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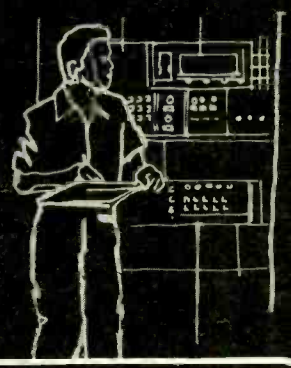

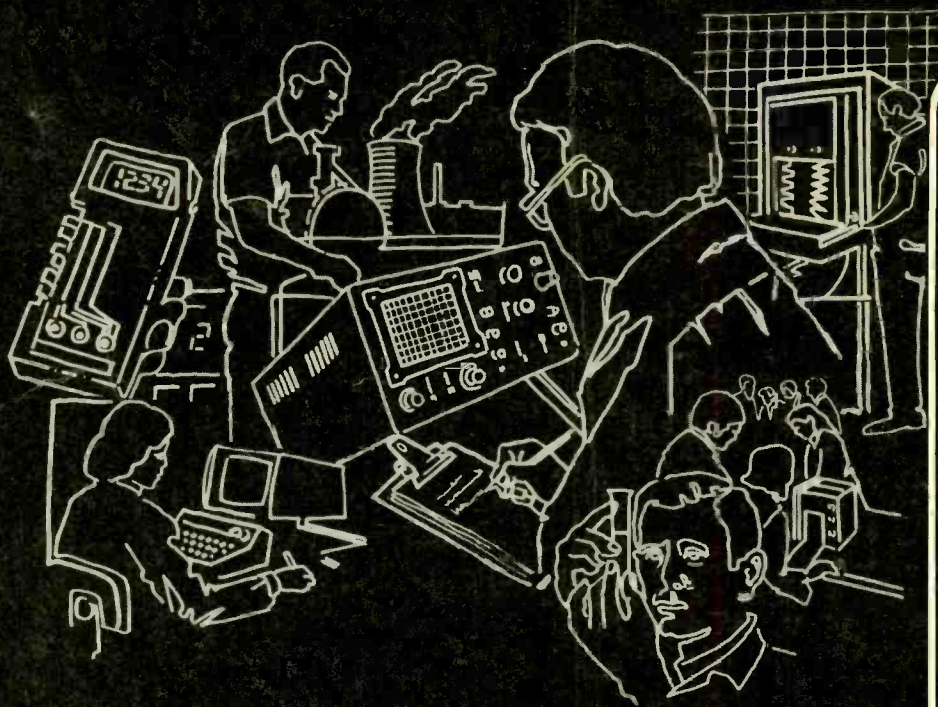

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INFO & MISCELLANEOUS

ON THE COVER: The Sony CRF-320, a fine example of the sophisticated shortwave receivers now listened to by SWL enthusiasts. This one was kindly lent to us by Murray Lamoert at Hamtraders in Toronto. (Ask Murray about his deal on this set!) Original photograph by Eric Trussler Photography.

NEWS DIGEST

New Satellite Link

Teleglobe Canada is conducting service proving exercises on its fourth earth station, scheduled to be operational by early Fall. The $14 million facility, under construction since April, 1978, will meet the need for growth and diversity of routes in the 1980's.

Teleglobe, in common with the international carriers of other technically advanced countries, has set the long term goal of assigning half of its traffic to satellites and half to cable systems. This target will not be achieved immediately, however, as some 65 percent of outward communications from Canada now go via undersea cable.

In the past, remote sites were considered mandatory, to avoid manmade background noise. Consequently Teleglobe's older earth stations can be found in Mill Village, Nova Scotia, and Lake Cowichan, British Columbia. The location of the new station, however, is just an hour's drive North from Montreal.

More recently, very careful analysis of the frequency spectrum has made it possible to find noise-free sites much closer to the larger centres. There are substantial economies to be gained as a result. Leased microwave lines, for instance are charged on a distance-sensitive basis.

The terrestrial and satellite portions of the network, operating in the same frequency bands, can be troubled by interference. The site at Weir was chosen by Teleglobe because the terrain offers natural protection from radio interference, as nearby hills screen the antenna from unwanted signals.

The main reflector, 105 feet in diameter, is a modified parabola. Its surface accuracy is specified at .047 inches RMS. It consists of 256 curved aluminum alloy panels held in place by 1,000 adjusting bolts. Total area is 9,600 square feet.

Each of the high-powered amplifiers in the base of the antenna includes klystrons supplied by Varian Canada. Located near these are redundant low-noise thermo-electrically cooled amplifiers, at 50 degrees K, which produce a gain of 60 dB.

Present schedules call for replacement of the IV-LA by the next generation INTELSAT V satellite by the end of 1981. The new satellite requires earth stations to handle cross polarised signals, which contain two signals for each frequency. Des Laurentides is equipped for cross polarisation from the outset, and Mill Village No. 2 station will receive a retrofit this summer.

Canadian content on the project is in excess of 80%. Foundation design and construction is by CML Industries. Comdev Ltd. of Dorval supplied some RF components. The antenna structure was designed by TIW Systems of Palo Alto, California, and erected by TIW Systems Ltd. of Toronto. Airborne Instrument Laboratories of New York provided the low-noise amplifiers, and Electro Space Inc. of Richardson, Tex., supplied the step track system.

Robert Caron, earth station manager, stands in front of Teleglobe Canada's new satellite communication facility at Weir Quebec. The architecture of the station has been designed in traditional 18th century Quebecois style. To be officially inaugurated September 7, the new station has actually been operational since mid summer.

Another Microsoft BASIC

A microcomputer BASIC compiler for 8080 and Z80 CP/M systems is now available from Microsoft. The compiler supports all the features of Microsoft BASIC-80, which is claimed to be the most widely used BASIC language interpreter in the microcomputer industry. The optimized, relocatable machine code produced by the BASIC compiler is in Microsoft's standard binary format; this means compiled BASIC programs can be loaded and linked with subroutines generated by Microsoft's FORTRAN-80 and COBOL-80 compilers, and MACRO-80 macro assembler.

Because the code is fast, relocatable and ROMable, the compiler can be used as a development tool for microprocessor system and application software. During compilation, optimizations are performed to reduce the size and maximize the speed of the resulting binary code. The compiler's code generator is template driven, allowing optimal sequences to be generated for many commonly used operations. The result is a significant decrease in execution times over the BASIC-80 interpreter.

The BASIC compiler is supplied on a CP/M diskette with Microsoft's standard MACRO-80 macro assembler and LINK-80 linking loader. Single copy price is $395. Dealer and OEM prices available on request.

For more information, Paul Allen, Microsoft, 10800 NE 8th, Suite 819, Bellevue, WA 98004.

Expose Yourself

News digest is a regular feature of ETI Magazine. Manufacturers, dealers, clubs and government agencies are invited to submit news releases for possible inclusion. Submissions, or questions about material, should be sent to: News Digest, c/o ETI Magazine Unit 6, 25 Overlea Blvd., Toronto, Ontario, M4H 1B1.

Audio products news will be directed to Audio Today's product department, and similarly Shortwave news will appear in Shortwave World. Sorry, submissions cannot be returned.

Ham Club

Amateur or "Ham" Radio — does it interest you?

Classes begin at the Nortown Amateur Radio Club in October. General Meetings are held the first and third Friday, monthly, at 8:00 p.m. Location is 3230 Bayview Ave. (north of Finch). For information in other areas, write to Canadian Amateur Radio Federation Inc., Box 356, Kingston, Ontario, K7L 4W2.

Alphanumeric Calculators

Sharp Electronics of Canada Ltd. has two scientific calculators in which alpha numeric formulae can be entered as written, without being translated into machine language.

With it, engineers, scientists, other professionals, or students can write an actual formula into a calculator and recall it without going through any translation phase," said Craig Hustadt, national sales manager, calculators.

The top of the line model is the thin, horizontally-designed EL-5100 which comes in a brushed metal finish and carries a suggested retail price of $129.95.

The EL-5100 is 6-7/8 inches wide, 5/16 inch thick, and 2-3/4 inches deep. It weighs just over five ounces and operates on silver oxide batteries for 1000 hours.

The second model with the rolling writer LCD in which formulae can be entered without translation is the EL-5101. It has a 16-character display which can roll to 80-characters, storage up to 80-steps, and 5 data memories. Other features are similar to the EL-5100. Suggested retail price is $99.95.

Contact Sharp Electronics of Canada Ltd., 116 Galaxy Blvd., Rexdale, Ont., M9W 4Y6.

More Info For Readers:
ETI Introduces Reader Service Cards

The advertisers in this magazine are interested in talking to you about their products or services. That is, of course, why they are advertising. But they can't necessarily say all they would like, and besides, they can't anticipate all your questions. So you may be left wanting more information.

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The Reader Service Card will also provide advertisers with useful information about what products interest readers, and how best to present their advertisements. The end result is a better response to customer desires, and better business.

Finally, the card will help keep us in touch with our readers, and thus help us to serve and interest you best.

More details on page 62!

Analog Switches

Intersil has a new family of CMOS monolithic analog switches featuring ultra-fast switching times t_{ON}80 nanoseconds typical and t_{OFF}50 nanoseconds typical, The IH5140/IH5145 devices are claimed to be the fastest switches available, and combine the speed of the hybrid DG180 family with the inherent reliability and low power consumption of CMOS construction.

The switches are available in single or dual SPST, SPDT or DPDT functions and feature power supply currents of less than 10 uA max. "OFF" state leakage is guaranteed at less than 100 pA at 25°C. The IH5140 series can be toggled at rates greater than 1 MHz, and switching is guaranteed break-before-make even over the full mifitary temperature range.

Devices are available in TO-100 cans, 14-pin plastic and flat packages, and 16-pin plastic or hermetic packages. Prices start from $3.75 for plastic packages in 100-unit quantities. Delivery is from stock.

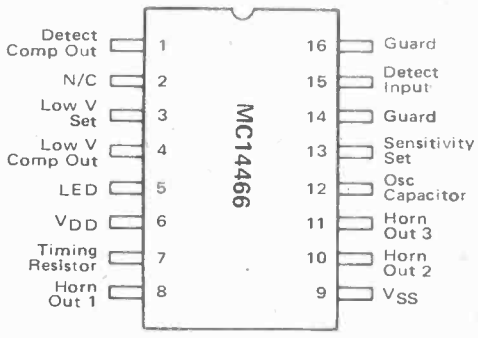
Write to, Intersil, Inc., 338 Queen Street East, Suite 208, Brampton, Ontario L6V 1C4.

CMOS Smoke Detector

While few of our readers build their own smoke detectors, if this IC ever hits the hobby market, it might have interesting applications.

The MC14466 together with an ionization chamber will detect smoke using a minimum of external components. When smoke is sensed, an alarm is sounded via an external piezoelectric transducer and internal drivers.

Price, in lots of 100, is $1.50 from Motorola.



NEWS DIGEST

Fun News Of The Month

The production of News Digest consists largely of editing out some of the more exuberant claims in manufactures' press releases.

Every once in a while however, we get the odd one that fanatically extols the virtues of some product. The task of cutting out superfluous superlatives and excess imagery is more than the average editor can handle.

Here is one news release we just didn't know what to do with. (The text is theirs, we have italicized certain words.)

For Immediate Release

Comradar introduces the second generation of car radar warning systems: The Superfox, Super-Heterodyne Remote

DAYTON, OHIO — July 12, 1979 — ComRadar Corporation *proudly* introduced the *second generation* of car radar detectors: THE SUPERFOX, super-heterodyne remote car radar warning system with an adjustable sensitivity control.

ComRadar *unveiled* their *brilliant* invention at the Chicago Consumer Electronics Show and the audience *witnessed* the *world's first* super-heterodyne remote radar warning system in the marketplace for a suggested retail of $299.95.

SuperFox is a *unique* radar detector receiver featuring *state-of-the-art* noise rejection circuitry which results in *extreme* radar receiving sensitivity and operating ranges.

ComRadar's *renowned achievement in superior* sensitivity enables the SuperFox to *keenly* detect radar over hills and around curves. It also features an *exclusive* built-in high concentration Plus 50 focusing lens to further expand radar signal gathering.

The Plus 50 Lens is a computer designed microwave lens to improve antenna gain and efficiency between radar detectors and cavity areas.

As a remote unit, the SuperFox mounts in the vehicle's grille. This eliminates previous black box dashboard mounts which had unsightly cords and wires. A coinciding small control box mounts permanently under the dash hidden from obvious view of potential thieves.

ComRadar not only eliminated the old *unsightly* appearance, but they've developed a *pleasant signal tone* which alerts the driver at the first detection of radar. As the distance to the signal source is reduced, the tone increases in frequency until a *continuous mellow sound* is generated.

Other *innovative* benefits of the SuperFox include ability to detect all band radar frequencies plus circuitry to *cleanly* block out false and superfluous signal. The *excellent* engineering on SuperFox performs tremendously against the new pulsed K band traffic radar signals.

To further announce the SuperFox, ComRadar is scheduling a *massive* fourth quarter advertising campaign to coincide with delivery of the product in August.

ComRadar also markets Fox XK, Fox XK (RW) Remote radar detectors and the Plus 50 Lens radar extender.

For more information: Ms. Nancy M. Valent, Public Relations Director, Sharp Advertising Inc., 24500 Chagrin Blvd., Cleveland, Ohio 44122 (216) 464-3636.

Companies wishing to participate in Fun News Of the Month, should send their submissions to Fun News, c/o News Digest, ETI Magazine.

All claims should be extravagant and highly self laudatory, but must be absolutely factual in their content.

Automotive MPUs

Intel Corporation is supplying 8048 single-chip microcomputers to Ford Motor Company for use in new feedback carburator systems designed for certain 1980 model cars.

The new system is designed to minimize exhaust emissions consistent with good fuel economy. This is the first Ford system to use an industry standard microcomputer product.

The microcomputer control unit (MCU) was designed by Ford's Electrical and Electronics Division (EED). MCU modules are being supplied by Ford EED and by Motorola Automotive Products Division. Intel is supplying the 8048 microcomputers to both module suppliers.

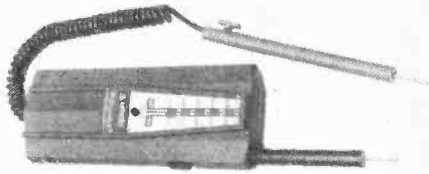
The value of the MCU systems was not disclosed.

Intel Corporation, 3065 Bowers Avenue, Santa Clara, CA 95051.

Catalogue

B&K-Precision Dynascan Corporation has a new catalogue. The 48 page catalogue is designated as BK80 and describes BK-Precision's line of general line test instruments.

B&K-Precision Dynascan products are available from Atlas Electronics, 50 Wingold Ave., Toronto, Ontario M6B 1P7.



Neon Voltage Tester

Voltprobe Voltage Testers manufactured by Amprobe Instrument, New York incorporate neon lamp design for the indication of different voltage levels. A column of five neon lamps light up thermometer-style as higher steps of voltages are applied.

Two models offer the neon lamp design. Model VT-124 has two separate neon lamps for indication if 24 and 48VAC in addition to the five lamps for indicating voltage levels of 115/220/277/440/550VAC and 115/220/400/600/750VDC. Model VT-100 indicates voltage levels of 115/220/277/400/550VAC and 115/200/400/600/750VDC and has two separate lamps for polarity indications.

On the back of each tester is a receptacle check chart label which explains the meanings of the different possible indications.

Amprobe Instruments is represented in Canada by Atlas Electronics Limited, 50 Wingold Avenue, Toronto, Ontario M6B 1P7.

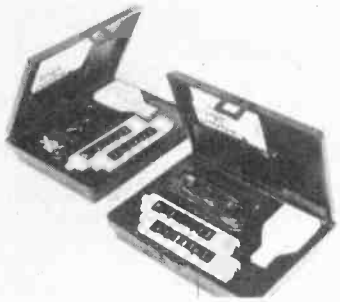
JFET Applications

An up-to-date JFET Catalog and Application Manual is now available from Teledyne Semiconductor. This 272-page edition features detailed characteristic curves and data sheets on all JFET products manufactured by Teledyne Semiconductor.

Also included is a cross reference guide listing FET products and replacements, and application notes. A few of the applications are: Junction FETs Theory and Applications, Design Parameters, Amplifiers, Switches, Low Noise FETs, Trans-admittance Analysis and High Frequency Amplifiers/Mixers.

The reference manual also offers a Selector Guide, Package Drawings and Hi Rel Ordering Information. Cost is $4.50.

Send check or money order to Teledyne Semiconductor, 1300 Terra Bella Avenue, Mountain View, Calif. 94043.



Logic Test Kit

Continental Specialties now offers the LTC-1 Standard Test Kit and LTC-2 High Speed Test Kit.

A complete kit of portable logic-state-oriented test equipment that makes it possible to detect and change the state of individual logic elements without removing ICs or cutting copper paths.

Consisting of a CSC Logic Probe, a CSC Digital Pulser, a CSC Logic Monitor and all the accessories needed for instant, incircuit testing, Logical Analysis Test Kits can save enormous amounts of time in all phases of digital work. And without bulky power supplies or cumbersome batteries.

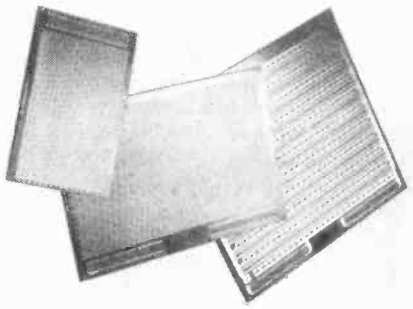
For further information please contact Len Finkler Limited, 25 Toro Road, Downsview, Ontario M3J 2A6.

Square Pad Board

Electronic Packaging Systems Limited and Vero Electronics Limited, has a new range of universal prototyping boards, the Square Pad Board, offering the designer total flexibility.

Designed primarily to accommodate wire-wrap sockets which can be retained on the board by soldering the two opposing corner pins, the design of the boards allows mixing of wire-wrap and solder techniques and also the flexibility to mix IC's and other components as necessary with no lay-out restrictions.

Write to Electronic Packaging Systems, P.O. Box 481, Kingston, Ontario, Canada K7L 4W5.



Calendar Date

Organizers of the 1979 Canadian Computer Conference (to be held concurrently with the Canadian Computer Show at the International Centre in Toronto, November 13, 14 and 15) say this year's event promises to be one of the most interesting ever held.

The '79 theme is "The Next Decade" and a line-up of authoritative and highly qualified experts will cover the entire spectrum of computer communications and systems technology developments likely to take place in the 1980s as well as discuss the possible impacts of these developments on the EDP industry, on business generally and on society at large.

For more information contact Reg Leckie, Show Manager, Canadian Computer Show, 36 Butterick Road, Toronto, Canada M8W 3Z8.

Webster Move

Webster Instruments Ltd. announces a move to new and larger headquarters, effective July, 1979. Their new address is 1200 Aerowood Drive, Mississauga, L4W 2S7, and they may be reached at (416) 625-0600.

Calendar Date

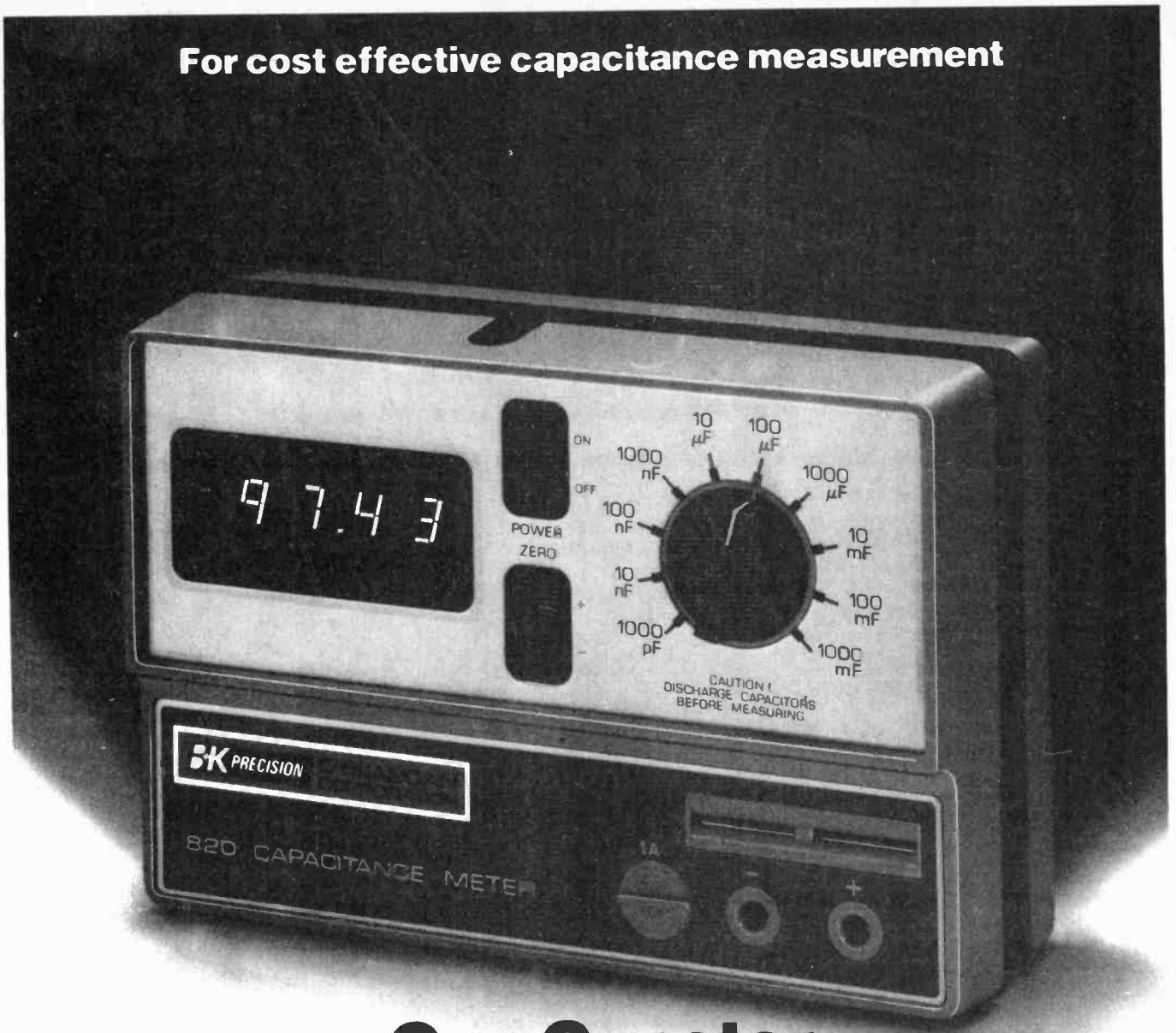
March 10, 11 and 12, 1980 — Toronto, Ontario: The National Office Exhibition and The Office of Tomorrow Conference. The exhibition, including some 150 companies, will be located at the Automotive Building, Exhibition Place, Toronto. The concurrent Office of Tomorrow Conference will be held at the show site (Automotive Building) on Day One, then moving to the Harbour Castle Hilton Hotel, Toronto, for Days Two and Three, March 11 and 12, 1980.

The three day conference program will feature panel sessions, keynote addresses and workshops on such topics as; office automation, micrographics, personnel considerations/stress/flex-time, space planning, telecommunications, furniture/ergonomics, copiers, energy conservation, word processing, and more.

The above areas will be approached from two streams — basic levels and advanced levels.

For more information, write Whitsed Publishing Limited, 2 Bloor Street West, Suite 2504, Toronto, Ontario. M4W 3E2 or phone Janet Glover, Conference Co-ordinator, at (416) 967-6200 or toll free across Canada at 1-800-268-7108.

For cost effective capacitance measurement



One C-meter stands out of the darkness— the $165 B&K-PRECISION 820

For about one-third the cost of the most popular digital capacitance meter, you can own five times more measurement capability. The new B&K-PRECISION 820 reads all the way to 1 Farad, in ten ranges. With 0.5% accuracy, the 820 resolves to 0.1pF for a maximum count of 9999.

The 820 keeps on going in freezing cold to blistering 100 degree heat, making it ideal for field use. The bright LED display is easily readable under all lighting conditions. It has the versatility needed for any application and the durability to stay on the job. The 820 can be powered by disposable batteries or optional rechargeable batteries.

Unlike many specialized instruments, the 820 has almost unlimited applications in engineering, production line work, QC, education and field service. First time users are quickly discovering that the number of time-saving applications exceed their original expectations. For example, you can measure unmarked capacitors...Verify capacitor tolerance ...Measure cable capacitance...Select and match capacitors for critical circuit applications...Sample production components for quality assurance...Measure capacitance of complex series-parallel capacitor networks...Set trimmer capacitors to specific amounts of capacity...Check capacitance in switches and other components.

You can start discovering your own applications today by seeing your local distributor for immediate delivery.

Circle No. 11 on Reader Service Card.

B&K PRECISION DYNASCAN CORPORATION

Represented in Canada by Atlas Electronics Limited,
50 Wingold Avenue, Toronto, Ontario M6B 1P7.
416/789-7761

NEWS DIGEST

New From OSI

Ohio Scientific recently introduced the C4P ME personal computer.

Features include a 32 x 64 character display with 16 colors and graphics resolution of 256 by 512 points. The C4P MF design offers a large memory capacity mini-floppy based computer with 24K static RAM. It can be expanded to 48K and two mini-floppies.

Ohio Scientific feels the C4P ME will find applications with professional, personal and home computer users.

The C4P MF comes in a 14 lb. typewriter style package. It has a suggested retail price of U.S. $1695. An 8K BASIC-in-ROM version, the C4P, with 8K of static RAM and audio cassette interface is available at a suggested retail of U.S. $698. The computer is available through any of Ohio Scientific's authorized computer dealers.

For further information contact Nancy M. Valent, 24500 Chagrin Blvd., Cleveland, Ohio 44122.

Fluke RMS DMM

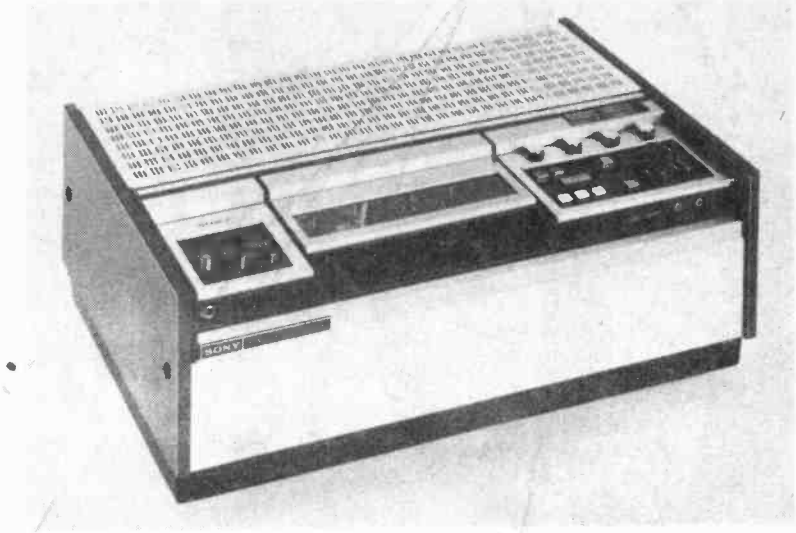
The Model 8922A, the latest addition to the Fluke 8920 series of True RMS digital voltmeters, extends Fluke's ability to measure low voltage and low frequency signals.

The 8922A may be used to measure signal levels from 2mV to 20V at frequencies from 2Hz to 11MHz.

A selectable damping feature allows low frequency measurements down to 2Hz.

The selectable 200 kHz low pass filter allows measurements to be made free of unwanted high frequency noise components.

For more information please contact Mr. David Green, Allan Crawford Associates Ltd., 6503 Northam Drive, Mississauga, Ontario L4V 1J2.



More Video

It seems that VCRs are popping up all over the place.

A 3/4" videocassette recorder/player, the LVO-7000 from Sony of Canada, Ltd., records in the 2-hour mode but has the capability of playing back programs in either the one or two hour modes.

The LVO-7000 provides color/monochrome video and two-channel audio. Time base corrector connections make the unit suitable for cable and broadcast applications.

Other features include; remote control, logic control, timer operation capability, auto rewind, and programmed operation.

Write to Sony of Canada, Ltd. 405 Gordon Baker Road, Willowdale, Ontario M2H 2S6.

Audio Today

Developments in audio reviewed by Wally Parsons

ANYONE WHOSE RECORD collection goes back over ten years will have noticed that, in many respects, the phonograph record hasn't changed much in that period of time; bandwidth is not significantly greater, CD-4 notwithstanding, distortion is a bit lower, but not all that much, and although surface noise has been reduced, production techniques have been adopted which increase tape noise , thus negating the reduction in groove noise. Indeed, one of the most striking characteristics of current digital and direct-to-disc releases is the background of silence.

Another striking characteristic is the wide dynamic range, which is partly a result of the low noise, and partly the result of increased peak recording levels. Or, to put it more accurately, higher velocities and accelerations.

In order that the audiophile may accurately reproduce such recordings pickup manufacturers have been developing better and better pickups with emphasis on the ability to trace these fast accelerations and high velocities which they produce at high signal levels. Generally, this ;has been accomplished as some sacrifice in output levels; with some manufacturers the range may be as great as 2:1. However, there is a limit as to how much of a trade-off is practical, since you could reduce the output to a point where the pick-up is unuseable with commercially available preamps. As a result, many of the current generation of pickups are capable of tracing very high velocities and yet enough research has gone into efficiency to produce very little reduction in output. Indeed, some current models, such as Stanton's 881S will deliver higher output than their predecessors.

PREAMP DESIGN

One result of all this is that designers of preamps and integrated circuits intended for preamp use find themselves forced to come to grips with the problem of signal overload. Unlike other stages in the electronics chain, the phono input level is not routinely subject to manual control. As a consequence, it has to be capable of dealing with whatever is thrown at it, so to speak.

As we discussed last month, the average high quality moving iron or moving magnet pickup delivers an output level of between 0.7 and 1.2 mV/cm/sec from each channel. Signal velocities as high as 80 cm/sec have been observed in the region of 4500 Hz, resulting in signal levels potentially as high as almost 100 mv. The fact that almost any pickup will mistrack at such velocities means that we can still encounter such levels even though they may be mostly distortion components.

Even owners of moving coil pickups aren't spared; such devices, when fed through either a transformer or a head amp, will be subjected to a voltage step-up or gain of at least 20 dB, and even an Ortofon pickup, with it's very low output can still deliver enough output to overload a standard preamp.

Last month I illustrated this problem with a fairly common but simple preamp circuit and discussed some design considerations aimed at overcoming, or at least minimizing any overload tendencies. This was a discrete circuit, which allows a fair amount of flexibility as regards choice of devices and operating voltages. With integrated circuits this flexibility does not exist, and since we may select a device for some particularly desirable characteristic, it's definitely worthwhile considering means of maximizing performance in other areas, including overload characteristics.

LM381 FAMILY

Fig. 1 shows the schematic of one channel of the type LM381 low noise dual preamplifier. Except for the regulator section, Q11-Q15, which is common, both channels are independent. Notice too that the output and driver sections operate directly from the supply voltage rail. Except for the inclusion of a resistor matrix the LM382 uses the same circuit, as does the LM387 whose pin-out does not provide for a variety of external arrangements. This discussion will apply to all three types.

For our purposes the following specifications are relevant:

Supply Voltage: +40 Absolute maximum, **Output Voltage Swing:** Vcc-2Vpp; **Small Signal Bandwidth:** 15 mHz; **Power Bandwidth:** 75 kHz at Eo=+24V; **Maximum Input Voltage:** 300 mV, rms.

In addition it should be mentioned that the minimum useable supply voltage is +9 V, and that the device is internally compensated for a gain of 10,

or 20 dB but that the LM381 and LM381A can be further compensated to unity gain by adding a single external capacitor across the internal compensating capacitor.

PHONO PREAMP EXAMPLE

This device is used here for illustration because I recently used it in a preamp in which careful attention was paid both to output stage overload and to slew limiting distortion. The latter will be discussed in a later column.

Since the preamp was to be used in evaluating a variety of pickups, it was essential that it be capable of handling, either as is, or by simple modification, the output of any pickup on the most demanding recorded material without overloading. This is particularly important when attempting to evaluate trackability, as even very slight and brief overload, especially at high frequencies, often sounds similar to mis-tracking.

The circuit in fig. 2 appears in the National Semiconductor data sheet for the LM381. From the data, with a supply voltage of +24 V, the maximum output peak-to-peak is 22 V, or 11 V peak, or (11 x .707) 7.8 V rms. In the circuit of Fig. 2, the approximate mid-band gain is set by the ratio of R1 and R2, and for the values shown gain equals 417, or 52 dB. Maximum peak output will be achieved with a peak input of 26 mV. RIAA equalization will introduce a roll-off at 4500 Hz of about 7 dB, so gain is reduced to 45 dB, or 178. Peak output will be achieved with a peak input of 62 mV. If a pickup is used whose output is 1mV/cm/sec, and the highest velocity encountered at this frequency is 62 cm/sec (assuming the pickup can trace it) there will be no overload problem. However, we have stated that velocities as high as 80 cm/sec, which is 2.5 dB over our peak acceptable input.

Two other specifications entered into the design finally used. In order to ensure that slewing rate would not be a limiting factor in performance it was decided that small signal frequency response would not exceed power response. Unity gain bandwidth is not explicitly specified in the sheets, but perusal of all data suggest 15MHz to be the pertinent figure. Since actual frequency response varies inversely with gain, then for bandwidth to equal 75 kHz (the power bandwidth) gain mut be at *least* 200, or 46 dB. Doesn't leave much margin does it.

For several reasons, including the facility of trimming equalization independently for the two main constants, it was decided to divide the high and low frequency functions into two separate circuits, as shown in Fig. 3. If the original values were retained, with only C1 removed, we would have the potential for overload in the 4500 Hz region. It was decided, then to increase the supply voltage to +30 V. This has the advantage of increasing peak output to 14V while operating far enough below maximum supply ratings that supply voltage regulation is not required. Next, gain was set at 40 dB. This allows an input of up to 140 mV before output stage overload occurs. It also makes possible rating of the pickup-preamp *system* in VOLTS/cm/sec, if gain is also changed to match different pickups. This is easily accomplished by changing the value of R1. One bonus arising from this is that it will be possible to set up two arms and preamps on one turntable to allow A/B comparison of two different pickups at equal level.

The only consideration left now is dealing with bandwidth. Holding gain at 40 dB results in a frequency response extending, a full octave beyond maximum power bandwidth. This can be dealt with by means of a first order filter at the input, which has the additional advantage of reducing input noise.

Interested readers who may wish to pursue this design on a practical level are advised that Fig. 3 does not quite represent the final design. Actually, it's not yet finished.

But she's getting there. And will provide a basis for future columns, including one on RF interference.

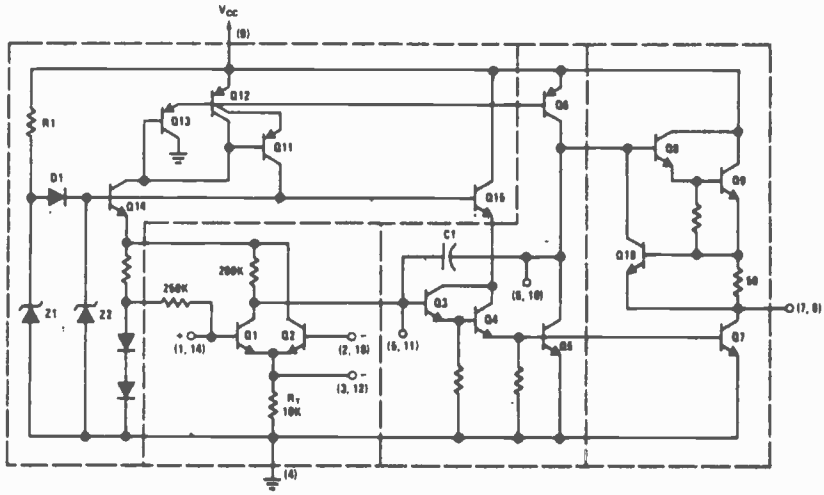


Fig. 1. The guts of the LM381A.

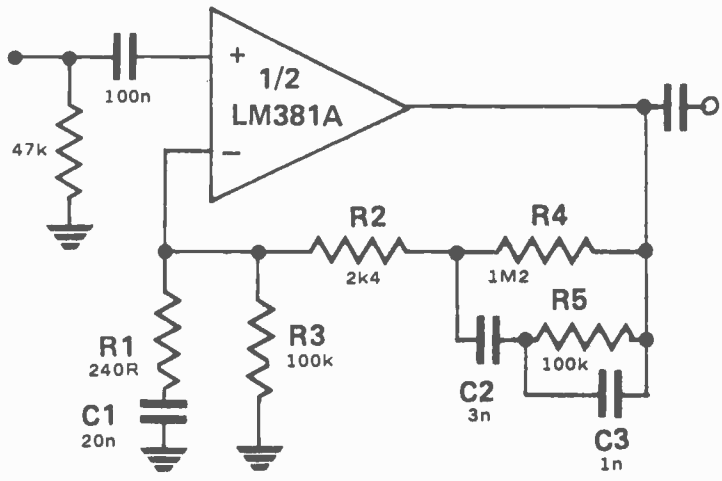


Fig. 2. The LM381A in a typical phono preamp application.

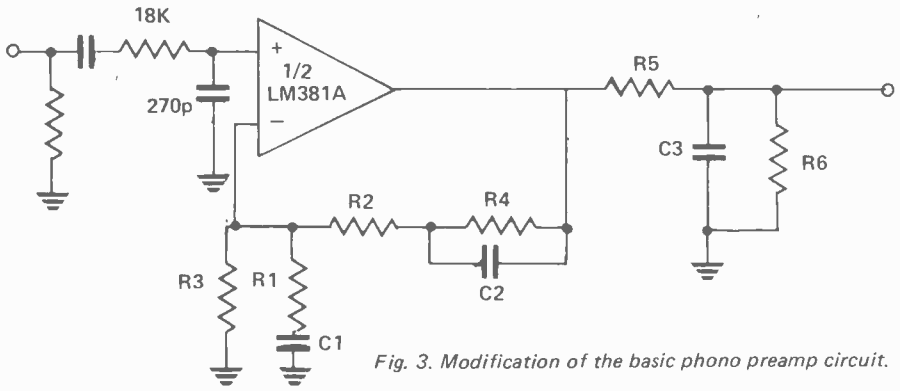


Fig. 3. Modification of the basic phono preamp circuit.

Audio Today Products

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

IN ABOUT A MONTH or less the annual Consumers' Audio Show will open in Toronto, but at the time of this writing the Audio *Trade* Show finished about a week ago. The idea behind such shows and their timing is to give all you lucky people a peek at all the wonderful, revolutionary breakthroughs which will be NEW for the first year of the second Great Depression (or is it the third?). This is timed in the fall while you have lots of money, but haven't yet squandered it on wasteful extravagances like new shoes for the baby, a down payment on a house, or a tankful of gas for the car.

In the summer, the dealers get a chance to see these marvels which they will be priviledged to sell in the fall (John Crosbie and the Bank of Canada permitting). And, of course, people like me and other assorted and sundry scribblers get a chance to ooh and aah, and otherwise hob nob with the Great Ones, eternally grateful for something to feed into the Underwood's voracious maw.

Unfortunately, what little there is that is genuinely new, is so small a proportion of the total that it is often missed. For reasons which probably have a lot to do with economics, those with only last year's recycled leftovers seem to have made enough money to be able to afford to warm them up again for lavish presentation, while the true innovators are so busy innovating that there are no resources, either human or material, left over to bring their fruits to front stage centre.

Thus, not even a teaser on magnetic amplifiers, except a discrete indication of *private showing* elsewhere, no indications of seminars on digital recording, and even the Hill Plasmatronic speaker, for pete's sake, on display in a third floor room just like every other product, from a tinkle-boom box down the way next to a manufacturer whose speakers had about as much bass substance as a castrated cricket. Meanwhile, across the hall Mike Wright was demonstrating his latest exercise in amazing friends and confounding enemies. I remain convinced that his aim is nothing less than creating the ideal electrostatic speaker using dynamic units. The remarkable thing is that he seems so well on the way to achieving it that he might succeed. This time he has built a woofer as a complete and self-contained unit with mid-range and tweeter arranged in separate tubular affairs which sit in a framework on top and positioned in accordance with the requirements for his particular approach to phase accuracy. He claims it will reproduce both square and triangular wave with a high degree of accuracy, and that it is optimized for use in small rooms. I find no reason to doubt this, especially after hearing them, and if Mr. Murphy and his gang of gremlins haven't been up to their usual tricks, a picture can be seen elsewhere on this page.

The Hill Plasmatronic speaker was in another room across the hall (just follow your nose and look for the bluish glow). This is one of those lovely

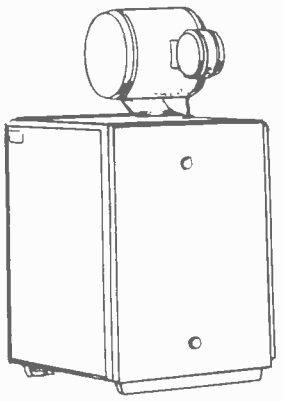


Fig. 4. Watson Laboratories' Model Five Loudspeaker system.

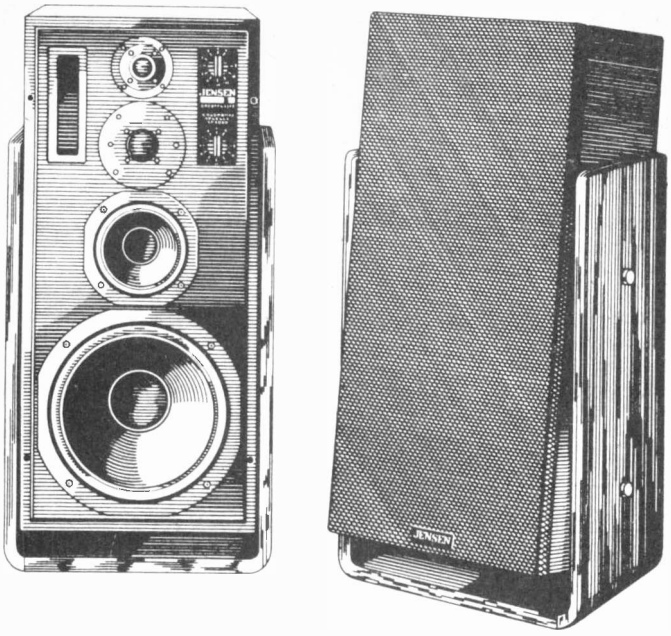


Fig. 5. Jensen System B.

acoustically transparent speakers which is so neutral that it doesn't obviously impress. Impressive it is, nonetheless, and the peculiar aroma is not noticed for long, even in the confined quarters of a small hotel room.

THE SOUND OF MOS

At this point, some mention should be made of the HH Power amplifiers, distributed by Heinl and Co, which use MOSFET output stages. Charter members of the ETI True North Strong and Free club will recall my enthusiasm for these devices when they were introduced a couple of years ago (ETI, Oct, Nov, 1977), and it pleases me mightily to learn that this enthusiasm wasn't ill advised. They even drove the Dayton-Wright electrostatics without complaint and surely deserve much of the credit for eliciting the top performance of which the Hill and the Watson Labs (Mike Wright's creations) are capable. This is one amplifier about which I shall try to get more information, as well as the Carver Magnetic Amplifier (which I wasn't able to audition).

Still on the subject of speakers, Jensen has successfully taken aim at the quality market in which it once had a prestigious place. Ever since they dropped their large Imperial horns with the Triaxial integrated speakers, their position in the consumer and audiophile market seems to have been along the lines exemplified by their lifestyle series. This has always impressed me as a series of speakers whose performance might be appropriate to some of the better units often sold as house brands, but hardly worthy of Jensen. Sort of a Volkswagen with a Rolls Royce grill.

But the system B is something else again. A reflex unit, probably a James Novack design, it does not impress with big room shaking bass, but the bottom is clean and tight and smooth, and if you really want more it will comfortably accept large amounts of boost without complaint, and without straining a modestly powered amplifier. Lovely definition in the mid-range, a sparkling top end which is *not* peaky, praise be, and splendid imaging. Even my wife liked it, and she sneers at almost anything which I didn't design (now, there's faith for you). At $1500 a pair it easily outshone many exotic speakers, including a certain British made unit (Scottish, actually) which, its representatives inform me, is "The greatest passive speaker in the world", at twice the price. I'd name them, but I don't wish to cause them further embarrassment than they've brought upon themselves elsewhere in the world. Too bad, really, because it actually is a truly respectable speaker, as is their turntable which has likewise been the subject of similar preposterous hyperbole.

Again, if Mr. Murphy permit, we see PSB's entry into the metronome form, with a passive radiator unit. I realize that the Beta series with their motional feedback have had excellent reviews, and that Paul Barton is understandably proud of them, but I think that now he may have just created some stiff competition for himself.

Interesting things seem to come out of the Kitchener-Waterloo-Guelph area. Must be the pure spring waters.

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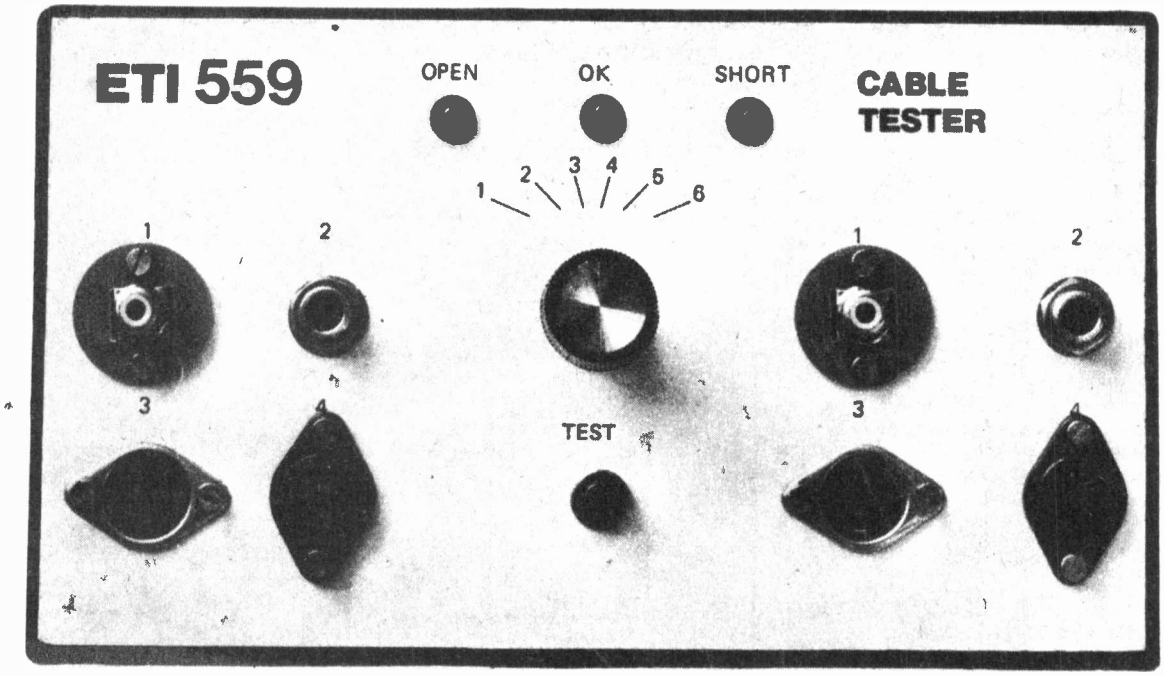
Cable Tester

Quickly test audio cables with this ingenious project.



ALMOST ALL THE faults in an audio system are caused by cables. Have you ever tried to find which cable is broken among the many connections in a stage audio system, especially with anxious people looking over your shoulder?

The answer is to check each cable before the performance, a rather tedious business.

This Cable Tester checks each wire in turn for both open circuits and short circuits to ground.Each cable can then be thoroughly tested before use and hopefully faults can be found before they cause problems.

The circuit makes cunning use of a 7474 dual D flip flop to light one of three LED's after the test switch is pushed, indicating short, open, or OK.

CONSTRUCTION

The unit is mounted on a standard plastic box measuring 196 x 113 x 60 mm. If it is to be used on-stage, then use the strongest box you can find, such as diecast aluminium.

Wiring the switch is the only difficult part of the construction. Note that some of the switch contacts are linked together as shown in table 1.

The sockets we have chosen for the prototype are the most common type, however there is no reason why others can't be subsitituted. The jack plugs, J1, 2 and the RCA sockets SK1, 2 must be insulated from the metal front panel, or the earth connections will be permanently connected together through the panel. RCA sockets are available with insulating mountings, while insulating washers can be made from plastic sheet for mounting the jack sockets.

HOW IT WORKS

To understand the operation of the cable tester refer to the simplified diagram and the truth table in fig. 1.

IC1 is a 7474 dual D flip-flop with its clock (CLK) and D inputs held at 0V.

First lets assume an open circuit cable. ZD1 conducts, as it has 12 V across it, and turns on Q2, which holds the preset (PR) input on IC1/1 low. The PR input of IC1/2 remains high because ZD2 is not biased. When the test switch is pressed, putting a 0 on the CLR input, the outputs of IC1/1 become: Q, high; Q low. When the test switch is released, leaving both the CLR inputs high, the following outputs are obtained: IC1/1 - Q, high; Q, low; IC1/2 - Q, low; Q, high. Since the output of Q, IC1/1 is low, Q3 is turned off. Therefore LED1 is on, LED2 is off, and LED3 is off.

Now let's look at the 'short to ground' condition. The 12 V rail is shorted to ground through D1 (exit one diode).Q2 is turned off leaving the PR input of IC1/1 high. The PR input of IC1/2 is held low. When the test button is pressed the outputs of IC1/1 go: Q, low; Q, high. When the button is released, placing a high on the CLR inputs, these outputs remain the same. The outputs of IC1/2 are: Q, high; Q, low. Therefore LED1 is off, LED2 is off because the base of Q3 is held low by IC1/2, and LED3 is on, indicating a short.

Finally, if the cable is OK, the voltage across ZD1 is held at 3.3 V by ZD2. Q2 is off because ZD1 (6.8 V) is not conducting. The PR input of IC1/1 is left high and the PR input of IC1/2 is also high. When the test button is released the outputs of IC1/1 go: Q, low; Q, high. The outputs of IC1/1 go: Q, low; Q, high, when the button is pushed and remain the same when it is released. Both the Q outputs are low so LEDs 1 and 3 are off and the Q outputs are high so Q3 is conducting and LED2 is on.

The only difference between this circuit and the final circuit is that D1 in the simple circuit has been replaced with a FET constant current source, Q1. SW1 selects the wires to be tested and a power supply has been included.

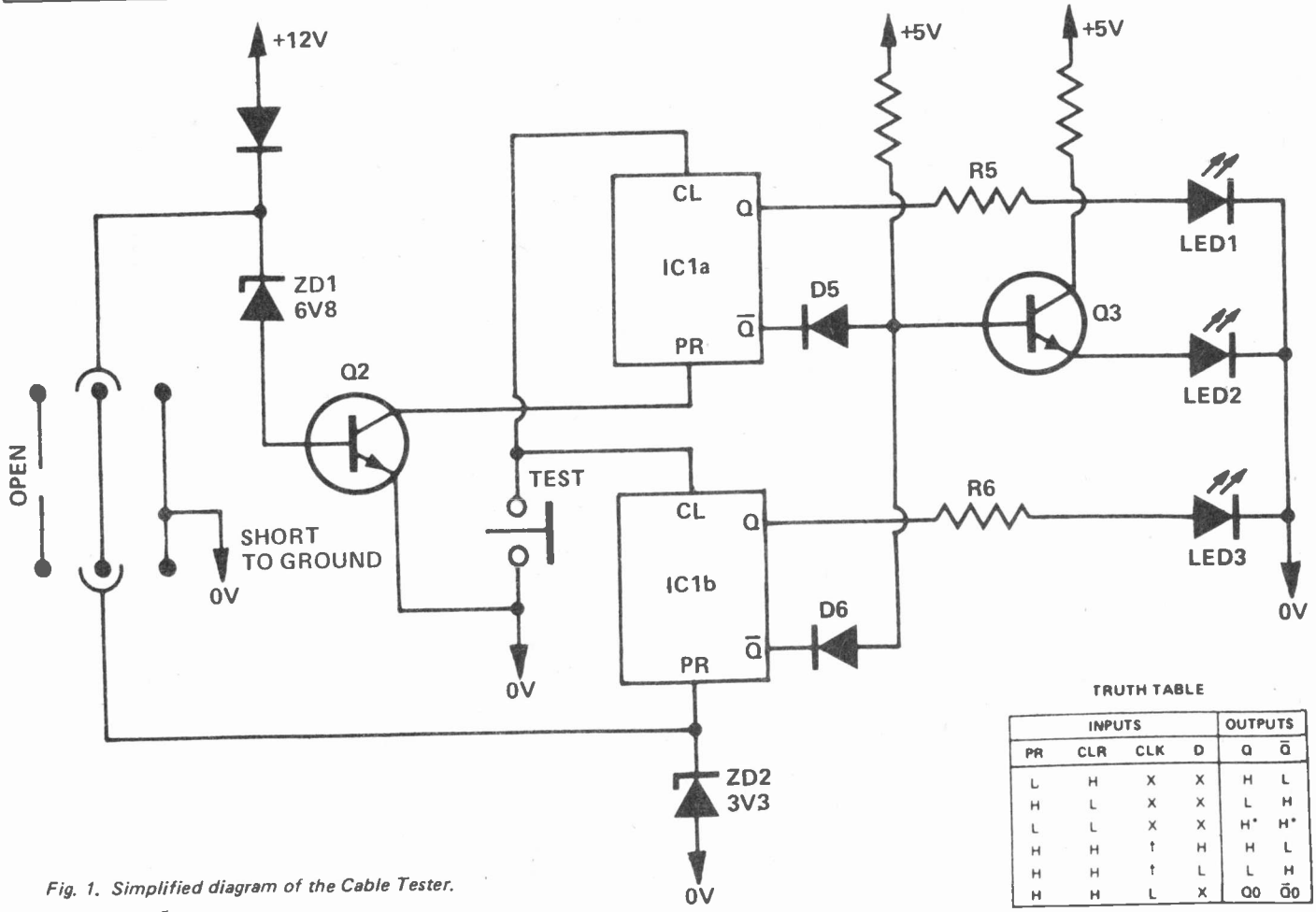


Fig. 1. Simplified diagram of the Cable Tester.

TRUTH TABLE

INPUTS				OUTPUTS	
PR	CLR	CLK	D	Q	Q̄
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H*	H*
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	L	X	Q0	Q̄0

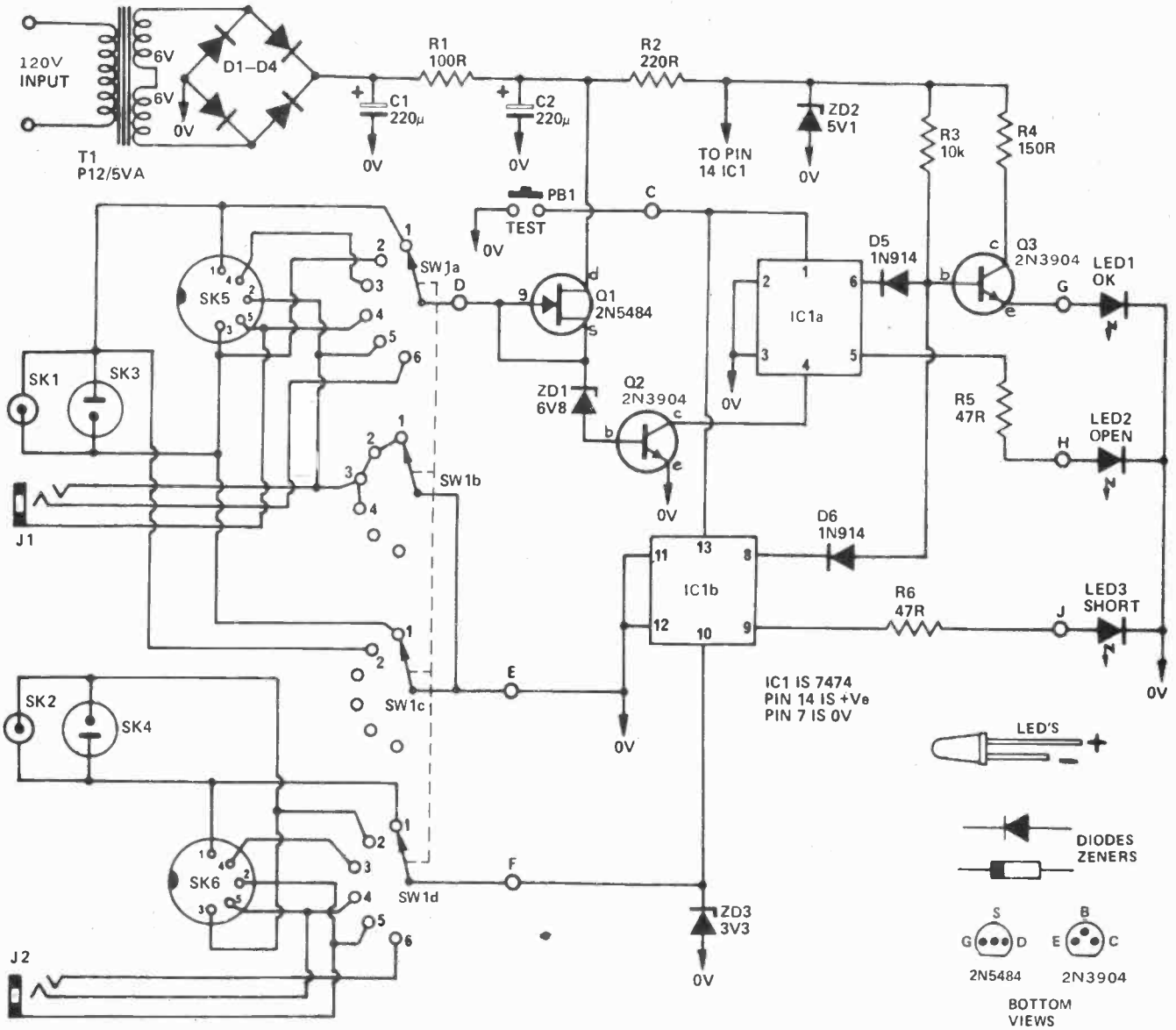


Fig. 2. Final circuit of the Tester.

For pcbs for this project please contact: Spectrum Electronics, P. O. Box 4166D, Hamilton Ontario L8V 4L5, or B & R Electronics, P. O. Box 6326F, Hamilton Ontario L9C 6L9.

PARTS LIST

RESISTORS — all ¼W, 5%
- R1 . . . . . 100R
- R2 . . . . . 220R
- R3 . . . . . 10k
- R4 . . . . . 150R
- R5 . . . . . 47R
- R6 . . . . . 47R

CAPACITORS
- C1. . . . . 220µ 25VW
- C2. . . . . 220µ 25VW

SEMICONDUCTORS
- IC1 7474
- Q1 . . . . . 2N5484 FET
- Q2, 3 . . . . . 2N3904 or equivalent
- D1-D4 . . . . . 1N4001 or equivalent
- D5-D6 . . . . . IN914 or equivalent
- ZD1. . . . . 6V8 400 mw zener
- ZD2. . . . . 5V1 400 mw zener
- ZD3. . . . . 3V3 400 mw zener
- LED1-LED3. . . . Red LEDs

SOCKETS
- SK1, SK2 . . . . . RCA Socket
- SK3, SK4 . . . . . 2 pin DIN socket
- SK5, SK6 . . . . . 5 pin DIN socket
- J1, J2. . . . . Stereo jack socket

MISCELLANEOUS
- SW1. . . . . 4 pole 6 pos switch
- T1. . . . . 120V to 12V,5A
- PB1 . . . . . miniature momentary contact pushbutton
- pcb . . . . . ETI 559
- Box to suit (195 x 110 x 60 mm); Power cord, plug, etc.

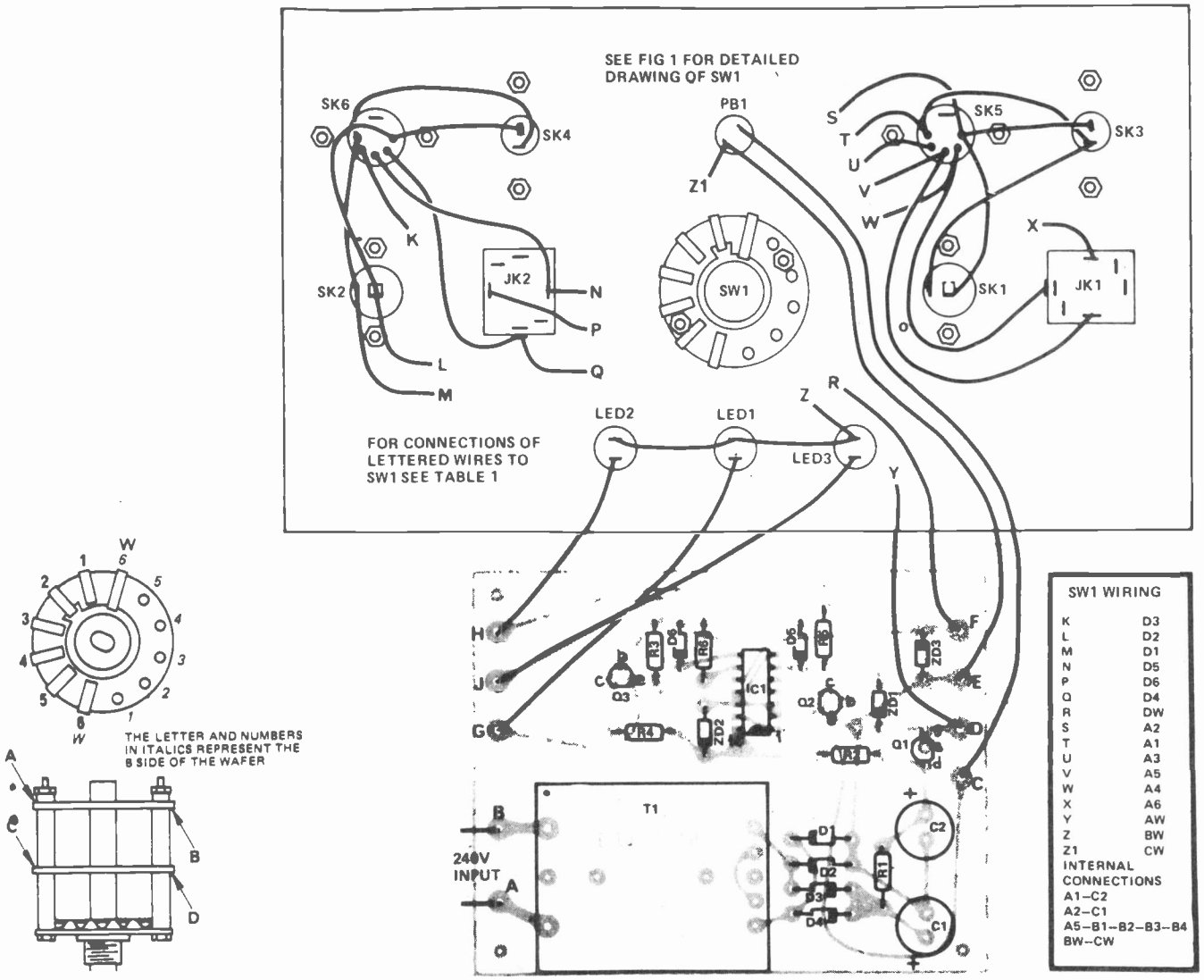


Fig. 3. Component overlay and front panel connections.

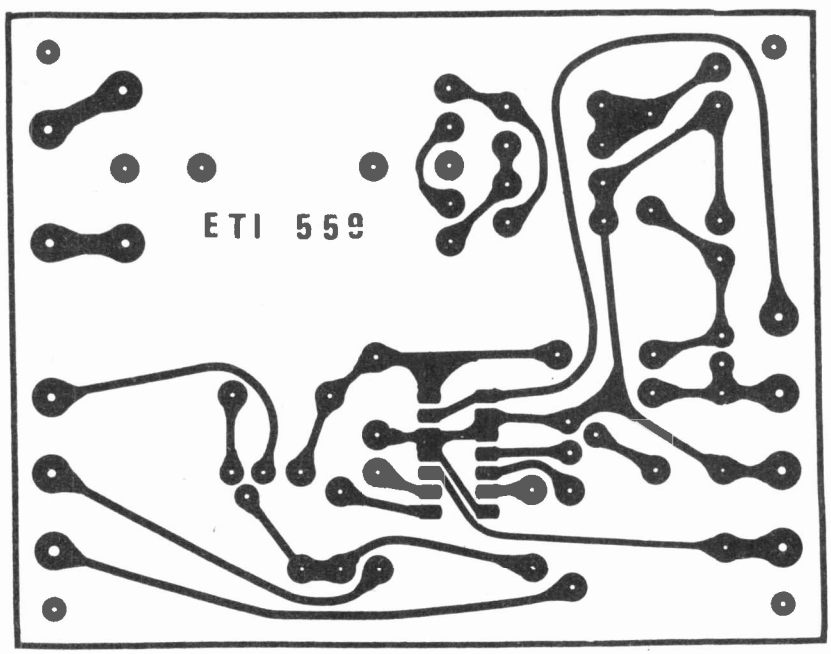
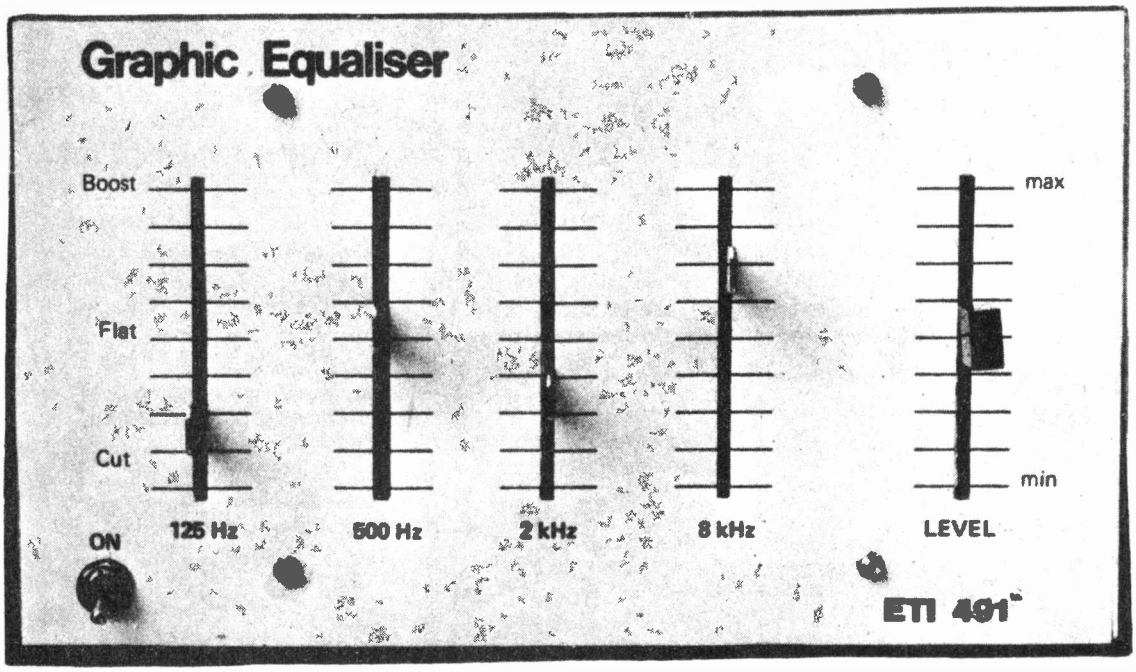


Fig. 4. Printed circuit board pattern (full size).

Simple Graphic Equalizer

Take the bumps out of your audio system with our simple Graphic Equalizer.

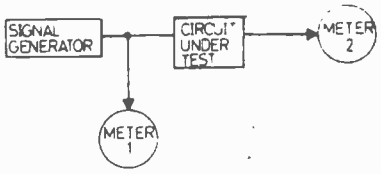


A GRAPHIC WHAT, you ask? A graphic equaliser is a complex form of tone control. It can be used to smooth out the frequency response of a hi-fi, or as a guitar effects unit. In fact, it will prove useful in any audio application.

FREQUENCY RESPONSE

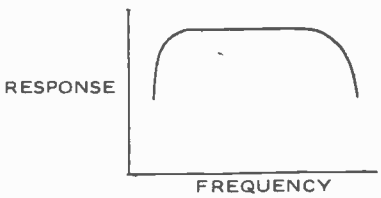
In order to explain how the equaliser works, here is a quick explanation of the term 'frequency response'.

Say we take a circuit and set it up like this:



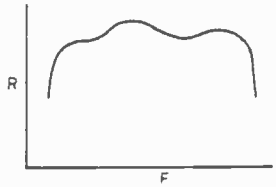
The ratio of the reading of meter 1 to the reading of meter 2 is called the response of the circuit. If the generator frequency is varied, the output reading on meter 2 varies because the circuit behaves differently when fed with different frequencies. If this ratio of input to output voltage is plotted against frequency, the resulting graph is called a Frequency Response Curve.

The frequency response of a typical amplifier looks something like this:



The central section of the curve is fairly 'flat' but when it comes to the very high or very low frequencies it rolls off as the circuit under test finds it difficult to maintain its output at these frequencies, reducing the reading on meter 2.

Once the signal from the amplifier has been passed to the speaker (which has its own frequency response as well), the response of the system overall may look like this:



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2N3055	.69	70V	NPN
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2N3771	1.95	50V	NPN
2N3772	1.95	100V	NPN
2N3773	2.50	160V	NPN
TIP29	.50	1A 60V	NPN
TIP30	.50	1A 60V	PNP
TIP31	.55	3A 60V	NPN
TIP32	.55	3A 60V	PNP
TIP41	.98	6A 60V	NPN
TIP42	1.10	6A 60V	PNP
TIP115	.85	2A 60V	PNP
TIP125	.85	5A 60V	PNP
TIP127	.95	5A 100V	PNP
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8259	14.95		

MOS Static RAM's

Part No.	Price	
2101 (1K 22 PIN)	~~$2.69~~	$1.98
2102LFPC (1K 350NS (Low Power))		$1.19
2102-1PC (1K 450NS)	~~$.98~~	0.94
2114 (4K (1K x 4) 300NS)	~~$8.75~~	$5.99

MOS Dynamic RAM's

Part No.	Price
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UART's

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AY5-1013A	~~$4.80~~	$4.25
AY3-1015	~~$5.60~~	$5.25

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Part No.	Price	
5101 (450NS (Low Power))	~~$4.50~~	$3.95

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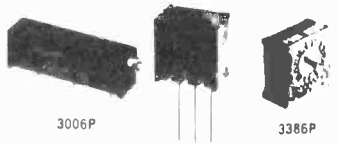
P = Printed Circuit Pins (flat mounting)
W = Printed Circuit Pins (edge mounting)



3006P 3299W 3386P

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		Z80-SIO/1	$35.00
		Z80A-SIO/1	$45.00
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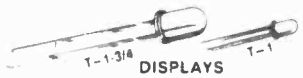
LED211	T-1 3mm Green	.14
LED212	T-1 3mm Yellow	.13
LED220	T-1-3/4 5mm Red	.11
LED222	T-1-3/4 5mm Green	.15
LED224	T-1-3/4 5mm Yellow	.14



DISPLAYS

MAN74A	.300"	Common Cathode		$0.99
FND357	.375"	Common Cathode	~~$1.45~~	$1.09
FND500	.500"	Common Cathode	~~$1.80~~	$1.09
FND507	.500"	Common Anode	~~$1.80~~	$1.09
FND567	.500"	Common Anode	~~$1.80~~	$1.29
DL747	.630"	Common Anode	~~$2.95~~	$2.30
DL704	.300"	Common Cathode	~~$1.65~~	$1.29
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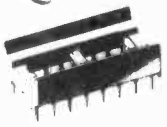
16 PIN	.17	28 PIN	.34
18 PIN	.22	40 PIN	.48
20 PIN	.24		



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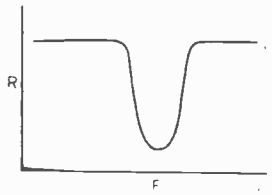
This will be further modified by the response of the room where the hi-fi is – even your curtains have a response curve! By the time the signal finally reaches your ears the overall response will be fairly well mangled.

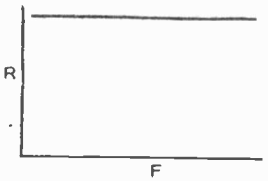
An equaliser is a device for correcting (equalising) the frequency response of a system.

IRONING OUT THE BUMPS

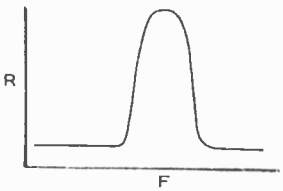
Say, for instance, that the frequency response looked like this when it reached you (rather exaggerated, perhaps!):



and we would of course like it to look like this:



If we have a device (called an equaliser) which has a response like this (the opposite to the one we wish to correct):



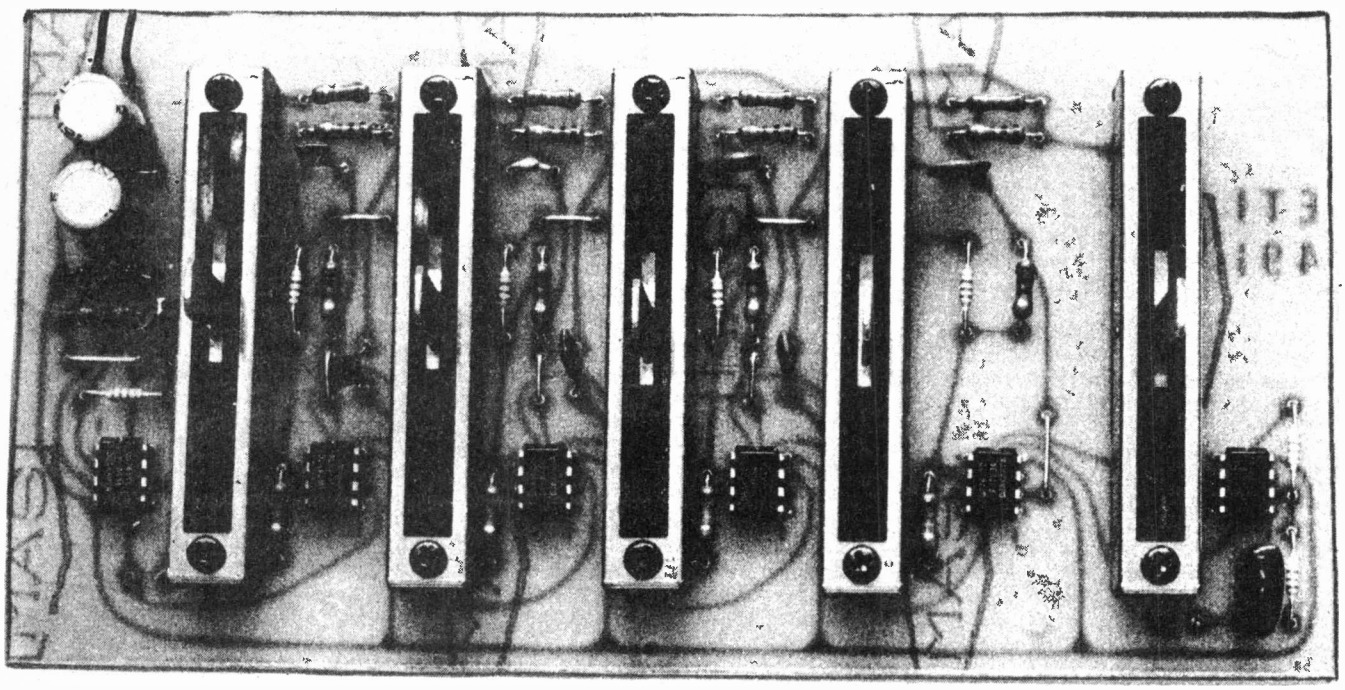
and we put it in series with the system, the overall response would be the sum of the two responses:

In this way we can take any system, be it a microphone, a telephone line or a hi-fi system, and iron out the variations in its response.

There are two ways of finding the correct equaliser settings. One is to measure the system response curve and design a custom equaliser to correct it. This is fine if you are prepared to do all the sums and build a complete new unit for each different application. The other is to build a device which has a variable response which can be adjusted to give the desired effect.

The way this is usually done is to build a unit which will split the incoming signal into a number of frequency bands and then remix these in the desired ratios. This will give the device a number of plateaux on its response curve, all of which can be moved up or down independently of each other to give an approximation to the desired shape.

An equaliser of this type is called a graphic equaliser if the controls which determine the positions of the plateaux are of the 'slider' type. The positions of the control knobs will then look like the frequency response graph of the equaliser.



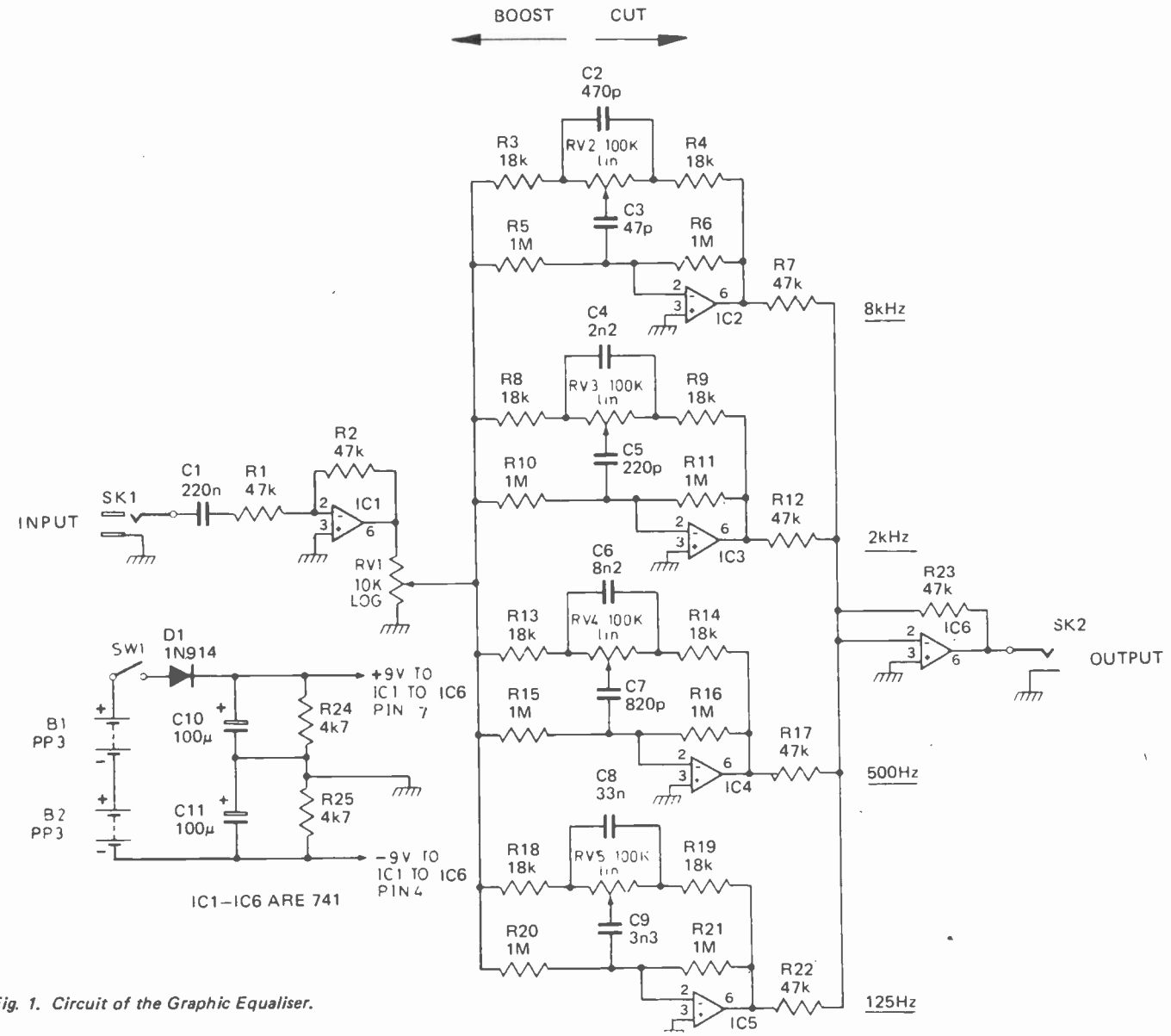


Fig. 1. Circuit of the Graphic Equaliser.

HOW IT WORKS

The input to the unit is decoupled (to remove DC) by C1 and fed into IC1, which acts as a 'buffer' - it can be driven from a source with a very small current capability, which would be incapable of providing enough input otherwise. The output of IC1 is sufficiently powerful, however, to drive the rest of the circuit.

The output from IC1 is fed (via RV1, which controls the overall volume) to the four filter stages (ICs 2, 3, 4 and 5). These each respond to a particular frequency band and their output levels are adjustable by means of RVs 2, 3, 4 and 5. The outputs from these filters are summed by IC6, which acts as a virtual earth mixer. The "-" input is held at zero volts by virtue of the feedback through R23 and so the output of the unit is the inverted sum of the voltages at the outputs of the filter ICs.

The individual filters work as follows: the feedback will cause the output to be equal to the input times $(-Z_f/Z_{in})$, where Z_f is the impedance from the output to the "-" input and Z_{in} is the impedance from RV1 to the "-" input.

This is the same situation as in the buffer - IC1. In its case, Z_{in} = 47k and Z_f = 47k. Thus the output is -1 times the input (i.e. the signal will be 'inverted' - it will *sound* the same, though).

In the filters, if the variable resistor is at mid-position, with an equal resistance between the wiper and either end, then $Z_{in} = Z_f$. Thus each filter will pass all frequencies with output = -1 x input when the slider is in mid-position.

When the slider is at the left-hand end on the circuit diagram, however, the impedance of the capacitors will cause the gain of the filter (gain = output/input) to vary with frequency in such a way as to increase the gain in a particular frequency band.

Similarly, moving the slider to the other end of the potentiometer will cause the same band of frequencies to be attenuated.

Thus, by moving the slider from one end to the other, the response of the filter to its particular frequency band can be changed. As the output is the sum of all the filters' outputs, the overall frequency response of the unit will follow the shape the sliders make on the front panel - pushing one of them up will boost that particular frequency band.

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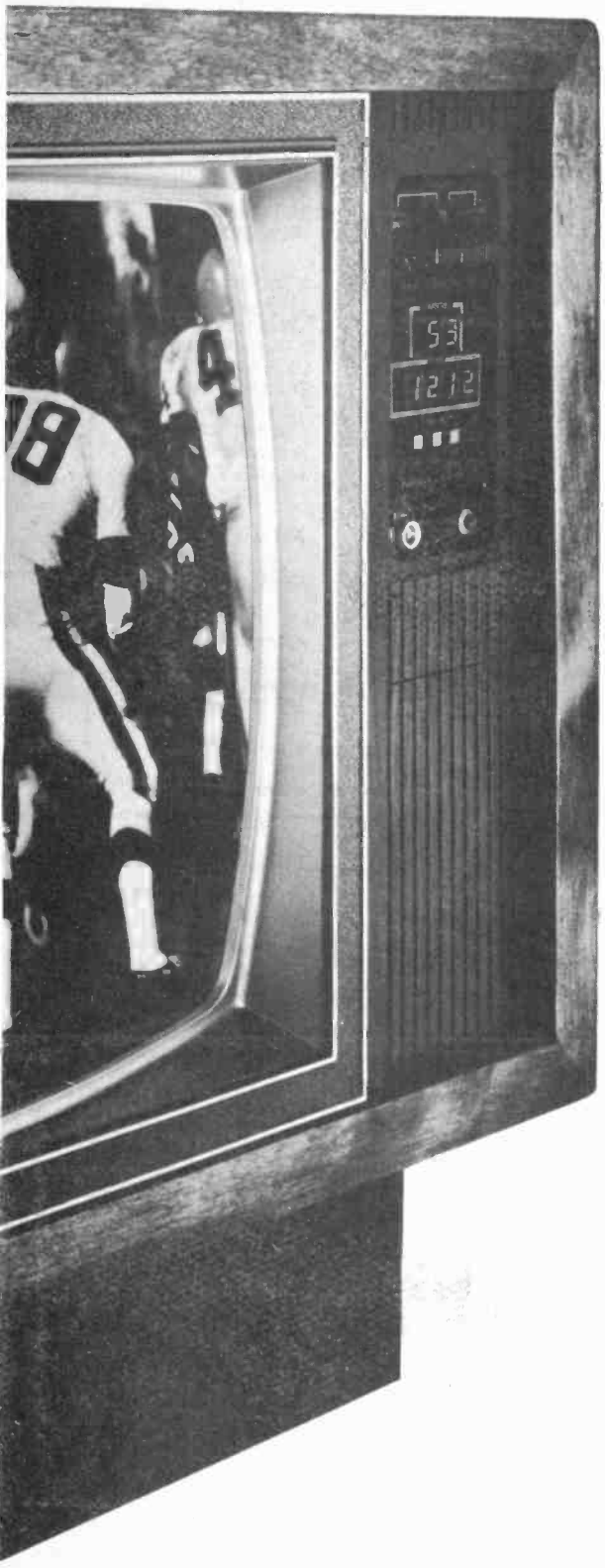

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CONSTRUCTION

All components, except the power switch, are mounted on the pcb. Take care to insert the electrolytic capacitors and ICs the right way round.

Use the front panel drawing to mark out the cutouts for the slide potentiometers. The cutouts can then be made by drilling small holes, as close as possible to each other, down the marked line. A small rat-tail file can then be used to file down the length of the cutout and a thin wide file to smooth the edges. They can be fairly sloppy as the front plate will hide any roughness.

The pcb can then be mounted off the front panel with four screws and 20 mm spaces. The positions for these screws are shown as black dots on the front panel and pcb artwork.

We used phono sockets for the input and output connections, however any other connector is suitable.

Piher pots will work nicely and are available from Dominion Radio in Toronto, and Supreme Electronics in Vancouver. If the pots you obtain don't fit the holes exactly, attach lengths of bare wire to each of the terminals and bend as needed.

OPERATION

The input to the equaliser should be of a fairly high level, say between the pre-amp output and the main amplifier input. The output from a microphone or guitar would be too low for acceptable performance.

The sort of effects you can get from this unit are a telephone line (with the 500 Hz slider up and the rest down), a shout from a long way off (with the 8 kHz slider up and the rest down), or just a simple bass boost (with the sliders forming a diagonal up at the left).

Of course, by trying the unit yourself, you can adapt it to new applications or use it in conjunction with other effects units to provide a versatile addition to your effects equipment.

HI–FI

Naturally, if your hi-fi is stereo, you'll need two of these units.

The unit should go between your pre-amplifier and power amplifier. The simplest way to adjust it is by ear, although it's not the most accurate method. You can reduce that annoying 'boominess' your speakers have always had, or boost the bass and treble and cut the middle from the signal from your tape recorder.

If you want to do it properly, however, you will need an Audio Spectrum Analyser such as the ETI 487 (June 78, Electronics Today). The equaliser is adjusted until the system's response to all frequencies is the same. Make sure the amplifier's tone controls are in mid-position.

This sounds simple enough – but remember that the room's response will change if you move the sofa or open the curtains – so first adjust these to their normal position. Also remember the neighbours!

Readers wanting a more sophisticated 10 band equaliser are refered to our Sept 77 issue.

PARTS LIST

RESISTORS — all ¼W, 5%

R1, R2	47k
R3, R4	18k
R5, R6	1M
R7	47k
R8, R9	18k
R10, R11	1M
R12	47k
R13, R14	18k
R15, R16	1M
R17	47k
R18, R19	18k
R20, R21	1M
R22, 23	47k
R24, R25	4k7

POTENTIOMETERS

RV1	10k log slider pot
RV2, 3, 4, 5	100k linear slider pot

CAPACITORS

C1	220n greencap
C2	470p ceramic
C3	47p ceramic
C4	2n2 greencap
C5	220p ceramic
C6	8n2 greencap
C7	820p ceramic
C8	33n greencap
C9	3n3 greencap
C10, 11	100µ 25V electrolytic

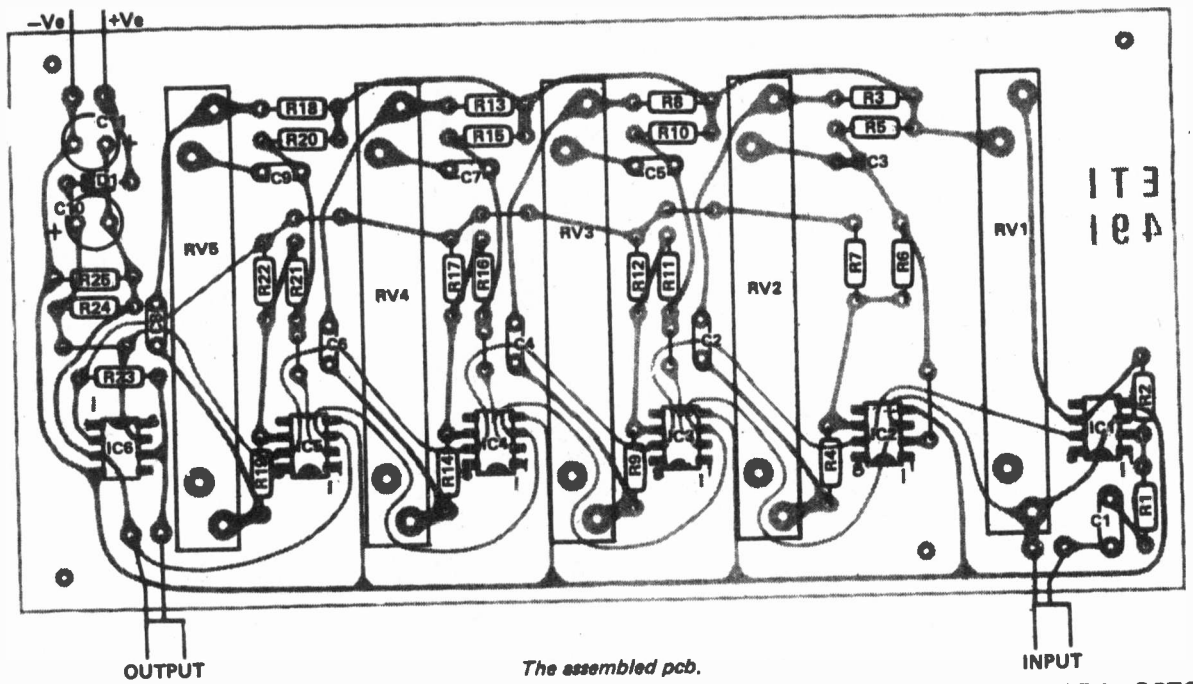
SEMICONDUCTORS

IC1-IC6	741 8 pin DIP
D1	IN914

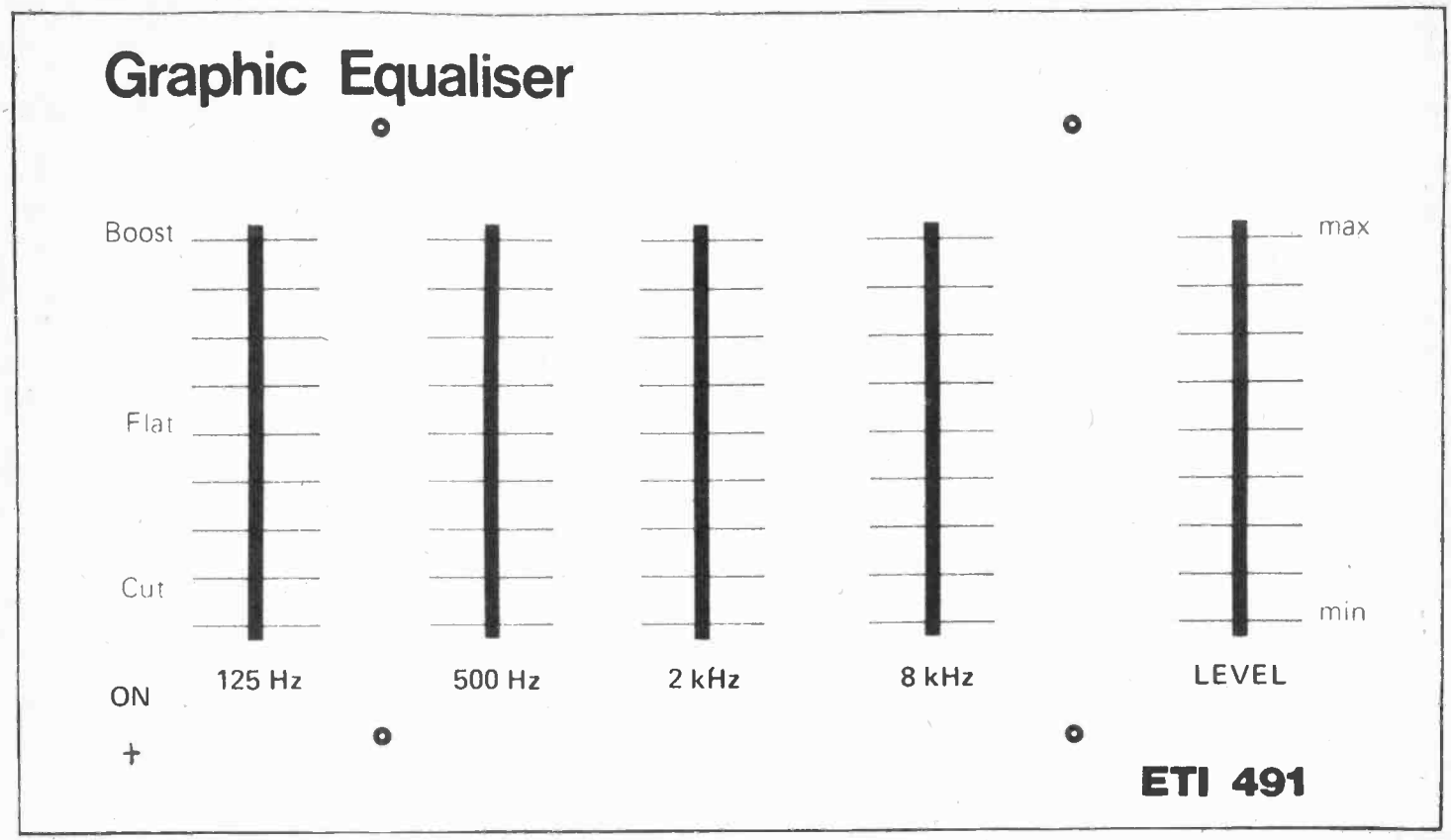
MISCELLANEOUS

SW1	spst miniature toggle switch
SK1, 2	mono jack sockets
B1, 2	9V 216 batteries

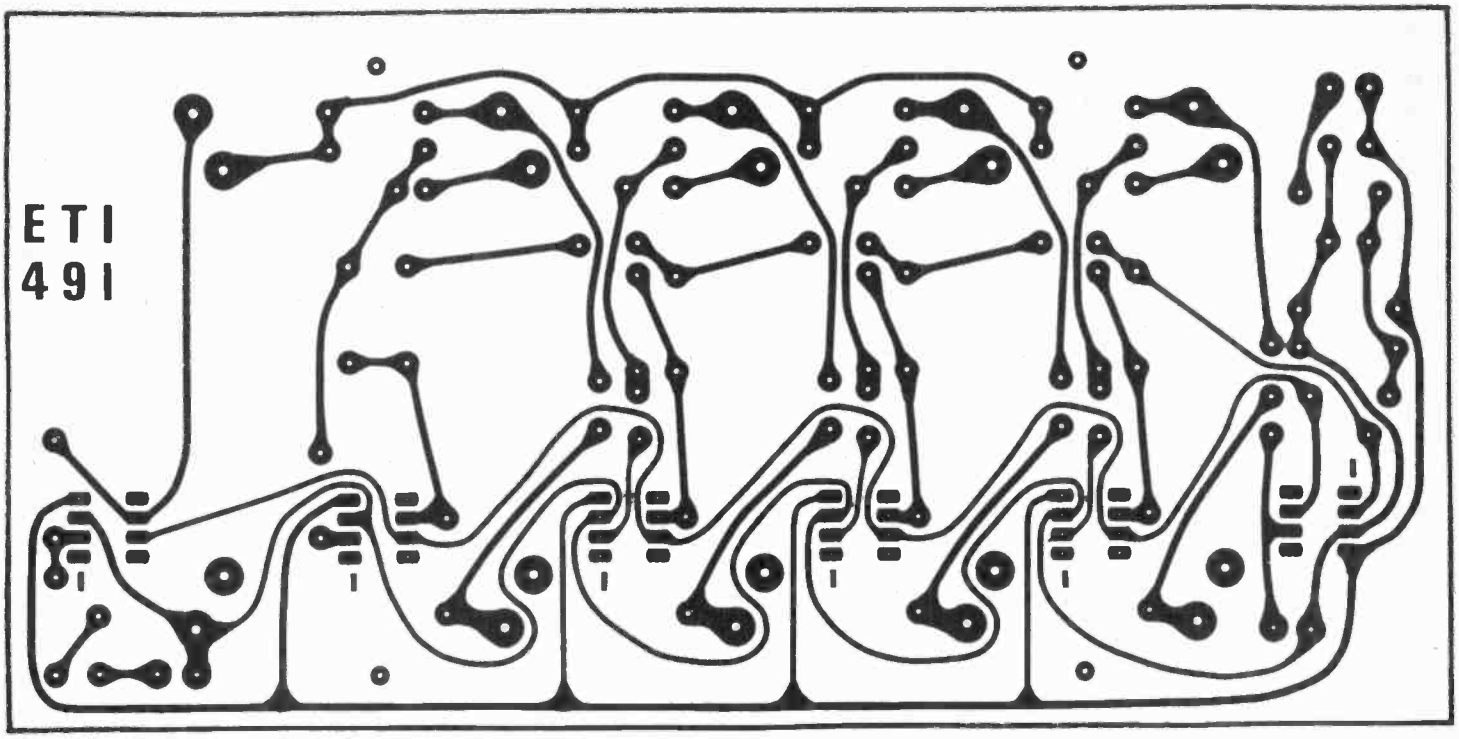
Battery clips, box to suit (195 x 110 x 60 mm)
pcb - ETI 491, 20 mm spacers, slider caps



The assembled pcb.



For pcbs for this project please contact: Spectrum Electronics, P. O. Box 4166D, Hamilton Ontario L8V 4L5, or B & R Electronics, P. O. Box 6326F, Hamilton Ontario L9C 6L9.



Front panel and pcb layouts for the Equaliser, shown full size. Note the black pads on each for drilling the mounting holes.

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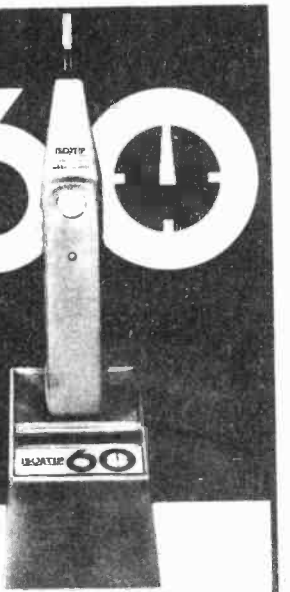

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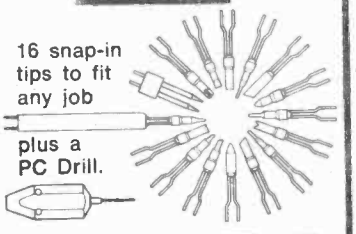

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Computer Speech

Tim Orr looks at the fast paced "talking computer" scene, and the concepts and theory behind it.

COMMUNICATION VIA SPEECH is a tremendously efficient way of transmitting information. A computer terminal with just a VDU or a hard copy printer compels the operator to be continually looking at the display. This limits the operator's freedom to do other jobs, such as controlling equipment, reading literature, typing, etc. If the computer had the option of being able to talk how much easier many operations would become. VDU's could also 'talk' their data and computer games could speak their instructions.

Computers have had this 'speech' option for many years, but as technology has improved, the size and cost of the equipment has been reduced to realistic proportions and the speech quality has got better. The microprocessor boom has helped this process and there are now several peripheral plug-ins that can be made to talk and even 'listen and understand'!

ROM FOR IMPROVEMENT

There are many methods by which a computer can generate speech. Some systems use a library of stored spoken text on a disc, just as the speaking clock does. Short phrases and individual words are sequentially selected by the computer programme and strung together to form the desired sentence.

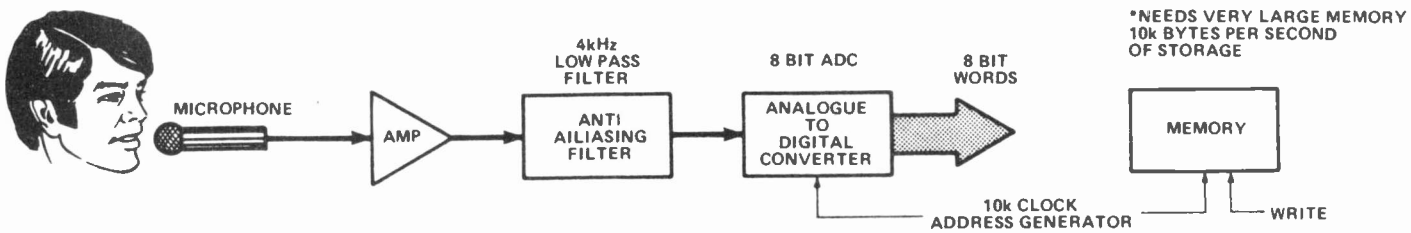
This technique is fine for some applications, where the set of phrases is small or where there will be no need to change them, because this means changing the disc. However, the unit is physically large and suffers from all the faults of any mechanical system.

An all electronic method of speech storage can be implemented using ROM's. Spoken words can be converted into a digital code (using an ADC). and programed into a ROM. Various words and phrases can then be selected by the computer and used to generate sentences by converting the reassembled data back into analogue information. This technique is the same in concept as the disc method, only the storage medium is electronic.

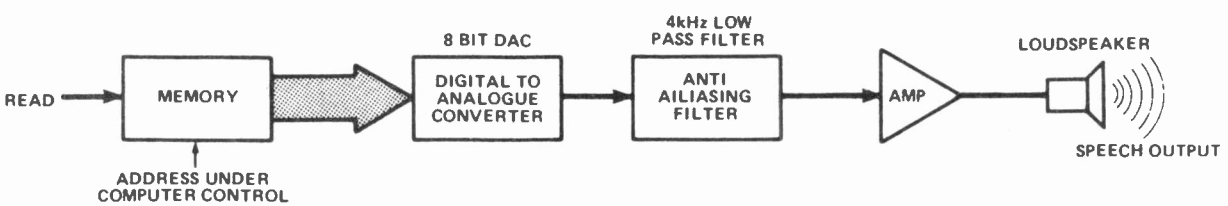
However, this type of storage would require enormous amounts of memory to generate short pieces of speech, because the unfortunate fact of life is that about 95% of the information stored by this method is redundant. The redundancy problem can be overcome by doing some special coding on the information. Linear predictive coding is one such technique, and this can result in very efficient ways of storing speech

AS A RULE

Yet another method of generating speech, which certainly gives the most versatile output (and is undoubtably the most complicated solution) is SPEECH SYNTHESIS BY RULE, using a speech synthesiser model controlled by data from the computer. ▶



Block Diagram of the digital method of achieving voice storage.



The phonetic code reads almost as if it were written in English (maybe someone will write a program to convert English to phonetic code?). Before discussing the speech program or the synthesiser it is desirable to explain just how human beings generate speech.

THE VOCAL TRACT

Speech production has been studied for centuries and there have been many historical examples of 'mechanical talkers', that is mechanical models that can be manipulated so as to produce synthetic speech. These models generally have employed bellows, reeds and moveable acoustic resonators to synthesise the speech sounds and this is not too dissimilar from the real thing, the vocal tract, Fig. 1.

Air from the lungs is expelled through the vocal cords causing them to vibrate (when you breathe in the vocal cords don't vibrate — try it!). These vibrations produce a buzz which the speaker can control in pitch and volume. This buzz is coloured by a set of acoustic resonators known as the vocal tract.

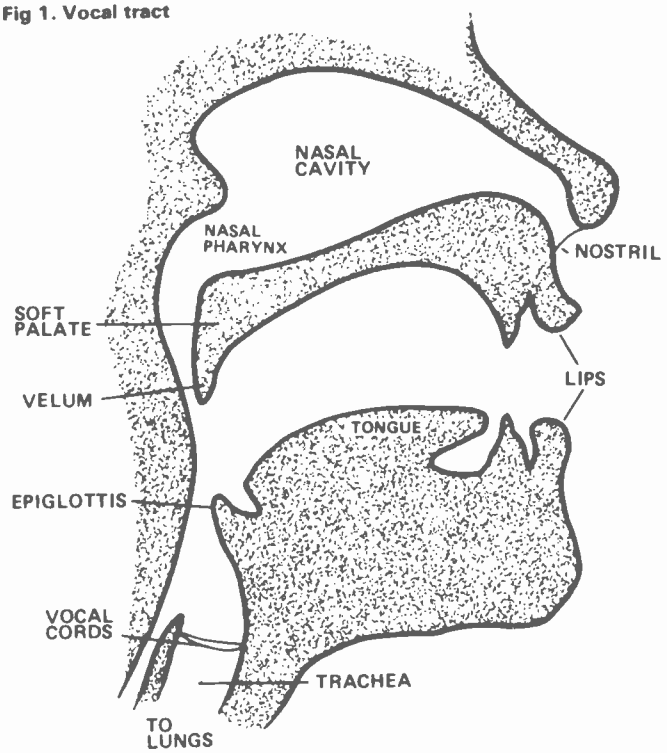
By opening and closing the mouth, by moving the tongue hump and by connecting or disconnecting the nasal cavity, the resonances of the tract can be manipulated so as to generate speech.

Take, for example some steady state vowels, AE as in HAD, EE as in HEED and OO as in WHO. Fig. 2 shows the acoustic frequency response for various vowels.

The operator types a phrase that is to be spoken. The phrase is spelled phonetically — it usually takes an operator a few hours to come to grips with the new way of spelling — and the computer converts the phrase into a series of parameters which control the speech synthesiser.

For example, the phrase 'Well, it can do with me' would be typed in as 'WEHL IHT KAAN DOO WIHTH MEE'.

Fig 1. Vocal tract



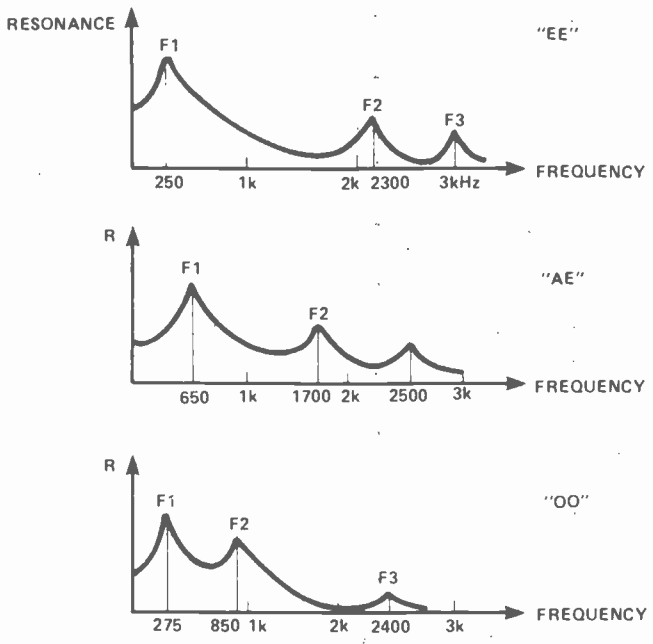


Fig 2. Acoustic response of some vowel sounds.

The first three peaks in the response, F1, 2, 3 are known as the first three formants. These are frequencies at which major resonances occur. For example, the 'OO' vowel has F1 and 2 close together at a low frequency and so the overall effect is a low frequency resonance. This is obtained by almost closing the mouth and pushing the tongue hump to the bridge of the mouth, whereas the 'AE' vowel is generated by opening the mouth and lowering the tongue hump.

FILTER VOWELS

It is possible to synthesise vowels by making an electronic model using active filters. If three band-pass filters (Q=5) are cascaded one after the other, set at frequencies of 660Hz, 1720Hz and 2410Hz and a saw-tooth wave form (100Hz) is injected into them, the resultant waveform will sound like the 'AE' vowel as in HAD.

A list of vowel resonances is given in Fig. 3. Note that they are for a typical MALE speaker.

A woman's voice is different in two respects. The resonances are about 10% higher because the vocal tract in women is about 10% smaller than that of a man.

Fig 3. Listing of vowel resonances.

		FORMANT (ALL IN Hz)		
		F1	F2	F3
HEED	EE	270	2290	3010
HID	I	390	1990	2550
HEAD	E	530	1840	2480
HAD	AE	660	1720	2410
HOD	AH	730	1090	2440
PAW	AW	570	840	2410
HOOD	U	440	1020	2240
WHO	OO	300	870	2240

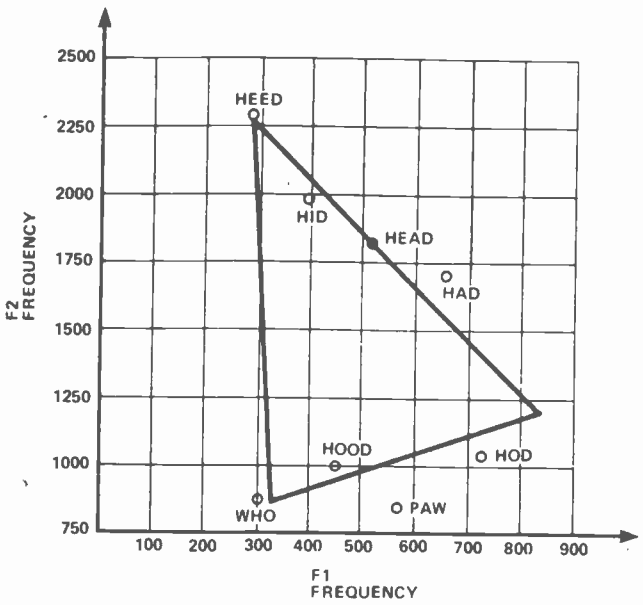


Fig 4. The vowel triangle!

Second, the pitch of the speech is perhaps an octave higher. These two effects characterise female speech as distinct from male.

Note that the formants 1 and 2 move over quite a wide range, but F3 doesn't move much at all.

However, including F3 in a model does help to improve the intelligibility. If we plot out F1 versus F2, we get what is called the 'vowel triangle', Fig. 4. Try gliding from the PAW vowel to the WHO vowel. The resulting dipthong is that which is found in HOW. Others are:— BAY, BUY, BOY and HOE.

SAY THROUGH THE NOSE ?

When the mouth is closed, virtually no sound comes out of it(!) However there is a secondary path via the nasal cavity, which is available when the velum is open. The group of sounds generated via this route are known as NASALS. They include such sounds as 'M' as in MAN, 'n' as in NUT and 'ng' as in STING. The nasal cavity is virtually a static resonator and so all nasal sounds have an undynamic quality about them.

Vowels, dipthongs and nasals are all voiced sounds, that is they are all pitched, being generated by the vocal cords. There is a group of sounds called fricatives which are pitchless and are generated by blowing air between the teeth and lips. These sounds are the 'th', 'f', 's' and 'sh' noises and are very similar to bandpass filtered noise. 'Th' can be modelled by a bandpass filter at 8kHz whereas at the lowest frequency, 'sh' is modelled by a 2k5 Hz filter.

CONSTANTLY TALKING

There are many other types of sounds but for the purposes of brevity we will consider only one more, the STOP CONSONANT. These sounds are characterised by a sudden opening of the mouth. This produces two effects.

One, there must be a period of silence (if only briefly), before the sound is generated.

Two, as the mouth opens, the formants rapidly move toward temporary target positions.

The stop consonants, 'T', 'P', 'K', 'D', 'B', 'G' are shown in Fig. 5. The vowel 'AH' has been used in this ▶

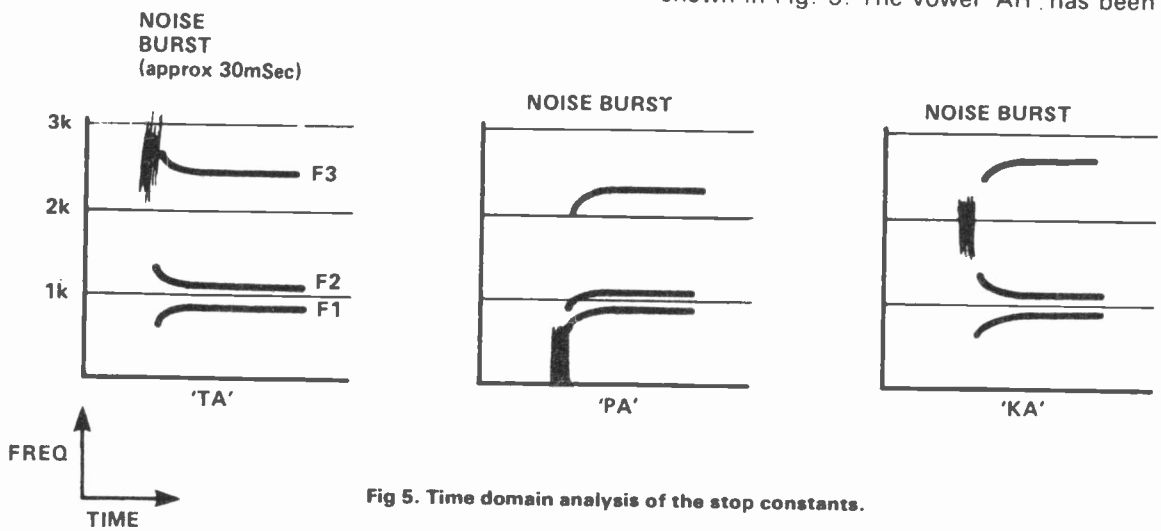
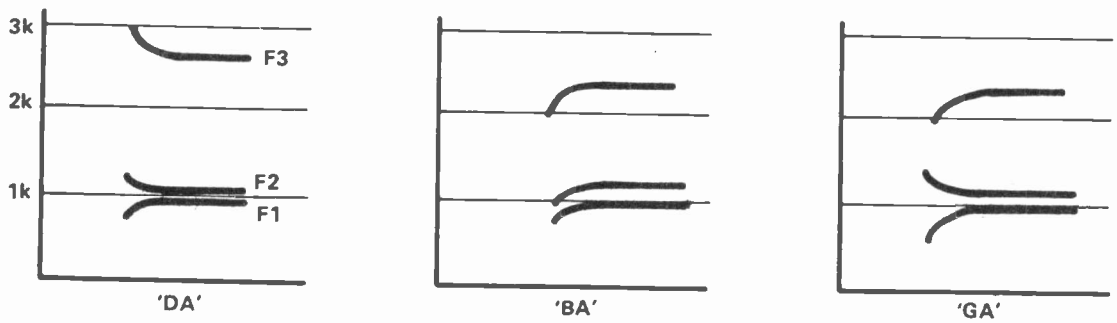


Fig 5. Time domain analysis of the stop constants.



example and so the stop consonants are 'Ta', 'Pa', 'Ka', 'Da', 'Ba', 'Ga'. The first group are characterised by having a small noise burst which preceeds the opening of the mouth.

This burst only lasts for about 30 to 50 mS and it has a different resonant frequency for each of the examples. However, it is a very important phonetic element and does much to characterise the sound.

The lower group of stop consonants has no noise burst. This is the major difference between these two sets of sounds.

VERBAL CIRCUITS

Well, that's the end of the very rapid phonetics lecture, now for the electronics. The speech synthesiser must be able to model the vocal tract. It needs a voltage controlled oscillator, a noise generator, a controlled fricative formant, a controlled set of formants F1, 2, 3 and a nasal resonator. There are 9 parameters in this model which need controlling. These are:—

AH — amplitude of aspired sounds.
AV — amplitude of vowels sounds.
AF — amplitude of fricative sounds.
AN — amplitude of nasal sounds.
F1 — frequency of formant 1.
F2 — frequency of formant 2.
F3 — frequency of formant 3.
Ff — frequency of fricative formant.
Fv — frequency of oscillator.

The model is known as a serial 3 formant synthesiser with parallel fricative and nasal formants. The computer delivers data which is converted into 9 voltages which represent the 9 parameters.

It is entirely up to the computer to generate the parameters correctly, the synthesiser merely does what it is told to do.

SPEECH LESS LATCHES

The parameter generator is shown in Fig. 7. When the computer decides to deliver a frame of information it sends out an address and a data block. This address is unique to this peripheral device and is decoded by an address decoder inside the synthesiser. This decoded address generates a clock pulse which clocks a 12 bit latch.

Four of these 12 bits of data are another address which decides which of the 9 parameters is being updated. The other 8 bits are data which drive an 8 bit DAC. The analogue output from this DAC is fed to a demultiplexer which drives 9 sample and hold units.

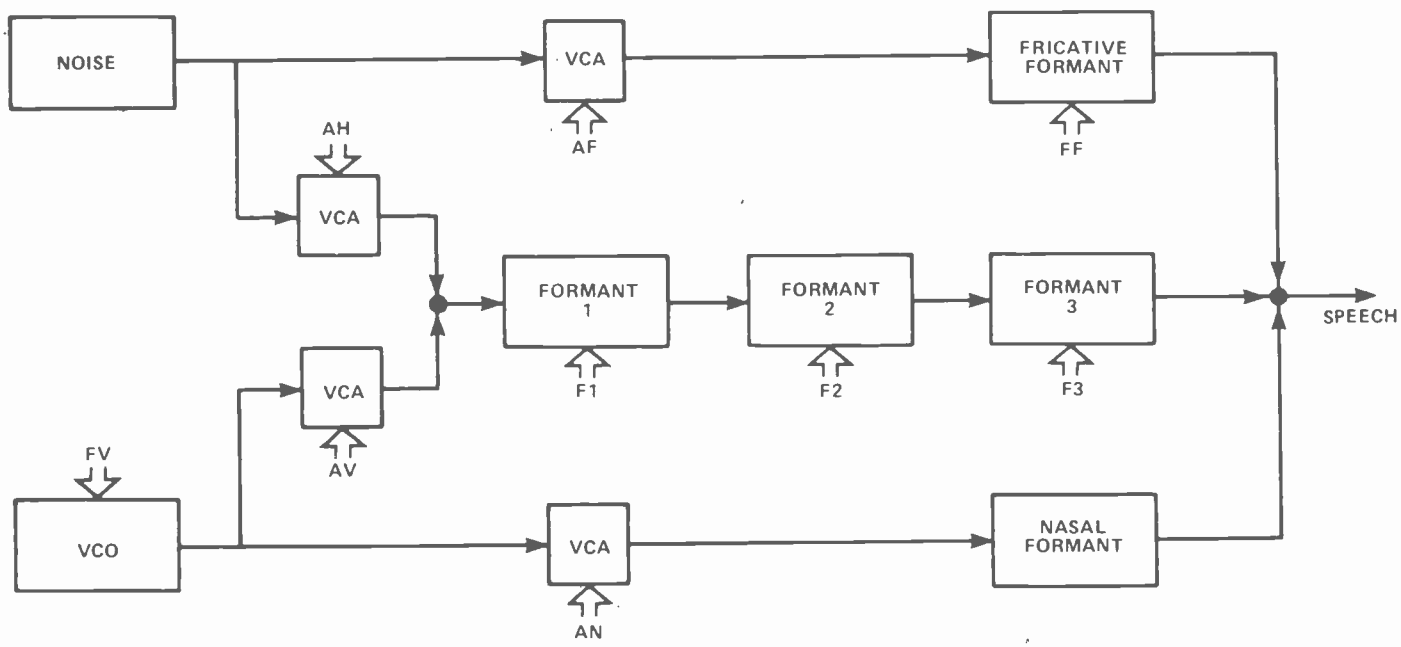
Thus the 8 bit data word is converted into a control voltage and is then steered by the 4 bit address into the correct sample and hold. The whole frame of 9 parameters is updated 50 times a second. This consumes only a small percentage of the computer time, and yet it allows the speech program to be run on a slower time scale without the steps between frames becoming noticeable.

PITCH IN

The program was written so as to make the operator's job as easy as possible. There is a listing of about 50 phonemes which can be used to generate speech. Gaps can be typed in and changes to existing sentences can easily be implemented.

The pitch of the speech is controllable so that the correct pitch inflections can be used to stress various words. Also, an external sound source can be used in place of the VCO so that effects such as 'talking music' can be produced.

Fig 6. Block diagram of a three formant speech synthesiser.



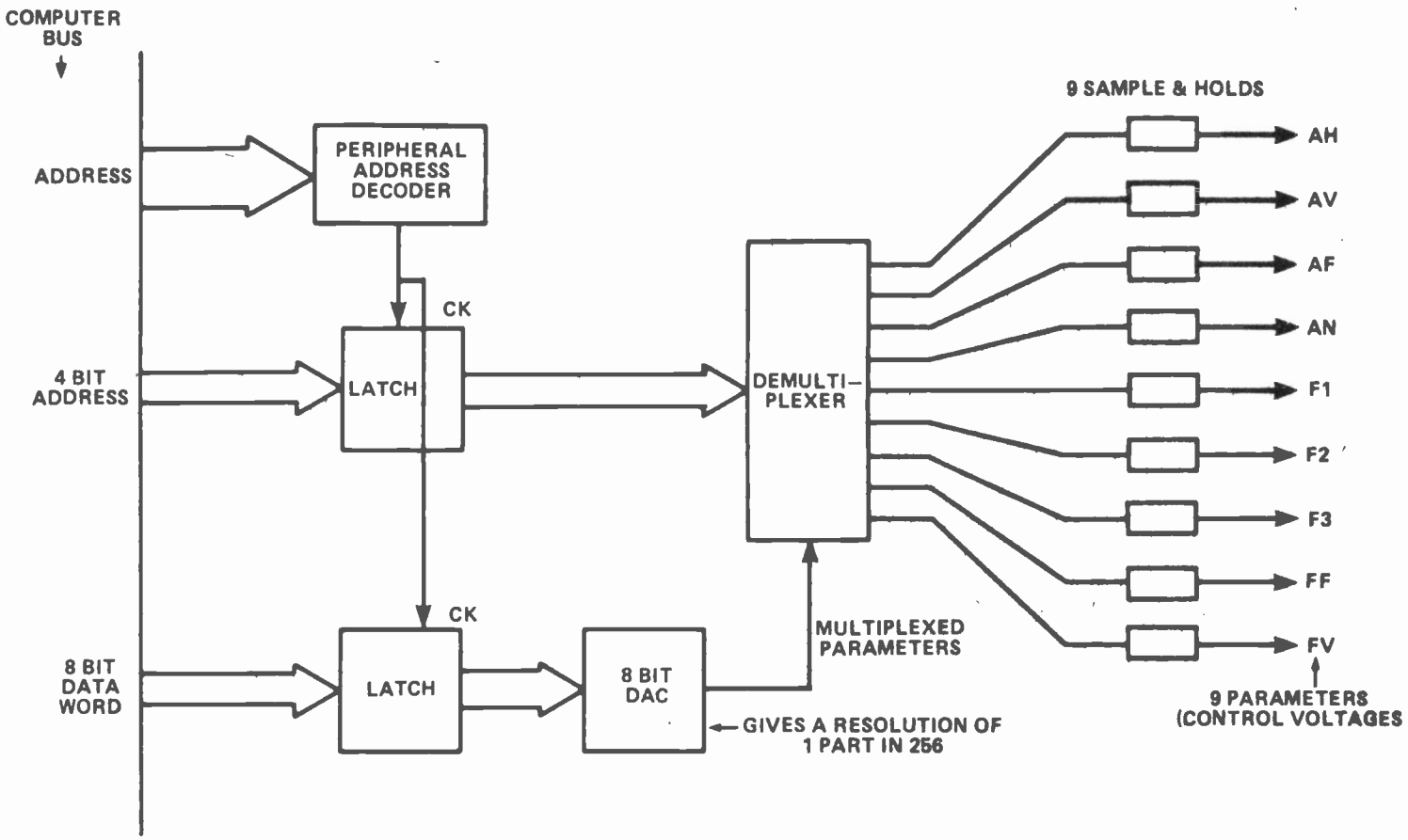


Fig 7. Block diagram of a parameter generator for a speech synthesis machine.

RESUME OF SPEECH PRODUCTS

The number of speech products that are being produced is rapidly increasing. Here is a list of some of them.

Texas Instruments have brought out a teaching aid called 'speak and spell'. This unit has an alphabetical keyboard plus display. The word that is typed in is spoken by a ROM that uses a linear predecive coding technique, enabling more than 200 words to be stored.

Federal Screw works make a speech synthesiser called Votrax. It generates speech by rule and it can be used as a computer peripheral or as a stand alone unit.

They also make a speech synthesiser which is a bit like a large pocket calculator, except that words are printed next to the buttons. This is intended as a limited talker for people with speech loss.

Telesensory systems make a 'talking' pocket calculator, a 'speaking chip set' and they are also working on a reading tool for the blind. This uses a little hand-held camera which converts the printed text into letters which are then converted into speech.

OVE III made by Fonema is a speech synthesiser similar to that described in this article. However, it uses lots of parameters and the speech output can be better than the real thing!

Speech Lab made by Heuristics is a microprocessor peripheral. This device recognises the spoken word (after you have trained it to do so). The manufacturers claim real time operation and a 95% correct recognition rate.

Computalker made by Computalker Consultants is a microprocessor peripheral speech synthesiser using the vocal tract analogue as described in this article.

Microspeech made by Richard Monkhouse and Tim Orr. A microprocessor peripheral speech synthesiser designed to run from 6800 orientated systems.

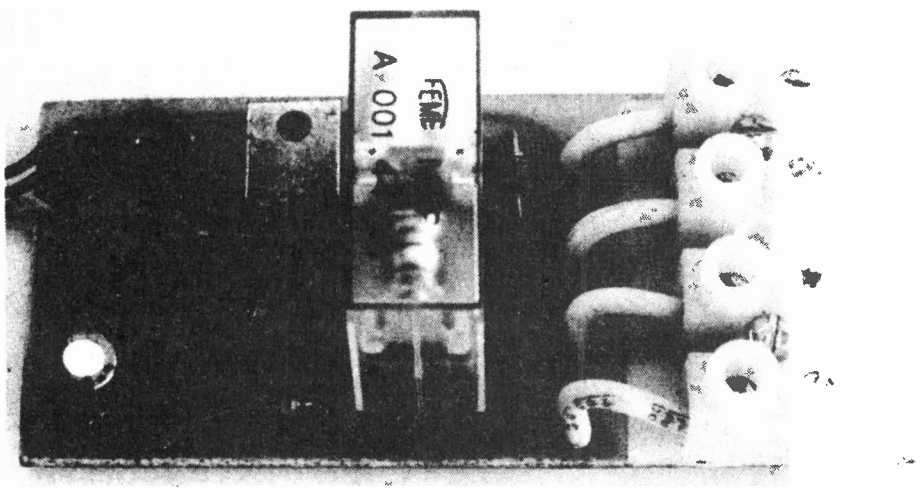
Vocoder and Vocoder 2000. The first commercially available channel vocoders for the music market manufactured by EMS. Enables normally inarticulate sounds to speak. (For example, talking pianos.)

Vocaliser pedal made by Coloursound. A music product, not a Wah-wah pedal but a vowel pedal. Vowels available EE to AH to OO.

Dipthoniser made by Coloursound. Produces dipthong filter sweeps primarily for bass guitar. Sounds such as BOW, YEH, WAH and YAE are available.

Variwiper

This pulsed windscreen wiping circuit can be used on cars fitted with most types of modern wiper motors.



WHEN OPERATING IN heavy rain windscreen wipers often have difficulty providing adequate visibility However, during light rain or mist all that is necessary is an occasional sweep of the blades at intervals of a few seconds.

Turning them on and off repeatedly takes the driver's concentration off the road, and his hands off the wheel, increasing the risk of an accident. Alternatively, if the wipers are kept working all the time in such conditions the blades tend to scrape on dry glass, wearing out the rubber inserts, your nerves, and worse still, the screen itself.

The answer is obvious; have the wipers operate intermittently at a duration which can be varied to suit the conditions.

Figure 1 shows the circuit of a modern wiper assembly. Dynamic braking is achieved by applying a short across the armature, by a cam-actuated change-over switch synchronised with the wiper blades. When the wipers are switched off, the change-over switch shorts out the motor armature via the main wiper ON/OFF switch.

The circuit of fig. 2 is suitable for use with negative earth cars fitted with permanent magnet motors. Some early model cars are fitted with wound field coil motors and are not suitable for use with this circuit (more about them later).

Some types of permanent magnet wiper motors, especially those on British cars, have a fifth wire extended to the wiper switch. These motors are designed to operate independently of a ground to allow for their use on either positive or negative ground vehicles. The circuit of fig. 2 can also be used with these motors provided they are fitted to a negative ground car. However, some more expensive American cars have wiper motors which are reversed in the parking sequence to lower the blades below the bottom of the windscreen when not in use. The Vari-Wiper unit described cannot be used with these wipers.

Before installing the Vari-Wiper unit make sure that you have one of the types of permanent magnet wiper motors described. If necessary remove the cover of the motor and identify the wire to the centre contact of the cam-operated switch.

NORMAL WIPER OPERATION

Conventional operation of the wipers is obtained by using the vehicle wiper switch in the normal way. Figure 2 shows the sliding contacts of this switch in the correct position for each function. Note that in the off position the switch shorts lead B to lead C. In the SLOW position the short is removed and an ground is extended to B, while in the FAST position the ground is removed. from B and extended to A. For single speed wipers slide contact A will be omitted.

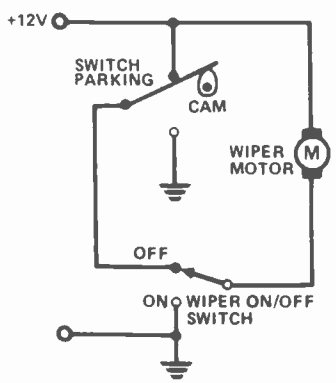


Fig. 1. Circuit of modern wiper motor assembly. Dynamic braking is achieved by applying a short across the armature.

HOW IT WORKS

The timing circuit is energized by operating switch SW1, which is part of switch/potentiometer RV1. This switch applies power to the unijunction/SCR circuit via the still-closed parking switch contacts.

Capacitor C1 charges via RV1 and R1, at a rate determined by the setting of RV1, until the unijunction 'fires', producing a positive going pulse which triggers the SCR into conduction. Resistor R4 ensures that the SCR latches on, thus energizing relay RL1.

Relay contacts RL1 (1) now changeover, removing the short circuit from the motor armature before energizing the motor by extending an ground via the now-closed relay contacts.

As the motor gathers speed, the associated cam-actuated switch changes over, removing power from the timing circuit (causing the relay to drop out) and extending an ground to the wiper motor via wiper switch contacts B and C, the now de-energized relay contacts, and the cam-actuated switch.

The wipers continue their sweep across the screen, but on their return the cam-actuated switch cuts in just before the end of the sweep. This removes power from the wiper motor and places a short circuit across the armature.

Operation of the ETI319A unit is similar except the motor, which does not require dynamic braking, can be driven directly from the SCR, saving the cost of a relay. Note that either D1 or D2 become redundant depending on the polarity of the vehicle.

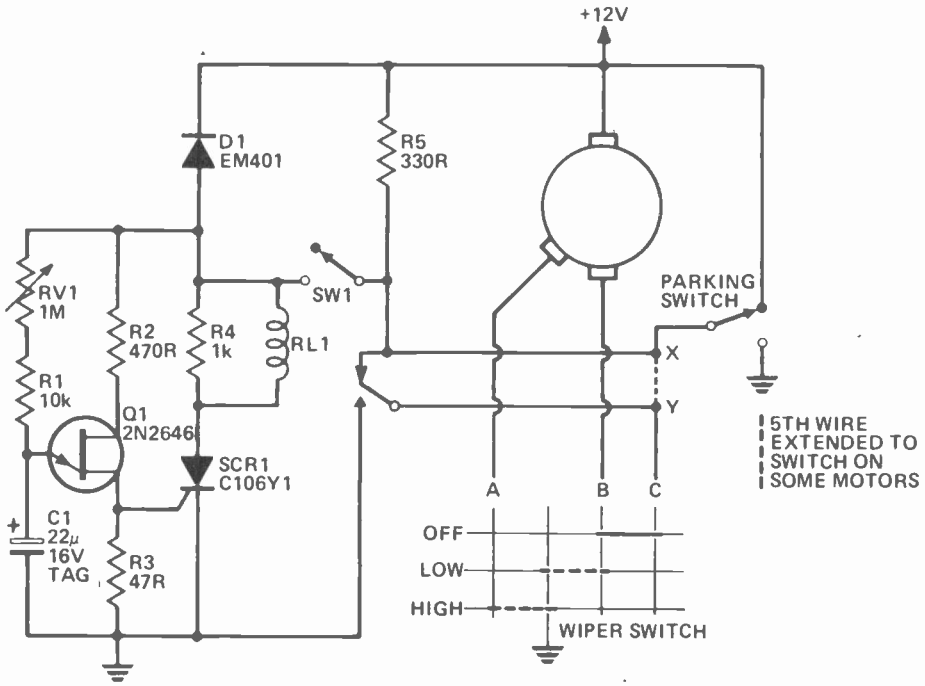


Fig. 2. The ETI319B Vari-Wiper circuit using relay output for use with permanent magnet motors.

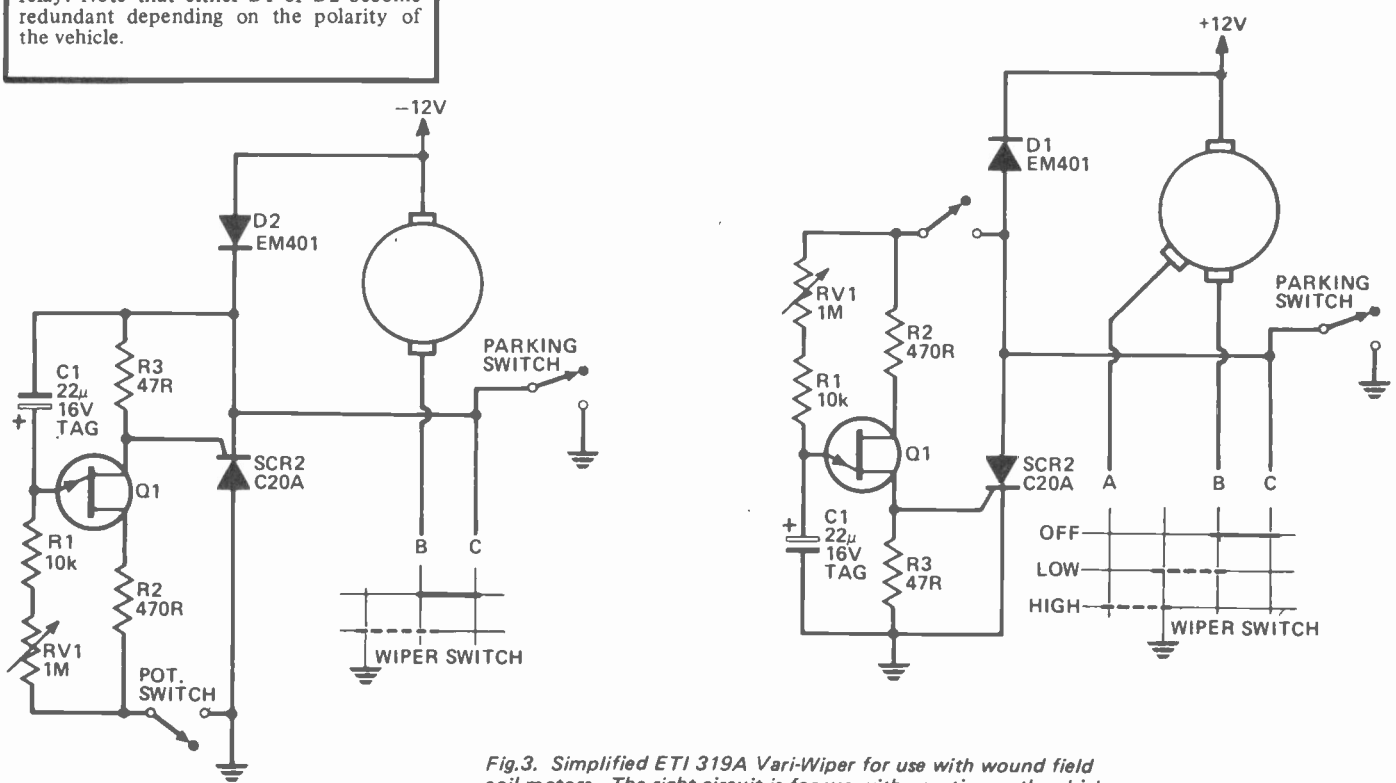


Fig.3. Simplified ETI 319A Vari-Wiper for use with wound field coil motors. The right circuit is for use with negative earth vehicles, and the left for positive earth. Both share the same PCB.

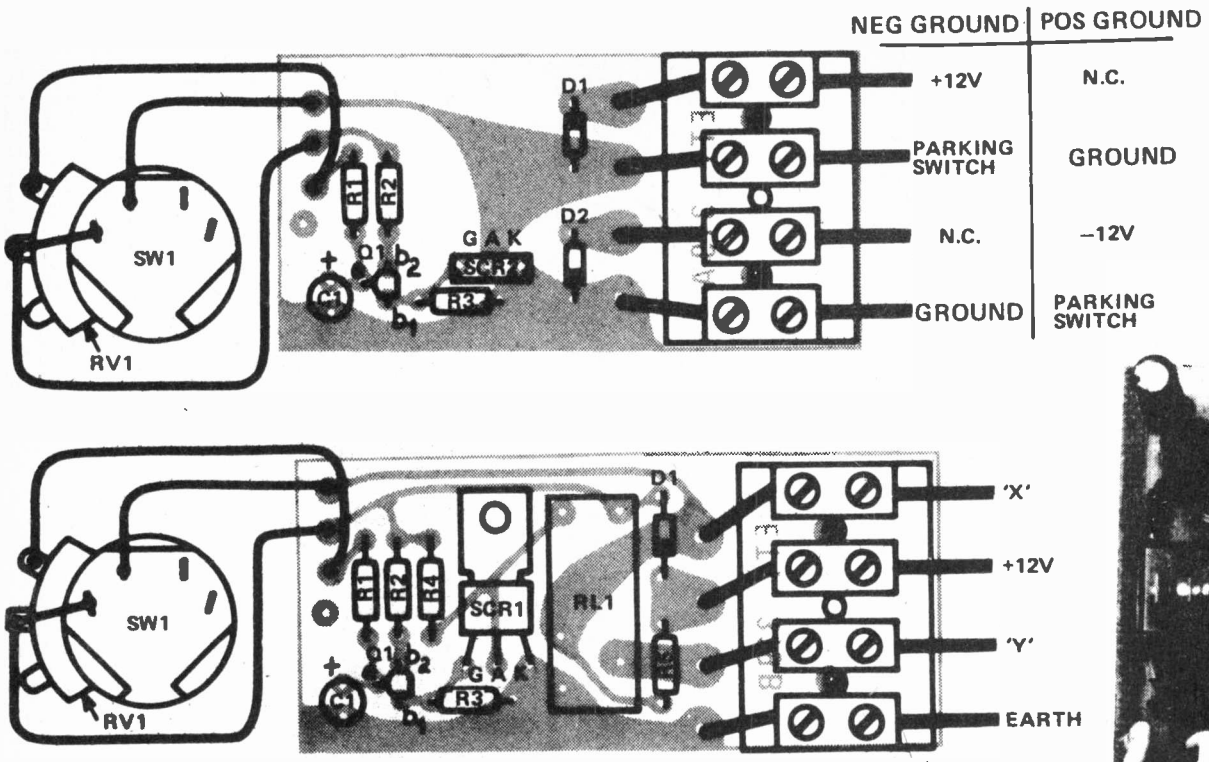


Fig. 5. Component overlays. Note that the same PCB is used for both ground polarities on the ETI 319A.

DELAYED OPERATION

When delayed operation is required, the upper switch is left in the OFF position and the timing circuit energised by operating SW1 which is part of the switch/potentiometer RV1.

After a time which is set by the position of RV1 (0.5-25 secs.) the relay contacts RL1 (1) change over, removing the short circuit from the motor armature before energising the motor by extending an ground via the now closed relay contacts.

As the motor gathers speed the associated cam-operated switch changes over, removing power from the timing circuit (causing the relay to drop out), and extending a ground to the wiper motor via the wiper switch contacts B and C, the now de-energised relay contacts, and the cam-activated switch.

The wipers continue their sweep across the screen, but on their return the cam-operated switch cuts in just before the end of the sweep. This removes power from the wiper motor and places a short across the armature. The motor is thus dynamically braked and remains stationary until the next relay closure from the timing circuit. When this arrives the sequence is repeated.

WOUND FIELD COIL MOTORS

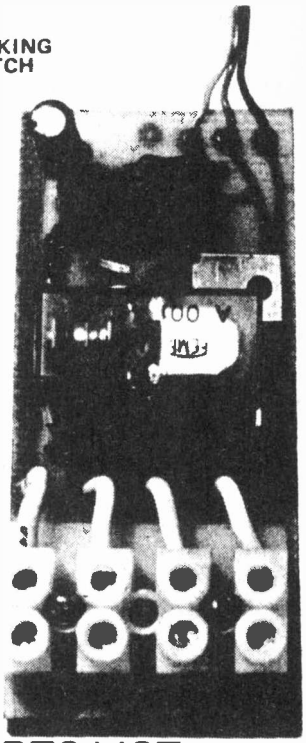
Because wound field coil motors do not use dynamic braking, the Vari-Wiper can be made without a relay. Figure 3 shows the simplified Vari-Wiper circuit and its connections to either a positive or negative ground vehicle. The same printed circuit is used for both arrangements. Operation is similar to the previously described unit, having an ground extended through the SCR to start the motor.

CONSTRUCTION

Assemble and solder all components on the printed circuit board as shown in fig. 5. Do not bend the lugs of the SCR too close to its case and ensure all semiconductors are the right way round.

To connect the unit to the wiper motor circuit, the existing lead from the centre pole of the wiper motor change-over switch to the wiper ON/OFF switch (shown in dotted lines in fig. 2), should be broken at points X and Y and these leads taken to the normally closed contacts on the relay. Ensure that point X goes to the fixed contact and point Y to the moving one.

The potentiometer should be connected to the unit with just enough wire to allow the printed circuit to be mounted in a convenient position under the dash. The potentiometer can be mounted through a 10 mm hole drilled in the facia panel or by attaching it to a bracket mounted in a convenient place.



PARTS LIST

Relay Output Unit

Resistors all ¼W 5%
- R1 . . . . . 10k
- R2 . . . . . 470R
- R3 . . . . . 47R
- R4 . . . . . 1k
- R5 . . . . . 330R

Potentiometer
- RV1 . . . . . 1M switch pot

Capacitor
- C1. . . . . 22μ 16 V electro

Semiconductors
- D1 . . . . . 1N4001
- Q1 . . . . . 2N2646 or MU10 unijunction
- SCR1. . . . . C106Y1

Miscellaneous
- RL1. . . . . Mini PC heavy duty 12 V relay
- PCB ETI 319B
- Nylon terminal strip

SCR Output Unit

All components identical, except:
- R5 . . . . . deleted
- D1/2 . . . . . 1N4001
- SCR2. . . . . C20A
- RL1. . . . . deleted
- PCB ETI 319A

Variwiper

For pcbs for this project please contact: Spectrum Electronics, P. O. Box 4166D, Hamilton Ontario L8V 4L5, or B & R Electronics, P. O. Box 6326F, Hamilton Ontario L9C 6L9.

Circle No. 5 on Reader Service Card.

Shortwave Receiver Survey

AM broadcast band getting you down? Move into the world of international radio. John Garner, our Contributing Shortwave Editor has compiled this survey of receivers available today.

THIS MONTH'S SURVEY of shortwave receivers was put together in order to help our readers wishing either to buy a receiver for the first time or to purchase a better set than they already own. We have tried to point out the major features of each receiver but only the basic data is presented here. We would suggest that you write to the manufacturers or dealers shown for further information. The contacts shown after each item are those that supplied the information for the survey. All data given has has been supplied by the manufacturers or dealers and is not meant as a recommendation by ETI.

TUNING

For the serious shortwave listener accurate tuning is a must. The better receivers now feature a digital frequency display which generally is accurate within 1 kHz or better. These make tuning a short wave station about as easy as tuning in your favorite TV station. The large vernier dials with good spacing between the kilohertz markings can also provide very precise tuning. The slide rule type tuning which is generally found on inexpensive portables are very difficult to use for searching for stations since the shortwave broadcasters are so close together and the dial itself is usually not too accurate. When buying a new receiver, check the tuning for accuracy. A good check is look for WWV's time signals on 5, 10, 15 or 20 MHz — the tuning scale or digital readout should indicate these frequencies accurately.

SENSITIVITY

Sensitivity is the ability of a receiver to pick up signals from weak stations which have travelled a long ways to reach your receiver's antenna. Most of the inexpensive sets lack sufficient sensitivity to pick up many of these interesting stations from around the world thus depriving the listener of some very enjoyable listening hours.

SELECTIVITY

Selectivity indicates how well a receiver will be able to reject signals which are close to the desired station's frequency. Most international broadcaster operate on frequencies 5 KHz apart. Before buying a receiver check this feature. Listen to several stations and look for interference from nearby frequencies.

MODES

Most international broadcasters use the AM (Amplitude Modulation) mode. This is the same mode as is used by your local Broadcast band station. However a few broadcasters use single side band (SSB) and one of the proposals being made at the World Administrative Radio Conference (WARC '79) now being held in Geneva, is that broadcasters use the SSB mode in order to conserve space in the frequency spectrum. Also you will be able to hear many interesting transmissions in the Ham and Utility bands if your receiver is capable of receiving SSB signals. Otherwise these transmissions will sound something like Donald Duck.

FREQUENCY RANGE

The following are the shortwave bands currently being used by international broadcasters. These bands may be increased or new bands may be added after the WARC '79 conference which was mentioned above. It would be wise to consider buying a receiver with full shortwave coverage up to 30 MHz so that you will not miss out on any bands that may be added.

120 meter band 2.3 — 2.5 MHz
90 meter band 3.2 — 3.4 MHz
75 meter band 3.8 — 4.0 MHz
60 meter band 4.5 — 5.0 MHz
49 meter band 5.7 — 6.3 MHz
41 meter band 7.0 — 7.5 MHz
31 meter band 9.5 — 10.0 MHz
25 meter band 11.5 — 12.0 MHz
19 meter band 15.0 — 15.5 MHz
16 meter band 17.5 — 18.0 MHz
13 meter band 21.5 — 22.0 MHz
11 meter band 25.6 — 26.1 MHz

ABBREVIATIONS USED IN THE SURVEY

kHz — kilohertz (1000 cycles per second)
MHz — Megahertz (1,000,000 cycles per second)
AM — amplitude modulation
FM — frequency modulation
SW — shortwave
MW — medium wave
LW — long wave
AGC — Automatic Gain Control
BFO — Beat frequency oscillator
uV — microvolts
dB — decibel
(S + N)/N — signal plus noise divided by noise
AF — Audio frequency
RF — radio frequency
IF — intermediate frequency
VFO — variable frequency oscillator
ANL — automatic noise limiter
PSB — Public service band

PRICES

The prices in the survey are in Canadian dollars where ever possible. These prices include any duty and federal sales tax. Where a price is given in U.S. dollars, you must consider the premium on American money, custom duties and federal sales tax. This would make the price of these items about 40% higher than the American prices quoted after importing them into Canada.

WHO'S INCLUDED

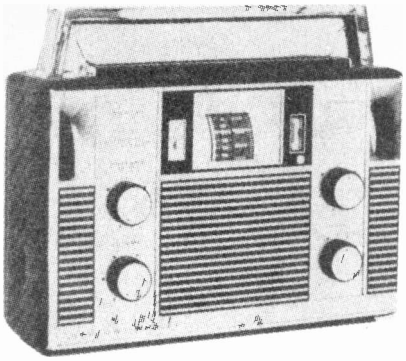
We have tried to include every SW receiver available but there are probably one or two that we've missed.

Receiver Survey

In this case we will include them in future editions of the Shortwave World column. Any additional information would be welcome. Send this to Shortwave World, P.O. Box 142, Thunder Bay, Ontario, P7C 4V5.

ADDRESSES

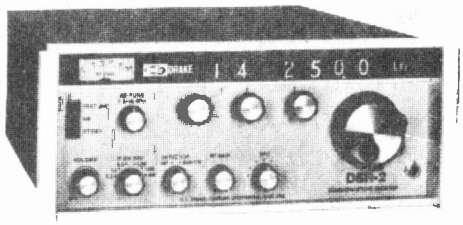
The addresses below are those to contact to find out where to obtain the receivers listed. In some cases these are the addresses where the receivers may be purchased. In other cases you many be advised where to purchase the equipment in your area. In any case literature should be obtainable from these sources.



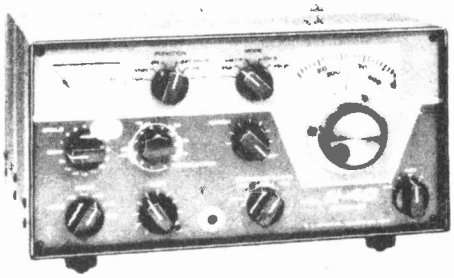
COLLINS R-390/URR
Type: rack mount
Frequency range: 500 kHz-32 MHz
Tuning: spread out dial with digital presentation
Modes: AM; SSB; CW; RTTY
Speaker: external
Antenna: coax provisions, long wire provisions
Provisions for: headphones
Power: 120/220V AC
Other features: plug-in modules
Price: $949 U.S.
Contact: DAMES COMMUNICATIONS SYSTEMS

COLLINS 51S-1
Type: table model
Frequency range: 200 kHz-30 MHz in 30 bands
Tuning: digital readout
Modes: AM wide, AM narrow, FM, FM stereo, SSB, USB, LSB, CW wide, CW narrow; RTTY
Speaker: external
Antenna: coax provisions, long wire provisions
Provisions for: headphones, earphone, recorder, external speaker
Power: 120 V AC
Other features: built-in 100 kHz calibrator; vacuum tube design
Price: $4770 U.S.
Contact: COLLINS

COLLINS 651S-1
Type: table model
Frequency range: 400 kHz-30 MHz continuous
Tuning: digital — main & fine tuning dials
Modes: AM, FM, USB, LSB, CW, RTTY
Speaker: built-in external
Antenna: built-in whip, ferrite rod, coax provisions, long wire provisions
Provisions for: headphones, earphone, recorder; external speaker
Power: 120/220 V AC, 28 V DC (optional)
Other features: switchable AGC, BFO, bandwidth selector
Price: $10,257 U.S.
Contact: COLLINS



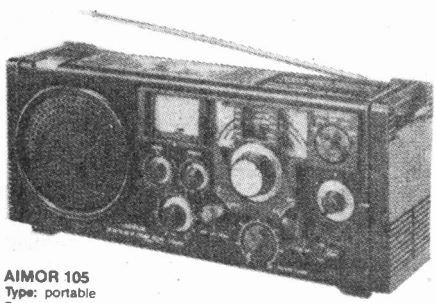
DRAKE DSR-2
Type: table model
Frequency range: 10 kHz-30 MHz continuous
Tuning: digital (nixie tubes)
Modes: AM, USB, LSB, CW, RTTY, ISB
Speaker: built-in
Provisions for: headphones
Power: 120/220 V AC
Sensitivity: 01 - 5 MHz AM — less than 25 uV for 10 dB SINAD at 6k Hz
5 to 30 MHz — less than 2 uV for 10 dB SINAD at 6k Hz
Other features: noise blanker
Size: 340 mm wide x 140 mm high x 380 mm deep (13.4" x 5.5" x 15")
Weight: 7.7 Kg (17 pounds)
Price: $4599 Can
Contact: WSI RADIO



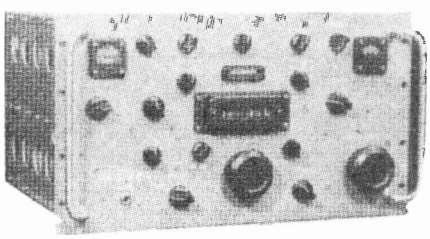
DRAKE R-4C
Type: table model
Frequency range: 1.5 to-30 MHz — crystal controlled
Tuning: Vernier dial — gear driven
Modes: AM, USB, LSB, CW
Speaker: external
Provisions for: headphones, external speaker
Power: 120 V AC
Selectivity: 6 pole 8 kHz for AM
Other features: 25 kHz calibrator, noise blanker (optional)
Price: $1029-1069 Can — matching speaker $54 Can
Contact: WSI RADIO, HAMTRADERS INC

ADDRESSES

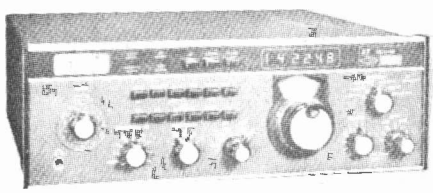
- **Collins Radio Group,** Rockwell International, Cedar Rapids, IA, 52406, USA
- **R. L. Drake Company,** 540 Richard Street, Miamisburg, OH, 45342, USA
- **Gilfer Associates Inc.,** P.O. Box 239, Park Ridge, NJ, 07656, USA
- **Glenwood Trading Co., Ltd.,** 278 East 1st Street, North Vancouver, BC, V7L 1B3, Canada
- **Ham Traders Inc.,** 45 Brisbane Rd., Unit #18, Downsview, Ont., M3H 2K1
- **Lafayette Radio Electronics Corp.,** 111 Jericho Turnpike, Syosset, NY, 11791, USA
- **Matsushita Electric of Canada Ltd.,** 5570 Ambler Dr., Mississauga, Ontario L4W 2K9 (Panasonic)
- **McKay Dymek Company** P.O. Box 5000, 111 S. College Avenue, Claremont, CA 91711, USA.
- **National Radio Company,** 89 Washington Street, Melrose, MA 02176, USA
- **NordMende, Sterling HiFi Inc.,** 22-20 40th Ave., Long Island City, NY, 11101, USA.
- **C. M. Peterson Co. Ltd.,** 220 Adelaide St. N., London, Ontario N6E 3H4
- **Radio Shack,** Box 34,000, Barrie, Ontario, L4M 4W5
- **Radios International,** P.O. Box 6053, Richardson, TX, 75080, USA
- **Radio West,** 3417 Purer Road, Escondido, CA 92025, USA
- **Sony of Canada Ltd.,** 1370 Sony Place, Winnipeg Manitoba R3C 3C3.
- **Tandberg of America Inc.,** Labriola Court, Armonk, NY 10504, USA
- **Ten-Tec Inc.,** Sevierville, TN 37862, USA
- **WSI Radio,** 18 Sheldon Avenue North, Kitchener, Ontario N2H 3M2
- **Yaesu Musen USA, Inc.,** 15954 Downey Ave., P.O. Box 498 Paramount, CA 90723, USA



AIMOR 105
Type: portable
Frequency range: 530 kHz-30 MHz + 88-108 MHz in 5 bands
Tuning: large Vernier dial+fine tuning
Modes: AM, FM
Speaker: built-in
Antenna: built-in whip; ferrite rod
Provisions for: earphone
Power: 120 V AC; 6 V DC, 4-D cells
Other features: built-in 60 min. sleep timer
Size: 369 mm wide x 157 mm high x 92 mm deep (14.5" x 6.2" x 3.6")
Weight: 2.7 Kg (6 pounds)
Price: $199.95 Can.
Contact: GLADSTONE ELECTRONICS



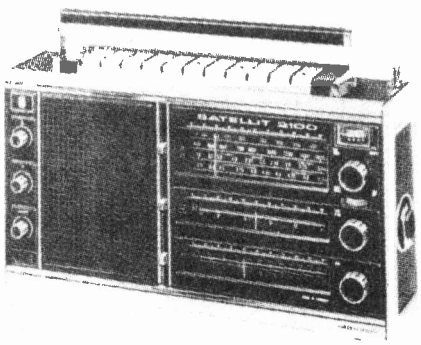
BARLOW WADLEY XCR 30 MARK 2
Type: portable
Frequency range: 500 kHz-30 MHz continuous
Tuning: MHz & kHz dials
Modes: AM; USB; LSB; CW
Speaker: built-in
Antenna: built-in whip; long wire provisions
Provisions for: earphone
Power: 6-9 V DC; 6-D cells
Sensitivity: exceeding 2 uV
Other features: triple conversion Wadley loop ceramic if filters
Price: $329 Can
Contact: WSI RADIO



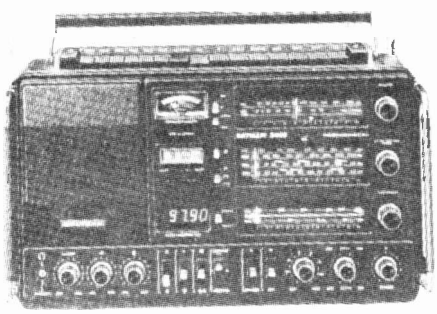
DRAKE R-7
Type: table model
Frequency range: 0-30 MHz
Tuning: digital
Modes: AM, USB, LSB, CW, RTTY
Speaker: built-in
Provisions for: headphones, external speaker
Power: 120/220 V AC, 13.8 V DC
Sensitivity: AM (1.8-30 MHz) less than 1.2 uV for 10 dB (S+N)/N @ 30% modulation
Selectivity: 2.3 kHz -6 dB, 4.2 kHz @ -60 dB
Other features: 25 kHz calibrator, adjustable pass band
Size: 346 mm wide x 116 mm high x 330 mm deep (13.6" x 4.6" x 13")
Weight: 8.34 Kg (18.4 pounds)
Price: $1899 Can
Contact: HAMTRADERS INC, WSI RADIO

Receiver Survey

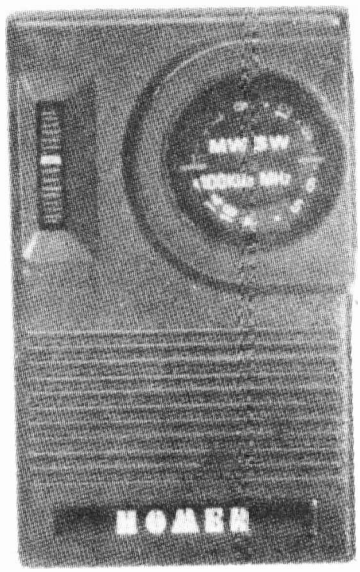
GRUNDIG KMV 1000
Type: converter for car radio
Frequency range: 13 16 19, 25, 31, 41, 49, 60, 75, 90 meter bands
Tuning: push button for bands + car radio tuning
Modes: AM
Power: 12 V DC
Other features: converts car radios with AM range into SW receivers
Size: 178 mm wide x 30 mm high x 86 mm deep (7" x 1 2" x 3.4")
Price: $119 50 U S
Contact: RADIOS INTERNATIONAL



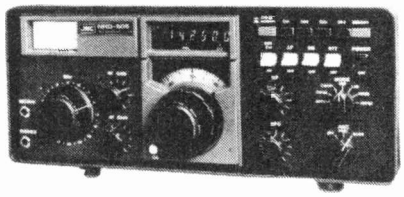
GRUNDIG SATELLIT 2100
Type: portable
Frequency range: 21 bands cover 18 SW bands from 160 to 10 meters, plus FM, AM, and LW
Tuning: drum tuner — separate FM section
Modes: AM FM SSB, CW
Speaker: built-in + 2
Antenna: built-in whip, ferrite rod, coax provisions, long wire provisions
Provisions for: headphones, earphone, recorder, external speaker
Power: 9-16 V DC, 6 cells
Other features: 7 Watts music
Size: 460 mm wide x 270 mm high x 120 mm deep (18 1" x 10 6" x 4 7")
Weight: 6 3 Kg (13 pounds 15 oz)
Price: $579 U S
Contact: RADIOS INTERNATIONAL



GRUNDIG SATELLIT 3400
Type: portable
Frequency range: 21 bands cover 18 SW bands from 160 to 10 meters. plus FM AM and LW (150-400 kHz)
Tuning: analog & digital — drum tuner — separate FM section
Modes: AM, FM USB LSB, CW
Speaker: built-in -2
Antenna: built-in whip, ferrite rod
Provisions for: headphones
Power: 120 220 V AC, 12 V DC
Other features: 24 hour removeable digital clock, noise limiter
Size: 500 mm wide x 290 mm high x 120 mm deep (19 7" x 11 4" x 4 7")
Weight: 8.9 Kg (19 pounds 10 oz)
Price: $975 U S -1095 U S
Contact: GILFER SHORTWAVE, RADIOS INTERNATIONAL

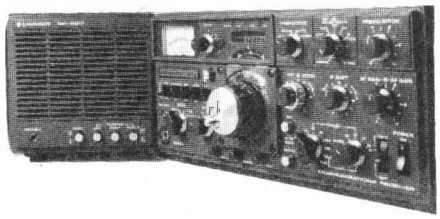


HOMER EP-8
Type: portable
Frequency range: AM + SW (3.9-12 MHz) in 2 bands
Tuning: round dial scale
Modes: AM
Speaker: built-in
Antenna: built-in
Provisions for: earphone
Power: 2 hearing aid batteries
Other features: must be placed close to telephone or AC line for most SW reception
Size: 57 mm wide x 65 mm high x 25 mm deep (1½" x 2½" x 1") approx
Price: $29 95 U.S
Contact: RADIOS INTERNATIONAL



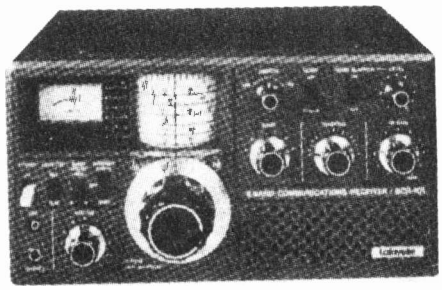
JAPAN RADIO CORP. NRD 505
Type: table model
Frequency range: 100 kHz-30 MHz
Tuning: digital & analog — MHz & kHz dials
Modes: AM wide, AM narrow, USB, LSB, CW wide, CW narrow, RTTY
Speaker: external
Antenna: coax provisions, long wire provisions
Provisions for: headphones, recorder, external speaker
Power: 120/220 V AC
Sensitivity: (S/N 10 dB) AM — 1 6-30 MHz — less than 2 uV
100-1600 kHz — less than 40 uV
Selectivity: AM (wide) 4 4 to 7 kHz @ -6 dB, 10 kHz or less @ -60 dB
AM (narrow) 2 to 2 6 kHz @ - 6dB; 6kHz or less @ – 60dB
Other features: noise blanker, input attenuator, AF active filter
Size: 340 mm wide x 140 mm high x 300 mm deep (13 4" x 5 5" x 11.8")
Weight: 10 Kg (22 pounds)
Price: $2275 U S. — matching speaker $9C U S
Contact: GILFER SHORTWAVE

KENWOOD R-300
Type: table model
Frequency range: 170 -41 kHz + 525 kHz-30 MHz in 6 bands
Tuning: main dial + bandspread dial
Modes: AM; FM, FM stereo; SSB, USB; LSB, CW wide; CW narrow; RTTY
Speaker: built-in
Antenna: built-in whip; ferrite rod coax provisions; long wire provisions
Provisions for: headphones; recorder, external speaker
Power: 120/220 V AC; 12-16 V DC
Sensitivity: (S+N)/N 10 dB @ 50 mW — AM — better than 1 uV
(280 kHz-3 MHz & 24-30 MHz) better than 1 5 uV (3-18 MHz)
Selectivity: narrow — 2 5 kHz -6 dB, 12 kHz -60 dB
wide — 5 kHz -6 dB, 17 kHz -60 dB
Other features: 500 kHz marker; wide-narrow selectivity
Size: 362 mm wide x 163 mm high x 322 mm deep (14.2" x 6.4" x 12.7")
Weight: 7 6 Kg (16.7 pounds)
Price: $389-399 Can.
Contact: GLENWOOD TRADING CO.; HAMTRADERS INC.



KENWOOD R-820
Type: table model
Frequency range: 160, 80, 40, 20, 15, 10 meter ham bands plus 5.9-6.4; 9.4-9.9; 11.5-12; 15 0-15.5; 17.7-18 2 MHz in 14 bands
Tuning: digital — + large Vernier dial & subdial
Modes: AM, USB; LSB; CW; RTTY
Speaker: external
Provisions for: headphones, recorder, external speaker
Power: 120/220 V AC, 12-15 V DC
Sensitivity: AM — 3 uV (S+N)/N for 10 dB minimum
Selectivity: AM — 6 kHz -6 dB; 12 kHz -60 dB
Other features: separate selectivity selector variable attenuator
Size: 336 mm wide x 167 mm high x 397 mm deep (13.2" x 6.6" x 15 6")
Weight: 12 Kg (26 pounds 8 oz)
Price: $1599 Can — matching speaker — $89 95 Can
Contact: HAMTRADERS INC ; GLENWOOD TRADING CO LTD.

KENWOOD R1000
Frequency range: 200kHz to 30MHz (continuous)
Tuning: analog dial and digital readout
Modes: AM Wide, AM Narrow, SSB, CW
Speaker: built-in
Antenna: external
Provision for: recording, headphones
Other features: digital clock and timer
Price: $629.00 CAN.
Contact: Glenwood Trading Co. Ltd.



LAFAYETTE BCR-101
Type: table model
Frequency range: 170-400 kHz & 530 kHz-30 MHz in 6 bands
Tuning: drum scale plus bandspread
Modes: AM; SSB; CW
Speaker: built-in
Antenna: ferrite rod; long wire provisions
Provisions for: headphones, earphone, recorder, external speaker
Power: 120 V AC; 13 8 V DC
Sensitivity: SW — 1 uV or better
Selectivity: (-6 dB) 8 kHz (wide) 3 kHz (narrow)
Other features: wide/narrow bandwidth selector; 50/500 kHz calibrator
Size: 301 mm wide x 178 mm high x 241 mm deep (12" x 7" x 9½")
Weight: 6.1 Kg (13 pounds 8 oz)
Price: $249.95 U S.
Contact: LAFAYETTE RADIO

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TYPE	DESCRIPTION		PRICE
T2322F	50V	2.5A	$0.70
T2322B	200V	2.5A	0.99
T2801F	50V	6A	0.82
T2801A	100V	6A	0.90
T2801D	400V	6A	1.45
T2806B	200V	8A	1.50
T4121B	200V	10A	4.25
T4120D	400V	15A	5.00
T6426B	200V	40A	6.80

MICROPROCESSORS 6800

TYPE	DESCRIPTION	PRICE
6800	CPU 8 - Bit parallel	10.00
6802	MPU with clock and RAM	15.80
6821	Peripheral interface adapter	5.55
6840	Programmable timer module	18.90
6845	CRT controller	33.70
6846	ROM-I/O - timer	36.36
6847	Video display generator	25.45
6850	Asyn chronous comm. interface adapter	4.55
68488	General purpose interface adapter	26.90

LIGHT EMITTING DIODE

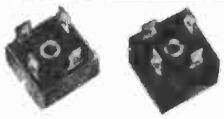
TYPE	DESCRIPTION	PRICE
LED220	T - 1 - 3/4 5mm RED	$0.12

MEMORIES - ALL MAJOR BRANDS

TYPE	DESCRIPTION	PRICE
2708	8K PROM ceramic D.I.L.	12.00
4045	1024 word by 4-Bit static RAM, 450 NS.	8.00
2716	16K PROM ceramic D.I.L.	25.00
4116	16,384-Bit dynamics RAM, 300 NS plastic DIL	9.00

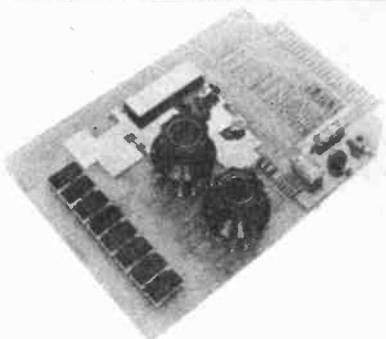
TEXAS INSTRUMENTS SOCKETS

Contacts	PRICE	Contacts	PRICE
8 PIN	$0.13	20 PIN	0.24
14 PIN	0.15	22 PIN	0.26
16 PIN	0.17	24 PIN	0.36
18 PIN	0.21	28 PIN	0.42
20 PIN	0.24	FSTNIP	
22 PIN	0.26		



EDI BRIDGE RECTIFIERS EDI

TYPE	DESCRIPTION			PRICE
PA40	15A single phase	400 PIV		$2.50
PB40	25A	"	" 400 PIV	2.60
PE40	5A	"	" 400 PIV	2.00
PF40	15A	"	" 400 PIV	0.54



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Model ICM 7226 EV/kit Price $79.95

All prices shown are Canadian funds with Federal sales tax not included in price. Add 9% for FST where applicable.Provincial sales tax also to be added

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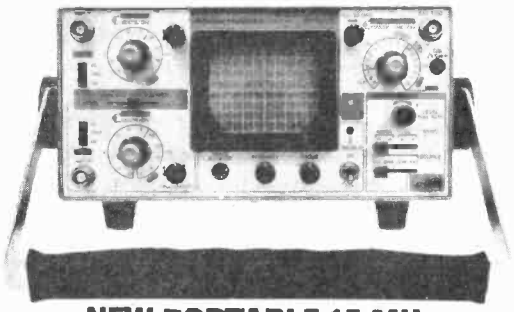

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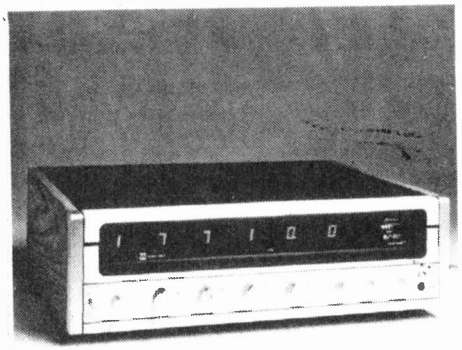
Circle No. 7 on Reader Service Card.

Receiver Survey

McKAY DYMEK DR 22
Type: table model
Frequency range: 50 kHz-29 7 MHz continuous
Tuning: digital
Modes: AM; USB, LSB, CW, RTTY (with external converter)
Speaker: 4" built-in
Antenna: coax provisions; long wire provisions
Provisions for: headphones, recorder, external speaker
Power: 120/220 V AC
Sensitivity: 10 dB (S+N/N) AM (4 kHz bandwidth) — 10 uV @ 100 kHz to 1 5 uV @ 20 MHz
Selectivity: 4 kHz bandwidth 4 kHz -6 dB, 10 kHz -60 dB 8 kHz bandwidth 8 kHz -6 dB; 28 kHz -60 dB
Other features: 4 or 8 kHz bandwidth selector
Size: 430 mm wide x 130 mm high x 370 mm deep (17 5 ' x 5 1" x 15")
Weight: 6 8 Kg (15 pounds)
Price: $1399 Can
Contact: WSI RADIO

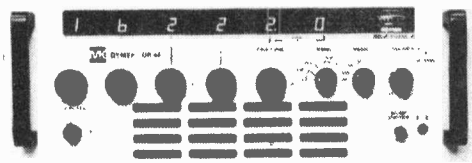
McKAY DYMEK DR 22 C
Same as DR 22 plus noise limiter
Price: $1499 Can
Contact: WSI RADIO

McKAY DYMEK DR 22 C-6
Same as DR 22 C except with 600 Ohm audio output
Price: $1579 Can
Contact: WSI RADIO



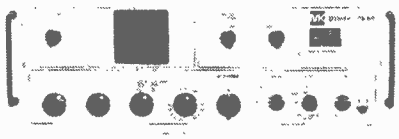
McKAY DYMEK DR 33 C
Type: table model
Frequency range: 50 kHz-29 7 MHz continuous
Tuning: digital
Modes: AM; USB, LSB; CW; RTTY (with external converter)
Speaker: 4" built-in
Antenna: coax provisions, long wire provisions
Provisions for: headphones, recorder; external speaker
Power: 120/220 V AC
Sensitivity: 10 dB (S+N)/N: AM (4 kHz bandwidth) — 10 uV @ 100 kHz to 1 5 uV @ 20 MHz
Selectivity: 4 kHz bandwidth. 4 kHz -6 dB, 10 kHz -60 dB 8 kHz bandwidth 8 kHz -6 dB, 28 kHz -60 dB
Other features: 4 or 8 kHz bandwidth, noise limiter independent selection of reception mode & IF filter
Size: 430 mm wide x 130 mm high x 370 mm deep (17 5" x 5 1" x 15")
Weight: 7.3 Kg (16 pounds)
Price: $2249 Can
Contact: WSI RADIO

McKAY DYMEK DR 33 C-6
Same as DR 33 C except with 600 Ohm audio output
Price: $2329 Can.
Contact: WSI RADIO

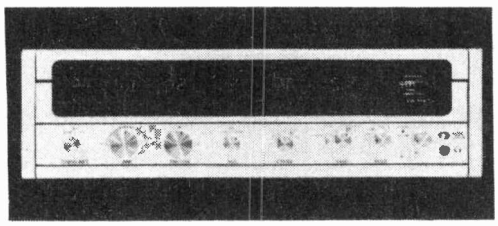


McKAY DYMEK DR 44
Type: rack mount
Frequency range: 50 kHz-29.7 MHz continuous
Tuning: digital
Modes: AM; USB; LSB, CW; RTTY (with external converter)
Speaker: 4" built-in
Antenna: coax provisions, long wire provisions
Provisions for: headphones; recorder; external speaker
Power: 120/220 V AC
Sensitivity: 10 dB (S+N)/N: AM (4 kHz bandwidth) — 10 uV @ 100 kHz to 1.5 uV @ 20 MHz
Selectivity: 4 kHz bandwidth: 4 kHz -6 dB; 10 kHz -60 dB 8 kHz bandwidth: 8 kHz -6 dB; 28 kHz -80 dB
Other features: 4 or 8 kHz bandwidth: noise limiter: independent selection of reception mode & IF filter
Size: 480 mm wide x 180 mm high x 370 mm deep (19" x 7" x 15")
Weight: 7.3 Kg (16 pounds)
Price: $2399 Can.
Contact: WSI RADIO

McKAY DYMEK DR 44-6
Same as DR 44 except with 600 Ohm audio output
Price: $2479 Can
Contact: WSI RADIO



McKAY DYMEK DR 55
Type: rack mount
Frequency range: 50 kHz-29.7 MHz continuous
Tuning: 5 rotary indicator switches
Modes: AM, USB; LSB, CW, RTTY (with external converter)
Speaker: 4" built-in
Antenna: coax provisions, long wire provisions
Provisions for: headphones, recorder, external speaker
Power: 120/220 V AC
Sensitivity: 10 dB (S+N)/N AM (4 kHz bandwidth) — 10 uV @ 100 kHz to 1 5 uV @ 20 MHz
Selectivity: 4 kHz bandwidth 4 kHz -6 dB; 10 kHz -60 dB 8 kHz bandwidth 8 kHz -6 dB; 28 kHz -60 dB
Other features: 4 or 8 kHz bandwidth. noise limiter independent selection of reception mode & IF filter
Size: 480 mm wide x 180 mm high x 370 mm deep (19" x 7" x 15")
Weight: 7.3 Kg (16 pounds)
Price: $1199 Can
Contact: WSI RADIO



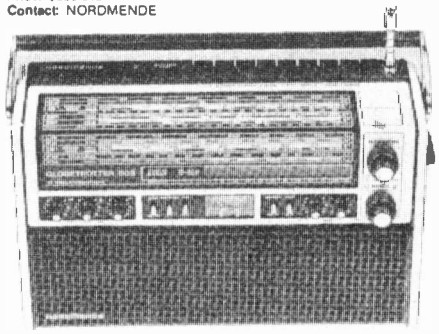
McKAY DYMEK DR 101
Type: table model
Frequency range: 50 kHz-29 7 MHz continuous
Tuning: digital — 3 speed control
Modes: AM; USB; LSB; CW; RTTY (with external converter)
Speaker: 4" built-in
Antenna: coax provisions; long wire provisions
Provisions for: headphones; recorder; external speaker
Power: 120/220 V AC
Sensitivity: 10 dB (S+N)/N: AM (4 kHz bandwidth) — 10 uV @ 100 kHz to 1.5 uV @ 20 MHz
Selectivity: 4 kHz bandwidth: 4 kHz -6 dB, 10 kHz -60 dB 8 kHz bandwidth: 8 kHz -6 dB, 28 kHz -60 dB
Other features: 4 or 8 kHz bandwidth: noise limiter:
Automatic scanning: independent selection of reception mode & IF filter
Size: 430 mm wide x 130 mm high x 370 mm deep (17.5" x 5.1" x 15")
Weight: 7.3 Kg (16 pounds)
Contact: McKAY DYMEK

NATIONAL HRO 600
Type: table model
Frequency range: 16 kHz-30 MHz in 30 bands
Modes: AM; SSB; CW
Speaker: built-in external
Antenna: coax provisions; long wire provisions
Provisions for: headphones;recorder; external speaker
Power: 120 V AC
Sensitivity: 0.75 uV for 10 dB (S+N)/N
Other features: 8, 2.4, 2, 1, 0.135 bandwidth selector; antenna RF voltage protection
Size: 432 mm wide x 133 mm high x 394 mm deep (17" x 5¼" x 15½")
Price: $4190 U.S.
Contact: NATIONAL RADIO CO

NATIONAL HRO 600/601
VFO search version; tuning accuracy better than + 50 Hz; four digit frequency display (kHz) fine tune
Price: $4990 U.S.
Contact: NATIONAL RADIO

NATIONAL HRO 600/602
Synthesizer version — tuning accuracy better than + 10 Hz; four digit frequency display, fine tune control
Price: $4990 U.S
Contact: NATIONAL RADIO

NORDMENDE GLOBEMASTER
Type: portable
Frequency range: 1 6-30 MHz + AM, FM, LW in 10 bands
Tuning: includes fine tuning
Modes: AM; FM
Speaker: built-in
Antenna: built-in whip
Provisions for: headphones; recorder, external speaker
Power: 120/220 V AC, 6 'D' cells
Size: 381 mm wide x 203 mm high x 89 mm deep (15" x 8" x 3½")
Price: $230 U.S
Contact: NORDMENDE



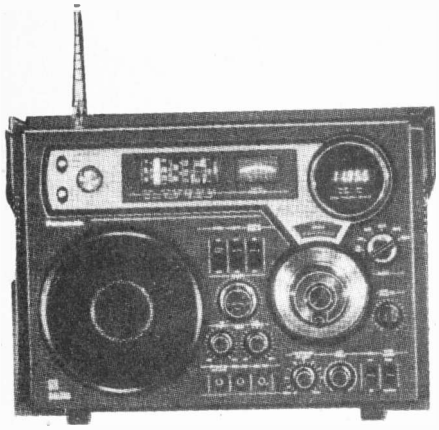
NORDMENDE GLOBETROTTER 808
Type: portable
Frequency range: 17 wave ranges (FM, MW, LW, 3 SW ranges from 1.58-19 MHz and 11 spread SW bands — 10, 11, 13, 15, 16, 19, 20, 25, 40/41, 49 75/80 meter bands)
Tuning: drum scale
Modes: AM, FM; SSB, CW
Speaker: built-in
Antenna: built-in whip, ferrite rod long wire provisions
Provisions for: headphones, earphone, recorder, external speaker
Power: 120 V AC, 12-14 V DC, 6 'D' cells
Other features: 7 Watt music power; antenna trimmer
Size: 400 mm wide x 250 mm high x 120 mm deep (15 7" x 9 8" x 4 7")
Weight: 4 4 Kg (9 pounds 11 oz)
Price: $429 95 U S -$439 U S.
Contact: RADIOS INTERNATIONAL, GILFER SHORTWAVE

PANASONIC RF-2200
Type: portable
Frequency range: 3 9 MHz-28 MHz + AM + FM in 8 bands
Tuning: direct frequency readout — main & bandspread dials
Modes: AM, FM, SSB, CW
Speaker: 4" built-in
Antenna: built-in whip, ferrite rod, long wire providions
Provisions for: headphones, recorder, external speaker
Power: 120 V AC; 6 V DC; 4 x 'D' cells
Sensitivity: S/N 20 dB 30% modulation 50 mW (SW) 7 uV to 22 uV
Selectivity: wide: + 2.5 kHz @ -6 dB, + 15 kHz @ -60 dB narrow: + 1 7 kHz @ -6 dB, + 10 kHz @ -60 dB
Other features: 125 & 500 kHz markers
Size: 318 mm wide x 188 mm high x 100 mm deep ($12\frac{9}{16}$" x $7\frac{7}{16}$" x $2\frac{15}{16}$")
Weight: 3 4 Kg (7 pounds 8 oz) (with batteries)
Price: $269.95 Can.
Contact: PANASONIC

Number One ETI CIRCUITS

The first in a series of 'ideas books' for the experimenter

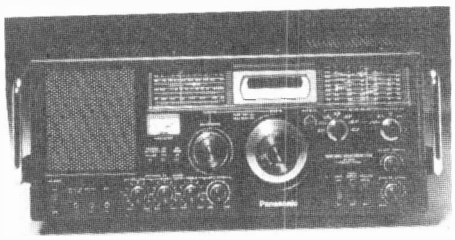
Contents



PANASONIC RF-2600
Type: portable
Frequency range: 3 2-30 MHz + AM + FM in 6 bands
Tuning: digital readout — single speed dial
Modes: AM, FM, SSB, CW
Speaker: built-in
Antenna: built-in whip, ferrite rod, long wire provisions
Provisions for: headphones, earphone recorder external speaker
Power: 120 V AC 9 V DC 6 'D' cells
Size: slightly smaller than the RF-2800
Price: $214 U S
Contact: GILFER

PANASONIC RF-2800
Type: portable
Frequency range: 3 2-30 MHz + AM + FM in 5 bands
Tuning: 2 speed drum dial (digital readout on SW)
Modes: AM, wide, AM narrow FM, SSB CW
Speaker: 4" built-in
Antenna: built-in whip ferrite rod long wire provisions
Provisions for: headphones, earphone recorder external speaker
Power: 120 V AC, 9 V DC, 6 'D' cells
Sensitivity: S/N 20 dB 30% modulation 50 mW (SW) 11 to 16 uV
Selectivity: + 2 5 kHz @ -6 dB + 15 kHz @ -60 dB
+ 1 7 kHz @ -6 dB, + 9 kHz @ -60 dB
Other features: adjustable calibration of digital readout
Size: 381 mm wide x 245 mm high x 120 mm deep (15 " x 9 11/16 x 4 3/4")
Weight: 3 9 Kg (8 pounds 10 oz) (with batteries)
Price: $389.95 Can
Contact: PANASONIC

PANASONIC RF 2900
The same as RF-2800 except with digital readout on all bands — this model will replace the RF-2800
Price: $390 approx Can
Contact: PANASONIC

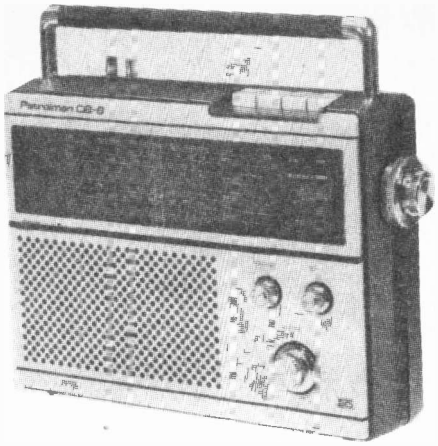


PANASONIC RF-4800
Type: table model
Frequency range: 1 6-31 MHz + AM + FM in 10 bands
Tuning: 2 dial drum with digital readout on SW
Modes: AM wide, AM narrow, FM, SSB, CW
Speaker: built-in
Antenna: ferrite rod, long wire provisions
Provisions for: headphones, earphone, recorder, external speaker
Power: 120 V AC, 12 V DC, 8 'D' cells
Sensitivity: S/N 20 dB 30% modulation 50 mW (SW) 2 5 to 7 uV
Selectivity: wide + 2 5 kHz @ -6 dB + 15 kHz @ -60 dB
+ 1 7 kHz @ -6 dB; + 6 kHz @ -60 dB
Other features: adjustable calibration of digital readout, antenna trimmer 'ANL' circuitry
Size: 482 mm wide x 200 mm high x 354 mm deep (19" x 7 7/8" x 13 15/16")
Weight: 9 Kg (19 pounds 14 oz) (with batteries)
Price: $699 95 Can
Contact: PANASONIC

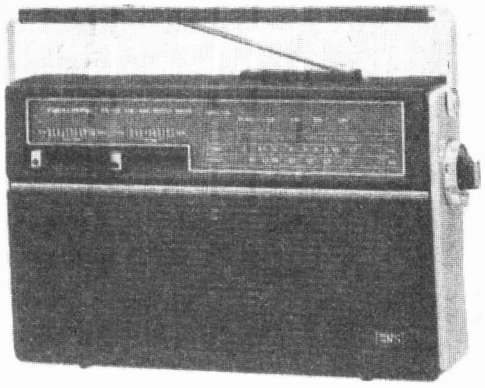
PANASONIC RF-4900
The same as RF 4800 except with digital readout on all bands — This model will replace the RF-4800
Price: $700 approx Can
Contact: PANASONIC

PANASONIC RF-4900 MODIFIED
Stock RF-4900 modified by Gilfer to vastly improve 'narrow' selectivity
Price: $479 U S
Contact: GILFER SHORTWAVE

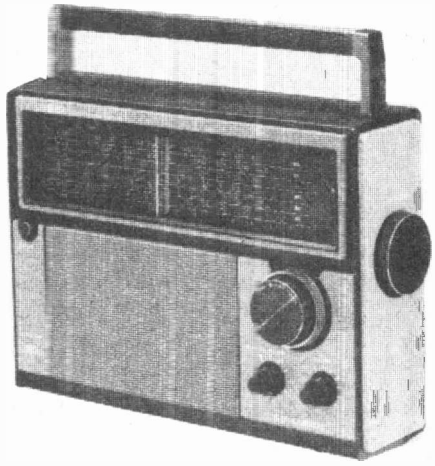
PANASONIC RF-8000
Type: portable
Frequency range: 150 kHz to 230 MHz in 24 bands
Tuning: twin rotary dials
Modes: AM wide, AM narrow, FM, USB; LSB, CW wide, CW narrow RTTY
Speaker: built-in-2
Antenna: built-in whip, ferrite rod, coax provisions, long wire provisions
Provisions for: headphones, earphone, recorder, external speaker
Power: 120/220 V AC, 12 V DC, 8 'D' cells
Sensitivity: (S+N)/N 6dB — 0.3-0 5 uV (AM narrow) on SW
Selectivity: wide (LW, MW, MB, SW) + 1 7 kHz @ -3 dB, + 17 kHz @ -60dB
+ 1 1 kHz @ -3 dB, + 3 kHz @ -60 dB
Other features: built-in clock, automatic noise limiter, loudness switch
Size: 512 mm wide x 361 mm high x 213 mm deep (20 3/16" x 14 1/4" x 8 3/8")
Weight: 21 Kg (48 pounds 5 oz)
Price: $4200 Can
Contact: PANASONIC



PATROLMAN CB-8
Type: portable
Frequency range: 6-18MHz + AM, FM, VHF & UHF in 8 bands
Tuning: slide rule dial
Modes: AM, FM
Speaker: built-in
Antenna: 2 built-in whip
Provisions for: headphones
Power: 120 V AC, 6 'D' cells
Other features: CB channels 1-40
Price: $149 95 Can
Contact: RADIO SHACK



REALISTIC DX-40
Type: portable
Frequency range: 4-22 MHz + AM & FM in 4 bands
Tuning: slide rule dial
Modes: AM, FM
Speaker: 3½" built-in
Antenna: built-in whip, ferrite rod, antenna jack
Power: 120 V AC 4 'C' cells
Price: $64 95 Can
Contact: RADIO SHACK



REALISTIC DX-60
Type: portable
Frequency range: 3-26 MHz - AM & FM & C-B in 6 bands
Tuning: slide rule dial
Modes: AM FM
Speaker 4" built-in
Antenna: built-in whip, ferrite rod, long wire provisions
Provisions for: headphones
Power: 120 V AC 4 'C' cells
Price: $89 95 Can
Contact: RADIO SHACK

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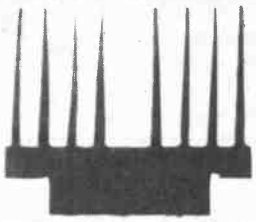

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Thurs., Fri. 9:30-9
(Closed Mon.)

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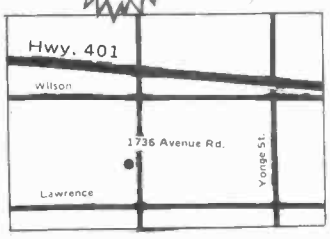

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16 page insert To ETI Canada, Oct. '79.

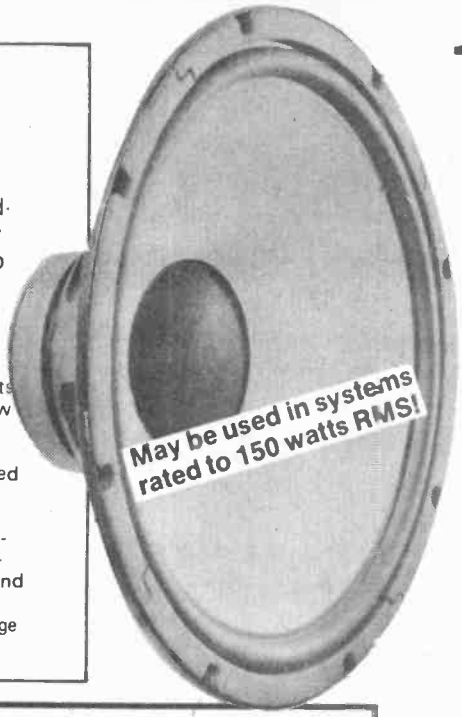
PHILIPS DeForest HI-FI SPEAKERS

GLADSTONE'S SPEAKERKITS

UNDENIABLE VALUE!

Build a set of Philips DeForest speakers and take advantage of Gladstone's low prices. Our volume purchases keep the prices down!

TECHNICAL NOTE: WOOFERS: All DeForest woofers have large magnets, sturdy suspension, and low fundamental resonance - meaning that the bass response in the recommended enclosures will be deep, powerful, and distortion-free. The rated power handling of all DeForest woofers is a minimum rating and most woofers can exceed rated specifications by large margins.



15'' 80 WATT WOOFER!

LIST PRICE 112.00

MODEL AD15240/W8

74.95

A heavy duty high quality woofer for Super Lows! Reproduces frequencies from 18 Hz to 1000 Hz, handles up to 80 watts RMS, yet can be used with amplifiers as low as 15 watts per channel, due to it's high efficiency. Rigid paper cone with high flexibility foam surround and 40 ounce magnet. 2" aluminum voice coil. 18 Hz is nominal resonance. 8 ohms. Requires sealed enclosure.

GUARANTEE

Gladstone Electronics offers a one-year unconditional warranty against factory defects on all Philips Deforest components. Immediate over-the-counter exchange or replacement of defective components. (Warranty does not cover speakers that have been abused or burned out.)

5" CLOSED-BACK MID-RANGE

21.95

LIST PRICE
AD5060/SQ

*the most popular mid-range "add-on" on the market.

Housed in its own optimum volume sealed enclosure, this excellent mid-range handles frequencies between 400 and 8,000 Hz. Handles 40 watts in system. Use 2 for 80 watts. Available in 4 or 8 ohms - please specify.

DeForest 12" 40 WATT WOOFER

LIST PRICE $59.00

MODEL AD12600/W8

42.95

A real deal! 12" woofer for hefty bass performance at an ultra-low price. Reproduced frequencies from 25 Hz up in sealed enclosure. Uses foam cone rim. Maximum power handling is 40 watts RMS (60 watts in systems). Magnet weight is 11 oz. Volce coil is aluminum/copper. One year warranty.

TEXTILE DOME MIDRANGE

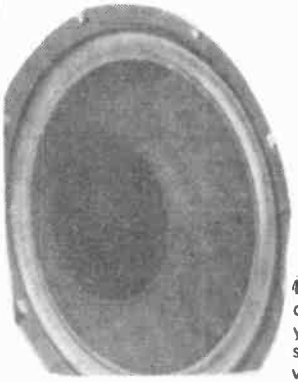
List price **49.00**

32.95

AD0211/SQ

Latest refinement of the famous DeForest Dome Midrange Speaker! Now the dome is made of textile to provide smoother, silkier midrange response than ever! Provides superior dispersion in the critical 500-5000 Hz range, can handle up to 60 watts in a system (use two or more for higher power requirements). Unit is delf-contained in its own sealed-back enclosure. Size is 5½". Aluminum/copper voice coil. Specify 4 or 8 ohms.

AD12240/W8



12'' 70 W WOOFER

MODEL AD12240/W8

74.95

LIST PRICE 110.00

For higher powered systems, this 12 incher give substantial performance. Bass you can feel! Has a rugged foam roll surround, 40 oz. magnet, 2" high power voice coil. Handles up to 70 watts. Use with amplifiers up to 120 watts/channell

NEW 12" WOOFERS

AD12200/W8 80 watts. 30 Oz. magnet. $74.95
AD12250/W8 100 watts. 40 Oz. magnet $79.95

FREE CABINET PLANS ARE PROVIDED WITH THE PURCHASE OF ANY SPEAKER SYSTEM.

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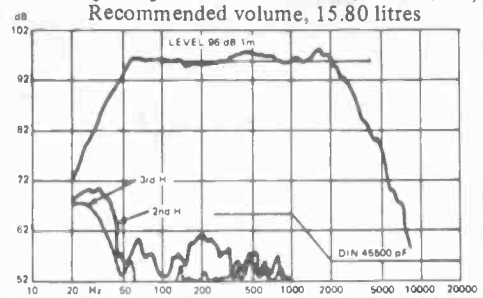
Canada's most popular speakers at super-low prices! Gladstones sell DeForest speakers at up to 50% savings from Philips recommended resale price to consumers.

NEW 12" 60 WATT WOOFER 49.95

LIST PRICE $72.00
Type Number AD12650/W

Another new model from Deforest, this 12" incher handles 60 watts RMS, peaks to 100 watts. Excellent defined bass response due to butyl rubbed cone rim surround. Aluminum/copper voice coil. Resonant frequency 20 Hz. 20 oz. magnet weight. Full Gladstone/DeForest One-Year Warranty.

Recommended volume, 15.80 litres



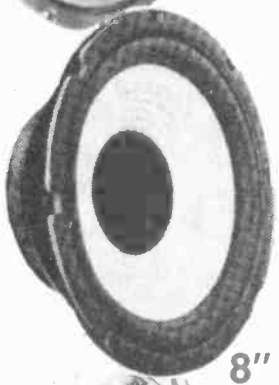
10" 70 WATT WOOFER

AD10240/W8

LIST PRICE 100.00 EACH **69.95**

For more substantial, agressive bass performance in higher powered systems, use this hefty ten incher! Has a 40 oz. magnet, rugged foam roll edge surround, a 2" high power voice coil, and handles 70 watts continuous, Useable with amplifiers up to 120 watts/channel!

8" 60 WATT WOOFER

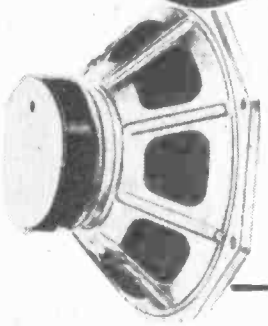


LIST PRICE 48.00 **35.95**

AD80100/W8

For higher power applications where a compact enclosure must be used. Resonant frequency is 30 Hz. Magnet is 20 oz. aluminum/copper. Foam rim cone for powerful bass. Use in two or three way systems.

8" 40 WATT WOOFER



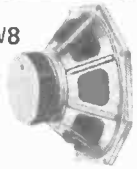
LIST PRICE $40.00 **26.95**

AD8066/W8

Superb woofer handles 40 watts in systems with easy, and will provide excellent bass in a compact enclosure (typically .75 cubic feet). Resonant frequency is a low 39 HZ ensuring accurate deep response. Combine in two way or three way systems.

COMPACT WOOFERS

5 INCH— AD5060/W8 **16.95**



7 INCH— AD7066/W8 **26.95**

Ideal for matching the ADO 162/T8 dome tweeter to create really compact, high fidelity systems. The AD-5060/W8 woofer (5") handles 10 watts power, has frequency response from 50-5000 Hz, and fits into the tightest enclosures.
The AD7066/W8 woofer (7") handles 30 watts of power, has response from 60-3000 Hz with a resonant frequency of 45 Hz.

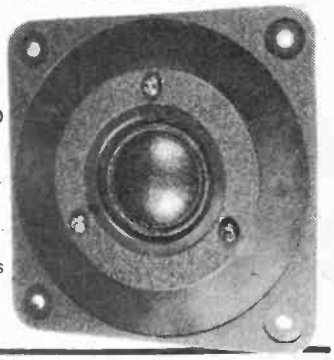
EXTRA-HIGH SENSITIVITY 4" DOME TWEETER

List price $23.00
ADO 162/T4, T8, T15 **14.95**

A new concept in tweeters - Textile Dome assures smoother response, lower harmonic distortion - extended highs! High sensitivity; ideal for direct and indirect radiating systems. Response 1000- 20,00 Hz. Rated at 50 watts RMS (5000 Hz crossover).

Available in 4, 8, or 15 ohms

DeForest DELUXE SQUARE DOME TWEETER!



LIST PRICE $30.00
AD01600T **19.95**

The Latest from DeForest! 1" hi-fi textile dome tweeter with very low distortion, wide dispersion. 10 ounce magnet. Recommended for 3-way systems in single or multiple array. Rated 40 watts RMS (per tweeter) with crossover above 3700 Hz. Available in 4, 8, or 15 ohms.

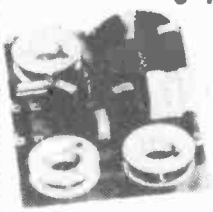
4-WAY 150-WATT CROSSOVER

AD4WXSP

LIST PRICE 78.00 **$52**

New from Deforest, provides 12 db/octave attentuation at 200, 1600, 5500 Hz crossover points. Allows use of speaker to handle the critical lower midrange. Crossover will handle up to 200 watts peak. Air core coils.

3-WAY CROSSOVER



AD3WXSP

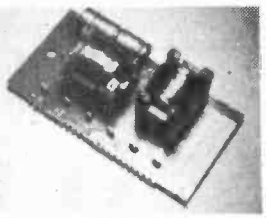
LIST PRICE 64.00

750 WATTS $42.50 EACH

Use with Philips or other high quality systems for better transients without saturation effect. Features 5 air-core coils for lower distortion and Philips polyester film crossovers. Operates at 700 and Hz. 12db per octave attenuation. Size: 5½x8". Use in systems rated up to 200 watts per channel.

80 WATT CROSSOVERS

AD3WXA—3-way crossover. Use to combine any Philips woofer, with midrange and tweeter. 80 watt system rating. Crossover frequencies: 600 and 4500 Hz. Attenuation: 6 db/octave.
LIST PRICE $29.00
Price each **$17.95**



AD2WXB—2-way crossover. Use to combine any Philips woofer, with tweeter. 60 watt system rating. Crossover frequency: 1800 Hz. Attenuation: 12 db/octave, low side; 6 db/octave high side.
LIST PRICE $16.00
Price each **$12.95**

Note: Cabinet dimensions and wiring instructions supplied. For information on cabinet construction techniques, the Philips Speaker Book is recommended ($6.95). order "THE PHILIPS SPEAKER BOOK".

Philips DeFOREST

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Speaker Systems at Good Savings from Philips suggested retail price!

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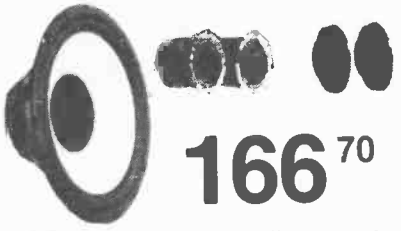
15" BEST-BUY SYSTEM

No. 15SKP-II 80 WATT COMBINATION

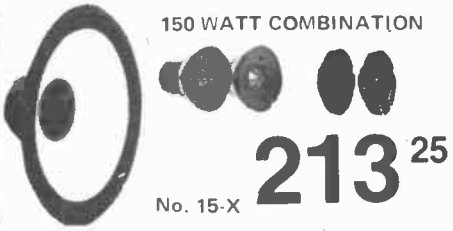


166.70

Each System Includes: 15" woofer (AD-15240/W8), two 5" midrange (AD5060/SQ4), two 4" dome tweeters, 3-way crossover (AD3WXA).
Specifications: Power: 15W min., 80W RMS max., 200W peak. Response: 18Hz-20 KHz. Cabinet size: 30" x 19" x 14"

15" SUPER SYSTEM

150 WATT COMBINATION



No. 15-X

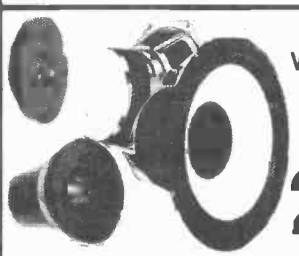
213.25

Each System Includes: 15" woofer (AD-15240/W8), two 5" dome midrange, and two 4" dome tweeters, three way crossover (AD3WXSP).
Specifications: Power: 15W min., 150W max. Response: 18Hz - 20 KHz. Cabinet: 30" x 19" x 14".

15" FOUR-WAY SYSTEM

200 WATTS

No. 15-4W



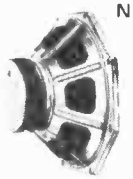
201.80

Each Kit Includes: 15" woofer (AD15240), 7" lower midrange (AD7066), 5" dome midrange (AD0211), 4" high sensitivity dome tweeter (AD0162), 4-way crossover (AD4WXSP).
Specifications: Power handling: 20-200 watts RMS per channel. Frequency response: 18-22 KHz. Cabinet size: 40" x 18" x 14¼"D. Impedance: 4-8 ohms.

8" AND 10" SYSTEMS

8" BUDGET SYSTEM

No. 8-B



54.85

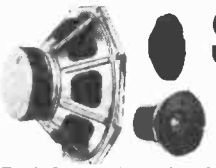
EACH

40 WATT RATING

Each System Includes: 8" woofer (8066/W8), 4" dome tweeter, 2-way crossover (AD2WXB).
Specifications: Power: 10W min., 40W RMS max., 60W peak. Response: 39-20 KHz. Cabinet: 18"x 11" x 5¾"D.

8" SUPER SYSTEM

No. 8-SP



$101.80

60 WATTS RMS

Each System Includes: 80100 woofer, 5" dome midrange, 4" dome tweeter, 3-way crossover (AD3WXA).
Specifications: Power: 10W min., 46W RMS max., 80W peak. Response: 39-20KHz. Cabinet: 20-7/8" x 12-5/8" x 6"D. Features smoother midrange response.

10" BEST-BUY SYSTEM

70 WATT RATING

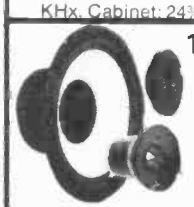
124.80

EACH

No. 10-60

Each System Includes: 10" woofer (AD-10240/W8), 5" midrange (AD5060/SQ8) 4" dome tweeter, 3-way crossover (AD-3WXA).
Specifications: Power: 15W min., 60W RMS max., 100W peak Response: 25-20 KHz. Cabinet: 24¾" x 15" x 6"D.

10" SUPER SYSTEM



$160.35

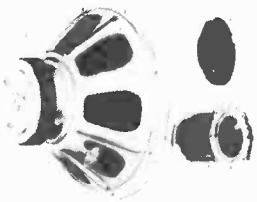
No. 10-S EACH KIT

100 WATTS RMS

Each System Includes: 10" woofer (AD-10240/W8), dome midrange, 4" dome tweeters, 3-way crossover (AD-3WXSP).
Specifications: Power: 15W min., 100W RMS max., 60W peak. Response: 25-20 KHz. Cabinet: 30½" x 18¾" x 7"D.

12" SYSTEMS

12" BUDGET SYSTEM



60 WATT RATING

97.80

EACH

Each system includes: 12" woofer (AD12600), 5" midrange (AD5060) 4" dome tweeter, 3-way crossover (AD3WXA). Specifications: Power: 10-60 watts RMS per channel. Response: 25-20KHz. Cabinet size: 572 x 425 x 210 mm.

12" BEST-BUY SYSTEM

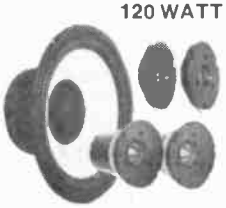
60 WATT RATING

141.70

Each System Includes: AD12650 woofer, two 5" midrange (AD5060/SQ4), two 4" dome tweeters, 3-way crossover (AD3WXA). Specifications: Power: 15W min., 60W RMS max. 100W peak. Response: 25-20 KHz. Cabinet: 28½" x 16½" x 13"D.

12" SUPER SYSTEM

120 WATT RATING



$213.25

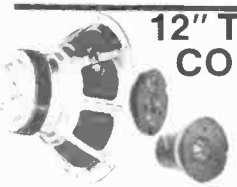
Each System Includes: AD12240 woofer, two 5" dome midrange, two 4" dome tweeters, 3-way crossover (AD3WXSP).
Specifications: Power: 30W min., 120W max., 200 watts peak. Response: 25 - 20KHz. Cabinet: 28½" x 16½" x 13"D.

BUILDING HI-FI SPEAKER SYSTEMS

6th Edition

$6.95

12" TIME COMPENSATED SYSTEM



$165.35

EACH KIT 12 TCS

FREE REPRINT — "TIME-COMPENSATED HIFI SPEAKER SYSTEM" Send self-addressed envelope for your free copy.

Here is the excellent design from RADIO-ELECTRONICS Magazine. Time compensation produces a smoother frequency response by reducing interference between drivers, improved transient response, better depth, and better stereo Imaging. Speakers included are: 12" Woofer (AD12240/W8) 5" dome midrange (AD0211 SQ8), 4" dome tweeter (AD0160T8), 3-way crossover (AD3WXSP). Specifications: Power handling — 100 watts RMS max. Response — 22-20,000Hz. Cabinet construction article included.

30 WATT CAR KIT

$48.85

Each kit included: AD4060/W8 4" 30 watt woofer, dome tweeter (AD0163/T15), 2-way crossover (AD2WXB). Ideal system for cars, vans, kitchens, bedrooms, etc. Woofer only: $19.95.
Compares with factory finished compact speakers 2-3 times the price!

GLADSTONE ELECTRONICS, insert to October '79 ETI
1736 Avenue Rd., Toronto, Ont., M5M 3Y7, (416) 787-1448

GLADSTONE'S

If you're serious about sound...

KEF

SPEAKERKITS

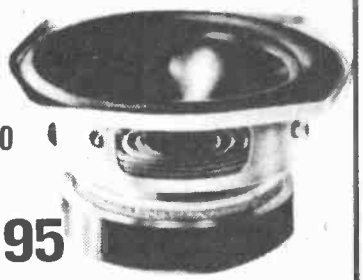
KEF Drivers use becstryne plastic cones for better defined response!

Exclusive
10 YEAR WARRANTY
Superior Quality Speakers

B200

59.95

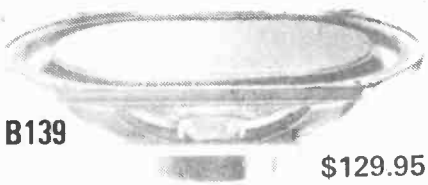
8 INCH WOOFER - outperforms most 12" units. Best in it's class! 8 ohms, nominally rated at 50 watts RMS. 1 inch voice coil. Recommended enclosure is 20.4 litres (2-way infinite baffle system) but used successfully in air suspension, reflex or transmission line enclosures. 25-3,500 Hz. Resonance: 25 Hz. 10 year guarantee!



B110

54.95

5½ INCH WOOFER-MIDRANGE -covers bass, midrange, or both! May be used in compact system (7.26 litres, 13 x 9 x 6") with power handling of 20-30 watts. Response: 55-3,500 Hz. Or, may be used as a midrange with B139, covering frequencies above 4000 Hz, and requiring separate sub-enclosure. Resonance: 30 Hz.



B139 $129.95

9 x 13" WOOFER

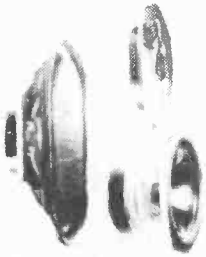
9" x 13" WOOFER - with unique plastic cone! Rated by experts as one of the world's best! 8 ohms, nominally rated at 100 W. Voice coil diameter 2". Recommended enclosure size 62.0 litres (3 way reflex system) but may be used in other types. Frequency response: 20-10,000 Hz. Resonance: 23 Hz!

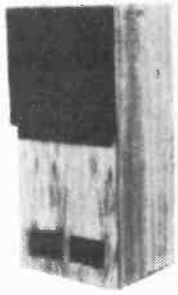
T27 **39.95**

DOME TWEETER

DOME TWEETER - NEW DESIGN IS AN INDUSTRY STANDARD! Remarkable 4" dome tweeter with response from 3,500 to 40,000 Hz. Can be used in systems rated at 40 watts. 8 ohms. Like all other KEF units, the T27 is backed by a 10-year Warranty.

STATE-OF-THE-ART TRANSMISSION LINE SPEAKER KITS





$285.80

EACH

- Compare to factory built systems of 3 times our low kit price!

KIT CONSISTS OF:
KEF B139 Bass Driver;
KEF B110 Midrange,
KEF T27 Tweeter,
Crossover,
Long fibre Wool,
Cabinet Plans.

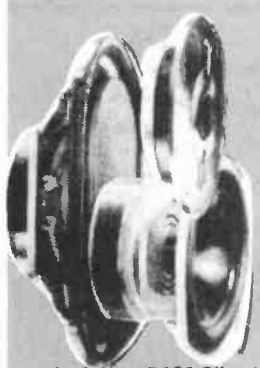
(CABINET NOT INCLUDED)

SPECIFICATIONS: POWER: 25 watts min. recommended. 100 watts RMS, max. continuous (200 watts peak). RESPONSE: 20 Hz to 40 KHz. EFFICIENCY: 94 db with 2.1W at 1 M. RESONANCE: 23 Hz. IMPEDANCE: 8 ohms. CROSSOVER: Multi-element, air core inductor, precision capacitors,, 12 db/octave slope. CABINET: 38" x 16" x 18". WARRANTY: 10 years against factory defects.

KEF CROSSOVERS

DN12— 3-way crossover (400 and 3500 Hz) combines B139, B110 and 127.
Price each $39.95
DN13—2-way crossover (3500Hz) . $24.95

3 RECOMMENDED KEF SPEAKER COMBINATIONS!



KEF

3-WAY FLOOR-STANDING SYSTEM

264.80

EACH

* 100 watts!

Includes: B139 9" x 13" woofer, B110 5½" midrange, T27 Dome Tweeter, DN 12 3-way crossover, and enclosure plans.

Build a superb quality, three way floor-standing system using KEF drivers featuring bextrene plastic cones for audibly superior performance with clearer, cleaner transients and better bass response. The combination listed is KEF's best. Handles up to 100 W RMS, yet may be used with amplifiers as low as 15 watts. Response: 25-40,000 Hz. Recommended cabinet size 676 x 396 x 270mm.

KEF

2-WAY HIGH-QUALITY BOOKSHELF SYSTEM

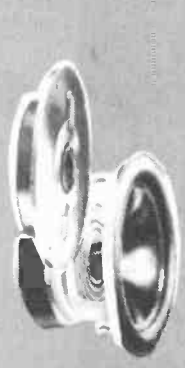
$124.85

EACH

* 50 watts

Includes: B-200 woofer, T27 dome tweeter, DN13- 2-way crossover, and enclosure plans.

A compact size enclosure that gives full-size sound. Utilizes KEF's amazing 8" woofer (better than most 12" woofers) and the fabulous T27 tweeter. Nominally rated at 50 watts RMS. Response is 35-40,000 Hz. Recommended cabinet size is 446 x 258 x 178mm deep.



KEF

2-WAY COMPACT BOOKSHELF SYSTEM

$119.85

EACH

* 50 watts

Includes: B110 5½" woofer, T27 dome tweeter, DN13 - 2 way crossover, and enclosure plans.

Amazing performance from a miniature enclosure. Available to kit builders at a price far lower than comparable built systems in other brands. Cabinet size is a diminutive 306 x 206 x 104 mm deep. Nominally rated at 50 watts Response is a superlative 50-40,000 Hz. The ideal portable system for auto sound; great for kitchens, bedrooms, etc.

GLADSTONE ELECTRONICS, insert to October '79 ETI
1736 Avenue Rd., Toronto, Ont., M5M 3Y7, (416) 787-1448

Two New

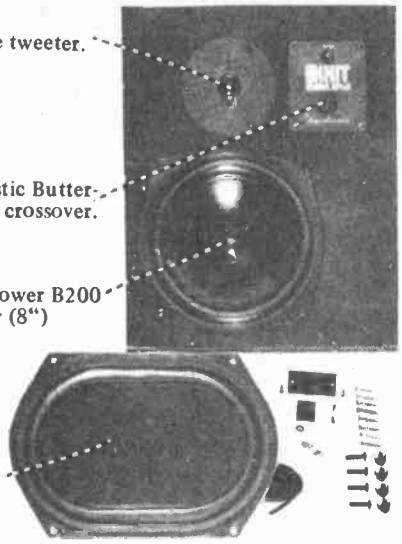
KEFKITS

KEF

104aB KIT

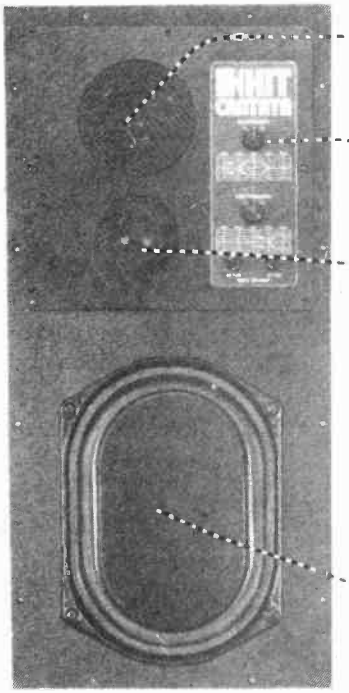
$299.00 ea.

Compare at $600 each factory finished!



Build the world-famous KEF 104aB speaker system at a 50% saving from manufacturer's assembled price! All speaker components and hardware plus detailed instructions are included. Power handling is 100 watts. Frequency response is 50 to 20,000Hz 12db. System resonance is 35 Hz. 8 ohms. Recommended cabinet volume is 36 litres. Sold in pairs. Ten-year warranty.

CANTATA Kit



$ 499.00 ea.

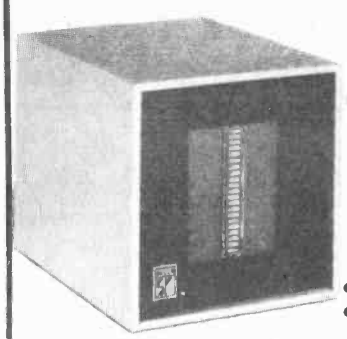
Compare at $900 each factory finished!

Superb Kef System at a $400.00 saving (each speaker) from the suggested retail price of the factory finished systems. Premounted on tough, laquered baffle, and fully wired. Supplied in matched left-right pairs. Fully detailled instructions. Handles up to 150 watts RMS input. Frequency response 35 to 20,000 Hz 3 db. Resonance 38 Hz. Baffle dimensions: 622 x 312 x 348 mm, 10 year warranty. Sold in pairs.

GLADSTONE'S

SPEAKERKITS

NEW! The Decca Super Tweeter

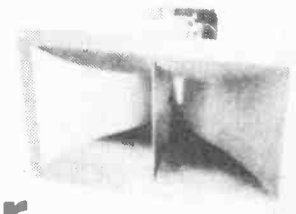


$199.50

- **Improves quality speaker systems**
- **Built-in crossover network**

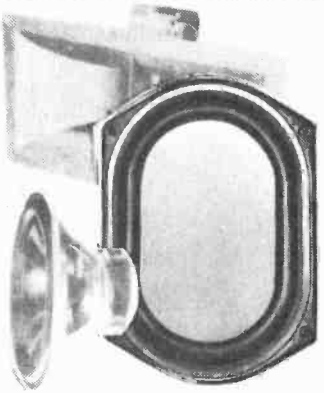
The New Decca Super Tweeter is a small gray box that can be added on to any speaker system to give the clarity and sparkle or the live performance. It will improve the top end of "state-of-the-art" speakers with its response of 7000 to 30,000Hz. It connects simply to the input terminals of your present speaker system. Operates on the ribbon principle (explained below) of low mass and powerful magnet. Impedance: 8 ohms. Efficiency: 88db for 4 watts input. Size: 4"x4"x5 1/8"D.

Decca Ribbon Tweeter $199.50



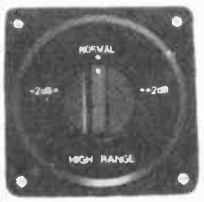
Perhaps the finest "top end" available. The reason lies in the ribbon itself - only 1/10th the thickness of a human hair - which, being the only moving part of the speaker has a very low mass, therefore, low inertia. You get better transient characteristics and cleaner sound than ever before available in a wteeter. The ribbon is coupled to the air by a specially designed horn for high efficiency at all frequencies from 1K to 35 KHz. Insertion loss less than 1 db. Distortion less than 0.5%. Rated at 30 watts; can be used safely in 100 watt systems
Response: 1K to 25,000 Hz. Impedance 8/15 ohms.
CROSSOVER: Frequency: 1000 Hz. 12 db/octave; 45 db/octave above 700 Hz. **$39.50**

KEF — Decca Speaker System



#KD1 $424.35 ea.
System price

Our finest woofer (KEF B139), midrange (KEF B110) and tweeter (Decca Ribbon Tweeter) plus KEF 3-way crossover. Suggested box dimensions 32 x 13½ x 15"D (Cantata-style enclosure). Or build transmission line enclosure. Plans provided.



SPEAKER LEVEL CONTROLS

DA-1 - high range
DA-2 - Midrange.

$6.95

ACOUSTIC PADDING

For Lining of Speaker Enclosures
15 square feet package (5' x 3'). Essential for reducing internal resonance in speaker cabinets. **No. AP-15 . Price per pkg. $5.00**

SOLDERLESS SPEAKER TERMINALS

$1.59 Each

GLADSTONE ELECTRONICS, insert to October '79 ETI
1736 Avenue Rd., Toronto, Ont., M5M 3Y7, (416) 787-1448

PEERLESS MIX & MATCH COMPONENTS

GLADSTONE'S SPEAKERKITS

8" WOOFERS

KO-80T-WF 8 INCH WOOFER — 40 WATTS

Magnet - 9 oz. ceramic
Voice Coil - 1" Aluminum
Impedance - 8 ohms (Nom.) 7.2 D.C.R.
Resonance - 45 Hz
Frequency Range - 50-3000 Hz
Power Handling - 40 watts

$29.95

KP-80U-WF 8 INCH WOOFER — 80 WATTS

Magnet - 14.7 oz. ceramic
Voice Coil - 1½" Aluminum
Impedance - 8 ohms (Nom.) 6 ohms D.C.
Resonance - 32 Hz
Frequency Range - 45-2500 Hz
Power Handling - 80 watts

$37.50

10" WOOFER

KP-10V-WF 10 INCH WOOFER — 100 WATTS

Magnet - 14.7 oz. ceramic
Voice Coil - 1½" Nomex
Impedance - 8 ohms (Nom.) 5.7 D.C.R.
Resonance - 28 Hz
Frequency Range - 40-2000 Hz.
Power Handling - 100 watts

$42.50

12" WOOFER

KA-12X-WF 12 INCH WOOFER — 120 WATTS

Magnet - 38 oz. ceramic
Voice Coil - 2" Aluminum
Impedance - 8 ohms (Nom.) 6.9 ohms D.C.
Resonance - 22 Hz
Frequency Range - 32 Hz-1500 Hz
Power Handling - 120 watts

$79.95

FOAM SPEAKER GRILLES 12.95

Give your speaker that modern look! Foam grilles will not affect speaker response. Available in one large size, 18 x 36", easily cut down to fit your cabinet. Available in black or brown.

GRILLE CLOTH 12.95 PRICE PER YD.

Acoustic grille fronts for speakers that won't affect high frequency response. Give your speakers that professional finish. 36" width, available in a variety of colours. Specify colour: black, brown, white, beige.

DOME TWEETER

KO 10 DT DOME TWEETER

$24.95

70 WATTS.

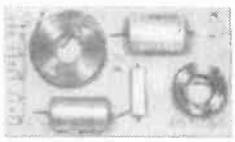
Magnet - 9 oz. ceramic
Voice Coil - 1" Aluminum
Impedance - 8 ohms
Frequency Range - 1500-20,000 Hz
Power Handling - 70 watts

MIDRANGE

KO 40 MRF MIDRANGE — 100 WATTS

Magnet - 9 oz. ceramic
Voice Coil - 1" Aluminum
Impedance - 8 ohms
Resonance - 230 Hz
Frequency Range - 500-5000 Hz.
Power Handling - 100 watts

$33.50



Reg. **$34.95**
Special
$29.95

PEERLESS 3-WAY CROSSOVER

*100 watt crossover with air core coils. Crossover frequencies 500 and 4000Hz.

no.3E10 . . . . . $29.95

HOW TO DESIGN, BUILD and TEST COMPLETE SPEAKER SYSTEMS

By David Weems. The complete do-it-yourself guide for audio buffs who want the ultimate in sound quality. Its 336 pages tell you everything you need to know about speaker systems. Highly recommended. 1 Tab Book # 1064.

Price $8.95

STEREOPHONIC INPUT SELECTOR

Connects as many as 3 separate stereo components (high impedance) to a single stereo amplifier input. Ideal for such items as tape players, turntables, tuners. Shielded wiring virtually eliminates "cross-talk" interference. Phono jack inputs and outputs for easy hook-up. Walnut vinyl clad aluminum cabinet.

Cat. No. 30-5010 . . . . . **$27.95**

SPEAKER WIRE

22 gauge standard speaker wire, colour coded for maintaining proper phasing.

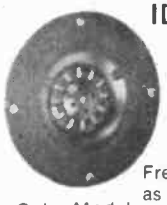
MEA-66. 50 ft. roll $4.95
MEA-67. 100 ft. roll $8.95
MEA-67. 1000 ft. spool $69.95

18 gauge speaker wire. Heavy duty for high power use and permanent concealed installations.

Price Per Foot: Specify length . . . 12¢
MEA-70. 250' spool $29.95
MEA-71. 1000' spool $99.95

COLES SPEAKERS

IDEAL "ADD ON" FOR KEF SYSTEMS



Midrange

Coles Model 3000

Frequency response 2-15KHz for use as an upper-midrange. Ideal for use with Falcon crossovers listed below in KEF systems. Power handling 30-50 watts. 8 or 16 ohms. **$25.00**

Tweeter

Coles Model 4001

The famous Coles super-tweeter with excellent transient response, and virtually omni-directional properties over a wide frequency range. Response 6-20KHz. 2½" diameter x ¾ inch depth. Available in 8 or 16 ohms. **$25.00**

FALCON CROSSOVERS

4-WAY CROSSOVER. Designed for use with KEF B139, B110, T27 and Coles 4001G Super-tweeter. Equivalent design to the Cambridge R50/CJ speaker. Cabinet plans will be provided with crossover purchase.
Model #6 MP. . . . . **Each $55.00**

5-WAY CROSSOVER. Designed for use with KEF B139, B110, T27, Coles 3000 midrange and 4001K super-tweeter. Plans are provided for the transmission line speaker by P. Atkinson.
Model #16 RHP . . . . . **Each $75.00**

BBC LS3/5a equivalent crossover for KEF R110 and T27 in a small enclosure.
Model #23 (kit) . . . . . **Each $45.00**

HIGH POWER 4-WAY CROSSOVER. Similar to #6, but designed for high power use.
Model #33 . . . . . **Each $65.00**

ACCESSORIES. Long Fibre Wool. As recommended for transmission line speaker enclosures.
Price per pound **$7.95**

BITUMENIZED FELT PANELS. 10"x14" x 3/4" wool felt impregnated with tar. To be mounted internally in speaker enclosures to reduce cabinet resonances.
Price for 3 . . . . . **$9.95**

RECTANGULAR SPEAKER INPUT PANELS. For the back of cabinets, with round-banana sockets plus DIN connector, fuse holder.
Price per pair **$9.95**

A must for the audio hobbyist—

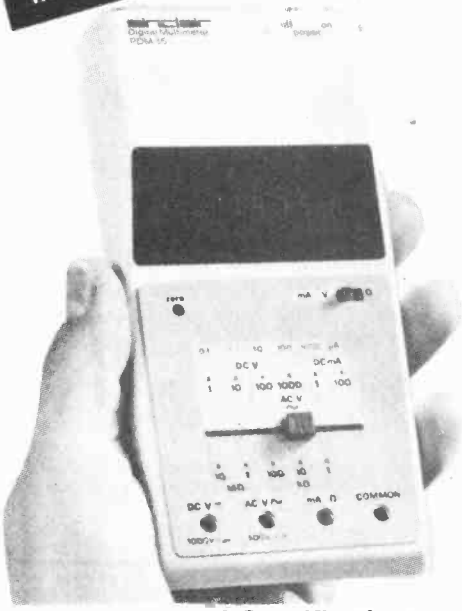
5-POSITION SPEAKER SELECTOR SWITCH

Switch up to 5 pairs of speakers. Unit has resistive network to provide positive protection against accidental damage to transistor amplifiers. Handles up to 55 watts per channel. High quality printed circuit construction, rugged switches, handsome wood grain cabinet. Cat. No. 30-5004.

Price each **$45.00**

NOW EVERYBODY CAN AFFORD TO OWN A DIGITAL MULTIMETER!

The sinclair PDM35 personal digital multimeter.



Features of the PDM35

3½ digit resolution.
Sharp, bright, easily read LED display, reading up to ± 1.999.
Automatic polarity selection.
Resolution of 1 mV and 0.1 uA.
Direct reading of semiconductor forward voltages at 5 different currents.
Resistance measurement up to 20 MΩ.
1% of reading accuracy.

still only

$89.95

Automatic over-range indication by horizontal bars. Accuracy is quoted as a percentage of reading. All ranges except x 1000V can be used up to +1.999 without loss of accuracy. Resistance ranges provide a diode test facility at 5 decade steps of current.

PDM35 Technical Specifications

19°C – 23°C

DC ⎓ VOLTAGE

Range	Resolution	Accuracy	Protection	Input Impedance
× 1V	1mV	1.0% ± 1 Count	240V	10MΩ
× 10V	10mV	1.0% ± 1 Count	1000V	10MΩ
× 100V	100mV	1.0% ± 1 Count	1000V	10MΩ
× 1000V	1V	1.0% ± 1 Count	1000V	10MΩ

AC ∿ VOLTAGE

Range	Resolution	Accuracy	Protection	Freq. Response
× 1000V	1V	1.0% ± 2 Counts	500V	40Hz – 5kHz

DC ⎓ CURRENT

Range	Resolution	Accuracy	Protection	Voltage Burden
× 0.1μA	0.1nA	1.0% ± 1nA	240V	1mV per Count
× 1μA	1nA	1.0% ± 1 Count	240V	1mV per Count
× 10μA	10nA	1.0% ± 1 Count	240V	1mV per Count
× 100μA	100nA	1.0% ± 1 Count	120V	1mV per Count
× 1mA	1μA	1.0% ± 1 Count	30mA	1mV per Count
× 100mA	100μA	1.0% ± 1 Count	500mA	1mV per Count

RESISTANCE

Range	Resolution	Accuracy	Protection	Measuring Current
× 1kΩ	1Ω	1.5% ± 1 Count	15V	1mA
× 10kΩ	10Ω	1.5% ± 1 Count	120V	100μA
× 100kΩ	100Ω	1.5% ± 1 Count	240V	10μA
× 1MΩ	1kΩ	1.5% ± 1 Count	240V	1μA
× 10MΩ	10kΩ	2.5% ± 1 Count	240V	0.1μA

Dimensions 6″ × 3″ × 1½″

Weight 6½oz (180 gms)

The PDM35's DC input impedance of 10MΩ is 50 times higher than a 20kΩ/volt analogue meter on the 10V range.

Now everybody can afford to own a DIGITAL FREQUENCY METER

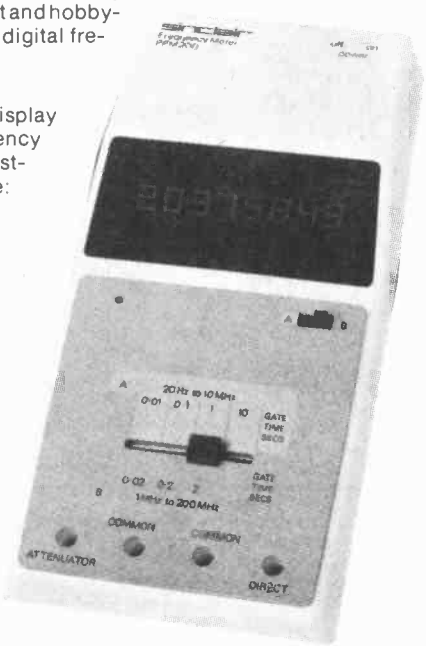
The sinclair PFM200 digital frequency meter

$149.95

The PFM200 outperforms many much more expensive instruments. Its 8-digit display and variable gate-time give high-resolution coverage of frequencies from 20 to over 200 MHz. It gives exceptional sensitivity and simplicity.

The Sinclair PFM200 is ideal for use with audio, video and radio systems, and all electronic and digital circuitry. Now every engineer, service technician, student and hobbyist can afford to have a personal digital frequency meter.

Brief specifications:
Frequency range: 20 Hz to 200 MHz. Display resolution: up to 8 digits. Lowest frequency resolution: 0.1Hz. Gate time: decade adjustable from 0.01 secs to 10 secs. Sampling rate: varies with gate time up to 5 per second. Attenuator: 20db. Input impedance: 1M, Time-base accuracy: 0.3 ppm/deg C, 10 ppm/year. Dimensions: 6.2x3x1.25 in. Weight: 6 oz. Power: 9V DC or AC adapter. Standard accessories: test leads and clips carrying wallet, owner's manual.



TRY IT TODAY ON GLADSTONE'S 10-DAY MONEY-BACK TRIAL OFFER.

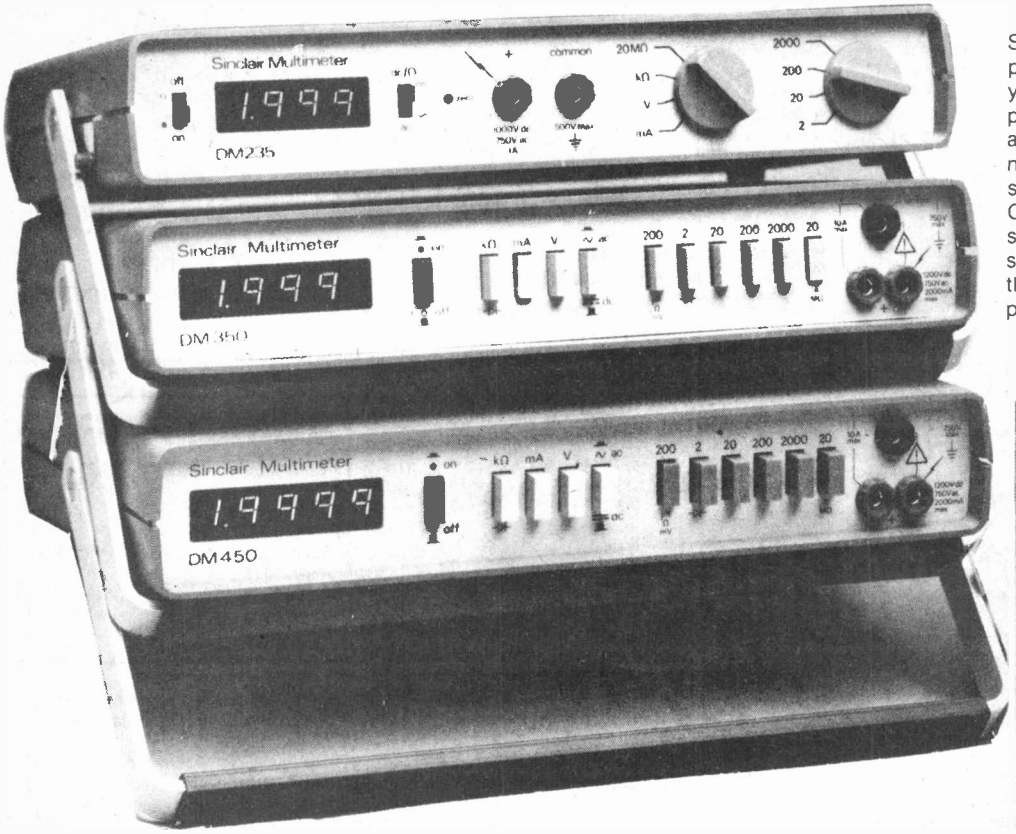
ACCESSORIES FOR SINCLAIR TEST EQUIPMENT.

	DM450	DM350	DM235	PDM35	PFM200	COST
4 'C' cells	×	×	×			$6.60
9 volt battery				×	×	$2.95
rechargeable ni-cads		×	×			$19.90
AC-1 AC adapter		×	×			$14.95
AC-2 AC adapter				×	×	$9.95
AC-3 AC adapter	×					$14.95
Deluxe case 35				×	×	$9.95
Deluxe case 235	×	×	×			$32.50
High voltage probes	×	×	×	×		$44.95
Service Manual	×	×	×	×	×	$5.00

GLADSTONE ELECTRONICS, insert to October '79 ETI
1736 Avenue R..., Toronto, Ont., M5M 3Y7, (416) 787-1448

Sinclair Digital Multimeters

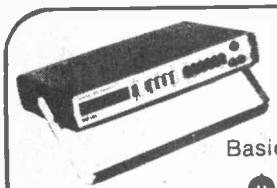
Preferred for their quality, precision, small size and low, low price!



Sinclair multimeters feature high performance and low cost. They give you what you need and at the right price. The complete line features high accuracy, easy use, and the most needed functions and ranges. You select the one that meets your needs. Gladstone Electronics have been selling Sinclair products in Canada since 1971 and highly recommend these quality-crafted English-made products.

10 DAY MONEY BACK GUARANTEE

If you are not satisfied with your Sinclair Digital multimeter, you may return it within 10 days for a complete refund.



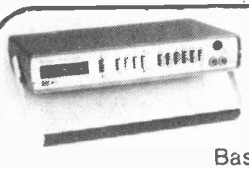
DM 450

4½ Digits
6 Functions
34 Ranges
Basic Accuracy 0.05%

$339.95

FEATURES:

- **Measures Directly**
  - **DC voltage 10μV to 1200V**
  - **AC voltage 100μV to 750V**
  - **DC/AC current 1nA to 10A**
  - **Resistance 10mΩ to 20MΩ**
  - **Diode Test Forward voltage drop at 1mA**
- **High input impedance—10MegΩ, <1000MegΩ optional on 2000mV range**
- **Frequency response 30 Hz to 20kHz**
- **Calibration guaranteed 1 year**
- **Auto-polarity, Auto-zero correction, Auto-over-range, Auto-decimal point**
- **Full protection, except 10 Amp jack**
- **Built in battery test**
- **Extremely rugged construction, high impact case**
- **Adjustable display intensity for extended battery life**



DM 350

3½ Digits
6 Functions
34 Ranges
Basic Accuracy 0.1%

$239.95

FEATURES:

- **Measures Directly**
  - **DC voltage 100μV to 1200V**
  - **AC voltage 100μV to 750V**
  - **DC/AC current 1nA to 10A**
  - **Resistance 100mΩ to 20MΩ**
  - **Diode Test Forward voltage drop at 1mA**
- **High input impedance—10MegΩ, <1000MegΩ optional on 2000mV range**
- **Frequency response 30Hz to 20kHz**
- **Calibration guaranteed 1 year**
- **Auto-polarity, Auto-zero correction Auto-over-range, Auto-decimal point**
- **Full protection, except 10 Amp jack**
- **Built in battery test**
- **Extremely rugged construction, high impact case**
- **Adjustable display intensity for extended battery life**

DM 235

3½ Digits
6 Functions
21 Ranges
Basic Accuracy
0.5% to 1.5%

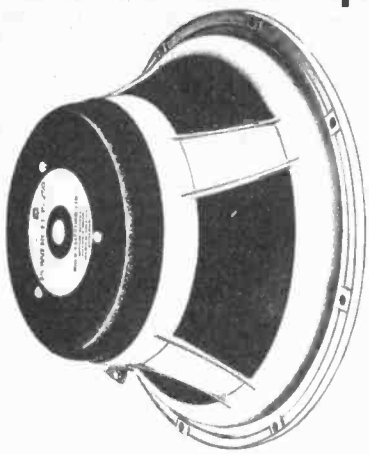
$149.50

FEATURES:

- **Full protection**
- **Measures D.C. voltage from 1mV to 1kV**
- **A.C. Voltage from 1mV to 750V**
- **Currents from 1μA to 1AMP**
- **10 MEGΩ input impedance**
- **Measured Vf at five different currents directly**
- **Auto polarity and moving decimal point**
- **Overrange indicator**
- **Extremely rugged construction, high impact case**
- **Built in battery test**
- **Runs 40 hours on replaceable alkaline "C" cells or AC adaptor AC-1**
- **Accepts Sinclair rechargeable NiCad Pack NC-1**
- **Weighs less than 1½ lbs.**
- **Fits in tool case**

GLADSTONE ELECTRONICS, insert to October '79 ETI
1736 Avenue Rd., Toronto, Ont., M5M 3Y7, (416) 787-1448

Professional, affordable disco starts with Celestion Power Loudspeakers.



Disco Woofers

18" 250 WATT WOOFER
G-18-250 **269.50**

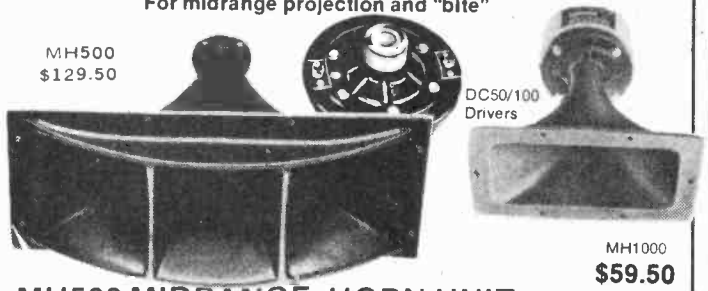
Incredible power handling capacity and sound at a low price! Handles 250 watts RMS. Cast frame with 3" voice coil. Response 25-5000Hz. Reonance 45 Hz. Overall magnet weight a hefty 26 POUNDS! 8 ohms. Recommended cabinet — 32 x 23 x 12"D.

OTHER POWER RANGE WOOFERS

G15/250 15" 250 W	$249.50	G15/150B 15" bass guit.	$179.50
G15/150 15" 150 W	$169.50	G12/80 12" 80W	$89.50
		G12/30 12" 30W/15	$49.50
		G10/50 10" 50W/15	$44.50

CELESTION DISCO HORNS

For midrange projection and "bite"



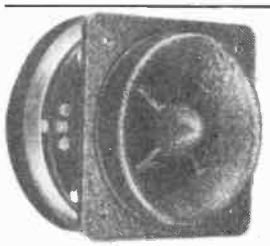
MH500 MIDRANGE HORN UNIT

Large sized midrange horn (18 x 8 x 22"D) designed to accept either 50 or 100 watt drive units. The precision horn casting has machined throat to be accurately coupled to drive unit. An optional threaded twin coupler, the TC200 allows the MH500 horn to accept 2—DC50 or 2—DC100 drivers for higher power applications.

MH500	Heavy-duty midrange horn with single threaded coupler to accept either one DC50 or one DC100	$129.50
DC50	Compression driver for MH500 — 50 watts	$79.50
DC100	Compression driver for MH500 — 100 watts	$109.50
TC200	Threaded twin coupler for MH500 to allow it to accept two DC50 or two DC100	$19.50

MH1000 MID/HIGH HORN AND DRIVER! $59.50

Designed for mid/high frequency reinforcement in high quality music systems. Self-centering diaphragm and phase-corrected throat, exponential horn. Response: 800-10 KHz. Power handling: 25 watts (may be used in systems up to 100 watts). Impedance: 8 or 15 ohms. Size: 6¾" x 6¾" x 3-5/8".



Powercel HF20 High Power High Frequency Tweeter

$129.50

Incredible sound output and power handling. The HF20 is rated 100 watts RMS and can be used in systems rated to 250 watts. Response is 3000-20,000Hz. 2" voice coil diameter and 7 pound magnet weight. High efficiency produces 100.2 db white noise SPL at 1 metre with 1 watt input. Match with Celestion or other high quality drivers.

CELESTION HEAVY-DUTY CROSSOVERS

2-WAY HEAVY-DUTY CROSSOVER. 800 Hz. 100 watts. 2WX **$39.50**

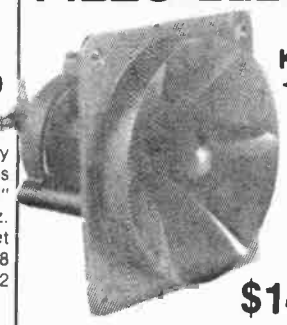
3-WAY HEAVY-DUTY CROSSOVER with level control. 800 Hz. and 3000Hz. 250 watts. 3WX **$69.50**

GLADSTONE'S

SPEAKERKITS

MOTOROLA

PIEZO-ELECTRIC TWEETERS!



KSN-1005A

$14.95

3½" Front-Mount
Ideal for hi-fi and sound reinforcement Response 4-27 KHz

KSN-1036A

$9.95

3½" Ultra-Thin
Ideal for auto sound
Response 3-30KHz

*Ideal for hifi and sound reinforcement.

SUPER HORNS

KSN-1025A — 2" x 6" Extra wide dispersion. Response 1.9 —40 KHz. **26.95**

KSN-1016A — 2 x 5" Wide dispersion. Response 2 - 40 KHz. **16.95**

"No Crossover required." Rated to 100 watts. A breakthrough in tweeter design, these Motorola devices hook simply to the output terminals of any speaker system. High output level makes them ideal for sound reinforcements systems and high efficiency high fidelity systems. Excellent transient response. Low harmonic distortion. High impedence, requiring no crossover. No voice coil and magnet structure due to use of pienzo-electric element. **QUANTITY BUYERS: 10 lots assorted, less 10%. 25 lots, less 20%.**

STEREO DISCO MIXER! LIST PRICE $239.00 169.95

Two Phono Inputs with CROSSFADE - Adjustable Volume Level on Headphones - With BUILT IN CUE AMPS!

Introduced to meet the demand of the professional. A quality mixer at an affordable price! The MM3 offers these outstanding features: 3 stereo source inputs, 1 mike input. Slide volume controls. Microphone talkover reduces music by 10 db. Headphone monitor built in with level control. Unique feature is a CROSS-FADE. Built in magnetic preamp for magnetic cartridges. The MM-3 housed in a functional sloping cabinet with wood end-pieces to make it a valuable addition to a home or disco type set-up. SPECIFICATIONS: Distortion: 0.3% maximum. S/N ratio: 55 db (aux. input). Response: 20 - 20k Hz. Size: 260W x 186D x 115H mm. Weight: 2 kg.

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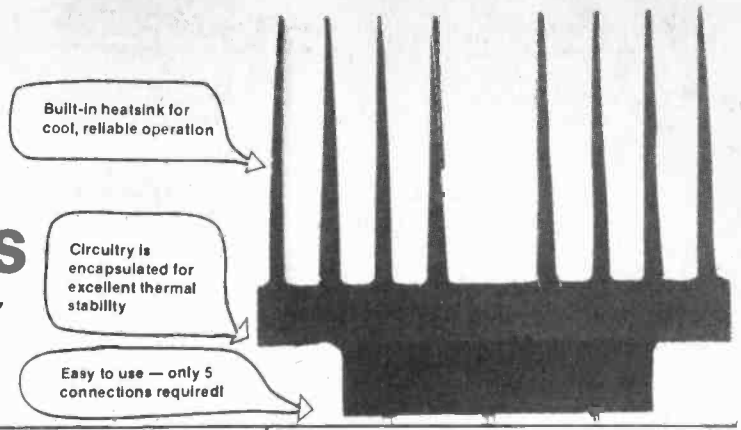
ILP

Amplifier Modules

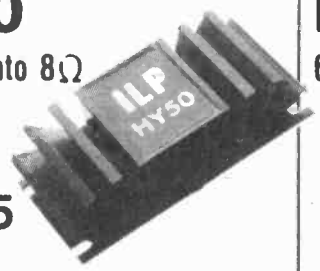
NEW 5 YEAR WARRANTY

- 5 Year Warranty
- Easy to use — only 5 connections
- Exceptional low cost
- True high fidelity performance
- Fully protected circuitry
- For home stereo, discos, PA, guitar/organ amps, etc.



HY50

Watts into 8Ω



$28.95

Ideal for those wanting to build or up-grade a hi-fi system, run a small high quality P.A. system, amplify a musical instrument, or use for lab work. The HY50's useful 30 watts RMS output into 8 ohms, its rugged construction and freedom from heatsinks make it the ideal all-purpose quality power amp — and it is unconditionally guaranteed for five years! Thousands in use!

Specifications:

Input — 500 mV. Output — 30 Watts RMS into 8 Load impedance — 4 to 16 Distortion — 0.04% from 100 mW to 25 watts at 1 kHz. Supply voltage — +25V (Use 167P36 transformer). Size — 105x50x25 mm.

HY120

60 Watts into 8Ω

$57.50

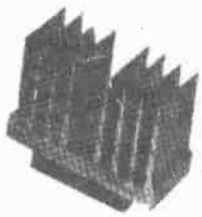
A high specification amplifier ideal for high fidelity use. Features fully protected circuitry — making it virtually indestructible in any application. The built-in heatsink very effectively dissipates any heat, removing the possibility of thermal instability. Guaranteed five years.

Specifications:

Input — 500 mV, Output — 60 Watts RMS into 8 Load impedance — 4 to 16 Distortion — 0.04% at 60 w at 1 KHz. Frequency response — 10-45 KHz. Signal/noise ratio — 90 db. Supply voltage — + 35V (Use 167P50 transformer). Size — 114x50x85 mm.

HY200

120 Watts into 8Ω



$79.50

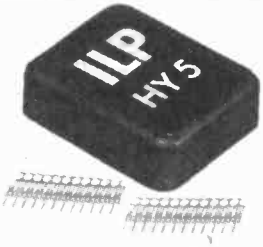
The most popular amplifier in the line for high fidelity use, the HY200 has been complimented on its superb quality and reliability! Also ideal for musical instrument, disco, or PA amplification. Features very low distortion, thermal shutdown, open and short circuit protection. A pair of HY200s can drive virtually any set of speakers to room-filling levels with superb clarity. Ideal for use in bi-amp and tri-amp applications. 5-year warranty.

Specifications:

Input — 500 mV. Output — 120 Watts RMS into 8 Load impedance: 4-16 ohms. Distortion: 0.05% at 120 watts at 1KHz. Signal/noise ratio — 96 db. Frequency response — 10-45 kHz. Supply voltage — +45 V (Use 167 S64 transformer). Size — 115x50x85 mm.

HY5

Preamplifier



$21.99

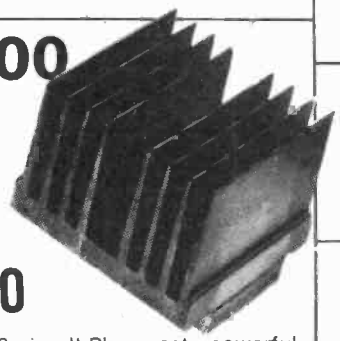
Compatible with ILP power amps and power supply units. In a single small package, the HY5 contains all functions for preamplification — 5 inputs, tone controls etc. Requires external switches and pots. To simplify mounting and construction, a printed circuit connector is supplied. Use two for stereo. Excellent quality sound featuring low noise, low distortion and high overload capability. Can be used for guitars, PA, disco, etc.

Specifications:

Inputs — Magnetic (3MV), ceramic (30 mV) tuner (100 mV), microphone (10 mV), auxiliary (3-100 mV), input impedance 47 K Outputs — main output 500 mV, tape output 100 mV. Active tone controls — bass and treble, +12 db. Distortion — 0.05% at 1 kHz. Signal/noise ratio — 68 db. Overload — 38db on phono. Supply voltage — +16-50V. Complete instructions provided. 5-year warranty.

HY400

240 Watts into 4Ω



$99.50

The HY400 is ILP's most powerful amplifier, specifically designed for high power disco or public address applications. If the amplifier is to be used at continuous high power levels a cooling fan is recommended. The HY400 includes all the qualities of the ILP family to lead the market as a true high power high fidelity power module. Features thermal shutdown, open/short circuit protection — all backed by a five-year warranty.

Specifications:

Input — 500 mV. Output — 240 Watts RMS into 4 Load impedance — 4-16 ohms. Distortion — 0.1% at 240W at 1 KHz. Signal/noise ratio — 94 db. Frequency response — 10-45 Khz. Supply voltage — +45 V (Use 167S64 transformer). Size: 114x100x85 mm.

Power Supplies

power supplies for ILP

FOR USE	HY50	HY120	HY200/ HY400
power transformer (rated for stereo)	167P36 36V,5A $21.25	167P50 50V, 5A $28.05	167P64 64V, 10A $59.40
Capacitors (price for two)	5500uF 35V $15.90	5000uF 50V $16.95	4700uF 63V $16.95
Rectifier bridge (4)	200PIV 4A $2.40	200PIV 8A $5.92	200PIV 8A $5.92
Printed circuit board (optional)	$9.95	$9.95	$9.95
Complete power supply kit (not including pcb)	HY50PSK **$39.55**	HY120 PSK **$50.92**	HY200/ 400PSK **$82.27**

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METAL CABINETS

give extra ventilation

Rugged aluminum equipment cabinets with handsome blue and grey finish - ideal for test equipment, science and hobby projects, kits, etc. Flip-up stand for easy viewing, padded legs and perforated sides for heat dissipation.

Model 00 ..... $9.75
Size: 120 x 284 x 138 mm.

Model 10 ..... $8.75
Size: 120 x 224 x 138 mm.

Model 20 ..... $11.25
Size: 120 x 284 x 188 mm.

2 EICO CRAFT QUALITY KITS. . . . .

Model BW-300

ALPHA BRAIN-WAVE MONITOR FOR BIO-FEED BACK

'GET INTO YOURSELF'

Kit — $69.15
Wired - $118.50

Price breakthrough in the brainwave biofeedback field - features and sensitivity comparable to professional models!. Detects Alpha waves - 5 uv sensitivity. All accessories supplied, less 9 v battery.

COLOUR ORGAN KIT

$50.00

3 Channel Sound / Lite Translator

With the EC-4300, you command 3 independent bands of audio frequencies to modulate 3 discrete strings or groupings of any color lamps. Just connect your hi-fi speaker, power amplifier, radio, recorder, phono, etc. to the EC-4300; and then plug each string of color lamps into its independent channel (up to 300 watts per channel).

Model EC-4300

Wireless Microphone

$24.95

FM wireless transmitter with a range of up to 300 feet. Output tuneable to the FM band of any receiver or radio. Ideal for entertainers, pulbic address. Compact hand-held size. 9-volt battery. Jana # 1021A

jana FUN-AND-EDUCATION KITS -

- Learn electronics by doing!
- Fun and educational — each kit illustrates an electronic principle!
- The plastic package serves as case for completed project.

THREE CHANNEL COLOR ORGAN
Now in kit form! a genuine three channel color organ that can control 600 watts of lamps - make them flash in rythm to music! Advanced solid state circuitry uses SCR's to control lights. Sensitivity control for variable effects. **$21.95**

XENON STROBE
Genuine Xenon strobe unit in kit form! Build this interesting kit which makes a variable-rate, high output strobe which can be used for light displays, photography, etc. Operates from AC power line. All parts are supplied. **$19.95**

Sound Transducer

$31.99

3082. Makes any wall or ceiling an efficient loudspeaker! Attach one or more of these transducers to any flat, resonant surface and the area will be filled with sound. Units measure just 3" square of 1" deep and are held to the mounting surface with wood screws. **SPECIFICATIONS:** Impedance 8 ohms. Output Power 30 watts continuous, 70 watts peak. Response 40 - 15KHz. Complete with instructions.

Each $31.99
6 each at $29.95

Stereo Preamp

19.95

Adapts any amplifier without built-in preamp to accept magnetic cartridge. Response 20-20,000 Hz, low distortion.

MAGNUM FM TUNER MODULES

FM Tuner/IF Strip

$21.95

Made in Canada

FM Tuner and IF strip modules, prebuilt and tested, ready to hook up. Features include AFC, muting. Requires 9 volt supply. 3uV sensitivity.

For complete stereo tuner order all modules listed below.

Supplied with wiring instructions:
FQ215/002 FM Tuner/IF Strip $21.95
Stereo Decoder (35 db separation) 14.75
Power supply kit (includes transformer) . 14.75
Completer kit - (includes tuning meter, wiring components etc) $4.95
Detailed schematic/technical manual .. $1.50

Some "Best Sellers" from Gladstone's Book-Rack

NUMBER	TITLE	PRICE EACH
20520	How to Build Speaker Enclosures	$ 6.75
21035	TTL Cookbook	12.75
21398	CMOS Cookbook	13.95
21405	Tube Sub Book (20th Ed.)	3.95
21524	Cheap Video Cookbook	7.95
21572	Transistor — Transistor Logic (2nd Ed.)	$ 8.95
21583	Microcomputers for Business Applications	11.95
1064	How to Design, Build & Test Complete Speaker Systems	8.95
1060	303 Dynamic Electronic Circuits	8.95
912	88 Practical Op Amp Circuits You Can Build	6.95
856	Master Op Amp Application Handbook	$ 12.95
841	Build Your Own Working Robot	7.95
800	Master Handbook of 1001 Practical Electronic Circuits	12.95
796	Mosfet Circuits Guidebook	6.95
	THE BASIC HANDBOOK — The definitive reference and "idea" book which explains in detail the BASIC language as used in over 50 micros, minis, and mainframes. Not a dictionary, not a text, it is a virtual ENCYCLOPEDIA of the BASIC language. Explaining all you need to know about over 250 BASIC statements, functions, operators and commands, it is the "missing link" needed to convert programs from one computer to RUN on another.	$ 19.95

Many more titles in stock! Write for complete listing.

Top buy Cartridge

GRADO FTE+

$29.95

Designed for high output and excellent stability under severe use. Frequency response of 10-50,000 Hz and tracking capability of 1 gram make it a super value for any system. With elliptical stylus, output of 5mv is achieved with an average channel separation of 20db! Compares with most cartridges at twice the price. Guaranteed 18 months.

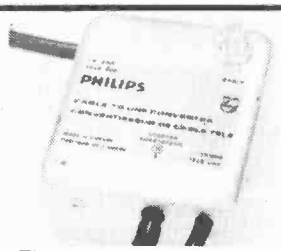
SPECIAL!

PHILIPS

CABLE TV CONVERTER

~~44.95~~

$34.95



Fits all TV sets with UHF tuners! Easy to install. Supplied with CSA approved AC adaptor. Provides the extra "midband" and superband channels now being distributed by cable companies in Canada. Converts cable channels to UHF channels for easy selection thru your UHF tuner. Stable, reliable.

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PAIA ELECTRONICS, INC.

ELECTRONIC MUSIC SYNTHESIZER KITS!

GNOME the original micro-synthesizer

$117.00

John Simonton's time-proven design provides two envelope generators VCA, VCO & VCF in a low cost, easy to use package.

Every day more people discover that the GNOME is the most versatile, cost effective special effects device on the market today.

The Gnome has two function generators (one with repeat for cyclic effects), VCA, VCF and VCO. Use alone with its built in ribbon controller or modify to interface to guitar, electronic piano, polytonic keyboards, etc.

With the Gnome's normalized controls you'll soon be able to produce those far out electronic sounds even if you've never been near a synthesizer before. The Gnome can make outer space sounds for rock musicians, demonstrate principles of music and accoustics for educators, provide rhythmic pulses for modern dance groups and sound effects for theatre companies and is one of the neatest toys in the world for the audiophile.

Complete kit and well illustrated step-by-step instructions and using manual make the GNOME the perfect introduction to electronic music synthesis.

3740 GNOME Micro-Synthesizer Kit — shipping wt. 4 lbs.

Mini-Organ

A Battery powered polytonic pitch source speaker & amplifier

Oz is polytonic with over 6-1/2 octaves total range from its specially manufactured 1-1/2 octave keyboard. A built in speaker and amplifier makes Oz a truly self-contained instrument. Large Scale Integration and CMOS technology allow battery powered portability. Oz has a single tuning knob (no internal adjustments) and a mixing input that allows other instruments to play through the amplifier. Output jack and switch selectable step or multiple pulse trigger provides simple synthesizer interface. LED's indicate: Power on, octave setting and trigger status. A unique pressure-sensitive pitch bender chromotically transposes single notes or whole chords by up to a full octave. The entire package closes into an extremely portable, rugged 13 x 11 x 4 inch vinyl covered wood case.

Complete kit includes all parts, circuit board, completely finished case and front panel, specially manufactured keyboard and our step-by-step, loaded with pictures instruction manual.

No. 3760 OZ Mini-Organ Kit — **$199.00** — shipping wt. 12 lbs.

Interface OZ with the GNOME for a completely portable, polytonic synthesizer-like instrument complete with speaker and amplifier for less than you'd expect to pay for a guitar.

PHLANGER

- ★ Delay Time .5 ms. to 10 ms.
- ★ Wide Range of Effects
- ★ Remote Voltage Control Capability

$135.00

Phil Spector's original "Big Hurt" sound, which can only be approximated by using frequency dependent phase shifters, is exactly duplicated using our new constant time delay PHLANGER. This unit features a 1024 stage Charge Coupled Device analog shift register that exactly duplicates the effect of two tape recorders running slightly out of synchronization. Multiple user controls allow effects ranging from chorusing, voice doubling and reverb to full "jet plane" effects. Optional foot pedals provide hands free control of internal oscillator sweep speed or manual spectrum sweeping.

No. 1500 Phlanger Kit — wt. 4 lbs.

PROGRAMMABLE DRUM SET

256 BYTE MEMORY

TAILOR TIME SIGNATURE, DRUM SOUND & INDEPENDENT BRIDGE RHYTHM TO EACH APPLICATION

TOUCH SENSITIVE ELECTRONIC CONTROLS

While most electronic rhythm units offer only a limited choice of pre-determined rhythm patterns, the PAIA Programmable Drum Set allows you to select percussion sounds — Heavy Bass, Light Bass, Snare Drum, Rom-Tom, Conga, Wood Block or Clave — and structure pattern and time signature in any concelvable combination.

Touch sensitive switches allow scores to be entered in seconds, and NO PROGRAMMING KNOWLEDGE IS REQUIRED.

Without question the Programmable Drum Set advances the state of the art in automatic percussion units with features and abilities far too extensive to cover completely, including: Score editing, Bridges and Intros, external synch to sequencers — foot controls, memory save switch and many more.

High Fidelity Magazine describes the 3750 as "an easy project . . . fun to do and yields delightful results. . . . an excellent educational tool and a versatile aid to the musician who can't afford a live rhythm section."

3750 PROGRAMMABLE DRUM SET KIT — **$199.00** — wt. 5 lbs.

ORGANTUA T.M

REPRESENTING THE FIRST MAJOR ADVANCEMENT IN COMBO ORGAN TECHNOLOGY IN TEN YEARS!

Forget about the "thin" sound of single voice combo organs, ORGANTUA has three individual ranks, each with a five position octave switch, for a thick, textured sound. The multi-voice feature allows ranks to be detuned slightly for flanging or chorusing effects, or ranks can be tuned to wider intervals such as 4ths or 5ths to simulate drawbar organ or multi-oscillator synthesizer effects. Super wide-range sound is possible by tuning the ranks apart in increments of an octave, with up to 5 octaves between voices.

The master rank utilizes a voltage controlled clock to allow pitch bending, vibrato (two waveforms), and percussion effects. The two slave ranks can each be synchronized to either the master clock or an alternate tunable clock. The output amplifier allows variable attack time and overdrive control. A master level control is also provided.

Optional footpedals and footswitches allow the musician to bend pitch up or down, introduce vibrato or trilling, and switch the slave ranks in and out. ORGANTUA also features a unique "octave jump" footswitch capability, which raises all ranks one octave.

$577 **#6780**

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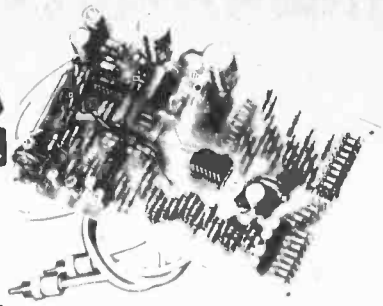
PAIA STEREO CHORD EGG



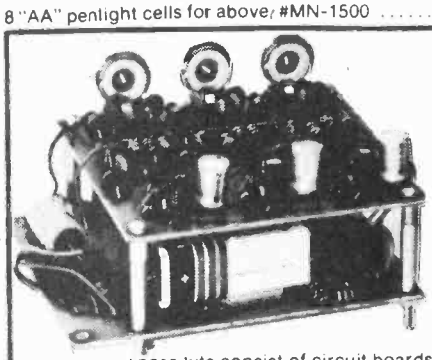
THE ULTIMATE MEDITATION/ENVIRONMENT MACHINE?

$85.95

The egg plugs into any stereo amplifier to create soothing, flowing environmental sound textures — and through headphones it's incredible. The chords and notes EXIST in your mind, and never repeat. The combinatiokn of LSI organ technology with synthesizer-type processing and digital randomizing/control elements make the EGG an altogether intriguing package from either technological or metaphysical viewpoints. Kit includes curcuit board, all parts and step-by-step instructions.

Stereo Chord Egg #3790. PRICE EACH **$85.95**

8 "AA" penlight cells for above, #MN-1500 ..... **$8.80**



They're Fun!

PAIA

Environmental Sound Effect Kits

These kits consist of circuit boards, parts and step-by-step instructions. They're battery operated and designed to plug into any hi-fi amplifier.

SURF SYNTHESIZER. Imagine the sound of the surf electronically synthesized. Use this kit as a substitute for a vacation to the ocean, or as a way to cope with the Canadian winter. #3711 $29.00

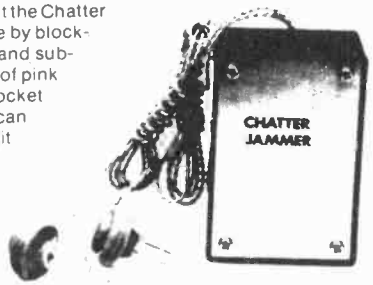
WIND KIT. Adjustable range of effects from moderate breeze to full gale. #3730 $29.00

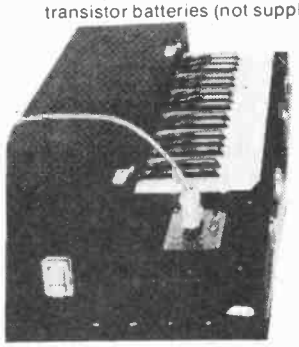
WIND CHIMES KIT. Relax to teh gentle random tinkling of Electronic Wind Chimes. Internal adjustments allow you to select from the ring of brass chimes or the percussive resonance of bamboo rods and many in between. #3721 39.95

CHATTER JAMMER

$16.95

We make only one claim for the Chatter Jammer: if you must work in a noisy environment the Chatter Jammer will help you to concentrate by blocking out distracting outside sounds and substituting the gentle "rushing" sound of pink noise. The Chatter Jammer is shirt pocket size, completely self contained and can be assembled in less than an hour. Kit includes circuit board, case, earphones, selected noise diode and instructions. Requires two 9volt transistor batteries (not supplied)





DIGITALLY ENCODED KEYBOARD

A scanning, matrix encoder tied to a 37 note AGO keyboard provides 6 bits of data and both STROBE and STROBE control outputs. Input control lines to the encoder include SCAN (starts and stops the encoder clock), RESET, START and RANDOM making the keyboard universally applicable to all computer/processors from the very largest to the very smallest. Housed in a trim and sturdy vinyl covered road case, the kit consists of all parts including keyboard, power supply and detailed assembly instructions; software overview for computer applications and detailed instructions for digital sample and hold.

* 8782 ENCODED KEYBOARD KIT (shipped freight collect) **$249.00**

PAIA 8700 COMPUTER/ CONTROLLER

8700 Processor 6503 MPU. Wire free "Active Keyboard". Mic to Diagnostic. Extensive documentation. Fully Socketed.

Piebug Monitor User Subroutines. Relative address calculator. Pointer High low. Back-step key.

Cassette Interface Load I; Dump by file #. Positive indication of operation. Tape motion control.

The Answer For... Student. Hobbyist. Manufacturer.

An exceptional price on an applications oriented 6503 based microprocessor system featuring: 1K bytes RAM locations (512 bytes supplied), 1K bytes ROM locations (256 byte monitor included), two 8 bit input ports, two 8 bit output ports, one latched and one buffered.

A 24 key touch operated keypad is used by the monitor to allow entry and execution of user programs as well as controlling features not normally found on low-cost single board computers; including a relative address calculator that completely eliminates this normally tedious hexadecimal calculation and back-space key that eases entry and editing of programs. Pointer High and Pointer Low keys allow the 8700's twin seven segment displays to serve the multiple functions of indicating both address location and data.

The 8700 fits in a space reserved in the 8782 encoded keyboard's case. PAIA software support available for Electronic Music Synthesizer interface.

* 8700 COMPUTER/CONTROLLER KIT **$285.00** wt. 4 lbs.

CASSETTE INTERFACE OPTION

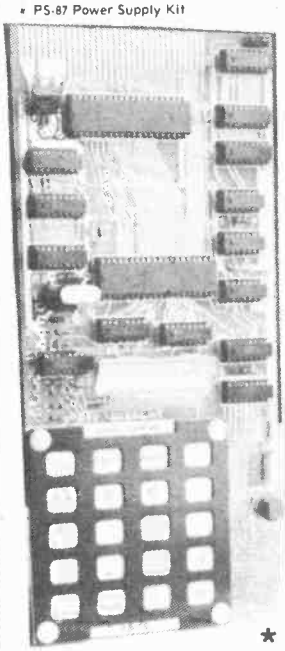
This is one of the most reliable and easy to use cassette systems that we've seen. A single LED indicates proper cassette volume control setting and provides a positive indication of data flow. We've even made software and hardware provision for tape motion control (relays must be added). The CS-87 option fits entirely on the 8700 circuit board and consists of the POT-SHOT PROM and a handfull of additional components.

* CS-87 Cassette Interface Option **$40.95** plus postage

POWER SUPPLY

The logical choice to power the 8700. Fully regulated 5v. at 1 amp, —9 volts @ 300 ma. Also provides a 60 Hz. output for real-time clock applications.

* PS-87 Power Supply Kit **$52.00** wt. 3 lbs.



•Designed for fast easy assembly
•FREE MANUAL

ACCESSORY OPTIONS

RAM I/O	$48.75
Extra Memory Chips (2 x 128 bytes)	$22.00
Cassette Interface	$37.95

The new Science of Cambridge MK14 Micro computer kit

SPECIAL Was $199.95

Now **$139.95**

MK14 Specification

- ★ Hexadecimal keyboard
- ★ 8-digit, 7-segment LED display
- ★ 512 x 8 Prom, containing monitor program and interface instructions
- ★ 256 bytes of RAM
- ★ 4MHz crystal
- ★ 5V stabiliser
- ★ Single 6V power supply
- ★ Space available for extra 256 byte RAM and 16 port 1/0
- ★ Edge connector access to all data lines and 1/0 ports

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USE THIS HANDY ORDER FORM!

GLADSTONE ELECTRONICS

1736 AVENUE ROAD,
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( ) Money order
Amount enclosed
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C.O.D. ORDERS are acceptable only when accompanied by a 20% deposit. Postal charges are added to the cost of your order. All shipments are FULLY INSURED. Stereo equipment, and orders over $200 or 20 lbs. are shipped express by rail, bus, truck or air. Send no money for express shipments . . . pay deliveryman at your door.

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In conjunction with the Bank of Nova Scotia, we can offer low cost bank financing on purchases over $330.00. Please fill out order blank as usual, mark it SCOTIA-PLAN in large letters. Include a 10% (minimum) deposit. Indicate 12, 18, or 24 month repayment term of your contract. We will send back to you completed application forms for your signature. Minimum financed balance is $300.00.

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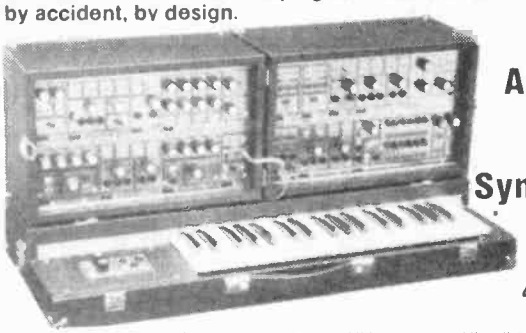
PAIA SYNTHESIZER SYSTEMS... ...COST EFFECTIVE DESIGNS

From the analog basics to computer controlled digital systems

.... for the beginner, a package configuration devised by experienced users removes a lot of the guess work.

As you grow, your system can grow because every PAIA module, from the simplest to the most complex, those you buy today and the ones that we're developing for tomorrow are compatible. Not by accident, by design.



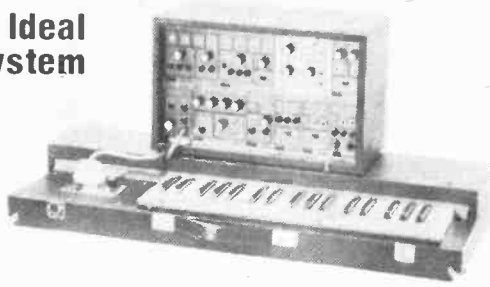
° The Go Anywhere Do Anything Synthesizer Package

4700/S

When you combine all of the modules that are part of this package and then throw in a keyboard, 12 event sequencer and a four input stereo mixer, it's almost like having two synthesizers in a single package. Wrap them all in sturdy road cases and you have an instrument that goes anywhere and does any job. Module complement includes: Road keyboard with glide, two road module cases, two balanced modulator VCA's, stereo mixer, reverb, three 4720 VCO's, 4730 VCF, two envelope generators, three watt blocks, control oscillator/noise source and 12 event sequencer.

No. 4700 S synthesizer kit **$1099.00** (shipped freight collect)

° The Ideal Starter System

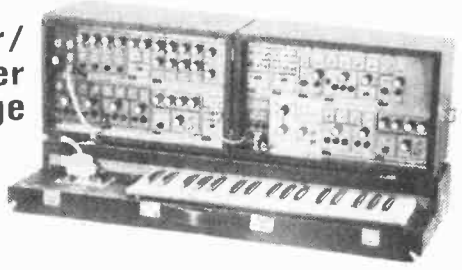


4700/C

The ideal monotonic starter system. Can be used without a computer/processor as a conventional electronic music synthesizer. But, by simply unplugging the synthesizer head from the keyboard, a computer can be put into the loop to provide power and versatility never before possible for synthesizers of any cost. The 4700/C module complement includes the 8782 Encoded Keyboard, Digital to Analog Converter, 2720-5 Control Oscillator/Noise source, 4710 Balanced Modulator VCA, Reverb, 4720 VCO, 4730 VCF, Envelope Generator, two Watt Block power supplies and a 4761 Wing Cabinet, complete step-by-step assembly instructions and using manual.

No. 4700 C Synthesizer Kit **$675.00** (shipped freight collect)

° Computer/ Synthesizer Package



4700/J

By anyone's standards this is a BIG synthesizer...as you can see by reviewing the module complement. Like our other packages, it may be used without a computer as a normal monotonic synthesizer. With a computer in the loop, you are ready to do polyphonic instruments, multi-track recording work, and innumerable composer and performer assisting functions that are only possible with a computer/synthesizer combination. The 4700 J module complement consists of: the 8782 Encoded Keyboard, Digital to Analog Converter, QuASH, two 4710 Balanced Modulator VCAs, three 4720 VCOs, 2720-5 Control Oscillator Noise Source, 4730 Filter, 4711 Stereo Mixer, two Envelope Generators, Reverb, three Watt Block power supplies and two Road Module Cabinets. Included are step-by-step assembly instructions and using manual.

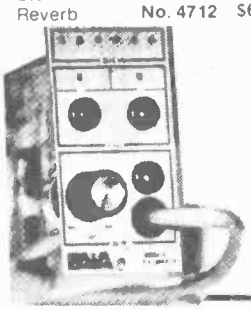
No. 4700 J Synthesizer Kit **$1130.00** (shipped freight collect)

PAIA 4700 SERIES MODULES

Comprising the 4700 series synthesizers. May be ordered "step at a time" to experiment and build up your synthesizer system. Full instructions included with each module.

VC Oscillator	No. 4720	$96.95
VC Filter	No. 4730	$81.95
A/D/S/R	No. 4740	$61.95
VCA Bal/Mod	No. 4710	$51.00
Stereo Mixer	No. 4711	$68.00
Reverb	No. 4712	$63.00

Watt Block	No. 4770	$30.00
Sequencer	No. 4780	$144.00
Wing Cabinet	No. 4761	$41.00
Road Keyboard	No. 4782	$317.00
Glide	No. 2720-9	$24.50



EQUALLY TEMPERED DIGITAL TO ANALOG CONVERTER

Unlike more conventional R-2R ladder type digital to analog converters, the PAIA 8780 kit is based on a multiplying principle that allows the module to generate the exact exponential stair-step function required to make even the simplest linear response oscillators and filters produce equally tempered musical intervals. The 8780 uses only 6 bits of data to generate over five octaves of control voltage. In an 8 bit system, the remaining two bits are ordinarily reserved for trigger flags, but may be used to provide micro-tonal tunings.

The module is physically and electrically compatible with the complete line of PAIA music synthesizer modules and is easily interfaced to any micro-processor.

8780 Digital to Analog Converter **$85.00** wt. 1 lb.

P-4700 C & P-4700 J

These P-4700 series packages pull it all together: synthesizer, computer and software ready to load from any cassette recorder and begin playing. Each package includes all of the synthesizer modules listed above as well as an 8700 Computer Controller fully loaded with RAM, CS-87 cassette interface, power supply and all required hardware and connectors. Each represents a significant savings when purchased in this package configuration.

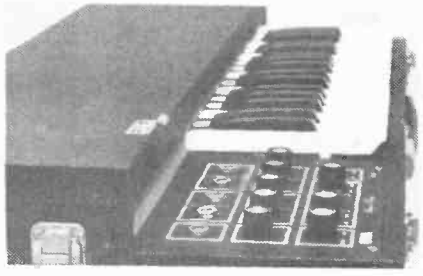
Music software and firmware provided with the P-4700 J includes both the MUS-1 PROM and PMUS cassette. The P-4700 C package includes the SEQUE 1.0 sequencer operating system.

P-4700 C Synthesizer with Computer Controller (shipped freight collect) **$1025.**

P-4700 J Synthesizer with Computer Controller (shipped freight collect) **$1550.**

keyboard with computer controller as featured in P-4700 packages. (Cassette recorder not included.)

Stringz 'n' Thingz from PAIA



$619

includes compact rugged carrying case.

We can't possibly cover all of the features and options of STRINGZ 'N' THINGZ in this limited space but even in this small space we can say that the 1550 is the most advanced and versatile string ensemble available at any price, from anybody. Features include: Violins/Cello/Piano, separate mixable piano output, synthesizer interface, variable chorusing, variable sustain controls, jacks for foot controls, keyboard split, dual violin/cello mixers, stereo string option and even a modestly priced computer interface option. You'll love it. Computer interface will be announced when available.

pygmy Portable Amplifier

Take it anywhere!

PYGMY PORTABLE AMP **$89.00**

Tiny, lightweight and LOUD. Eight penlight cells are used to drive the Pygmy's 5-inch acoustic suspension speaker to a room filling 1.2 watts RMS (up to 8 watts peak). Excellent practice amp, also ideal for silent listening on headphones. Heavy duty ½ inch plywood case with vinyl covering, road corners, strap pegs, provided. Easy to build — 3 hours most required. 6 lbs.

ELECTRO-LARYNYX RETROFIT for Pgymy amp — convert your Pygmy to the new talking guitar effects. ..... **Each $12.00**

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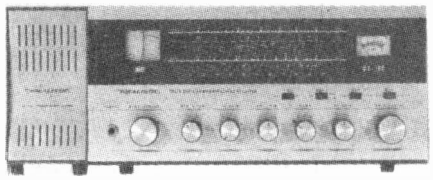


REALISTIC DX-160
Type: table model
Frequency range: 1.6-30 MHz + AM & LW in 5 bands
Tuning: slide rule scale plus bandspread dial
Modes: AM; CW
Speaker: external (included)
Antenna: long wire provisions
Provisions for: headphones; external speaker
Power: 120 V AC; 12 V DC
Other features: receiver mute switch
Size: 362 mm wide x 165 mm high x 235 mm deep (14 ¼" x 6½" x 9¼")
speaker 3½" x 7" x 5⅛" 89 mm x 178 x 235
Price: $229.95 Can.
Contact: RADIO SHACK

REALISTIC DX-300
Type: table model
Frequency range: 1 6-30 MHz + AM and LW in 30 bands
Tuning: digital with MHz & kHz dials
Modes: AM, FM, SSB, CW
Speaker: built-in
Antenna: screw-on whip, coax provisions, long wire provisions
Provisions for: headphones, recorder, external speaker
Power: 120 V AC, 12 V DC, 8 'C' cells
Sensitivity: 10 dB S/N — AM — 1 uV @ 900 kHz and 0 5 uV @ 7 1 MHz
Selectivity: + 3 kHz -6 dB, + 10 kHz @ - 70 dB
Other features: RF attenuator, built-in code oscillator
Size: 356 mm wide x 152 mm high x 248 mm deep (14" x 6" x 9¾")
Price: $499 95 Can
Contact: RADIO SHACK

REALISTIC SX-190
Type: table model
Frequency range: 3 5 to 30 MHz in 14 bands
Tuning: large Vernier dial crystal controlled
Modes: AM; CW
Speaker: external
Antenna: coax provisions
Provisions for: headphones; earphone, recorder, external speaker
Power: 120 V AC
Sensitivity: AM — 1 uV for 10 dB (S+N)/N
Other features: Q multiplier, 25 kHz & 100 kHz calibrator
Size: 381 mm wide x 178 mm high x 254 mm deep (15" x 7" x 10")
Price: $469 95 Can speaker $33 95
Contact: RADIO SHACK
Note: This receiver is no longer manufactured but may still be available in some Radio Shack stores at a well discounted price

SONY CF-270L
Type: portable
Frequency range: 4 5-28 MHz + AM & FM in 4 bands
Tuning: slide rule dial
Modes: AM, FM
Speaker: built-in-2
Antenna: built-in whip, ferrite rod
Provisions for: earphone
Power: 120 V AC, or batteries
Other features: built-in cassette recorder, sleep timer
Contact: SONY

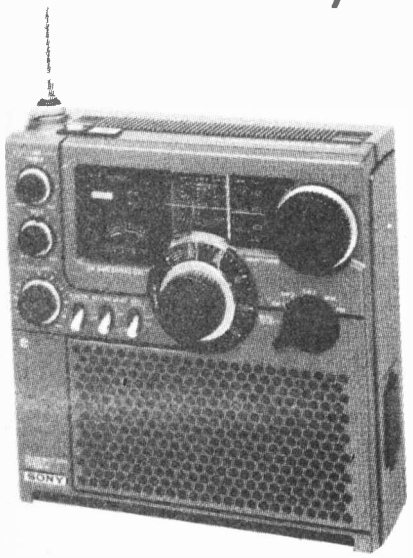
SONY CF 470 S
Type: portable
Frequency range: 2 4 -16 MHz + AM, FM in 4 bands
Tuning: slide rule dial
Modes: AM, FM, FM stereo SSB, LSB, CW wide, CW narrow, RTTY
Speaker: built-in
Antenna: built-in whip, ferrite rod
Provisions for: earphone
Power: 120 V AC, or batteries
Other features: sleep timer
Contact: SONY

SONY CRF-320
Type: portable
Frequency range: 1 6-30 MHz + AM, FM, & LW in 32 bands
Tuning: digital with MHz & kHz dials — separate AM, FM & LW sections
Modes: AM wide, AM narrow, FM, USB; LSB, CW
Speaker: built-in
Antenna: built-in whip, ferrite rod, coax provisions; long wire provisions
Provisions for: headphones, earphone, recorder, external speaker
Power: 120 V AC, 8 'D' cells
Other features: built-in timer, FM muting, quartz crystal clock, antenna tuning
Size: 451 mm wide x 308 mm high x 206 mm deep (17 ¼" x 12⅛" x 8⅛")
Weight: 13 Kg (28 pounds 11 oz)
Price: $2150 Can
Contact: SONY

SONY CRF-5100
Type: portable
Frequency range: 1 6-26 MHz + AM, FM, LW, PSB in 10 bands
Tuning: turret type dial + bandspread
Modes: AM, FM, SSB, CW
Speaker: built-in
Antenna: built-in whip, ferrite rod, long wire provisions
Provisions for: earphone, recorder
Power: 120 V AC, 8 'D' cells
Other features: world time zone chart on cover
Size: 340 mm wide x 230 mm high x 160 mm deep (13⅜" x 9 1/16" x 6 5/16")
Weight: 6 4 Kg (14 pounds 2 oz)
Price: $499 95 Can
Contact: SONY

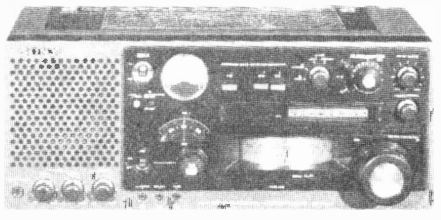
SONY ICF-5800 L
Type: portable
Frequency range: 1 6-12 MHz + AM, FM & LW in 5 bands
Tuning: drum dial
Modes: AM wide, AM narrow, FM, FM stereo, SSB, USB, LSB, CW wide, CW narrow; RTTY
Speaker: built-in
Antenna: built-in whip, ferrite rod, long wire provisions
Provisions for: headphones; earphone, recorder; external speaker
Power: 120 V AC with adapter; 4 'C' cells
Other features: built-in timer
Size: 208 mm wide x 228 mm high x 84 mm deep (8¼" x 9" x 3⅜")
Weight: 2 Kg (4 pounds 7 oz)
Contact: SONY

Receiver Survey

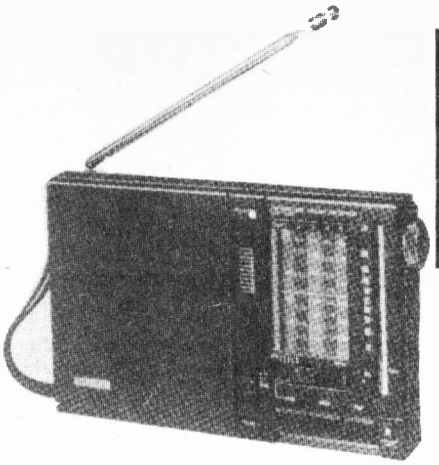


SONY ICF-5900 W
Type: portable
Frequency range: 3 9-28 MHz + AM & FM in 5 bands
Tuning: drum scale with large dial + bandspread
Modes: AM FM SSB, CW
Speaker: 4 " built-in
Antenna: built-in whip, ferrite rod long wire provisions
Provisions for: earphone, recorder
Power: 120 V AC, 3 'D' cells
Sensitivity: DX & local sensitivity selection
Size: 222 mm wide x 235 mm high x 102 mm deep (8¾" x 9¼" x 4")
Weight: 2 Kg (4 pounds 7 oz)
Price: $239 Can
Contact: SONY

SONY ICF-6700 W
Type: portable
Frequency range: 1 6-30 MHz + AM & FM in 5 bands
Tuning: digital plus slide rule dial scale
Modes: AM wide AM narrow, FM USB, LSB, CW
Speaker: 4 " built-in
Antenna: built-in whip ferrite rod, coax provisions long wire provisions
Provisions for: headphones, earphone, recorder external speaker, timer
Power: 120 V AC 6 'D' cells
Other features: fold down world map cover
Size: 451 mm wide x 183 mm high x 229 mm deep (17¾" x 7³/₁₆ " x 9")
Weight: 5 5 Kg (12 pounds 2 oz)
Price: $630 Can
Contact: SONY



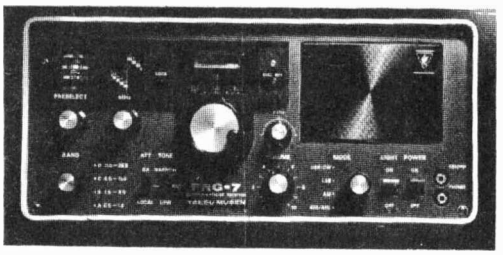
SONY ICF-6800 W
Type: portable
Frequency range: 1 6-30 MHz + AM & FM in 31 bands
Tuning: digital with gear driven drum scale dial
Modes: AM wide AM narrow FM, USB, LSB, CW
Speaker: 4" built-in
Antenna: built-in whip, ferrite rod, coax provisions, long wire provisions
Provisions for: headphones earphone; recorder, external speaker
Power: 120/220 V AC, 9 V DC, 6 'D' cells
Other features: timer jack, world time zone chart on top panel, memo lite
Size: 453 mm wide x 184 mm high x 227 mm deep (17¾" x 7³/₁₆" x 9")
Weight: 5 8 Kg (12 pounds 13 oz)
Price: $1000 Can
Contact: SONY



SONY ICF-7600
Type: portable
Frequency range: 3.9-4; 5.95-6.2, 9 5-9 8; 11 7-12, 15 1-15.5 MHz + AM & FM in 7 bands
Modes: AM, FM
Speaker: 3" built-in, external
Antenna: built-in whip; ferrite rod
Provisions for: earphone; recorder
Power: 120 V AC with adapter; 4 'AA' cells
Sensitivity: SW — 0.63 uV (-4 dB) S/N = 6 dB
Selectivity: SW & MW — -36 dB + 10 kHz
Other features: pocket size
Size: 178 mm wide x 117 mm high x 32 mm deep (7" x 4⅝" x 1¼")
Weight: 5 Kg (1 pound 3 oz)
Price: $229 95 Can.
Contact: SONY

SONY TFM 8000 W
Type: portable
Frequency range: 1 6-26 MHz + AM, FM, &PSB in 6 bands
Tuning: slide rule scale + bandspread
Modes: AM, FM
Speaker: built-in
Antenna: built-in whip; long wire provisions
Provisions for: earphone
Power: 120 V AC, 4-'D' cells
Size: 291 mm wide x 210 mm high x 105 mm deep (11⁷/₁₆" x 8¼" x 4⅛")
Weight: 3 2 Kg (7 pounds 1 oz)
Contact: SONY

TANDBERG TR 2025
Type: table model
Frequency range: 3 3-30 MHz + AM, FM, LW
Modes: AM; FM, FM stereo
Speaker: built-in
Power: 120 V AC
Other features: 25 Watts/channel (FM)
Size: 559 mm wide x 146 mm high x 324 mm deep (22" x 5¾" x 12¼")
Price: $685 U S.
Contact: TANDBERG



YAESU-MUSEN FRG-7
Type: table model
Frequency range: 0 5 MHz-39 9 MHz in 4 bands
Tuning: small MHz knob — large kHz dial
Modes: AM, USB, LSB, CW narrow
Speaker: built-in
Antenna: coax provisions, long wire provisions
Provisions for: headphones, earphone, recorder, external speaker
Power: 120/220 V AC, 13.5 V DC, 4 'D' cells
Sensitivity: SSB/SW better than 0 7 uV for 10 dB S/N @ 30% modulation
Selectivity: 3 kHz -6 dB 7 kHz -50 dB
Other features: fine tuning
Size: 340 mm wide x 153 mm high x 285 mm deep (13 4" x 6" x 11 2")
Weight: 7 Kg (15 pounds 7 oz)
Price: $479 Can
Contact: HAMTRADERS INC, WSI RADIO

YAESU-MUSEN FRG-7 (PACKAGE #1)
FRG-7 modified by Radio West with your choice of Collins mechanical filters for greater selectivity
Price: $430 U S
Contact: RADIO WEST

YAESU-MUSEN FRG-7 (PACKAGE #2)
FRG-7 modified by Radio West with your choice of Collins mechanical filters for greater selectivity plus an outboard digital display unit
Price: $570 U.S.
Contact: RADIO WEST

YAESU-MUSEN FRG-7 (PACKAGE #3)
FRG-7 modified by Radio West with your choice of Collins mechanical filters for greater selectivity; an outboard digital display unit, and the addition of the VLF band (5 kHz-30 MHz frequency range)
Price: $655 U S
Contact: RADIO WEST

YAESU-MUSEN FRG-7 (PACKAGE #4)
FRG-7 modified by Radio West with your choice of Collins mechanical filters for greater selectivity; an outboard digital display unit; the addition of the VLF band and a crystal controlled BFO to permit precise frequency measurement
Price: $710 U S.
Contact: RADIO WEST

YAESU-MUSEN FRG-7-3
FRG-7 modified by Gilfer with a 3 kHz ceramic filter for greater selectivity
Price: $392 50 U S.
Contact: GILFER SHORTWAVE

YAESU-MUSEN FRG-7-4
FRG-7 modified by Gilfer with a 4 kHz filter installed selectivity 4 kHz @ -6 dB, 10 kHz @ -60 dB
Price: $380 U S.
Contact: GILFER SHORTWAVE

YAESU-MUSEN FRG-7000
Type: table model
Frequency range: 0.25 to 29.9 MHz in 5 bands
Tuning: digital — MHz & kHz dials
Modes: AM, USB, LSB; CW
Speaker: built-in
Antenna: coax provisions, long wire provisions
Provisions for: headphones; recorder, external speaker
Power: 120/220 V AC
Sensitivity: AM — 10 dB — better than 2 uV for S/N
Selectivity: AM — + 3 kHz -6 dB; + 7 kHz -50 dB
Other features: built-in clock; RF attenuator
Size: 360 mm wide x 125 mm high x 295 mm deep (14 2" x 4 9" x 11 6")
Weight: 7 Kg (16 pounds 7 oz)
Price: $869 Can
Contact: HAMTRADERS INC; WSI RADIO

YAESU-MUSEN FRG-7000 (GILFER MOD)
Stock FRG-7000 modified by Gilfer with a 4 kHz filter (at -6 dB) to give two AM selectivity positions — wide & narrow
Price: $625 U.S.
Contact: GILFER SHORTWAVE

YAESU-MUSEN FRG-7000 MODIFIED
Stock FRG-7000 modified by Radio West for better selectivity selectivity — 4 kHz @ -6 dB; 10 kHz @ -60 dB
Price: $600 U.S.
Contact: RADIO WEST

QRM QRM QRM

Ham's should take pains to earn their frequencies, claims Bill Johnson, VE3APZ.

WHY DO WE have the frequencies which we use? That's certainly a question that has been talked about a lot in the past, and during the World Administrative Radio Conference, presently under way in Geneva, it is a question that a lot of non-amateurs are asking the International Telecommunications Union.

Certainly, the amateurs of the world deserve the frequencies that they have, there is nobody in our ranks that would disagree. But the problem is that there is a jungle out there, and it is fine for us to sit back in our camp and talk about how good we are around the camp camp fire, but sooner or later we have to send an emissary out to the hostile natives who want the land that we have camped on.

Amateur radio is as old as the hills. As a matter of fact, amateur radio is as old as radio is itself, since there was no commercial money available to help the early radio experimenters. But we cannot rest on our laurels. We must strive to be of use to our community or, like so many old people today, we will be shipped off to some nice place where people will take care of us and we will not have to worry about anything. Is it possible that this is already happening? We are in an age when the young ham is attracted to the fraternity not because he has been a constant companion of the local amateur, holding his tools while he builds a new piece of equipment long into the midnight hours, but by hearing the local amateurs on the local repeater yakking it up into the wee hours.

I am not saying that repeaters are an evil. Just as money isn't — it's the love of it. Repeaters serve a very useful purpose in amateur society. They are one of the few ways to satisfactorily have an intercom net with your friends, are ideal for mobile operations, lend themselves easily to portable and mobile use, and provide a few people in each repeater society with some good technical experimentation.

The problem really lies in the fact that we are fast becoming users of radio instead of the revered 'boffins' that gave it to the rest of the world. As such straight users, we have to stand in the same line as the other users when the frequency bands are handed out.

Now that we know the problem, you might say, how do we arrive at a solution. The answer to that question is entwined in politics at all levels, because what we are dealing with is not purely technical, but something that concerns every citizen in the country and every country of the world. What we are talking about is like saying that because somebody has lived in a certain house for twenty years, and they have always been nice neighbours and always reported any fires, car accidents, and emergencies that they may have seen to the appropriate authorities, then they should be allowed to go on living there. We must be eternally vigilant - that is the price of freedom. We must not only do justice to ourselves, but we must be seen to do it. We must make amateur radio a revered part of our community's activities. We must always be on our toes, looking for ways to promote amateur radio before the public. It is not enough to keep working at improving the art of radio, of finding new ways to communicate — we have a lot of competition in this area from Universities and research institutions with government grants. We must assess every opportunity to project the image of amateur radio in the public's eye. When somebody asks you 'is that a CB', don't just grunt an answer, take a few seconds to tell them what it is all about. When somebody asks you what your special license plate means, tell them all about the hobby. Also, tell them how you can send a message free for them all across North America. (If you don't know how to handle traffic, do it anyway, a traffic-handling friend will be glad to take a message for you.)

Finally, never let an opportunity pass by to do a service to somebody where amateur radio can take the credit. I witnessed an incident recently here in Toronto where an amateur saw a severe weather pattern appear over a major intersection. He drove into a nearby plaza and casually sat talking to a friend about how it looked like a tornado he had witnessed in the Southern States. He even described the funnel-like spout that is characteristic of clouds in that type of storm. Finally, another ham broke in and suggested that he had better call the weather office and report it. He gave him the number, but when the local repeater's autopatch failed to connect him he nonchallantly said 73 and that he'd better get on with his shopping. It took another amateur to phone the weather office and report the storm, which had not been reported as a tornado until that time. Half an hour later, the weather office issued a tornado watch. The tornado devastated a huge area of southern Ontario causing millions of dollars of damage.

It is not only our responsibility in such a case as mentioned above to report the circumstances promptly to the proper authority, but it is also as important to take a few minutes to scan the local directory and pick ut the right numbers to call in an emergency, both for our own and surrounding neighbourhoods.

LESSON OF THE MONTH

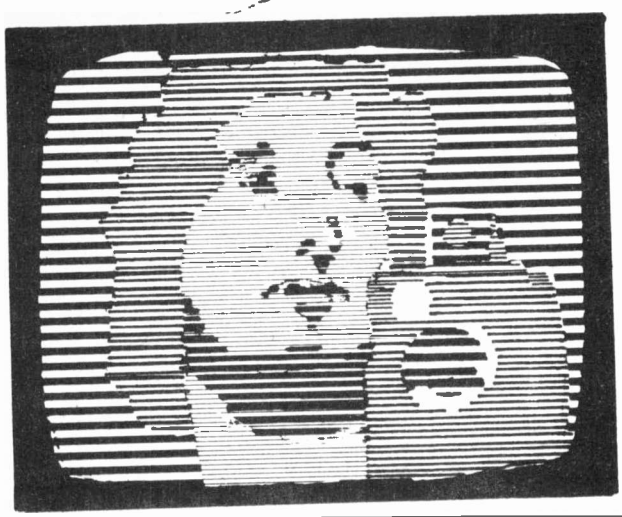
Procedure for calling in an emergency. Cut this out and paste to sunvisor, back of portable, or forehead, where applicable.

1) Keep calm - you can't help anybody if you sound like a blithering idiot at the other end.
2) If calling via a patch, notify the other person that you are an amateur mobile unit calling by two way radio.
3) Give the position of the incident FIRST.
4) Give them details of the emergency, how many people are injured, what property is damaged.
5) Wait for them to ask you questions. It's guaranteed that if you hang up, they will have something important to ask you that you forgot.

MOST IMPORTANT OF ALL

Don't grasp your mike button as if you will die if you let go. Let it go when you pause for breath. This will let the emergency dispatcher break in if anything is not clear and avoid time-wasting repetitions.

Continued on p76.



WHAT'S ON

Steve Rimmer, ETI's semi-resident video expert and (semi-?) wit, turns his talents to telling how to get the most out of your cable.

CO-EXISTING WITH THE WIRE

THE PLAGUE HAS come and gone, as have the wage and price controls and the Liberal government. We still remain. We have survived the iron age, the coal age, the atomic age, the space age, middle age and seem to be doing pretty well with the present dark age, Arabs or no Arabs. Swine flu couldn't do us in, nor Skylab or the John Allen Cameron Show. We have stood, steadfast, before all the horrors of our existence . . . but, can we now make peace with . . . cable television?

Probably not.

Like most insanely complex things, the idea behind cable, referred to in the industry as community access television or CATV, is quite simple. Instead of every household in a community putting up its own little DEW line of TV aerials, and getting poor reception, not to mention turning suburbia into a full scale model of a shipwreck, a company erects one big antenna and rents the signal to each of the individuals in said community. The overall cost of getting television reception is reduced, reception should be better, due to the larger antenna made possible by the resources of the company, and no one will have to worry about having a roof full of metal work blow down during monsoon season. Marx might have seen the concept as a wonderful example of the benefits that can be reaped by an organized alliance of the common man . . . but, then, Marx didn't have to watch it.

The cable companies, upon first getting into the project, thought they had just struck gold. Here they were, with a few hundred thousand dollars invested, having people pay them for something that used to be free. They needed no larger an organization than was required to turn on the signal amplifiers and write up the bills. With transistorized equipment, very little maintenance was required, and the whole show could be run by half a dozen people with no trouble at all. Many early CATV operations were set up in basements.

The thought that these few handfulls of businessmen and engineers seemed to have found the Philosopher's Stone appears to have upset the government. What probably upset it most was that it had not thought of it first. Therefore, it dumped an assortment of regulations upon the cable industry. It invented community access programming, whereby each cable station would be required to operate one television channel, and supply cameras and the appropriate studio facilities to any individual or group from the community wishing to say something on the box. Then it started insisting that a certain number of channels be occupied with Canadian programming, no matter how mediocre or redundant it may have been, at times. Shortly there after, it got further into the psychology of enforced national viewing. Not completely grasping the random access nature of the rotary television channel selector, it decreed that the lower numbers on the dial should be occupied with *our* channels, the good guys, leaving the nasty Americans, which, of course, nobody really wanted to watch, anyway, up there in the high end. This necessitated the installation of demodulators and remodulators, signal level compensators and a lot of other shiny new hardware, and, suddenly, running a cable station became expensive.

There was only one thing to do: raise the rates.

The fact was that the CATV industry was, at the outset, making embarrassingly large sums of money. When the government stepped in, it became apparent that a lot more of that money was going to have to be plowed back into the operation. However, the government did not seem to be beefing about things like signal levels and S/N ratios, but, rather, what the signals carried. In other words, it was fine to have a screen so full of snow that the picture was unwatchable, provided that the snow was Canadian. As such, there was no motivation for the cable companies to improve the basic system. Instead, they dumped their excess thousands into television cameras, switchers and the other paraphernalia of small TV production studios. The investment was great for taxes, and the powers that were were satisfied.

Of course, video studios don't come cheap. They had to raise the rates some more.

The unfortunate thing about Canadian broadcasters, from the point of view of CATV, was that there weren't always enough of them in a given area to fulfill the "Can-con" ratio requirements. On the other hand, there were plenty of U.S. stations, especially the diverse UHF broadcasters, and the cable subscribers were clearly interested in cable in order to be able to receive those stations. This had worked out well in the beginning, before the outbreak of legislation, as one simply had the local CBC and CTV in their usual places on the dial, with the remainder of the channels being occupied by more distant stations. However, once the ruling were handed down, there was no longer enough space on the dial, in many areas, to

accomodate all the Americans plus the three or four CBC transmissions necessary to keep the hounds at bay. Therefore, the cable converter system was introduced. In addition to the twelve regular TV channels, a number of others were introduced above and below the "mid-band". While a standard tuner could not pick these up, a television set could be fitted with an accessory front end which beated the extra stations down into the VHF broadcast region. Subscribers wishing to have reception of all of the stations available on the cable could simply buy, or rent, one of these "converters".

Of course, the equipment needed to get all these extra channels on the wire was quite elaborate. It was also expensive. Another rate increase became necessary.

One of the first rules in starting up a cable station is to buy a billing machine with at least one digit more than is initially needed.

By now, it probably seems that cable TV is a nasty, money grubbing organization bent on fleecing the public while not even providing the service it was set up to make available. Clearly, this is not true. I have never encountered a cable company that was nasty.

GETTING THE MOST OUT OF CABLE

There are a number of specific ways that the average cable subscriber usually finds him or her self at odds with the far end of the wire. In many cases, with a bit of cunning, and a few simple hand tools, it is possible to get around these without either a monthly rate increase or some clown digging up the front lawn to bury something. This month, we're going to look at three of the more common ones.

In our area, channel four, CBS, comes in on channel five on cable. However, off cable, CBC comes in on five. In fact, CBC comes in quite well on five, so well, in fact, that most sets can pick it up without an antenna attached. This rather generous signal is quite sufficient to sneak its way into the workings of the set even with the cable attached. Thus, during certain atmospheric conditions, channel five gets a bit crowded, with the Maple Leafs taking slap shots at the Little House on the Prairie. A great situation, this, if your attention happens to be equally divided between contact sports and prime time soap operas.

Needless to say, this situation has been brought to the attention of the cable company, and it came up with a simple solution. CBS also comes in on channel F. However, you may have noticed that you may not have noticed an "F" on the dial. There's a reasonable explanation for this: you can't get channel F on a regular TV. You need a converter. Guess who sells (and rents) converters.

A plot to expedite the sales of converters, you say?

On top of getting the usual stations... one at a time..., a converter would also permit reception of the PBS station below the boarder, a couple of UHF independents, and several CBC affiliates, which occasionally have good flicks on the insomnia theatre. However, the present incarnations of these little electronic wonders begin at around a hundred dollars, and many of us may feel a bit resentful at having to part with this volume of money for a couple of transistors and a plastic box.

There are several ways around the converter problem.

The first technique is rather limited: it only brings in one additional channel, this being I or 22. However, the price is right... it doesn't cost a thing... and, if it happens to be the converter station you'd really like to receive, it's certainly worth trying. Due to a peculiarity of the converter system, the channels up to and including I usually get filled first, so, chances are there will be something coming in on this frequency in your area.

The VHF TV broadcast band is actually two bands. In between channels 6 and 7 is a large gap, which contains, among other things, the FM broadcast band. However, even with this service in there, there's still enough room to put a number of TV channels in between 108 mc, the last FM frequency, and channel 7, at 174 mc. This, in fact, is where a few of the converter channels go. The uppermost of these "mid band" frequencies is channel I.

The fine tuning, on many television sets, can swing as much as six megacycles off its centre frequency. In effect, the, with the dial set to channel 3, for example, the set could be "fine tuned" to get either channels 4 or 2. If the channel selector is set to channel 7, fine tuning down will pick up the converter channel adjacent to 7, which is channel I.

Since the fine tuning, on most sets, actually sets an individual slug in a coil for each channel, once the tuner has been set to pick up channel I instead of 7, it can be left set up in this way, eliminating the need to re-adjust it every time the channels are changed.

This fine tuning trick works on most sets. Almost all colour models will have the necessary fine tuning range, as will many of the better black and whites. Cheap portables, in which the fine tuning does not adjust each channel individually, but, rather, just throws a capacitor across the occilator's tuned circuit, usually won't be able to pull in this extra station.

In the black and white which I use to feed "off the air" video to my VTRs, I came up with a problem that may plague a number of those trying this approach. The tuner could pull in channel I, but just barely, resulting in a picture of poor quality. In this case, it is possible to shift the oscilator slug in the tuner for channel 7 *very* slightly, and thus "drag" the range of this channel more toward the lower adjacent channel than the upper. In attempting this adjustment, however, one must be extremely careful not to get the tuner too far out of alignment... or you won't be able to get back to channel 7.

What about building a converter? The push button, varactor tuned, digital readout moon shot control systems commonly seen atop the family tube are quite out of the question. Having had one apart, I have come to realize that there are some things better left unattempted. However, there is a second approach to converter operation which is, theoretically, much less complex. There is no reason why the entire VHF television spectrum, standard as well as converter channels, could not be heterodyned up into the UHF television broadcast band, where a set's UHF tuner could deal with them. The required circuitry would be quite simple, consisting of a mixer and a local oscillator. Everything would be very broadband, with no real heavy alignment to bother with. While the frequencies involved are prohibitively high, much more so than most basement technicians are usually comfortable working with, they can be overcome with careful construction techniques and fairly simplistic design.

Hopefully, we'll look at some actual circuitry in a few months . . . if I don't blow my last UHF transistor by then.

Along these lines, it should be pointed out that this type of converter is available commercially, although it seems to be a bit hard to come by. Philips makes one, at about $45.00 a shot.

AMPS AND BOOSTERS

The second problem which many

cable subscribers run into is that of exceedingly low signal levels coming out of the wire a their ends. This is due, primarily, to a reluctance, on the part of some cable companies, to invest more than they consider necessary in things like line amps and distribution pedestals. Pedestals, by the way, are those little green boxes protruding from the odd lawn, the ones the snow plows usually wipe out each winter. With the pedestals overtaxed, a slight dip in the signal at the feeding end of the system can manifest itself in fading colour, interference and snow on your screen.

There are two basic solutions to this problem. The first is the simplest, but does have its drawbacks. Basically, one locates the pedestal for his or her neighbourhood, disconnects all his or her neighbours, and then attempts to leave the area without becoming shot. The second, and probably the more workable, is to boost the signal once it emerges from the wire.

Booster amplifiers come in several types. There are the cheap type, which are easy to install, cheap to run, and don't work, and the rather expensive ones, which do. In essence, they are simply broad band, low noise RF amplifiers. In order to do what they do, however, they usually require quite a number active elements . . . which is what gets a bit costly.

Figures 1 and 2 are two of the common types of boosters. Both are tube types, but solid state models are available, and look about the same.

The first amp is the typical commercial type. It uses one 6J6 tube, and has a gain of seven to ten db on a good day. It isn't very broadband, and must be tuned for maximum signal for each channel. It can make a marginal signal good, or a good signal almost perfect, and contributes very little noise. Although designed for use with 300 ohm antenna line, there is no reason that it cannot be inserted between the set and the cable matching balun with a bit of "Mickey Mousing".

The second amp is of the industrial type. A true broadband system, its gain is relatively constant at up to 60 db from the high short waves right to the fringes of UHF. It uses ten 6AK5 RF pentode tubes in two stages, each stage having five tubes in parallel. The circuitry includes a switch selectable AGC, which will reduce the amplification for large input voltages to avoid clipping. This is not all that essential, as few cable companies ever supply large signals.

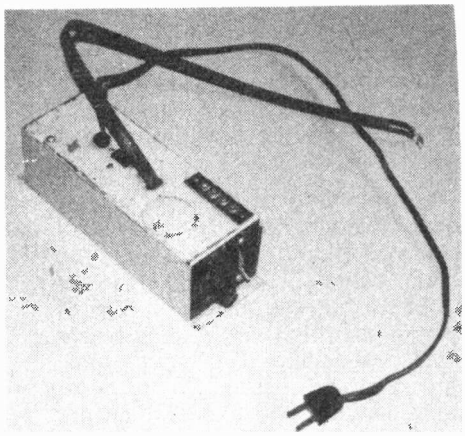


Fig. 1. Low cost commercial booster.

The industrial type amp can get a watchable picture out of practically any reasonably clean signal. Since the circuitry in a television is better able to cope with adjacent channel type intereference when it has lots of signal to play with, the high gain of this type of booster will often, indirectly, cure a number of other cable hassles as well. Having more tubes, the noise figure of this type of amp is naturally higher than that of a signal stage booster, but the signal to noise ratio is considerably better, simply because there is more signal at the output of this type of circuitry for a given input.

The simple signal booster amplifiers, in their present solid state form, go for between thirty and fifty dollars, while multi-stage wide band systems begin at around one hundred and fifty to two hundred dollars a shot. The obsolete tube type sets, however, are not at all uncommon as surplus, at around ten bucks each. (The amp in Figure 2, for example, was purchased from a guy who thought it was an automatic garage door opener).

The thought of having to buy equipment in order to be able to take advantage of a service which one is paying for might seem a bit hard to live with. However, the alternatives in many cases are no more palatable; either live with poor reception, or erect an antenna. Yes, you see, the cable companies are in largely the same position as the phone company, and you know what Ma Bell usually tells you to do with complaints.

The analogy of the cable outfits to the telephone company brings us to our final topic. Just as, in many homes, convenience dictates the installation of one or more extension phones, so too do a large percentage of cable subscribers want to hook more than one set to the wire. The cable companies will do this for you, of course, but, just as with the phones, it requires an expensive service call, waiting in for several days until the truck shows up, and then a regular monthly charge thereafter which very shortly amounts to considerably more than the actual cost of the materials used to do the job.

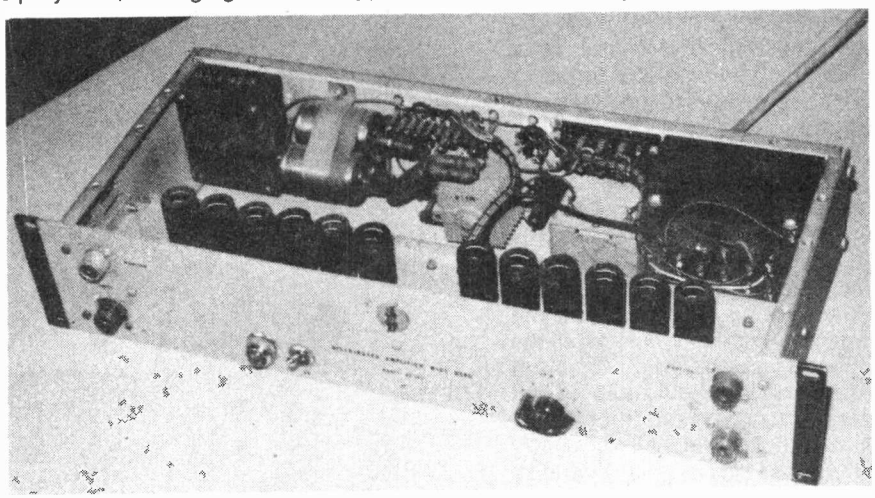


Fig. 2. An industrial broadband amplifier. Equipment of this class is usually found in commercial MATV and CATV installations.

UNDERGROUND CABLE

It is grim truth that, even in our civilized society, there are some utter cads who take advantage of the good nature of the Bell and install their own additional phones. A number of such finks may be working for the American FCC, as this organization recently upheld their right to do it. If you have a

phone in every room, and have thus run out of things to hook up, you might be interested to know that adding additional cable lines is hardly more difficult.

To increase your allotment of cables, you must first locate the point at which your "drop", your private wire, enters your dwelling. This is usually found around the fuse box or the telephone connector. Shortly after the cable appears, it will usually run into a union, that is, there will be a male type connector, a female to female adapter, and another male type connector running into the remainder of coax. The reason for this is quite simple: new homes and apartments are usually built with a cable drop installed no matter if the future occupants will be using the service or not. "Hooking up" a new subscriber then requires simply attaching the "drop" to the local distribution amplifier and attaching an appropriate length of line to get from the fuse box to where ever the TV is living. In some older homes, it may be necessary to cut the cable at a convenient point and install a union.

With the union located, the first thing to do is to de-unionize it. Unscrew the two male connectors, remove the female adapter, and put it somewhere where it won't get lost and you'll never find it again. Then get a splitter.

You can't hook up extra cable lines in the same way as you might add more phones; simply by connecting all the wires together. It is essential that all the lines "see" the same 75 ohm impedance, and this requires some sort of network to match any additional taps to the impedance of the main drop. The widget that does this is usually called a "splitter".

Splitters are quite cheap, around five to ten dollars, depending upon the type required. They are available with the same type 59 as the cable connectors use, and can be installed in a few minutes with only a screw driver to mount one or more of the little beasties on a convenient wall. Splitters come in denominations of two or four taps . . . four lines are about the maximum that most homes drops can feed before the signal begins to get a shade on the weak side.

You can buy splitters at most stereo-TV places, or at Radio Shack.

The aspect of midnight cable installation that does in most would be do-it-yourselfers is the assembly of the additional cables required. Type 59 connectors are used because they are very cheap. They use a single piece bushing, in which the cable's center conductor becomes the "pin". There is no soldering involved in using them, and, supposedly, they are quite easy to install. Ha!

The first thing to do is to assure yourself that you have the right sort of cable. You should use the same type that the cable companies themselves do,RG59U, but there are a number of other kinds which will give tolerable results, especially over short runs. There are, however, two physical requirements of the cable which are essential. The center conductor must be solid, and not stranded, and the cable itself must be of the usual diameter, and not the "mini" type.

Attaching a type 59 connector to your cable is not that hard. As illustrated in Figure 3 , you remove a section of the outer jacket and the braid, and, about 3/8" up the cable, the insulator that covers the centre wire. The narrow tube on the connector gets pushed into the cable so that it slides in between the inner insulator and the braid. This is a bit easier if you loosen up the outer jacket by squeezing it a few times with a pair of pliers.

In order to keep the connector in the end of the cable, a metal ring is brought up from behind and slid over the end of the outer jacket, essentially, on top of where the tube of the connector is inside it. The ring is then crimped with any handy instrument to jam everything together.

The far end of the new cable must, of course, be terminated by a matching transformer, just as the first, original line was, and these are available from the same place you bought the splitter for a dollar or two.

This month's column was originally going to be about video disc players, but a delay in the availability of the latest "final" data from one of the manufacturers necessitated its delay. Next month, if the three headed swamp trolls of fate are kind, we will look at video discs. Maybe. Until then, stay tuned.

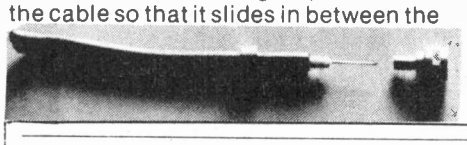
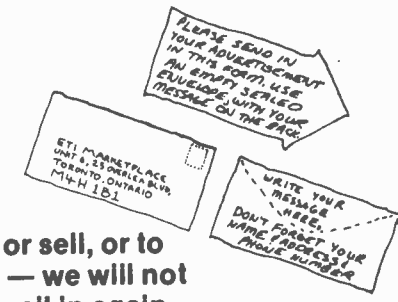


Fig. 3. Installing type 59 connectors.

ETI MARKET PLACE



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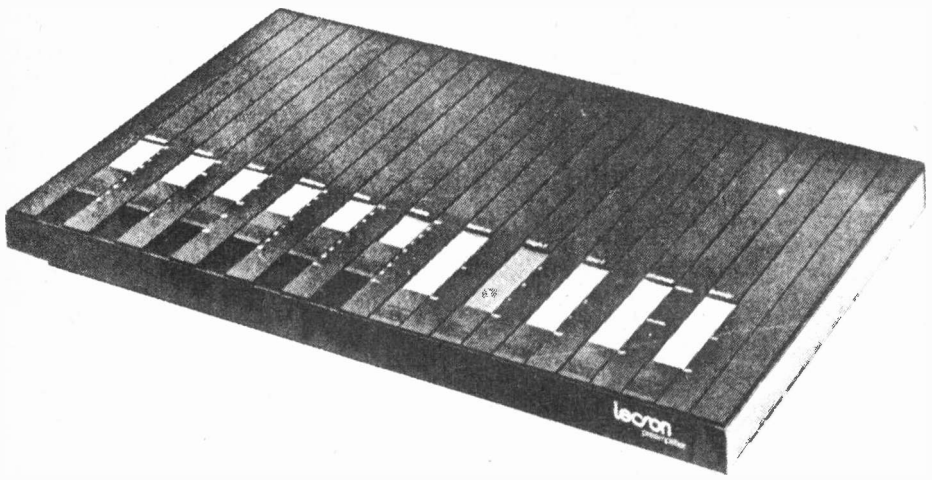
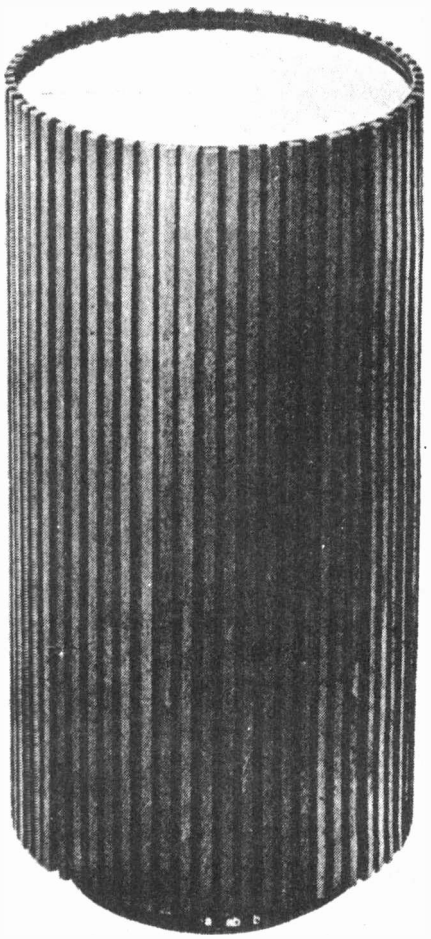
Ultra Fidelity Amplifiers:

Audio amplifier design has come a long way since the introduction of semiconductors into hi-fi. Stan Curtis, who has been responsible for such excellent examples of the art as the Cambridge Audio and the Lecson, explains here the black arts of ultra hi-fi design.





CAREFUL listening tests have shown that while an amplifier that measures badly is *unlikely* to sound good one that measures well *cannot* be guaranteed to sound good. Thus it is apparent that the traditional measurements of power distortion and frequency response need supplementing by new and more powerful laboratory tests. Such tests should more closely relate to the conditions prevailing when the amplifier is driving realistic loads and using music signals rather than sine-waves, which of course represent only one special case.

BALANCING ACT

The first such test was popularised by Peter Walker of Quad. It is a simple nulling system which attempts to cancel the input and output signals of an amplifier. With full cancellation whatever remains must be distortion, i.e. signals added to or subtracted from the original. The ideal or perfect amplifier will produce no residual at the output of the nulling circuit.

In practical terms the balancing of this circuit is very difficult if a significant degree of accuracy is required. Thermal drifts can aggravate the problem and generally it is difficult to set up for more than one amplifier type as usually the whole phase-balance network needs to be recalculated and readjusted each time. However this simple circuit is useful for showing just how often amplifiers are clipping the signal in the course of a piece of music and how frequently some amplifiers slew-rate limit the signal.

OFFSETTING LONG TAILS!

Dc offset has been a major problem with many dc coupled amplifiers (i.e. those having no output capacitor). The offset voltage measured across the output terminals should not be any more than ±50 mV. Once this voltage starts to rise the loudspeaker is subjected to a dc bias which moves the coil out of the central position. This in turn causes the coil to heat up and the power-handling capability of the loudspeaker to be restricted.

Eventually (and often sooner) the loudspeaker will blow.

Design Principles

Many amplifiers have an offset voltage that is acceptable when the amplifier is first switched on but which starts to increase as the amplifier heats up. Such amplifiers are subject to thermal drift and this drift is normally due to a component mismatch in the circuit. The conventional amplifier, with a long-tailed pair at the input, is "theoretically" free of thermal drift as these will be automatically compensated for by the DC feedback.

However, this is on the assumption that the first two transistors (or FETs), forming the long-tailed pair, are perfectly matched.

The input offset voltage (upon which the output offset voltage is dependent) is related to the base-emitter voltage V_{BE} of each transistor.

$$\text{e.g. } V_{OS} = V_{BE1} - V_{BE2}$$

This difference can be made almost insignificant by using a dual-transistor or a monolithic integrated-circuit differential stage where matching is provided by the simultaneous adjacent fabrication of the two transistors. With discrete transistors, however, a close match is unlikely.

Similarly unbalanced output loading or mismatch of the collector resistors also increases the offset voltage. These mismatches also worsen the linearity (and hence the distortion) of this stage. Thus well designed amplifiers usually use 1% tolerance resistors in these positions and adopt balanced circuitry throughout.

The offset voltage is considerably reduced by the application of local dc feedback that occurs when emitter resistors are fitted. In this case;

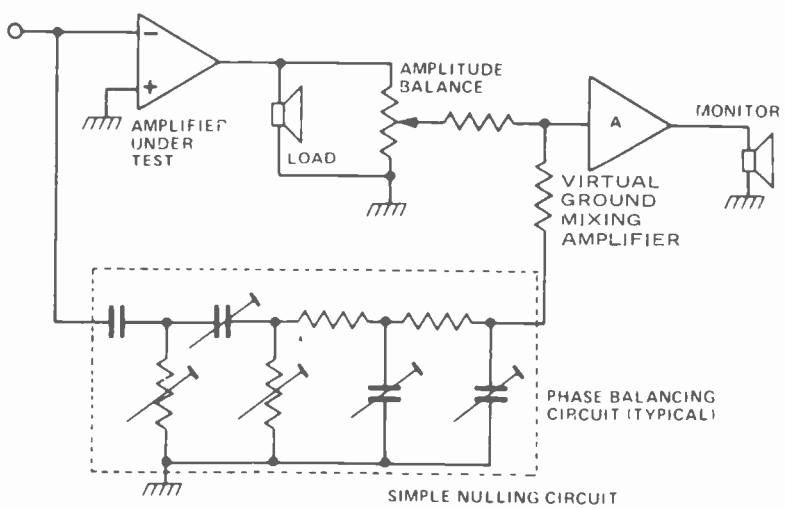
$$V_{OS} = V_{BE1} - V_{BE2} + I_{E1} R_{e1} - I_{E2} R_{e2}$$

and so by adjusting the balance between R_{e1} and R_{e2} with a trimpot a balance can be achieved.

EMITTER RESISTANCE

Note that $R_e = R_E + r_e$ is the total external emitter resistance and r_e is the transistor dynamic emitter resistance. Thus it can be seen that in the earlier typical example of a stage without emitter resistors, an imbalance of r_e and r_e will cause a worsening of the offset voltage. More importantly it can reduce the common mode rejection of the stage.

Of course the presence of emitter resistors also lowers the ac gain of the stage. For reasons to be discussed later this is not such a bad thing. This gain can be recovered by using bypass capacitors.



Block diagram of the Peter Walker balancing test.

CLIP ON OFF SET

Another situation where abnormal dc offset voltages occur is following a clipping overload. When many amplifiers are driven into clipping, the dc voltage of output rises towards one of the HT lines and then when the signal comes out of clipping the amplifier takes a finite time (often several seconds) to recover with the output dc voltage often oscillating between a positive and negative voltage before finally settling back to its nominal zero. Of course, when the amplifier is driven into clipping the normal negative feedback system ceases to control the amplifier.

Thus the dc instability is indicative of poor low frequency stability in the amplifier. Some of the worst (but not all) amplifiers in this respect, have separate ac and dc feedback loops and so have big electrolytic capacitors (decoupling the ac loop) which take time to charge and discharge.

The old Cambridge P100 amplifier had this problem and the effect on the reproduction of a loud bass note can be imagined. Regrettably many amplifiers still suffer from this problem.

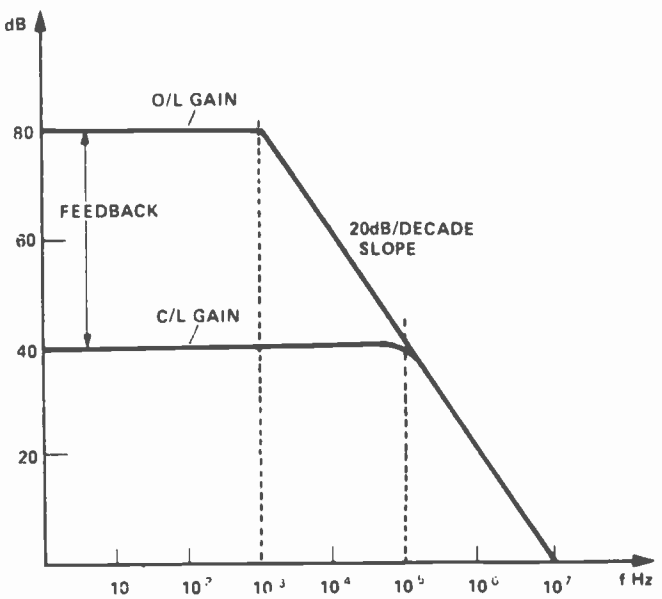
Quite often some amplifiers go unstable without their owners becoming aware of the problem. Sometimes the oscillation may be moderate in level and at a very high frequency; the only symptom being that the amplifier seems to run hotter and next-door's electric drill causes more TV interference than before!

COMPENSATION PHASE

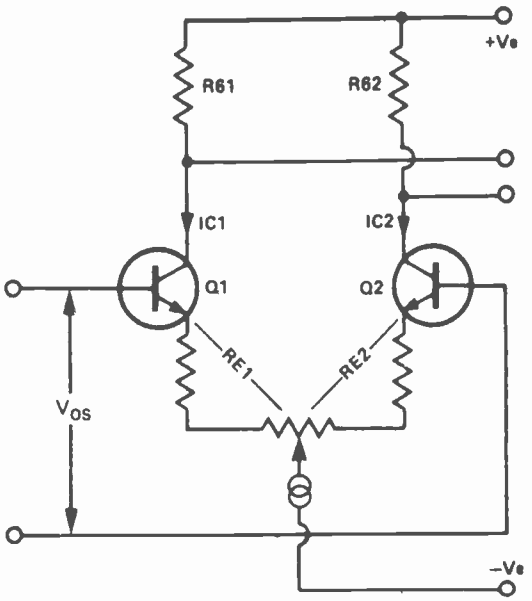
To know why some amplifiers are potentially unstable it is necessary to understand the principles of phase compensation. Much of the low distortion characteristics of amplifiers is achieved through negative feedback. If the phase shift around the feedback loop reaches 360 at any frequency at which the loop gain (i.e. the overall amplifier gain) is unity the result is a self-sustaining oscillation at that frequency.

The phase-inversion to provide negative feedback produces a stabilizing 180 (eg. "out of phase") phase shift, but an additional 180 can be developed in the amplifier.

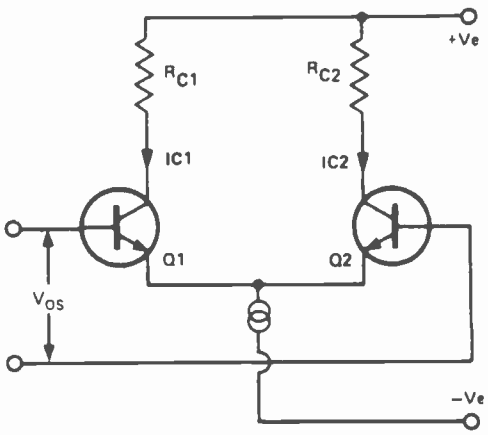
The phase shift developed through an amplifier is the combined phase shift of its several stages, and it usually develops 180 at higher frequencies. To ensure frequency stability under feedback conditions, phase compensation *reduces* the amplifier gain at those frequencies for which phase shift is high and it reduces high frequency phase shift by accepting a greater phase shift at low frequencies. This is



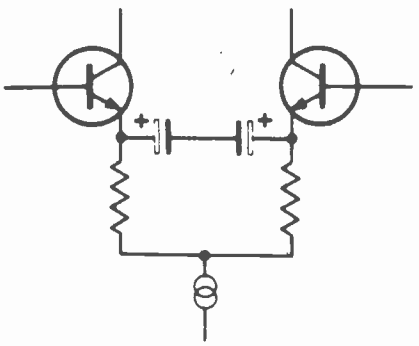
In the case shown in the diagram (unconditional stability) the open-loop response of the amplifier is stabilised by rolling it off at a slow 20 dB/decade slope with a single pole at 1 kHz. This amplifier would be stable with any amount of resistive feedback. However it will be seen that at higher audio frequencies the amount of feedback available reduces and so the distortion of the amplifier will increase. For this reason many amplifiers are of the "marginally stable" type.



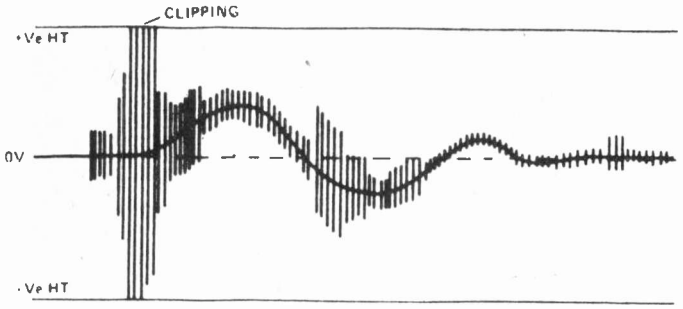
Differential pair with variable emitter resistances balanced by variation of the potentiometer.



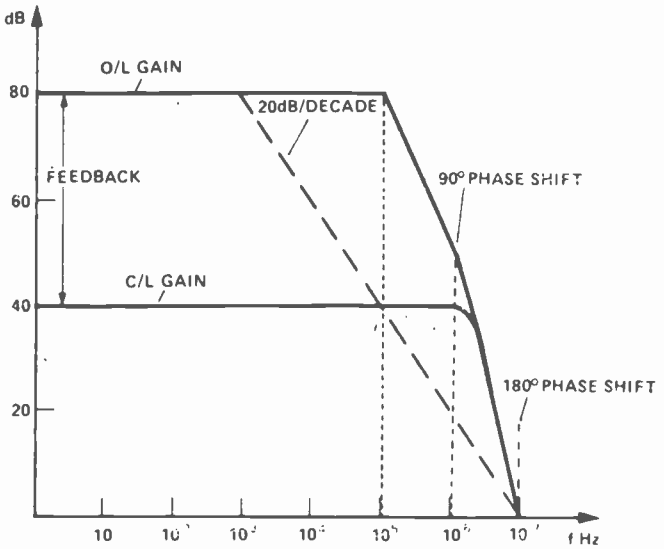
In this circuit the input offset voltage is related to the base-emitter voltage of this transistor.



Recovering lost gain by use of bypass capacitors across the emitter resistances.



Effect of a sine wave of varying amplitude as signal upon the dc offset voltage at the output.



In this case the amplifier has a fast roll-off which allows an improved closed loop performance at higher frequencies but without careful compensation they are not stable under all conditions of feedback. Once the phase shift reaches 180° the amplifier will become unstable so it can be seen that our example is only marginally stable.

accomplished by adding response poles and zeros in the form of resistor-capacitor networks (real or inherent in the transistors) in the amplifier circuitry.

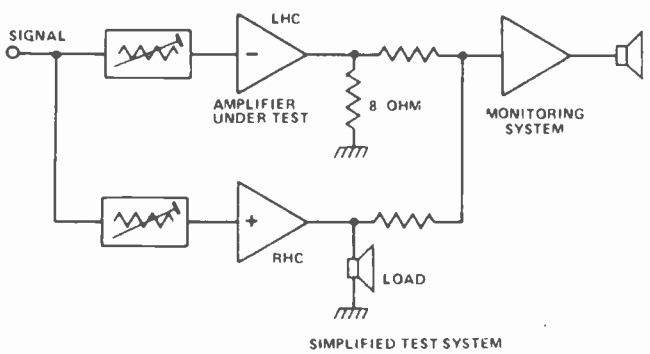
Equally important, to the owner of an expensive pair of loudspeakers, is the problem of high-frequency instability. These days very few high quality amplifiers are so unstable that they break into oscillation. However, quite a few respected units are on the edge of instability and so can potentially become unstable following a shift in operating conditions or of output loading.

SUM THEORY

The author used another technique at Cambridge to investigate the changes in amplifier performance that are dependent upon the loudspeaker load. The two channels of a stereo amplifier are driven in mono but one channel is converted to become non-inverting. The outputs of both channels are summed and the resulting signal is monitored. Theoretically both channels should transmit the signal in the same way and (for a given circuit design) any distortion, time aberrations etc. should be the same for both channels. It is often quite possible to balance the two channels (driving 8 ohm resistive loads) so that the residual is inaudible. However when one 8 ohm load is replaced by a real "live" loudspeaker the residual betrays problems caused by the new load. In a refined form the test works well and reveals two interesting things;

i) the two channels of average amplifiers are rarely identical

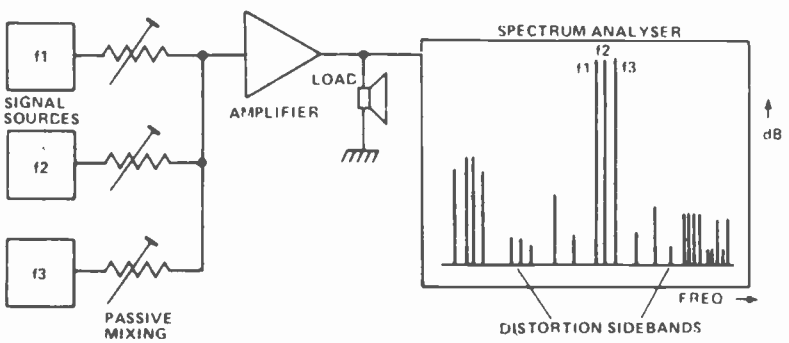
ii) some amplifiers work better in the inverting mode than in the non-inverting.



Using one channel as an inverting amplifier to monitor distortion produced by the design.

IM HIGH

The conventional IM test uses an LF (50 Hz) and an HF (7 kHz) tone in a 4 to 1 ratio and then measures the sum-total of the sideband (e.g. distortion) components. This is of



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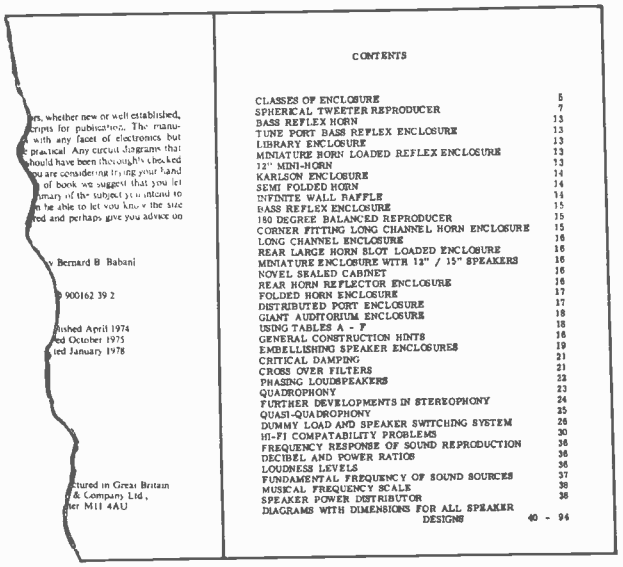

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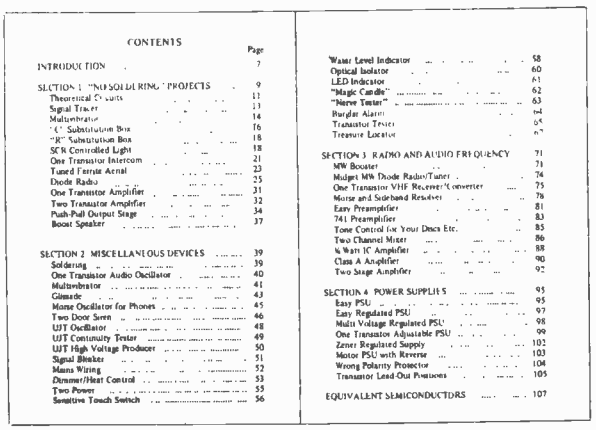

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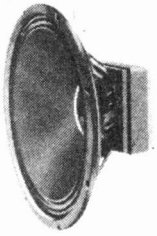

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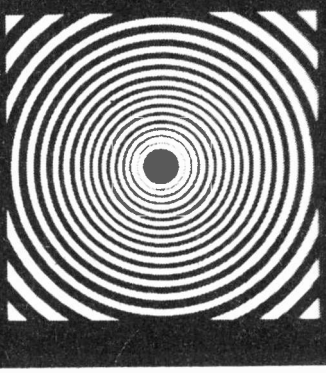
Handbook of IC Audio Preamplifier & Power Amplifier Construction

F.G. RAYER, T. Eng. (CEI), Assoc. IERE



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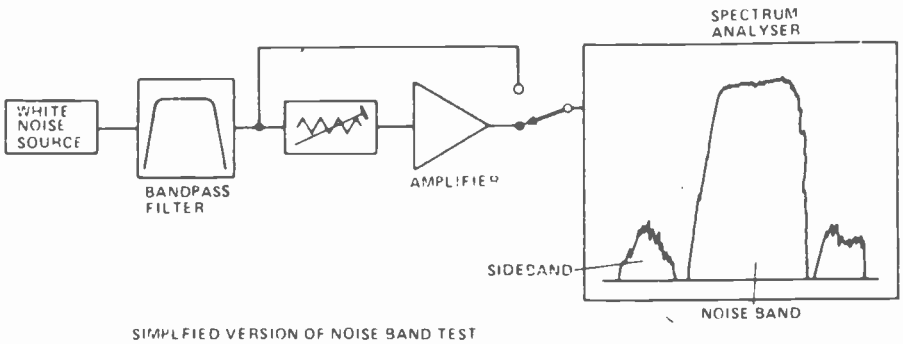
little practical value unless the amplifier is particularly non-linear.

The HF IM test uses two tones of, say, 15 000 Hz and 15 100 Hz and the resulting side-bands are viewed on a spectrum analyser. The frequencies can be altered to suit whatever simulation that is desired, e.g. two sopranos trying to sing the same note.

By repeating the tests at different levels it can be seen that many amplifiers have a performance which varies appreciably with signal level, and the test results correlate very well in identifying amplifiers with an aggressive "top end".

which the computer can use to correct the data during the subsequent error analysis.

Once a series of measurements have been made in the course of playing a passage of music the resultant data can be subjected to a series of Fourier and coherence analytical calculations. Put simply, this means that any difference between the input and output signals can be described in a form that is useful to the engineer and related to the structure of the music signal at that instant. Unfortunately this test shows that, as yet, no perfect amplifier exists – each type of amplifier circuit produces its own particular types of "transient error".



Noiseband testing with a spectrum analyser, the sidebands produced by the amp are clearly visible.

DYNAMICALLY NOISY

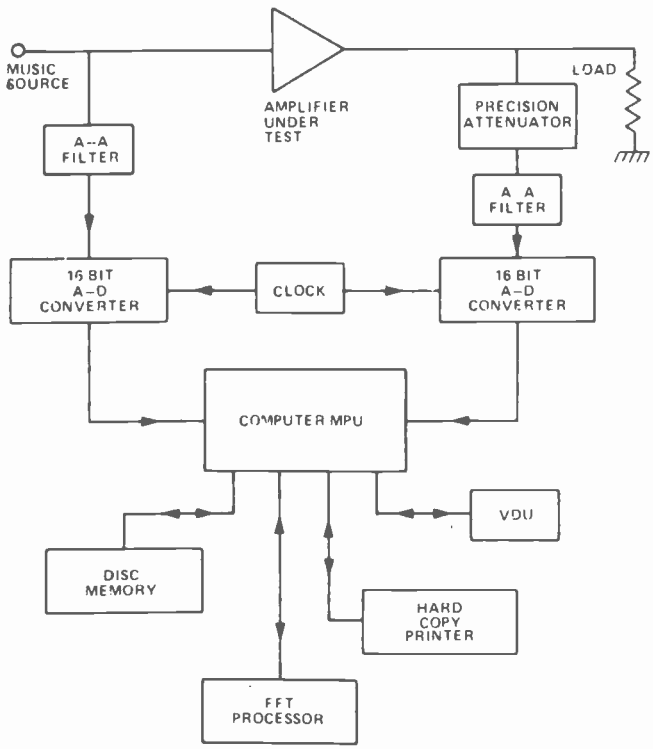
The second test is similar but attempts to measure the, amplifiers' performance under more varying "dynamic" conditions. A white noise source has a harmonic and amplitude structure which is variable and random and thus provides a better simulation of a music signal than does a sine-wave. The noise signal is passed through a bandpass filter to define its frequency response. The bandwidth and centre-frequency can be altered to suit the investigation as can the overall operating level. The output of the amplifier is fed to a spectrum analyser where the out of band components can be studied. Again this test is very useful for studying the effects of different loudspeaker loads but more significantly for subjecting the amplifier to random momentory "clipping" overloads.

A CHANNEL AND A LOG

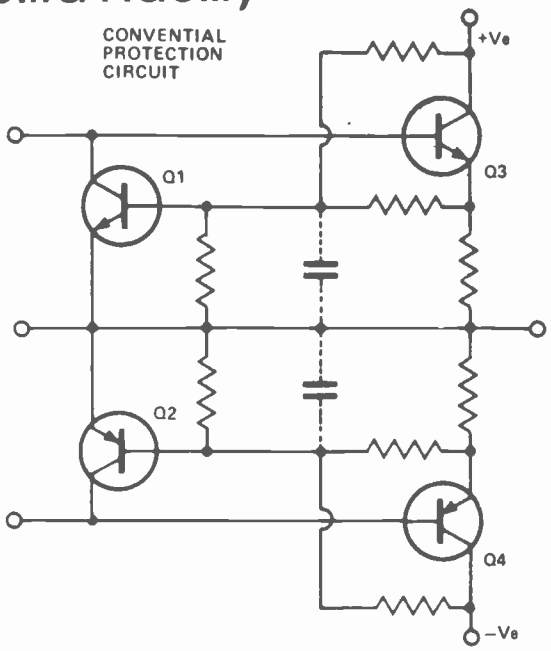
Possibly the most complex type of testing in use is a form of input and output signal comparison used by Analog Engineering Associates of the USA and, in a simplified form, by Mission Electronics in the UK.

AEA have developed a transient distortion measurement system that uses a music as a test signal to evaluate circuit performance under dynamic conditions. This system consists of a dual channel analogue to digital converter which is designed to have a resolution of 1 part in 65,536 or 0.0015%.

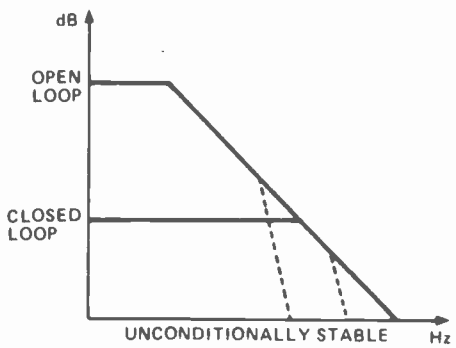
One channel of this is used to sample the input music signal whilst the second channel samples the output signal via a precision attenuator. The digitally encoded output of the convertors is fed to a computer memory system for later analysis. Instead of trying to compensate for the amplifier's phase and frequency response with a passive circuit (as in the earlier simple nulling circuit) a frequency sweep is made through the amplifier to generate a "transfer function"



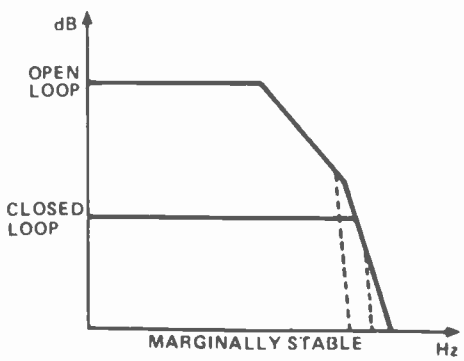
Analog Engineering's transient intermodulation distortion measurement system, used in Britain by Mission Electronics.

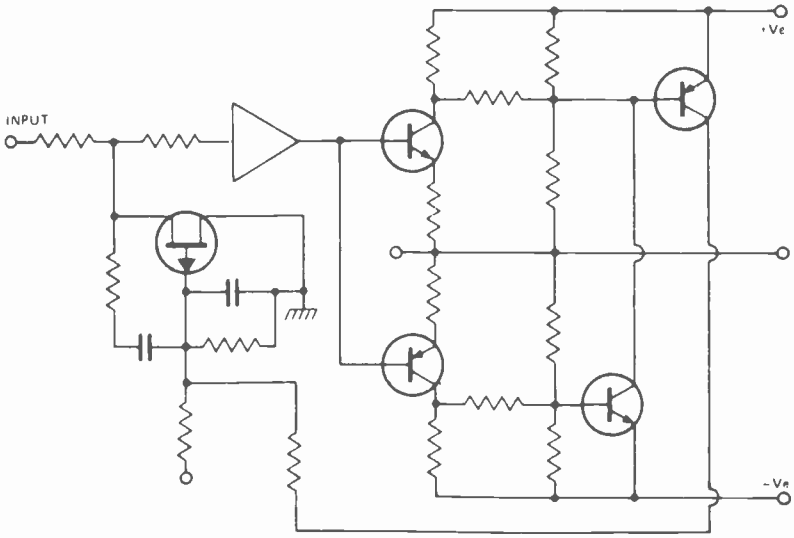


A study of the circuit of a conventional V - I protection circuit will show that as the protection transistors turn on they become a 'non-linear resistor' across the bases of output transistors Q3 and Q4 and as such create unpleasant distortion. One solution tried by some companies was to slug the bases of Q1 and Q2 with a capacitor to provide a time delay to prevent the protection operating except during a sustained short-circuit.

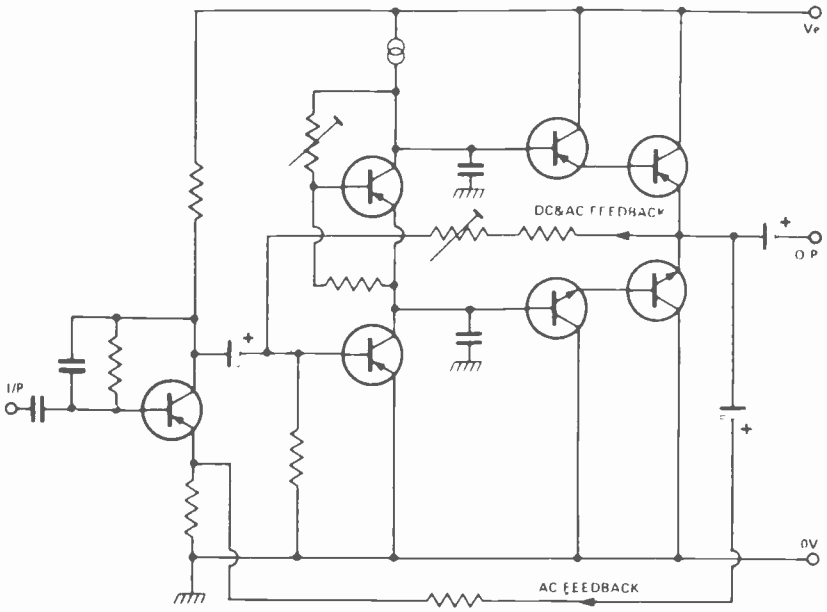


Above: Effect of adding an extra pole at the output of an unconditionally stable amplifier, such as might be added by a complex cross-over network. Below: Same condition applied to marginally stable type. Phase shift now borders on 180°, i.e. oscillation.





In this protection circuit the FET starts to turn-on when full-power is delivered into a 2 ohm load. The main advantage over a conventional protection circuit is that the limiting is "soft" (i.e. very gradual) and thus audibly acceptable and secondly that the distortion is much lower – and still only about 0.1% at limiting.



Circuit diagram showing a typical circuit which would prove to be prone to dc instability when in use. Note that separate paths exist for ac and dc feedback.

NEXT MONTH: Stan Curtis continues this discussion with in depth looks at two of his major designs, the Cambridge P60 and the Lecson AP3.

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Un vol. broché, 112 p., 65 schémas, format 15 × 21, couv. couleur.

4e édition, 176 pages, format 16 × 24, 94 figures. — **CALCUL ET RÉALISATION DES TRANSFORMATEURS** — par Ch. Guilbert — F168

Il est bon de savoir comment calculer un transformateur, mais il est profitable de gagner du temps, tout en écartant divers risques d'erreurs, et c'est pourquoi cet ouvrage groupe un certain nombre d'abaques, grâce auxquels l'élaboration des transformateurs est largement facilitée.

Extrait de la table des matières

Le transformateur électrique · Le redressement des courants alternatifs · Le filtrage · Les redresseurs à semi-conducteurs · Les inductances de filtrage · Le calcul des transformateurs · Les autotransformateurs · L'élaboration des amplificateurs B.F. · Le calcul des transformateurs B.F. · La réalisation des transformateurs et des inductances · Transformateurs spéciaux · Conseils pour la réalisation · Les relais et leur calcul.

50 jeux avec votre calculatrice électronique — F48

par E. Schlossberg et J. Brockman

D'une très belle présentation, ce livre propose pour la première fois en France 50 jeux inédits, tous différents, basés sur l'emploi d'une calculatrice de poche. Leur variété est telle qu'il est possible de jouer seul ou à plusieurs, avec une ou plusieurs calculatrices de tous modèles. Certains jeux s'apparentent au « solitaire », à la réussite ou patience, au poker, au bridge, au monopoly ; d'autres font appel aux calculs et à la manipulation des nombres. Les auteurs ont aussi voulu susciter la créativité de chacun pour diversifier, perfectionner, et ainsi mieux personnaliser les jeux.

Format poche 13,8 × 20, 128 pages.

3e édition, 240 pages, format 16 × 24, 98 figures, très nombreuses photographies — **TECHNOLOGIE DES CIRCUITS IMPRIMÉS** — par J.-P. Ebmichen — F187

L'auteur commence par examiner les matériaux de base : isolants cuivrés, résistances, condensateurs, supports et connecteurs divers, après quoi il traite de l'établissement d'un projet sur papier. Il est ensuite question des méthodes de report direct sur cuivre sans-opération de photogravure, puis de la réalisation du négatif, puis de la photogravure, c'est-à-dire du report sur le cuivre, à partir du négatif, d'un enduit protecteur.

Extrait de la table des matières

Les matériaux (isolant cuivré, supports, résistances et condensateurs, connecteurs) · Établissement du projet · Le passage direct sur cuivre · Réalisation du négatif pour photogravure · Le report sur cuivre par photogravure · L'attaque du cuivre · Le montage du circuit · Modification d'un circuit terminé · Évolution et perspectives d'avenir.

P. MELUSSON — 2e édition

INITIATION A LA MICROINFORMATIQUE LE MICROPROCESSEUR — F125

Grace au développement des technologies LSI, des circuits intégrés, il apparaît maintenant possible de pénétrer dans le domaine « Grand Public » de réalisations jusqu'ici réservées aux ordinateurs couteux et volumineux.
— Le microprocesseur a pu ainsi faire son apparition, il devient la pièce maîtresse d'un microordinateur de conception économique. Son système comportant des circuits intégrés de fonctions complexes sous un faible volume.
— Ce principe même de réalisation conduit à des possibilités d'applications dans tous les domaines. Les télécommunications, le radar, les transmissions HF, les automatismes industriels, l'optoélectronique et la signalisation électrique, l'électro-ménager, l'automobile, la télévision, la radio médicale, la radiophonie, etc.
— Le microprocesseur sera bientôt l'instrument de « la qualité de la vie ».

Un volume broché de 136 pages, 80 figures, format 12 × 18,5, sous couverture pelliculée.

176 pages, format 16 × 24, 141 figures — **50 MONTAGES ÉLECTRONIQUES A THYRISTORS** — par W. Sorokine — F37

W. Sorokine vous invite à faire la connaissance des thyristors au travers de leurs applications. Le meilleur moyen d'y parvenir est de réaliser soi-même, parmi les quelques centaines montages proposés ceux qui sont utiles, ou qui simplement excitent la curiosité : gadgets auto, allumage électronique, orgues lumineux, relais divers, chargeurs automatiques, alimentations stabilisées.
Chaque montage est accompagné d'un schéma de principe, d'un plan de câblage, et de tous les détails propres à en faciliter le choix et la réalisation. Ainsi, même un débutant n'éprouvera aucune difficulté à faire du bon travail.

Extrait de la table des matières

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BASES D'ÉLECTRICITÉ ET DE RADIO-ÉLECTRICITÉ pour le radio-amateur et l'exploitant

Ce livre est écrit pour les candidats radio-amateurs pour leur permettre d'apprendre les principes essentiels d'électricité et de radioélectricité qu'ils devront connaître pour passer avec succès leur examen et s'ils le veulent par la suite aborder des ouvrages d'un niveau plus élevé. Cet ouvrage n'est pas encombré de notions compliquées ou hors programme qui tout en étant intéressantes par elles-mêmes, pourraient décourager un débutant par une abondance de matière qui il pourrait étudier plus tard.
C'est un instrument de travail simple qui comprend quatre parties : 1. Électricité 2. Radio-électricité 3. Passage des tubes aux transistors 4. Compléments.

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B. FIGHIERA — 3e édition — F14

LES JEUX DE LUMIERE

et effets sonores pour guitares électrique

Au cours de cette troisième édition totalement refondue et augmentée, l'auteur a réservé une large place à la description pratique des principaux jeux de lumière. Les effets sonores n'ont pas pour autant été rejetés puisque la deuxième partie est réservée aux montages vibrato, tremolo, boîtes de distorsion, etc.
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■ The projects themselves can be split down into simpler building blocks which are shown separated by boxes in the circuits for ease of description, and also to enable any reader who wishes to combine boxes from different projects to realise ideas of his own
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■ Brian Dance is a highly experienced author who regularly contributes to many of the popular electronic magazines that are available both in the U.K. and overseas
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■ It will be found that in general the actual F.E.T. used is not critical and many suitable types will perform satisfactorily. The F.E.T. is a low-noise, high gain device with many uses, and the dual gate F.E.T. is of particular use for mixer and other applications
■ This book contains something of particular interest for every class of enthusiast — shortwave listener, radio amateur, experimenter or audio devotee
■ A valuable addition to the library of all electronic enthusiasts

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Popular Electronic Projects

■ Included in this book are a collection of the most popular types of projects which, we feel sure, will provide many designs to interest all electronics enthusiasts
■ All the circuits utilise modern, inexpensive and freely available components.
■ The 27 projects selected cover a very wide range and are divided into four basic areas: Radio Projects, Audio Projects, Household Projects and Test Instruments
■ An interesting addition to the library of both the beginner and more advanced constructor

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■ With the constructor in mind, several ideas are given to enable a small studio to be built including a mixer and various sound effect units.
Circuits are included for VCOs, VCAs, Envelope Shapers, VCFs, Active and Passive Mixers, Fuzz, Noise Generators, Metronomes and a 10-Note Programmable Sequencer etc.
All the units shown have been successfully built and used by the author and most of the projects can be built by the beginner.
■ An unusual, fascinating and highly rewarding application of electronics

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■ The purpose of this book is to introduce the LM3900 to the Technician, Experimenter and Hobbyist. It provides the groundwork for both simple and more advanced uses and is considerable more than just a collection of simple circuits or projects
■ The LM3900 is different from conventional 'Op-Amps', it can be used for many of the usual applications as well as many new ones. It is one of the most versatile inexpensive and freely available devices on the market today
■ The book is divided into six basic sections —

Introduction
Audio Applications
Simple Linear Applications
Simple Digital Applications
Signal Generator Circuits
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■ The LM3900 can do much more than is shown here — this is just an introduction. Imagination is the only limitation with this useful device, but first the reader must know the basics and that is what this book is all about

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■ Relays, silicon controlled rectifiers (SCR's) and bi-directional triodes (TRIACs) have a wide range of applications in electronics today. These may extend over the whole field of motor control, dimming and heat control, delayed, timing and light sensitive circuits and include warning devices, various novelties, light modulators, priority indicators, excess voltage breakers etc
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■ The CA 3130 is currently one of the more advanced operational amplifiers that is available to the home constructor. This means that it is often capable of a higher level of performance than many other devices and that it often needs fewer ancillary components.
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I Audio Projects
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III Test Equipment
IV Household Projects
V Miscellaneous Projects
■ An ideal book for both the beginner and more advanced enthusiast alike

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■ In this book the newcomer to electronics will find a wide range of easily made projects, many complete with actual component and wiring layouts. Furthermore, a number of projects have been arranged so that they can be constructed without any need for soldering and, thus, avoid the need for a soldering iron
■ This book which is written by the very experienced author Mr. F.G. Rayer is divided into four sections —
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2. Miscellaneous Devices
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4. Power Supplies
■ An absolute 'must' for all beginners in electronics.

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50 CMOS IC Projects

■ CMOS IC's are probably the most versatile range of digital devices for use by the amateur enthusiast. They are suitable for an extraordinarily wide range of applications and are now also some of the most inexpensive and easily available types of I.C.
■ In this book Mr. R.A. Penfold has designed and developed a number of interesting and useful projects which are divided into four general catagories
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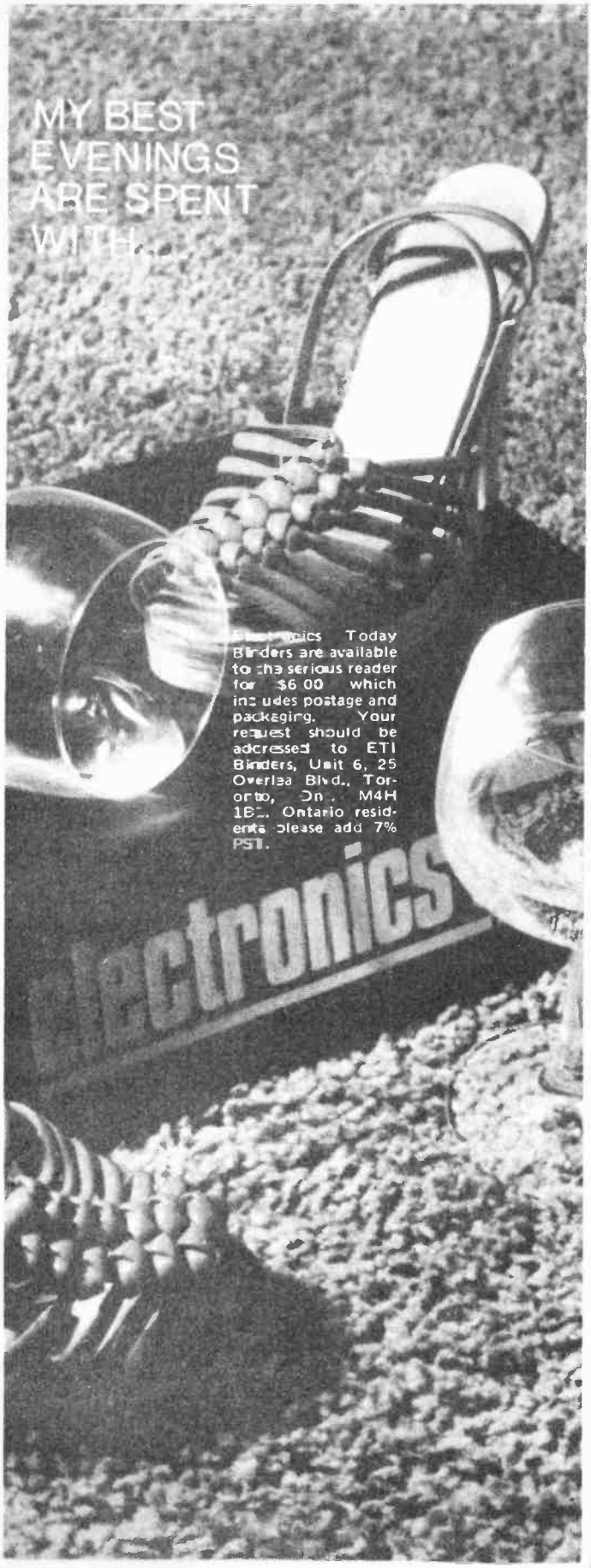

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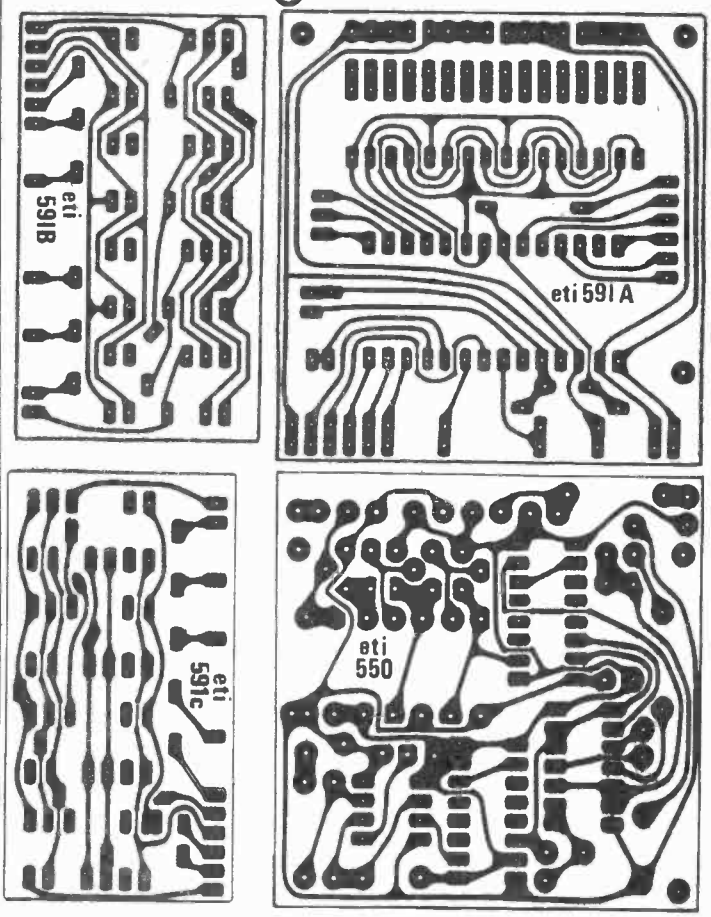
Digital Dial



Digital Dial

Most transistor radio dials are pretty hopeless these days, so we thought we'd do something about it.

WITH MODERN RADIOS which are designed to be operated anywhere in the world, the local station call signs are no longer marked on the dial. Instead the dial is marked with frequencies making it more universal. Unfortunately the scaling on many receivers leaves a little to be desired, with many car radios lucky to have 3 or 4 markings. The use of pushbutton selection helps but when a cassette is fitted or you are out of your local area there is still the problem of knowing to what station you are tuned.

This project gives a direct readout of the station being received allowing for easy identification and selection. The display is remote from the receiver allowing it to be mounted on the dashboard for easy viewing.

DESIGN FEATURES

While this project has a real use its main purpose is to illustrate how the up/down counter module published in last month's issue can be put to use.

If this module is to be used outdoors i.e. in the car, it is recommended that high brightness displays, such as the Hewlett Packard HDSP 4133, be used. As these have a different pin-out a new display board is presented in this article.

The theory of operation is that we actually measure the frequency of the local oscillator in the radio and subtract the IF frequency. While we could have subtracted this using digital logic we chose to do it by resetting the display not to zero but to 9545 (10 000 - 455).

SPECIFICATIONS

Frequency range	500-1700 kHz
Accuracy	∓ 5 kHz
Sensor	pickup coil or direct connection
Power supply	7–20 V dc @ 80 mA or 240 V ac
Display	4 digit LED

The first 455 pulses in the timing period are then used getting to zero and in effect, only pulses after this are counted and displayed. This number can be loaded into the counter by selecting the appropriate diodes and using the "load counter" input instead of the reset line. The only difference is that as the data is

Text continues on page 68.

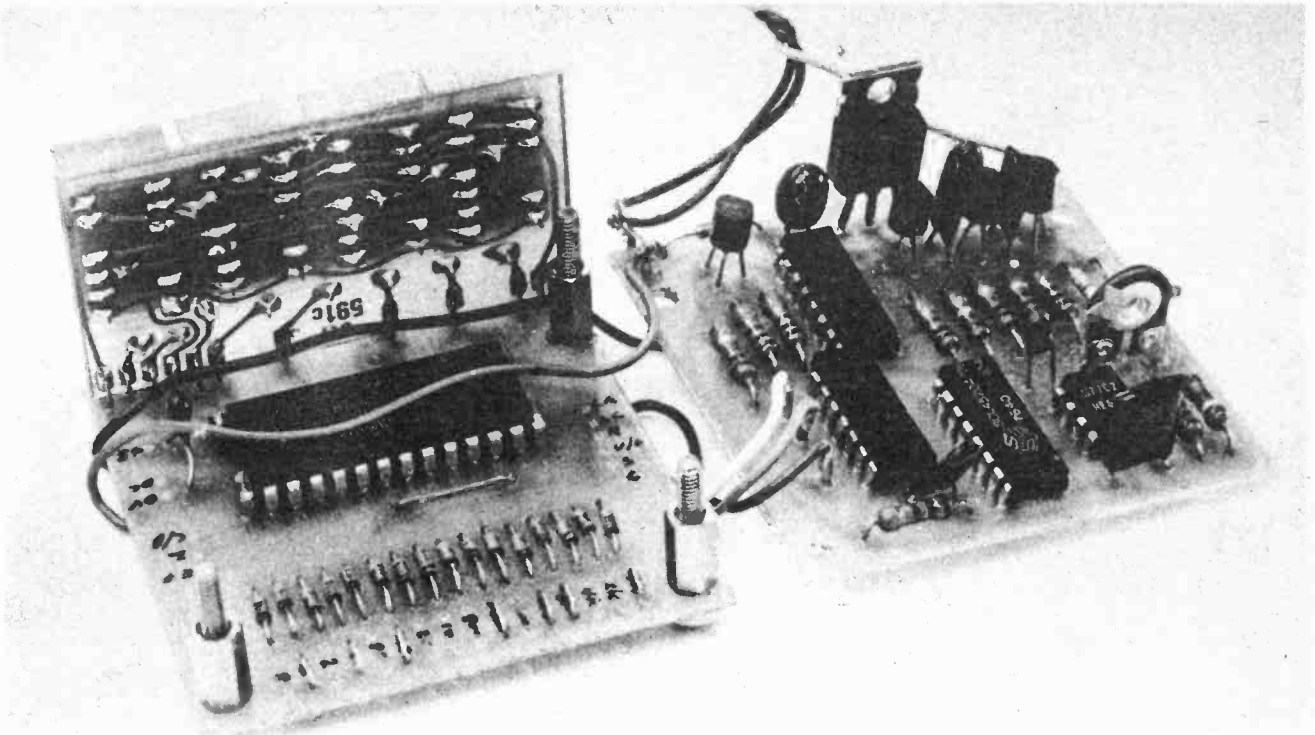
HOW IT WORKS

A signal from the local oscillator in the tuner is picked up either by a pickup coil or by direct connection to the set. It is then amplified by Q2-Q4 to give a square wave on the collector of Q4. The gain of this amplifier is about 250 (48 dB). The frequency of this signal will vary from around 1 MHz to about 2 MHz and this signal is then frequency divided by 256 (2^8) in IC4. This is used to clock the display module.

To measure the frequency we have to count the number of these pulses for 256/1000 seconds (256 because we divided the input by 256 and 1000 as we want a 1 kHz resolution). We used a 555 oscillator for the time base and its output is also divided by 256 (by IC2). This improves the stability of the time base by averaging out any short term variations in the 555 frequency.

The output of IC2 is a symmetrical square wave and when the output goes low a 1.5 ms wide pulse is generated by R3, C3 and IC3/1. This is then inverted by IC3/2 which turns Q1 on for the 1.5 ms period. Two resistors are used to bias the output of Q1 to 2.5V to ensure that the three level input will work.

This pulse "loads" 9545 into the counters (in the display module). Counting now starts from this number and after 455 pulses it is passing through zero. 256 ms after the load pulse ended the output of IC2 goes high. This resets IC4 back to zero, inhibits any further clocking via IC3/4 and opens the latches via the strobe line allowing the total in the counter to be displayed. 257.5 ms later when the output of IC2 goes low again, the store is closed, the counter is once again preset to 9545 with the process starting again.



The two boards which make up the complete dial. Note the links on the display board. The diodes where the links are not used may be deleted.

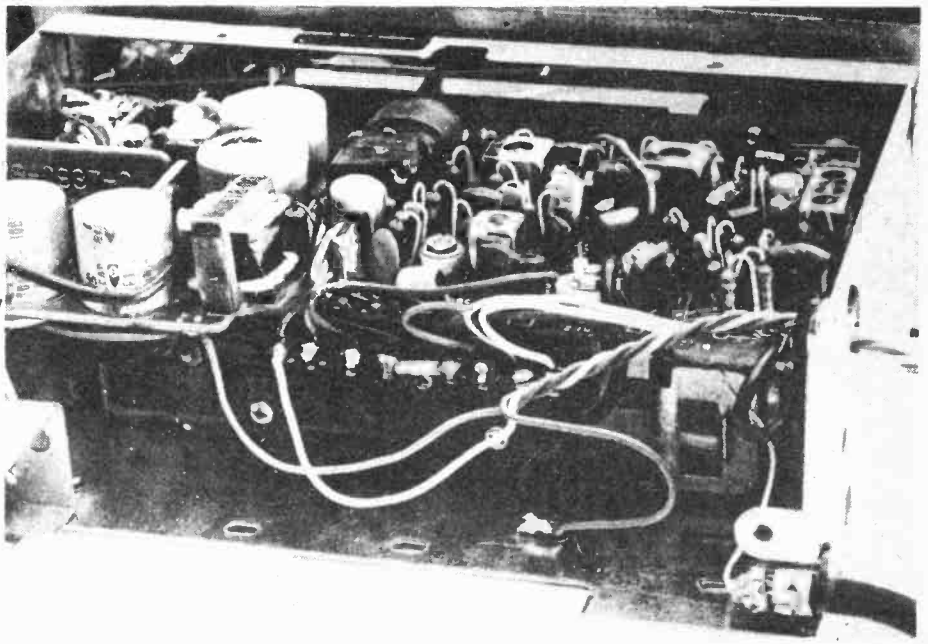


Photo showing where we tapped into the car radio.

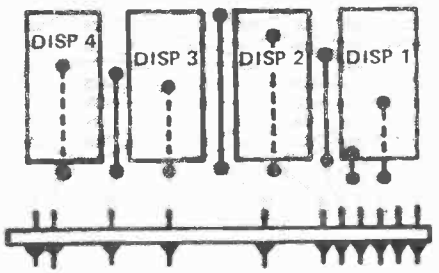
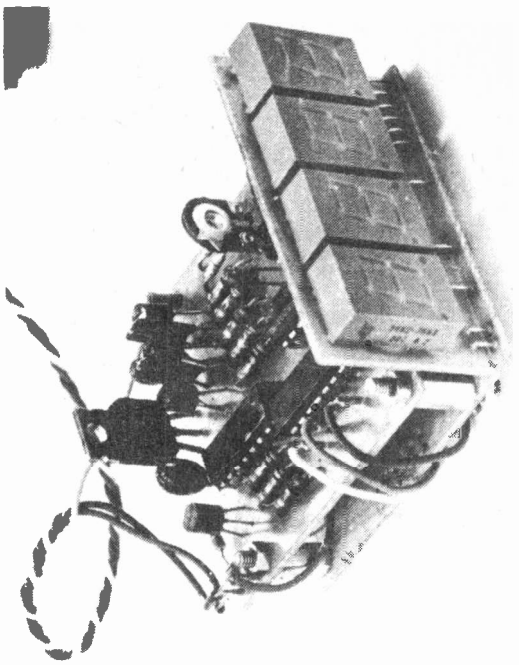


Fig. 4. The component overlay of the display when using the HP display.



The photo to the right shows the module with the HP 5082-7663 displays. Suitalbe displays and their light outputs are given below. The 10.9 mm displays need the ETI 591C pc board.

Type	Colour	Size	Light output
HDSP 4133	yellow	10.9 mm	2100μCd @ 20mA
HDSP 3733	red	10.9 mm	1800μCd @ 20mA
5082-7663	yellow	10.9 mm	1500μCd @ 20mA
5082-7653	red	10.9 mm	1720μCd @ 20mA
DL704	red	7.6 mm	320μCd @ 25mA

Fig. 3. The circuit diagram of the control logic.

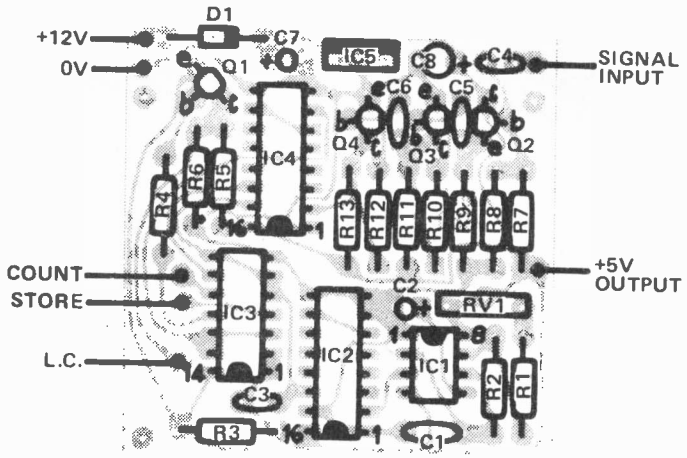


Fig. 1. The component overlay for the control card.
For pcbs for this project please contact: Spectrum Electronics, P. O. Box 4166D, Hamilton Ontario L8V 4L5, or B & R Electronics, P. O. Box 6326F, Hamilton Ontario L9C 6L9.

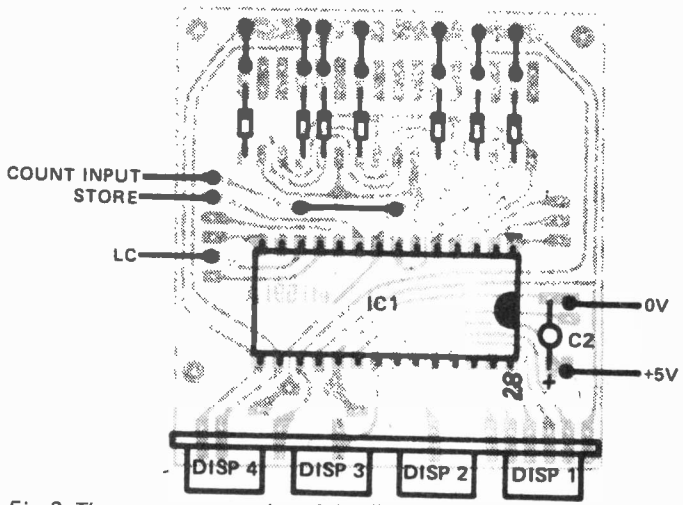


Fig. 2. The component overlay of the display module showing the diodes and links required.

PARTS LIST

RESISTORS all ¼W, 5%
- R1 . . . . . 39k
- R2 . . . . . 8k2
- R3 . . . . . 1M
- R4 . . . . . 10k
- R5, 6 . . . . . 1k
- R7, 8 . . . . . 47k
- R9 . . . . . 1k
- R10. . . . . 2M2
- R11. . . . . 10k
- R12. . . . . 220k
- R13. . . . . 1k

POTENTIOMETERS
- RV1 . . . . . 5k trim

CAPACITORS
- C1. . . . . 47n polystyrene
- C2. . . . . 1μ0 tantalum
- C3. . . . . 2n2 polyester
- * C4. . . . . 10p ceramic
- C5, 6 . . . . . 10n polyester
- * C7. . . . . 33μ tantalum
- C8. . . . . 10μ 25V electro

SEMICONDUCTORS
- IC1 555
- IC2 4520
- IC3 4001
- IC4 4520
- IC5 7805
- Q1 . . . . . 2N3905
- Q2–Q4. . . . 2N3904
- D1 . . . . . 1N4004

MISCELLANEOUS
- PC board ETI 550
- Display module ETI 591
- * Transformer 120V - 12.6V, 150 mA

* For 12V operation delete transformer. For 120V version C7 should be 220μ 25V. For use with pickup coil increase C4 to 1n0.

entered into the counter serially the pulse used must be longer than 4 times the internal oscillator period. Also as the LC input is a three state input it cannot be driven by conventional two-state.

We initially tried capacitive coupling onto the tuning capacitor of our portable radio (oscillator section!) but the loading detuned the set too much. We then tried a pickup coil and found enough signal with it in the correct place not to require any electrical connection to the set. With the car radio however the coils are shielded so well that reliable operation was not possible. However it was found that we could tap onto one side of the oscillator coil without affecting the operation.

We use a NE555 as the time base with its output being divided by 128 to improve stability. However if an accuracy of ± 5kHz is to be maintained its frequency has to be better than ¼% and a polystyrene capacitor for C1 and 2% resistors for R1 and R2 are recommended.

CONSTRUCTION

The display board should be built according to the overlay in Fig. 2 which shows which diodes are required. Note that R1,2 and C1 are not used in the display module and a link is used in place of R1.

The control card can now be assembled and wired to the display module. The two boards are mounted one above the other using 9.6 mm spacers. Check that these screws do not touch any tracks and insulate them if too close.

Depending on whether the unit is going to be used with a car radio or portable the values of C4 and C7 will vary. The pickup coil is made by winding about 80 turns of 0.25 mm enamelled wire onto a 25 mm long piece of 10 mm ferrite rod with the end terminated onto a twisted pair of plastic covered wires long enough to go between the radio and the position of the display. Do not use coaxial cable for this as the capacitance is too high.

The case chosen has been left to the individual with our own being from a discarded digital clock. If you use the 120V powered version be careful with the high voltage wiring. For the 12V version the power can come from the radio via a twisted lead (3 wires).

When connecting into a car radio, tune the set to a local station and try the pickup wire on the terminals of the tuning coils in turn until one is found which will give a reading without moving it off station. Permanently connect to this point. With a portable radio try moving the pickup coil around the set, probably in line with the aerial coil, until the best results are obtained.

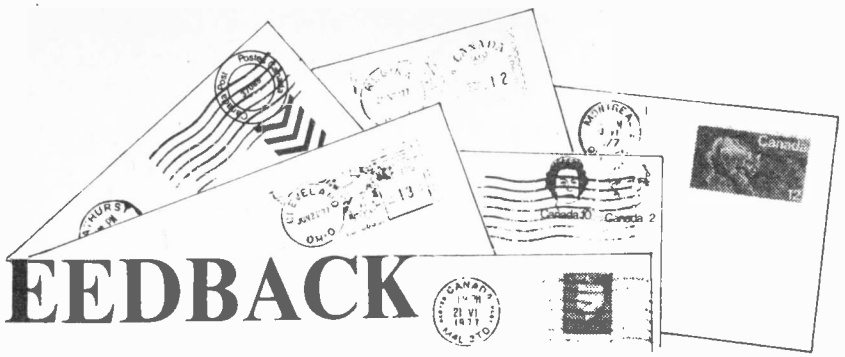
CALIBRATION

Place the pickup coil in position such that reliable operation is obtained and tune to a know station (preferably near the top end of the dial). Now adjust RV1 until the digital dial agrees with that station. Check then with other stations.

Alternately feed a known signal of between 1 and 2MHz from an oscillator into the input and adjust RV1 until it reads 455 less than that frequency.

POWER SUPPLY

The unit can be powered by an ac or dc voltage of between 7 and 20 volts. If an ac voltage is used the capacitor C7 should be increased to 220 μF. . A 120V to 12.6V, 150 mA transformer is recommended.



FEEDBACK

Dear Sir,

How do I get a negative for the printed circuit board for the Add-on FM Tuner in May 78. ETI?

R.S.,Dundas, Ont.

Negs for this project appeared in the June 78 issue. To get the negs, you have to get the whole issue from our back order department. See Reader Service Information at the back of each issue. Project Chart tells you this.

Incidently, there is a way of obtaining negatives from magazines. Check your local yellow pages under Lithographers. These guys have special cameras that are used to produce screenings and enlargements for magazines such as ETI. Ask them to make a full size negative directly from the page of the magazine. This usually costs between $6 to $10 and it might be wise to split the cost with a friend. You can also mount several different patterns on a board and so reduce the cost even more.

I am currently building the ETI 480 power amplifier that appeared in the April 77 issue. Where can I get a relay with a 280 ohms coil as specified.

T.Scharinger,
Edmonton, . Alta.

Most people seem to feel the need to adhere religiously to published parts lists. For most application parts such as relays, power transistors, diodes and so on are non- critical. In your case a 280 ohm relay is not very sensitive, anything with a greater impedance will work quite well (check Radio Shack or Dominion Radio and Electronics or similar).

In substituting parts for consider the application; For relays, make sure the contacts can handle the current, power transistors should have adequate current rating and so on.

Service News

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The ETA conference was not quite as planned. Dick Cartwright went along to help, and other things.

HI! THE LAST SERIES of articles seems to have stirred up a hornets' nest. Calls from local technicians, letters from the United States, and further communications from our local associations, have brought home to me the fact that this column of ours is now being read not only here in Ontario but across a large part of North America.

When Steve, our previous editor, asked me to investigate the status, etc., of associations here in Canada I had absolutely no idea that this would force me to research the editorials of the American counter parts of CEASA, OETA, etc.

However the article published in our July ETI magazine seems to have generated a great deal of interest. A request was received from Mr. Dick Glass, CET, for permission to reprint the article, and apparently some 600 copies were utilized in ETA's July membership mailing packet. A letter was received at our office in which our editor was thanked for the June and July issues, from which I quote:

"Of course my main interest was the article on ETA in the June issue. I want to thank you and would ask you to thank Dick Cartwright for doing such a refreshing job on the piece. I think I would be safe in saying that readers of ETI are now better informed about ETA and the association movement in general than readers of any other trade publications.

"When ETA eventually gains size and abilities enough to consider its own publication, I think my own vote would go for one that is identical to ETI. The mix of articles and professional job done on each make easy reading for all technicians, no matter what electronics specialty they are in. I commend you and your staff, wish you lots of luck, recommend to your readership that they recognize the real 'jewel' of a publication they can benefit from.

"We are looking forward to visiting Canada for our first convention in August and getting to know more of your readers. While our meeting will be small, we invite you or any of your staff to visit with us in Kitchener."

The greatest boost to my ego was the request that I would consider being the guest speaker at the Saturday night banquet at the ETA-I convention being planned for August 3, 4 and 5 in Waterloo, Ontario. The convention was planned originally was most ambitious, with everything ranging from a cocktail party to workshop sessions, and even including one for technicians' wives who wished to be of assistance to their spouses; and of course the usual election of officers and various business meetings.

Unfortunately almost before the ink was dry on the invitations the gasoline situation in the U.S. became an obvious deterrent to all forms of automotive transport, and my article mentioning the dates was hardly on the newsstands before my office received the news that the convention was being downgraded from a convention to a 2-day seminar. However I had promised the boss I would attend, and though I was far from well at the time I reported in to the Waterloo Motor Inn, the headquarters hotel. Shortly after checking in I was contacted by Mr. Dick Glass and met most of his impressive board of directors.

After adjourning to the home of the Canadian president, Mr. Bill Patullo, where we lowered a few of the L.C.B.O.'s best, I was driven to Bingeman Park, a favourite convention site for both Canadian and United States groups. The centre is worthy of further comment. It is located only a few miles from the industrial centres of Kitchener and Waterloo, Ontario. In addition to the meeting facilities there is an outstanding camp area for over 300 vehicles, a giant swimming area, and one of the largest roller-skating rinks in Canada. A delightful buffet style meal was enjoyed by all. There were no speeches, and other than asking for each person to stand and introduce himself we were able to concentrate on stoking ;up the inner man.

On Saturday the main business commenced promptly at 10 a.m. with an open meeting chaired by Mr. Jesse B. Leach, CET. Mr. Bill patullo welcomed

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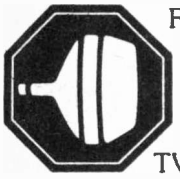

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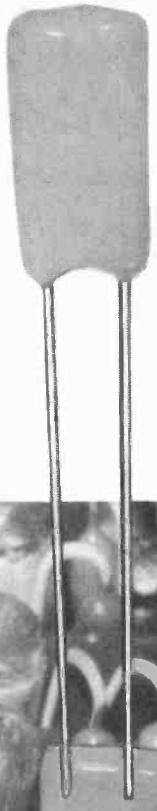

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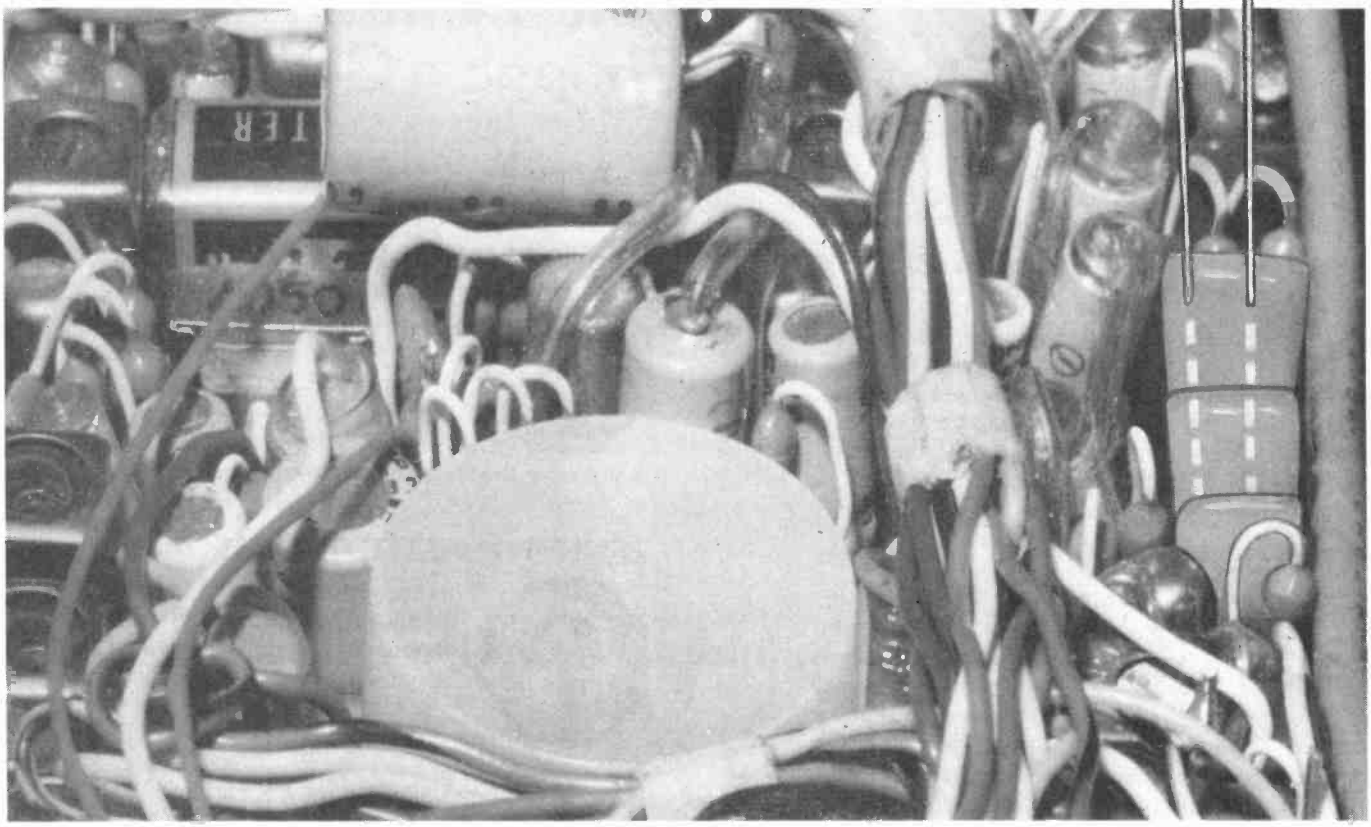

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our American friends to Canada, then the minutes of the Yorktown meeting were read, the treasurer's report, the vice-chairman's report, and finally an address by the president, Mr. Dick Glass. It would take up most of the magazine to quote verbatim the various subjects discussed, but listening to these extremely knowledgeable association directors it seemed quite apparent to me that for those electronic technicians, as opposed to shop owners, who are seeking an association of their own, ETA may well be the one for them.

Mr. Patullo in his opening remarks stated that when addressing students at the college he once said "There are a few people in this world who know more about electronics than I, but they are not with us today." However, as he looked over those present he smiled and said "They are apparently all here today." I had to smile with audience, as previous discussions with the members of the board of directors had made it very obvious that these gentlemen were not just successful business men, but extremely competent electronic technicians.

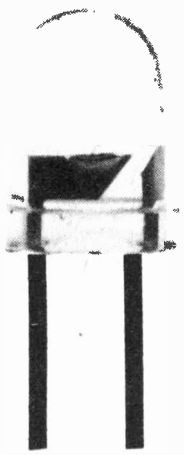
Final notes.

I was not sorry that because of the downgrading from the convention originally planned to a series of meetings, I was no longer faced with the prospect of having to speak to a group of men whose technical knowledge would probably far exceed my own, and whose business acumen was second to none. It was obvious that there was considerable disappointment in the enforced change of plans. Nevertheless I was delighted to meet at first hand these gentlemen who were previously just names appearing from time to time in various technical journals.

Inquiries re ETA should be directed to Mr. Bill Patullo, telephone 519/579-2839. His address is 10 Windywood Crt Kitchener Ont., N2N 1L5.

All the best.

Richard H. Cartwright



Teachers' Topics

New column for teachers and students: a forum for discussion on curriculum and concepts from high school to university.

WELCOME BACK TO SCHOOL everybody — teachers, students, and hi to those who didn't go back! For those who haven't been following ETI for a couple of months — first a few words about Teachers' Topics.

.Basically it's a forum for discussion of any matters relating to teaching or learning electronics. Hence we welcome your letters about good ways of teaching or learning the subject, questions on some particular aspect, news about what your school, board, or association is doing, conferences etc. (If you wish to contribute news of upcoming events, please note we need to receive notice 45 days before the first of the issue month.) Send your letters to:

TEACHERS' TOPICS, Electronics Today, Unit 6, 25 Overlea Blvd, Toronto, Ont M4H 1B1.

If we publish your letter or ideas we will award a free subscription to your school library or department.

CURRENT LETTER

Dear Sirs.

When I saw that ETI had started a column relating to the teaching of electronics, it reminded me of something which puzzled me last year. We were learning about basic electricity, and at one point learned that current flows from the negative terminal of a battery through a bulb say, to the positive terminal. Yet this doesn't seem to fit in with formulas like Ohm's Law, since you end up with a negative result. I eventually figured out that it must go the other way, but I don't know why. I am still confused over this, can you explain?

Michel Fernandez, Edmonton Alta
(No school mentioned)

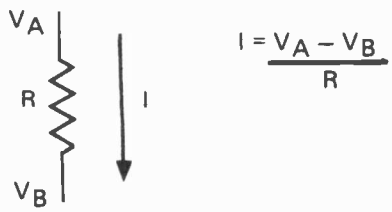
Michel, you're not the only one confused by this item. We've seen full grown technicians argue about this for hours on end!

Let's start at the beginning. Most people get their first exposure to "current" in an "electrostatics" or "fundamentals" course. Here it is taught that the flowing substance, which we call "current", is actually millions of tiny electrons pouring around the circuit. It's also taught that "like charges repel" and "opposite charges attract". Thus, obviously these electrons flow from a negative potential to a positive potential as you commented regarding the battery and bulb. This is "fundamental electricity", and the electrons moving en-masse should be called "electron flow" and NOT " current".

Way back in the beginning, some scientist threw a wrench into the works by arbitrarily declaring that an electron carries a negative charge, and the proton a positive charge. When it was discover ed that it's the electrons which flow and the protons are stationary, no one bothered to change things around. Consequently, electron flow is a flow of negative stuff, and herein lies the confusion.

BUT . . . . .

This is a most inconvenient notion, because it doesn't fit in with the concept that there should be flow from a "high potential" to a "low potential" like water flowing down hill, etc. So the term"current", when properly used, has come to mean a flow in the opposite direction to current flow, but equal in magnitude. It is a concept: you think about a circuit as though positive current was flowing one way, instead of having negative stuff flowing the other way.



I : Current, NOT electron flow.

Fig. 1. Ohm's Law.

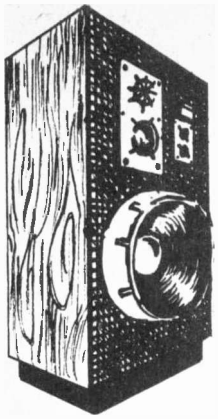
WHY TO

This makes all the formulae work out right, with the correct sign. (See Fig. 1.) Additionally, our circuit symbols are based on this, for the diode and transistor symbols all have arrows that indicate the direction that current may flow. (Fig. 2.)

It should be emphasised by us, and by teachers, that the word "current" is often misused. But we feel every effort should be made to reserve it for referring to the concept of positive current flow as opposed to electron flow.

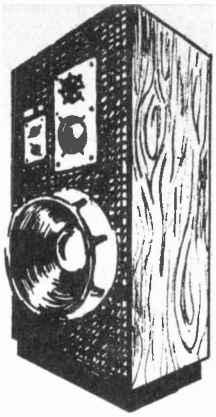
SOURCES AND SINKS

Reflecting this usage, a "current source" is a point from which current flows out (electrons flow towards) and vice versa for "current sink". However, one should be aware when reading that these terms also are occasionally reversed. A quick survey of manufacturers' data books at ETI turned up a couple of such misuses, but the overwhelming



How to impress all those rich hi-fi fans

while learning basic electronics.



How do you really know whether loudspeakers on radios, hi-fi sets and PA systems are really producing their rated output . . . like 10 watts or 75 watts?

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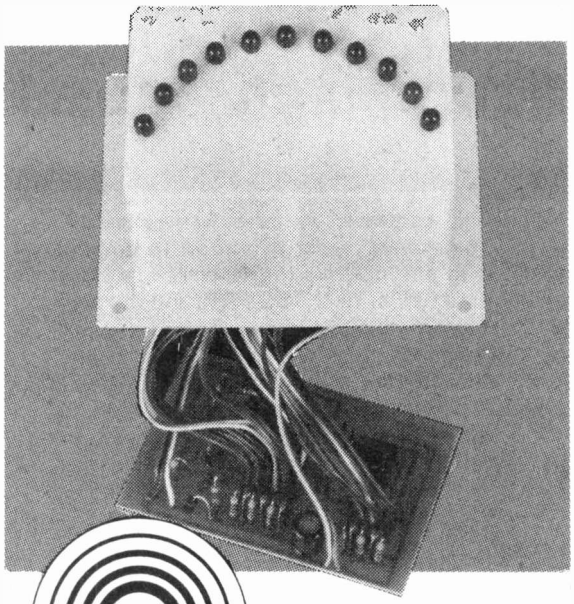

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majority of references agreed with our above definitions.

Fig. 2. The symbols were designed for current flow.

HISTORY

To round off this subject, we should note why it is that the "current" confusion has been so persistent.

The first reason was with relation to tubes. Everyone knew that the heater was used to cause electrons to fly off the cathode and head for the anode. Thus the idea was implanted that there was a flow in the direction the electrons go, and it was difficult to interpret this as a positive flow the other way.

After tubes came transistors. This did not improve things much, since the first common varieties were all PNP. These were typically drawn in circuits with the positive (or ground) supply at the bottom of the diagram, and the negative at the top. Diagram readers, predisposed to think of current flowing "down" the page again found it easier to see a flow in the direction of the electrons. Positive current direction would of course be "upwards" in this case.

DOWN WITH CURRENT!

Fortunately both these items have become less common, and it is becoming a widespread practice to draw diagrams so that positive current flows downwards. The theme of adopting certain conventions in order to draw enlightening diagrams is one we will no doubt return to in a future Teachers' Topics.

. . . . *continued from page 46.*

QRM

LETTERS ETC.

Since 1957, the Metro Amateur Radio Club, Incorporated, has sponsored the WOC-30 and WOC-50 Awards to encourage Amateurs outside as well as within Ontario to contact Amateurs in Ontario Counties and Districts.

However, over the past several years, various changes have been made in the arrangement of Counties and Districts in the Province of Ontario.

Some former Counties are now known as Regional Municipalities.

Some Counties have been absorbed and the enlarged area now is called a Regional Municipality.

Metro Toronto used to be part of York County. Now, the Municipality of Metropolitan Toronto is separate from the Regional Municipality of York, to the North.

And so on. . . . .

Consequently, it has become necessary to revise the rules governing the WOC Awards to conform to the present arrangement of political boundaries within Ontario. This has been done and you will find herewith a copy of the revised rules together with a list of 'Counties' (The word 'Counties' is taken to include also Districts and Municipalities).

For the purposes of the WOC Awards, the revised rules and list of 'Counties' will become effective September 1, 1979.

Any question regarding the WOC Awards or request for a copy of the revised rules and list of 'Counties' should be addressed to WOC AWARDS CO-ORDINATOR, METRO AMATEUR RADIO CLUB, INCORPORATED, P.O. BOX #352, DOWNSVIEW, ONTARIO, CANADA M3M 3A6.

(Note: due to space limitations, it is not possible to reproduce Metro Club's list. If you are interested, write to them at the above address.

Tech Tips

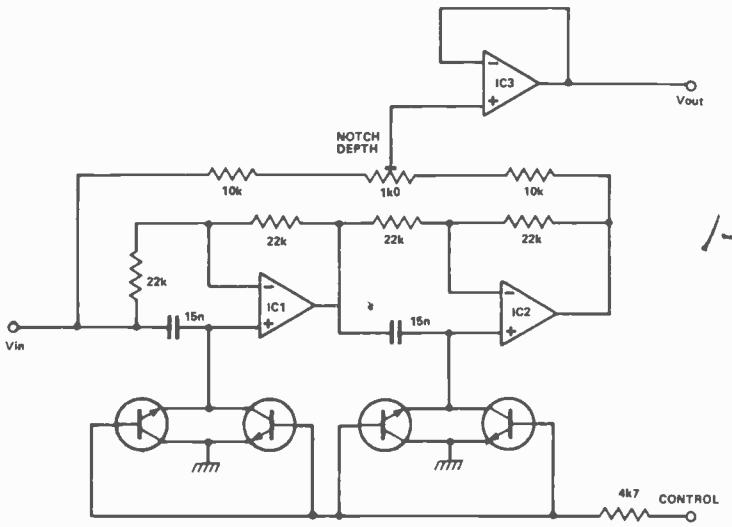
Tech Tips is an ideas forum and is not aimed at the beginner. ETI is prepared to consider circuits or ideas submitted by readers for this page. All items used will be paid for. Drawings should be as clear as possible, and the text should preferably be typed. Circuits must not be subject to copyright. Items for consideration should be sent to ETI Tech Tips, Unit 6, 25 Overlea Blvd., Toronto, Ontario, M4H 1B1

Variable Notch Filter

P. McChesney

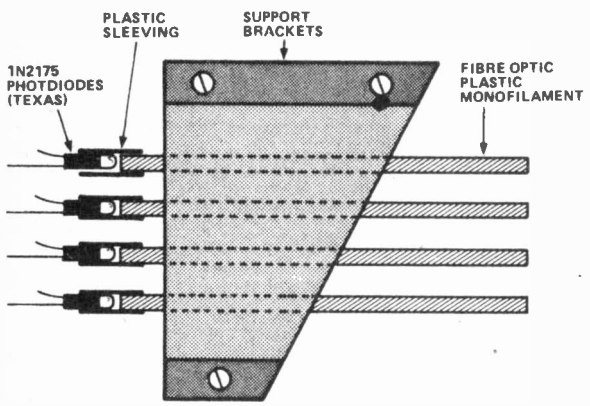
In electronic music circuits there is need for an all-pass notch filter possessing a movable notch frequency. The circuit shown is capable of moving the reject frequency over a 10 kHz range throughout the full range of audio frequencies, the position of the notch being dependent on the voltage applied to the control input.

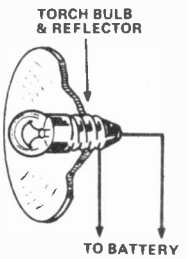
IC1 and IC2 are both all-pass filters possessing a flat frequency response well beyond the audio range, but having a phase difference between input and output signals of 0.5/CR. This phase difference becomes 180 degrees, so that if the output and input are mixed, signal cancellation occurs i.e. the circuit is now working as an all-pass notch filter, letting through all frequencies except at 0.5/CR.

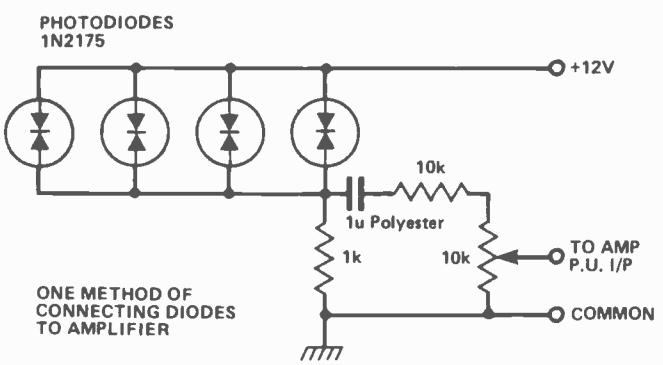


15N;1500p

The two transistor networks Q1, 2, and Q3, 4 act as voltage controlled resistors which allow the notch frequency to be moved when the control voltage is changed.





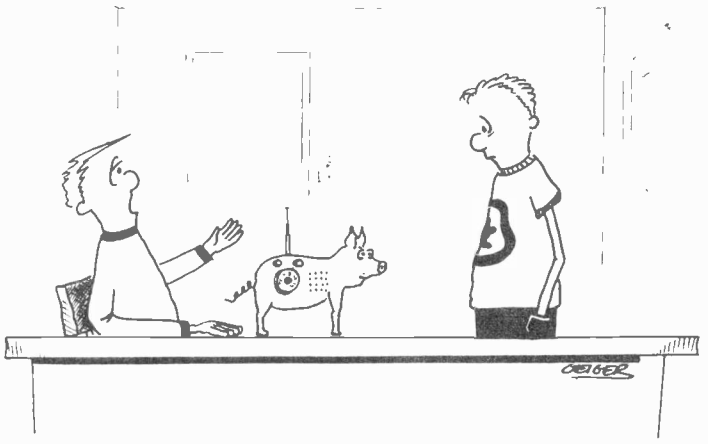


Fibre Optic Bass Guitar

J. Smith.

This item is in effect a simple musical instrument. It consists of a number of short lengths of plastic monofilament fibre optic material arranged in such a way that when a fibre is touched then released it vibrates at its own natural resonant frequency (like a ruler twanged on the edge of a desk). When in a light beam supplied from a torch battery the vibrating end sends sine wave impulsed along the fibre, at the fixed end there is a photodiode which with suitable circuitry feeds a signal to a normal audio amplifier. The sound produced is similar to that obtained using a tea chest, piece of string and Broom handle, remember those days? Thickness of the fibres and length are not critical and it is best to experiment to obtain the sound that pleases the constructor. The fibres need be no longer than about 60m/m. Remember the shorter they are the higher the note produced.

The Fun of Electronics



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We typeset your words (and put the first word and your company name in bold capital letters).

If we get your message by the 14th of the month, it will appear in ETI 1½ months later. For example, if we receive it by November 14th, you (and thousands more) will see it in the January issue.

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ETI Project File

PLEASE NOTE: WE CANNOT ANSWER PROJECT QUERIES BY TELEPHONE.

Updates, news, information, ETI gives you project support

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.

Write to: Project File
Electronics Today International
Unit 6, 25 Overlea Blvd.,
TORONTO, Ontario
M4H 1B1

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 refered to on hand.

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 100R, 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.

ETI Project Chart

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 refered to on hand.

ISSUE DATE	ARTICLE
June 78	Audio Analyser
June 78	Ultrasonic Switch & Neg.
June 78	Phone Bell Extender & Neg.
July 78	Proximity Switch
Aug 78	Neg.
July 78	Real Time Analyser MK II (LED)
Aug 78	Neg.
July 78	Acc. Beat Metronome
Aug 78	Neg.
July 78	Race Track
Aug 78	Neg.
Aug 78	Sound Meter & Neg.
Dec 78	Note: N
Aug 78	Porch Light & Neg.
Aug 78	IB Metal Locater & Neg.
Aug 78	Two Chip Siren & Neg.
Sept 78	Audio Oscillator
Nov 78	Neg.
Sept 78	Shutter Timer
Nov 78	Neg.
Sept 78	Rain Alarm
Oct 78	CCD Phaser
Nov 78	Neg.
Oct 78	UFO Detector
Nov 78	Neg.
Sept 79	C,D
Oct 78	Strobe Idea
Apr 79	Note:N
Nov 78	Cap Meter &Neg.
Nov 78	Stars & Dots
Nov 78	CMOS Preamp & Neg.
Dec 78	Digital Anemometer
Feb 79	Neg
Mar 79	Note:C. D
Dec 78	Tape Noise Elim
Feb 79	Neg
Dec 78	EPROM Programmer
Feb 79	Neg
Jan 79	Log Exp Convert.
Feb 79	Neg
Jan 79	Digital Tach.
Feb 79	Neg
Jan 79	FM Transmitter
Feb 79	Neg
Feb 79	Phasemeter & Neg
Feb 79	SW Radio
Feb 79	Light Chaser & Neg
Mar 79	Tape-Slide Synch
Mar 79	Synth. Sequ.
Mar 79	Dual Dice
Apr 79	Solar Control
Apr 79	Audio Compressor
Apr 79	Wheel of Fortune
May 79	Light Controller
May 79	AM Tuner
May 79	VHF Ant.
June 79	Easy Colour Organ
June 79	LCD Thermometer
June 79	Light Show Seq.
July 79	Note C
June 79	VHF Ant. 2
June 79	Bip Beacon
July 79	STAC Timer
July 79	Two Octave Organ
July 79	Light Activ. Tacho
Aug 79	Audio Power Meter
Aug 79	Two Octave Organ
Aug 79	Light Act Tacho.
Sept 79	Field Strength Meter
Sept 79	Sound Effects Unit
Sept 79	Digital Wind Meter
Sept 79	Up/Down Counter

Canadian Projects Book

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5W Stereo
Notes N, D May 79
Overled
Bass Enhancer
Modular Disco
G P Preamp
Bal. Mic. Preamp
Ceramic Cartridge Preamp
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VU Meter Circuit
Headphone Amp
50W-100W Amp
Note N May 79
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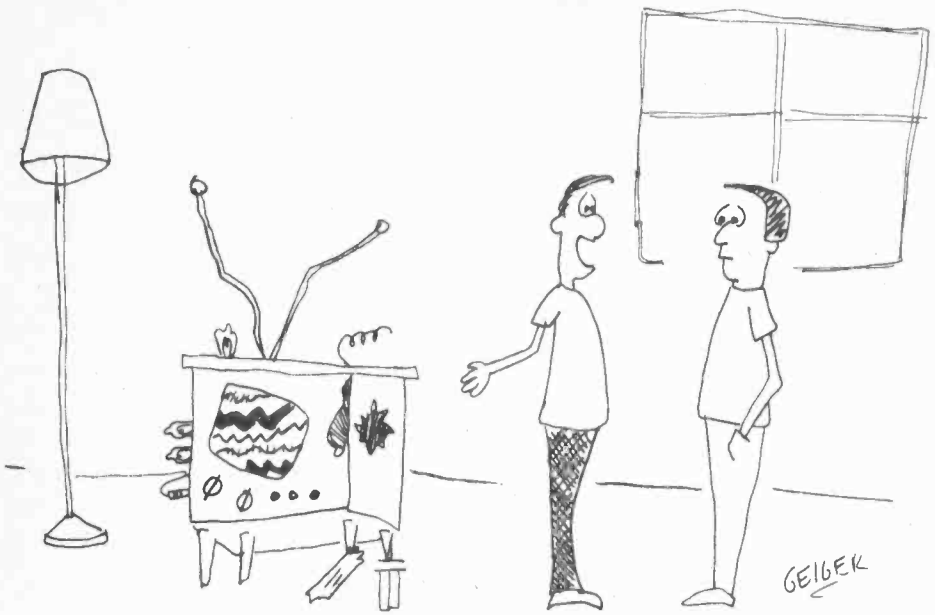
Heart-Rate Monitor
GSR Monitor
Phaser
Fuzz Box
Touch Organ
Mastermind
Double Dice
Reaction Tester
Sound-Light Flash
Burglar Alarm
Injector-Tracer
Digital Voltmeter

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



"Would you believe, I built it myself!!"

NEXT MONTH

KITS SURVEY

General Information For Readers

Editorial Queries

Written queries can only be answered when accompanied by a self-addressed, stamped enveloped, 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.

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.

1977	1978	1979
February	[redacted]	January
May	February	February
June	March	March
July	[redacted]	April
September	May	May
November	June	June
	July	July
	August	August
	September	September
	October	
	November	
	December	

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.)

Advertisers' Index

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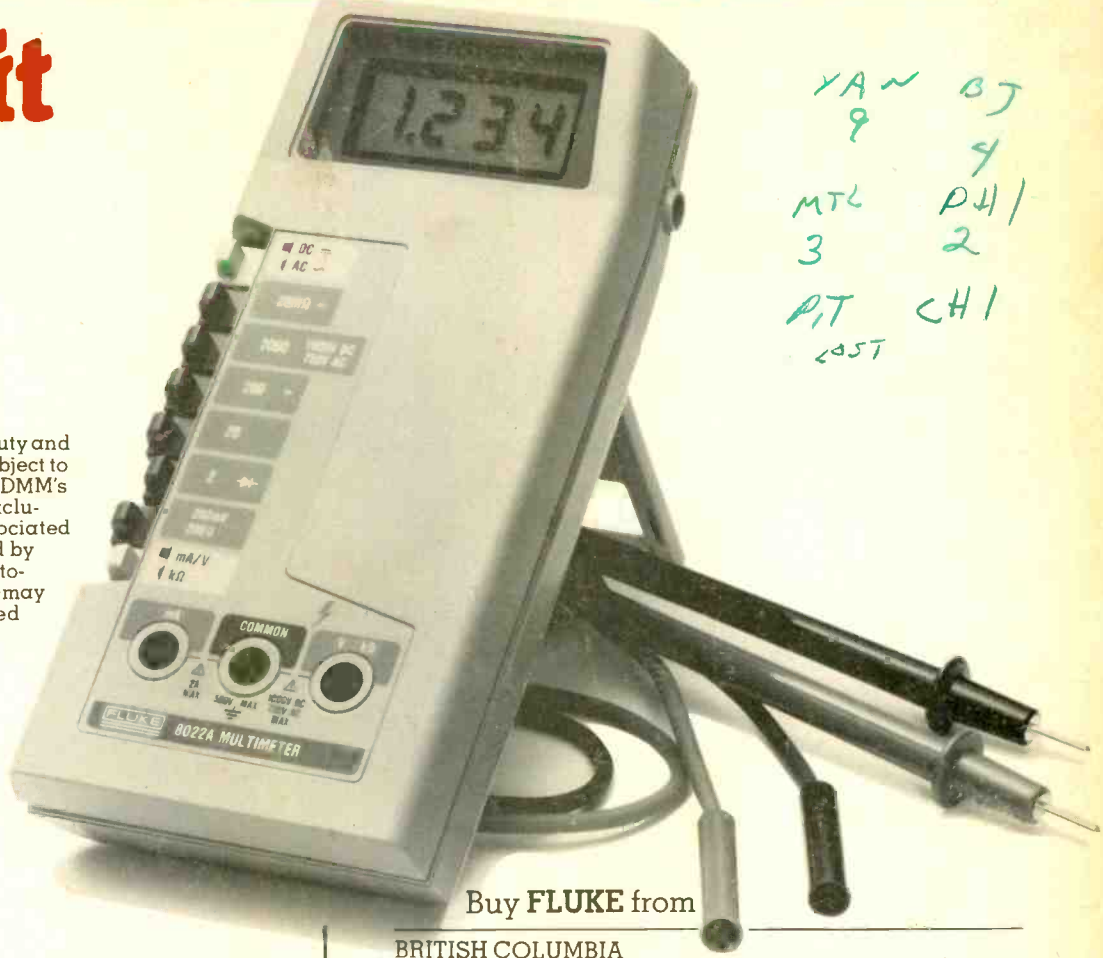

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