push button with LED-indication
Trigger frequency range: DC up to 70MHz
 Trigger threshold max. 0,5 div.

Horizontal Amplifier X

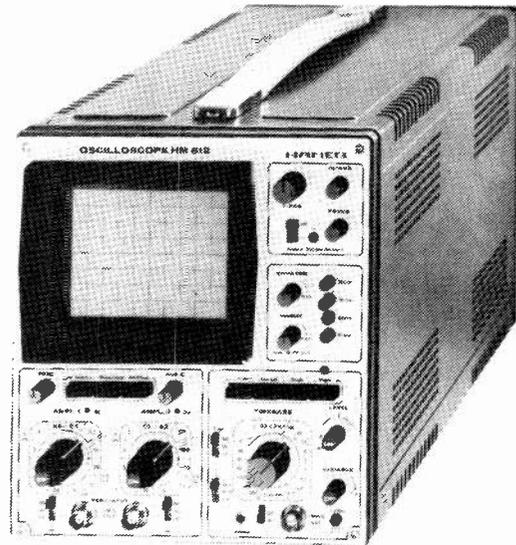
Frequency range 0 - 4MHz (-3dB)
Sensitivity max. 5 mVpp/div.
 Input impedance 1 MOhm // 25pF
 (input via channel II)

Storage Operation

Automatic erasing at switching Normal/Write
 Adjustable persistence 10ms - 5min.
 Erase push button, erasing time abt. 1 s
 Adjustable storage time approx. 30s - 1h
 Writing speed max. abt. 1cm/ μ s

Miscellaneous

Cathode-ray tube L 14-110 GH/55,
 intern. graticule, total acceleration 8,5kV
 Built-in square-wave generator of 1kHz
 for probe adjustment (output 0,2Vpp)
 DC inp. for Z-modulation (5Vpp; TTL compat.)
 18 integrated circuits, 83 transistors
Electronic stabilization
 Power supply for 110V and 220V
 Admissible mains voltage fluctuations
 94V - 121V and 187V - 242V, resp.
Power consumption approx. 53W
 Weight approx. 11kg
 Case 212x237x500mm, anthracite,
 with handle and tilt stirrup.



- Analog Storage
- Bandwidth DC - 40MHz
- Dual Trace
- Display Area 7,2x9 cm

The HM 812 is equipped with a cathode-ray tube with an electronically controlled storage system, which makes possible any reproducible display of an electrical process. If the storage control is switched off, the instrument can be operated just as any other normal oscilloscope. With the change-over to writing mode all signals stored before are automatically erased. By means of the variable persistence, signals with slow repetition rate can be displayed flickerless. Storage of non-recurring processes is limited to some 100kHz by the writing speed. In case of recurring processes, signals up to the limit frequency of the measuring amplifier can also be stored because of the integration ability of the storage tube. The maximum storage time depends on the adjusted trace brightness.

Available Accessories

10: 1 probe, demodulating probe, various test leads, viewing hood, dual-trace unit, registration camera, instrument cart, carrying case, components tester.

Distributed by

IP20 Oscilloscope Probe Kit x1



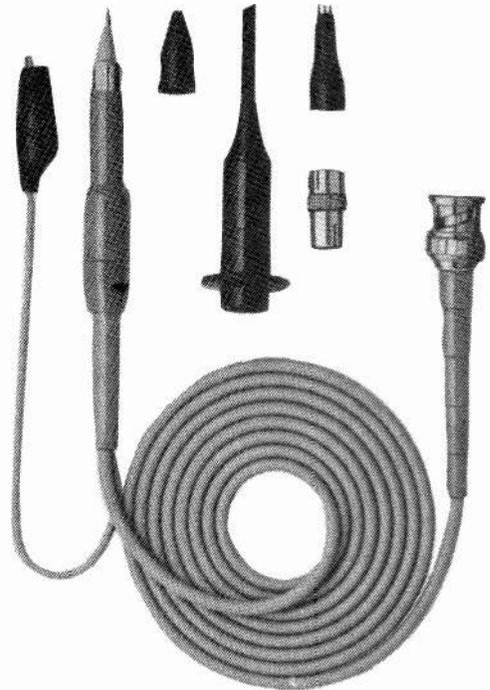
Part No. 900-90-505

Specification x1

Bandwidth: D.C. to 20 MHz
 Input Resistance: 1MΩ (oscilloscope input)
 Input Capacity: 47pF. Plus oscilloscope input
 Working Voltage: 600 Volts D.C. (including Peak A.C.)
 Cable Length: 1.5 Metres

Accessories Supplied

Insulating Tip Pt. No. 113016
 Sprung Hook Pt. No. 120079
 BNC Adaptor Pt. No. 100017
 I.C. Tip Pt. No. 120091



Distributed by

BCS ELECTRONICS LIMITED 980 Alness St. Unit 35, Downsview, Ontario M3J 2S2, Tel: (416) 661-5586.

HAMEG OSCILLOSCOPES

Model	Description	List Price
HM 307	Single trace 10MHz 3 inch portable	\$ 449.95
HM 312	Dual trace 10MHz 5 inch	825.00
HM 412-6	Dual trace 20MHz 5 inch Delay trig sweep	1,225.00
HM 512-6	Dual trace 50MHz 5 inch Delay trig sweep	1,877.00
HM 812	Dual trace 50MHz 5 inch storage	4,232.00

PROBES AND ACCESSORIES

Model	Attenuation	Frequency	List Price
LP20	1x	30MHz	\$ 23.15
P100	10x	100MHz	31.00
3P100	10x	100MHz	41.45
2LCP100	100x	100MHz	46.65
2P150	10x	150MHz	36.20
2P250	10x	250MHz	54.50
SP100	1x & 10x	100MHz	41.45
25P150	1x & 10x	150MHz	46.65
HV40	1000x	HI-VOLTAGE	127.70
DP300	Detector	300MHz 40V	31.00
DP750	Detector	750MHz (3 Positions)	49.30

Provincial Sales Tax extra.

BCS ELECTRONICS LIMITED

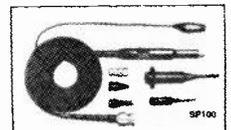
In addition to the instruments and accessories shown in the following pages we have increased our repair and recalibration facilities to handle your recalibration needs even better. As in the past, if you have a HAMEG, TEKTRONIX OR HEWLETT PACKARD, or any other make of oscilloscope, we at BCS are more than willing to serve you with sales and service in the old traditional friendly way.

Our Service Guarantee

If any repair work that we do should fail within 60 days, we'll repair the unit for only the cost of any parts used, and recalibrate at no charge to you.

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