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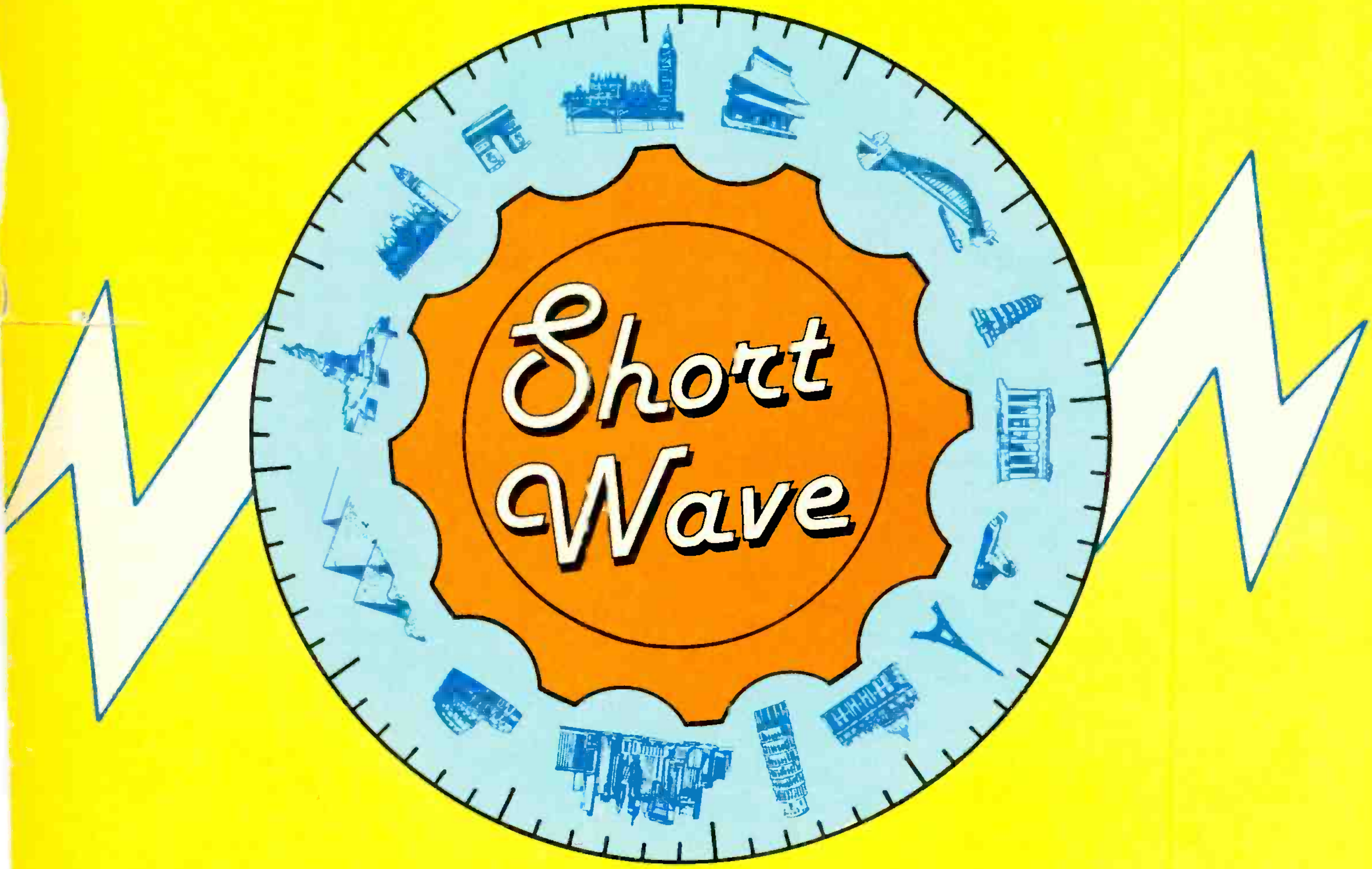

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CANADA'S ELECTRONICS MAGAZINE

PROJECTS

FEATURES

NEWS & INFORMATION

NEWS DIGEST

Solid State Relays

Twelve new solid state relays introduced by Motorola feature rugged cases, potting, internal protective circuitry, and transient-free zero-crossing switching. The relays offer output current ratings from 2 A to 10 A, and power line voltages of 120 V and 240 V. ICs and other low-level input drivers are protected from power line transients up to 1500 V, via an internal optical coupler.

The relays are closed by application of any DC voltage from 3 to 32 V. Unit prices in the US range from $2 to $20.

Cam Gard Catalogue

In response to seeing everybody else's catalogues in the Catalogue Survey of June ETI, Cam Gard have sent in their contestant for "Biggest Canadian Electronics Catalogue". Weighing in at 4 lbs, "No. 7475" has 994 pages, tied with the old Electro Sonic catalogue. As might be deduced from the number, this is the 74-75 model, but a new one is not expected for at least another year. It is packed full of product information, which is great if you're not looking for absolutely the latest stuff. No prices are given, but these, the products and the catalogue are available from Cam Gard's many outlets from coast to coast. There is no charge for the book, except to cover postage and handling, which is $2.50. Head office: Cam Gard, 1777 Elice Ave., Winnipeg.

Own Your Phone

Can Bell continue its monopolistic practice in Canada? Not where owning telephones is concerned, at any rate. In a test case in Toronto, Challenge Communications Ltd. won the first round in a bid to sell, outright, phones used in their system.

The judge rejected Bell's assertion that the CRTC had overstepped its legal jurisdiction when it ordered Bell to drop restrictions on that company allowing customers to own their own phones.

The phones, usually used in executive cars, are linked by radio to the Bell system. The CRTC decision was viewed as a precedent for further challenges to Bell's policy. Bell have already agreed to their customers attaching their own (DOC-approved) answering machines. *J.E.*

New Temperature Sensors

Motorola has announced a new series of silicon temperature sensors that is a highly linear, stable and reproducible alternative to thermocouples, thermistors and platinum resistance devices.

Intended for use in industrial, automotive and consumer systems, the series permits, for the first time, unskilled field replacement of sensors, without requiring elaborate recalibration procedures.

The new MTS devices produce a highly linear change in voltage, about 400 mV, over the -40 to +150°C operating range. A conventional "type K" Chromel-Alumel thermocouple produces less than 10 mV over this range, making it harder to amplify accurately, and more sensitive to noise. The silicon devices exhibit a "regression coefficient" (a measure of deviation from ideal temperature-voltage linearity) of 0.999999, as opposed to the less linear thermocouple's 0.999.

Because of their higher output voltage and "precalibration", MTS devices are suitable for applications where multiple remote sensors are selected by switching to a single amplifier, without the expense of special lead wires and very low contact resistance switches needed by other sensor types. Fast thermal response time of the MTS series permits steady state readings within 3 seconds of temperature change in liquid, or 8 seconds in air. Temperature accuracy is available in three grades.

In the US the MTS series is priced as follows:

Type	**Temperature Accuracy** (-40°C to +150°C)	**30-99 Price**
MTS102	+/-2.0°C	$1.25
MTS103	+/-3.0°C	$0.85
MTS105	+/-5.0°C	$0.50

Write on Time

Abaco International Trading (Houston) are selling a special kind of pen — with an LED month, date, day, hour, minute, and second display. The clock pen uses ordinary refills (ball-point and silver-oxide).

Electronics Market Report

Over the next five years the value of the world electronics market should expand by 70 per cent to reach $200 billion, claims Peter Evison in a new Financial Times International Management Report, *'Electronics: The Market to 1982,'* published June 14, UK price £50. Approximately half the total $200bn. market will be in the US, 30 per cent in Western Europe and 20 per cent in Japan, says the author. Additional information is available from the Business Publishing Division, Financial Times, Minster House, Arthur Street, London, EC4 9BH, UK. Telephone: 01-623-1211.

Electronic Typewriters

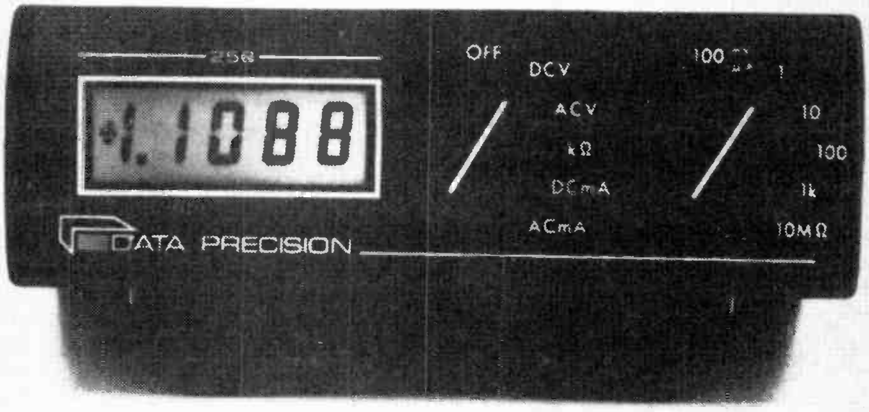
The new IBM Electronic Typewriter combines computer electronics with single-element head and error correction. A microprocessor helps sense the end of a line for automatic carrier return, and provides underlining, centering and electronic storage for margins and tabs, phrases and sentences.

RCA Power Devices

A 72-page brochure, Power Devices Directory, encompassing RCA's full line of solid state power devices, is now available from RCA Solid State Division.

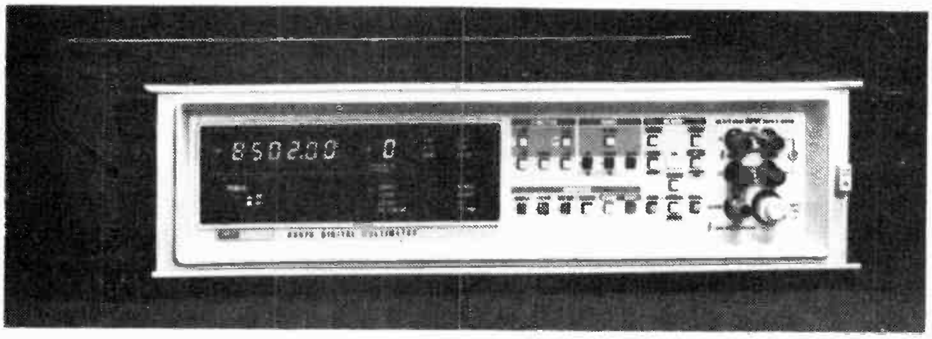
The brochure summarizes characteristics of and provides package information for RCA's extensive line of power transistors, power hybrid circuits, diacs, triacs, SCRs, gate-turnoff thyristors (GTOs), integrated thyristor-rectifiers (ITRs), and silicon rectifiers. The directory covers 1200 devices, including all those in the standard commercial line. Additionally, high reliability versions and military specification (JAN, JANTX and JANTXV) types are listed.

Intended as a guide for circuit and system design engineers, the directory also lists the titles of all available application notes on RCA power devices. Copies of the Power Devices Directory, PTD-187F, may be obtained by writing to RCA Solid State Division, Box 3200, Somerville, NJ 08876, or by calling Engineering Publications at (201) 685-7457.



LCD DMM

A miniature, portable digital multimeter which combines 10 micro-volt sensitivity, true RMS measurements, a 4½-digit liquid crystal display, and 40 hours of continuous battery operation has been introduced by Data Precision and is available in Canada from Webster Instruments Ltd. The price is $399 inc. duty. For more information contact Webster Instruments Ltd. PO Box 427 Port Credit PS, Mississauga, Ontario L5G 4M1, (416) 275-2270.



Microprocessor-Based 6½ Digit DMM

For applications where high accuracy and sophisticated measurement techniques are required Fluke has introduced its new model 8502A digital multimeter, available in Canada exclusively from Allan Crawford Associates Ltd.

This meter features a dc accuracy of 10 ppm in addition to ac volts, ohms and ac/dc current capability. Because the instrument is microprocessor based, a modular design technique has been achieved and powerful memory functions are available for user convenience.

In addition to basic DMM functions, the 8502A incorporates math functions which process input information into a format for readout that is more meaningful than mere measurement of analog input data.

All capabilities of this new meter, including the differential mathematical functions, can be addressed via the front panel.

Three systems options are available, IEEE, RS232, and duplex parallel. If purchased as a bench unit these systems options can be added at a later date.

Motorola RF Guide

A free 24-page RF Selector Guide and Cross reference from Motorola provides a thumbnail description of RF power transistors, RF power hybrid modules, linear RF amplifier hybrid modules, and small-signal, high frequency transistors.

Plastic Printed Circuits

Don't throw out those scraps of copper clad yet, but it looks as if the day is not too far off when strips of plastic may make them obsolete, thanks to research presently being conducted in England and Germany.

Work done by ICI (the British chemical conglomerate) has led to success in growing large crystals of polydiacetamine materials that exhibit metallic properties, and which could lead in turn to useful 'plastic conductors.' Meanwhile, research in Germany has focussed on methods by which diacetamine is converted from monomer to polymer form. Essentially, these consist of making one end of the diacetamene molecule hydrophylic (water seeking) and the other end hydrophobic (water hating); then, when a thin film of the substance is floated on water, it will line up the molecules in a way that makes them possible to polymerise via exposure to ultraviolet light. This opens up the way for selective polymerisation of films thus produced by exposure through a negative, following which the unpolymerised areas can be dissolved in acetone. Result — a 'plastic printed circuit'!

Success of this wheeze depends at present on discovering a 100% satisfactory conducting polymer, but things in this direction are looking good. It also occurs to this writer that nothing has been said so far on the subject of how electrical connections to 'printed plastic circuits' could be implemented, but one feels somehow that this might prove to be a minor hurdle. In fact, one can almost imagine the electronics buff of the future assembling his projects from bits of plastic stuck together with conducting glue . . . In fact, hobby kits of the future might come in formats resembling 'paint by number' kits of today. Care to pick me up a 'Captain Marvel Computer Comic' while you're at the store? No — wait a minute, make it one of those electronic jigsaw puzzles. . .

J.C.

TV Demise

All is not rosey at Electrohome. When the Kitchener electronics company thought manufacturing colour TVs was too expensive in Canada, they did what a lot of other companies have done — shifted the manufacture of TV chassis to Japan. This was to have been the panacea for all the ills — mainly higher labour costs and lower productivity which the Canadian manufacturers site at the real reason for switching. But, as labour Minister John Munro said recenlty in Cambridge, Ontario, while touring a local engineering plant, "the declining dollar also fans inflation as imported goods become more costly". This is reflected in the statement of Electrohome's Chairman and Chief Executive in his annual report to the shareholders in April. Mr. James Holmes said the declining dollar "also squeezed profit margins severely where operations depended on the purchase of imported materials or finished products."

Electrohome now import all their colour TV chassis from Japan and put them in the box here in Kitchener. The Kitchener-Waterloo Record recently quoted Mr. Holmes as saying that the consumer electronics division in Kitchener continued to operate at a loss because of the sharp increase in the cost of importing goods from Japan.

Ironically, the Canadian-based operations of the same company showed a profit!

Jim Essex

9V AM Tuning Diode

Motorola's addition of a nine volt silicon tuning diode to its line of voltage variable capacitors permits design into AM radios operating from the popular 9V battery. The MVAM109 has a minimum tuning ratio of 12 over a 1-9 volt control range. Capacitance is 460 pF — suitable for use with available high Q antenna and oscillator coils. The tuning diode's Q is guaranteed at 150 (minimum) at 1 MHz and maximum capacitance. The MVAM109 sells in the US for $1.10 in 100-up quantities.

Smoke Detector

The Tellus 007 is a 9V dual-ionization chamber smoke detector, designed and made in Canada by Tellus Instruments of 250 Don Park Road, Unit 5, Markham, Ontario, L3R 2V1. The unit twists into the base-plate mounting for easy removal (for replacing the battery). The usual power-on, low battery and test indicators are provided plus novel interconnection (to sound a chain of alarms in an emergency) facilities. The retail price is expected to be around $29.

BRS-5

BRS-5 is the NCR Basic Electronics Course With Experiments, a 440 page book which teaches basic electronic circuit principles. Prepared by the technical education department of National Cash Register, this 6 by 9 inch paperback is available at $9.50 from E&L Instruments and its sales representatives. E&L Instruments, Inc, 61 First St., Derby, CT 06418, USA.

1GHz Frequency Counter

A 1GHz counter with accuracy of 0.5 ppm (oven controlled), eight digit display, crystal checker, and audio measurements down to 0.1 hertz, is available from Sencore. Superior Electronics (1330 TransCanada Highway 5, Que, H9P 1H8) haven't told us the Canadian price, but multiplying up from the US price we'd guess the cost would be around two thousand dollars.

Video Modulator ICs

Two new TV Video Modulators from Motorola provide sound, luminance and chroma information in a composite RF signal that can drive colour television receivers in video game, data terminal, test equipment and video tape recording applications. The MC1372 contains a chroma subcarrier oscillator, controlled by an external 3.58 MHz crystal, which can also provide a stable clock output for use elsewhere. This precise frequency is driven, through on-chip lead and lag networks, into a quasi-quadrature, suppressed carrier DSB chroma modulator. The RF modulator combines the resultant video signal with the output of an LC-tuned RF carrier oscillator, to produce the required composite signal. Inputs required by the MC1372 are the baseband color-difference and luminance signals.

The simpler XC1373, in an 8 pin mini-DIP (compared to the MC1372's 14 pin DIP), provides the RF oscillator and dual-input modulator for applications where composite video is available.

Both ICs operate from a single 5V supply, providing NMOS and TTL compatibility, and are intended to produce signal output on VHF channel 3 or 4. A simple external connection gives composite inverted or non-inverted video output, rather than RF.

Samples are available now. In the US the ICs are priced at $2.95 each (100-up, MC1372) and $2.35 (100-up, XC1373).

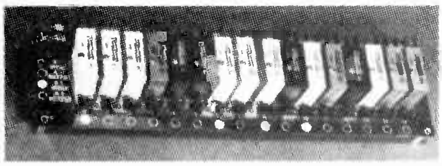
microfile

Dow Jones Info

Using a telephone link up, users of Apple II computers can now dial Dow Jones' Stock Quote Reporter Service for fifteen-minute-delayed stock and bond quotations. This information along with software provided by Apple will enable the user to determine current portfolio value, short and long term gains, and rate of return.

MPU Power Supplies

Five new triple-output supplies from Motorola provide five volt logic power 2 A to 15 A, and +/-9 to +/- 12 V outputs with ratings from 0.3A to 2.5A. US prices range from $68 to $145.



Input-Output Modules

Where the controlled world of MPU logic signals ends, and the world of input sensors, power line loads and big transients begins . . . that's where Motorola's new input/output modules go. The color-coded, vertical-plug-in modules fit a Motorola I/O board which can interface with standard minis and micros (or any system with CMOS, TTL, LS, NMOS or PMOS logic).

DC input module IDC5 translates 10-32 V input signals into standardized MPU logic levels, while AC input module IAC5 does the same for 95-130 V AC stimuli. Both feature a status indicator terminal, designed to drive a LED in visual troubleshooting applications.

DC output module ODC5 can drive 3A into a load, while withstanding up to 60 V across its output terminals. AC output module OAC5 switches 3 A into a line load at voltages from 12 V to 140 V RMS, with zero-crossing, low noise internal triggering.

All four modules withstand 1500 V transients between isolated terminals, and meet UL Isolation requirements.

US pricing of the modules is $11 and the board $60.

Apple Reduces Memory Prices

Apple reduced its 16K byte memory price by 40 percent in June. Previously priced at $500, a 16K memory increment now sells for US $300.

Apple Disk II

Apple Computer have a new minifloppy disk drive: Disk II.

The Disk II subsystem consists of an intelligent interface card and either one or two mini-floppy drives. The computer will handle up to seven controller cards and fourteen drives for instant access to more than 1.6 million bytes of data. The combination of a bootstrap loader in ROM and operating system in RAM provides powerful disk handling capability with the following features: • Full disk capability for systems with as little as 16K bytes of RAM • The ability to load and store files by name • Random and sequential access • Automatically generated file-name directories (catalog detailing diskette contents for each diskette) • Storage capacity of 116 kilobytes per diskette • Ability to be driven from Apple II power supply with no other power required • Patented design that reduces power consumption and motor wear while permitting the drive mechanics to operate at higher speed.

The 116K byte storage capacity results from using a soft-sectored format to store information on the diskette. The format calls for 35 circular tracks arranged in concentric circles from the center of the disk to the outer edge. While in most other manufacturer's formats, each track typically contains 10 or 11 sectors, in Apple's format each track contains 13 sectors of 256 bytes each. Disk II transfers data to Apple's memory at a rate of 156K bits/sec, approximately 25% faster than other mini disk drives, according to Apple.

Other measures of performance are track access time and disk rotation speed. Disk II's track access time, the time required to move from one track to another, is claimed to be 2.5 times better than competitive units. While the access time varies with the number of tracks crossed, the time required to move the disk read/write head over the full 35 tracks of the disk storage media is only 600 milliseconds (versus 1400 ms for more conventional designs). The average track access time is 200 milliseconds, since the majority of track movements will involve crossing from 1 to 10 tracks. This access time improvement results from the way Disk II moves its head. In a conventional floppy drive, a stepper motor is used to move the head one track at a time from the present location to the desired track location.

The Disk II began shipping in the US read/write head is located, and then the location of the desired track is determined. The head is then accelerated halfway to the desired track and then decelerated an equivalent amount.

Besides track access time, another element of disk speed is disk rotation: the disk rotates at 300 RPM. In the worst possible condition, the sector to be read or written has just passed under the read/write head, the drive requires a full rotation of the disk which takes 200 milliseconds to access information from the track. The disk latency (the average time required to access information) is 100 milliseconds.

The disk II began shipping in the US in June at an introductory price of US $495 (this includes both controller card and Disk II drive).

You Too Can Look Like This:

They're here! ETI's quality Canadian-made polyester-cotton T-shirts are now in our office awaiting your order. These are really sharp merchandise — not cheap foreign shirts that fade and shrink when you wash them. They're nice and long to stop draughts around your midriff and they're trimmed on the collar and sleeves. Colour scheme is light blue with dark blue trim and design.

Fill out this coupon and send to ETI T-Shirts, **Unit Six, 25 Overlea Blvd., Toronto, Ontario, M4H 1B1.**

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Audio Today

Developments in audio reviewed by Wally Parsons

MUCH OF THE IMPETUS behind the development of quality sound derived originally from the motion picture industry. This is not surprising in view of the fact that the movies were the first application of high power reproducers, due to the need to make the sound track audible to a large audience, with good intelligibility of speech. With the production of Hollywood musicals, and the increased use of music to heighten and punctuate dramatic effects along with the inclusion of associative sound effects came the realization of the importance of fidelity in the recording and reproduction of the sound track. Now, "Western Electric Noiseless Recording" which often appears on the credits of many movies of the '30's may seem like something of a misnomer by today's standards, but it must be realized that most home reproducing systems available at the time sounded pretty atrocious in comparison with even the most mediocre theatre system.

By the time television became a reality, it was inevitable that it would adopt standards derived from and compatible with those of the motion picture industry. The heavy dependence on film for many programmes not in real time made this a sensible course of action.

CONSPIRACY OF MEDIOCRITY

In terms of historical time, television's development parallels very closely that of FM radio. Even the sound transmission uses the same technique. Unfortunately, the same high sound quality is seldom realized in television as in radio. Conventional wisdom has it that television production people were quickly pre-occupied with the magic of transmitting pictures, that audio quality was pushed into the back seat and virtually ignored. This is one of those simple-minded beliefs concocted by someone who keeps his brain in a thimble overnight, and it's about time it was swept away.

In the early days of television, good pictures were not the easiest things to achieve. Those old Marconi cameras gave one beautiful picture, but were pretty touchy, and consequently needed a lot of attention. Studio heat required some pretty noisy air conditioning and the camera blowers also contributed. Live production resulted in a lot of off-camera action on the studio floor, and dead silence was all but impossible. An audio man was pretty hard pressed even to get a pick-up, let alone a good one. CBC's audio men originally came over from radio, and were without a doubt the best in the business. Consequently, producers put a lot of attention into picture, confident that a good sound man could handle his end, and even make compromises for the sake of the visual content.

If you want to look for blame for poor television sound quality, try the set manufacturers, whose idea of a super sound system is the addition of a second mediocre speaker to match the first one. Of course, if the buying public prefers to save a buck by buying junk, one can hardly blame manufacturers for believing that this is what people want, and catering to the desire. So maybe it's about time to set the record straight, and also describe some ways to realize the sound quality which is actually available from a television transmission.

Television transmissions are assigned to channels whose bandwidth is 6 MHz. Picture information modulates a carrier 1.25 MHz from the "bottom" of the channel, and the audio signal carrier is placed 4.5 MHz above this. While picture information is an *amplitude modulated single sideband* signal, audio information is of the *frequency modulated* type, and will be compared with FM radio in this discussion.

Standards in current use provide that the sound carrier strength shall be no more than 20% of the peak video carrier strength with a maximum deviation from centre frequency due to modulation of 25 kHz, as compared with FM radio's 75 kHz. Transmission also uses pre-emphasis at high frequencies of 75 usec, which is the same as has been used in FM, until it was modified recently. Both systems must be capable of transmitting a bandwidth of from 50 Hz to 15 kHz, with a maximum distortion of less than 3.5% from 50-100Hz, 2.5% from 100-7500Hz and 3% from 7500-15000Hz. Readers may be surprised at these distortion figures, but they are really no worse than those used for tape and disc recording and are better than a lot of very excellent speakers produce.

As you can see, any television station should be capable of transmitting a signal quality equal to that of a monophonic FM radio transmission, and indeed this level of performance is achieved more often than many people realize. If you live in a metropolitan area served by both CBC-TV and CBC-FM, you may, from time to time have had the opportunity to receive simulcasts of some select television programmes which illustrate the point perfectly, provided your television equipment is good enough.

Usually, though, it isn't, and anyway, the programme sources used aren't usually that good are they? Well, that's a relative matter, of course, and although most sources, especially optical film, will not match good audio discs and tape, they are still better than you might believe. For example, frequency response standards for broadcast videotape are the same as for audio, and even sound on film (optical) specifies a response of from 80Hz to 8000 Hz, ± 1.5 dB. Now, that range may not seem so hot, but it's still better than 8-track cartridge tape, and the deviation standard suggests a good useable response an octave each way. This may not be "state-of-the-art" but then, even much "state-of-the-art" isn't either. At their worst, today's television series offer sound quality at least as good as late monophonic discs. Indeed, it is becoming abundantly clear that all of the really good sound men have abandoned feature film work for television. It never ceases to amaze me that they can shoot an episode of, say, "Kojak" in less than a week, on location, and consistently achieve such a convincing and believable parallel between the visual and acoustic environment. Contemporary films, on the other hand, often sound as if the audio man and cinematographer were shooting different films, with Canadian film makers among the worst offenders. Very few seem to have any sense of microphone technique, or an ear for acoustic environment or perspective. Of course, the best of the sound efforts seem to be reserved for the commercials, which may be a terrible waste of talent, but at least it reduces the irritation level.

HOW TO DO IT

Several methods are available by which the audio portion of a television transmission may be received.

Of these, the simplest is direct connection to the speaker leads of the receiver feeding to an external amp, usually by means of a pair of clip leads. The biggest disadvantage to this method is that the signal quality is no better than the audio system of the set. After all, if the built-in speaker is a little tiny thing of poor quality, the manufacturer is not likely to include an amplifier which is much better. Such an amplifier will have its low frequency response rolled off to avoid overloading the speaker with bass which it cannot handle, and may even roll off the highs in order to provide a more balanced response and/or compensate for a rise in the speaker's response. It does allow volume to be adjusted at the television set, but this means that the built-in speaker is also operating, unless means is provided for removing it from the circuit, which, in turn, may require providing a dummy load. If normal operation of the set is to be retained, then either a switch must be provided, or a normalling jack used. Finally, the loudspeaker itself also acts as a microphone, and will pick up room sounds, including reverberation of the programme, which will be amplified by the external system. In extreme cases, feedback howl may be experienced.

A better method, which still allows use of the set's controls while using an external system, entails taking the signal from a voltage amplifier stage prior to the output. This is practical only with tube or discrete transistor sets; where IC's or modules are used one cannot always obtain access to internal signal points.

The most desireable point at which to take off the signal is at the output of the detector, which is also, usually, the input to the volume control. With all these techniques it is necessary to ensure that the characteristics of the system from the detector to the take-off are satisfactory, and the closer to the detector we operate, the fewer modifications must be made. The volume control contacts are usually easiest to get at, but you may find an input capacitor whose value must be increased to ensure adequate bass response.

Then there is the question of load impedance, and cable length. Usually you will find that impedances are too high to permit long cable runs, so some sort of buffer is needed. Although it is possible to use a voltage follower, a simpler solution is either an opto-isolator, or a transformer, suitably terminated. These have the additional advantage of providing ground isolation, essential with power transformerless circuits, and desireable even with transformer powered sets. My preference is for the transformer method; my own coupler provides a load of 100k across the detector with a 600 ohm line.

However, some receivers use poor circuitry in the detector section, resulting in high distortion, or even noise from the video circuits. The answer then is to use a separate tuner, i.f., detector and audio output, such as the Teledapter described in these pages a few months ago. This little device also produces a simulated stereo output. This is something which can be provided in many possible ways. The simplest way is to use a graphic equalizer adjusted such that each band is adjusted to provide alternate boost and cut, with the pattern reversed as to channel. Thus, on one channel a band is boosted and on the other it is cut by the same amount, while the next band is cut and boosted respectively. The average response of the two channels is flat, but the image is spread out. Another method mixes reverb with the signal, with different reverb times/depth/frequency response in each channel. Yet a third method provides selective phase resersal in one channel. This can be quite effective, but the disadvantage is that the channels cannot be recombined to produce mono. RCA produced some terrible "Re-channelled for Stereo" releases this way several years ago. I felt at the time (and still do) that the project was ill-conceived, to put it mildly, since I couldn't conveniently convert them to mono, and I'm stuck with them.

As for true stereo, I see no earthly reason why it's taking so long for committees to decide on a suitable stereo system. The present method of audio transmission should quite easily accept the multiplex system now in use by FM radio, despite the more restricted deviation capability, and would be fully compatible with receivers still on the market. But it won't come unless the public yells and screams and otherwise intimidates the politicians and their not-so-tame governmental Poo-Bahs.

Imagine watching "Earthquake" on the home screen and feeling the walls shake. Mine did. And things started falling down. And it scared the cats. The signals are there. Hamilton's CHCH-TV and Toronto's Global can be singled out for their exceptional audio quality, and I have no doubt that there are many similar stations in other parts of the country. People like CBC's Mas Kikuta work their butts off producing a first class musical pickup, only to have it mangled and mutilated beyond recognition at the receiving end. Television's potential as a musical medium has yet to be tapped. And it won't be until enough people discover the audio quality many broadcasters are currently transmitting.

But, be careful: you could become a TV addict.

Audio Today Products

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

RSC ACOUSTICS "CLASSIC" AND "ULTRAFLEX" DRIVERS

The initials "RSC" are familiar ones to Canadian hobbyists, and to manufacturers of complete speaker systems, both branded and house brand. Although they formerly stood for "Radio Speakers of Canada", the company has recently undergone extensive re-organization, and the name changed to "RSC Acoustics". Although new product lines are in the works the best of the older series have been retained in the catalogue, and illustrate the high calibre of product which can be produced by Canadians in what might be called the mainstream "bread and butter" type of product.

Typical is a series of high compliance, moderate power woofers, along with an associated mid-range and tweeter unit, dubbed "Classic" and the same drivers without the fancy finish and packaging dubbed "Ultraflex". The latter were introduced by Dominion Radio in Toronto at a considerably reduced price, and the samples evaluated were supplied by Dominion Radio.

The series includes three woofers, 8", 10", and 12", with free air resonances of 30 Hz, 25 Hz., and 25 Hz, magnet weights of 20 oz., 27 oz., and 32 oz., and a butyl rubber front suspension. Compliance and cone mass are moderate, permitting use in semi-air suspension systems, friction loaded systems, some bass reflex and transmission line enclosures, although only the 8" version is suitable for bookshelf size reflex systems.

The 8" and 10" samples were acquired particularly to explore the characteristics of a specific transmission line design when used with drivers of different characteristics, and although the enclosure was optimized for use with an 8" driver, both units delivered clean, smooth response down to 30 Hz. Although they are specified for woofer application in three-way systems, response remained quite smooth even beyond the piston region above about 500 Hz, exhibiting a gradual rising response above this frequency to about 200 Hz. Efficiency is quite good, thanks to an adequate magnet, which also contributes to good damping. Actually the small line is quite a challenge in itself, operating as a two-way unit, and with fairly small cross-section, and although the ideal driver unit would have a curvilinear cone, this becomes rather expensive. Thus the performance achieved is quite impressive. Cone "liveness" is quite low and well damped, thanks to the use of the butyl front suspension. All in all, a highly recommended series, and at prices, at the time of writing, of less than $15.00, a top buy.

SOUND BARRIER MODEL CONCORD

Or is it Concord Sound Barrier Model? I don't know, I'm just writing what it says on the box. Actually, it's difficult to avoid having a lot of fun at the expense of the instruction book (sic) which accompanies this unit. It's in a style which can only be described as "Early Japanese 'Ah, so'". It seems to have been translated into English by someone with limited knowledge of both languages, with lots of quaint little phrases which convey little information.

This is too bad, because it really is a pretty decent little speaker. Measuring approximately 4"x7"x4" it obviously is intended to take on the ADS 2002, a pretty ambitious undertaking, and it succeeds remarkably well. Although described as an automotive speaker, it's quite at home as an extension unit, perhaps on a bookshelf; I'm using them on the desk in my study. Used this way, bass response is dependent on the proximity of reflecting surfaces. It's too small to place on the floor, but placed on a desk, the increased mutual radiation extends the response nicely down to 100 Hz. Response is certainly not as smooth as a large transmission line, but taken on its own merits one quickly becomes accustomed to and accepts its character, which, although somewhat restricted, bright, and slightly boxy, is nevertheless much bigger than one would expect. I should like to have seen a treble contour control of some kind to reduce the brightness, but this can be accomplished with ordinary tone controls. Imaging is particularly outstanding, with a stereo field slightly wider than the speaker placement, positive localization, and a rock stable centre image. Efficiency is very high, and it will handle a peak power of 50 W. Incidentally, although it delivers virtually no output at 60 Hz, at the same time it does not exhibit any sign of doubling at any frequency, which is a great deal more than I can say of one highly respected speaker selling at nearly ten times the price, which I had occasion to audition recently. The styling and finish are particularly attractive, and auto installation is a snap. I must say, I don't particularly like this general kind of speaker for automotive use, because it's easy to steal and stands out as an invitation to thieves. But if you're prepared to accept this risk, which holds true for all surface mount speakers, it's a nice little unit, at about $150.00 a pair. They're available in Toronto and by mail from Dominion Radio, who also supplied the pair tested.

JENSEN MODEL 566 TRIAXIAL AUTOMOTIVE SPEAKER

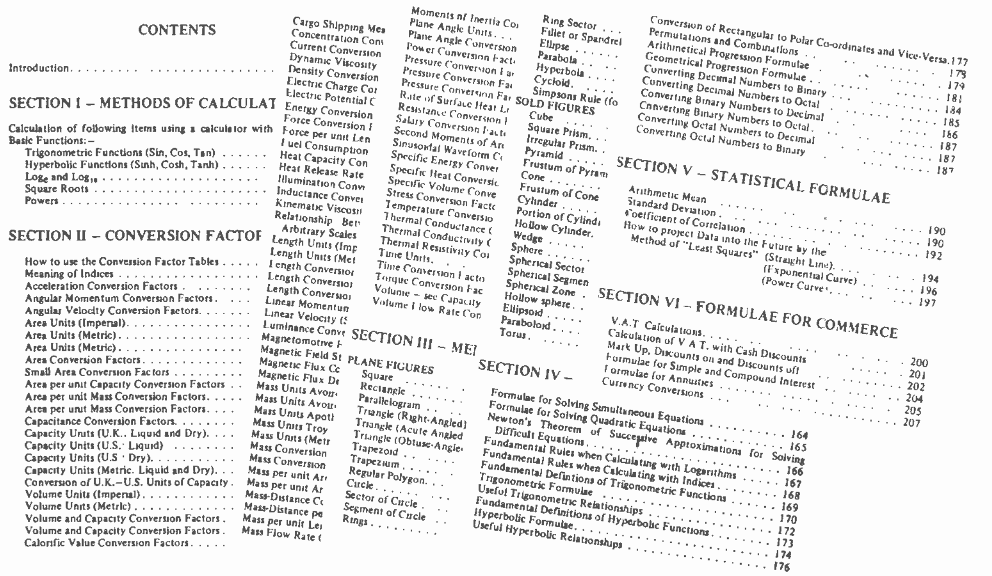
This is not a new speaker, but is one of the first high quality units offered for automotive use, and comes from one of the oldest and most prestigious manufacturers in the business. Jensen claims to make the only triaxial on the market, but in view of the number of copies currently around, this claim can no longer be considered accurate. Fortunately, this does not affect performance.

Evaluation is a little difficult. The 566 is intended for flush mounting, and one of Ford's better ideas when they built my car was to use a steel frame cut-out to match the round garbage can they installed in place of a loudspeaker. Therefore, evaluation had to be made using rather indirect means. Essentially, this involved mounting in a large infinite baffle, and the whole assembly installed in a small, highly damped room. This produces a reasonable approximation of an automotive interior. Under these conditions, response was very smooth from 80 Hz to 20 KHz. There was no sign of doubling and imaging was excellent. But the most noticeable characteristic was one of brightness, particularly on axis. The tweeter unit contains an acoustic lens, but this is not sufficient to produce wide dispersion from the deep tweeter cone. However, this is intended for flush mounting, in which the tweeter is aimed at the rear window and reflected. Consequently, one listens considerably off-axis, and under these conditions the brightness is toned down and balance remains constant at all likely listening positions. This does mean, though, that performance is less satisfactory in surface mount applications, or for most uses outside the car, including large vans, trailer homes, campers, and the like even with the improved dispersion afforded by the plastic grill included with the kit. On the plus side, response is exceptionally smooth, without the funny glitches in response common to cheaper units using whizzer cones, and a slight rise in midrange response is sufficient to produce a somewhat forward quality on voice which is highly desireable in overcoming road noise without using excessive levels. Imaging is positive and stable, transient response outstanding, thanks to the solid state tweeter. If you're accustomed to smooth bass response and overall accuracy in home equipment, you'll probably like this unit. The bottom end is solid without being boomy and may, at first, seem a little bass-shy. But it will also accept considerable boost without distress and without becoming a boom box. I should like to have seen some means of controlling mid-range and tweeter response, but I must admit that this would be difficult to accomplish in a way which would make adjustment accessible.

Efficiency is about the highest I've seen in a car speaker, and it can be driven quite easily directly from most car radios without booster amplifiers, but will still accept a 30 Watt booster. The question is, can the listener!

Listed at under $130.00 per pair, you can probably get a better price by shopping around.

Jensen speakers are distributed by Len Finkler, 25 Toro Rd., Downsview Ont. M3J 2A6, who also supplied the samples for review.



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Speaker Boxes

We want to build the best speakers we can for the most reasonable price possible. Could you give us any information regarding prices or plans etc. that might help? The speakers we are interested in mainly are bass reflex and transmission line speakers.

Any information of any kind would be most appreciated.

R. C. D. Kamloops, B.C.

Well, sir, you just spoke the magic words: Transmission Line. You've certainly picked one of the very best types of speakers. Also one of the most expensive. This design is not worth the trouble unless you're prepared to do the job properly, and that means using the right drivers, and lots of tender loving care. Reflex speakers simply will not work properly unless you do the job right. Now you know why most magazine construction projects are for air suspension or infinite baffle types.

In keeping with ETI's policy of being educational as well as fun, I'm going to recommend a couple of books to you. One is "How to Build Speaker Enclosures", by Alexis Badmaieff and Don Davis, Sam's 20520, and "Hi-Fi Stereo Handbook", by William F. Boyce, Sam's 20918. You might also check your library for a copy of "Sound Reproduction", and "Loudspeakers" both by the late G. A. Briggs. Also, the Journal of the Audio Engineering Society reprinted A. N. Thiel's "Loudspeakers in Vented Boxes", in the May and June, 1971 issues (Volume 19, no. 5 and 6). If your library can't help you with this write to Jacqueline Harvey, Managing Editor, AES Journal, 60 East 42nd St., New York, N.Y. 10017, to arrange for a reprint. This won't help you much with Transmission Lines, but all these publications should give you a good grounding in loudspeakers. Then write me again. At that time I might be able to discuss design considerations in a way which will be useful, and if you enclose a stamped self-addressed envelope, you'll be assured of a personal reply.

Yours is the kind of question to which I could give a brief glib reply, but I think I've outlined a more useful course of action. After living with my own big fellas for two years, I find very few speakers to be listenable for any great length of time. Now if only I could convince a backer that there are people who would pay money for such performance.

Tuner

In your May issue of ETI you described the construction of an "Add-on FM Tuner".

I am interested in building it and would like to clear up a few points: 1) What is the output voltage? 2) What is the output power? 3) What is the load (8ohm or 4ohm)? 4) What would be the suggested current of the power supply?.

J. P. P. Trois-Rivieres, P.Q.

This is a fairly complex circuit, and I must emphatically urge readers to read it carefully before attempting it's construction. It's not like sight-reading at the piano. In this case, all the information is in the text.

1) Peak-to-peak output voltage is 3V.

2) This is a tuner; it does not deliver power above a few milliwatts into a high impedance.

3) An 8ohm load across a 741 is like a dead short. Rather, it should work into a bridging impedance of at least 10 k.

4) The circuit draws about 110 mA at 12 V.

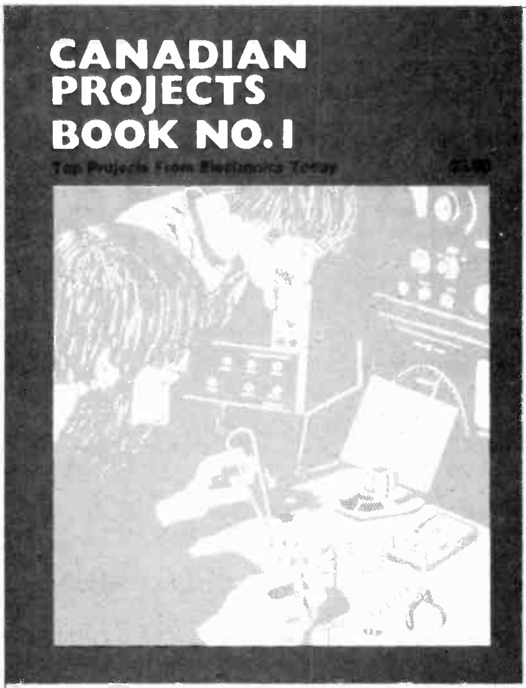
Allow me to emphasize again that this is a tuner, and should be connected to a separate amplifier.

Noisy Resistors?

In the June "Audio Today" section, you describe a technique which involves inserting resistors in the input of a phono preamp. I always thought that the higher the resistance the higher the thermal noise. Therefore, wouldn't increasing the input resistance increase the noise?

J. N. Mississauga, Ont.

It is true that the thermal noise component is increased by this method. The noise from the pickup itself is only that produced by the resistive component of the impedance. However, other noise mechanisms are at work, principally noise due to input stage noise current and voltage, and these are developed across the total impedance, and are generally of greater magnitude. Since this technique raises the input impedance by only a small amount, the effect on noise is quite small, unless the stage has been optimized for the specific pickup. In the kind of equipment discussed this is unlikely, and in any case, I feel that the benefits greatly outweigh the losses.



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HEART-RATE MONITOR

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

DOUBLE DICE

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

TOUCH ORGAN

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

PHASER

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

AUDIO LIMITER

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

SOUND-LIGHT FLASH

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

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Model No. 03

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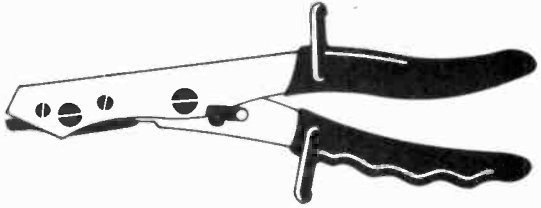

This hand held nibbler cuts sheet metal up to 1.2mm or 18 gauge, or plastic material up to 2mm or 14 gauge. It cuts quickly, cleanly without bending or distortion. The cutters are replaceable. The tool is bright nickel plated, the handles are PVC coated and self or spring opening. There is a locking device for keeping the nibbler closed. It's approximately 10-1/2" overall in length, and weighs 1 lb. 3 oz.

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Getting Into Shortwave

Hanging ten on a skywave and other etherial past times by Steve Rimmer

LEGEND HAS IT that in the pioneer days of radio, before much was understood about the subject, all the frequencies above what is now the AM broadcast band were considered useless for purposes of practical communication. Long distance transmissions were accomplished using very high power transmitters pushing through on long wave (about five hundred kilohertz and below) and it was not until the mid nineteen twenties that any serious exploration of those supposed radio "wastelands" began.

Even in our present enlightened age few people know what goes on in the spectrum beyond the dial of their kitchen radio. Few people know that besides the common bands there are over half a dozen others upon which can be heard not the local rock and roll outlet, but radio transmissions from all over the globe. In the space above the AM band, from about three to thirty megahertz, lies the fascinating world of short wave.

SKY WAVES

In ascertaining the propagational peculiarities of the short wave spectrum it was discovered that the reason radio signals in this band can travel such great distances that they are able to reach a portion of the upper atmosphere known as the ionosphere. This layer, under certain conditions, is reflective to short wave signals, and is thus able to bounce them back to Earth. But reflection occurs at such an angle that they meet the surface quite some distance from where they originated. The distance may be many thousands of kilometers. Furthermore, upon returning to Earth, they may be reflected once again up into the atmosphere, thus making multiple "hops". It is therefore possible, under the right conditions, to receive the signals anywhere in the world (see Fig. 1).

A radio transmission which propagates up through the atmoshere, instead of following the surface of the earth, is called the "sky wave".

Obviously, the key factor in long-distance short wave communication is the properties of the ionosphere.Think of this as a kind of "radio mirror", but it should not be envisioned as being solid. The nature of the ionosphere is extremely variable. It is greatly influenced by the sun, for example, and at night the reflective surface of the ionosphere is higher than during the day. It is also higher in the winter than in the summer. Simple geometry will indicate that the higher the ionosphere is, the farther radio signals can "hop". Therefore, nights, and particularly cold winter nights, are better times to listen to short wave.

Along the same lines, agents which disrupt the ionosphere, like upper atmosphere atomic tests (like those carried out by China last year), can black out short wave communication.

In practice it is only short-wave stations that depend on the reflective properties of the ionosphere. As the frequency of transmission increases, the ionosphere tends to become less reflective. The exact frequency at which it ceases to become a usuable "mirror" is determined by the degree to which the molecules of which it is composed are ionized. This, in turn, is determined by the amount of ultraviolet light falling upon and being absorbed by these molecules. The ultraviolet light is produced by the sun. Therefore, it is a good rule of thumb that the higher frequencies are better during the day. The lower ones are better at night.

VFOs, AGC, ANL, QRM...

It goes without saying that in order to receive radio signals one needs some kind of a radio receiver. Having said it anyway, we can now proceed to narrow down the field a bit.

The little plastic box with two knobs and a speaker which you use to tune in your local AM stations is, strictly speaking, a radio. But even were it able to tune the short wave bands, it would be unable to do very much with the signals it picked up. This is due to a number of characteristics of short wave.

First of all, the short wave broadcast bands are numerous, but very narrow, each one encompassing a chunk of spectrum only about half as wide as the AM broadcast band. The stations are, therefore, in many cases all but on top of each other; often less than five kilohertz apart. Contrast this with the AM band, on which stations usually maintain a spacing of at least forty kilohertz. In order to pick up one short wave signal without getting adjacent stations mixed in, the receiver must be able to tune in a very narrow piece of the spectrum and reject the rest of it. This characteristic is referred to as *selectivity*.

Secondly, signals on the short wave bands, although often broadcast with many hundreds of kilowatts, have been bouncing around the atmosphere quite a bit by the time they reach your receiver, so they are a lot weaker than AM signals, which come directly from the transmitter twenty or thirty miles away. Therefore, reception of short wave requires a receiver which is able to amplify signals a great deal more than a typical AM set. This is called *sensitivity*.

Although there are many other criteria for a good short wave set, these are the two primary ones. The others will be discussed momentarily:

The simplest type of short wave receiver commonly available at present is the familiar "all-band portable". You may well own one of these already, and, if not, they are typically priced under a hundred dollars. Usually, these sets will pick up the AM and FM broadcast bands, a portion of the long wave spectrum, perhaps a few VHF police, fire or weather frequencies, and what is usually designated SW1 and SW2. These abbreviations usually refer to the short wave band, which in this case has been divided up into two sections. The first usually stretches from about two or three megahertz to about ten or twelve, and the second from ten or twelve to anywhere from eighteen to thirty.

Although these radios do provide a good way to get started in short wave, they will prove frustrating if you wish to do any serious long distance listening. Although they are often passingly sensitive and selective, they usually fall down when it comes to dial calibration. For example one of the most popular short wave bands stretches from about nine point five to ten megahertz. On an average all-band radio, this space of dial encompasses less than two centimeters, a space which, at five kilohertz per channel, could hold up to a hundred stations. Each station would therefore occupy 0.2 of a millimeter of dial space. Now, consider, for example, that Radio Cairo comes in at 9.805, Radio Israel at 9.815 and Radio Moscow on 9.80. It is very difficult to tune in Cairo and be sure that you are not getting Moscow or Israel by mistake.

If you are to get into serious short wave listening, you must also get into a rather serious piece of equipment.

THE SERIOUS SHORT WAVE RECEIVER

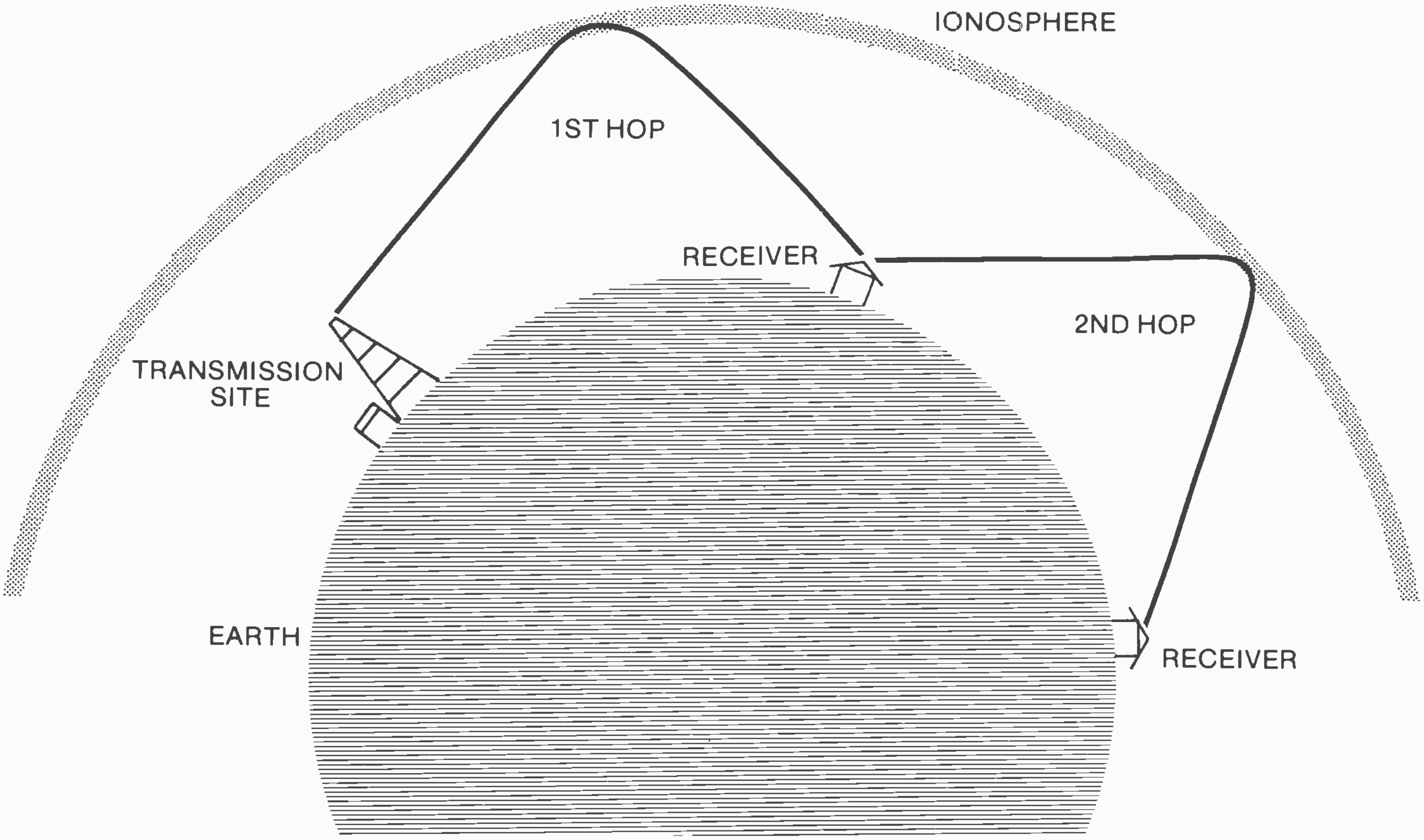
The first thing needed in a good short wave set is a large, spread out, easily-read dial. There are many things which can be done to compensate for deficiencies in sensitivity, selectivity, and so forth, but, as noted before, if the dial is unreadable, you will not be able to get the stations you want.

If you are interested only in the short wave broadcast bands, the dial need not cover the whole spectrum between three and thirty megahertz; there is a great deal of non-broadcast material on the bands. On the other hand, if you are of a curious bent, you may wish to go exploring for such off-beat fare as ham transmissions, utility communications or aircraft and marine traffic, to name but a few.

Table 1 lists the short wave broadcast bands, which would be the minimum coverage required of a receiver.

It was mentioned previously that a short wave receiver requires a high degree of sensitivity, or the ability to amplify weak signals. There are cases, however, where a signal might be very strong, such as from a nearby relay station, and may overload the receiver's front end, causing it to become distorted in much the same way as in an overdriven audio power amplifier. To avoid this, it is desirable to have some way to lower the degree of sensitivity if necessary. This is usually accomplished with a knob marked RF (for radio frequency).

We also noted earlier that short wave receivers required a very narrow pass band, or high selectivity. However, very selective sets may tend to filter out the higher audio frequencies from the detected signal, making music sound "boomy" and voices hard to understand. If there happens to be no stations immediately adjacent to the one being received, it is desirable to be able to reduce the selectivity somewhat. This is usually done, in sets so equipped, with either a continuously



variable control or with buttons marked "wide" and "narrow". The former is a little more versatile. In less expensive sets, selectivity may be improved with a built in *Q Multiplier*, which can be used either to narrow the pass band of the receiver or to cancel, or "null" out an adjacent station. Q Multipliers, however, can be a bit tricky to use and may take a bit of getting used to.

Another control, affecting both sensitivity and selectivity, is the *Preselector*. This is a RF amplifier which can be tuned independently of the main receiver. In a typical short wave receiver, the preselector would probably need returning about every quarter to a half a megahertz of band space. This device serves primarily to boost the level of weak signals and to knock out sources of interferance outside the band of interest. It can also be used to reduce the amplitude of adjacent interfering stations by adjusting the tuning until the edge of the preselector's pass band rests on the interfering signal and begins to cause it to drop off.

Some higher quality sets will have, in addition to or instead of the preselector, a knob marked *antenna tuner*. This device may behave in a manner similar to a preselector, but its function is to match the antenna to the input of the receiver, so that the maximum signal is transfered to the set (there is an amplification as such).

A good receiver should have a fairly powerful audio amplifier, a watt or two, perhaps with tone controls. There should also be a jack, in which to plug in a set of headphones. Headphones generally give a higher degree of intelligibility to weak signals, as well as permitting you to listen to the set without disturbing anyone. Some sets also have an audio peak limiter to keep your eardrums from being battered around by sudden loud noises; a handy feature.

Many sets also employ a device called *ANL*, or Automatic Noise Limiter. This is a circuit which clips the peaks off "impulse" type noise, such as electric motor interference or lightning bursts. The better sets use *ANG*, or Automatic Noise Gate, which is somewhat more effective, removing the whole noise pulse, not just the top. In either case, though, the noise reduction circuitry should be able to be switched out when not required — it may cause distortion in loud clear signals.

A good receiver should have an *"S" meter*, which provides a relative indication of the strength of the signal being received. It should be lighted, and large enough to be easily readable. The "S" meter also acts as a tuning indicator; the station is properly tuned in at the maximum "S" reading.

Many sets have provision to run on batteries, either internal "D" cells or an external supply. In this case, there is often provision to use the "S" meter as a battery indicator.

Receivers often incorporate crystal (abbreviated *XTAL*) calibrators into their designs. This is a circuit which allows you to inject a signal of known (and precisely controlled) frequency into the front end of the set to make sure that the dial reading is correct. Usually, the calibrator oscillates at 100 kilohertz and its harmonics will be heard every 100 kilohertz along the dial. Some calibrators offer 25 kilohertz markers as well.

Take care, when buying a receiver, that the calibrator is not included in order to compensate for a poorly designed dial mechanism. In some receivers, the dial must be re-calibrated every time you switch bands, and it gets to be very tedious at times.

Most short wave broadcast transmissions are broadcast in AM (amplitude modulation) just like conventional AM broadcast band signals. A few, however, use what is called *SSB*, or Single Side Band. Furthermore, if you intend to plumb the depths beyond the short wave broadcast band, many amateurs, marine, aircraft and utility concerns use SSB. An SSB signal, when received and detected in the conventional manner, sounds like Donald Duck talking with marbles in his mouth.

Receivers capable of making sense of SSB are usually equipped with a control marked "AM", "LSB" and "USB". The latter two designations stand for Lower Side Band and Upper Side Band, respectively, of which an SSB signal can be either. An RF gain control is necessary for SSB reception; in this mode the Audio amplifier is usually left at a high setting and the volume is controlled with the RF knob. A device called a *Clarifier* is also useful, though not essential, in SSB reception. This is a fine tuning control: SSB signals must be very precisely tuned in to be intelligible.

Note: When reference is made to 'AM' signals this means — in the context of this article — signals transmitted on the AM (Medium Wave) band. Short-wave broadcast signals are, of course, also amplitude modulated.

Physically, receivers should be of a good, solid design, in a metal case. There are good portable sets, (like the Sony 340), but most are table top models, some have "ears" for mounting in a 19" rack. The controls should have a smooth action, and tuning mechanisms should be accurately adjustable without any backlash or "jitter". There must, of course, be provision to connect an external antenna and ground: the little whip antennas provided with some sets are all but useless for serious listening.

TABLE I
THE SHORT WAVE BROADCAST BANDS

Short wave broadcast bands are usually designated in terms of wavelengths as opposed to frequencies. (Wavelength is obtained by deviding frequency (in kilohertz) into 300,000.00.) The short wave bands are given here with their wavelength designations and their approximate frequency ranges. In actuality, there may be a few broadcasters in the one hundred kilohertz directly above and below these bands as well.

120 Meter Band, 2.3-2.5 megahertz
90 Meter Band, 3.2-3.4 megahertz
75 Meter Band, 3.8-4.0 meghertz
60 Meter Band, 4.5-5.0 megahertz
49 Meter Band, 5.7-6.3 megahertz
41 Meter Band, 7.0-7.5 megahertz
31 Meter Band, 9.5-10.0 megahertz
25 Meter Band, 11.5-12.0 megahertz
19 Meter Band, 15.0-15.5 megahertz
16 Meter Band, 17.5-18.0 megahertz
13 Meter Band, 21.5-22.0 megahertz

ANTENNAS

Antennas are probably the biggest mystery in radio. There is a "perfect" design for every day of the year, pages of theoretical documentation for each and armies of hearty souls who will swear by them.

A brief discussion of antenna fundamentals and design basics would probably fill this magazine. Each design involves a host of trade offs in size, weight, cost, directional response, frequency response, gain, signal to noise ratio, and so forth.

If you insist on selecting your antenna using proper scientific principles and engineering practices, your local library will probably be able to supply you with a few mercilessly thick volumes on the subject.

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*Summary of survey results on request

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Fortunately, there is an easier way to erect an antenna. All that is really required for short wave listening is a big piece of metal hanging in the air and not connected to ground. Fifty or a hundred feet of wire strung between two trees with a lead in running to the antenna terminal of the receiver will serve admirably. At a pinch, a long piece of lamp cord thrown over the roof will do. If your dwelling happens to be equipped with a metal eavestrough that is not grounded (check this with an ohm meter between the eavestrough and a cold water pipe), you have a built-in receiving antenna. A fence made of wooden fence posts and single strands of wire which do not come in contact with the earth or any vegetation will work: simply scrape the rust off the highest strand and connect a lead in. Apartment dwellers have been known to tape a long strip of aluminum foil to a wall, preferably one which faces onto the outside, and connect a lead in to it with an alligator clip, and obtain pretty good results. If you are really desperate, a wire hooked to the finger stop of a telephone might work.

The only thing not to try, though a lot of people do, is hooking your radio up to the cable TV line or TV aerial. Not only will you not receive anything, but you may also distrupt the signal for anything else connected to that line.

The last thing to remember about antennas is that they only work properly if your radio is grounded. Sometimes this is taken care of by the third wire on the power plug, but for best results it is advisable to run an external ground line from the terminal on the back of your receiver to a good earth ground such as a cold water pipe, steam radiator, return air duct, or metal electrical conduit.

With all of the lengthy discussion presented here about the care and feeding of the equipment required to receive short wave radio transmissions, the uninitiated might begin to wonder if DX (for Long Distance) listening consists solely of the acquisition of an increasingly large array of knobs and buttons. However, with your equipment (finally) set up and working, you are ready to begin to reap the real rewards of short wave: the world at the twist of a dial.

INTROS, EXTROS & QSLs

The programming commonly heard on short wave is quite unlike that which you are probably familiar with. For one thing, it is what is called "block programming". This means that the broadcast day of a typical short wave station is comprised of a number of shows, or blocks of programming, with each one being of a pre-determined length and each in a different language. The times that these shows go on the air each day is rigidly scheduled and highly organized, and the transmissions carrying them are usually directed at a part of the world in which there is a large percentage of people speaking the language of the show. They are, as well, usually scheduled to reach that area either during mid-morning or, more often, during the evening.

Most of the broadcasters have several English language shows daily. Some, like the BBC World Service, broadcast in English almost continuously. Most short wave transmissions can be heard on several frequencies at the same time, allowing the listener to choose the best one for his local atmospheric conditions.

The blocks of programming are usually fifteen, twenty, thirty or fifty five minutes in length. All blocks from one station are proceeded by the same unique musical introduction signal. This consists of a brief passage of music, often the national anthem of the broadcasting nation, played repeatedly. Introduction signals, or *intros*, run for five or ten minutes before the show is to begin. In some cases they are accompanied by an announcer's voice informing listeners of the station's name and the language of the transmission.

Since each station's introduction signal is distinct intros are a very good for finding the programs you are interested in, especially since, having begun their programs, most stations sound very much alike. After a while, you will be able to recognize the melodies and associate them with their respective stations.

When the intro is finished, most stations list their frequencies. It is a good idea to write these down if you do not already have them, as reception in the future might prove to be better on one of them rather than the one you are presently using.

Immediately after the station identifies itself and lists its frequencies, it will usually present a program of world news and then a program of music or informative features, depending upon the individual broadcaster. The music can range from classical to jazz, to folk to some extremely good rock. The features encompass Radio Albania expounding upon the national steel production and the BBC's "Anguish of the Airwaves", a weekly comedy spot which has been known to turn strong men into gibbering idiots for at least an hour afterwards.

If you receive a rare station and would like to have something substantial to show for the contact, you can write the station and request what is called a *QSL card*. This is simply a post card which acknowledges your reception. When requesting a QSL card, you should include in your letter your location, the time of day (in GMT: see below) at which you received the station, a brief transcript of what you heard in order to confirm that you did not mistake another broadcaster for the station in question, and the quality of the signal you picked up. You should also mention the type of receiver used, and what type of antenna set up was connected to it. The engineers at the broadcasting station will be able to use this information to evaluate the effectiveness of their equipment.

When requesting a QSL card, you might also ask for a schedule of the station's broadcasts, which may inform you of a time or frequency which will make reception of its transmissions easier in your area.

When refering to short wave, the time of day is always given in what is called *Greenwich Mean Time*, or GMT, also known as Zulu time. It uses a twenty four hour cock which operates irrespective of time zones. 2400 or 0000 hours is midnight in Greenwich, England. If you are unsure what the GMT is at your location, you can tune in radio station WWV on 5.00, 10.00 or 15.00 megahertz or radio station CHU on 3330.00, 7335.00 or 14,670.00 kilohertz. These transmissions run twenty four hours a day and consist of time signals, with audable ticks or beeps every second and a voice announcement of exact time on the minute. WWV also provides atmospheric and meteorological information between some of the minute announcements; complete data on them can be obtained by writing the station. The address is given on the hour.

Because short wave transmissions are so rigidly scheduled, a listing of who is broadcasting what and when, a sort of TV guide of the airwaves, can be extremely useful. In fact, there are several of these around. The stations are normally listed by time of day, and are also rated in terms of reception quality. There is also a book published by Billboard, called the "World Radio and Television Handbook", which lists every short wave broadcast transmission in the world. Although it is fairly lengthy to plough through just for casual listening, it is indispensable for serious DX.

Having covered the basic essentials of short wave listening, all you need now are some stations to tune into.

THE SHORT WAVE DAY

- Beginning at **1315 GMT** in the morning, you can hear the Swiss Broadcasting Corporation, from Berne, Switzerland on 15.14 megahertz. The show is one half hour in length and contains world news and features about the country. The intro signal sounds like a music box.
- At **1400 GMT** Radio Stockholm, Sweden, begins its English Language service on 15.305 megahertz. This show is also thirty minutes long. The intro sounds like small bells, with a female voice announcing the station name in a number of languages.
- At **1515** there is a fifteen minute transmission of news from Athens, Greece. It has no intro signal, going directly from a program in another language into English. The exact time that the English language transmission begins may vary by a minute or two from day to day. The frequencies are 11.73, 15.345 and 17.83 megahertz.
- At **1600** BBC does a fifteen minute world news broadcast which should be very easy to receive, as it is relayed, on 9.58 megahertz, via Sackville. It also comes in on 17.84, from Ascension Island.
- At **1600** there is also a program from Radio Norway on 15.175 on Sundays only.
- At **1642** there is a mythical transmission from Radio Nederlands, of Hilversum, Holland. This one comes and goes, but if you do happen to catch it, it will probably be quite clear. The frequencies are 15.19 and 17.775 megahertz. The intro sounds like a carrolon. English programming thereafter may be preceded by five minutes of Dutch.
- **1700** hours is the home of the only English transmission from Radio France International. This program is directed to Africa, but also comes in extremely well in North America. It lasts for about an hour, and contains news, features and music. The intro (which begins at 1700, rather than 1655) is an accordian, playing a tune which sounds faintly nautical. The frequencies are numerous, a few of them being 11.93, 15.20, 15.30 and 17.72 megahertz.
- At **1930,** Baghdad, Iraq can be received, with a half hour program in English.
- At **2000** GMT two mid-east broadcasters are on the air; Jeruselam, Israel on 5.90 and 7.4125 and Tehran, Iran on 9.022. The intro for Israel sounds like a trumpet.
- At **2050** Cuba comes on the air with an hour long transmission in English from Havana. It consists of news and features about Cuba . . . and a little bit of propaganda. The frequencies are 11.865 and 17.75 megahertz.
- At **2100,** Berne, Switzerland returns to the air with another English transmission on 6.165, 9.535 and 9.59 megahertz.
- At **2100,** you can also hear Johannesburg, South Africa, Radio RSA, broadcasting a fifty minute program of news and features on 9.585 and 11.90. The intro is a nylon string guitar with the call of an unpronounceable national bird in the background.
- At **2130,** Sofia, Bulgaria comes in on 9.53 and 9.70.
- **2200** brings the first transmission of the day from Radio Cairo, Egypt, on 9.805. This program, however, is not directed to North America, and on some days may be swamped by an adjacent BBC transmission.
- At **2230,** Israel returns on 9.435 and 9.815.
- At **2230** you can also hear a second transmission from Radio South Africa on the same frequencies as the 2100 broadcast.
- At **2300** the ubiquitous Radio Moscow takes to the air on a multitude of frequencies, 9.80, 12.05, 15.18 and 17.72 to name but a few, with a program of news, views, features and denunciation of certain Western powers.
- At **2300** and for the next three or four hours there after, Radio NHK from Tokyo, Japan can be heard for fifteen minutes on 15.105 megahertz. It is not an easy station to receive, but for some reason it seems to come in better on Mondays. The intro is an Eastern sounding melody played on small bells.
- **0000** (or 2400) hours GMT brings Radio Sofia, Bulgaria, with a fifty five minute show of news and features on 7.115 megahertz.
- **0000** is also the beginning of Radio Peking's transmission schedule, with an hour long show of news, features and quotes from the writings of Chairman Mao, on 11.965, 15.060 and 17.530. Peking also comes in at 0100, 0200 and 0300 with these frequencies. The 0100 and 0300 transmissions also include two other frequencies, 7.12 and 9.78, which are relays, via Tirana, Albania.
- **0000** also brings Radio Luxembourg, on 6.09 megahertz, with about two hours of straight music. This is a fairly difficult station to receive.
- At **0030** you might be able to pick up a pair of Soviet stations, Keiv and Vilnius, on 9.78, 12.05 and 15.18 and on 5.94 and 7.355 respectively.
- At **0040,** Radio HCJB of Quito, Equador begins a six hour English transmission of music, news and religious pieces.
- **0100** seems to be the prime time short wave listening spot. There is Rome, Italy on 9.575, Spain, from Madrid, on 11.88 (the intro here is a melody played on bells, for fifteen minutes before the transmission is to begin), East Germany on 9.73, Radio Prague, Czechoslovakia on 7.345 and Havana, Cuba on 9.685 and 11.725.
- At **0130** there is a twenty minute broadcast from Radio Deutche Welle, of West Germany. The intro is a set of great, hammering bells. DW is relayed all over the globe, and it may, therefore, be receivable on any one of the following frequencies: 6.01, 6.04, 6.075, 6.10, 9.565, 9.59 and 11.685. Radio Deutche Welle maintains relay stations in Malta, Rwanda, Antique Island and Montserrot.
- Tirana, Albania comes in well at **0130** on 7.30 megahertz, and again an hour later.
- At **0200** there is a very clear hour and a half transmission from Radio Cairo on 7.12 and 9.475. The broadcast contains news, features about Egypt and some pleasant Egyptian music.
- At **0230** there is a broadcast from Radio Sri Lanka on 15.425. This is an extremely hard station to receive, as it is often blacked out by a transmission from Moscow on the same frequency.
- At **0300** Budapest, Hungary can be received for an hour on 11.91 megahertz.

This list of short wave broadcasters is by no means complete, but it will get you started. You can add to it yourself just by spinning the dials and seeing what you can pull in. Many of the stations listed here feature programs called DX Digests, which will inform you of other broadcasts which you might be able to pick up. The short wave schedules mentioned earlier will also be of great assistance. Whatever way you do it, though, short wave will bring you a world of listening pleasure.

Use A Scope

We try to talk you into getting an oscilloscope.

EVERYBODY HAS INTERESTS which beckon their thoughts, curiosities which call as they lie half asleep, some things which catch their fancies, finally demanding further investigation. For many of us, it's a fascination for some facet of the field of electronics. Some might already have been drawn into the electronic business, but there are multitudes who have as yet only a few toes in the water, are interested but not quite sure how to get in deep, or very significantly, how to justify it.

We all know (or perhaps are ourselves) photographers, car tinkerers, home handy-persons, all very acceptable activities. But have you ever noticed how electronics types are viewed a bit dubiously by their friends, thought of perhaps as just a little nutty? Who could blame a person then for wondering if this hobby is for him/her and especially whether any money spent in the pursuit of this interest can possibly be justified?

Let's face it, compared to some other pursuits, electronics isn't (necessarily) more expensive, it just has a strange balance of payments, ie, what you need to buy to get you going. But it's worth it! We want to encourage you to think about how you're going to develop your interest, so let's try to help with some philosophy. We'll check out what the electronics enthusiast needs to enjoy him/herself, and compare this to other activities in an effort to get you going.

THE BASICS

What are the tools of the electronics person? The basic tools are very modest, screwdrivers, pliers, soldering iron, wire strippers and a few odds and ends. Fifty dollars and you'd have that about covered. But, and it's a big but, you won't have much fun. You can construct but you can't see what you're doing — electrically that is. Yes, there's really nothing for it, sooner or later you are going to feel you want, absolutely *need* some test equipment. Here's the problem though, many wonder how they can justify the expense of buying something which is a) so exotic and relatively unusual and b) is not even used for construction but just for seeing what you're doing.

Objection (a) is easy to answer. If you're special enough to desire a meter or scope there's nothing exotic about it. Objection (b) is tougher to handle. Look at the Sunday mechanic. His couple of hundred dollars invested in tools is used directly to fix or improve his car. And the photographer, his major investment is in the basic picture making tool, the camera. But the poor beginning electronics enthusiast with only a soldering iron is about as well equipped as a photographer whose camera has no viewfinder.

What it all comes down to is that it's time to *stop* regarding meters and scopes as costly accessories, and start looking upon them as time saving, enjoyment enhancing, educational essentials.

What do you really want to do? Probably you've got the idea you'd like to try whipping up a circuit, perhaps one of our designs, or from somewhere else. But what happens? (and how many of us have had this happen?) You get the project together and it DOESN'T WORK. You check it through by eye but don't come up with any wiring mistakes. Are the ICs burned out, transistors on the fritz? Short circuit somewhere? Are the terminals on that pot really the way you guessed? Is that signal getting through?

So after a few years you end up with a big box of dead projects, and your family and friends tolerate your failures. (Which makes your expenditures in electronics even more difficult). How can you financially justify a meter or multihundred dollar scope to fix a $30.00 project? You can't! Why not just get it (them) for your own satisfaction — *that's* justifiable. As we said they are *essentials* not accessories.

A satisfied electronics enthusiast sees his hobby as observing interesting things on his scope, enabling him to nurse his projects to life, rather than simply building projects from exact designs and being lucky enough to get them working first time.

THE BENEFITS

What you get with a set of test equipment is of course the pleasure of seeing what you're doing and getting your projects working and adjusted properly. But there are other benefits too. With test equipment you can fearlessly repair radios, TVs, auto electrical systems, appliances, etc, etc. If you have not at present the knowledge, there's nothing better than a meter and scope to help you learn, with a diagram and perhaps a good book. Fixing is fun! *Anything* can be returned to working order — the challenge is in doing it.

TESTING

All testing is done to check that a circuit is working properly, to adjust it so that it does, or to find out why it doesn't. If a problem exists you proceed by observing a particular point in the circuit where the defect is noticeable.

Based on how this point misbehaves compared to proper operation you formulate a theory as to what could cause this mis-operation. Then you devise a test to see if you are correct, perhaps check another location in the circuit, etc. If the result is positive continue along the lines of your theory. If not, modify your theory.

Each test is an observation, to be compared with what you expect to find. Thus you need instruments that let you observe, and a means of establishing expected conditions. Many circuits need no external signals to provide their own expected conditions, such as say a light flasher, while a radio uses easily available radio waves as input. Other equipment, for example an audio amp, requires an input signal to operate fully and thus be tested fully.

From the range of circuits one encounters, it appears most logical to acquire the basic observational equipment first, and leave the signal generators (input condition establishers) until later. Usually a make-do signal source can be rigged up in any case.

OBSERVATIONAL EQUIPMENT

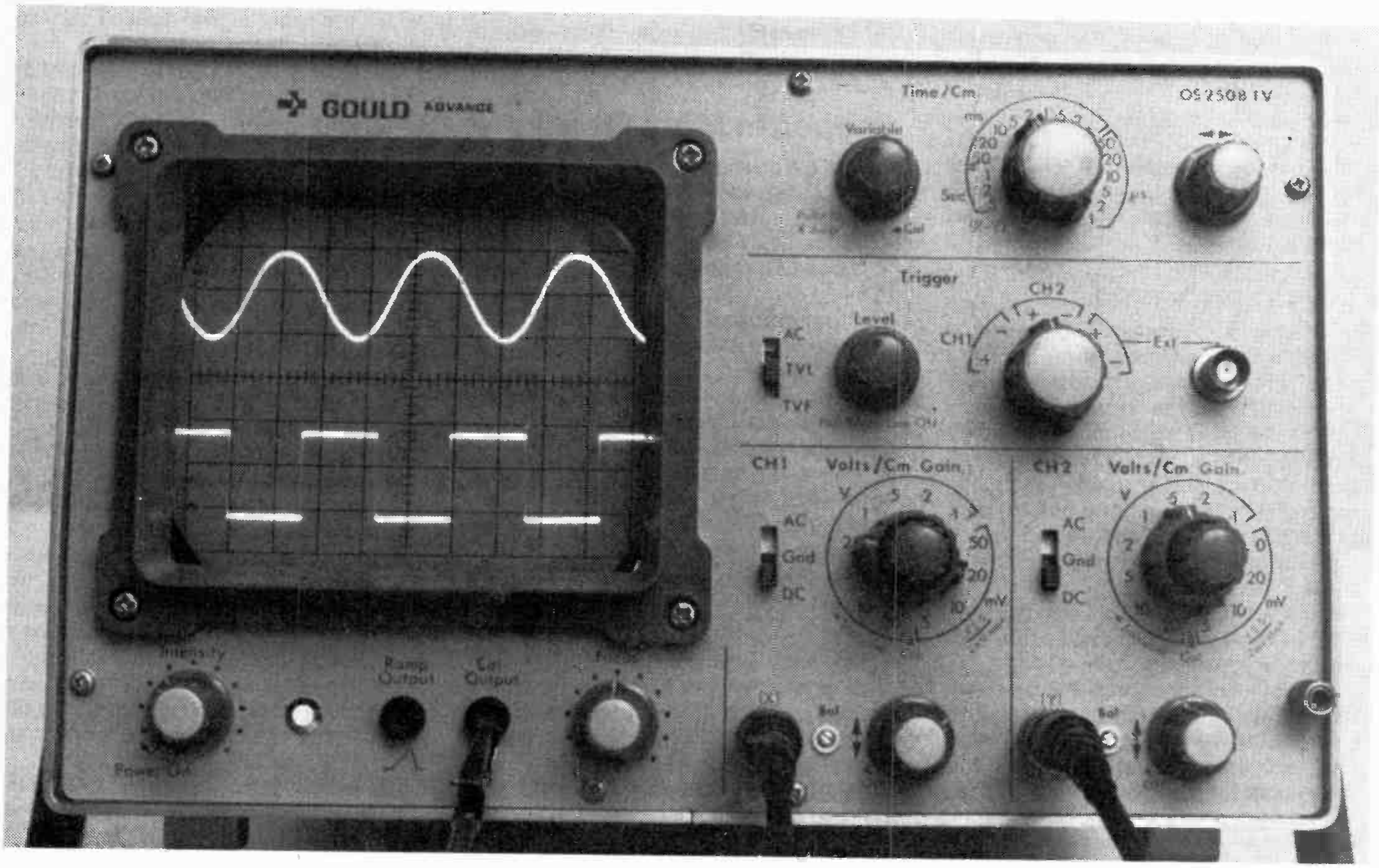
We are of course back to the multimeter and oscilloscope, plus a few others. The most important factors which pertain to this equipment is that it must not *significantly* affect circuit operation, and it must of course give you a reasonably good picture of what's going on.

The observing machine should provide you with the information you need. This will very much determine what kind of test equipment you purchase in each class.

MULTIMETERS

You are quite likely to be faced with a selection of multimeters from the $30.00 analog (needle) meter to $200.00 digital meters — how do you choose? You ask — what instrument best reflects my projected needs? After basic considerations such as ranges, portability, etc, have narrowed the field, you end up with two major factors versus dollars. The first factor is input impedance. Without any amplifying electronics in an analog VOM, the input impedance is typically 10k per volt, satisfactory for a large number of applications, but not high enough to just stick your probe anywhere without a care. With buffering electronics in either an analog or digital meter, impedance is usually a satisfactory straight 10M ohm. The other factor, accuracy and resolution, usually comes proportional to dollars. You probably need far less than you think. In fact, as a guess, probably 90% of all measurements you are likely to make need no better than 10% accuracy! Look at it this way — most circuits are designed to work with 10% tolerance components, even the AC line voltage may vary from 110V to 125V. Usually if a voltage is within 10% nothing much is wrong. There are of course exceptions such as TTL power supplies. But the point is that to buy .01% accuracy is probably not useful, 1% is quite adequate. In analog meters (which have been in use for years without complaint) just how accurately can you read it anyhow? Figure it out as a percentage!

The Gould Advance OS250B TV. Actual size is 29cm x 18cm x 42cm deep. Weight approximately 7.5Kg (17 lbs.). BNC connectors are used for X, Y and trigger inputs, while banana plugs connect to calibrate and ramp outputs. On the back are sockets for Z-axis modulation, AC power, and a switch for 120/240V selection.



For more information on digital meters, see our survey in last month's issue.

OSCILLOSCOPE

Have you ever been out in the snow on a bright day and been blinded by the light? What a feeling of relief you experience when you put on a pair of sunglasses. That's the same feeling you get with your first oscilliscope. You can SEE.

What do you see? Most obviously you can see the shape of the waveform, but the oscilloscope is also an important measuring instrument. It is capable of reading out with reasonable accuracy and resolution (5%) on both amplitude and time axes. What you get as price increases are features which relate to convenience of use, and which increase the accuracy and range of measurement. We study these features in more detail below.

MORE METERS?

How about frequency, capacitance and inductance, do you need to measure them? Probably not, and if you do you can measure them all on the scope.

In the case of frequency you can use the time scale of a triggered scope to find this to probably 2 to 5% accuracy, often close enough. Capacitance and inductance can both be measured using a signal generator and series resistance to figure out the impedance of the component, from which actual L or C can be calculated. If you have to measure alot of F, L, or C or need great accuracy *then* get the appropriate meter.

LOGIC PROBES?

There are a variety of logic probes about with one, four, many inputs. A wide range of designs tells you such information as the logic state of one point, the logic state of many points simultaneously, the logic state of one point for the last n clock cycles, the logic state of all pins of a particular IC etc. It's best to wait and see what your specific needs are before buying one of these. You *can* do the job with a scope (which will also tell you if you have any "½" logic states but logic probes are designed to ease the job.

In fact, some troubles that are likely to be encountered, especially in microcomputers, are much better handled with an initial poke about with the scope, followed by a custom circuit employing handfulls of LEDs, some CMOS latches and a breadboard!

SIGNAL SOURCES?

A basic sine, square, triangle wave generator can be invaluable as a source of known signals. You'll probably want to be able to set frequency, amplitude and DC offset voltage easily and accurately, and have a sufficient range. Beyond that signal generators start getting specialized.

At a pinch you can build for about $1 a CMOS oscillator to give a square wave output from 0 to 15V, 1Hz to 2MHz. This will get you by in many situations, audio, rf, digital, and very cheaply. You need a suitable scope to "calibrate" it.

In fact there are many simple circuits that will generate a signal for you. The key is that a "signal generator" is really only useful if you *know* what it's generating. This either costs you money to buy a commercial generator, or means you must have a scope to observe the signal from your experimental generator. It seems more and more that the scope is the essential instrument! It is.

Specialized signal generators include audio types capable of sweeping up and down the audio spectrum (test hi-fi equipment) RF generators for radio and TV, picture pattern and colour pattern generators for TV and so forth. They generally make easier things that would otherwise be possible but tedious without.

Scopes In More Detail

Let's take a closer look at the features available on today's oscilloscopes, with particular reference to the Gould-Advance OS245A and OS250B.

These two models we feel represent the kind of general purpose instruments that would satisfy the enthusiast for many years. They are of course also in widespread use as service instruments. As a starting reference point, the 245 costs about $500 and the 250 around $700. The 250 is the more "luxurious" model, and is somewhat larger with a 5 inch rather than 4 inch CRT.

Next month we will survey the makes and models of scopes available in Canada.

INPUT IMPEDANCE

As with multimeters the input impedance is important, but most scopes are satisfactory. In our example scopes this is 1M ohm resistive and a capacitive load of 28pF. Special scope probes may also be obtained for various tasks to reduce even further the effects of loading.

TRIGGERING

Probably the most differentiating feature between scopes is the means used to stablize the display. As the electron beam scans across the screen it is deflected up and down by the signal being monitored.

When the end of the trace is reached the electron beam is quickly returned to the start position and the trace is again started. The beam is of course blanked during the "return" sweep.

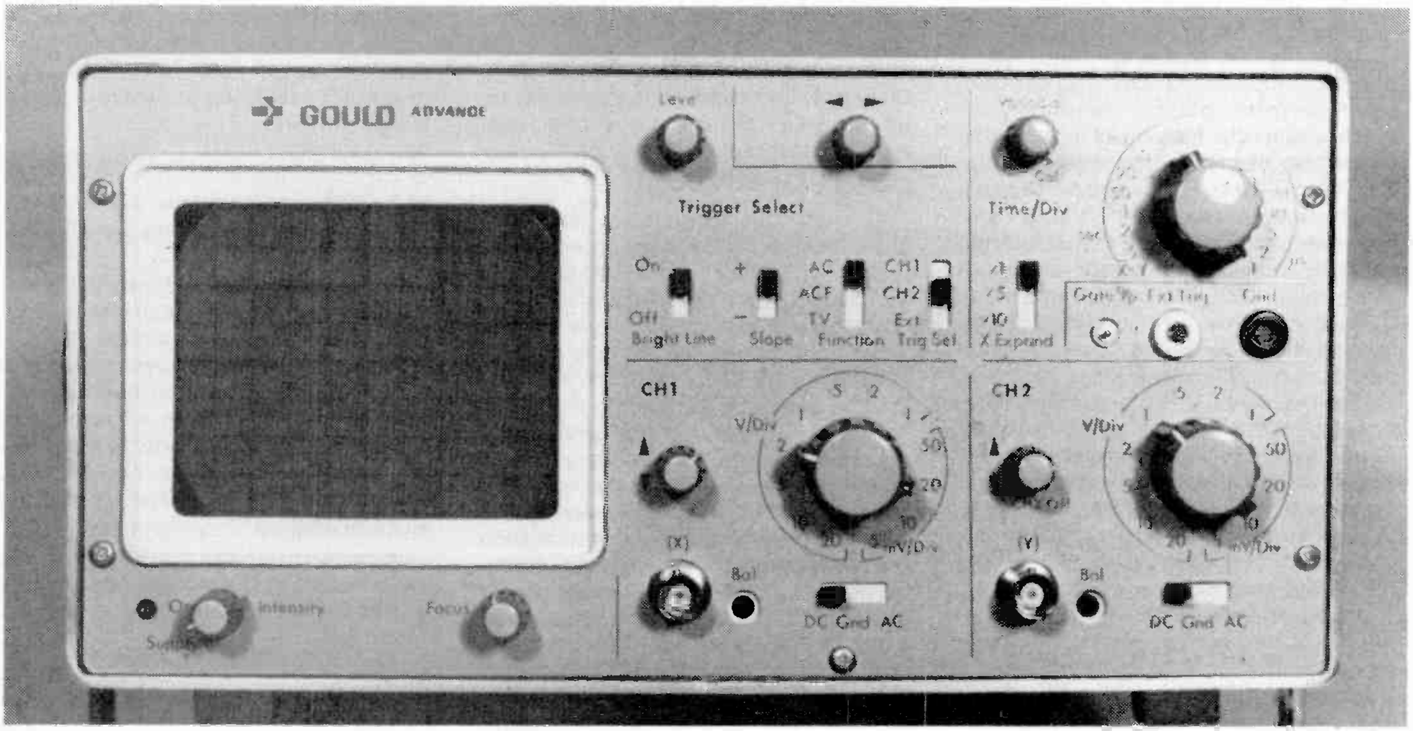
This process happens so many times a second that the eye cannot see individual traces. With a repetitive input signal, it is desired that each subsequent trace draws exactly over the previous trace, to present the eye with a stationary picture. If this does not occur the waveform will appear to drift sideways, or worse yet may be completely unobservable. So how do you coordinate the sweep with the input signal?

The first method would be to have the sweep oscillator running freely, and hand tune it to give a stable display, a very tedious approach. The second method is called "synchronization", whereby the input signal "influences" the sweep frequency approximately, then the sweep oscillator "locks on" to the input to provide a stable display, while the input signal doesn't vary too much in frequency. The main drawbacks of synchronized sweep are that it only locks over a limited range of frequency (you couldn't observe clearly the signal from an audio sweep signal generator for instance), and you have no means of figuring out the time scaling directly from the scope. If you want to see what the time scale is (say how many cm/ms the beam covers) you must add to the input a reference oscillator signal and work it out from that.

"Triggered" sweep solves most of the problems. The sweep is not generated by an oscillator, but instead by a constant slope ramp generator. At first the ramp is at its initial value, holding the beam off to the left of the screen. Then a particular condition occurs in the input signal, (perhaps it exceeds a certain voltage) which triggers the ramp generator, sweeping the beam across the screen at a constant (known) rate, which you have selected.

At the end of the trace the beam returns and the trigger circuitry awaits a recurrence of the particular condition, to start the beam off again.

Because the particular condition occurs at the same point in the wave each time, each successive trace will be



The Gould Advance OS245A, shown the same scale as the 250, is 27cm x 13.2cm x 31.7cm deep and weighs 5Kg (11 lbs.). Like the 250 it has a handle which flips beneath it to act as a support for convenient viewing.

exactly "on top of" the last one, yielding a stationary picture. In addition, since the sweep rate is known the time scale can be read directly from the scope. If the signal frequency should vary, the picture will appear to compress or expand horizontally but still be perfectly visible.

The particular triggering condition may be an adjustable positive or negative voltage, or slope, and may also be automatically taken care of by the scope.

SWEEP SPEED AND DELAY

Having already established the virtues of triggered sweep with it's ability to allow a direct read-off on the horizontal time scale, what other factors are there?

Our example scopes both have calibrated sweep speeds in "1 — 2 — 5" steps from 1 us/cm to .5 s/cm. In addition there is an "expansion" mode available, which will "blow up" the horizontal scale by 5 (245 only) or 10 (both) times. Effectively the horizontal sweep speed extends up to .1 us/cm. This expansion mode gets around another problem, discussed below.

The sweep speed is further adjustable between calibrated speeds for occasions where you want to fit a wave form into a particular number of squares on the graticule, such as for easy measuring of duty cycle.

This feature is also useful in a case where one has say a repeating 8 pulse sequence, and the triggering mechanism cannot distinguish between pulses. One merely adjusts the sweep speed to fit 8 pulses on the display, then the trigger acts on the 9th (first repeated) pulse.

A further problem is encountered when trying to display a waveform such as relatively narrow but widely spaced pulses in reasonable detail.

An example would be a 1 us pulse recurring every 20 us. The trouble is that the trigger will operate on the pulse, but by the time the sweep actually starts some of the 1 us pulse will have been lost. What would be ideal is a trigger that happened before the event, an impossibility of course.

Various fancy schemes have been tried to delay the signal to the display with respect to the trigger. The least expensive solution however, is to use the expansion feature. In this case you reduce the sweep speed to allow the display of a second complete pulse with normal sweep width. Then expand to ten times. (This means that the sweep *is* actually ten times the width of the screen, but only a portion is visible). Adjust the horizontal positioning control to locate the pulse as desired. Effectively you are using ten times the sweep speed, and triggering using a preceding pulse and adjustable time delay.

In fact, some scopes incorporate an adjustable time delay on the trigger for exactly this reason, and then they do not need an expansion mode. This is an improvement because the expansion mode display sometimes tends to be dimmer and less well focussed.

In the case of the Gould scopes, triggering occurs on your choice of a particular positive or negative slope (on either input channel). There is an independent trigger input in addition to allow triggering from a signal other than those displayed. On the 250 the trigger level is adjustable. On the 245 and 250BTV models there are special TV settings for even easier triggering on the horizontal and vertical TV signals often encountered.

Both scopes have a "bright line" feature, which draws a bright line at the zero input level when there is no or very little input signal. This stops the confusion which results from not having a trace when the input signal is too low to trigger the sweep itself.

Particularly with digital signals, less so with audio or TV signals, you are likely to find the triggered scope more useful than the older synchronized type.

DUAL TRACE

Naturally two traces are better than one, but not just because you can see twice as many traces. The important extra capability this gives you is the ability to see the time relationship between two (or even three) waveforms. Since both traces are triggered from the same signal, points on both waves at the same horizontal position are occuring at the same time. This is very useful for understanding causes and effects that may be only tens of nano seconds apart.

The dual trace also of course has the convenience of displaying two signals at once such as input and output to an amplifier, perhaps to see how distortion varies with input signal level.

There are three methods of generating the two traces. The first, most obvious and most expensive way is to have two electron guns, with individual deflection plates for each beam, this is known as "dual beam". The second method is to have a single beam draw one trace, then the other, "alternating" between the two, but drawing a complete trace each time. In the third method the beam draws both traces in one sweep by alternating very quickly between traces. In this "chopped" mode the beam may draw say .1mm of the top trace, then .1mm of the bottom one, then back to the top, etc.

Most moderate price dual trace scopes give you a choice of the alternate and chopped modes (you need both to cover all sweep rates) or, as these Gould scopes do, automatically select the mode for you.

INPUT CHANNELS

The controls associated with each input channel allow you to vertically position the trace upon the screen, and to adjust the amplification (or attenuation). In the case of the 245, the range extends (again in calibrated "1-2-5" steps) from 5mV/cm to 20V/cm. For the 250 the basic ranges are the same, plus a "2.5 times" switch, and also a control to vary the gain between switch positions. The last of these is useful when initially adjusting a waveform to appear an exact number of units high to see percentage changes in amplitude.

There is usually a switch which provides you with AC or DC coupled input, or shorts the input (but not the probe!) to ground to position the trace. The low frequency roll-off starts at 2Hz for the AC input of the two Gould scopes.

At the high frequency end, the important characteristics are the "bandwidth" and the "rise time". The bandwidth is defined as that frequency at which a sine wave display would be reduced in amplitude by 3dB (.707) from its lower frequency size. The rise time is the time between 10% and 90% points on a square wave of a specified size (usually 75% of the scope graticule) assuming a "perfect" square wave input. The rise time is approximately equal to the reciprocal of 2.8 times the frequency, ie: TR = 1/(2.8 x BW), in seconds and hertz. Thus, these two factors are not always both quoted.

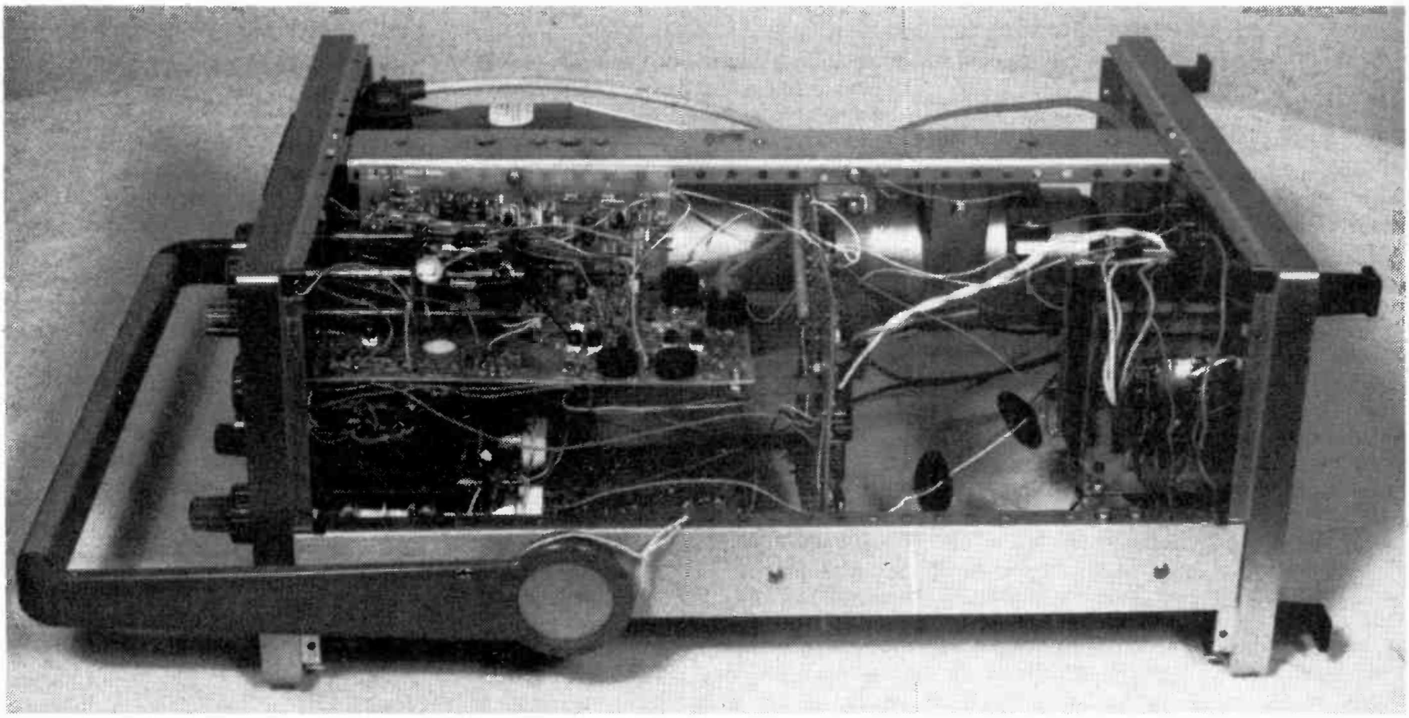
In the case of the 245 the bandwidth is 10MHz giving a rise time of about 35ns. With the maximum sweep rate of 100ns/cm, a perfect square wave input displayed with 6cm height will appear with edges which take about 3.5mm (horizontally) from bottom to top. From this kind of information one can judge whether a particular scope will provide a useful display.

In order to check the calibration of the vertical amps a calibrated signal generator is often provided.

An additional capability with many scopes (not just dual trace models) is the X versus Y mode, where the vertical channel operates as before, but the second input drives the horizontal sweep rather than the normal sweep oscillator. This capability is used for comparing two signals ("lissajous" figures) and it's also useful for using the scope as a curve tracer for semiconductors etc.

While X versus Y is available on many

Inside the case of the 250, a frame supports three PCBs containing most of the circuitry. The power supply is mounted on the rear panel. The carrying/support handle is attached directly to the frame.



single trace scopes, the horizontal channel usually has limited versatility.

Z AXIS

Most oscilloscopes have a facility for modulating the brightness of the trace, which is useful for showing markers, and can even be used for slow scan TV.

LAST DETAILS

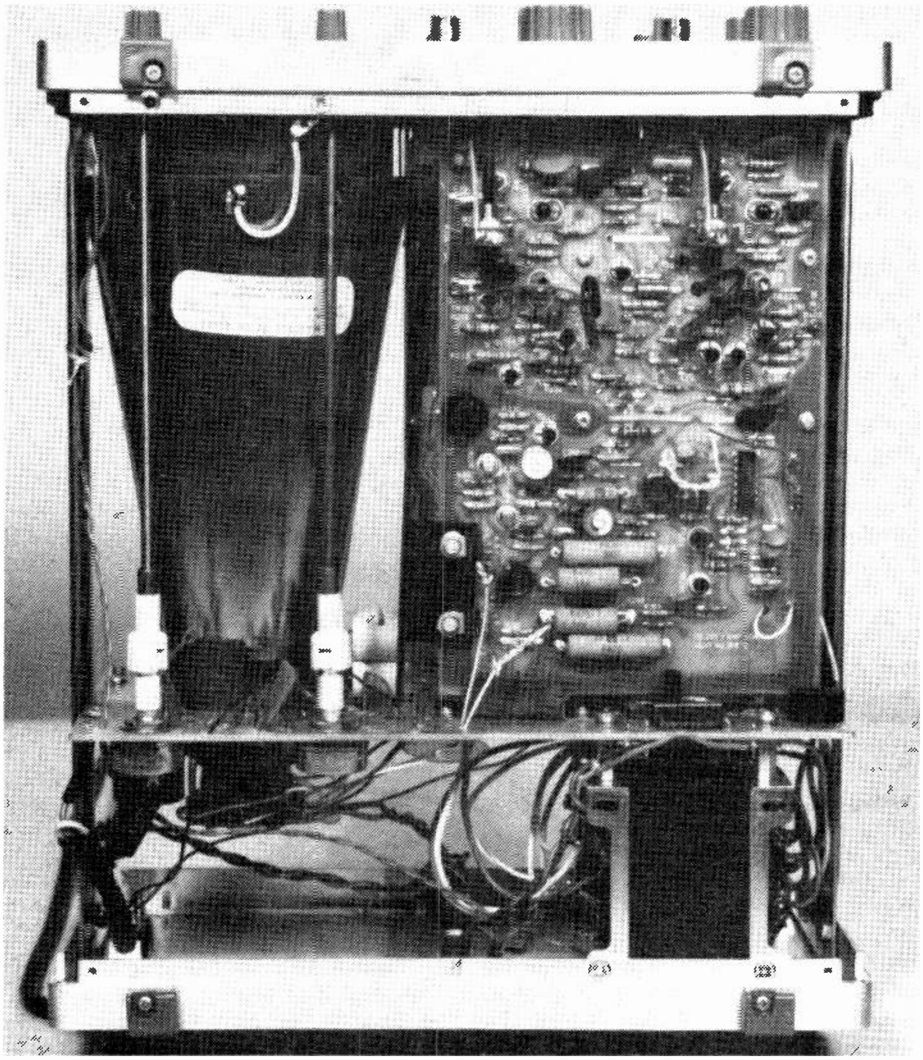
The last few factors relating to choice of scopes are those such as battery power (somewhat rare), service support, choice of connectors, ruggedness of case and so forth.

So how about enjoying yourself. A scope can be a very worthwhile investment, for education, business or entertainment.

Next month we will review all the "not-too-expensive" scopes we know about that are available in Canada.

The particular scopes used as examples in this article are manufactured by Gould-Advance. Information and the instruments themselves are available through Allan Crawford Associates at:
Toronto: 6503 Northam Drive, Mississauga (416) 678-1500, Calgary: 2280-39th Ave., N.E. Calgary (403) 276-9658, Montreal: 1330 Marie Victorian Blvd., Longueuil (514) 670-1212.

Vancouver: 3795 William St., Burnaby (604) 980-4831.

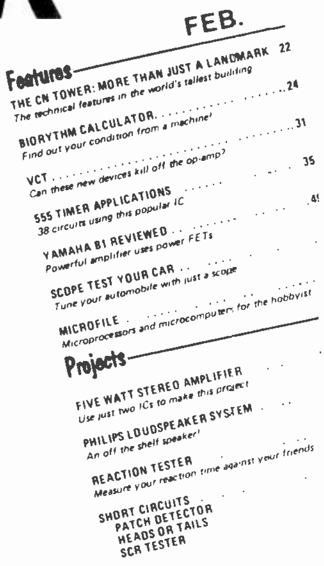


The 245's innards are of much the same design as the 250, but slightly less complex and more compact, using a smaller CRT.

LOOK

Since we started publishing ETI in Canada the circulation growth has been dramatic. That means that there's thousands of our readers who have missed some terrific issues.

1977



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An off the shelf speaker!

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SHORT CIRCUITS
PATCH DETECTOR
HEADS OR TAILS
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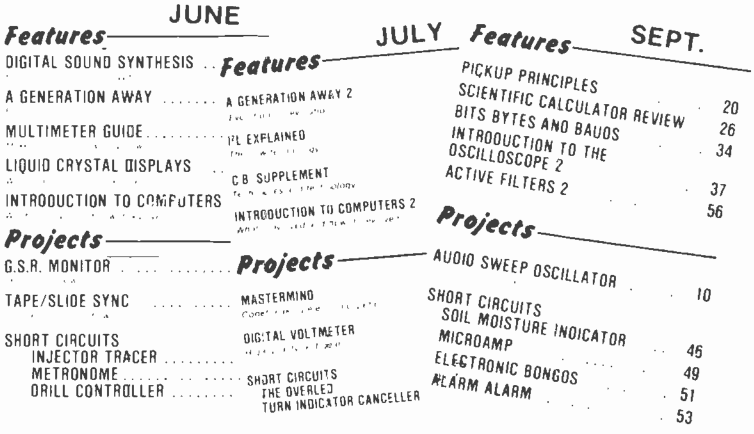

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The chart shows just the main features and projects in the various issues we have available, but for some months we are selling out fast so you'd better hurry and get your copies now. Just send us $2 (not cash) for each issue you require, to ETI BACK-NUMBERS, Unit 6, 25 Overlea Blvd., Toronto, Ontario M4H 1B1.

Shortwave World

Following the success of our Audio Today column ETI now gives you Shortwave World. Through these columns ETI will keep readers in touch with developments in these areas.

We are currently setting up another new column, in response to the analysis of a questionnaire sent to a sample of our readers earlier this year. This column will cater for readers who service TV sets and other consumer electronic equipment.

And we have even more plans for regular columns — but at the moment these have to remain secret.

The first installment of a new column in ETI. John Garner introduces himself and Short Wave Listening.

IN THE LATE 1930's my father came home one evening with a multi-band console radio. Even though I was only a youngster at the time, I was quite intrigued to hear radio programs from many far away places. Many of these programs were in foreign languages and I had no idea of what they were saying but I still found them interesting to listen to. We followed the progress of the Second World War through the news service of the BBC from London England.

Even though the shortwave bands in those days were not nearly so crowded as they are today, listening to stations was quite difficult, except for a few of the major broadcasters. This is because the quality of the average home radio left a lot to be desired.

My interest in short wave listening as a hobby started about six years ago with the purchase of a multi-band portable radio. And I've been tuning into the short wave bands quite regularly ever since. I was fascinated by what I could hear from around the world and soon found the portable was not adequate for all my listening, so I purchased a better communications receiver. I now do my listening on a Yaesu Musen FRG-7 receiver.

Soon after buying that first portable I realized that owning a radio was not enough to enjoy the hobby — I needed information. I needed times and frequencies where I could hear the broadcasts. I found out by listening that most stations welcomed reception reports and comments on their programs from listeners. In return the stations would send out attractive QSL cards verifying reception, as well as transmission schedules and sometimes other interesting items, such as pennants, tourist information about their countries, booklets, etc.

Eventually I learned that there were a number of clubs devoted to the hobby of short wave listening and I became a member of one of these. The monthly club bulletins contain a wealth of information for the SWL (Short Wave Listener) — such as station schedules, loggings of stations heard by other members listing times and frequencies, listings of QSL cards received by members, technical articles, and much more. I now belong to a number of SWL clubs and in the spring of 1977, along with two other local listeners, I helped organize the Canadian S-W-L International.

WHAT IS AN SWL?

This is a question often asked. Many seem to think that we are amateur radio operators (hams). When told that we strictly listen to short wave radio some wonder why we don't get a ham licence so that we can also transmit. The answer is quite simple — we just enjoy listening to the many facets of short wave radio. On these bands here is so much of interest to be heard: news, direct from the countries where the news is being made; commentaries on the news with differing viewpoints from various countries; programs of history and geography of countries around the world; language lessons; and most stations devote some time to the music of their countries. Many evenings I have stayed up late listening to the different music types of the various South American countries. The programs may be broadcast in the Spanish language but music is a language all of its own to be enjoyed by all nationalities. Before turning in, I often tune into Radio Tahiti to listen to their beautiful island sounds. A great way to end the day!

John Garner listening on Short Wave.

Broadcasting as we know it to-day, began about 1920 and soon there were many interested listeners. The oldest radio listeners club was formed over fifty years ago by a newspaper in New Jersey, The Newark News. World War Two brought about an increase in short wave listening as people around the world tuned in to hear the latest developments of the war. After the war many Europeans emmigrated, especially to North America, and these people began listening to short wave to hear the news and cultural programs from their native lands in their own languages.

Today's modern technology has brought about a great increase of interest in the hobby since receivers are now being manufactured to high standards of quality and are being sold at very reasonable prices.

Besides these international broadcasters, shortwave radio is also used in many countries with large sparsely populated areas. These domestic services can reach all parts of the country and many of these may be heard in other parts of the world by short wave listeners. Many of these transmissions are very interesting since they are broadcasting to their own people and not trying to impress the rest of the world. For this reason many SWLs prefer listening to the domestic service rather than the foreign service of some stations. One of these domestic services is the CBC Northern Service here in Canada. Many of the programs in this service are those carried on the regular CBC AM network but you can also hear programming in Indian and Eskimo languages. It is also in these domestic services that you will often hear commercials, which normally do not appear on the international broadcasters foreign services. Notable examples are Israel and South Africa.

Other interesting features on the short wave bands such as utility stations, time and frequency standard stations and the amateur bands will be discussed in future columns.

Short Wave Listening is a "NOW" hobby. There is something happening all the time, day and night, and each day brings about something different. Tune into Short Wave. I know you will enjoy it.

Any comments or suggestions for this column would be greatly appreciated. I will also attempt to answer any questions you may have regarding Short Wave Listening. You can write me at P.O. Box 142, Thunder Bay, Ontario, Canada, P7C 4V5.

Until next month, 73 and good listening.

Sound Level Meter

This sound level meter gives accurate results to allow noise levels to be monitored and controlled. An 'A' weight response is provided as well as the 'flat' mode.

THE PUBLIC TODAY is increasingly critical of excessive noise levels. Aircraft like the Concorde, for example, face opposition on grounds of noise levels while jet aircraft of around 1958 were just as noisy but then they were a great advance in science! Public awareness of noise has caused laws to be passed limiting the sound levels which can be produced without prosecution.

However, while it may be good to have a law to say the acoustic output of your party should not exceed 85 dB, how can you tell precisely what the actual level is! If the local constable is called the chances are he will not have a meter and will only be able to give his subjective assessment.

For this reason we have designed this project. It is not a super-duper do-all sound level meter but one which is economical yet gives meaningful results. The microphone used is relatively cheap but is rugged and has a good frequency response.

There are many weighting networks used with sound level meters including ones which need a computer to calculate the results. We chose only the two most popular, the "A" weight and flat. The response of the "A" weight filter is given in Fig. 1.

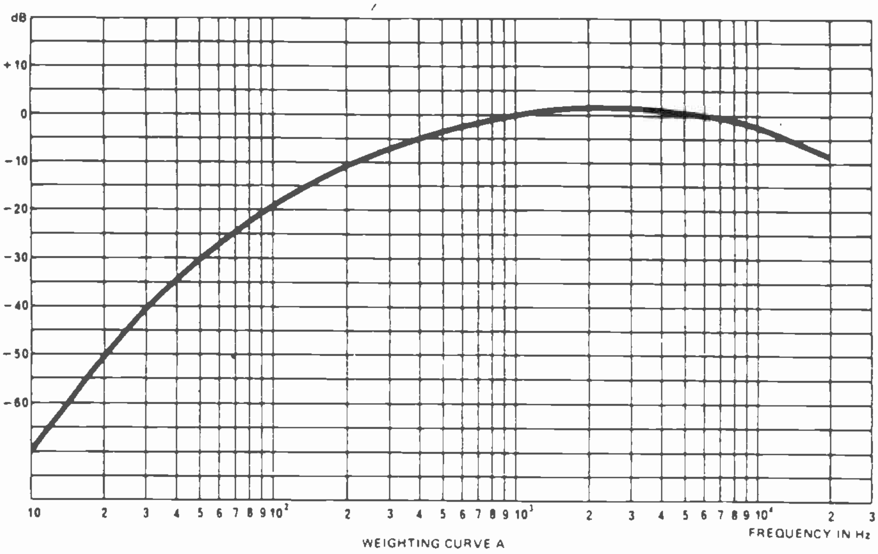
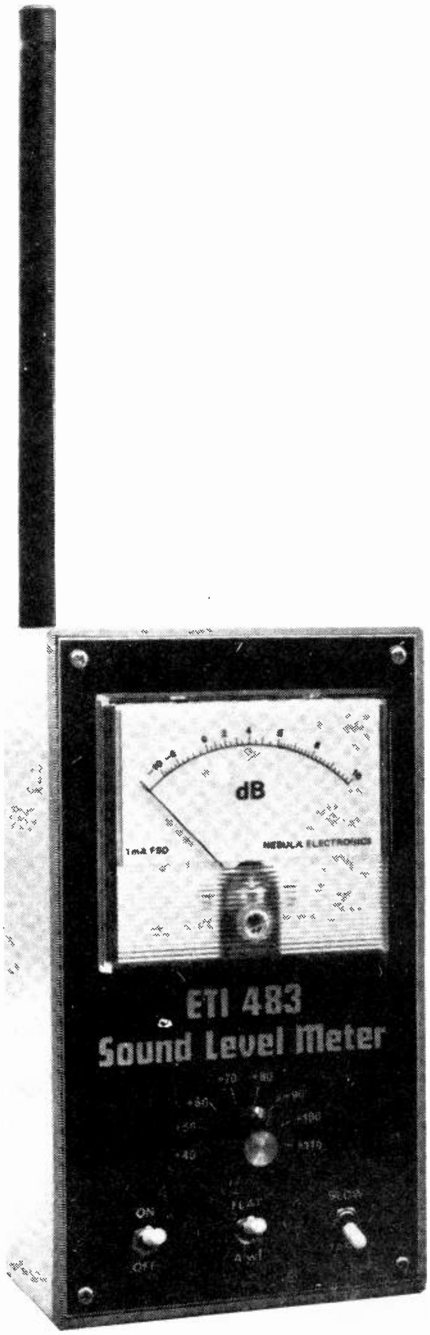


Fig. 1. The response of the 'A' weight filter.



CALIBRATION

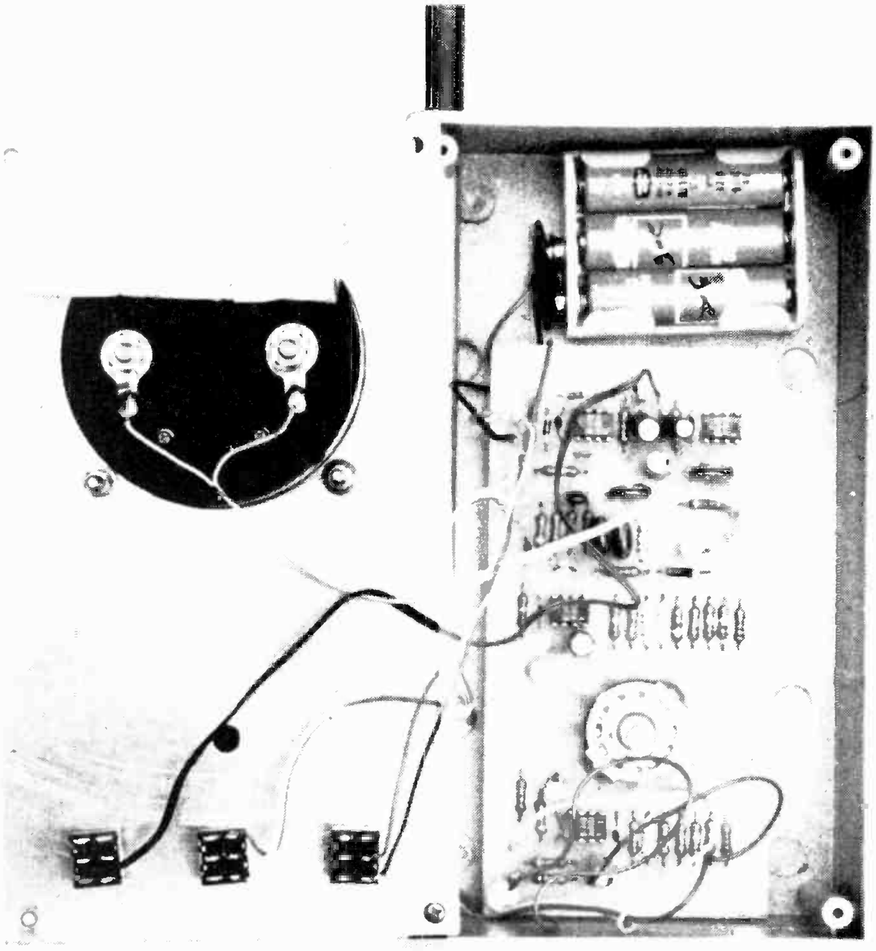
This is a little difficult as a known reference is needed or another sound level meter to match it against. Initially however the "flat" attenuator potentiometer must be adjusted. To do this a 1kHz audio tone or sine wave signal across R1 is needed. Select "A" weight and an appropriate range and note the reading. Switch to "flat" and adjust RV1 to give the same reading.

Calibration is performed by RV2 and is adjusted with a known audio signal.

CONSTRUCTION

Assemble the PC board according to the overlay in Fig. 4. The rotary switch can be one of the popular sizes and can be mounted either with tinned copper wires or by drilling large (3mm) holes in the PC board, through which the leads of the switch can be passed and soldered directly to the tracks. Check when assembling that the wiper contact is in the correct position.

Assemble the front panel and leave the leads to the switches and meter long enough to be able to hinge it forward, as the PC board is mounted in the base of the box. The microphone insert is mounted on the end of a length of aluminium tube well away from the box. This is to help prevent reflections from the box affecting the readings. We attached the microphone using a length of heat shrink tubing over the aluminium tubing.



An internal view of the unit.

The meter scale shown full size.

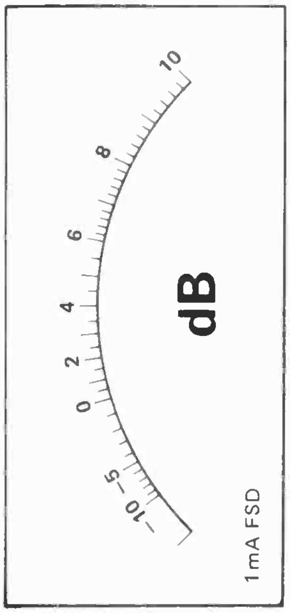
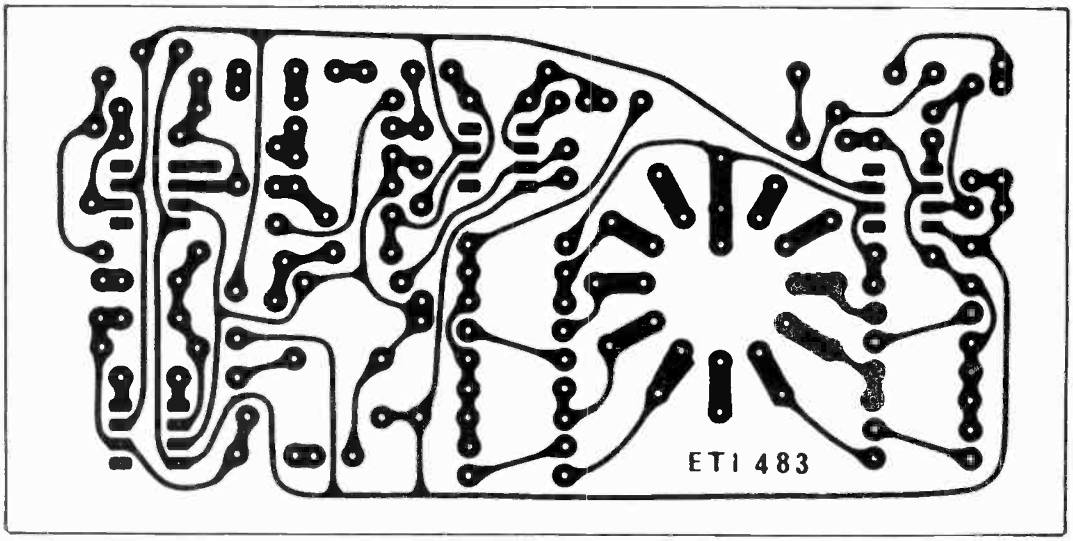


Fig. 2. The printed circuit layout of the sound level meter ETI 483 shown full size.



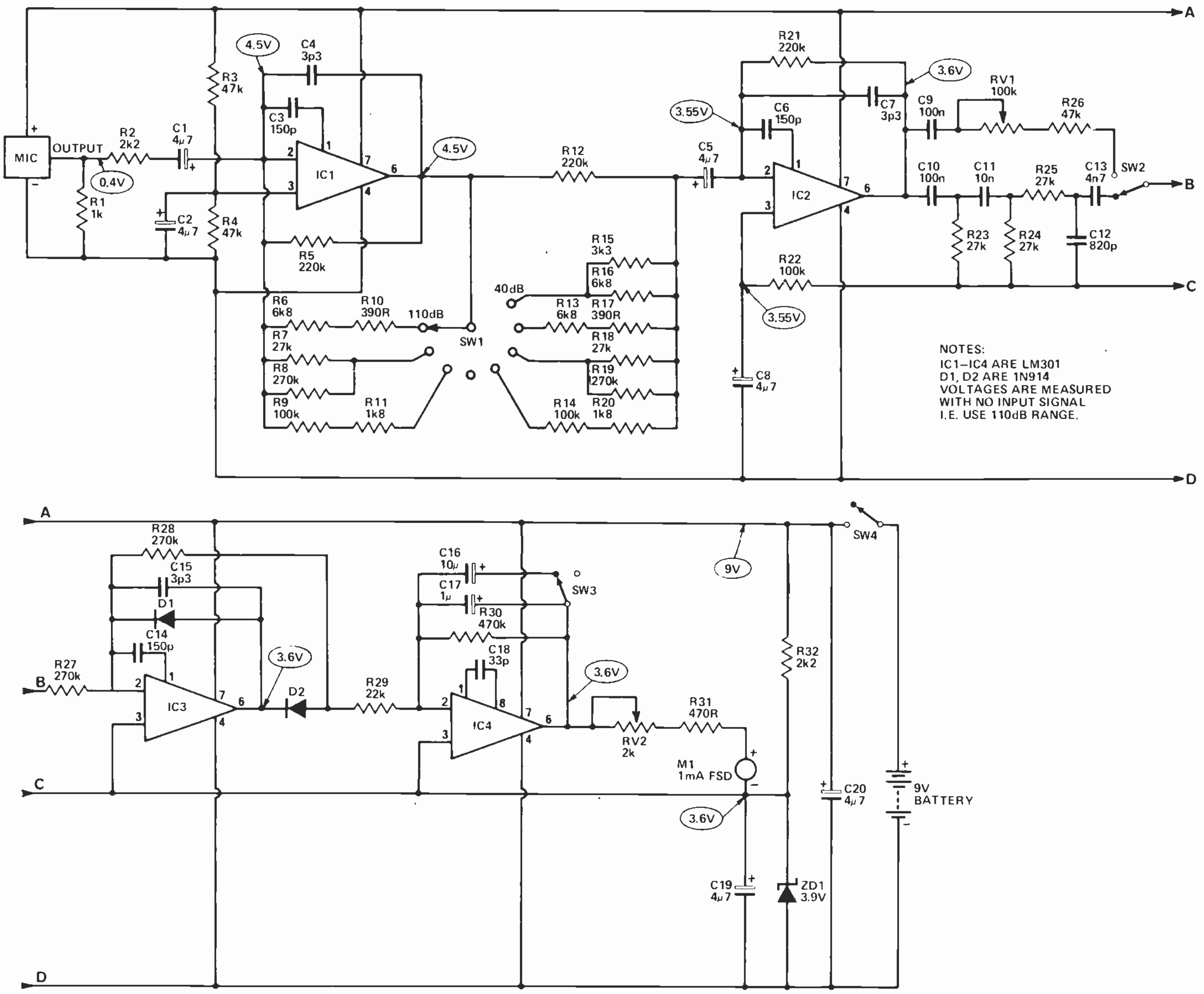


Fig. 3. The circuit diagram of the unit.

HOW IT WORKS

We have used an electret microphone insert which has the necessary FET preamp inside. As its output is a low level, especially in ambients around 40dB it is amplified by IC1 and IC2. The range switch SW1 is used to vary the gain of both ICs as shown below:

Range (dB)	Gain IC1 (dB)	Gain IC2 (dB)	Total Gain (dB)
+40	40	40	80
+50	40	30	70
+60	40	20	60
+70	40	10	50
+80	40	0	40
+90	30	0	30
+100	20	0	20
+110	10	0	10

The use of a switch as shown allows a single pole switch to control the gain of the two ICs while reducing the possibility of instability where gains of 80dB are involved.

The output of IC2 is filtered by the "A" weight network C10-C13, R23-R25 and R27. Switch SW2 selects either this "A" weighted output or the "flat" output via RV1, R25. The potentiometer RV1 is necessary to compensate for the loss of the filter network. Both networks should have the same loss at 1kHz.

IC3 is used to halfwave rectify the signal and IC4 integrates the signal to give the average level. Two values of integration capacitor are used to give the two response speeds.

The bias for the first IC is provided by R3 and R4 while the other three are biased by the voltage across ZD1. The meter is also biased to the zener voltage.

SPECIFICATIONS

Sound level range	30dB to 120dB
Weighting networks	Flat or 'A' weight
Microphone	Electret
Power supply	9V dc @ 10mA

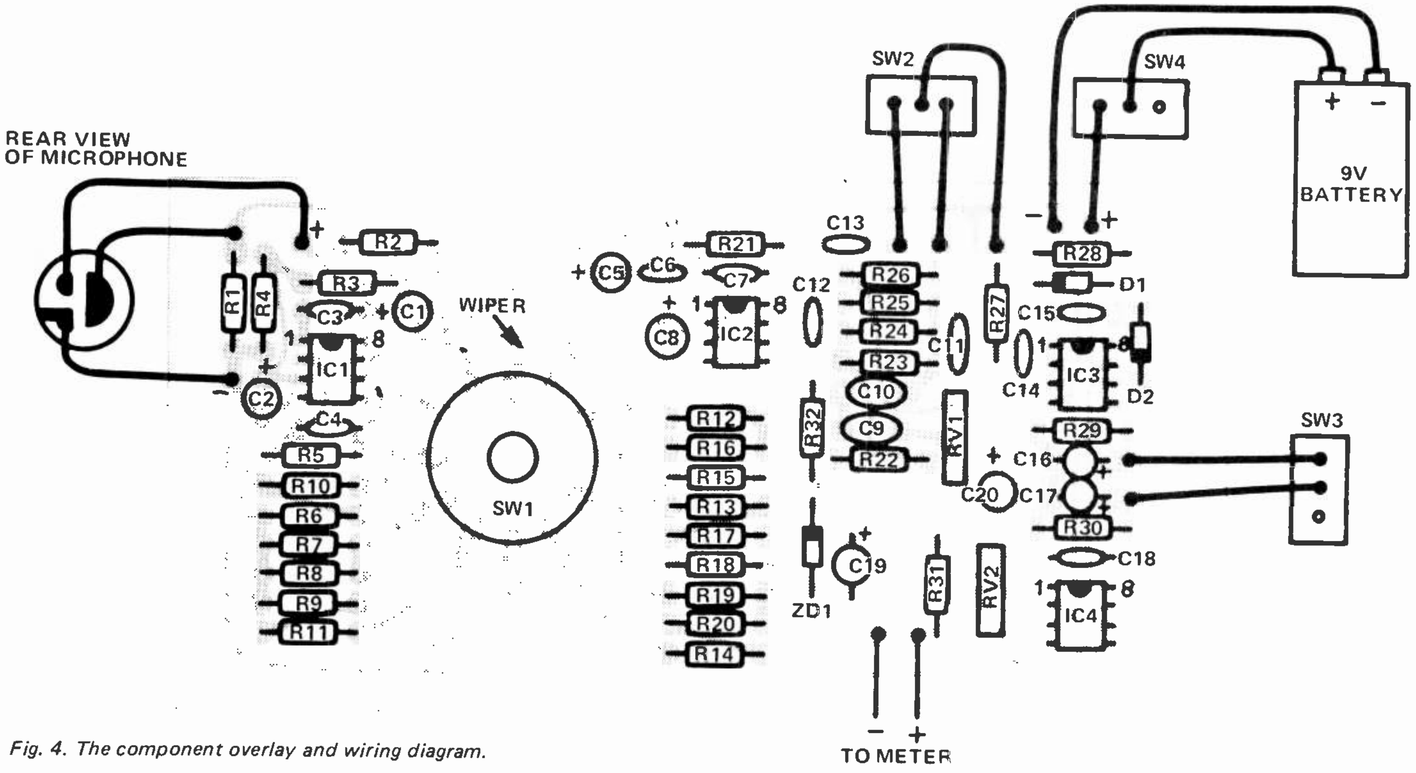


Fig. 4. The component overlay and wiring diagram.

PARTS LIST

RESISTORS all ½W 5%

R1	1k
R2	2k2
R3,4	47k
R5	220k
R6	6k8
R7	27k
R8	270k
R9	100k
R10	390R
R11	1k8
R12	220k
R13	6k8
R14	100k
R15	3k3
R16	6k8
R17	390R
R18	27k
R19	270k
R20	1k8
R21	220k
R22	100k
R23–R25	27k
R26	47k
R27,28	270k
R29	22k
R30	470k
R31	470R
R32	2k2

POTENTIOMETERS

RV1	100k trim
RV2	2k "

CAPACITORS

C1,2	4µ7 16V electro
C3	150p ceramic
C4	3p3 "
C5	4µ7 16V electro
C6	150p ceramic
C7	3p3 "
C8	4µ7 16V electro
C9,10	100n polyester
C11	10n "
C12	820p ceramic
C13	4n7 polyester
C14	150p ceramic
C15	3p3 "
C16	10µ 16V electro
C17	1µ0 16V "
C18	33p ceramic
C19,20	4µ7 16V electro

SEMICONDUCTORS

IC1–IC4	LM301A
D1,2	1N914
ZD1	3.9V 300mW

MISCELLANEOUS

PC board ETI 483
Microphone insert
(Armaco M139)
SW1 single pole 11 position rotary
(Radio Shack 275 1385)
SW2–SW4 SPDT toggles
1mA meter
Plastic case
6xAA size battery holder

The Decibel (db)

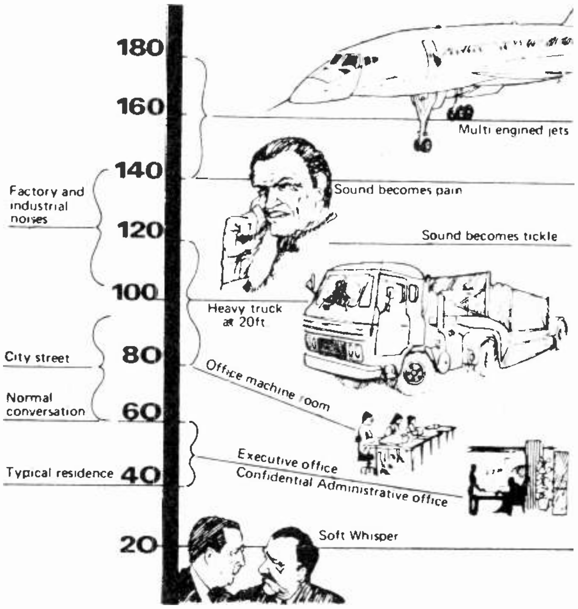
The ear can hear a sound power as low as 10^{-13} watt – this is a pressure of 0002 dynes per cm². The ear drum moves an amount approx. equal to the diameter of a molecule of nitrogen. When sound is uncomfortably loud, the hearer "feels" a tickle, then pain in the ear, a power level of 1 watt. approx.

Engineers take the logarithm of the power ratio and call it the DECIBEL (db).

The db level is given by – $db = 10 \log 10 \frac{\text{Watts}}{10^{-13}}$

The sound pressure level is $= 20 \log 10 \frac{P(\text{dynes})}{\cdot 0002}$

Typical Decibel levels encountered



- *For a sound to be perceptibly louder or softer, it must be changed by 3 decibels.*
- *A noise twice as loud or ½ as loud is a change of 10 decibels.*
- *A reduction in noise of a few decibels in the low noise region (administrative office) is not significant. The same change at high sound levels (office machine room) is significant.*

Two Chip Siren

Use this circuit as an alarm, warning or simply as a noise-maker. It's VERY effective.

There are many times when you want to generate a LOUD tone, and perhaps make it variable, as a siren, to attract even more attention. This circuit achieves these ends, and includes two different siren options, and the capability to sound in two distinct ways. This last feature makes the circuit ideal for a multi-switch alarm situation where identification of the alarm switch being activated is desired.

ALARM USE

In an alarm system one set of alarm switches may be connected between point Y and battery negative and another set from point X to the battery. Then when a switch is activated it will be possible to tell from the sound which area of the building, for example, the alarm applies to.

CONSTRUCTION

Very straight forward to build, either use the pcb and mount the components on it (using sockets for the ICs is preferable), or build it on Veroboard or similar material. Wiring is not critical, so long as everything connects to where it should and not to where it shouldn't!

The power source can be 6V to 16V, car battery power (13.5V) is also ideal.

By the way, for *less* volume you can put a resistor in series with the speaker.

TESTING

With the speaker wired as shown and the battery positive connected, tentatively connect the battery negative to point Y and a continuous tone should issue forth. Also note operation of RV1. If it doesn't, don't leave the battery connected for too long or the speaker may burn out to

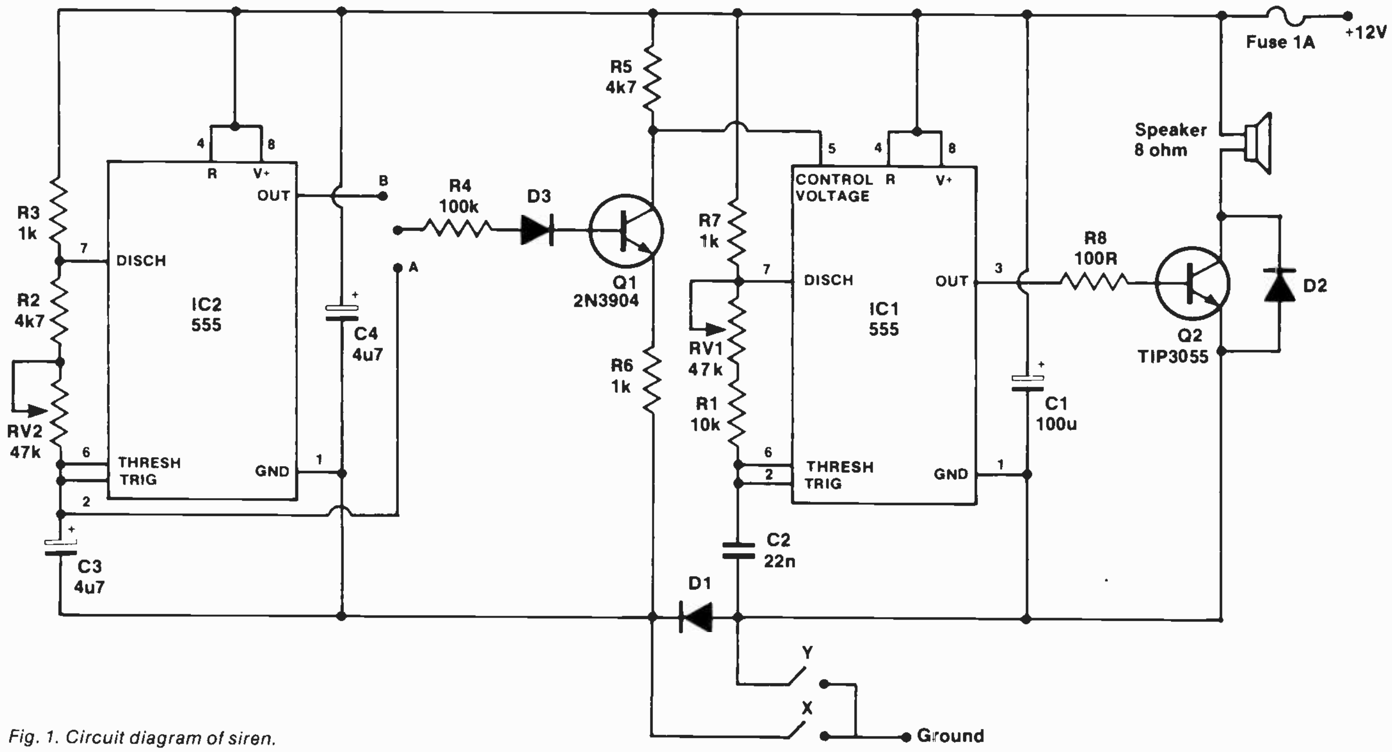


Fig. 1. Circuit diagram of siren.

protect the fuse, if Q2 happens to be on.

Having got this stage operating, plug in IC2 and connect battery negative to point X. Note the "swept" and "ping pong" siren effects available with the jumper connected from R6 to points A or B (one at a time!). Observe effects of RV2.

HOW IT WORKS

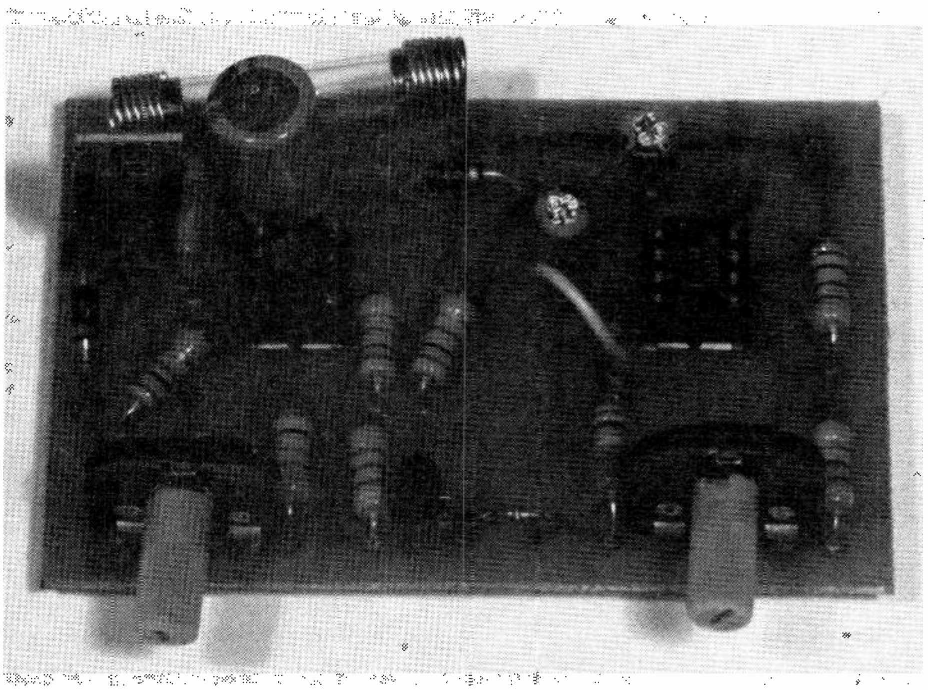
As may be seen from the circuit diagram we have two 555's each wired up in very similar configurations. Let us initially start with the negative battery terminal connected to point Y. In this case D1 will not be conducting and therefore Q1 and IC2 will be inoperative, and only IC1 will need studying.

Suppose initially C2 is discharged. The output of IC1 (pin 3) will be high. Current flows through R7, RV1, R1 to charge it up. When it reaches a particular threshold voltage (in this case 2/3 of the power supply or battery voltage) this signal at the threshold input (pin 6) causes the output to go low again, and also turns on an internal transistor which shorts pin 7 to ground, thereby starting to discharge C2 through R1 and RV1. When the voltage on C2 is down to 1/3 the battery voltage the 555 is again triggered, the output goes high, pin 7 is "off" and C2 starts to charge up again.

The square wave signal is buffered by Q2, which simply switches the battery voltage across the speaker very rapidly and thus makes an audio tone.

It may be seen that as RV1 controls the charging/discharging rate of C2, it controls also the frequency of the output tone.

Now with point X connected to the negative of the battery, the entire circuit will be supplied with power. IC2 oscillates in the same way as IC1 but much slower due to C3 being much larger than C2. One of two signals from this oscillator are used, either the square wave output or the roughly triangular wave found on C2. Your choice of one of these (A or B) is buffered by Q1 and fed to IC1 pin 5, the "control voltage" input. Essentially this varies the threshold voltage used for stopping the "charging" cycle of C2, and thus may increase or decrease the period, and hence the frequency of IC1. The square wave from IC2 of course causes the ping-pong siren sound, and the "triangle" wave makes the swept sound.



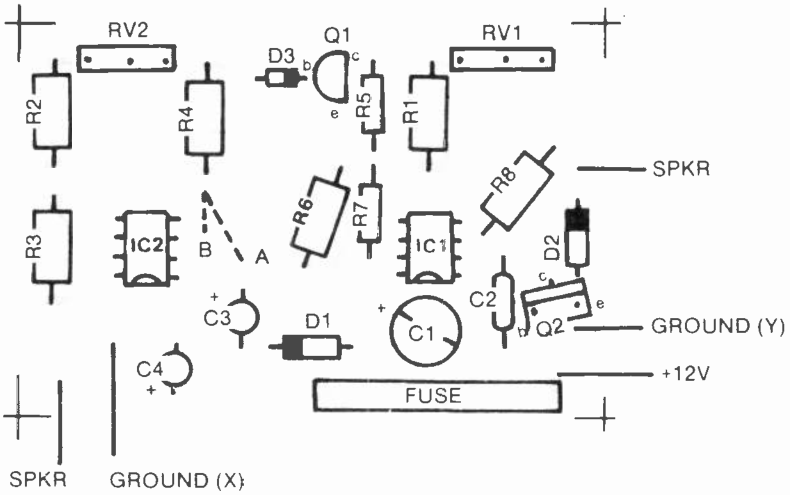


Fig. 2. Component overlay diagram.

PARTS LIST

RESISTORS all W 5%

R1	10k
R2,5	4k7
R3,6,7	1k
R4	100k
R8	100R

SEMICONDUCTORS

D1,2	1N4001
D3	1N914
Q1	2N3904
Q2	TIP3055
IC1,2	555

POTENTIOMETERS

RV1,2	47k

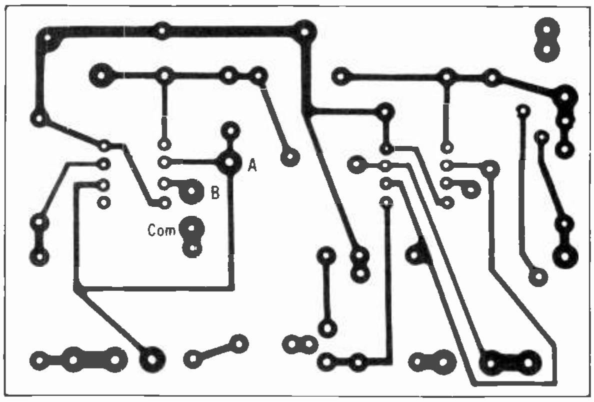
CAPACITORS

C1	100u/25V electrolytic
C2	22n
C3,4	4u7 electrolytic

MISCELLANEOUS

1A fuse, fuse clips, battery, IC sockets, 8ohm speaker, etc.
Kits of parts for this project and also PCBs are available from Jana. See their ad in this issue for address.

Fig. 3. Printed circuit board pattern.



From the people who brought you the
ETI Digital Multimeter Survey
(ETI July 1978)

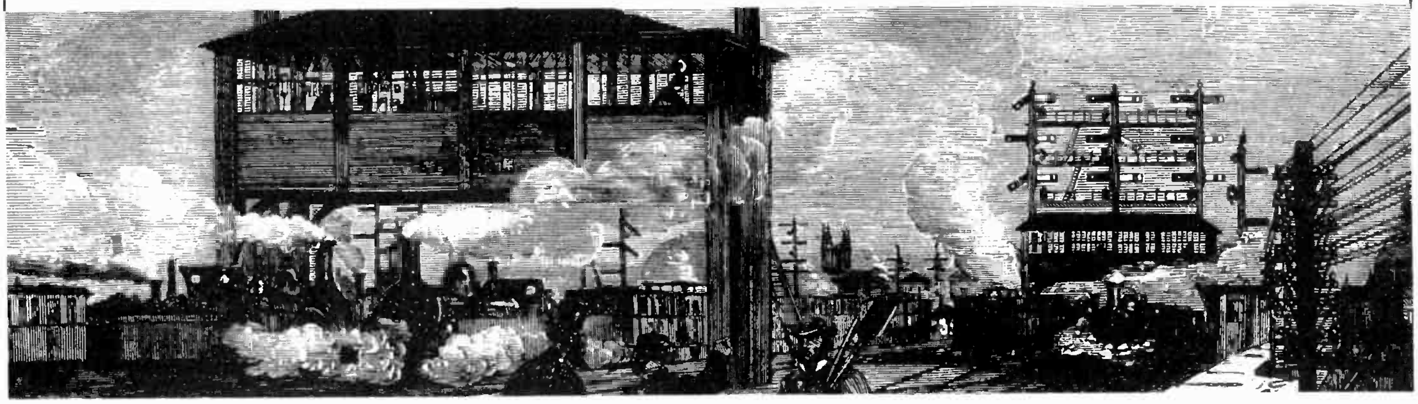
OSCILLOSCOPE SURVEY

in next month's issue.

ELECTRONICS IN MODEL RAILWAYS looks at the sophisticated circuits used by railway enthusiasts to control their model trains.

PLUS the usual Tech-Tips, Audio Today, Shortwave World, etc.
AND MUCH MORE.

PROJECTS include a wide-range audio oscillator with digital frequency readout, an electronic shutter timer to check the accuracy of your camera (again with digital display), and a simple rain alarm.



Canadian Semiconductor Guide

Where to get what from whom in Canada. Compiled by Bill Johnson and Gail Manning.

IF YOU'VE EVER TRIED to buy any semiconductor (other than a 741, 555 or 2N3904) in Canada, you know how much you don't know about where to get it. Thus the accompanying chart and list of addresses should prove invaluable.

In the chart we have listed manufacturers down the left side with representatives and distributors across the top, hence the R and D entries in the body of the chart.

Representatives, as the name implies are simply people who represent the manufacturer, so far as large orders are concerned, and are good sources of information, literature, data sheets, etc. Representatives do not in general have any stock, or desire to handle small orders. Distributors on the other hand are most interested in selling, and are less likely to have information. However, each outfit is different, and has a different approach to serving its customers.

When you've found out who might be able to help, look them up in the list of addresses and phone numbers, and hopefully you'll be on the trail of the part you need.

We have tried to put together all the information available to us, but we realise that the chart is no doubt incomplete. Also, while great effort has been expended in attempting to insure the correctness of the information presented here, errors can occur. Additions and corrections will be found in future issues at the end of News Digest.

Active Electronic Sales Corp. (Counter Sales Division of Future Electronics)			
Ont	Toronto	(416) 675-3311	44 Fasken Dr., Unit 25, Rexdale M9W 1K5
Que.	Montreal	(514) 735-6425	5651 Ferrier St. H4P 2K5
Allan Crawford Associates			
Alta.	Calgary	(403) 276-9658	3829 12th St. N.E. T2E 6M5
N.S.	Dartmouth	(902) 469-7865	800 Windmill Rd., Burnside Industrial Park B3B 1L1
Que.	Longueuil	(514) 670-1212	1330 Marie-Victorian Blvd. J4C 1A2
B.C.	Vancouver	(604) 980-4831	116 E 3rd St. North Vancouver
Ont.	Mississauga	(416) 678-1500	6503 Northam Drive
Ont.	Ottawa	(613) 829-9651	1299 Richmond Rd. K2B 7Y4
Amphion Electronics			
N.S.	Halifax	(902) 429-7211	
N.B.	Moncton	(506) 855-3337	
Bowtek Electric Co. (Bowtek Electronics)			
Alta.	Edmonton	(403) 426-1072	10573 114 St.
B.C.	Vancouver	(604) 736-1141	
Mtba.	Winnipeg	(204) 633-9523	
Cam Gard Supply Ltd.			
Alta.	Calgary	(403) 287-0520	640 42nd Avenue S.E. T2G 1Y6
Alta.	Edmonton	(403) 426-1805	10505 111th Street T5H 3E8
Alta.	Red Deer	(403) 346-2087	4910 52nd Street T4N 2C8
B.C.	Kamloops	(604) 372-3338	825 Notre Dame Drive V2C 5N8
Mtba.	Winnipeg	(204) 786-8401	1777 Ellice Ave. R3H 0W5
N.B.	Fredericton	(506) 455-8891	Rookwood Ave. E3B 4Y9
N.B.	Moncton	(506) 855-2200	15 Mount Royal Blvd. E1C 8N6
N.S.	Halifax	(902) 454-8581	3065 Robie Street B3K 4P6
Sask.	Regina	(306) 525-1317	1303 Scarth Street
Sask.	Saskatoon	(306) 652-6424	1501 Ontario Ave.
B.C.	Vancouver	(604) 291-1441	
Canadian Electronics Ltd. (Dominion Electric C.E.L.)			
Alta.	Calgary	(403) 287-1800	
Alta.	Edmonton	(403) 454-9393	16120 114th Ave.
Mtba.	Winnipeg	(204) 947-1321	
Cantec Representatives			
Que.	Montreal	(514) 694-4049	207 Place Frontenac, Pointe Claire
Ont.	Ottawa	(613) 225-0363	17 Bentley Ave.
Ont.	Toronto	(416) 675-2460	83 Galaxy, Rexdale
Carsten Electronics			
Ont.	Toronto	(416) 751-2371	25 Howden, Unit #5, Scarborough M1R 3E8
Cesco Electronics Ltd.			
Ont.	Toronto	(416) 661-0220	24 Martin Ross Ave., Downsview M3J 2K9
Ont.	Ottawa	(613) 729-5118	1300 Carling Ave. K1Z 7L2
Que.	Montreal	(514) 735-5511	4050 Jean Talon W. H4P 1W1
Que.	Quebec	(418) 524-4641	98 Ouest St.-Vallier G1K 6W8
Conti Electronics			
B.C.	Vancouver	(604) 324-0505	
Cramer Electronics			
Ont.	Toronto	(416) 661-9222	No Toronto Address
Dominion Radio			
Ont.	Toronto	(416) 922-1818	535 Yonge St. M4Y 1Y5
Electronic Wholesalers			
Que.	Montreal	(514) 769-8861	
Ont.	Ottawa	(613) 746-4413	1131 Newmarket
Electro Sonic Industrial Sales Ltd.			
Ont.	Toronto	(416) 494-1666	1100 Gordon Baker Rd., Willowdale M2H 3B3
Future Electronics			
Ont.	Toronto	(416) 675-7820	44 Fasken Dr., Unit 24, Rexdale M9W 1K5
Ont.	Ottawa	(613) 232-7757	
Que.	Montreal	(514) 735-5775	5647 Ferrier St. H4P 2K5
General Instrument of Canada Ltd.			
Ont.	Toronto	(416) 762-8154	61 Industry (C.P. Claire Ltd. (Division of Gen. Inst.))
Que.	Lachine	(514) 636-9454	
Ont.	Waterloo	(519) 744-8101	
Haltronics Ltd.			
Ont.	Oakville	(416) 844-2121	

Canadian Semiconductor

R = Representative
D = Distributor

	Electro Sonic	Cesco	Motorola	RCA	Philips	Vitel	Hamilton Avnet	Cantec Representatives	Tracan	Weber	Semad	Allan Crawford	Prelco	Future	Active	RFQ Associates	RN Longman	Munro	Cramer	Zentronics	Westburne/Haldane	Kaytronics	Dominion Radio & Electronics	Carsten	Intel	General Instrument	Saynor	ITT Semiconductors	Penryn	CM Peterson	National Semiconductor	Plessey	Cesco	Motorola	Philips	Hamilton/Avnet	Cantec Representatives	Tracan	Semad	Prelco	Future	Munro	Zentronics	Electronic Wholesalers	Allan Crawford	Wackid	Haltronics Oakville	CM Peterson London	Texas Instruments	Intersil Brampton	Varah's Hamilton
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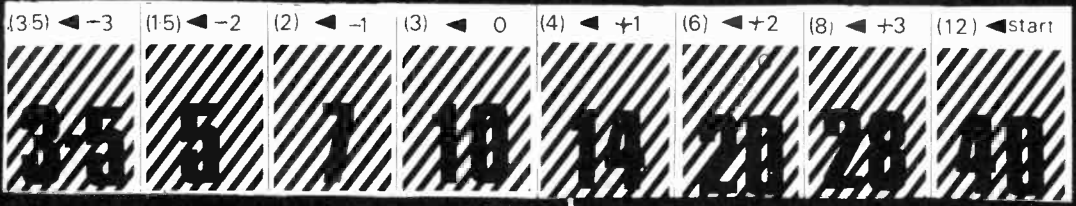
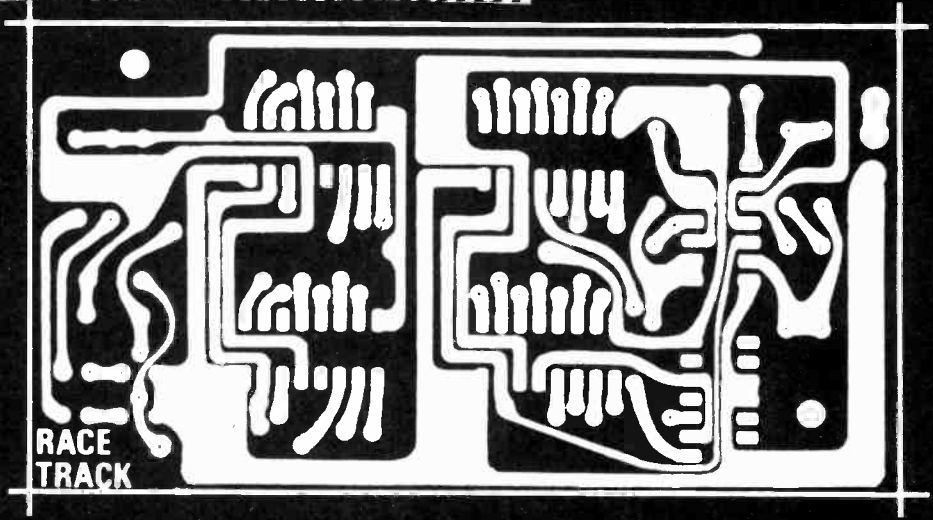
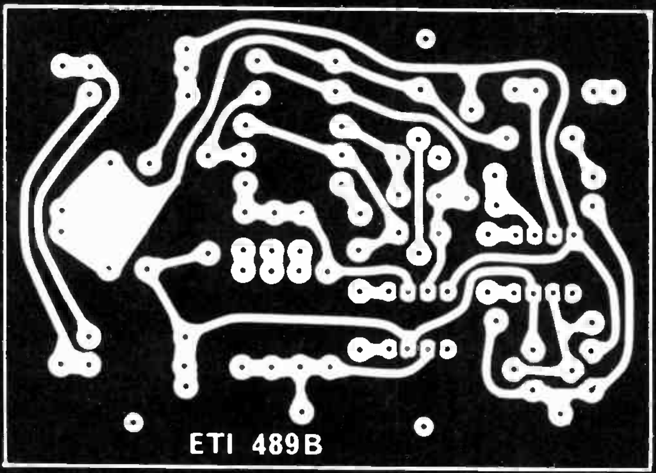
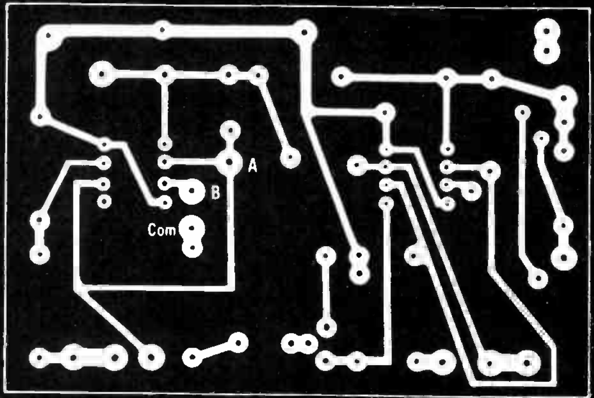
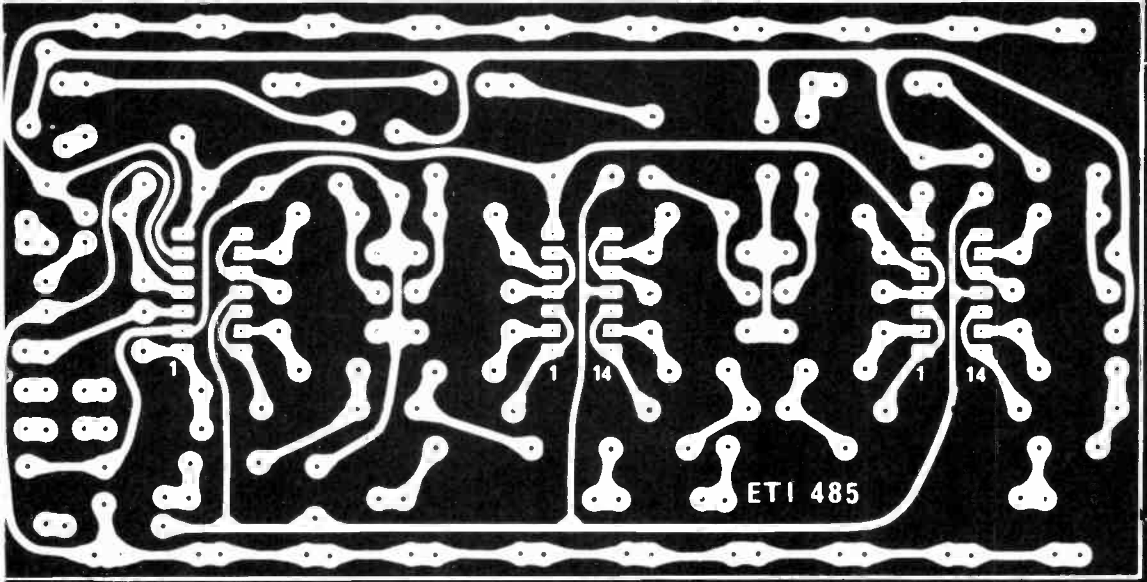
ETI PCB Negatives

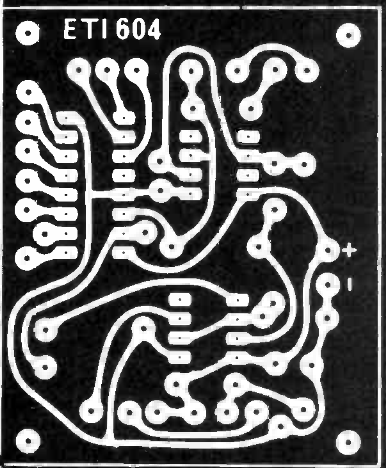


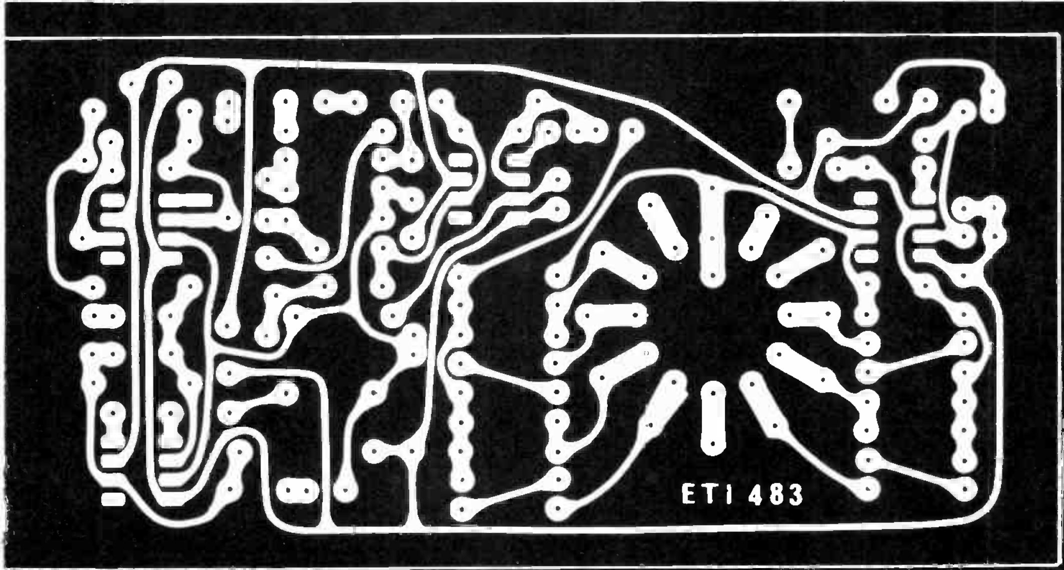




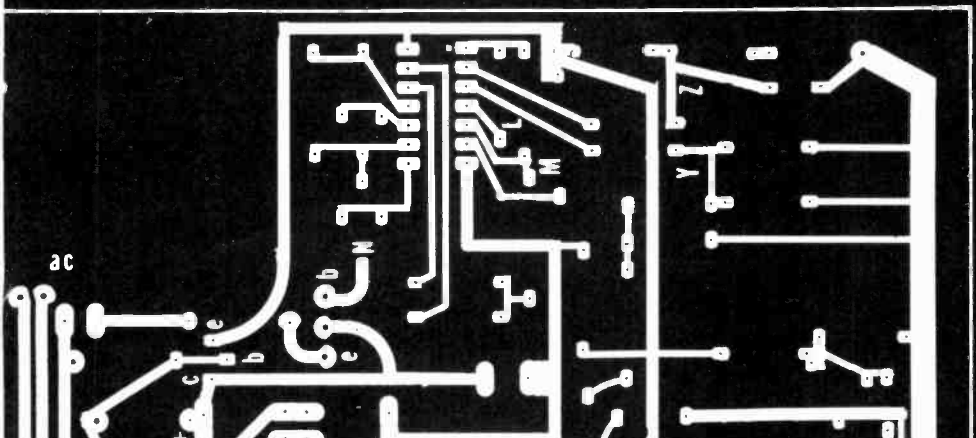


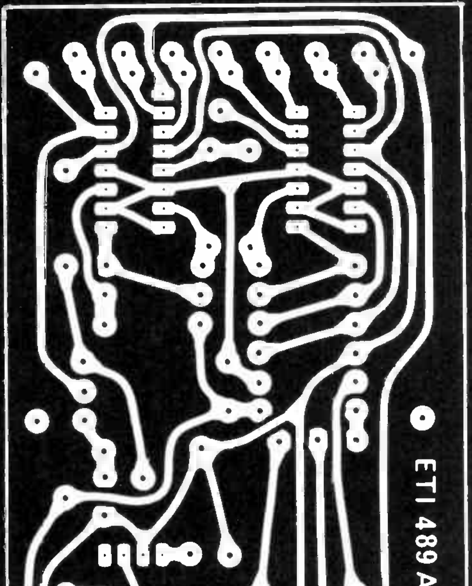






HERE WE present negatives for July and August, plus a special bonus, the popular ETI Graphic Equaliser 485 from our October 77 issue. These negs can be used with presensitized boards (eg. Injectorial). Typical exposure times under a No. 2 photoflood bulb with reflector at ten inches we expect to be around 20 minutes. Use test strip to make test exposures to find optimum exposure for your setup. Full details were given in Jan. 78 ETI.





Guide

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NEWS DIGEST

You Need Never Miss The Beginning Again

Have you ever had that situation where you are watching one TV channel, and keep flipping the dial because there's another show coming up on a different channel that you don't want to miss? Thanks to a new patent issued to ITT your troubles may be over. In the proposed set-up, switching to the second channel will be electronic, and will take place so fast that, as far as your eyes are concerned, both channels will be received at the same time (the one you're not watching, but only waiting for, displayed on a second miniature screen, of course).

ITT are to be commended for coming up with a practical solution to what has been a very serious and pressing problem since TV's inception. The effect on the mental health, divorce, heart disease, etc, statistics will no doubt be considerable. —JC

Horsepower in the Good Old Days

It's not exactly electronics, but readers might be interested to know that an early version of the esteemed 'Philishaver' used a horse as its motive power. This gem of information is one of many contained in a new book called 'Animal Powered Engines,' by J. K. Major. The reason we thought you might be interested was... oh well, it was the first 'filly shaver,' wasn't it?—JC

Troubleshooting By Thermal Scan

Hughes Corporation (these are the same people who are rumoured to have produced a human clone — no prizes for guessing his identity) have come up with a technique for troubleshooting which threatens to do away with old-fashioned DVMs, dual trace scopes and the like. Known as IRFITS, for Infrared Fault Isolation Test System, a thermal imager produces a TV display of the faulty circuit board, from which any discrepancy between it and a 'good' board can be located. IE, the heat dissipated by faulty components would be different from that emanating from the corresponding ones on a good board. It is possible also to program an analyser to pinpoint faults on production boards using thermal scan methods, with programming time equal to one quarter of that needed to program conventional fault-isolation software.

So that seems to take care of that.-JC

Canadian Semiconductor Guide

Hamilton/Avnet Electronics			
Ont.	Toronto	(416) 677-7432	3688 Nashua Dr., Units G & H, Mississauga L4V 1M5
Ont.	Ottawa	(613) 226-1700	1735 Courtwood Cres. K1Z 5L9
Que.	Montreal	(514) 331-6443	2670 Paulus St., Ville St. Laurent H4S 1G2
ITT Semiconductors			
Ont.	Toronto	(416) 630-7971	4001 Chesswood, Downsview
Intersil Inc. (Field Sales Office)			
Ont.	Brampton	(416) 457-1014	338 Queen St. East
Intek Electronics Ltd.			
B.C.	Vancouver	(604) 324-6831	
Intel Corp.			
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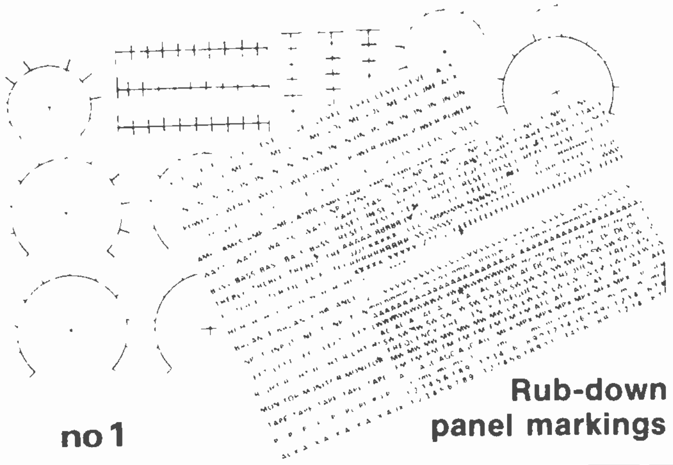

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IB Metal Locator Mk 2

Over a year ago we described a really excellent metal locator using the induction balance principle. The ETI Project Team have taken another look at the design and come up with an alternative way of using this principle.

IN THE MARCH 1977 issue of ETI we described an Inductance Balance metal locator. We know that literally thousands upon thousands of these were built and although a few readers did have problems, most of them were accounted for by poorly set up search coils.

TREASURE HUNTING

The hobby of treasure hunting using a metal locator started in North America about ten years ago and has been growing in popularity ever since. Commercial metal locators are not cheap — starting with kits at the $30 mark but with a big gap before most of the built models appear The average price is in the $100 region (there are notable exceptions of course) yet the circuitry in this is by no means complex. The important part about an induction balance metal locator is the search head and no one should underestimate this — this accounts for a significant part of the total cost and, if you tackle this project, expect to devote a lot of time to lining up and experimenting with this.

The reason for the popularity of treasure hunting is that it works — using a reasonable metal locator you can hardly fail to find coins and other items lost or thrown away. Our fields and pathways are littered with metal which has been there for hundreds, even thousands of years. The art of knowing where to look is almost more important than the technical performance of the machine: a good detector helps of course but it's how it is used that's important.

DESIGNING THE MARK 2

Because of the enormous popularity of the Mark 1 we couldn't resist the temptation of having a good look at the circuit and design to see if it couldn't be improved upon. Readers who are interested in this field are strongly recommended to see the March 77 issue or the reprint in Canadian Projects No. 1.

Our first step was to look at the original design — in the light of experience could we improve it? We came up with a dozen variations to try but to our surprise we were unable to make any real improvement on the first circuit using the general principles. We could have reduced the package count by using an LM389 (which includes three independent transistors plus an audio output amplifier) but that would have cost more with no real change.

In the original design the transmitter was modulated and the peaks of the detected signal were gated and enormously amplified (See How It Works and Fig. 1 a). Although we refer to the signal being modulated, it was actually switched on and off and this resulted in ringing in the tuned circuit.

After literally three weeks solid experimenting we decided to take another approach. We decided to dispense with a modulated transmitter and work with DC until the final stages. In the original design the audio frequency was fixed, being dependent upon the modulator and metal was sensed by an increase in audio level. However, our ears are highly insensitive to changes in level, they are, however, very sensitive to a change in audio frequency. Once we had decided to tackle it from this side everything fell into place. For a long while our voltage controlled oscillator was a unijunction transistor and although we achieved excellent results we were not satisfied with the unit in practice and eventually adopted the circuit shown in Fig. 3.

THE COIL

We cannot emphasize enough that the search head is the key to the whole operation: be prepared to spend some time on this, our own workshop is full of discarded experiments.

The housing of the coils is not important. In the Mk 1 we adopted a circular head but this is difficult for the non-woodworkers to tackle so we went for a rectangular shape. The coils L1 and L2 should be sandwiched between two pieces of masonite or plywood separated by thin battens — about 6 mm thick. The top should be built first and the battens fitted — for a better appearance you can then file off the corners slightly.

To wind the coils you'll need to get hold of a cylinder about 140mm (5½ in) in diameter. Using 32 gauge enamelled copper wire, trap one end onto the former with a piece of tape and carefully wind 40 turns as close together as possible. Carefully remove the coil and then wrap tape around it at intervals to keep it from spreading.

Two identical coils are required.

Lay one of the coils into the dish formed from the top of search head and the battens as you see in the photograph and spot glue it into place except on the part near the

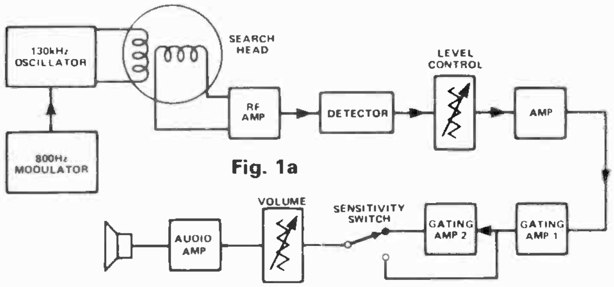


Fig. 1a

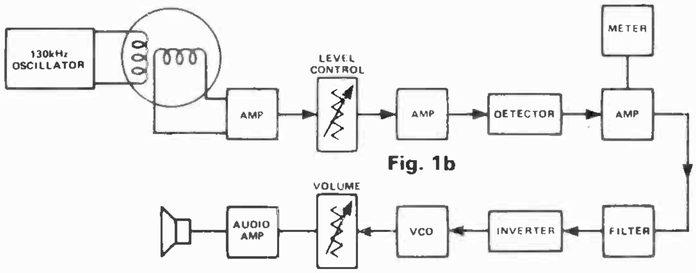


Fig. 1b

Fig. 1. a) On the left shows the block diagram of the Mark 1. In this the peaks of the modulated signal were gated and enormously amplified. On the right is shown the new arrangement, the RF signal, which is unmodulated, is converted to a DC signal which drives a voltage controlled oscillator (VCO).

middle. Lay the other coil next, again spot gluing it except near the middle. A hole should be made in this piece of wood to feed through the connecting cable to the main circuit. This cable must be a four-wire type with individual shielding — the shields are not used at the search coil end but don't cut them too far back: we still have a few experiments to try out on our prototype and access to this sheilding may be used.

THE CONTROL BOX

The circuit should be built up next. Everything except for the controls, the speaker and the meter are on a single PCB. Building this up should present few problems. Spacing is designed for eighth watt resistors, and tantalums are used, again to save space though the control box has plenty of room in it.

Fit terminal pins to the points shown in the PCB overlay as this will make connections far easier to make later on.

SETTING UP

We repeat — don't rush this part — it's what counts.

Assuming you haven't got the coil in exactly the right position by luck in the original setting, you should get an audio tone of about 700Hz from the speaker and the meter (if connected) will be hard over.

If you don't get this, adjust RV1 and it should appear. Back off RV1 until the frequency falls and then increase it a bit so that the tone is slightly higher than the minimum.

Now gently and slowly bend the coils and adjust the overlap till the tone falls. Add a few more blobs of glue but leave yourself with some adjustment. Readjust RV1 again and repeat. Continue to do this until you can no longer get any lower adjustment on RV1.

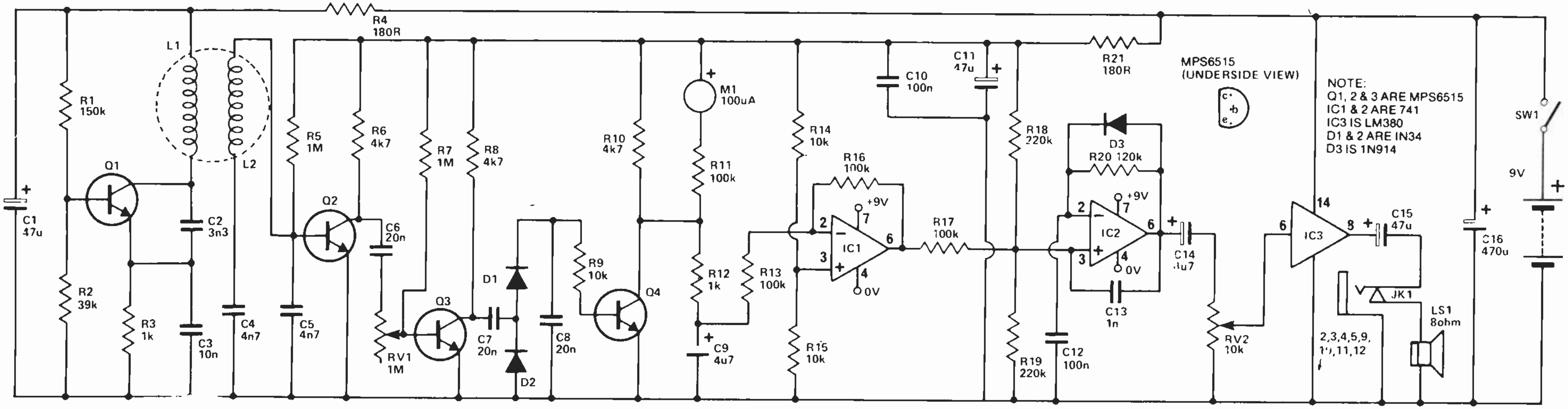


Fig. 3. The complete circuit of the IB Metal Locator Mk2.

HOW IT WORKS

The heart of the circuit is the search coil, L1 and L2. These two coils, which are essentially identical, are arranged in the same plane with a small overlap in such a way that there is practically no inductive coupling between the two. There is minimum pickup when the fields generated in L1 are cancelled in L2 when in free air. Any metal brought into the electro-magnetic field of L1 will distort the field, causing pickup in L2.

Q1 is a straightforward Colpitt's oscillator working at a nominal 130 kHz. This type of circuit is very stable and the use of polystyrene capacitors also help with stability. The supply to this stage is separately decoupled by R4 and C1.

The pickup coil L2 is tuned by means of C4 and C5 and amplified by Q2 which feeds to the level control RV1. This controls the "free air" state of the circuit and is set to the point where the later stages are just operating. The signal is further amplified by Q3 (here it is still an RF signal) and is detected by D1 and D2. When no metal is in the vicinity of the search coil and with RV1 correctly adjusted, a DC voltage of about 500 mV appears across C8. R9 increases the effective input impedance of Q4 as seen by the detector stage.

Q4 is just held off by the voltage available but as soon as any metal distorts the electromagnetic field, L2 produces a larger RF signal, a higher voltage across C8 and a consequent fall (from 8 V) in the voltage at the collector of Q4. This voltage is also monitored by the meter in parallel with the load resistor of Q4. The fall in voltage is dependent upon the proximity and/or size of the metal near the search coil.

It is necessary to ensure that the DC voltage fed to the next stage is clean and R12 and C9 act as a filter to remove any residual AC even if this is at low frequencies.

IC2 (the next but one stage) is a voltage controlled oscillator — but to operate this so that metal is indicated by a rising note, rather than a falling one, the voltage at the junction of C9 and R12 has to be inverted and this is achieved by IC1: in "no-metal conditions there is about 2 V at the output of this op-amp which rises when metal is near. This stage quickly saturates to give about 7 V at pin 6. IC1 has unity gain.

In "no-metal" conditions IC2 gives about 70 Hz which rises to 500 Hz when metal is present, diode D3 gives a rapid recharge to C12 and affects the mark/space ratio of the output which results in lower battery consumption. R20 and C12 can be altered to give a different range of audio frequencies if desired.

The output is taken to a volume control and fed to the LM380 audio power amplifier which in turn feeds the speaker.

The levels of signal around Q2, 3, 4 are all dependent upon transistor gain, temperature and supply voltage but this doesn't matter because the level control RV1 is adjusted until Q4 just begins to conduct.

Current drain for the complete circuit is in the order of 50 mA.

PARTS LIST

RESISTORS all ¼W 5% unless stated otherwise

R1	150k
R2	39k
R3, 12	1k
R4, 21	180R
R5, 7	1M
R6, 8, 10	4k7
R9, 14, 15	10k
R11, 13, 16, 17	100k
R18, 19	220k
R20	120k
RV1	1M linear (level)
RV2	10k log (volume)
CAPACITORS	
C1, 11	47u 16V tantalum
C2	3n3 polystyrene, 5%
C3	10n polystyrene, 5%
C4, C5	4n7 polystyrene, 5%
C6, 7, 8	20n polystyrene
C9, 14	4u7 16V tantalum
C10, 12	100n polyester
C13	1n polyester
C15	47u 16V electrolytic
C16	470u 16V electrolytic
SEMICONDUCTORS	
Q1, 2, 3, 4	MPS6515 or equivalent
IC1, 2	741 8-pin DIL
IC3	LM380
D1, D2	1N34
D3	1N914

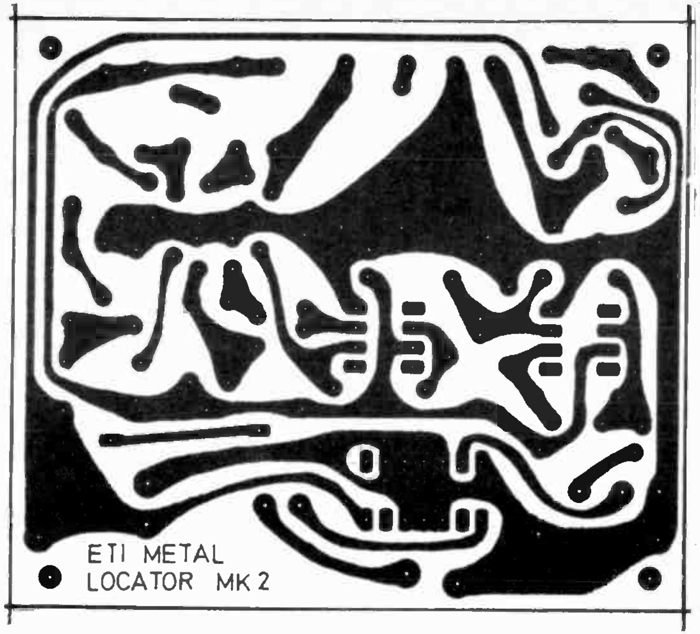


Fig. 4. The PCB for the IB Mk2. Full size is 89 x 77 mm.

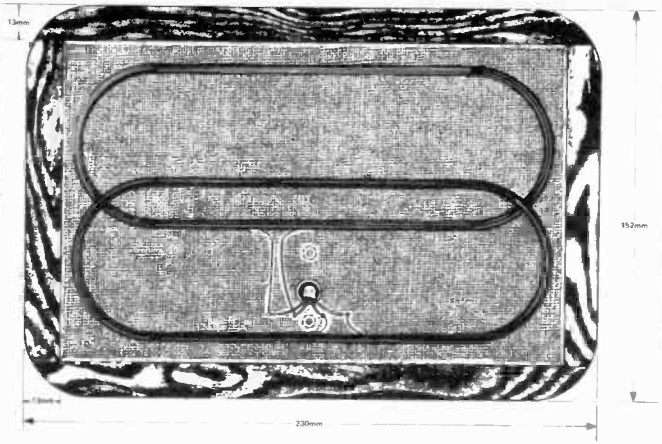


Fig. 2. The search coil. This comprises L1 and L2 which are made from two coils originally wound on a 140 mm former and then squeezed into the shapes shown.

MISCELLANEOUS

LS1 8 ohm miniature loudspeaker
JK1 stereo jack socket
M1 100uA level meter
L1, L2 — see text
PCB — see drawing
4-core, individually screened cable
Batteries and holder (6 penlite)
Plastic pipe
Bicycle hand grip
Verobox, 4¼" x 7½" x 2¼"

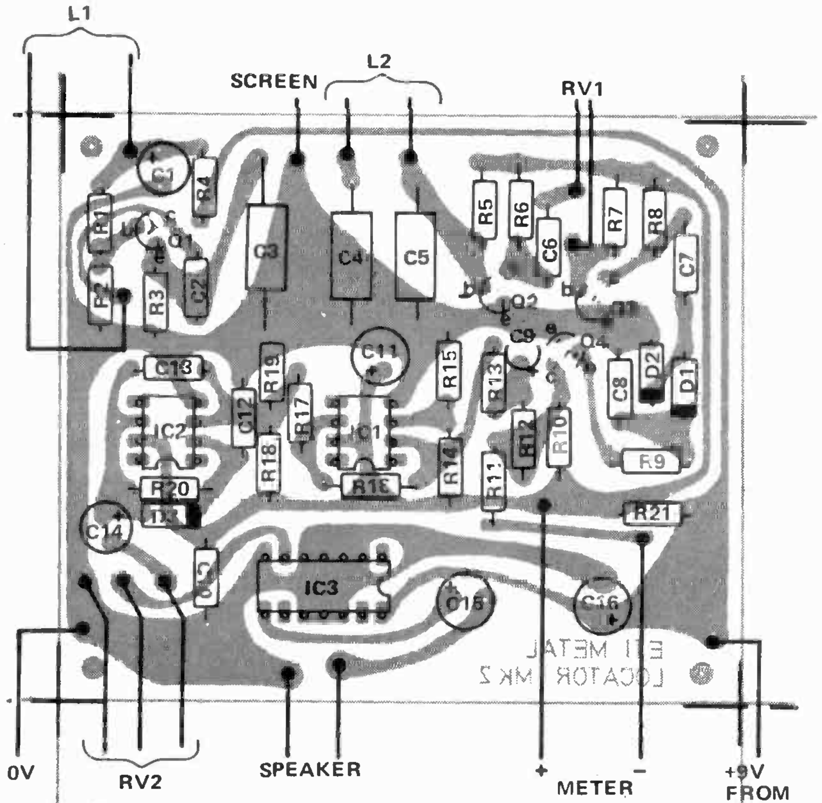
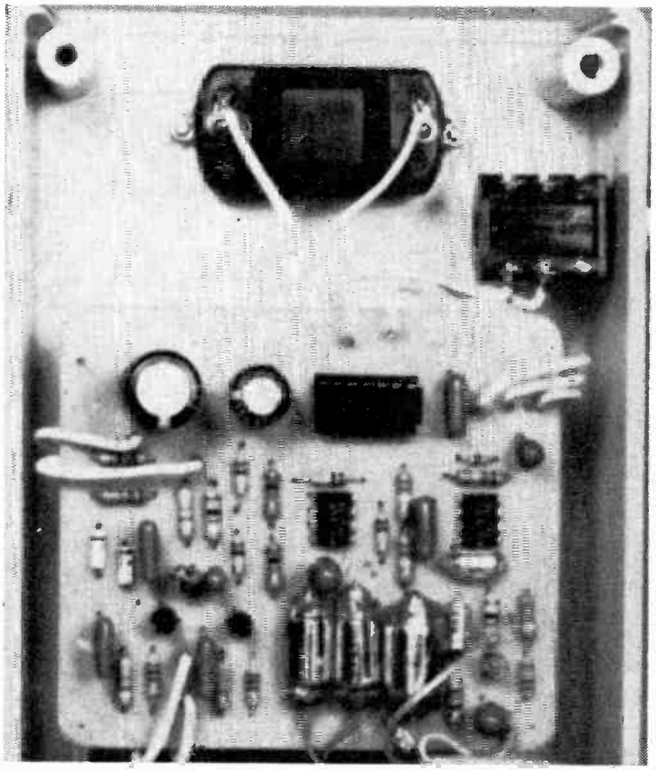


Fig. 5. The component overlay on the PCB with the wires leading off to other parts of the circuit.



Internal view of the control box.

Next time don't lose the map!

Now check that no metal is in the vicinity (don't forget cuff-links, watches and rings) and continue the manipulation.

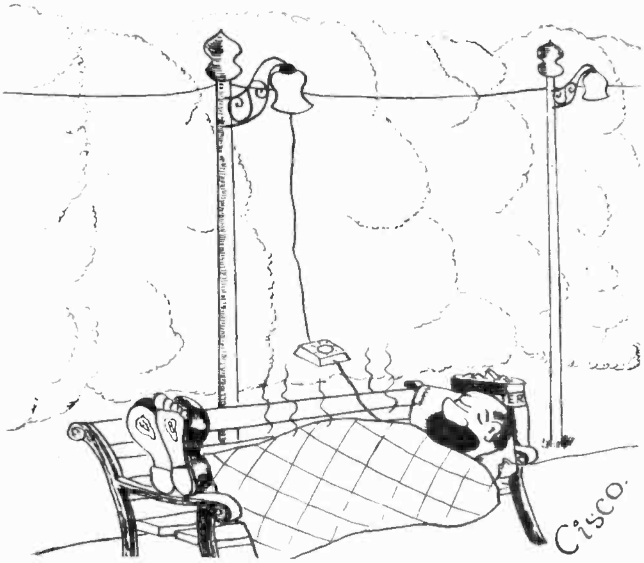
If you use a scope, monitor the level of the signal of the collector of Q2: when you are near to a minimum the level should fall considerably.

If all works as described, bringing a piece of metal near the coil should result in the frequency rising. If the frequency falls instead of rising, continue adjusting. Near the minimum you can reach a point where the metal firstly adds to the cancellation.

Don't glue down the final tiny, tiny adjustments until you are quite certain that all is OK. The amount of final adjustment is extremely critical as you'll find out.

GENERAL CONSTRUCTION

The general design can be seen from the photographs. We used a Verobox to house the main circuit and cut a piece of broom-handle at an angle and fitted a bicycle hand-grip to this. The stem is made up from cold water plastic tubing, available from many plumbers. The connection to the search-head was accomplished by softening a short length of the stem plastic in hot water and quickly clamping this in a vice. The connectors on the stem are also pipe fittings.



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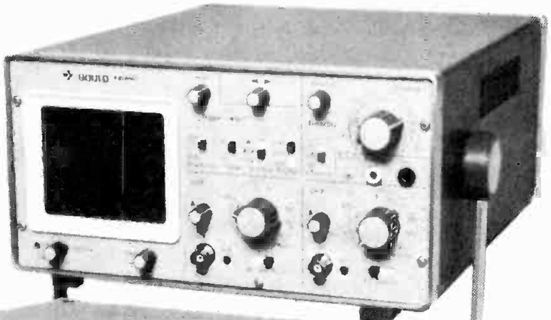

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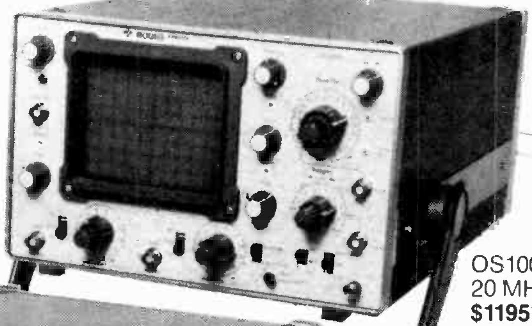

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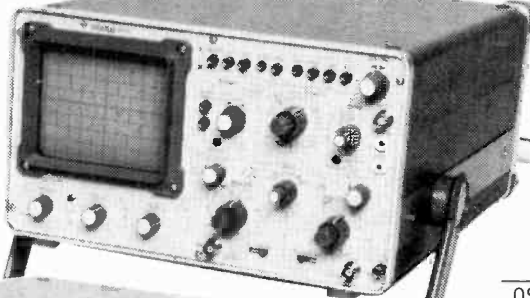

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Porch Light

An attractive project that should banish night-time gloom from the front door step.

WHEN RETURNING HOME on a dark winter's night, with gusting winds and pouring rain making the thought of gaining the inner warmth of home very appealing, it is no fun when the front door proves difficult to find in the gloom. The solution is to install a porch light to banish the all prevailing gloom forever. Things being what they are, however, in order to ensure that this guiding light is present whenever it is required would mean an extortionate demand from your friendly local hydro company.

The answer is the circuit presented here. It arranges for the porch to be lit for a short time when required, and here's the clever bit, it uses the bell push to turn it on — No need to install a separate switch.

The unit will only operate when it is dark enough to require it — you choose the level, and turns off automatically unless latched on from inside the house. Flicking the internal switch also operates the light.

As well as saving money the circuit is also a valuable addition to the domestic security arrangements. Thus, while friends will soon realise that just because the porch light comes on you need not be at home, the light should put off any unwelcome callers.

CONSTRUCTIVE THINKING

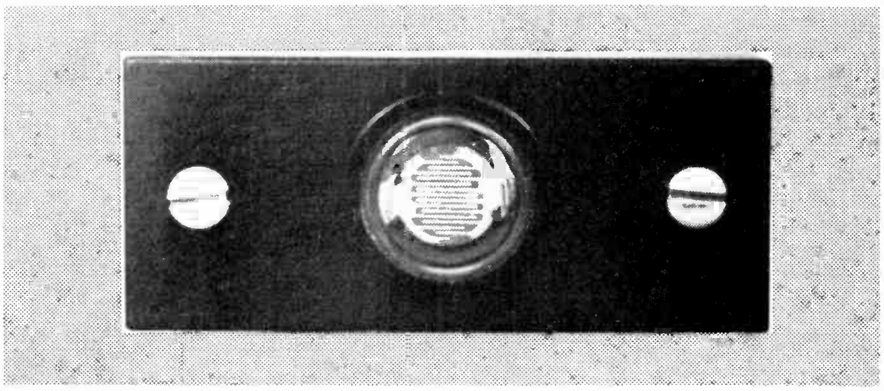
Construction of the project should pose no problems if the PCB shown is used and the component overlay followed carefully. Take care to ensure that the components are mounted close to the board if space is at a premium.

PUTTING IT IN

When installing the unit note that the bulb is powered by a DC voltage and thus if an existing porch light is used care must be taken when installing the unit as two separate wires are required from the porch unit to the bulb.

The other points to note are the connections to the bell push. If the bell circuit is operated with an AC supply there will be no problem. If a DC supply is used take care to ensure that the positive side of the push is connected to point F

When installed the unit can be operated in three different ways. It will be activated when the bell push is operated or if the interior switch is turned on briefly. The porch light can also be turned on for as long as is required by moving the interior switch to the on position.



The light sensitive resistor was mounted in a standard bell push unit (not the one that operates the bell!)

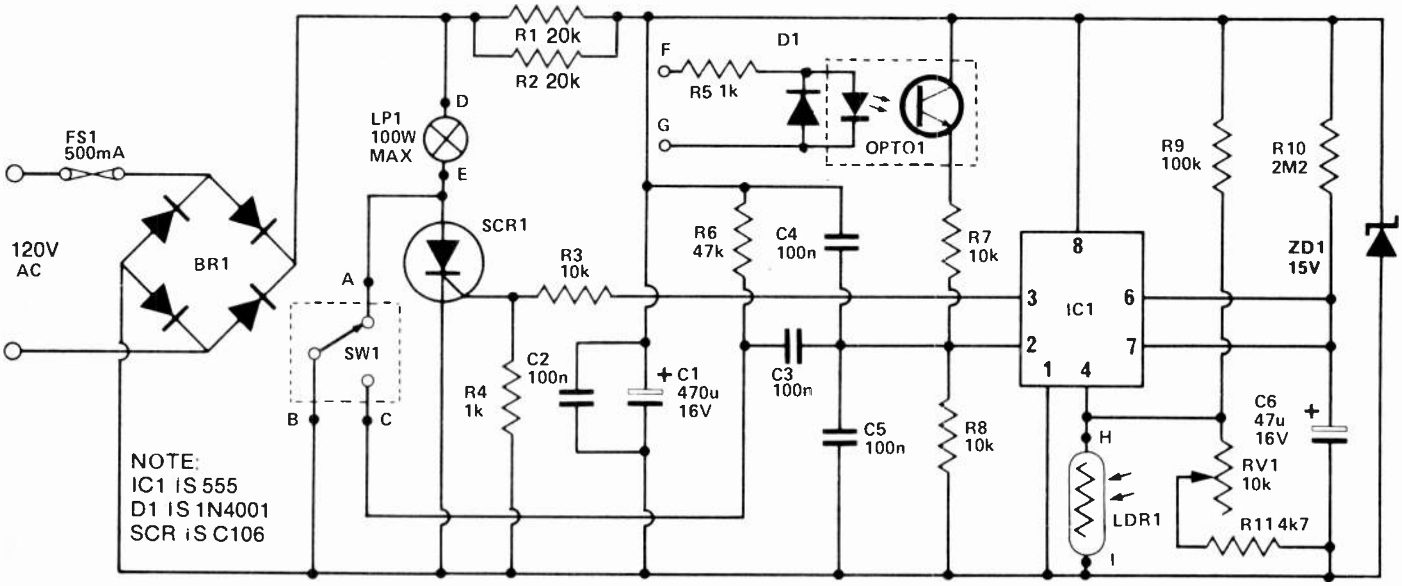
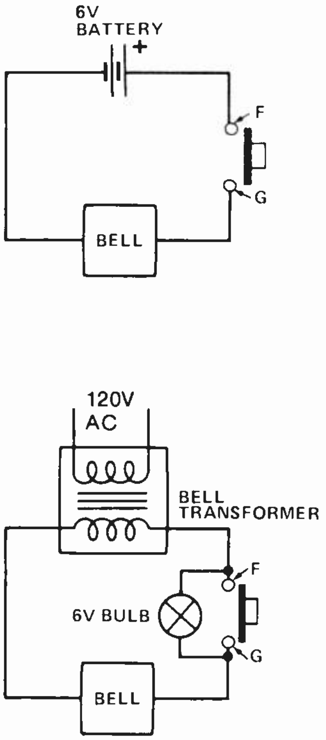


Fig. 1. The full circuit diagram of the Porch Light is shown above.

Fig. 2. The diagrams below show two of the most common bell circuits. In each case the diagrams indicate the points that should be connected to the Porch Light circuit.



HOW IT WORKS

THE porch light circuit is formed by a timer, based on IC1, with an isolated trigger circuit formed by OPTO 1, circuitry to control the lamp, and finally a power supply section.

The timer is formed by a 555 configured in the monostable mode. Under quiescent conditions the output of this device (pin 3) is low. If, however, the voltage at the trigger input (pin 2) is taken below one third of supply voltage, the output at pin 3 will go high for a period of time determined by the timing components R10, C6.

The voltage at this trigger input is usually held high by the action of the opto-isolator, OPTO 1. This device consists of an optically coupled infra-red Gallium Arsenide LED and silicon photo-transistor encapsulated in a six pin DIL package.

The action of the photo-transistor is similar to that of other transistors, except that collector current flow can be initiated (the device turned "on") either by biasing the base in the usual manner, or by illuminating the exposed semiconductor junction with light. In our application, with the base open circuit, device operation is controlled solely by the amount of light falling on the junction, which in turn is controlled by the current flowing in the infra-red LED.

This current, derived from the voltage applied to points F and G, is limited by R5. D1 is included to protect the LED from any reverse bias voltage. The voltage referred to above is supplied by the external bell circuit. This circuit must supply a voltage to this point at all times except for the period of time when the bell push is pressed. Thus the photo transistor is turned on, maintaining a high voltage at the 555's trigger pin until the bell is operated, when R8 pulls pin 2 low to activate the timer.

The time period may also be initiated by a negative pulse applied to the trigger input via C3. This pulse is derived from S1 which, in normal operation, connects point B to point C. By momentarily operating this switch a negative pulse is generated to activate the timer.

The potential divider network formed by R9, R11, RV1 and LDR1, which is connected to the 555's reset pin (pin 4), also controls timer operation. If the reset pin is held below 0.4V the timer's action is inhibited. The LDR's resistance varies between 10 M and 130R, the more light incident upon it the lower the resistance, and with the values shown this ensures that the circuit is inoperative during daylight hours.

The output of the 555 is fed, via the potential divider R3 and R4, to the gate of the thyristor SCR1. This is a sensitive gate device which is triggered by an 0.8V, 0.2mA gate pulse.

The thyristor is connected in series with the porch light and is powered by the 120V AC line voltage derived from the bridge BR1. Thus the lamp is on at all times when the 555's output is high.

Power to the rest of the circuit is derived via R1 and R2.

The circuit is protected from spurious triggering by components C1, C2, C4 and C5.

CAUTION

Extreme care should be taken to properly insulate this circuit from possible human contact as it is directly connected to the AC line. This includes being careful if operating the circuit out of its case during initial testing. A lethal shock may result from touching this circuit while it is operating.

PARTS LIST

RESISTORS (all ¼ W 5% unless stated)

R1,2	20k 2 W
R3,7,8	10k
R4,5	1k
R6	47k
R9	100k
R10	2M2
R11	4k7

POTENTIOMETER

RV1	10k preset

LIGHT DEPENDENT RESISTOR

LDR1	Clairex CL705HL

CAPACITORS

C1	470u 16 V electrolytic
C2,3,4,5	100n polyester
C6	47u 16 V tantalum

SEMICONDUCTORS

IC1	555
D1	1N4001
SCR1	C106
BR1	0.9 A 400 V
OPTO 1	Opto-Isolator 4N29
ZD1	15V Zener 400mW

SWITCH

SW1	AC SPDT Switch

MISCELLANEOUS

AC surface mounting box, fuse plus holder, PCB as pattern.

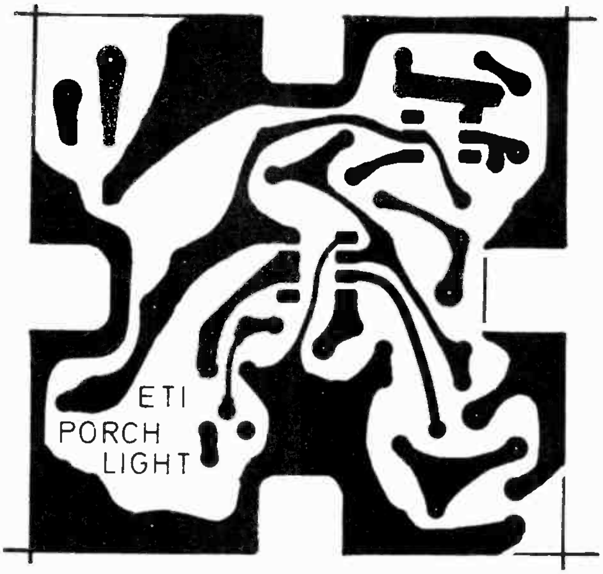
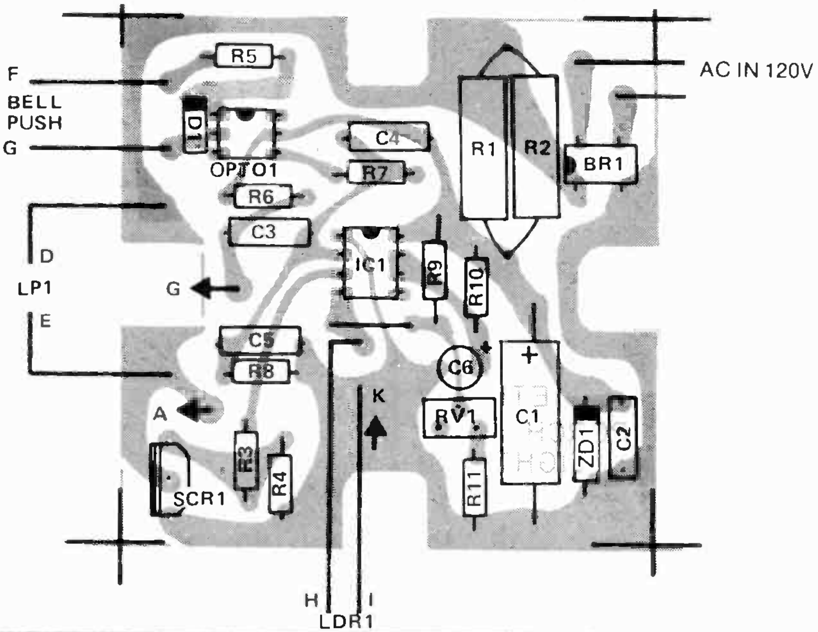
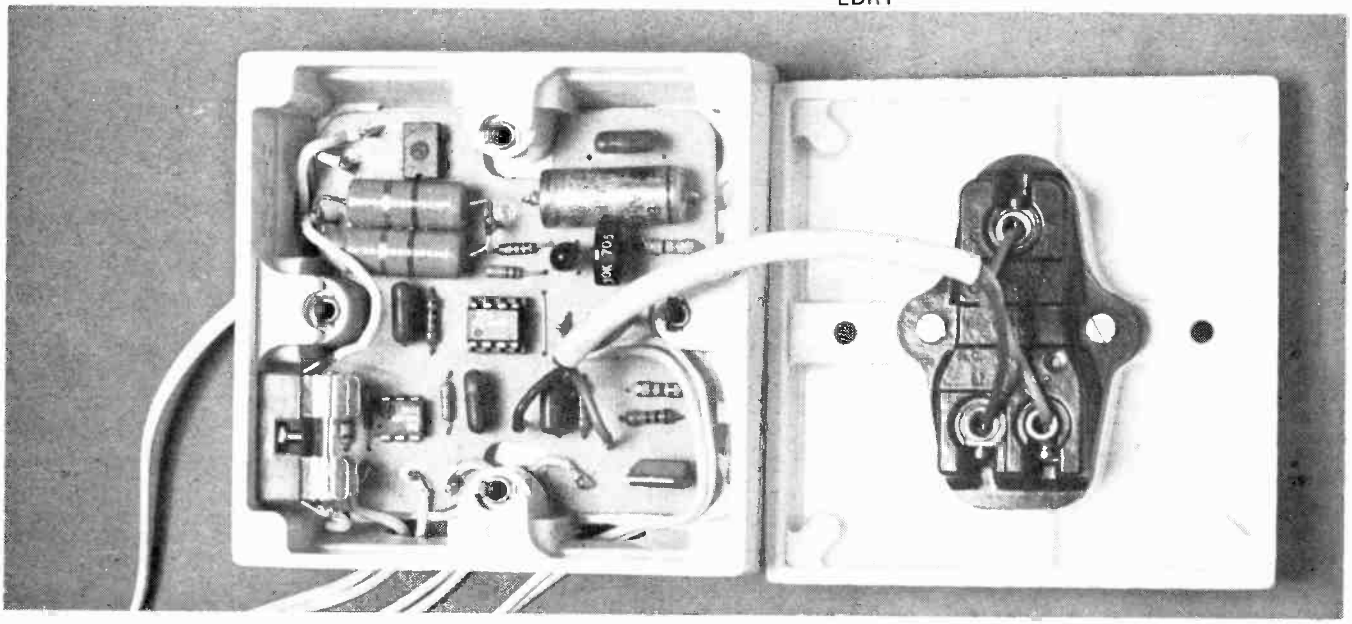


Fig. 3. The foil pattern for the Porch Light is shown full-size (70 x 70 mm).

Fig. 4. (below) shows the component overlay for the Porch Light project.



Photograph showing the internal layout of the project. Note — a set of ventilation holes should be drilled in the mounting box above and below resistors R1 and R2. These holes will also allow access to RV1.



FEEDBACK

LETTERS to the editorial staff for ETI should be addressed to the appropriate department, Project File, Audio Today, or ETI Query for questions on other articles, and ETI Feedback for letters of general interest. If you wish a personal reply you must enclose a self addressed stamped envelope. Letters without will probably end up in our round file. Write to: Appropriate Department, Electronics Today International, Unit 6, 25 Overlea Blvd., TORONTO, Ontario, M4H 1B1.

Protest

I cannot protest too strongly the police state tactics which have resulted in the incarceration of Dr. Peter Treu, following a secret trial in which even the true nature of his charge has not been made public. The implications for everyone working in all engineering disciplines are terrifying.

I should like to use your pages to urge all professional engineering and technology societies and associations to voice their protest of this injustice, and to urge their members to refrain from entering into any contractual arrangement which might involve work for the Dept. of National Defence, NATO, the Department of Justice, or any other government department or agency, particularly where it might involve security rating. The alternative is that anyone risks the loss of reputation, personal security, and freedom by arbitrary police action, and denial of due process of law.

(Name withheld by request)

Frustrating Electronics

Write me a nice little note with your reactions to the following:

You are in the business of transmitting technical information in electronics. As a supplement you also publish construction articles to make use of said knowledge.

1. Last March I wrote a note asking for an explanation or an article on the purpose of a .Olufd capacitor in parallel with a 1000ufd capacitor in a power supply. I enclosed a stamped, self-addressed envelope as you so often request in your magazine. Result: NOTHING. . .

2. I decided to put together the 5 watt stereo amplifier, featured in the Feb. '77 issue. I ordered the controls, transformer and I.C.s from Canmos Electronics. They came promptly. I moved rather slowly on this project and in early May '78 I had finished the entire PC board except the IC's. I had already taken note of the item in the March '77 issue indicating that the LM379 had been changed from .6" spacing to .3" spacing but nowhere was it mentioned that it was also changed from 16 to 14 pins. In early May 78 I wrote to Canmos for data on the 14 pin package so I could sort out which pins went in which holes. Result: NOTHING. . .

3. For years I have been looking for a good FM tuner project. Finally in your May '78 issue it shows up. I immediately begin the enormous task of tracking down the parts. I located everything except the LP1186 and L1. I immediately wrote to Philips and at the instruction of Mr. Wideman, via a note from Sharon Wilson, I was informed that L1 was available from Livingstone Electronics. I wrote both parties on April 27, 1978. I have had an answer from Philips now for over a Month. From Livingstone: NOTHING.

My reaction to these instances of electronic project building in Canada are as follows:

Regarding #1, nobody seems to know the answer and you're too embarassed to say so.

For #2, the business has the money, now to hell with the customer, even if the material supplied did not conform with the order; we won't help you complete your project and ensure that you become a future customer. The attitude is, screw the customer the first time around because you won't get a second chance at him.

On #3, I figure you operate Livingstone Electronics as a front and L1 is available only in the total package at a tremendous mark-up. The best projects from your point of view are the ones with at least one key component that is absolutely impossible to get except through you, that way you have the market exclusively yours.

You can be sure that I am spreading the word about your projects and your suppliers to my fellow electronics teachers and my students. The facts speak clearly: the obstacles in the path of anyone attempting to build your projects are so overwhelming one wonders why you publish projects at all. You have certainly turned me off and I affect the attitude of many future potential customers.

If you have read this far and wonder whether its just bad luck on my part, I have already tried the push button light dimmer and couldn't find a supplier of the 3/8" ferrite rod. I am also attempting to build the car alarm circuit from ETI Top Projects number 3, just try and find the relay to fit the PC board pattern. After all this, would you really expect me to attempt another one of your projects?????????

Yours truly finished R. J. Sweet
Electronics Instructor, Aldershot High School

Your outburst underlines the frustration you have experienced in building a few projects on a casual basis. Imagine how some of the people trying to make a living from a small electronics business must feel! Let's have a look at your points one by one.

"Transmitting technical information" is only a small part of our function. We want to make it easier to learn about electronics, obtain parts in Canada, build projects, publicize new developments, and offer encouragement. As the only widely distributed Canadian electronics magazine we are also a forum for discussing the electronics business in Canada. A number of industry spokesmen have commented that Canada's expertise in electronics could be like Switzerland's watch industry (used to be!) so let's encourage it! My personal hope is that electronics instructors such as yourself would be instrumental in instilling in their students some excitement about electronics, and technology in general as useful tools for mankind, and as an asset to Canada.

About your letter regarding capacitors, we apologise for not replying sooner. Our staff is excedingly busy, and a letter regarding a question not directly connected with the proper operation of a project receives lower priority. We have no obligation to answer such a query, we are not a $1.25 consulting service! However, answering letters is an interesting part of our job, hence something we enjoy doing, rather than something we try to avoid.

The answer is that the 1000u capacitor filters the 60Hz rectified waveform, but being an electrolytic it has quite a high impedance at high (such as r.f.) frequencies. The .01u capacitor, being probably ceramic or polystyrene filters any noise in the higher frequency range which would otherwise not be trapped.

Regarding the 5 watt amp, we printed the revised pcb (kindly provided by Canmos) in April 78. Since then Canmos (one of those smaller business mentioned before) has been through some changes and is now the Watt Shop, P.O. Box 434, Oshawa, Ontario, L1H 7L5. Why not write to National Semiconductor if you want information on a National Semiconductor IC. Livingstone Electronics is another small business, who came to us desiring to sell kits and parts for some of our projects. As is our policy in all such arrangements, we freely permit anyone to do this, including making and selling pcbs to our design. We can retract permission if the service of a particular company is not satisfactory, thus sending a complaint regarding Livingstone to us is useful for our information. However, since this is the first complaint we have seen, and we know that Livingstone's staff is earnestly trying to help the Canadian constructor we will simply pass your comments along to them. We will ignore your accusation that we are in some way involved in a rare parts rip-off.

In view of the fact that we are doing a service to the Canadian electronics industry, providing a medium to advertise hitherto unavailable, informing our readers of those places where parts are available, and encouraging both new businesses and the expansion of commercial outlets to accomodate personal or smaller buyers we find your comments disheartening. You are doing yourself a great disservice by trying to make our existence harder, since this will simply make your hobby more difficult.

We are surprised at your astonishment at the "difficulty" of obtaining parts in this country. If you had been into electronics for any length of time you would know that the electronics hobby in Canada means not only how to put things together, but knowing all the ins and outs of where to get parts. If a little bit of difficulty is going to stump you, then forget it, watch TV instead. Be glad you're not in Eastern Europe, where CMOS has not arrived, and TTL is excruciatingly difficult to obtain, even for institutions, let alone the home constructor!

ETI Data Sheet

CA 3140 Op Amp

Operational amplifier with the beauties of CMOS

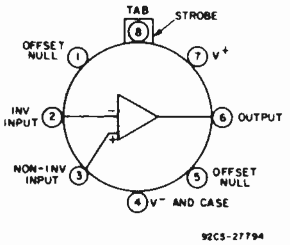


Fig. 1. Functional diagram of CA3140 series.

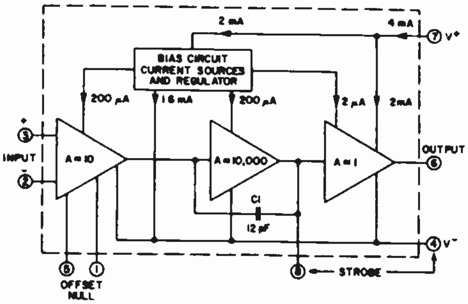


Fig. 2. Block diagram of CA3140 series.

TYPICAL ELECTRICAL CHARACTERISTICS

CHARACTERISTIC		TEST CONDITIONS $V^+ = +15$ V $V^- = -15$ V $T_A = 25^oC$	UNITS	
Input Resistance	R_I		1.5	TΩ
Input Capacitance	C_I		4	pF
Output Resistance	R_O		60	Ω
Equivalent Wideband Input Noise Voltage	e_n	BW = 140 kHz R_S = 1 MΩ	48	µV
Equivalent Input		f = 1 kHz R_S =	40	
Noise Voltage	e_n	f = 10 kHz 100Ω	12	
Short-Circuit Current to Opposite Supply Source	$10M^+$		40	mA
Sink	$10M^-$		18	mA
Gain-Bandwidth Product 8	f_T		4.5	MHz
Slew Rate	SR		9	V/µs
Sink Current From Terminal To Terminal 4 to Swing Output Low	8		220	µA
Transient Response: Rise Time 8	t_r	R_L = 2kΩ	0.08	µs
Overshoot		C_L = 100 pF	10	%
Settling Time at 10 Vpp 1 mV		R_L = 2kΩ	4.5	
10 mV	t_s	C_L = 100 pF Voltage Follower	1.4	µs

MAXIMUM RATINGS, Absolute-Maximum Values.

DC SUPPLY VOLTAGE
(BETWEEN V+ AND V- TERMINALS) . . . . .36 V
DIFFERENTIAL-MODE INPUT VOLTAGE . . . . ±8 V
COMMON-MODE DC INPUT VOLTAGE . . . . (V+ +8V) to (V- -0.5V)
INPUT-TERMINAL CURRENT . . . . 1 mA
DEVICE DISSIPATION:
WITHOUT HEAT SINK –
UP TO 55°C. . . . . .630 mW
ABOVE 55°C . . . . Derate linearly 6.67 mW/°C
WITH HEAT SINK –
Up to 55°C . . . . 1 W
Above 55°C . . . . Derate linearly 16.7 mW/°C
OUTPUT SHORT-CIRCUIT DURATION . . . . .INDEFINITE

Short circuit may be applied to ground or to either supply.

The CA3140B, CA3140A, and CA3140 are integrated-circuit operational amplifiers that combine the advantages of high-voltage PMOS transistors with high-voltage bipolar transistors on a single monolithic chip. Because of this unique combination of technologies, this device can now provide designers with the special performance features of the CA3130 COS/MOS operational amplifiers and the versatility of the 741 series of industry-standard operational amplifiers.

The CA3140, CA3140A, and CA3140 BiMOS operational amplifiers feature gate-protected MOS/FET (PMOS) transistors in the input circuit to provide very-high-input impedance, very-low-input current, and high-speed performance. The CA3140B operates at supply voltages from 4 to 44 volts; the CA3140A and CA3140 from 4 to 36 volts (either single or dual supply). These operational amplifiers are internally phase-compensated to achieve stable operation in unity-gain follower operation, and, additionally, have access terminals for a supplementary external capacitor if additional frequency roll-off is desired. Terminals are also provided for use in applications requiring input offset-voltage nulling.

The use of PMOS field-effect transistors in the input stage results in common-mode input-voltage capability down to 0.5 volt below the negative-supply terminal, an important attribute for single-supply applications. The output stage uses bipolar transistors and includes built-in protection against damage from load-terminal short-circuiting to either supply-rail or to ground.

The CA3140 Series has the same 8-lead terminal pin-out used for the "741" and other industry-standard operational amplifiers.They are supplied in either the standard 8-lead TO-5 style package (T suffix), or in the 8-lead dual-in-line formed-lead TO-5 style package "DIL-CAN" (S suffix). The CA3140B is intended for operation at supply voltages ranging from 4 to 44 volts, for applications requiring premium-grade specifications and with electrical limits established for operation over the range from −55°C to + 125°C. The CA3140A and CA3140 are for operation at supply voltages up to 36 volts (±18 volts). The CA3140 and CA3140A can also be operated safely over the temperature range from −55°C to + 125°C, although specification limits for their electrical parameters do not apply when they are operated beyond their specified temperature ranges.

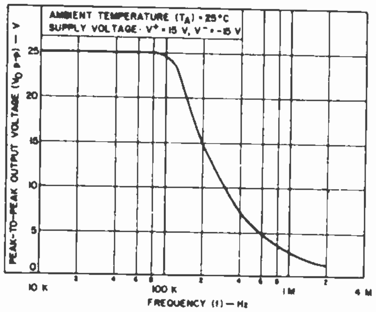


Fig. 3. Maximum output voltage swing vs. frequency.

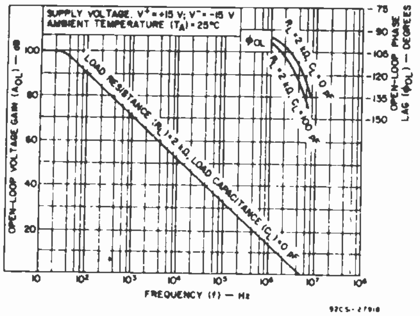


Fig. 4. Open-loop voltage gain and phase lag vs frequency.

ELECTRICAL CHARACTERISTICS FOR EQUIPMENT DESIGN

At V$^+$ = 15 V, V$^-$ = 15 V, T_A = 25^{o}C Unless Otherwise Specified

CHARACTERISTIC	Min.	Typ.	UNITS Max.	
Input Offset Voltage, V10	–	5	15	mV
Input Offset Current I_{10}	–	0.5	30	pA
Input Current I_I	–	10	50	pA
Large-Signal Voltage Gain, A_{OL}^*	86	100	–	dB
Common-Mode Rejection Ratio, CMRR	70	90	–	dB
Common-Mode Input-Voltage Range, V_{ICR}	–15	–15.5 to +12.5	11	V
At V$^+$ = 5 V, V$^-$ = 0 V,	–0.5 to +2.6			V
Power Supply Rejection Ratio, PSRR (see Fig. 11)	76	80	–	dB
Max. Output Voltage■	V_{OM+} V_{OM-}	+12 –14	13 –14.4	– –
Supply Current, I^t	–	4	6	mA
Device Dissipation, P_D	–	120	180	mW

★At V_O = 26$V_{p\text{-}p}$, +12V, –14V and R_L = 2kΩ

■ At R_L = 2kΩ

DRIVING TTL

Excellent interfacing with TTL circuitry is easily achieved with a single 6.2-volt zener diode connected to terminal 8 as shown in Fig 5. This connection assures that the maximum output signal swing will not go more positive than the zener voltage minus two base-to-emitter voltage drops within the CA3140.

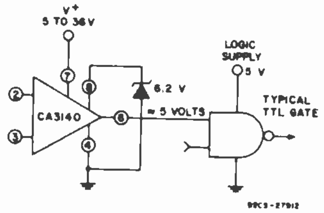


Fig.5. Zener clamping diode connected to terminals 8 and 4 to limit the CA3140 output swing to TTL levels.

OFFSET-VOLTAGE NULLING

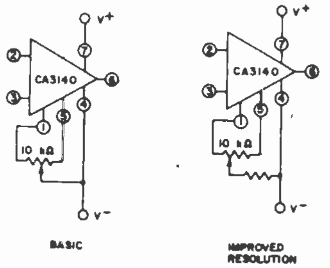


Fig.6. Two offset-voltage nulling methods.

INPUT CIRCUIT CONSIDERATIONS

As mentioned previously, the amplifier inputs can be driven below the terminal 4 potential, but a series current-limiting resistor is recommended to limit the maximum input terminal current to less than 1 mA to prevent damage to the input protection circuitry.

Moreover, some current-limiting resistance should be provided between the inverting input and the output when the CA3140 is used as a unity-gain voltage follower. This resistance prevents the possibility of extremely large input-signal transients from forcing a signal through the input-protection network and directly driving the internal constant-current source which could result in positive feedback via the output terminal. A 3.9-kΩ resistor is sufficient.

The typical input current is in the order of 10 pA when the inputs are centered at nominal device dissipation. As the output supplies load current, device dissipation will increase, raising the chip temperature and resulting in increased input current.

TONE CONTROL CIRCUITS

High-slew-rate, wide-bandwidth, high-output voltage capability and high input impedance are all characteristics required of tone-control amplifiers. Two tone control circuits that exploit these characteristics of the CA3140 are shown in Figs 7 and 8.

The first circuit, shown in Fig 7, is the Baxandall tone-control circuit which provides unity gain at midband and uses standard linear potentiometers. The high input impedance of the CA3140 makes possible the use of low-cost, low-value, small-size capacitors, as well as reduced load of the driving stage.

Bass treble boost and cut are ±15 dB at 100 Hz and 10 kHz, respectively. Full peak-to-peak output is available up to at least 20 kHz due to the high slew rate of the CA3140. The amplifier gain is -3 dB down from its "flat" position at 70 kHz.

Fig 8 shows another tone-control circuit with similar boost and cut specifications. The wideband gain of this circuit is equal to the ultimate boost or cut plus one, which in this case is a gain of eleven. For 20-dB boost and cut, the input loading of this circuit is essentially equal to the value of the resistance from terminal No. 3 to ground. A detailed analysis of this circuit is given in "An IC Operational Transconductance Amplifier (OTA) With Power Capability" by L, Kaplan and H. Wittlinger, IEEE Transactions on Broadcast and Television Receivers, Vol. BTR-18, No. 3, August, 1972.

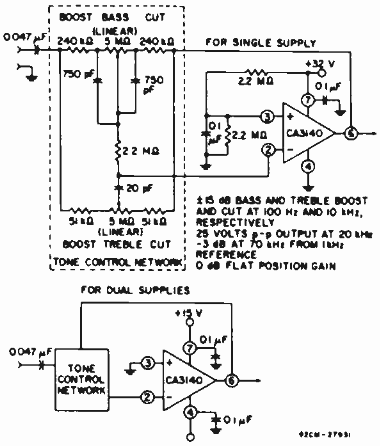


Fig. 7 — Baxandall tone control circuit using CA 3140 series.

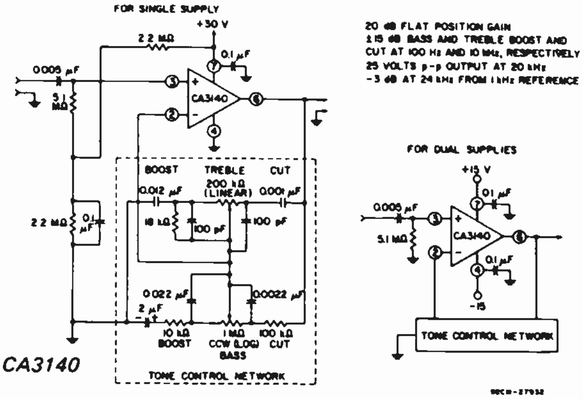


Fig. 8 — Tone control circuit using CA3140 series (20-dB midband gain).

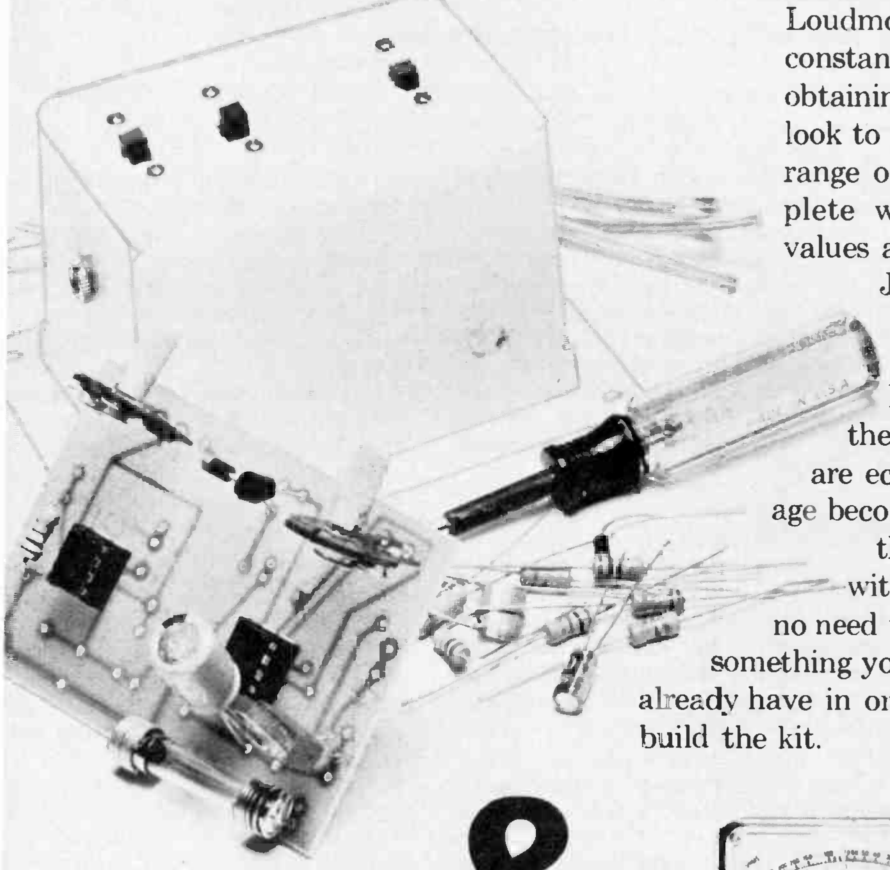
BRITISH COLUMBIA
Cam Gard Supply Ltd.
VANCOUVER
Cam Gard Supply Ltd.
KAMLOOPS

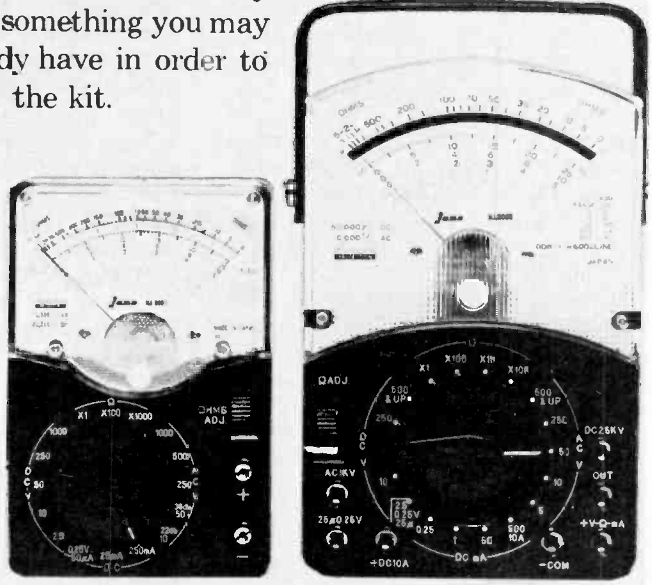
ALBERTA
Cam Gard Supply Ltd.
CALGARY
Cam Gard Supply Ltd.
EDMONTON
Cam Gard Supply Ltd.
RED DEER

SASKATCHEWAN
Cam Gard Supply Ltd.
REGINA
Cam Gard Supply Ltd.
SASKATOON

MANITOBA
Cam Gard Supply Ltd. (Head Office)
WINNIPEG

ONTARIO
ARC Electronics & Comm. Centre
WELLAND
A & S Communications
STONEY POINT
AVA Electronics
ETOBICOKE
Abbey Electronics Ltd.
REXDALE
Allcan Comm. Ltd.
BURLINGTON
Altronics Stereo 2000
TORONTO
Andersons Radio
LONDON
Ardex Distributing Co.
WEST HILL
Arkon Electronics
TORONTO
Asseff T.V. Service Ltd.
WINDSOR
Al Electronics
TORONTO
Atwater Electronics
MISSISSAUGA
Bills T.V. & Electronics
MILOMAY
Bimbo Sales
BRAMPTON
Brant Electronics Supply Co. Ltd.
BRANTFORD
CDN Admiral Corp Ltd.
LONDON
C M Peterson Co. Ltd.
LONDON
CYS Radio & Equipment
HAMILTON
Canadian Admiral Corp. Ltd.
TORONTO
Carsall Industries
SAULT STE. MARIE
Cathay Television Supply
TORONTO
Circle T.V
BELLEVILLE
Classic Auto Radio
TORONTO
Comm. Spec. Co. Ltd.
TORONTO
Communications Unlimited
MISSISSAUGA
Concord Sound
TORONTO
Cristie Electronics
TORONTO
D. G. Enterprises
KINGSTON
Dominion Radio Ltd.
TORONTO
Drumbo Shoes & Variety
DRUMBO
Dufferin Muntz Centre
TORONTO
Electrocraft Industrial Sales
NEWBURGH
Electronics Wholesalers
OTTAWA




Jana
OHMS ADJ.
AC 1KV
DC 25KV
+DC10A
DC mA
-COM
+V-Ω-mA

An Introduction To Amateur Radio Part Two

Amanda King describes how you can become part of the global network of radio enthusiasts. This month, final part.

VHF

Two meters is by far the most popular VHF ham band in Canada and the United States, and the most popular mode used on 2 meters — wide-band FM — is legally permitted between 146 and 148 MHz. Wide-band FM is ideally suited to mobile and portable operation, with the added advantage that these rigs can be made small, compact, and easily carried.

Two-meter operation is generally confined, however, to fairly populated areas for the simple reason that its range is limited. VHF frequencies can't bounce off the ionosphere to produce the far-reaching range found on the low bands; instead VHF operation produces superb, interference-free results when the two hams talking to each other are in "line of sight".

However, in some locations maintaining "line of sight" is almost impossible. (Think of mountainous British Columbia or the prairies where hams are few and far-between.)

That is where the VHF repeater comes in.

Repeaters are generally set up, paid for, and installed by a local ham club. These repeaters can vary technologically from ancient tube-type models to sophisticated computer-controlled units which can (1) identify themselves in code every few minutes, (2) can be rigged to an "auto-patch" enabling hams so equipped to make telephone calls while mobile or portable using their own rigs, or even (3) announce the time and weather.

Ideally, repeaters are located on the tops of mountains, tall buildings, or hills, thereby greatly increasing the range of a ham's 2-meter portable or mobile. Often regular users of a particular repeater find themselves forming informal "clubs" of their own, and friends are very often made on 2-meters. It is the "city" band: once outside a populated area and out of a repeater's range 2-meters is really only useful if there are two or more hams using it to remain in touch, talking to each other directly.

Two meters offers the technically-inclined some challenging opportunities to apply their skill. The newer 2-meter rigs in some cases can be modified for computer control to allow the automatic scanning of all frequencies, the synthesizing of any frequencies the original rig did not have, and other more complex functions.

EVENTS

If the many bands available to hams present good opportunities for operation, experimentation, and socialization, so also do the many events sponsored by ham clubs and other organizations: contests, sweepstakes, and — best of all — Field Day.

Field Day is an annual event in which hams all over the world take part. If you have joined or are thinking of joining a ham club, you will soon be filled in on all the details: but here is a preview.

Generally taking place in late spring or early summer, Field Day can combine barbeques, camping, and the great outdoors with a challenging and rigourous test of a ham's operating abilities. It is up to you to provide a rig, power supply, and stamina: the object is to make as many QSO's as possible within the given time limit. CW operators and SSB (single sideband) operators are classed separately as are QRP (low power) operators and QRO (high power) operators.

Basically, Field Day challenges the ham to operate as best he can on an "emergency"-type set-up.

Another exciting annual event, in which you can take part in the comfort of your own operating area of "shack", is the ARRL Sweepstakes. Usually held in November, awards can be won both in the CW and in the SSB classes. The CW part takes place one weekend for a period of 24 hours; the SSB operators then participate the following weekend for the same length of time. The ARRL's ham radio magazine "QST" announces the Sweepstakes, regulations, and operating frequencies well ahead of time, and you also have to apply for special forms on which you record all your QSO's in order to be eligible for an award.

Individual clubs may also sponsor their own events, workshops, and so on. The larger clubs send out regular bulletins announcing up-coming events, and Canada's CARF Bulletin keeps well up-to-date on the Canadian ham radio scene.

WHY STOP NOW?

Imagine now that you have been operating successfully for several months, a year, or longer. Perhaps you have turned several rigs and other pieces of equipment inside-out. Maybe you have joined a club, made some friends. The wall of your shack is getting covered with exotic QSL cards. You feel yourself becoming pretty much the kind of ham radio operator you wanted to be when you first became interested in ham radio.

Why not get your advanced amateur certificate?

The advanced amateur can do some things an ordinary ham can't do. The single most important one is that he can use phone — usually SSB — on the low bands as well as CW and thus enjoy a variety of choices as to how he can communicate with other hams. He enjoys a really "personalized" conversation and can exchange information and interesting news much more quickly and efficiently than most average-speed CW operators can. In addition, the increased choice of modes and frequencies enables an advanced ham to experiment more broadly and exercise technical skills with more complex equipment if he so chooses. Many hams think of the advanced certificate as one of the capstones of being a ham.

The requirements are straightforward:

(1) you must operate CW on the low bands regularly for at least a year and be able to prove this by showing your logbook to the DOC examiner: also, if possible, your QSL cards.

(2) You must write an exam similar to the one required for the amateur certificate, but in order to pass the advanced exam you must in addition have a knowledge of single sideband theory, FM, and regulations pertaining to phone operation on the ham bands in Canada. No diagrams are required, but an oral exam is given instead, and the candidate should be able to draw simple sketches if necessary to illustrate answers which are difficult to explain verbally.

(3) You must pass a code proficiency test which requires the candidate to send and receive text at a speed of no less than 15 words per minute.

Now, satisfying the first requirement is not difficult providing you can make CW contacts fairly regularly: several times a week on the average.

Such regular operation will give you the added advantage of helping your code speed along. The difference between 10 to 12 words per minute and 15 is negligible to a regular operator: listening to a 15 word per minute code cassette and tuning in on W1AW's 15 word per minute transmissions is also recommended.

(Again, it is an excellent idea to have your code speed at a fairly solid 17 or 18 words per minute when you take the exam: you'll always be nervous, and every extra word per minute helps!)

For a person with an electronics background and some technical ability the theory will prove fairly easy as well, but still some reading is definitely required.

The CARF Advanced Study Guide, a sequel to the CARF Certificate Study Guide by Bushell and Hovey, is a good source on what is required in Canada for the advanced standing.

The Ham Handbook for the Advanced, by Morton Bibeck, also provides a useful outline on the areas on which to focus your knowledge.

And don't forget the DOC circulars, exam syllabus, and regulations exerpt!

The ARRL is an unparalleled source of supplementary reading, especially for the technically-minded as pointed out earlier. One of their publications is devoted to SSB theory, and another covers FM and repeaters. Many electronics stores offer other books on related theory, and it is a good idea to leaf through a few ham radio magazines: you can spot quite a few good articles written by other hams covering many aspects relating to advanced theory.

As far as operating SSB on the low bands goes, the procedure involved in making a QSO is basically the same as it is for CW: with some minor differences.

The RST is one of them. First of all, it isn't an RST anymore on SSB: just an RS. Again, the best signal report would be 5-9, and again, it is important to be honest about reporting what another ham's signals really sound like.

Calling CQ also changes slightly in style. An SSB operator should say something like "CQ, CQ, CQ, this is VE2YZ, Victor Echo Two Yankee Zulu, VE2YZ, Victor Echo Two Yankee Zulu standing by." Again, a long string of CQs is irritating and unnecessary. It is good procedure both on SSB and on CW to pause afterwards and listen carefully for a reply before calling again on the same frequency.

You probably noticed the Victor Echo business above. Yes, it is a very good idea to learn the standard ICAO — (International Civil Aviation Organization) alphabet if you are going to operate SSB. But it should only be used sparingly and when necessary — when calling CQ for instance, or if interference is strong — or else it becomes confusing and even downright silly.

You'll find the ICAE alphabet in most ham radio books dealing with operating, but here it is anyway:

A — Alfa
B — Bravo
C — Charlie
D — Delta
E — Echo
F — Foxtrot
G — Golf
H — Hotel
I — India
J — Juliette
K — Kilo
L — Lima
M — Mike

N — November
O — Oscar
P — Papa
Q — Quebec
R — Romeo
S — Sierra
T — Tango
U — Uniform
V — Victor
W — Whiskey
X — X-ray
Y — Yankee
Z — Zulu

A good SSB operator speaks clearly and distinctly, just as a good CW operator sends clear, distinct code. It is a sign of good manners to pause in between sentences during a transmission just for a second or two in case the other ham wants to break in to tell you the phone is ringing, the cat wants out, or the cookies are burning. There is nothing more impolite than a chatterbox who won't stop for breath in case his VOX feature (automatic mike activation) turns his mike off. That should be his problem, not yours.

Although DX-ing is a favorite pastime with SSB, generally the farthest and most exotic locations can be reached using CW. (Operators in some poorer countries are also hard-pressed to afford an expensive SSB rig). However, it is common to turn on the rig and hear hams in Japan talking to their counterparts in England, or hear Spain coming in loud and clear. Some hams even set up schedules (commonly called "skeds") with friends or family half-way around the world, and talk to them regularly on SSB!

The following is a list of frequencies on which it is legal to operate SSB in Canada:

3.725 to 4 MHz on 80 meters
7.150 to 7.3 MHz on 40 meters
14.1 to 14.35 MHz on 20 meters
21.1 to 21.45 MHz on 15 meters
28.1 to 29.7 MHz on 10 meters
50.050 to 54 MHz on 6 meters
144 to 148 MHz on 2 meters

(SSB is also permitted on UHF and experimental frequencies as specified in the regulations.)

While CW is generally permitted on all ham portions of a band, SSB is restricted to those frequencies listed above only.

The advanced amateur also faces a myriad of choices as far as equipment is concerned; and in most cases the SSB rig is definitely going to cost more than the simpler CW rig. Here again it is basically up to the individual ham. Some of the modern rigs are models of sensitivity, precision, and trouble-free operating; but, as with so many of the good things in life, you pay for it. A ham with a talent for repairing an old rig, on the other hand, can save many dollars going that route. He may have to baby the rig a little and blow on the tubes to keep them cool, but renovated older rigs can be quite servicable, nonetheless: as many, many hams have found!

Technically-competent hams can design their own combination SSB-CW rigs from the ground up and build them incorporating the most up-to-date technology. There are a lot of books on the market containing valuable information for projects of that nature.

Remember, too, that your ham club can almost always help you out if you're trying to decide on equipment, and ham radio stores are generally quite co-operative.

EXOTIC WAYS TO RAGCHEW

So far, so good. We've talked about regulations, exams, equipment, antennas, CW, SSB, VHF, ham clubs, events, and general operating.

Now how about RTTY, ATV, SSTV, OSCAR, moon-bounce, and facsimile?

Huh?

These are just a few of the varied things hams can do with their talents, time, and equipment. Not all hams are interested in all of these exotic modes, of course, but here is a kind of buffet. It's up to you to sample:

RTTY stands for radioteletype transmission: a means of sending

Advanced Electronic Career

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Including A Microprocessor Laboratory

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The microprocessor has ushered in the age of microtechnology and electronics will never again be the same. The microprocessor has made possible the placing of an entire computer on a silicon chip one quarter inch square. The microprocessor "miracle chip" is in the process of changing the world. Soon all technical personnel in electronics will have to understand and work with the microprocessor. It is invading virtually every area of electronics. And it is profoundly affecting your electronics career.

Brand New Program

CREI has a brand new program to help you learn how to work effectively with this revolutionary electronics development. CREI's new program in Minicomputer and Microprocessor Technology is designed to prepare you for this field by giving you the education and practical experience you need.

The program provides solid preparation in electronics engineering technology with a specialization in minicomputers and microprocessors. In addition, it includes a microprocessor laboratory which features a fully programmable microcomputer which utilizes the Motorola 6802 microprocessor chip. This is an extremely important element of your program.

Programming Essential

As you may well know, you must learn how to *program* the microprocessor in order to design, service or troubleshoot microprocessor electronic systems. There is only one effective way to learn this all-important skill of programming, and that is by actually *doing it*. CREI's new program gives you this opportunity as you work with the exciting microprocessor laboratory.

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With CREI's new program, learning the skill of programming is simple. Within a few hours you'll be programming the microprocessor and in a short time you'll learn how to program it in three languages: BASIC, assembly and machine languages. In addition, you will learn how to interface the microprocessor with other systems and to test and debug specialized programs.

Preparation at Home

Wide Choice of Programs

Please note, however, that CREI's new program is only one of 16 state-of-the-art programs in advanced electronic technology offered by CREI. So even if you choose not to specialize in microprocessor technology, CREI has an advanced electronics program to meet your needs.

With CREI, you may choose from any of the following areas of specialization in advanced electronics:

Microprocessor Technology
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An exclusive option available with CREI programs in electronic engineering technology is CREI's unique Electronic Design Laboratory program. It gives you actual experience in designing practical electronic circuits. It also helps you to understand the theories of advanced electronics and gives you extensive experience in such areas as tests and measurements, breadboarding, prototype construction, circuit operation and behavior, characteristics of electronics components and how to apply integrated circuits. Only CREI offers this unique Lab Program.

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There isn't room here to give you all of the facts about career opportunities in advanced electronics and how CREI prepares you for them. So we invite you to send for our free catalog. This fully illustrated, 56 page book describes in detail the programs, equipment and services of CREI.

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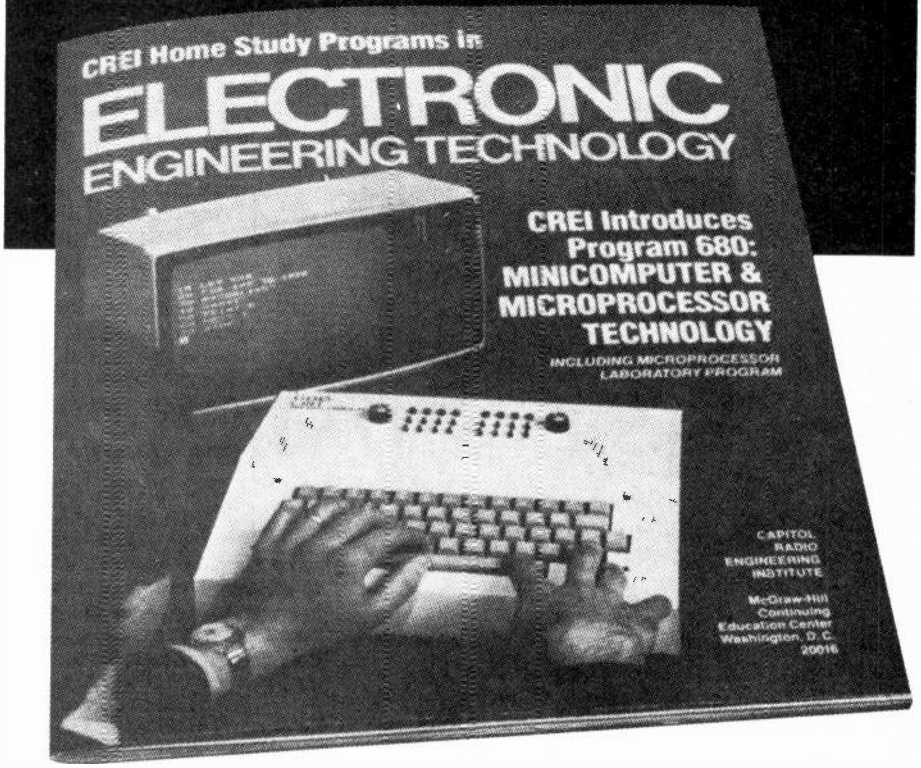
You may be eligible to take a CREI college/university-level program in electronics if you are a high school graduate (or the true equivalent) and have previous training or experience in electronics. Program arrangements are available depending upon whether you have extensive or minimum experience in electronics.

Send for this FREE Book describing your opportunities and CREI college/university-level programs in electronics



Mail card or write describing qualifications to

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written messages over the air with a typewriter-like machine. If the person you are working has a similar machine it will automatically print out whatever you type on yours, and vice-versa. If you have ever listened to shortwave radio and heard a peculiar two-toned signal wavering up and down at irregular intervals, that's RTTY. It operates on the same principle as International code — with "marks" and spaces of varying lengths — but using a different coding system altogether.

One of the nicer things about RTTY is that you can type out good, long, comprehensive messages; you can also get up and stroll out of the room while the other ham is sending to you, and when you get back his transmission is all written out for you.

(If you're interested in different applications of RTTY and various modifications and improvements, the September 1977 issue of "73" Magazine is devoted exclusively to RTTY.)

ATV stands for amateur television: sending motion pictures over the air. Although the range is somewhat limited — 20 miles or so — ATV is not difficult to do. You can start off with a used or new closed-circuit TV camera and modify a surplus commercial UHF FM transceiver by adding a video modulator. Add an old TV set and a frequency converter, and you've got ATV. This mode transmits high-quality, well-defined images.

(For more info about ATV, see Specialized Communications Techniques for the Radio Amateur.)

SSTV, or slow-scan television, works on a slightly different principle than ATV. While a regular fast-scan TV signal produces 30 frames a second, slow-scan TV takes 8 seconds to send one frame. On a shortwave receiver an SSTV transmission sounds like a rough, warbling, variable-toned carrier wave; you can hear it actually scanning.

Although SSTV is slow and the picture definition four times less than with fast-scan TV, its advantages are that it can be used in any amateur phone portion of a band above 3.5 MHz: and DX-ing is possible, as well. All you need is an SSB station (this is where your advanced certificate comes in!), an SSTV monitor, and a camera.

Facsimile, or FAX, is similar to SSTV, but the picture is much better and it comes out on paper rather than on a picture tube. Good quality photographs can be sent on any of the VHF/UHF bands, and inexpensive surplus FAX machines are not difficult to find. Again, the book Sepcialized Communications Techniques for the Radio Amateur provides more details on getting set up.

These, then, are the visual means of ham radio communications. A non-visible but no less exciting means, a child of the space-age, is communication by satellite: OSCAR.

OSCAR (Orbiting Satellite Carrying Amateur Radio) is a case where technology has a tremendous impact on ham radio. The OSCAR satellites are amateur radio stations designed and built by volunteer hams all over the world; each successive satellite is an improvement over the last. They are paid for in a most interesting way: advertisements in ham radio magazines offer hams a chance to "sponsor" a solar cell for $10, or even a more expensive part costing $50 or more. The reward for contributing $50 or more is the engraving of the ham sponsor's call-sign and name inside the satellite itself.

OSCAR 6 and 7 are complex satellites, comparable to the multi-million dollar ones constructed by NASA. Their transponders, their most important parts, receive in the range of 145.9 MHz (2 meters) and transmit around 29.5 MHz (10 meters).

The ARRL station WIAW daily transmits times when OSCAR is avialable for various major cities; you pick the times for the city nearest you.

You don't need complex or delicate equipment to use OSCAR, either. Any rig that will generate a few watts on 2 meters is suitable; in fact it can be harmful to use really high power on OSCAR in case of damage to the transponders. Some transceivers are practically tailor-made for OSCAR.

The most common modes on OSCAR are CW and SSB: they are the most efficient and cause the least amount of wear and tear on OSCAR's transponders and batteries.

OSCAR is one of the most exciting things happening in ham radio today; many hams swear it is the most rewarding way to go DX, and others find in OSCAR a satisfying challenge to apply complex technology to enhance their capabilities with OSCAR.

(Also see the book Getting To Know OSCAR From the Ground Up: a re-print of popular articles written about OSCAR in the ham magazine "QST".)

Moon-bounce really sounds exotic, and it is. It has been described as the most spectacular VHF propagation method. Briefly, it involves using a multi-element antennas to send a signal to the moon using the frequencies 144 MHz and 432 MHz extensively. The reflected signal can be heard a continent away providing the moon is visible in the sky to both stations. Moon-bounce is rapidly becoming a popular way to operate DX on HF, the low bands, as well.

RTTY, ATV, SSTV, FAX, OSCAR, and moon-bounce are all described in some detail in the ARRL's Ham Radio Operating Guide as well.

So here it is. A whole wealth of choices, directions in which to pursue knowledge, to focus interests, talents, and skills, to broaden horizons, to meet new people. Amateur radio is like a hundred hobbies in one, as flexible as each individual who participates, capable of stimulating the interests of engineers, housewives, technicians, salespersons, journalists, movie stars, politicians, students, businessmen. . .

And you?

APPENDIX

Here is some information on some of the amateur radio organizations you might be interested in joining:

(1) The Canadian Amateur Radio Federation, better known as CARF, was created in 1967 for the purpose of providing a national voice for amateur radio operators and provincial amateur radio organizations. CARF supplies input and response from the DOC on individual and club problems and sponsors many discussions on the future of ham radio, as well as keeping on top of the Canadian ham radio scene. The Canadian Amateur is published by CARF eleven months a year.

For information about CARF write to P.O. Box 356, Kingston, Ontario, K7L 4W2.

(2) The Canadian Radio Relay League, or CRRL, is one of sixteen American Radio Relay League (ARRL) divisions: the only one, in fact, not located in the United States. Joining the CRRL means an automatic membership in the ARRL, with membership dues including the monthly issue of the ARRL ham magazine "QST". Write to the American Radio Relay League, Newington, Conn., U.S.A., 06111.

(3) The Canadian Ladies Amateur Radio Association, better known as CLARA, seeks to encourage and promote efficiency and fellowship in amateur radio amongst women. CLARA publishes the Clarion which features articles and information written by and for women in ham radio. CLARA also sponsors events, contests, and nets. For more information write to CLARA, Marjorie Karl, VE6LC, President, Box 191, Foremost, Alberta, T0X 0X0.

In addition to the three major organizations listed above, many ham radio stores and ham clubs can supply information about other organizations and clubs including some which are not directly related to amateur radio but are of interest to persons with a technical background.

Crisis!

This entertaining dramatic excuse for a calculator program was contributed by Wes Potter of Saskatoon.

1984 01 01 00:13h

An insane millionaire, after a year of secret activity and several million dollars investment, attempts to blackmail the world into peace by launching a deadly missile into orbit.

1984 01 03 24:00h

Pushed to the brink of mental instability by the pressure of his situation, the madman goes berserk in his own control room. Control of his mind and his missile are lost simultaneously. The doomsday device breaks out of its high orbit and plunges toward Earth. Two planes, one Russian and the other from Canada, are immediately dispatched. Each equipped with one highly sophisticated interceptor missile, the jets approach the runaway weapon from opposite directions. It is found to be moving along a latitudinal line (±0.5km deviation) with a constant downward acceleration. The jets match these.

THE DRAMA UNFOLDS

YOU are in the brand-new modified Canadian jet fighter and the Russian pilots a fully automatic HP-67 jet fighter. The runaway instrument of destruction must be destroyed before it wreaks havoc and death on an unprepared home country or ally. Only YOU or the Russian can prevent it.

The target has a relatively small kill radius if vaporized by one of the advanced interceptor missiles. Guided by computer-controlled sensing systems, these weapons have a 99.8% chance of destroying their target if fired within one kilometre of it. Thus, your missile is launched automatically only when you are within this range (a one unit division on the linear playing grid).

The madman's weapon is equipped with a sophisticated jamming system which allows you to take a distance-to-target reading, but prevents you from knowing its direction along the line of movement. If *you* inadvertently pass through the *target's* 1km zone, the runaway unleashes a deadly dose of radiation which your plane's shielding barely handles. A short period of instrument unreliability ensues which incapacitates your plane (for one turn). If the *target* passes by *you*, it does not attack and you register its presence on your panel (as 1.1). All of the above also applies to the Russian. You and the Russian exchange all this information with each other to aid in the speedy destruction of the runaway.

A CRISIS SOLVED

If you destroy the missile, you will haved saved the world, brought glory to yourself and your united homeland, Canada, and won two points. If, in your overzealousness, you place yourself in the missile's way (ie., the missile enters your 1km zone), you are destroyed, the missile is destroyed, and the Russian can return knowing the world is safe, the Canadians are out one jet, and that he has one point. All this applies to the Russian in the same way.

Actually, there isn't really an international crisis (there are several), and the runaway never reaches Earth anyway. But it's how you play the game that counts (and who is the first to earn 10 points).

CRISIS is a simple but tricky test of your memory and mathematical manipulation if played without pencil and paper. In this game, the calculator plays against you equipped with an identical intelligence, or decision-making power, in its program. This is possible due to the simplicity of the game, and is not a reflection on the I.Q. of the human opponent! (although the score may be).

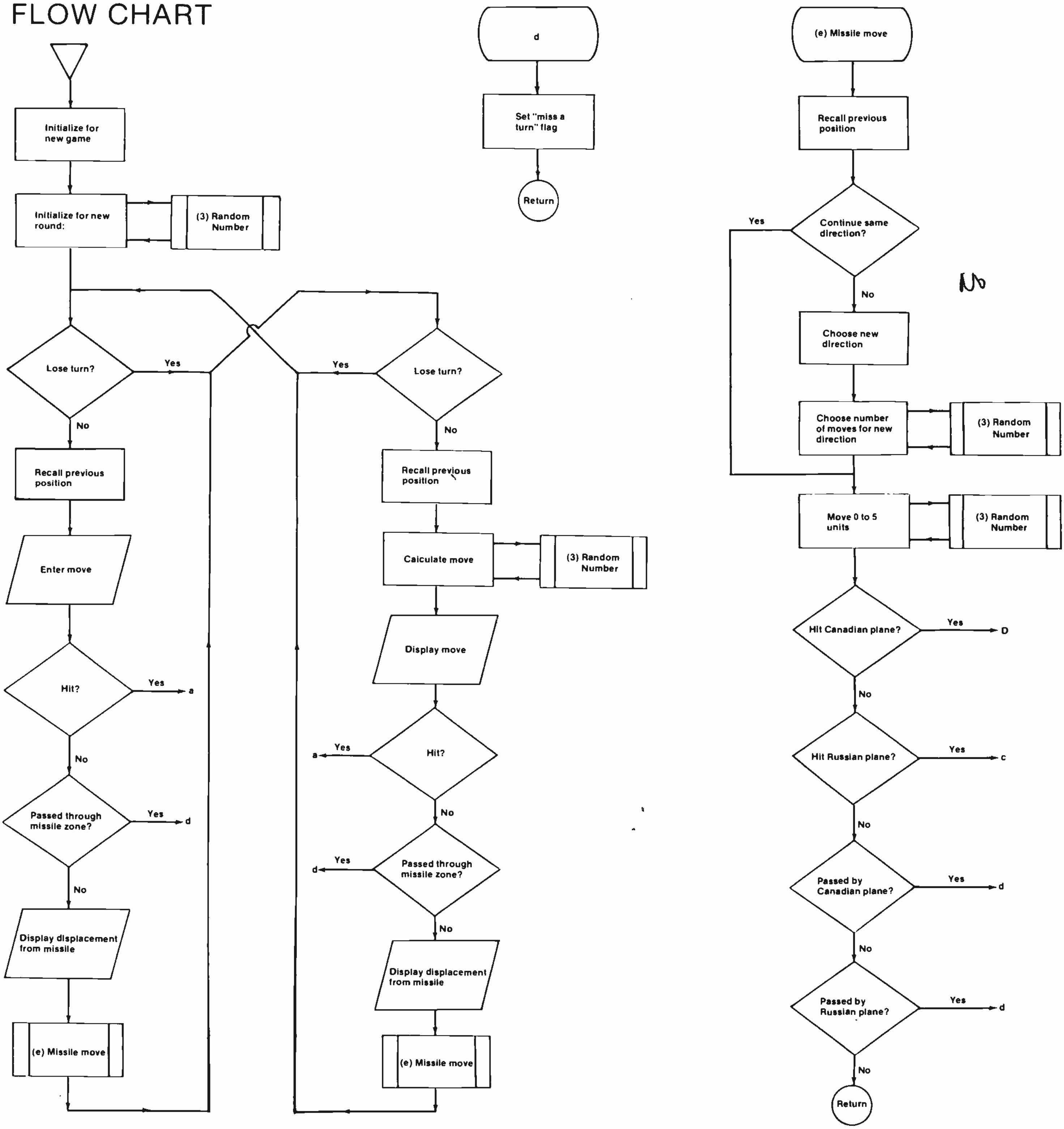
EXECUTION

1. Load side 1 & 2 of Crisis!
2. Key in a seed between 0 and 1 (0.abcdefg, g=1, 3, 7 or 9 for best statistical randomness)
3. Your position: 100
   Calculator (Russian) position: 0
4. Key in your move. If you have passed through the missile's position, a "0." is output before displacement*.
5. Step 9, 10, 11, 12, 13, 14, 15, or 16 or nothing happens.
6. Calculator moves for Russians. If it has passed through the missile's position, a "0." is output before the displacement*.
7. Step 9, 10, 11, 12, 13, 14, 15, or 16 or nothing happens.
8. Returns to step 4 for a new Canadian move.
9. You hit missile and win 2 points. (Goes to step 3 for a new round).
10. Russians hit missile and win 2 points. (Goes to step 3 for a new round).
11. Missile hits you and Russians wins 1 point. (Goes to step 3 for a new round).
12. Missile hits Russians and you win 1 point. (Goes to step 3 for a new round).
13. You win game. (Score 10).
14. Russians win game (Score 10).
15. Missile passes by your position.
16. Missile passes by Russian's position.
17. If missile position is very close to 0 (ie: about to be negative), or you make a mistake in the run, a new round is started (Step 3).
18. If you don't think the numbers are properly random after a period of running, key in a new seed, Press C, and a new round starts.

* Player who has passed through the missile's position loses his next turn.

ETI Softspot

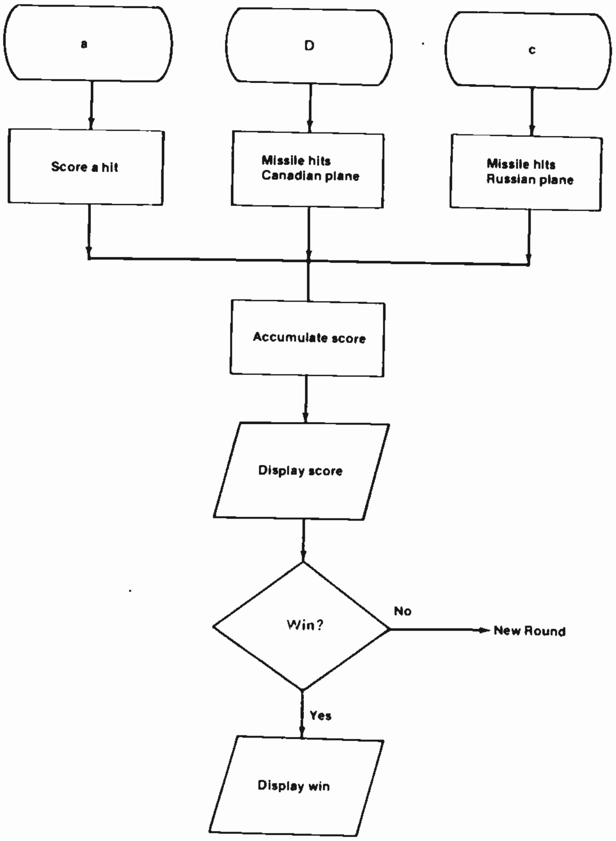
FLOW CHART



SOFTSPOT is ETI's programmable calculator software department. We know there are many of you who have gone to a lot of effort to write routines for your machines — how about sharing the fun. Send us a copy of your pet program, preferably with flow chart. To make things interesting we will restrict our choices to only those programs making use of loops or conditionals.

All programs we publish will be paid for.

Mail to: ETI Softspot
Unit 6, 25 Overlea Blvd.,
TORONTO, Ontario
M4H 1B1



PROGRAM

Program for HP67, HP97 calculators.

```
001  LBL A     31 25 11
     DSP 0        23 00
     FIX          31 23
     CL REG       31 43
005  LBL C     31 25 13
     STO C        33 13
     LBL B     31 25 12
     0               00
     STO 9        33 09
010  CF 2      35 61 02
     CF 3      35 61 03
     3               03
     0               00
     GSB 3     31 22 03
015  3               03
     5               05
     +               61
     STO 2        33 02
     EEX             43
020  2               02
     STO 8        33 08
     3               03
     STO 3        33 03
     LBL 1     31 25 01
025  F3?       35 71 03
     GTO 2        22 02
     1               01
     STI          35 33
     RCL 8        34 08
030  STO 4        33 04
     DSP 1        23 01
     R/S             84
     DSPO         23 00
     CF 3      35 61 03
035  STO 8        33 08
     RCL 2        34 02
     x = y?       32 51
     GSB a     32 22 11
     GSB d     32 22 14
040  RCL 2        34 02
     RCL 8        34 08
     –               51
     ABS          35 64
     PAUSE        35 72
045  STO 6        33 06
     GSB e     32 22 15
     LBL 2     31 25 02
     F2?       35 71 02
     GTO 1        22 01
050  0               00
     STI          35 33
     RCL 9        34 09
     STO 7        33 07
     RCL 3        34 03
     2               02
     ÷               81
     ENTER           41
     INT          31 83
     x = y?       32 61
060  CHS             42
     ÷               81
     INT          31 80
     RCL 6        34 06
     x               71
065  RCL 8        34 08
     +               61
     STO A        33 11
     2               02
     GSB 3     31 22 03
070  x = o?       31 51
     GSB b     32 22 12
     4               04
     GSB 3     31 22 03
     x               71
075  RCL A        34 11
     +               61
     STO 9        33 09
     PAUSE        35 72
     RCL 2        34 02
080  x = y?       32 51
     GSB a     32 22 11
     GSB d     32 22 14
     RCL 2        34 02
     RCL 9        34 09
085  –               51
     ABS          35 64
     PAUSE        35 72
     GSB e     32 22 15
     GTO 1        22 01
090  LBL e     32 25 15
     RCL 2        34 02
     STO B        33 12
     RCL 5        34 05
     x > 0?       31 81
095  GTO 5        22 05
     CF 1      35 61 01
     2               02
     GSB 3     31 22 03
     x = 0?       31 51
100  SF 1      35 51 01
     6               06
     GSB 3     31 22 03
     STO 5        33 05
     LBL 5     31 25 05
105  1               01
     STO 5     33 51 05
     6               06
     GSB 3     31 22 03
     F1?       35 71 01
110  CH S            42
     STO + 2   33 61 02
     RCL 2        34 02
     RCL 8        34 08
     x = y?       32 51
115  GSB D     31 22 14
     x ⇌ y        35 52
     RCL 9        34 09
     x = y?       32 51
     GSB c     32 22 13
120  SF 0      35 51 00
     1               01
     STI          35 33
     RCL B        34 12
     RCL 2        34 02
125  RCL 8        34 08
     GSB d     32 22 14
     0               00
     STI          35 33
     RCL B        34 12
130  RCL 2        34 02
     RCL 9        34 09
     GSB d     32 22 14
     CFO       35 61 00
     RTN          35 22
135  LBL d     32 25 14
     x ≤ y?       32 71
     GTO 8        22 08
     x ⇌ y        35 52
     RV           35 53
140  x ≤ y?       32 71
     GTO 6        22 06
     RTN          35 22
     LBL 8     31 25 08
     x ⇌ y        35 52
145  RV           35 53
     x > y?       32 81
     GTO 6        22 06
     RTN          35 22
     LBL 6     31 25 06
150  F0?       35 71 00
     GTO 0        22 00
     0               00
     – x –        31 84
     RCI          35 34
155  x ≠ 0?       31 61
     GTO 9        22 09
     SF 2      35 51 02
     RTN          35 22
     LBL 9     31 25 09
160  SF 3      35 51 03
     1               01
     STO + 3   33 61 03
     RTN          35 22
     LBL 0     31 25 00
165  RCI          35 34
     x ≠ 0?       31 61
     STO + 3   33 61 03
     x = 0?       31 51
     GSB b     32 22 12
170  1               01
     •               83
     1               01
     x               71
     DSPI         23 01
175  – x –        31 84
     DSP 0        23 00
     RTN          35 22
     LBL 3     31 25 03
     RCL C        34 13
180  9               09
     9               09
     7               07
     x               71
     FRAC         32 83
185  STOC         33 13
     x               71
     INT          31 83
     RTN          35 22
     LBL D     31 25 14
190  0               00
     STI          35 33
     1               01
     CHS             42
     GTO 7        22 07
195  LBL c     32 25 13
     1               01
     STI          35 33
     GTO 7        22 07
     LBL a     32 25 11
200  RCI          35 34
     x = 0?       31 51
     GSB b     32 22 12
     2               02
     x               71
205  LBL 7     31 25 07
     STO+(i)   33 61 24
     PAUSE        35 72
     PAUSE        35 72
     9               09
210  RCL(i)       34 24
     PAUSE        35 72
     ABS          35 64
     PAUSE        35 72
     x ≤ y?       32 71
215  GTO B        22 12
     RCI          35 34
     DSP 9        23 09
     LBL E     31 25 15
     PAUSE        35 72
220  GTO E        22 15
     LBL b     32 25 12
     1               01
225  CHS             42
     RTN          35 22
```

Selling The Furniture To Pay The Rent

EDITORIAL INTRODUCTION

In June 78 ETI John Cox suggested I publish a regular column, "Making Waves", in which readers can express dissatisfaction. Mr. Cox started the ball rolling (the spoon stirring?) with an attack on the government and people of Canada. He argued not sufficient was being done to foster manufacturing industries in this country, and as an electronics enthusiast he was particularly concerned about being unable to buy Canadian components. Avoiding any specific political standpoint, Mr. Cox left it to the reader to do what he thought best to achieve a healthier economy.

In this issue Wally Parsons agrees with John Cox, but goes one step further in giving his views on how the government can achieve the desired conditions, and how the rest of us can get the government into action. Mr. Parson's article, by necessity, becomes a piece of political propaganda, and is presented as such (if your views are different you can always write in and I'll print them)*.

Hopefully "Making Waves" will not aim all its blows at the government. How about someone writing in to have a go at another target: business, consumers, media, the universities, the professional institutes, CBers, hams, computer freaks; there's plenty of scope. S.B.

Provided they're sensible

FOR THE PAST ten years Canada has been experiencing a gradual but sure slide downhill from a relatively prosperous nation with good future prospects to a level which threatens to rival the banana republics and the police states of Africa as regards personal freedom and industrial health. Interestingly enough, the two conditions seem to parallel each other and correspond to the period of rule by the present government. Under this regime Canada has seen runaway inflation, record unemployment, unprecedented frequency of business and personal bankruptcy, increased foreign economic domination, intolerable balance of trade deficits, and the weakest dollar since the depression (and, in part, to prevent its weakening even further, a national debt greater than the national budget of ten years ago, a debt so great as to absorb almost half of our tax dollars just to pay the interest, and which promises to keep the country in hock for generations to come).

Along with this we have seen a decline in industry, particularly secondary, ie. manufacturing industry. At the same time, we have experienced such a flight of skilled tradespeople and professionals, that what job opportunities still exist cannot be filled. Our solution is to bring in immigrants, who are promptly accused by the unemployed of stealing their jobs. (Meanwhile, our Prime Minister tells us that if we don't like it here we should get out.)

There's even more, but this **is** a family magazine, and ETI simply does not have enough pages to permit a detailed catalogueing of the evidence of the Decline and Fall of the Dominion of Canada.

BLAME

Obviously, the villains of the piece are the guys in Ottawa. But, hold on a second. Is it not true that a people, especially in a democracy, get the kind of government they deserve? I don't recall the Liberal party mobilizing the army and seizing Ottawa by force of arms, 1970 and the War Measures Act notwithstanding. I seem to recall an election in 1968, 1972, and 1974, in which the Canadian people voted this government into power, at least that portion of the people who cared enough to even bother voting. In 1972 we even showed enough displeasure to vote for a minority government, and in 1974, with the same grievances still unsettled, we gave them back a majority, after an election in which they consistently repudiated the opposition policies, and then implemented them after regaining office.

No, dear friends, we cannot lay all the blame on the government. Back in June, John Cox kicked off this feature with a brief run-down of the problems in finding Canadian-made parts. If he had found some, how many Canadians would buy them? When was the last time **you** bought an item of clothing, or a pair of shoes marked "Made in Canada"? The textile industry is fighting for its life, too. You think Canadian products aren't good enough? Too expensive? The jacket I'm wearing right now is Canadian, it's comfortable, wears well, cleans easily, is quite stylish, and didn't cost an arm and a leg. In examining my personal wardrobe, I find that, with few exceptions, the best pieces are Canadian made (the exceptions being a few pieces from countries like Italy, England, and France which are hardly noted for cheap junk).

INVESTMENT

Part of the problem lies in the fact that the same people who won't buy Canadian also won't **invest** Canadian. Or they'll invest only on the most impossible terms. My own experience over the past two years illustrates this. During this time I've attempted to obtain backing to launch a series of transmission line speakers, as well as develop a series of innovations in other areas of audio. Most of my resources have gone into developing the speakers. In terms of performance, the results have been worth every penny. But the adventure has been an eye-opener.

The project started in conjunction with another, commissioned by a Canadian distributor. But when **his** US client dried up he certainly wasn't prepared to use his own money. Another dealer liked the performance, but felt the styling was wrong. By the time he had completed a description of what he had in mind, it looked exactly like the imported speaker whose styling and performance he **didn't** like. However, the price was acceptable. At least until he was asked to put some money up front (oh, yes, I had learned something from the previous experience).

Then here's the guy who went to great lengths to contact me through ETI, spent considerable time outlining grandiose plans, and then disappeared. Or the list of people who don't keep appointments. Like the marketing manager of a Toronto company, who never returns phone calls. One guy didn't want to leave the house because it had snowed the night before, but didn't have the decency to phone. Like a lot of people. The point is, that these are all business people (including the ones who express interest) but they refuse to audition except under the most impossible terms.

You might dismiss this as mere sour grapes complaining, but the fact is that I can't tell this story to anyone without getting a similar story in return. In a good healthy industrial society we can afford these kind of "show me" games. We can't afford an attitude which favours the quick buck over the long term gain. You want a safe investment, put your money in the bank, and accept a modest return; you want to make a killing, put it on the horses and take your chances. But you can't have it both ways.

Canadians must realize that the only real wealth is that which is created. Service and sales activities do not create wealth, they spread it around and facilitate its creation, but **somebody** has to create it first. Digging minerals out of the ground doesn't create wealth. It's found money, but money that was already there. Depending on resource sales is like selling your furniture to pay the rent; sooner or later you run out of things to sell, and if you also sell your tools, you don't even have the means of earning money.

I cannot support measures which would force Canadians to buy Canadian goods, even though public apathy to such things as the Treu secret trial, RCMP raids on newspapers and broadcast stations, and the like, suggest that the people really want a totalitarian state. **But there are measures which can be taken which would turn imports into expensive luxuries, reduce the parasitic opportunism which often masquerades as import business, and put a rein on irresponsible foreign investment, in both directions.** Some of these measures involve federal jurisdictions, others are provincial, some may even require amendment of the BNA act. Not all are absolutely crucial, but can, nevertheless, be instrumental in reversing the present trends. It should be realized that they are not applicable exclusively to an electronics industry but conditions which benefit industry as a whole, also benefit parts of industry.

WALLY'S SOLUTION

NATIONALIZATION OF ALL CHARTERED BANKS

The banks constitute one of the major concentrations of capital, and as such exert a major influence on the economy. They cannot function as an instrument of national policy unless they are under complete government control.

NATIONALIZATION OF ENERGY AND MINERAL RESOURCES

This would be followed immediately by a halt in the export of energy except on a real swap basis. We cannot designate oil and gas as surplus. A wiser course would be to make energy available for manufacturing at rates which effectively subsidize industry, especially small or fledgeling industries.

GRAIN AS A WEAPON OF INTERNATIONAL DIPLOMACY

By endeavouring to force up the world price of wheat, while holding it down at home, we might have a fighting chance of repatriating some of the money extorted from us by the OPEC bandits. This in no way impairs our functioning in the area of foreign aid.

EXTENSION OF RENT CONTROLS TO COMMERCIAL PROPERTY

Rent is one of the costs of doing business. I see no reason why landlords should make excessive profits on the backs of the businessmen, any more than businessmen should be allowed to exploit their workers.

CONFISCATORY TAXATION OF REAL ESTATE CAPITAL GAINS

Real Estate speculation ties up capital non-productively. This measure would make such speculation unprofitable and therefore unattractive.

ABOLITON OF ALL SALES AND EXCISE TAXES ON DOMESTIC PRODUCTS

Revenue lost could be recovered by increasing sales taxes on imported goods. Where provincial taxes are involved a province might legitimately limit this exemption to products manufactured in that province and in other provinces which grant the same exemption. It's interesting to note that when Quebec tried to use this approach with the federal government's sales tax subsidy, the feds bent over backward to thwart it. But Levesque and Parizeau really should be complimented, and I see no reason why Ottawa couldn't have modified its bill accordingly, and applied it to all provinces.

Although this proposal envisages increased federal sales taxes on imports, these could be dropped on parts imported for incorporation into Canadian-made goods, if suitable equivalents cannot be obtained here, and/or the finished product represents some minimum percentage of Canadian labour or materials.

STRICTER INTERPRETATION OF "ANTI-DUMPING"

This would mean that where the country of origin uses heavy government subsidies to hold down the price of its exports, then a surtax is applied to arrive at a fair market value. This is much like current anti-dumping surtaxes applied to goods imported at prices below market value in the country of origin. In view of the fact that I'm proposing the use of subsidies by **our** governments, this would seem self-defeating, because surely other countries would enact the same measures against our exports. However, it becomes a bargaining point in trade negotiations, and, as such, may be far more useful than in direct application.

DISCRIMINATORY TAXATION OF INVESTMENT PROFITS.

This is really a simple carrot-and-stick concept. Profits on investments in foreign countries by Canadian residents would be taxed at a higher rate than investments in Canada. In addition, such tax reliefs as a five year tax exemption, plus deductibility of the principal invested can make such investment more attractive. This concept is sufficiently flexible that it can be applied selectively for the purpose of encouraging investment in certain industries (eg, electronics) or certain kinds of enterprises (eg, new businesses, or businesses of less than two years of age).

CONTROL OF FOREIGN CONTROL

Require all foreign-owned manufacturers in Canada to devote a specified minimum percentage of gross profits to research and development. This can be enforced by taxing away the equivalent percentage from any manufacturer who does not comply. Further, the parent company must not be able to acquire complete control of patent resulting from such research, if such control results in restriction of Canadian manufacturer and/or exports.

Canadian subsidiaries must participate in all export sales to at least the extent of the parent company's investment in the subsidiary. Under no circumstances must any Canadian subsidiary be bound by the laws of any foreign country, including that of the parent company. Enforcement should have teeth, and the sharpest teeth are those which involve loss of profits.

IMPLEMENTATION OF A SUBSIDIZED APPRENTICE SYSTEM

Manufacturers could be subsidized to provide on the job training, with the highest subsidies paid to small or newly established manufacturers, those who are in the greatest need of cheap labour. This way the manufacturer gets labour cheap, thus gaining a small edge on the big guys, the worker learns a trade without starving to death while doing so, and our skilled work force is increased. This programme should be made available only to wholly-owned Canadian companies.

A RATIONAL IMMIGRATION POLICY

An immediate halt to immigration is essential, except of bona fide refugees, political and other, or reasonable compassionate exemptions. After all, no one really has a **right** to come to Canada, despite the bleatings of the bleeding hearts, but anyone invited to enter **is** entitled to all the ordinary rights of any Canadian, including a fair opportunity for employment. And this is as it should be. However, any increase in the work force, through any cause, in a period of high unemployment, only aggravates the problem. We can't stop people from growing up and leaving school and we certainly don't want to try to stop people from having babies (even if we did it wouldn't help right now). But we **can** control the influx from other countries.

I don't believe Canada has an obligation to ease over-population from other countries, especially those with high birth rates, but we do have an obligation to our present population, both native born and recent immigrants. Moreover, I don't see much point in contributing to foreign aid to train technical people in underdeveloped countries, and then enticing those same technical people away from their home countries by bringing them here. That's not technical foreign aid, it's exploitation and a particularly noxious form of neo-colonialism. I'm aware that the knee-jerk trendy ten-speed set will holler "racism"

Making Waves : One Man's View

right on cue, as will some of the imported agitators (remember, Canada is a country which gives government grants to known terrorists), but one must not be intimidated by yahoo-ism. Unbridled immigration at a rate which exceeds assimilation only breeds racism and social upheaval, as Britain can testify. You don't have to like the truth, but disliking it won't change it.

FUNDING

Revenue raised through customs and exise duties are presently added to general revenue. You'll notice that no mention has been made of raising high tariff barriers, and although these can also be used as economic tools, they are set by international agreement, and unilateral increases would be unacceptable. However, if all revenues raised by these means, plus the taxation structure outlined above were earmarked for administration by a body similar to the Canada Council (but, we hope, with a more responsible outlook) along clearly laid out guidelines, funds could be made available for research, not only by universities and the like, but also by individuals and small groups able to demonstrate a concept which has some reasonable chance of being productive.

Basically, this is the sort of thing which the rip-off "invention developers" promise but don't deliver. Such funds could also be used as seed money to start up manufacturing, particularly where an individual invention is involved. My own experience described earlier, is an example of the sort of thing which would be appropriate, and I have no doubt that many readers are in a similar position.

Incidentally, there is no evidence to support the thesis that any manufacturing, to be viable, must have immediate access to an export market. There is no reason why the domestic market cannot be established first. The "instant export" fixation seems to be more a manifestation of the desire for instant profit.

POLITICAL ACTION

If you agree with any of the above, then you should help to bring it to reality. How? John Cox urges you to go to political meetings, vote for the guy who supports you. I say, determine what your own political philosophy is, which party most nearly articulates it (no one party's platform can possibly be an exact fit), join in and have a voice in policy. Stand for executive office, campaign, write to newspapers, phone radio phone-in programmes, proselytize, bug your MP and MPP. And, above all, VOTE.

And if you're too apathetic to even vote, don't bother me with your problems. I'm too busy preparing for the day when we may not have that option.

Making Waves, Mail

I just finished reading Mr. Cox's Article, and I must say I couldn't agree with him more! At the last Economic Meeting of the Premiers of the Provinces here in Ottawa, it was painfully clear where the heart of the country's economical blight lies, to most concerned people, except to our politicians, our 'leaders'!

There are innumerable examples where countries much smaller then Canada, both in terms of manpower as well resources, managed to develop those 'secondary' industries and hence maintain a certain amount of freedom from the exploitationary tactics of some very powerfull technological countries.

Unfortunately, as Mr. Cox has pointed out, our politicians find it very inconvenient to break away from that old fashioned 'resources' mentality, where the rewards (votes) were immediate and easy for the pickin'.

What we need now, is a realization that the only way out of our present day dilemma lies through some intelligent long term planning, where we may have to shelve our 'get rich quick' plans for the benefit of all, and put the country where it rightfully belongs: a strong, **Independent** industrial nation!

Emil Nagy, Ottawa.

Club Call

Newsletters came in this month from TRAC, LARC and WIARC, but the only new club contact was from ROMS. ROMS is a Regina-based microcomputer club with 48 members. Unfortunately the communication received was incomplete — membership details were lost somewhere en route to our editorial office. If you live in Regina and want more details the only person I can put you in contact with is Dave Cole. Write to him c/ — Saskatchewan Computer Utility Corporation, 2161 Scarth Street, Regina, Saskatchewan. He's probably not the right person to contact so I'll give you the correct procedure as soon as I get details.

The letter from LARC was another promotion for the RSO Convention this October (13, 14, 15). WIARC's newsletter announced the 18th Annual World-Wide RTTY DX "Dominion" Sweepstakes, sponsored by the Canadian Amateur Radio Teletype Group, which will run from 0200 GMT October 21 to 0200 October 23. More details from CARTG, 85 Fifeshire Road, Willowdale, Ontario. The TRAC newsletter carries a page of comment on CARF handling of dealings with the DOC on proposed WARC policy and the proposed experimenter licence.

John Garner of CSWLI has been busy — writing for ETI. In this issue is the first installment of our SWL column. If SWL clubs have anything interesting to say they can write to Club Call or John in Thunder Bay. Club Call is interested in hearing from any SWL clubs that haven't yet been mentioned.

If you know about any clubs that haven't been announced in these pages please write and tell us. All clubs are looking for new members and thousands of ETI readers could get a lot more out of their hobby if they knew the address of a club in their area. Just write a short note saying how prospective members can approach you.

Club call can also be of assistance to people who want to start a club.

Previously Listed Clubs

TRACE: Computer Club, Toronto. See p7 Jan 78 ETI.
CSWLI: SWL Club, Thunder Bay. See p7 Mar 78 ETI.
TRAC: Amateur Radio Club, Thornhill. See p7 Mar 78 ETI.
ODXA: SWL Club, Don Mills. See p61 Apr 78 ETI.
CCCC: Computer Club, Montreal. See p61 Apr 78 ETI.
ECEC: Electronics Club, Elphinsone. See p61 Apr 78 ETI.

CHSSCC: (Computer Club, Houston. See p37 May 78 ETI.
WIARC: Amateur Radio Club, Dorval. See p37 May 78 ETI.
OSWCC: SWL Club, Prescott. See p37 May 78 ETI.

LARC: Amateur Radio Club, London. See p. 61 June 78 ETI.
FGARC: Amateur Radio Club, Prince George, See p. 61 June 78 ETI

BARC: Amateur Radio Club, Burlington. See p71 July 78 ETI.
MARC: Amateur Radio Club, Montreal. See p71 July 78 ETI.

4 ETI Publications

Canadian Projects Book No. 1

$3.00

Top projects from the early issues of ETI's Canadian edition, plus some of the projects from the UK edition's issues which were distributed in Canada in 1976. All projects use parts available in Canada. Those projects from UK edition have been completely re-worked in Canada for Canadian constructors. Includes a series of modular disco projects, plus games, biofeedback, metal locator, etc.

Circuits No. 1

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A brand new concept from the house of ETI More than 100 pages packed with a wide range of experimenters circuits. Based on the 'Tech Tips' section carried in the overseas editions of ETI. Circuits 1 is the first of a series of specials — produced for the enthusiasts who know what they want, but not where to get it! Circuits 1 will also act as a catalyst for further development of ideas, ideal for the experimenter The collection of more than 200 circuits is complemented by a comprehensive index, making searches for a particular circuit quick and simple Also, similar circuits can be compared easily, due to the logical layout and grouping used throughout Last and by no means least, Circuits 1 has no distracting advertisements in the main section!

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Electronics — it's easy Volume 2

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1N4007	1000v	1A	.15
1N4148	75v	10mA	.05
1N4733	5.1v	1 W Zener	.25
1N753A	6.2v	500 mW Zener	.25
1N758A	10v	"	.25
1N759A	12v	"	.25
1N5243	13v	"	.25
1N5244B	14v	"	.25
1N5245B	15v	"	.25

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8-pin	pcb	.20	ww	.35
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4002	.20
4004	3.95
4006	.95
4007	.20
4008	.75
4009	.35
4010	.35
4011	.20
4012	.20
4013	.40
4014	.75
4015	.75
4016	.35
4017	.75
4018	.75
4019	.35
4020	.85
4021	.75
4022	.75
4023	.20
4024	.75
4025	.20
4026	1.95
4027	.35
4028	.75
4030	.35
4033	1.50
4034	2.45
4035	.75
4040	.75
4041	.69
4042	.65
4043	.50
4044	.65
4046	1.25
4049	.45
4050	.45
4066	.55
4069/74C04	.25
4071	.25
4081	.30
4082	.30
MC 14409	14.50
MC 14419	4.85
4511	.95
74C151	1.90

– T T L –

7400	.10
7401	.15
7402	.15
7403	.15
7404	.10
7405	.25
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7407	.55
7408	.15
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7491	.70
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74151	.65
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74192	.75
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74194	.95
74195	.95
74196	.95
74197	.95
74198	1.45
74221	1.00
74367	.75
75108A	.35
75491	.50
75492	.50
74H00	.15
74H01	.20
74H04	.20
74H05	.20
74H08	.35
74H10	.35
74H11	.25
74H15	.45
74H20	.25
74H21	.25
74H22	.40
74H30	.20
74H40	.25
74H50	.25
74H51	.25
74H52	.15
74H53J	.25
74H55	.20
74H72	.35
74H101	.75
74H103	.55
74H106	.95
74L00	.25
74L02	.20
74L03	.25
74L04	.30
74L10	.20
74L20	.35
74L30	.45
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74L51	.45
74L55	.65
74L72	.45
74L73	.40
74L74	.45
74L75	.55
74L93	.55
74L123	.85
74S00	.35
74S02	.35
74S03	.25
74S04	.25
74S05	.35
74S08	.35
74S10	.35
74S11	.35
74S20	.25
74S40	.20
74S50	.20
74S51	.25
74S64	.15
74S74	.35
74S112	.60
74S114	.65
74S133	.40
74S140	.55
74S151	.30
74S153	.35
74S157	.75
74S158	.30
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74S257 (8123)	1.05
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74LS02	.20
74LS04	.20
74LS05	.25
74LS08	.25
74LS09	.25
74LS10	.25
74LS11	.25
74LS20	.20
74LS21	.25
74LS22	.25
74LS32	.25
74LS37	.25
74LS38	.35
74LS40	.30
74LS42	.65
74LS51	.35
74LS74	.35
74LS86	.35
74LS90	.55
74LS93	.55
74LS107	.40
74LS123	1.00
74LS151	.75
74LS153	.75
74LS157	.75
74LS164	1.00
74LS193	.95
74LS367	.75
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LM309K (340K-5)	.85
LM310	.85
LM311D (Mini)	.75
LM318 (Mini)	1.75
LM320K5(7905)	1.65
LM320K12	1.65
LM320T5	1.65
LM320T12	1.65
LM320T15	1.65
LM324N	1.25
LM339	.75
7805 (340T5)	.95
LM340T12	.95
LM340T15	.95
LM340T18	.95
LM340T24	.95
LM340K12	1.25
LM340K15	1.25
LM340K18	1.25
LM340K24	1.25
78L05	.75
78L12	.75
78L15	.75
78M05	.75
LM373	2.95
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LM711	.45
LM723	.40
LM725N	2.50
LM739	1.50
LM741 (8-14)	.25
LM747	1.10
LM1307	1.25
LM1458	.65
LM3900	.50
LM75451	.65
NE555	.35
NE556	.85
NE565	.95
NE566	1.25
NE567	.95

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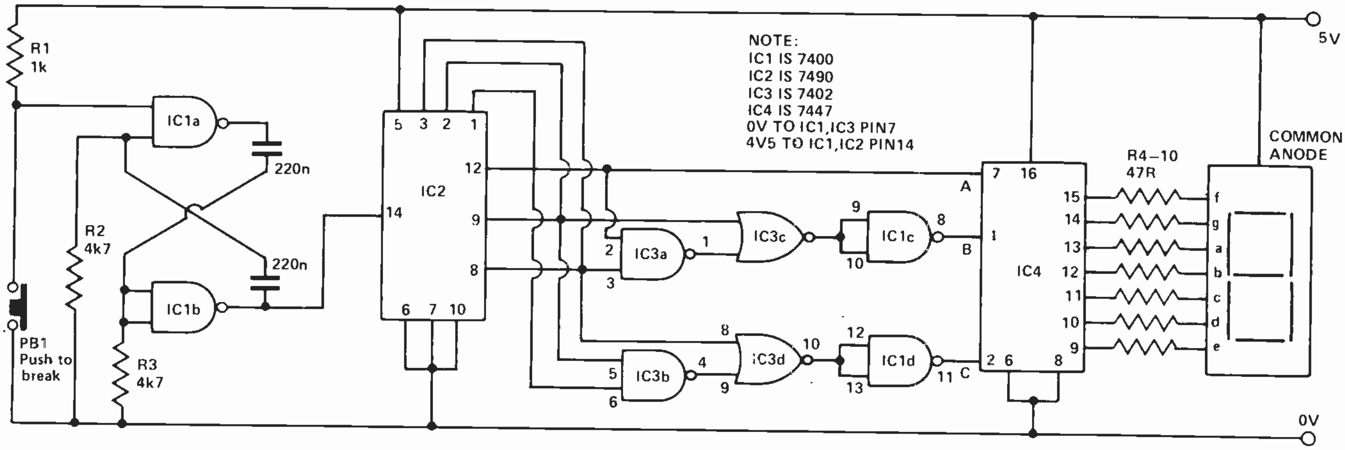
Tech Tips

Tech-Tips is an ideas forum and is not aimed at the beginner. ETI is prepared to consider circuits or ideas submitted by readers for this page. All items used will be paid for. Drawings should be as clear as possible and the text should preferably be typed. Circuits must not be subject to copyright. Items for consideration should be sent to ETI TECH-TIPS, Electronics Today International, Unit 6, 25 Overlea Blvd., Toronto, Ontario, M4H 1B1.

DIGITAL DIE

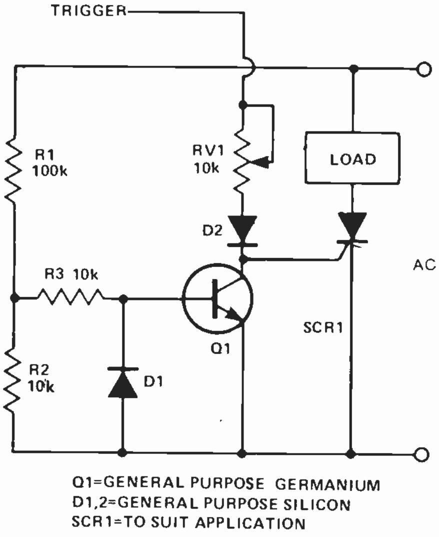
A. Slimming



IClа and IClb form an oscillator running at a few kilohertz. The output is fed to a 7490 binary counter which is wired to produce an output of 0 to 5 in BCD. So that the display is the same as a dice the display must read 1-6 and not 0-5, when the output of the 7490 is all '0's, the display must be made to show 6. IClc, d and IC3 perform this task, and convert an output of 000 from IC2 to 110 (b). IC4 is a BCD to 7-segment decoder which drives the display through the current limit resistors R4-R10.

ZERO CROSSING SWITCH

J. R. W. Barnes.



Q1=GENERAL PURPOSE GERMANIUM
D1,2=GENERAL PURPOSE SILICON
SCR1=TO SUIT APPLICATION

When switching loads with the aid of a thyristor a large amount of RFI can be generated unless some form of zero crossing switch is used. The circuit shows a simple single transistor zero crossing switch which, using surplus components, can be built for as little as a dollar.

R1 and R2 act as a potential divider, the potential at their junction being about one tenth of AC. This voltage level is fed, via R3, to the transistor's base. If the voltage at this point is above 0V2 the transistor will conduct, shunting any thyristor gate current to ground. Only when the line potential is less than about 2 V it is possible to trigger the thyristor.

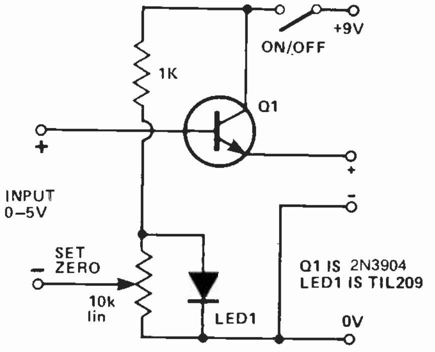
The diode D1 is to remove any negative potential that might cause reverse breakdown.

MORE OHMS PER VOLT

R. Soar

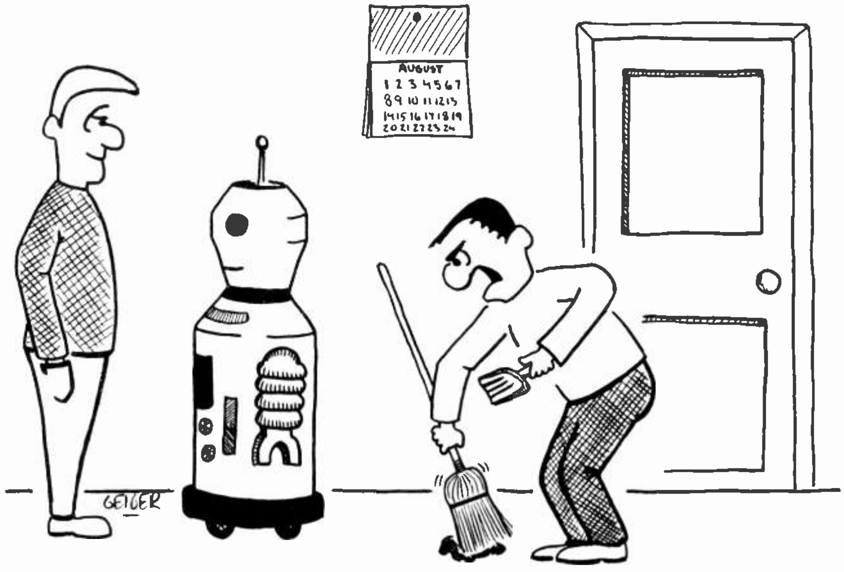
This circuit is designed to improve the performance of a low cost 1k/volt multimeter on the 0.5V DC range.

The 2N3904 emitter follower provides an impedance transformation with a gain of 100 or more, so that the effective input impedance of the multimeter is now 100k/volt. The LED provides a fixed reference voltage for the set zero control, which compensates for the voltage drop across the transistor.



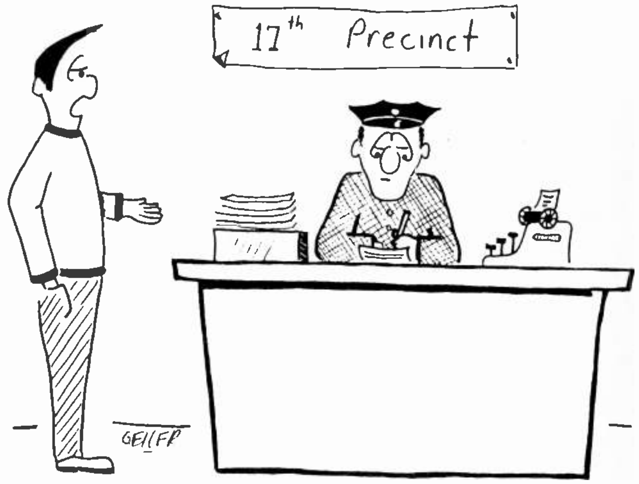
Q1 IS 2N3904
LED1 IS TIL209

The Fun of Electronics



I'll bet that all those people who dream of having their own robot never think about having to paper train it.

I was trying to build a flea-power transmitter — but I couldn't get the fleas to stay on the treadmill.



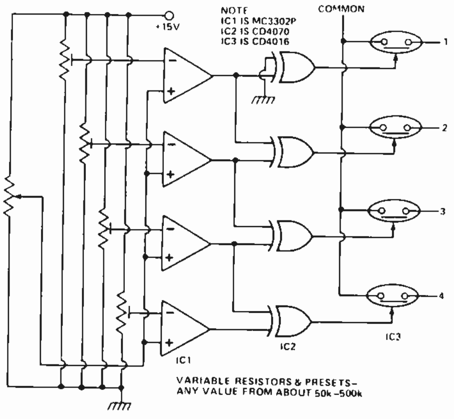
Two weeks ago, my CB rig was stolen, so I took your advice and bought a burlgar-proof CB that I bolted to the inside of my car. Today my car was stolen.

The main disadvantage with this model is that you have to be very careful when you switch it to "fast forward".

It's the next door neighbour, Sam, he wants you to stick to watching just one program at a time. He claims that everytime you use your T.V. remote control, his garage door opens.

SLIDE SWITCHES

C. Jordan



One of the disadvantages of slide pots is the unavailability of matching slide switches, as with rotary switches and pots, but slide pots can be given switching action by the use of this circuit.

Each analogue switch is only turned on when the comparators driving the respective EX-OR gate are in opposite states, i.e. when the voltage on the slider wiper is between the appropriate two preset voltages.

The example is a 4-way, 1-pole switch with off but any-way, any-pole switches can be made, using 741s as comparators if economic. A little mechanical ingenuity can provide click stops, if required.

TOUCH SWITCH

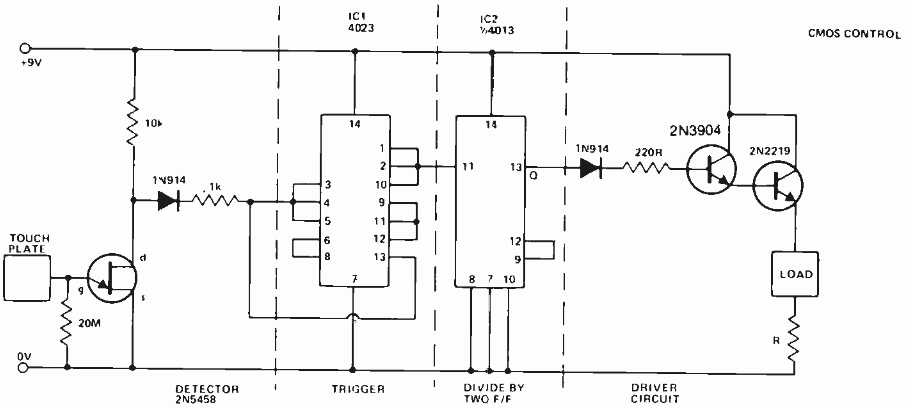
P. Reynolds.

Many designs for touch controls suffer from the disadvantage of low noise immunity, and this circuit was designed seeking to rectify this fault.

AC voltage from, for example, the hand is applied to the gate of the FET buffer. The resultant positive signal is applied via the diode, to the input of IC1. This IC is made up from three triple gates connected in a Schmidt trigger configuration. At the threshold voltage, a positive pulse is fed to the clock input of IC2, a D-type flip-flop. Connection is made between Q and the D input, so as to cause the flip-flop to run in the 'triggered' mode. Thus the input signals are divided by two and the output appears at the Q terminal.

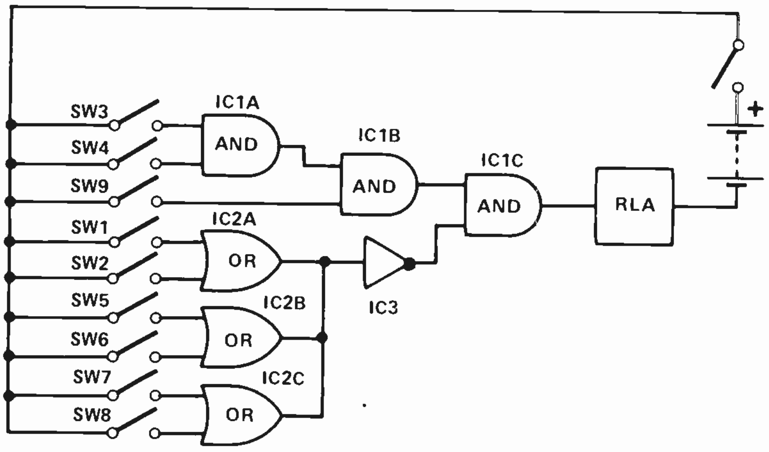
In operation, a single positive pulse sets the Schmidt trigger to its low level. (Removal of the hand causes reversion to the 'high' state). This, in turn, feeds the clock input of IC2, which changes the state of the Q output. When this is high, the output stage is driven on, enabling current to flow in the external load and the current limiting resistor, R.

A second positive pulse changes the state of Q to its low level, causing the output stage to be biased off.



SELECTIVE ALARM CONTROLLER

S. Butler.



This circuit provides greater versatility than the simple "in-series" switches mode of alarm, but is still cheap and easy to build.

When SW3 and 4 are closed, the output of the AND gate goes high. This high is fed to the second AND gate only when SW9 is pressed. The output of this gate goes high and providing no other switches are pressed, it will operate the relay: if any other switches are pressed, the OR gives an output to the inverter and cuts off the power to the AND gate, preventing the coil being energised.

ETI Project File

Updates, news, information, ETI gives you project support

Kitchener Bargain Hunters

Ray Whittemore of K. W. Surplus writes: "K. W. Surplus ahs now been operating in the Kitchener-Waterloo area for over one year. We deal in surplus electronic parts, assemblies and test equipment mainly for the hobbyist. We don't have a full line of anything but deal only in surplus items. No. catalogue or flyer is available and our hours of operation are limited to Thursdays and Fridays 3 to 9 p.m., Saturdays 9 to 5 p.m. We're not a fancy store but if the hobbyist can find some of the items he's looking for we'll save him money." K W Surplus, Clearing House, 327 Breithaupt Street, Kitchener, Ontario, N2H 5H6 519-745-2661.

Meanwhile In Saskatoon. . .

Don Rost writes: "I would like to mention that Northern Bear Electronics invites special requests from readers if they have trouble locating certain items. We have access to a number of parts suppliers and if the reader doesn't mind waiting for some of these items we can most likely obtain them. We would appreciate a S.A.S.E. with reader requests.

Also, of interest to computer hobbyists, NBE will be carrying a number of uP support IC's. We can supply most Motorola 6800 series IC's now. Our flyer should be out . . . at the end of July . . . but if anyone is in a hurry

ETI Project Chart August 77 to August 78

ISSUE DATE	ARTICLE
Aug 77	Skeet
Nov 77	Notes: C, D,
Aug 77	Dig. Freq. Meter
Aug 77	Bass Enhancer
Aug 77	Tachometer
Sept 77	Audio Sweep Osc.
Sept 77	Microamp
Sept 77	Bongos
Sept 77	Alarm Alarm
Oct 77	Graphic Equaliser
Feb 78	Note: D
Oct 77	Loud Hailer
Oct 77	Continuity Tester
Oct 77	Stereo Simulator
Nov 77	Digital Thermometer
Jan 78	Note: C, T, S,
Jan 78	Neg.
Feb 78	Note: S
Nov 77	3-Channel Tone Control
Jan 78	Neg.
Nov 77	Watchdog
Jan 78	Neg.
Aug 78	Note: D
Dec 77	50D50 Amplifier
Jan 78	Neg.
Feb 78	Note: T
Dec 77	Spirit Level
Jan 78	Neg.
Dec 77	Egg Timer
Jan 78	Neg.
Jan 78	Option Clock & Neg.
July 78	Note: S
Jan 78	LED Pendant
May 78	Note: C
Jan 78	Compander & Neg.
Feb 78	Tachomonitor
Apr 78	Neg
Feb 78	LCD Panel Meter
Apr 78	Note: C
Apr 78	Neg.
Feb 78	CB Power Supply
Apr 78	Neg
May 78	Note: N
Feb 78	Freezer Alarm
Apr 78	Neg
Mar 78	Hammer Throw
June 78	Neg
Apr 78	Computer PSU & Neg.
Apr 78	Audio Delay Line & Neg
Mar 78	True RMS Meter
Apr 78	Neg
Mar 78	Home Burglar Alarm
Apr 78	Gas Alarm & Neg.
May 78	White Line Follower
June 78	Neg
May 78	Acoustic Feedback Eliminator
June 78	Neg
May 78	Add-on FM Tuner
June 78	Neg
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	Sound Meter & Neg.
Aug 78	Porch Light & Neg.
Aug 78	IB Metal Locater & Neg.
Aug 78	Two Chip Siren & Neg.

Canadian Projects Book

Audio Limiter
5W Stereo
Overled
Bass Enhancer
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G P Preamp
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Ceramic Cartridge Preamp
Mixer & PSU
VU Meter Circuit
Headphone Amp
50W-100W Amp
Note: N Apr. 78
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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
***:- Notes for this project of complicated nature, write for details (enclose S.A.S.E., see text)

for these we will quote prices on request.": Northern Bear Electronics, P.O. Box 7260, Saskatoon, Sask., S7K 4J2.

Project Notes

ETI Watchdog Nov 77.

On the circuit diagram Q4 should be marked 2N3767. Also the neon indicator lights should be interchanged.

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 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.

Every few months we print a pull out section in the magazine which may be used as a photographic negative for making printed circuit boards (as described in our January 78 issue). Each edition of this sheet contains projects from the preceding few issues. Information on where to find which negative is included in the chart.

PROJECT CONSTRUCTOR'S INFORMATION

Useful information on the terminology and notation will be published each month in Project File.

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

Component Notations and Units

We normally specify components using an international standard. Many readers will be unfamiliar with this but it's simple, less likely to lead to error and will be widely used sooner or later. ETI has opted for sooner!

Firstly decimal points are dropped and substituted with the multiplier, thus 4.7uF is written 4u7. Capacitors also use the multiplier nano (one nanofarad is 1000pF). Thus 0.1uF is 100n, 5600pF is 5n6. Other examples are 5.6pF = 5p6, 0.5pF = 0p5.

Resistors are treated similarly: 1.8M ohms is 1M8, 56k ohms is 56k, 4.7k ohms is 4k7, 100 ohms is 100F, 5.6 ohms is 5R6.

Kits, PCBs, and Parts

We do not supply parts for our projects, these must be obtained from component suppliers. However, in order to make things easier we co-operate with various companies to enable them to promptly supply kits, printed circuit boards and unusual or hard-to-find parts. Prospective builders should consult the advertisements in ETI for suppliers for current and past projects.

Any company interested in participating in the supply of kits, pcbs or parts should write to us on their letterhead for complete information.

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We will allow you up to twenty-five words to advertise items you want to buy or sell, or to publicise meetings of clubs, etc. Advertising will be accepted at our discretion — we will not accept commercial or any form of company advertising. For more insertions mail in again.

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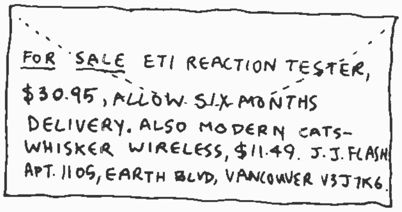

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Reader Service Information

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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
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December

1978
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We can supply photocopies of any article published in ETI-Canada, for which the charge is $1.00 per article, regardless of length. Please specify issue and article. (A special consideration applies to errata for projects, see Project File.)

LIABILITY: Whilst every effort has been made to ensure that all constructional projects referred to in this edition will operate as indicated efficiently and properly and that all necessary components to manufacture the same will be available, no responsibility whatsoever is accepted in respect of the failure for any reason at all of the project to operate effectively or at all whether due to any fault in design or otherwise and no responsibility is accepted for the failure to obtain any component parts in respect of any such project. Further no responsibility is accepted in respect of any injury or damage caused by any fault in the design of any such project as aforesaid.

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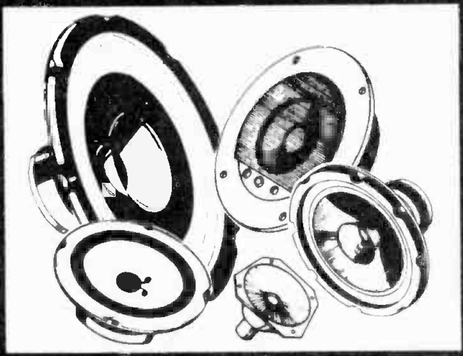

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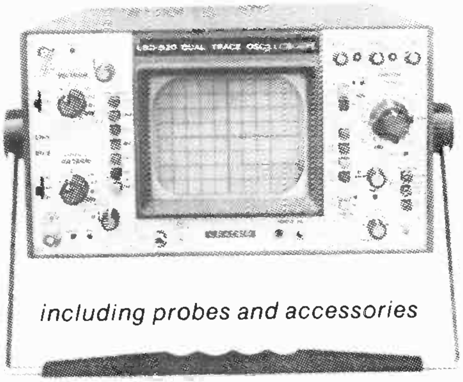
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