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JANUARY 1980

MM70924

**LM10 Applications**

**Hams Help At Mississauga Rail Disaster**

**More On Police Radar: Page 10**

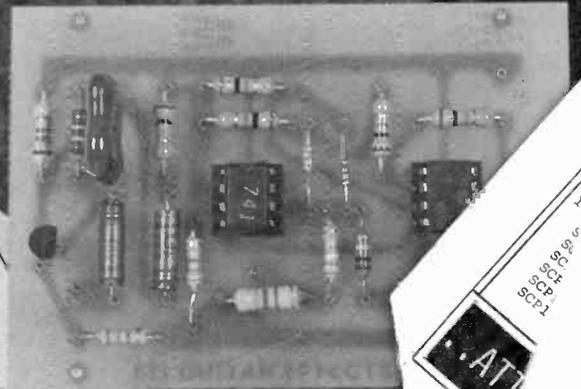
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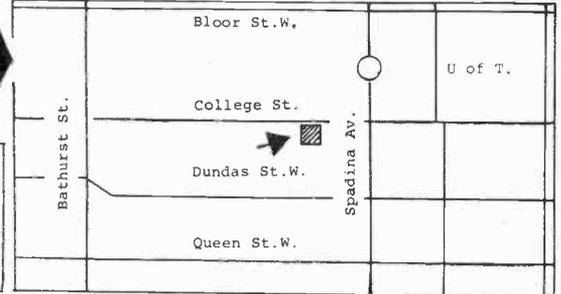
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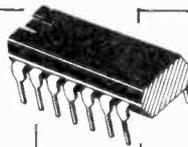
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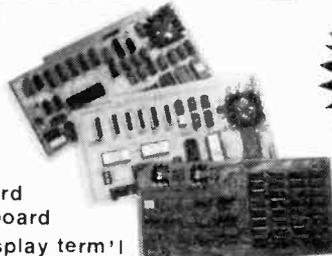
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THIS MONTH'S COVER. An anonymous ETI staff member demonstrates his virtuosity (ineptitude) on the bass guitar. Actually, you'd do better to look at our Fuzz/Struzz Box on page 15.

# NEWS DIGEST

## Fun Organ Kit

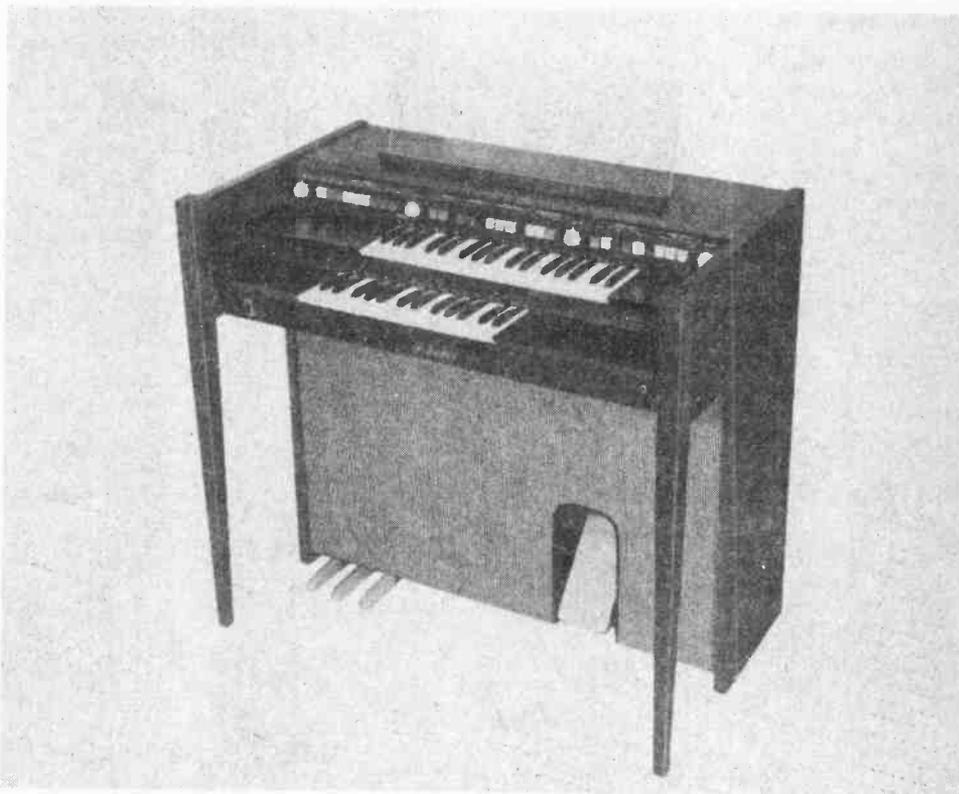
Automatic chords and rhythms, alternating and walking bass, harmonic memory, multiple arpeggios, and many other space-age musical effects identify the new Schober Showman Automatic Electronic Organ as the first of the modern "fun" organs in kit form.

Ranking with the most elaborate of this type of home instrument, designed to permit players with little or no musical training to produce highly varied and complicated musical effects, the Schober Showman is reported to cost only about half as much as comparable instruments. The kit contains every needed part, plus nontechnical step-by-step instructions for both building and playing. Assembly time is estimated at about 30 hours.

The Showman contains two separate keyboards. The upper carries melody (and right-hand harmony if the player wishes), while the lower controls harmony, automatically or manually. Three pedals modify one-finger-selected automatic chords to produce a total of 60 different harmonies. Five melody voices, including a wah-wah instrument, can be used alone or mixed. Delayed, regular, and wah-wah vibratos are provided.

Eight different automatic rhythmic patterns (which can be mixed) employ five realistic rhythm instrument sounds.

Tempo is fully controllable, and a special extra slow "practice" speed makes learning easy. Volumes of rhythm, bass (plucked-string or organ-pedal type), and harmony (steady or rhythmic), and melody are all independently controllable. Because of the automatic features, a one-finger player can actually produce more simultaneous rhythm, bass, accompaniment, and solo music than an accom-



plished musician could on a standard organ.

The Showman console is genuine walnut veneer and solids. Just as assembling the electronics requires no prior electrical knowledge, console assembly and finishing employ techniques which demand no woodworking experience.

The Schober Showman Automatic Electronic Organ Kit, priced at \$650 US (bench include), is available from The Schober Organ Corporation, 43 West 61st Street, New York NY 10023.

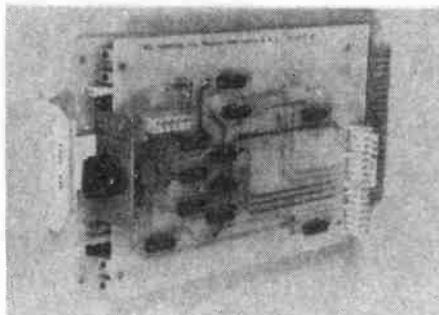


## Telephone Telemetry

A recently introduced telemetry system makes remote readout of temperature, pressure, level, power or any process variable easily available over a power or telephone line.

The RFL 64B TMX features accuracy of better than .5%. Utilizing full scale frequencies of less than 25 Hz, it readily mates with RFL's frequency shift transmitters, enabling a large number of signals to be carried on a single communication link. Optionally available features include; built in calibration, voltage or current input, and signal loss alarm.

For further information contact Dctfol, 94 Claude St., Arnprior ONT. K7S 2H5.



## Update On Analogue

For those interested in ADC, DAC and other analogue functions, Analog Devices offers their free house publication, Analog Dialogue. Volume 13, No. 2 includes application articles on very high speed data acquisition, statistics methods using RMS to DC, checking A/D converter linearity, a 300kHz continuous 12-bit conversion system and high-resolution  $\square T$  measurement. Product descriptions include V/I converters for process control, a 14-bit sample/hold amplifier, CMOS switches, three new power supplies, and several data converters.

Write to Tracan Electronics Corp., 1200 Aerowood Drive, Unit No. 46, Mississauga, Ontario L4W 2S7.

## Canada, Sink or Swim?

"Canada's intense interest today in research and development is a reflection of the profound economic malaise affecting all advanced western industrial societies. The developing recession is but one aspect of the current economic crisis and affects, over the long term, employment, inflation, competitiveness, the strength of our currencies, and the material well-being of western nations."

Thus the backdrop for his address was put in place by Frank Price, Vice President R & D of GSW Limited, at the annual conference of the Electrical and Electronic Manufacturers Association (EEMAC), in Ottawa last November.

Mr. Price noted that Lenin, fifty years ago, pointed out an "inherent contradiction of capitalism" that is still widely misunderstood today. Lenin had said that "The Capitalistic economy plants the seeds of its own destruction in that it diffuses technology and industry ... It raises up against itself foreign competitors which have lower wages and standards of living, and can outperform it in world markets."

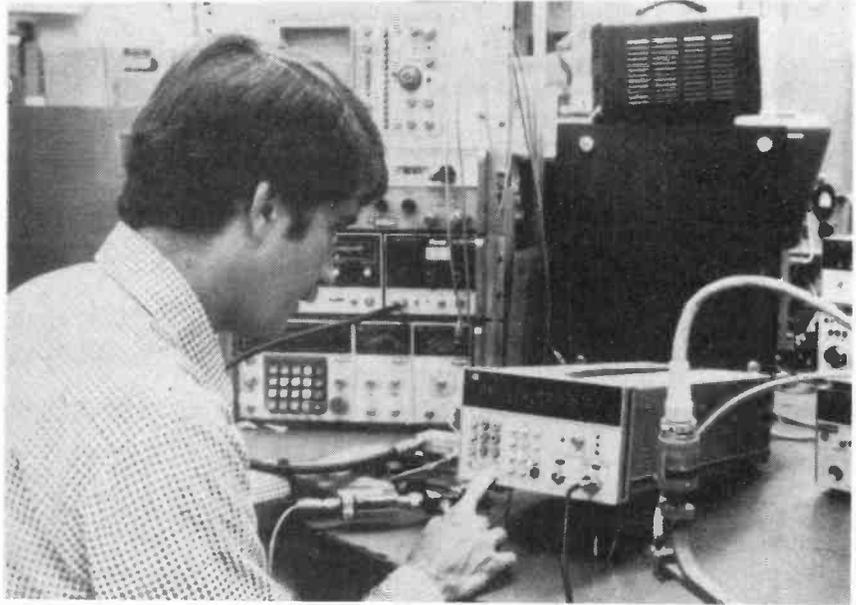
In his address, he described how, in the first half of this century, US industry gained leadership in many areas, with US multi-nationals growing into new markets around the world and transferring management, capital and technology into these new areas of opportunity.

"In the postwar years the US government has supplemented and fed this process by pouring research and development funds into industry, through large military and space programs.

"The consequences are apparent. The U.S., by 1970 had already penetrated the economies of other countries strongly — to 80% of GNP in Switzerland, 5% in several other countries, and just over 1% in Japan."

Those western economies who studied this performance after World War II drew the obvious lesson for their own reconstruction policies, Mr. Price said. Their prime task was to achieve technological excellence, specialization and marketing strength. Most importantly, they had to build their competitive positions in world markets, as the linch-pin of economic progress.

He described the government-industry cooperation in European countries, and the concerted national endeavour of Japan, which was underwritten by a



large and loyal domestic market. Japanese knowledge-based industries expanded rapidly, and indigenous basic research was accelerated.

Because of these and similar initiatives over the last ten years, the hitherto unchallenged position of US industry is

coming under siege. In addition to Japan, other powerful trading competitors are emerging. The Third World is now beginning to emulate the Japanese model, and the newly industrializing countries are developing into recognizable trading threats.

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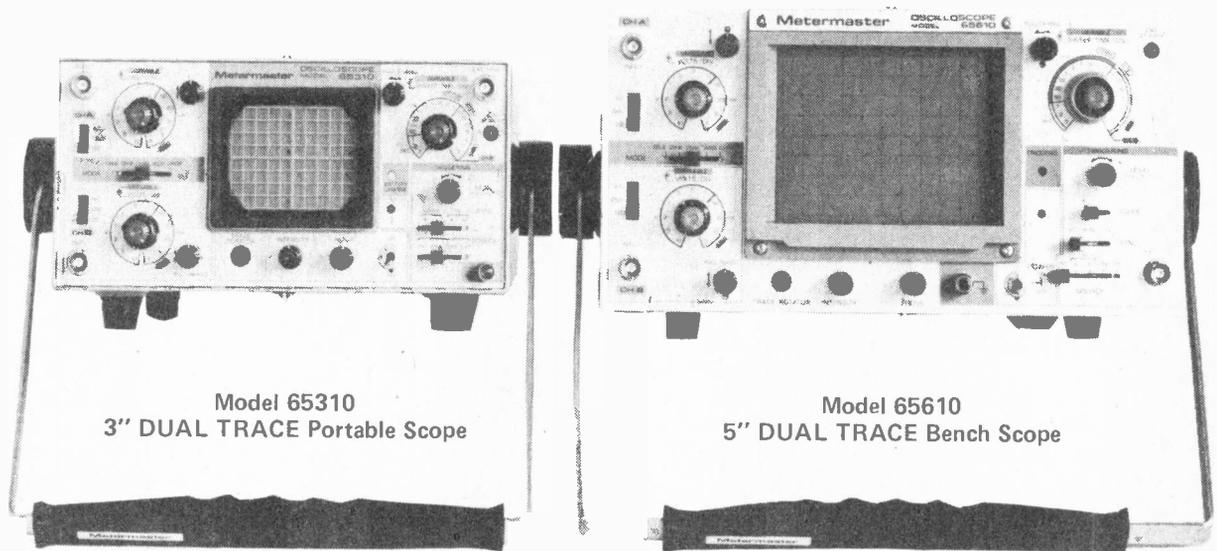
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## Intel Math Processors

A microcomputer using software programs to perform certain mathematical routines, such as floating point operation, may not be fast enough for certain applications. Special integrated circuits designed exclusively to perform math operations can improve a microcomputer system's performance significantly by carrying out computations in parallel with the main processor. Intel is offering two such chips, the 8232 and 8231 arithmetic processing units.

Designed to improve a system's performance in applications such as industrial control, numerical control, scientific calculations, graphics, and pattern generation, Intel's two chips can improve calculation speed by 10 to 100 times over a microprocessor executing software routines.

Both math processor chips contain a 16-bit arithmetic logic unit, a micro-programmed algorithm controller, an 8-by-16 operand stack, a 10-level working register stack, command and control registers, and a control read-only memory. All transfers (including operand, results, status and command information) take place over an 8-bit bidirectional data bus. Operands are pushed onto an internal stack and commands are issued for performing

## OSI Superboard Club

Owners of OSI CIP and Superboards, UNITE. Get updated information on use of your computer in a newsletter to be published every two months.

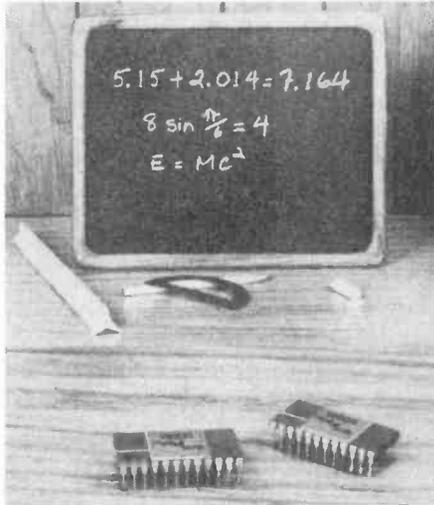
It will contain programs, ideas, technical data, hints and suggestions submitted by participating members.

Send a self-addressed business envelope and \$1.00 for further information to Superboard Club, Box 55, Agincourt, Ontario M1S 3B4.

## Expose Yourself

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

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



the required operations on the data in the stack. Following the operation, results data are also located in the stack.

The new integrated circuits will be available in sample quantities as of the fourth quarter of 1979; production quantities are scheduled for the third quarter of 1980. Pricing for each is \$175 in quantities of 100 or more and \$195 in single quantities.

## Calendar Date

Communications engineers and scientists will gather in Seattle this June to talk about the latest developments in light guide communications, home data terminals and a host of other ideas that are revolutionizing the way we communicate.

The forum is the International Communications Conference for 1980 (ICC '80), and is sponsored by the Communications Society and other members of the Institute of Electrical and Electronics Engineers.

ICC '80 is expected to draw more than a thousand engineers and scientists from more than 20 nations. Many will present technical papers outlining the latest advances in communications technology during some 50 conference sessions scheduled during the meeting.

Another attraction will be exhibits of latest communications hardware and test equipment.

The conference will be held June 8 to June 11 at Seattle's Red Lion Motor Inn.

For more information, write to Douglas L. Peck, 393 University Ave., 19th floor, Toronto, Ont. M5G 1W9.

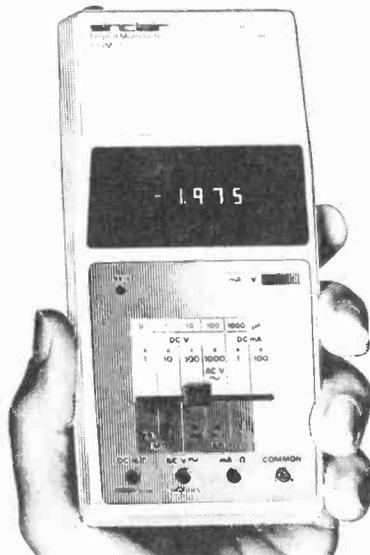
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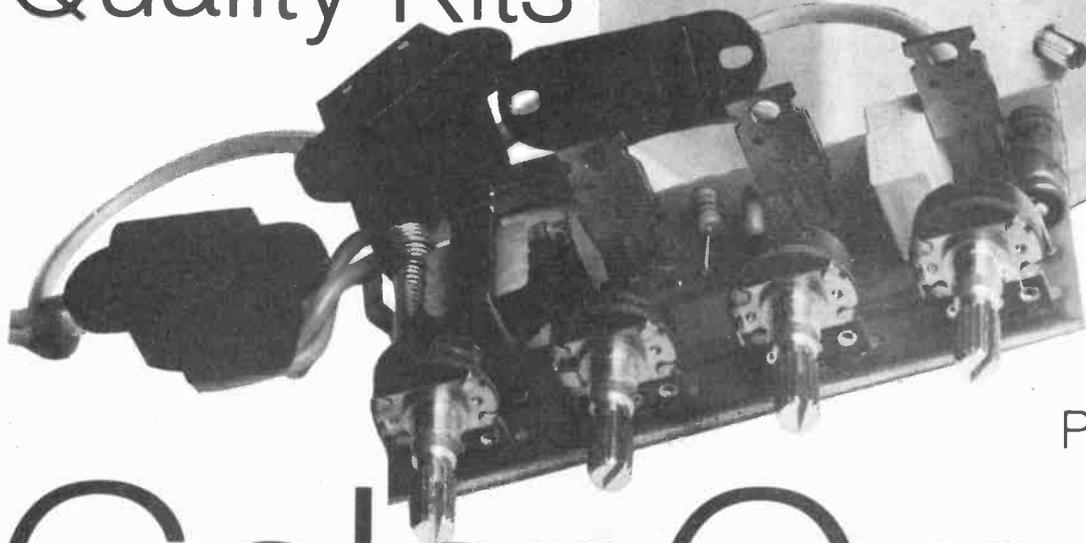
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# **jana** Quality Kits



Project # 23

# Color Organ

The Jana Color Organ is an ideal project for the experimenter who is a musician or a serious audiophile. This project is a three channel color organ with a capacity of 200 watts per channel.\* It comes complete with the PC board and instructions and its high power capability makes it ideal for all kinds of lighting effects, either with spotlights or back-lit lucite panels.

Remember, Jana projects come complete with electronic components of the exact value, so there's no need to substitute or hunt for specific capacitors, transistors or IC's.

Pick up a Jana Color Organ kit at your nearest Jana dealer today and while you're there, check out the other Jana Quality Kits.

- |   |                                   |                           |
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| 2. Battery Operated Fluorescent Light Kit | 11. Hi Power 12V DC Flasher       | 23. LJ 12016A Color Organ |
| 3. Bug Shoo                               | 12. Photo Electric Night Light    | 24. Loudmouth Siren       |
| 4. Code Oscillator                        | 15. 0-24V Power Supply            | 25. Roulette Wheel        |
| 5. Crystal Radio                          | 16. Single Channel Color Organ    | 26. Electronic Skeet Game |
| 7. Curiosity Box II                       | 17. Electronic Siren              | 27. Electronic Dice       |
| 8. Dally Lighter                          | 18. Shimmer Strobe Light          | 28. Super Roulette        |
| 9. Decision Maker                         | 19. Tone Generator                | 29. FM Mini Broadcaster   |
|   | 20. 5 Transistor 1 Watt Amplifier |                           |

\*Optional circuit to increase wattage capability to 1,000 watts per channel is shown in the instructions.

**Jana**  
Industrial Electronics

1777 Ellice Ave., Winnipeg, Man. R3H 0W5

Circle No. 18 on Reader Service Card.

## Bush(ing) Fever!

A new Heyco Labkit including 240 various sizes and types of terminal bushings is now available from Cords Canada Ltd.

The bushings are inexpensive, insulated receptacles for easy connection and disconnection of wires through panels or housings.

The units are nylon housings that require fingertip pressure to snap-lock into 1/2", 11/16" and 7/8" diameter mounting holes. They have one, two or three flat male terminals that mate with either 3/16" or 1/4" female quick-connect connectors.

The kit is the most recent addition to the Heyco line of Labkits. There are also five other Labkits which contain nylon strain relief bushings, insulated bush-



ings, hole plugs and cable clamps.

Complete information on the entire line of Heyco Labkits can be obtained from Cords Canada Ltd., 220 Bowie Ave., Toronto, Ontario. M6E 2R8.

## A Counter You Can Count On

After more than 6 months of field testing, Sonotek Ltd. of Mississauga, Ontario released a new, multipurpose, six digit counter. Armed with practically each and every feature that competition claims to have, the new DRT6000 series complements the Sonotek DRT3000/4000 family of 3 1/2 and 4 1/2 digit process indicators.

Based on advanced LSI technology, the counters lend themselves to applications in pulse or event counting, totalizing and batch control in up or down count modes, precision time-keeping or frequency measurements. Noise immunity, a characteristic of all DRT indicators, makes them suitable for industrial environments. Sensitive differential inputs with good common mode rejection allow clean reception of low level signals over long lengths of twisted pair or coaxial cable. Single ended, either input will accept directly TTL or CMOS logic signals — one input will trigger on leading edges, the other on trailing edges of the input waveform.

Digits are bright 10 mm (0.4") LED's, case is black aluminum, designed to fit



the standard DIN/NEMA panel cutout of 92 x 45 mm (3.62 x 1.77"). Variety of control inputs, optional digital outputs and inputs, companion thumbwheel units and accessories are available.

For more information please contact Bob Morgan Sonotek Limited, 2410-5 Dunwin Drive, Mississauga, Ontario L5L 1J9.

## Case Cat

Hammond Manufacturing now offers a new small case catalogue, designated no 9C-9. It features all of Hammond's small utility cases as well as hardware accessories. Other Hammond catalogues include, PacTec Electronic Enclosures, Plastic And Metal Diecast Boxes and Desk Top Consoles.

Available free from authorized distributors or Hammond Manufacturing, 397 Edinburgh Rd., Guelph, Ontario N1H 1E5.

## S 100 Mainframe

California Computer Systems today announced its new S-100 mainframe, a 12-slot, actively-terminated device designed to give system builders a powerful tool in a small package.

The S-100 Mainframe, measuring only 11 5/8 inches high, 7 inches wide and 18 inches deep, comes complete with a fan and a circuit breaker. It supports output voltages of + 8VDC at 20 amps and + 16VDC at 4 amps.

The CCS S-100 is available for \$399.95, assembled and tested, from California Computer Systems, 309 Laurelwood Dr., Santa Clara, CA 95050.

## GLADSTONE ELECTRONICS



**sinclair**

PDM35 3 1/2 digit multimeter

**\$89.50**

- \* 6 functions, 26 ranges \* operates from 9V battery
- \* 10 day money-back trial offer

SINCLAIR TEST EQUIPMENT IN STOCK:

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- PFM200 digital frequency meter . \$149.95



**ILP**

Audio Amplifiers  
\*5-year warranty.

- HY50 30 watts RMS . . . . . \$28.95
- HY120 60 watts RMS . . . . . \$57.50
- HY200 120 watts RMS. . . . . \$79.50
- HY400 240 watts RMS (4ohms) \$99.50
- HY5 mono preamplifier . . . . . \$21.95

Just arrived! ACE AUDIO SUBWOOFER CROSSOVER KIT. 100 Hz. 18 db/octave. Model 5000K. Only \$141.00  
NEW GLADSTONE STORE now open at 2936 EGLINTON AVE.E., Scarborough, Ont. Telephone 438-3999.

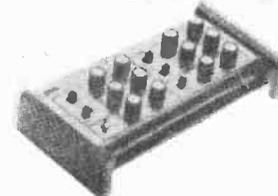


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*Quality Loudspeakers*

- AD15240/W8 15" Woofer (150W) \$74.95
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- AD0211/SQ8 (or 4) 5" dome mid \$32.95
- AD5060/SQ8 (or 8) 5" cone mid \$21.95
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- AD3WXSP. 200 watt 3 way xover \$42.50
- AD3WXA 60 watt 3-way crossover \$17.95
- AD2WXA 60 watt 2-way crossover \$10.25

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## Police Radar: Serious Problems

RIGHT AFTER finishing last month's extensive report on Police Radar Speed Meters, we were excited to find out about certain other studies done on these units. The US National Bureau of Standards has been evaluating units very carefully since 1978. Great interest was focussed on their studies when in May a judge in Florida disallowed such radar as "prima facie" evidence of speeding.

Major complaints with the sets tested by NBS were:

Radar antenna aimed at control box reads the display multiplex frequency.

Erroneous readings under high voltage lines.

Interference from neon and mercury vapour highway lights.

Travelling under an underpass confuses moving radars.

Interference from car's alternator, blower fan, and tranceivers.

Interference from nearby high-power airport and other radars.

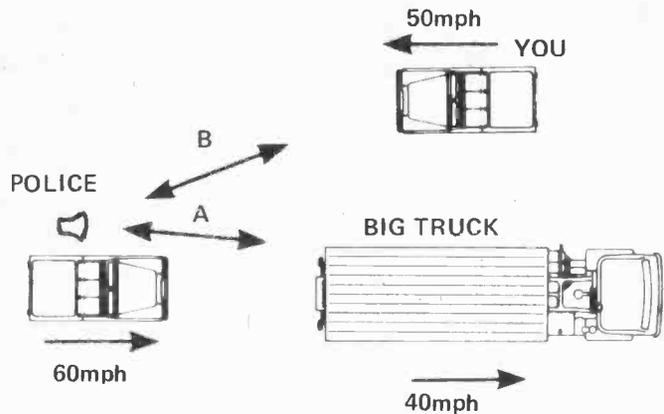
### NHTSA

The US Department of Transportation's National Highway Traffic and Safety Administration hopes to use the final NBS report to develop a list of "qualified products" to guide police forces in the market for such devices.

### CONFERENCE

In October members of the above groups, and representatives of police agencies and other experts gathered for a conference at Northwestern University's Traffic Institute (Evanston Ill.). The major criticisms revolved around the lack of documentation and operator instruction, either provided by the manufacturer, or required by the law enforcement agencies. The feeling appeared to be that the newer sets were so seemingly easy to operate as to allow anyone to come up with some kind of a reading, while not requiring the operator to use the set with the careful judgement required to obtain and interpret a useful measurement. Even the old "analog" (needle-meter readout) models were said to be more satisfactory in this respect. It was suggested that a graphic chart recorder output would be more useful in providing solid evidence for court purposes. Even an audio output of the demodulated returning radar signal

Here's how "moving radar" CAN be fooled . . .



A: Supposed to work out the speed of the cruiser from reflected signal from road, instead sees reflected signal from big truck, works out patrol speed to be 20mph.

B: Works out your speed relative to cruiser as 110mph.

Result: calculates your road speed to be  $110 - 20 = 90\text{mph}$ ! Gotcha.

would be of some use to the trained operator in overcoming some present ambiguities. (The Tribar MDR-1 which we reported on last month has such an output.)

Other items under attack were the auto-lock feature (some forces reported disconnecting theirs, on the basis that this feature made the instrument too easy to misuse), and the wide beam-width of some models which was not adequately indicated in the antenna "sights", nor accounted for by operators.

### FUZZBUSTER'S SMITH

A prominent speaker at the conference was Dale Smith, designer and president of Fuzzbuster the famous radar detector. He is regarded as a radar "expert" and has given seminars before several courts on radar theory. Among other interesting comments, he says: "An officer who cannot describe how a unit works should not be using radar."

So next time you get a speeding ticket find out what kind of equipment the officer was using, and prepare to ask him some technical questions in court. Like what's the effective beam width, and what does this mean in terms of lane widths at a certain distance (make sure you do YOUR math right!).

Good luck . . .

## Memory Book

A 440-page databook on "COS/MOS Memories, Microprocessors, and Support Systems," SSD-260, can now be obtained from RCA Solid State Division.

The new databook includes technical data, application notes, classification charts, cross-reference information, handling information, and ordering information on (1) the CDP1800 series of COSMAC microprocessors and associated memory and peripheral circuits, (2) the MWS5000 and CD4000 series of general-purpose memories, (3) the CDP18S600 series of COSMAC microboard computer systems, and (4) the CDP18S000 series of COSMAC microprocessor development systems. The data combine definitive ratings, electrical characteristics, dimensional outlines and user information.

Copies of SSD-260 may be ordered from RCA Solid State distributors or by sending checks, money orders or purchase orders to RCA Solid State Division, Box 3200, Somerville, NJ 08876. The suggested U.S. retail price is \$7.00 per copy.

Other databooks in the series include SSD-220B, Power Devices (transistors, RF devices, thyristors, rectifiers and high-reliability power devices); SSD-240A, Linear Integrated Circuits (industrial and consumer bipolar, MOS, BiMOS and I<sup>2</sup>L ICs), and SSD-250A, COS/MOS Integrated Circuits (A-series, B-series, special function and timekeeping ICs).



# Audio Today

Developments in audio reviewed by Wally Parsons

AN EXAMINATION of the human condition might suggest that life is just one great big time warp.

Except on those occasions when someone is assassinated, or the Iranians occupy the U.S. embassy, most people seem to devote more energy to either dwelling on the past or contemplating the future, but very little to contemplating the present. Perhaps this accounts for the existence of nostalgia; the past is yesterday's present, and we were too busy contemplating the past and future to consider it when it was contemporary. Moreover, it's easier to wear rose coloured glasses when contemplating the past.

Somehow, every once in a while the past and present seem too horrible to contemplate, so we indulge in flights of fantasy towards the future. Realizing that the future is probably no better than the past, we try to colour it. Prophets and soothsayers have always figured prominently in the world's religions, fortune telling has been as difficult for authorities to eliminate as prostitution and gambling.

Meanwhile, the beginning of a new year, new decade, new century, or new millenium seems to be regarded with some kind of magical awe. As if a date could actually be instrumental in controlling man's affairs. Ordinary folk are not privy to the secrets of the future, of course, so they turn to pundits, a pundit being anyone who can scribble some nonsense via a typewriter and get it published, or babble away in front of a camera and/or microphone and get his mumbled musings over the air. We are an infallible lot, it sez here, and after all, if it were not gospel it wouldn't get printed, right here in black and white, right?

Editors, being a gullible lot, prone to accepting the propaganda we experts write for them, and fond of requesting for a look at the future every new year. Asking a Cassandra like the professor here for a rosy forecast is like asking Jack the Ripper to perform open heart surgery.

Consequently, after consulting the stars, sheep entrails, Tarot cards, a crystal ball, and, of course, Gaylord, I shall now proceed to say some sooths.

## UNSOOTHING SOOTH

Forsooth, it would appear as if the coming decade will indeed be one of marvels undreamed of, Horatio. Super fi discs, digital this, digital that, new breakthroughs (did you know that, according to their recent TV commercials, Pioneer has found a way to improve bass performance? They do it by using a DC power supply. Will wonders never cease!), you name it.

This is all very fine, except for one very large fly in the ointment: the world's headlong dash to economic depression will not ease up barring a major war. This means business retrenchment. And the first thing to go is research. More effort will go into refining existing technology and dressing it up as new. The last time such a situation existed was in the early thirties; the long playing record might have become a commercial success had further research gone into groove geometry, and the 45/45 stereo disc could not have waited until the late fifties.

It's conventional wisdom to believe that today's state of the art technology will filter down to run of the mill equipment. Although this has been very much the case to date, it has usually been by way of Japan. However, if Hanoi does not spread its aggression

further, we may reasonably expect to see a great deal of manufacturing activity shift to Hong Kong, Taiwan, and possibly Korea, at the expense of Japan. Since the motives behind such moves will be monetary, the emphasis will be on low costs, high volume, and not much innovation. At this point, Japan will be in competition with the U.S. and Europe in the development of high end gear, with its limited market.

Now, even during a depression, the rich can always afford adult toys, no matter how expensive. However, the large market among the middle income people will most likely start to dry up, with the demise of many familiar brand names as a result.

I do have great faith in the future of power MOSFET technology, largely because it can still be utilized within the framework of bi-polar technology without requiring complete reorganizing of engineering and production. It can also offer simpler circuitry, and greater reliability, important considerations in price-conscious market. However, one must be pessimistic about the immediate future of such developments as magnetic amplifiers, or the likelihood of completely new technologies emerging.

## ENERGY EFFICIENCY

Greater emphasis will be placed on making electronics, especially power amplifiers, more efficient in their use of supply power. Not that a great deal will be gained, since a 100 Watt amplifier really doesn't use much power as compared with, say, the incandescent light bulb, but efficiency will still make a good selling point. More to the point, in the event of either a real or fictitious energy shortage, will be the importance of power supply regulation, both within amplifiers, and as regards AC supply.

Expect to see more turntables in the lower price class with even greater emphasis on immunity to supply voltage fluctuations.

## TAPE

With the advent of metal tape, we can expect to see the demise of the Elcassette. Not because it is not a good system, but because it is too late, with too little. Manufacturers with vested interests in the compact cassette system will be unwilling to invest development and promotional funds in a new technology when it can be matched by the old. Open reel tape machines will still be with us, because there will always be a purist market for such equipment, and it will be the first audiophile application for digital recording.

## RECORDS

Remember, you read it here first: despite the initial promise, digitized, laser-read discs will not gain a foothold in the market. Again, the investment in technological change-over. Soft-ware is the key here, and I doubt that many people will invest in the hardware before the software is available, and that many people, including producers, will invest in software if the equipment isn't around to create a market. This will not be the affluent, adventurous sixties.

Likewise, direct-to-disc recordings will finally be recognized as the gimmicks that they are. It simply makes no sense to overcome the excesses of multi-tracking and multi-stage processing by throwing out the whole tape. After all, it was tape which really made the long playing record possible. Major labels are not economically geared to the kind of limited editions demanded by direct-to-disc, and the smaller labels which are simply cannot attract the class of artist for whose recordings one would pay huge sums of money. However, digital tape will wipe out any benefits, and, when combined

with half-speed mastering (unuseable with direct-to-disc methods) will yield results far exceeding anything currently produced. If, in addition, the 45 rpm speed is adopted for such discs we may indeed get the closest approach to the real thing. The real pay-off lies in the fact that the tapes would still be useable for the production of what could be called a standard release for the mass market, and later perhaps even a budget pressing. Certainly record manufacturers will have to do something about the miserable pressings currently being churned out with high price tags.

## RADIO

AM stereo will arrive. Largely in an attempt to capture the automotive audience by offering them something approaching FM potential in a more reliable mobile reception medium. This will mean a better signal to the home

user, and so better home AM tuners (with stereo, of course).

This will no doubt give a much deserved kick in the head to the charlatans who mangle the audio signal before putting it on an FM transmission, and get them to clean up their acts as well as their audio. There should be greater interest in live (or at least, pre-taped) FM broadcasting, with semi-network affiliations and satellite transmissions paying the freight.

As for the future of a Canadian audio industry, well, with Le Grand Rene in Quebec, and sheik Lougheed in Alberta, all presided over by What's his name in Ottawa, who knows.

Anyway, if the Ayatollah takes over the world, all music will be banned, so it's game over.

Happy New Year. Hope everybody got wheelbarrows for Christmas.

# Audio Today Products

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

## TECHNICS MODEL SL-10 TURNTABLE

This is the unit unveiled in early September, which I described as being the way it should be done. It is a single play, semi-automatic system, housed in an enclosure whose dimensions are the same as a stack of about a dozen Long Playing records. It features Technics direct drive system with the rotor integral with the platter, and a straight line tracking pickup system.

The lower section houses the turntable and drive, nothing else. The upper section, which is also the lid houses the linear pickup system, the servo drive mechanism a pressure pad which fits over the record label when

the lid is lowered, and all controls, with only the latter exposed when the unit is closed. Included is a pickup, a moving coil unit similar to the 310 MC. An optoelectronic sensor controls the servo system, and senses record size and speed. Because it is servo operated, the unit may be used in the usual flat position, or on its side. I kid you not. Some wow is audible while actually changing orientation, but otherwise there is no audible difference.

Operation is simplicity itself. Open the "lid", place a record on the turntable, close the "lid", push a button, and enjoy. The pickup is automatically moved over the opening grooves, lowered, the turntable rotates at the correct speed, and that's it. If you don't like who's on the first cut, push another button and the pickup lifts up and moves in rapidly, or slowly, your choice, until you release it. When the record is over, or you're tired of it, just lift up the lid, and the pickup is returned to rest.

The point to all this is that finally a first class performer is useable even by the worst fumble-fingers.

It even includes a built-in pre-preamp for the pickup.

At a price of about \$800.00 it should be available sometime in the spring.

Contact Matsushita Electric of Canada, 5770 Ambler Drive, Mississauga Ont, L4W-2T3, or Phone (416)

## Jensen Triaxial® 3-Way Speakers

Quite simply, the most advanced car stereo speaker ever.

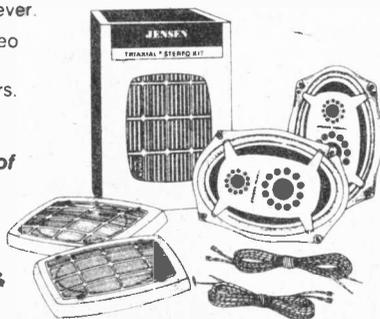
For the best sound ever in your car. The first car stereo speaker with a woofer, a tweeter and a midrange.

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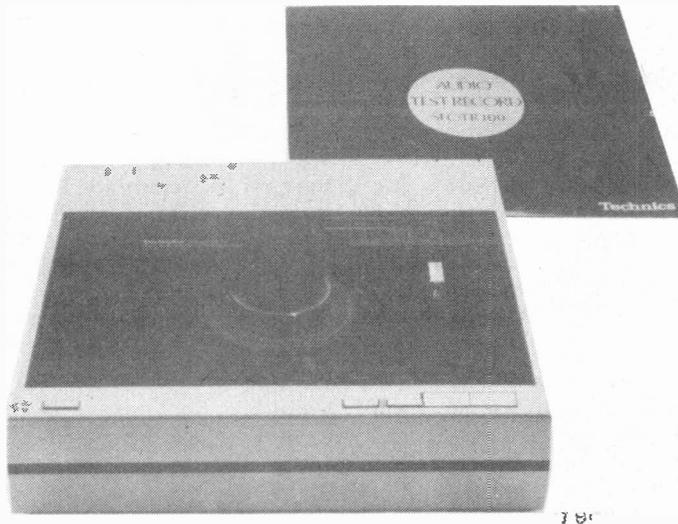
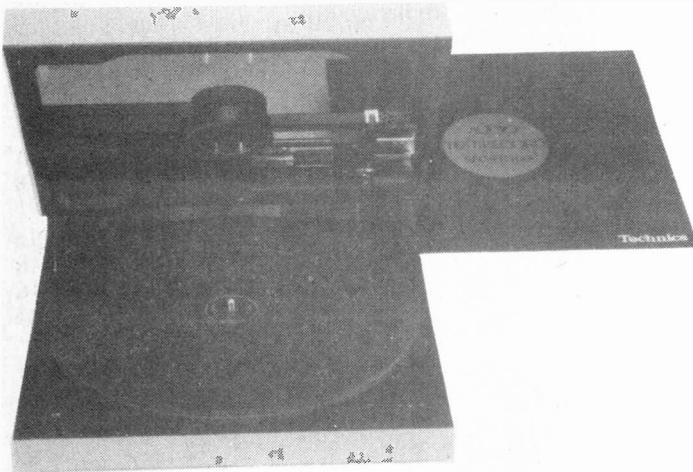
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## PSB SUMMIT SERIES Loudspeakers.

Paul Barton has a new speaker. And a major departure from previous designs. No rectangular box. No motional feedback. No Philips drivers.

This one is built in the shape of a metronome. Actually, PSB calls it a pyramid, but, as the picture shows, it isn't. The purpose is to remove parallelism between the side panels, and the standing waves which result. In addition, the tweeter works into a small panel area, by mounting it at the apex. This has several advantages which will be dealt with in a future column.

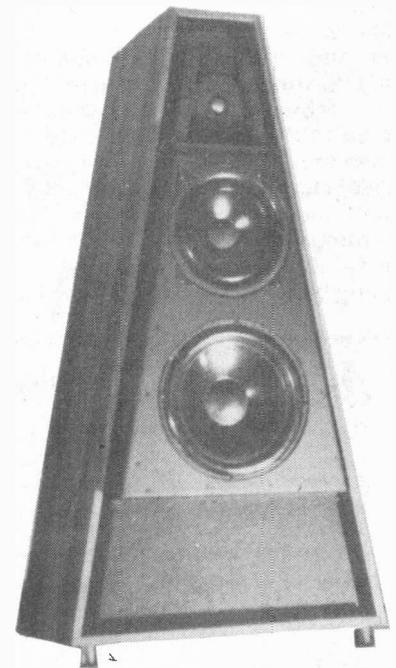
The bass system is a passive radiator design using Bextrene cones which look like Audax units. Both models, Summit Nine, and Summit Eleven, use eight inch woofers, the model Nine has an eight inch passive radiator, while the Eleven as a 10 inch.

Both use a one inch soft dome Audax tweeter.

When I heard it, it was good enough to display the deficiencies of a very good pickup, even in the clamour of an audio show, and to reveal the quality of the new unit which replaced it.

SUMMIT NINE sells for under \$900.00, and the SUMMIT ELEVEN for under \$1200.00. Prices are for pairs.

Contact PSB Speakers Inc., P.O. Box 144, St Jacobs, Ont, N0B-2N0. They're also in the phone book.



## Audio Today Letters

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

I'll start by saying that I enjoy your well thought out and informative column. The letters section is also very good. Which brings me to my question.

How do I connect a single extension speaker to a stereo amp., I would like the main speakers to still be in the stereo mode. Would it be easier to just get 2 speakers? Sound quality from the extensions is not of major importance.

Also, what can I do to protect the smaller extension speaker from excessive power (other than putting a

red line on the volume control).  
Hope you can be of some assistance.  
L.C., Port Alberni, B.C.

The secret to a good letter column is in the readers who write. So keep it up, friends.

Several methods are available for providing a mono feed. The simplest, and, in my opinion, the best, is to combine the two channels via a mixing pad at the output of the preamp, and

# Audio Today

feed the resulting sum to a separate amplifier which feeds the extension speaker. Several low power circuits appear in past issues of ETI, or you might use one of the many modules available, such as the Sanken, Epitek, ILP, etc. This will also take care of the overload problem. If your extension is very efficient and/or you don't want high levels you might use an LM380, LM384, TBA810, etc. Try one of the summing circuits on page 13 of the April/'79 issue. Simply connect a resistor of about 27k from each output to a common point, then a resistor of the same value from the junction to ground. This will not impair stereo separation, but will give about 9dB loss. In the June issue I showed an ambience circuit involving two speakers in series and the pair connected between the left and right speakers, and a resistor from the junction to ground. You could use 8 ohm resistors in place of the speakers, and an 8 ohm speaker in place of the single speaker. This would provide a load of 12 ohms across each channel, and 6 dB attenuation. If your extension is efficient enough, you can increase the resistor values for greater attenuation, and reduced amplifier loading. This circuit will raise the Q of the speaker, but if quality is not too important, you might even like the bass rise which results, even though it will not be too well damped. An L-pad can be used for level control.

Finally, you can always put two drivers in one box, but that is a little extravagant. For your information, I use the first method in my own system.

If necessary, you can always fuse the speaker line, but if you use cheap, low quality speakers, it would probably be cheaper to let them blow and replace them, rather than go into elaborate protection networks.

## Now That's Service

Ordinarily, in ETI, commentary on radio broadcasting is limited, to technical matters, rather than programming. However, an exception must be made.

As most readers are probably aware, on November 11, 1979, the City of Mississauga, was the scene of the largest population evacuation in North America history, due to the derailment of a railway train carrying combustible chemicals, and toxic chlorine.

First on the scene with in-depth coverage of the disaster was CBC radio, with reporters from many divisions keeping residents informed with developments, and aiding civil authorities in every way imaginable.

CBC Radio normally signs off the air at 1:00 AM and returns at 6:00 AM, but instead remained on the air, bringing in morning men Bob Leitch and Joe Cote, who worked the first of many long shifts. Technical staff was on hand all this time providing appropriate link-

ups with field reporters and others, all on what could only be described as an ad-lib basis, meanwhile trying to overcome the interference of another radio station.

There is no doubt that the efforts of all these people contributed greatly to the smoothness and orderliness of the evacuation and re-evacuation of 250,000 people, virtually the entire city and to the peace of mind of residents of neighbouring communities, such as Hamilton and parts of Toronto.

Since three major road arteries providing westerly access to Toronto were closed, it's inconceivable that traffic could have moved as smoothly and with so few tie-ups, without the able work of CBC's traffic reporter, Jim Curran, probably the best in the country.

Compare this performance with that of the private stations. With these guys: it was business as usual, ersatz music mixed with commercials, as if the event had taken place half way around the world. Even in Hamilton, nothing was offered by any of the stations. And yet a licence to broadcast is supposed to carry a mandate of service to the community. Some service.

So, the next time some hare-brained politician calls for the dismantling of the CBC and its sale to private enterprise, just mention Mississauga, and November 11, 1979.

Wally Parsons



## Get more!

... information about the things that interest you. Use ETI's handy Reader Service Cards. Page 58 has all the details. Individual numbers can be found under many of the ads in this issue.

Circle the numbers for those ads that interest you, mail it to us and more information will be on its way.

*'Look, Jasmin, TTL and CMOS ICs, transformers, cabinets and more! I want to find out more about these guys.'*

*'Oh Graham. . .'*

# Guitar Effects Unit

Our guitar effects unit isn't just a fuzz box. Use it to give you a new sound to play with.

LIKE US, YOU probably thought that one guitar effects unit was much the same as any other. After fuzz and Wah-Wah, what do you do? Well, we think we have come up with a new one, which we have christened **struzz**.

With this unit you can select either a conventional fuzz effect or our new struzz effect. A depth control allows you to alter the sustain rate of the effect. If the neighbours start banging the wall, you can instantly cut out the crunchy effects with a bypass switch.

## MAKE-UP

Construction should not pose any problems. It's even easier if you use our PCB. Make sure the electrolytic capacitors are put in the correct way round. As always, don't plug in the ICs until you have checked the circuit thoroughly. Happy fuzzing and struzzing.

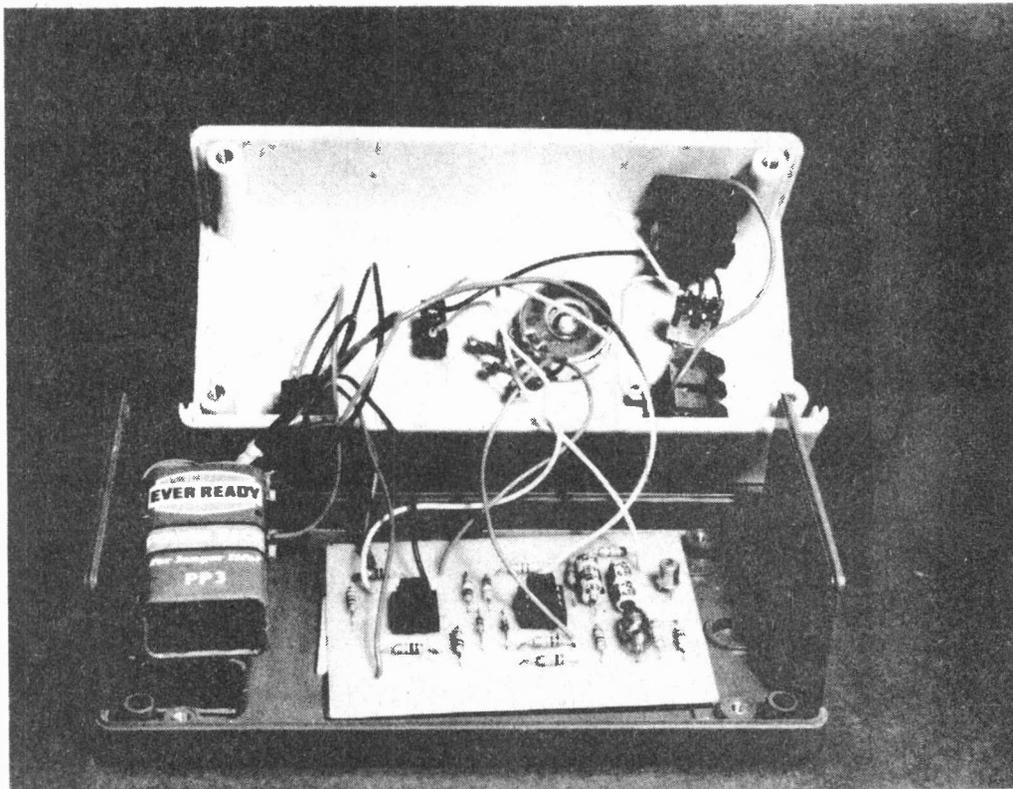


Internal view of the effects unit

## SMASHING SOUND

Now you are wondering what struzz sounds like, aren't you. Well, it's a distortion of fuzz. The fundamental frequency of the input is full wave rectified but the numerous harmonics are not. The result sounds rather like an antique piano finally succumbing to the ravages of woodworm, and collapsing. If you play the guitar (we don't) you will, no doubt, find many more musical uses for this effect than we could.

Switching between fuzz and struzz while playing produces an interesting sound. You might like to use a footswitch for this purpose.



# Guitar Effects Unit

## PARTS LIST

### RESISTORS (all 5% 1/4W)

R1	680k
R2	6k8
R3	270R
R4,6,9,10,11	10k
R5	8k2
R14	100k
R7	39k
R8	820R
R12,13	1k

### POTENTIOMETERS

RV1	1M0
-----	-----

### CAPACITORS

C1,3	1u0 electrolytic
C2	560p polystyrene

### SEMICONDUCTORS

Q1	MPS6515
IC1	741
IC2	LF356
D1,2	IN4148

### SWITCHES

SW1	SPDT Footswitch
SW2	SPDT
SW3	DPDT

### MISCELLANEOUS

Two 1/4in. mono jack sockets  
PCB

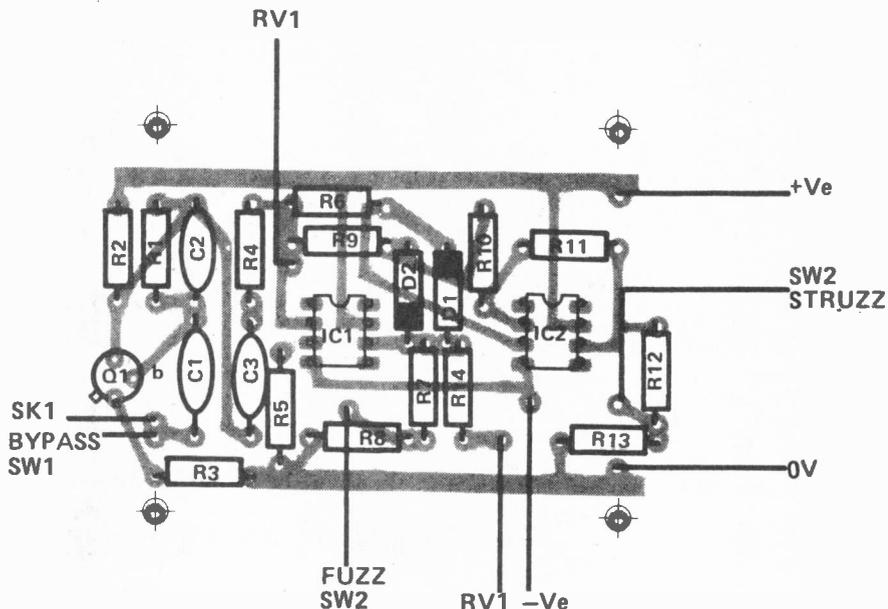


Fig. 1. (above) PCB component overlay

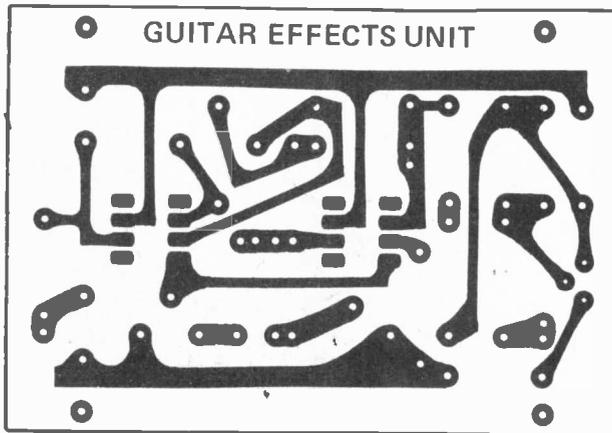
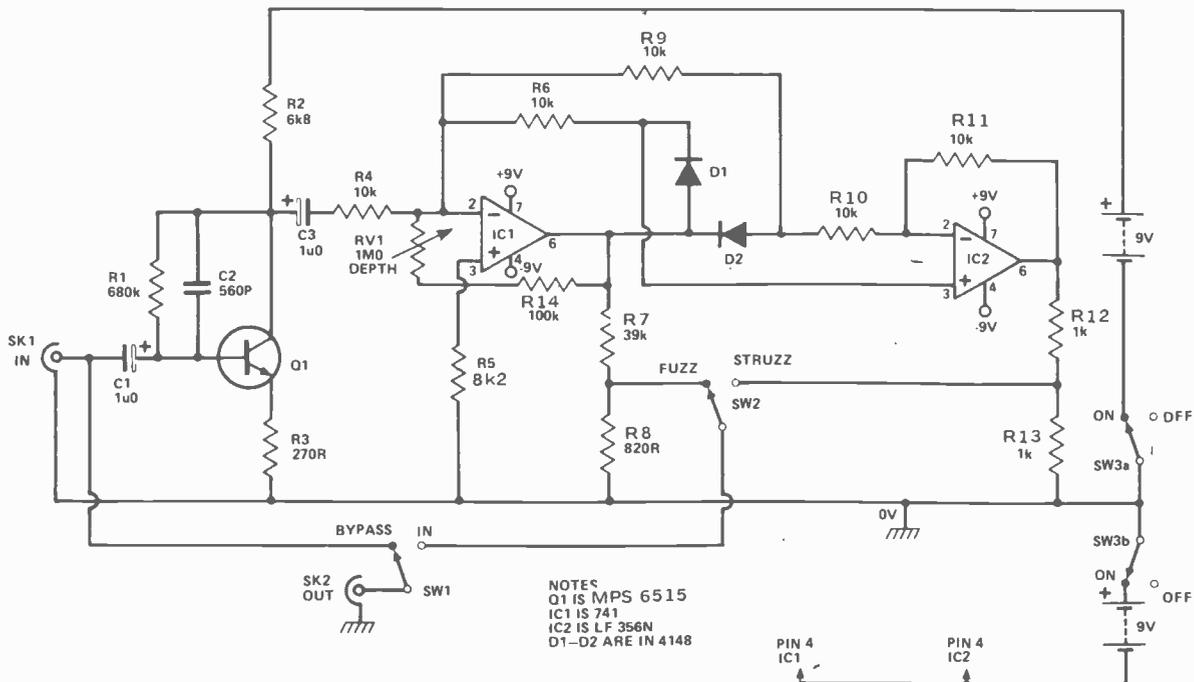
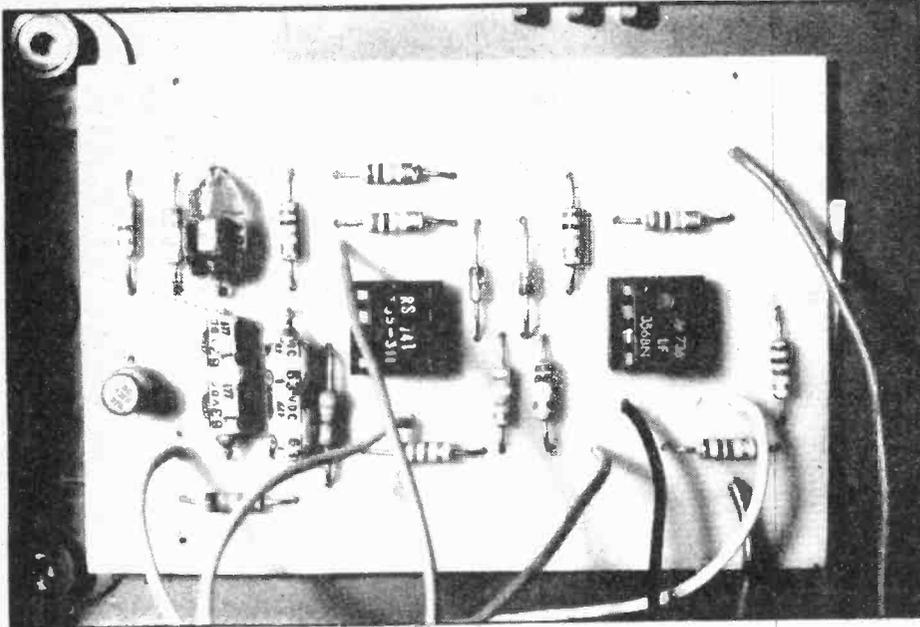


Fig. 2. (Below) Circuit diagram

For pcbs for this project, contact: Spectrum Electronics, P. O. Box 4166D, Hamilton Ont., L8V 4L5, or B & R Electronics, P. O. Box 6326F, Hamilton Ont. L9C 6L9. Northern Bear Electronics has available a "parts only" kit, see classified ads.

Complete PCB





## HOW IT WORKS

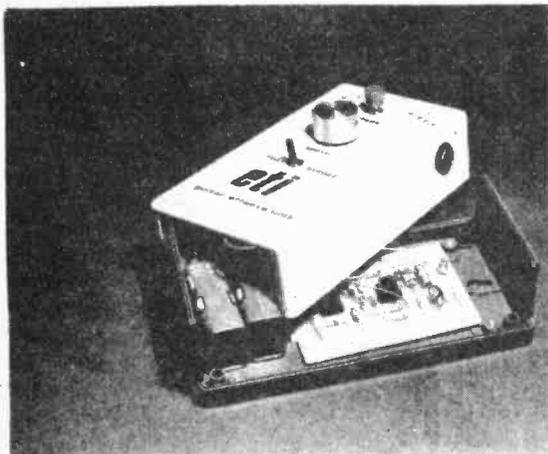
THE SIGNAL from the guitar pick-up is fed to common-emitter amplifier Q1 via blocking capacitor C1. Q1 has a voltage gain of about twenty-five, and brings the guitar signal up to a reasonable level for driving the fuzz and struzz circuitry. The upper frequency response of Q1 is restricted by C2, in the interest of circuit stability.

Operational amplifiers IC1 and IC2 are wired together as a 'precision' full wave rectifier, with its true output signal appearing at pin 6 of FET op-amp IC2. A very heavily clipped version of the input (Q1 collector) signal appears at pin 6 of IC1, and has a peak-to-peak amplitude of about 1.2 volts. RV1 enables the small-signal voltage gain of IC1 to be varied from  $\times 10$  to about  $\times 110$ , and controls the depth and 'sustain' characteristics of the sound effect unit. IC1 has a 'large-signal' gain of unity.

The fuzz output of the unit is taken from the output of IC1 via potential

divider R8-R9, and is a perfectly conventional, heavily-clipped, fuzz signal, with variable depth and sustain. The struzz output, on the other hand, is very unusual, and is taken from the output of IC2 via potential divider R13-R14. In the struzz mode the original guitar signal is full-wave rectified, so that its fundamental tone (which passes through zero cross-over points in each cycle) has its frequency doubled, but the overtones (which modulate the fundamental and do not pass through zero cross-over points) do not have their frequencies altered. The struzz output signal also has amplitude distortion imparted to it, due to the full-wave rectifier action.

Thus, the fuzz output signal has very heavy amplitude distortion, and the struzz output has both amplitude and frequency distortion. The sound effects unit can be switched in and out via bypass switch SW1, and should be interposed between the guitar and the main amplifier.



The PCB and batteries, mounted in the case, showing one of the jack sockets on the side of the case.

# Electronic Music and Creative Tape Recording

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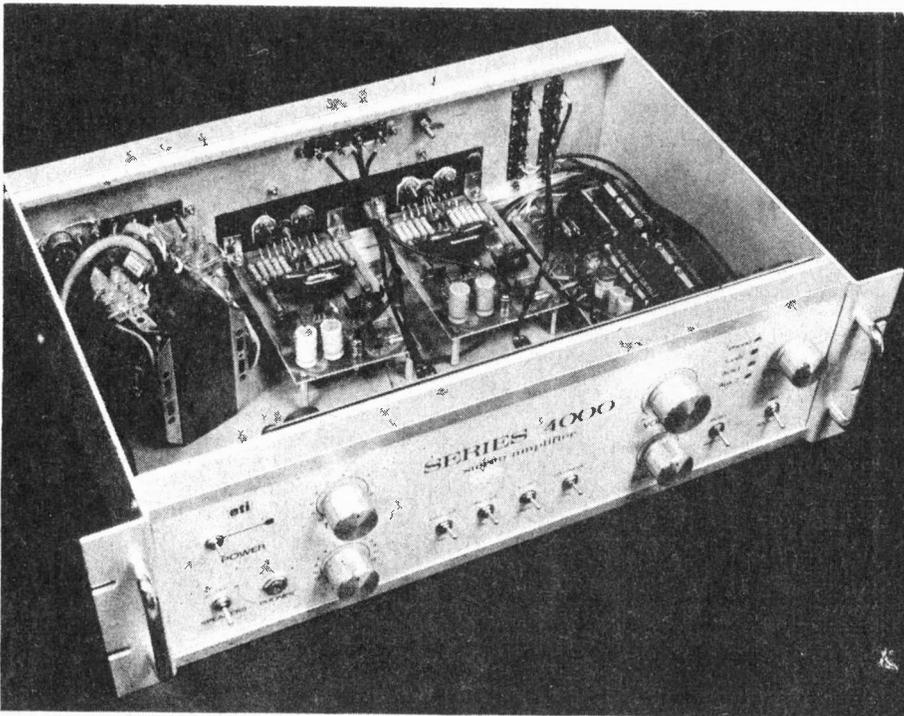
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# Series 4000 Stereo Amplifier

This month, we present details on how to combine our 60W power amplifier and single board preamp into one unit.



The completed stereo amplifier is shown here mounted in a handsome rack-mounting case.

WE HAVE ALREADY described the ETI 470 60 Watt module (Nov 79) and the ETI 471 Preamplifier (Dec 79) which have proved very popular as individual designs. This article presents the complete Series 4000 amplifier, made from these modules.

We chose to build the amplifier into a single box, being the most economical method as only one box and power supply is used for the preamp and both power amplifiers. However, this method has several drawbacks. Firstly, since the preamp and power amp share the same power supply, the regulation for the preamp must be very good, otherwise low frequency instability can occur, caused by the drop in supply line voltage when the outputs draw high current getting back into the preamp.

Hence we have chosen IC regulators for the preamplifier supply lines.

Secondly, the magnetic field from the large transformer and associated AC wiring required to supply the power amplifier modules is quite large and almost impossible to keep out of the sensitive preamp stages. Therefore you will notice that the specification for hum in the completed amplifier is lower than that of the individual units. We took this measurement using a standard EI lamination transformer after rotating it for minimum hum.

The hum induced by the transformer can be further reduced by using a C-core

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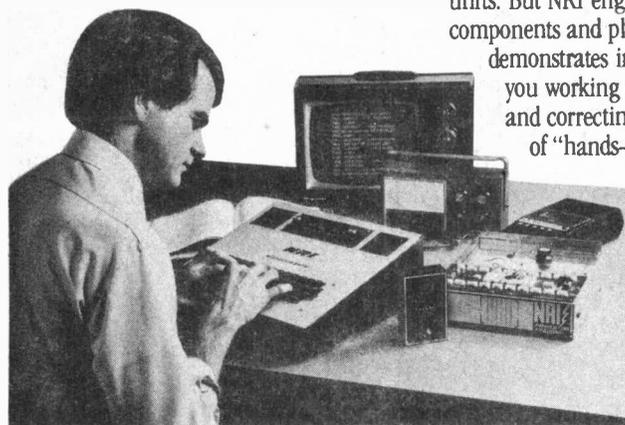


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# Series 4000 Stereo Amplifier

## SPECIFICATIONS

Power output . . . . .	60 watts @ 0.1% THD one channel driven 55 watts @ 0.1% THD both channels driven	Other inputs: 20 Hz to 20 kHz $\pm$ 0.5 dB Subsonic rolloff: 6 dB/octave below 20 Hz
Distortion . . . . .	0.05% THD @ 30 V p-p output across 8 ohm load, both channels driven.	Tape output . . . . . 150 mV RMS
Hum . . . . .	-70 dB on full output using standard transformer	Sensitivity . . . . . For 500 mV RMS output phono: 3 mV RMS other: 150 mV RMS (Phono overload level is 400 mV p-p).
Noise . . . . .	-80 dB on full output	Tone controls . . . . . Bass: $\pm$ 13 dB at 50 Hz Treble: $\pm$ 11 dB at 10 kHz
Damping factor . . . . .	57 (measured at 100 Hz, 1 kHz and 10 kHz).	Filters . . . . . High: 6 dB/octave, -3 dB at 5 kHz Low: 6 dB/octave, -3 dB at 100 Hz
Frequency Response . . . . .	Phono: Within 0.5 dB of RIAA from 20 Hz to 20 kHz (Follows new IEC curve).	Loudness . . . . . 8 dB boost at 150 Hz and 10 kHz.
		Mute switch . . . . . 20 dB attenuation

type, or better still a toroidal transformer, which have a contained field, but these are often hard to get and expensive to the hobbyist.

We feel that the specifications of the amplifier are very good, however the purist (with plenty of money) may like to do it this way:

The two power amplifier modules, together with individual power supplies using say, 30 000  $\mu$ F capacitors, could be mounted in a separate box to the preamplifier, which could then be powered from the ETI 581 regulated supply.

This would no doubt improve the power output and transient performance of the amplifier but the cost would be much greater.

### CONSTRUCTION

Construction details for the preamplifier and power amplifiers have been described previously, all that remains is to house them together, with the power supply, in a suitable box. As we said before, many variations are possible — here is how we did it.

Assemble the power supply board first, taking care to correctly orientate the semiconductors, IC regulators and capacitors. To simplify construction we used pc pins for all terminations to the boards.

The photo of the rear panel shows the position of the input and output connections. Slots are cut in the panel for the connector blocks and a large cut running across the back panel is used to inset the power amplifier modules from the rear. Holes then must

be drilled for the ground terminal, external power socket, power cord, mounting screws for the terminal blocks and holding screws for each power amplifier — which pass through the top of each heatsink fastening it to the panel.

The case measures approximately 420 x 135 x 285 mm. and was constructed from aluminum angle stock with anodized aluminum sides. This gave us a rigid chassis suitable for rack mounting. If you use any kind of anodized chassis be sure to break the finish in order to make good electrical contact.

One thing to watch though is that anodised aluminum does not conduct electricity and, after assembling the box, the various metal parts will probably not be connected to each other, causing a multitude of problems. To overcome this, strap the rear and side panels to the common ground point at the headphone jack on the front panel. (Yes, we found this out the hard way).

After the preamplifier/front panel, power amplifiers and power supply have been mounted in the box and the input/output sockets mounted onto the rear panel the unit can be wired as shown in the wiring diagram.

Common to all amplifier designs, the earth wiring is very critical. Most instability and hum problems can be traced to ground "loops" or incorrect wiring.

The common lead from each channel speaker is returned directly to the OV point on the power supply. A wire is then taken from this point and fed to one power module, to the other, and then to the preamplifier. To avoid an

ground loop the braid of the shielded cables from the preamplifier to the power amplifier is not carried through the connector block on the rear panel. OV leads for the LEDs and external power are also returned to the power supply common. The common is then grounded to the chassis at the headphone socket together with the transformer shield and mains ground. This is the ONLY ground point onto the chassis.

All the ac and speaker wiring is fed along the back and down the left side of the case as shown, well away from the sensitive parts of the amplifier. The dc wiring from the power supply to the preamplifier is carried along the front.

Lengths of shielded cable with RCA plugs on one end are used to connect the input sockets to the preamplifier. These can be made by cutting RCA patch cords to the appropriate length, one cord making two leads. The shields of these cables should not be connected together or to the case at the input sockets.

All that remains is to solder the 330 ohm resistors from the speaker switch to the plugs on the headphone socket.

Check that all wiring is correct and there are no frayed ends. The procedure for setting the bias current for the output transistors is given in the Nov. issue. As soon as this is done insert the 2 A fuses and the amplifier can be switched on.

If you have the older 50 watt ETI 480 modules these could probably be used in place of the ETI 470 module, though we haven't tried it.

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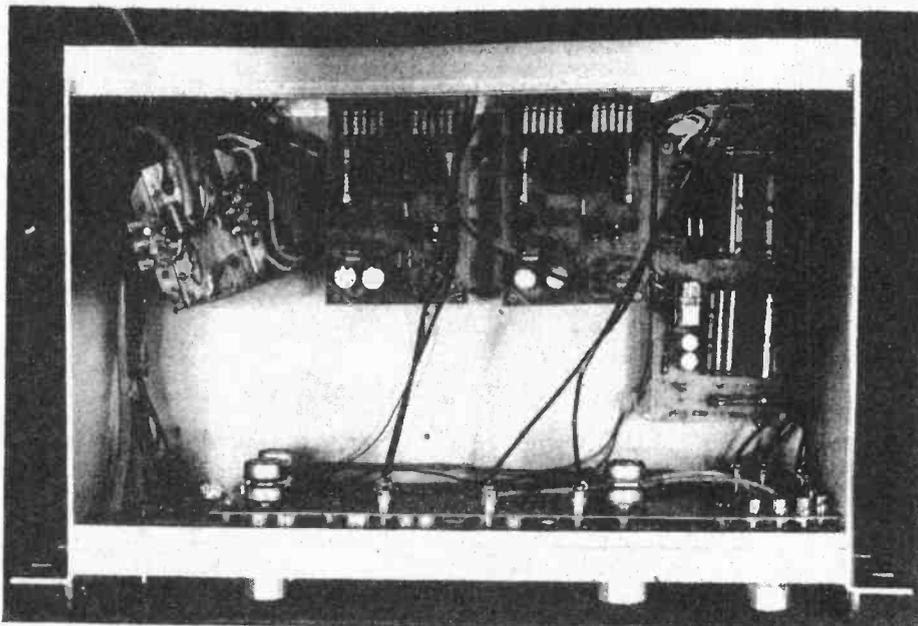




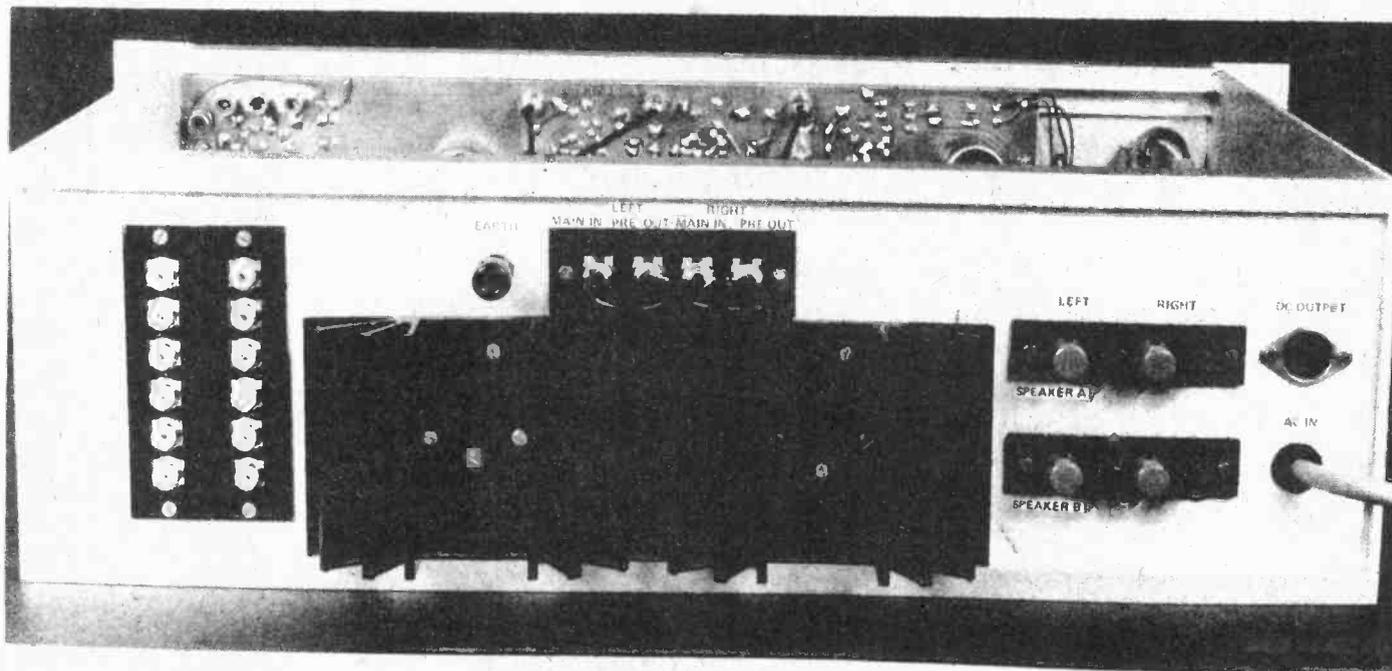
At first we tried mounting the power supply board in front of the transformer near the preamplifier, but found the proximity of the speaker wiring to the tone control stage caused high frequency instability if the treble control was advanced. The power supply board is now mounted at the opposite side of the case to the transformer and the ac secondary wiring run across the back.

Two three-terminal connector strips are mounted on top of the transformer, using the holes in the mounting plates, to take primary and secondary connections. The shield (green wire) makes up the third wire on the primary side and is run together with the 120V wiring to the front panel. We used three-core line cord for connections from the transformer to the power switch and the power supply pc board. A suppression capacitor (C1) is mounted across the transformer primary on the connector block.

Short patch leads will have to be made up to connect each of the preamplifier outputs to their respective power amplifier inputs.



This internal view shows the placement of the main modules and the orientation of the power transformer. The latter will have to be oriented individually to reduce hum levels to the minimum obtainable.



# Versatile Logic Probe

If you work or experiment with logic circuitry this project should be invaluable for debugging circuits. Inexpensive to build, it may be used both with TTL and CMOS circuitry, and indicates HI or LO conditions as well as pulse trains above 1 MHz. It will also detect short, isolated pulses having widths down to 500 ns.

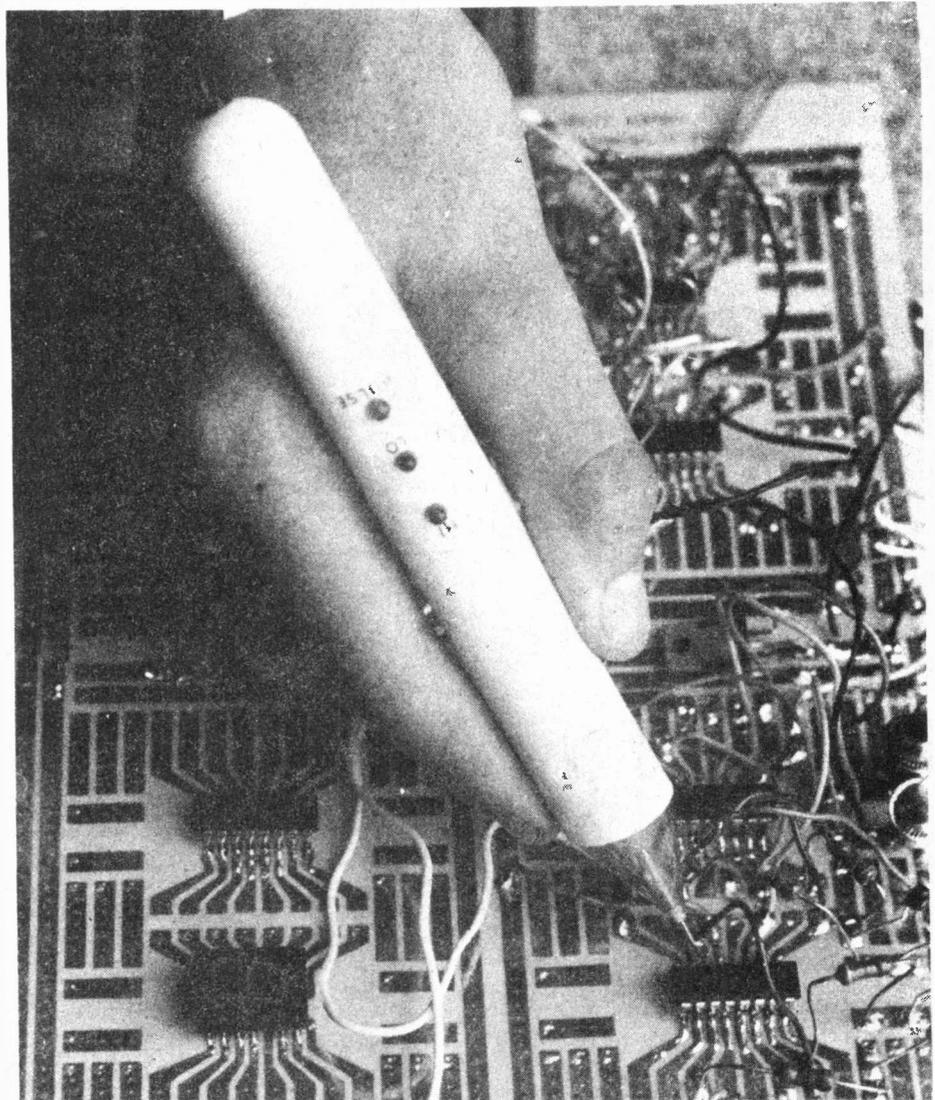
INTEREST in digital electronics has grown rapidly in the past few years with the advent of microprocessors and large scale integration. The most essential test instrument for experimenting with digital circuitry is a logic probe.

In its most basic form this should provide an indication of the logic level at any point in a circuit without overloading the section being tested. Other desirable features are the ability to follow high frequency pulse trains (preferably over 1 MHz) and to detect isolated, narrow pulses less than 1  $\mu$ sec in width. Finally, the instrument should be compatible with both TTL and CMOS ICs and be able to operate from a wide range of supply voltages (say five to 15 volts).

Commercial logic probes that satisfy all these requirements are available, but they invariably cost over \$30. The probe design described here offers comparable performance for less than \$10.00 combined with an excuse to enjoy a good cigar — a cigar tube is used for the case!

Indication is by means of three LEDs. Two red LEDs indicate either a HIGH or a LOW condition on the point under test, a green LED is used to indicate that a pulse train is occurring.

The circuit uses a single CMOS IC and a handful of resistors and capacitors. The components are mounted on a small pc board and housed in a tubular case such as an aluminum cigar tube or a length of plastic conduit. The power is supplied from the actual circuit under test and the performance characteristics of the prototype are described in the specification listed here.



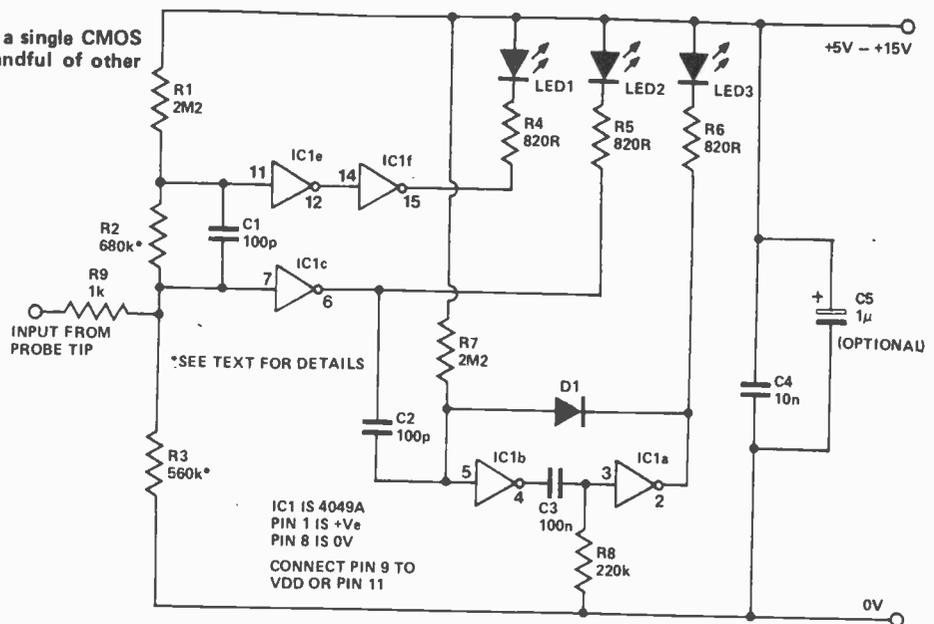
A logic probe is an invaluable aid for debugging or servicing digital circuitry. This project is inexpensive and easy to build.

# ETI Project

The circuit is simple, involves a single CMOS IC, three LEDs and a handful of other components.

## SPECIFICATIONS

- TTL or CMOS compatible
- Supply voltage: 5 to 15 volts
- Input impedance: over 400k
- Indicates HIGH (1), LOW (0) or floating states
- Follows high frequency pulse trains — over 1.5 MHz
- Detects single pulses down to 500 nsec in width, and stretches these to 15 msec.
- Relative brightness of HIGH/LOW LEDs indicates duty cycle of pulse trains.



## CONSTRUCTION

A printed circuit board is recommended for this project to provide consistent performance characteristics.

Before attempting to mount the components on the printed circuit board check to see that it fits easily into the case. The board must be a loose enough fit to allow it to be moved up and down within the case over a range of at least 5 mm. (Refer to the diagram).

If this is not possible, the width of the board can be reduced slightly with a file or coarse sandpaper, taking care not to remove too much or to damage the copper portions of the board.

The other alternative is to use a larger case — buy a bigger cigar! This movement within the case is necessary so that the LEDs can be juggled into position in the holes in the casing (see later).

Mount the wire links, the resistors and the capacitors on the pc board, keeping all components as close to the board as possible. Note that C3 is mounted on the underside of the board. Next, install the three LEDs. The height of the LEDs above the pc board must be such that the assembly will slide into the case with the board pushed down against the bottom of the case (see diagram). For a 20 mm diameter case this height should be about 12 mm. If the LEDs are not high enough, then it will not be possible to push the assembled board up into a position where the LEDs project through the holes in the case.

Next, add the power leads (without clips or E-Z hooks at this stage) and the 10 cm wire to the probe tip. Last of all

## HOW IT WORKS

Three of the six inverter/buffers in IC1 are used in the high/low detection circuit. IC1c is connected to the probe tip via R9. When the input goes HIGH (logic 1), IC1c output goes low and illuminates LED 2 through R5. Similarly when the input goes LOW (logic 0), the series pair IC1e and f illuminate LED 1 through R4. The resistor network R1, R2 and R3 ensure that the outputs of both IC1c and IC1f remain high when the input is 'floating'. C1 is connected across R2 as a 'speed-up capacitor' to maintain a sharp pulse shape into IC1e and so improve the ability to follow high frequency pulse trains (over 1MHz).

The two inverters IC1a and b form a monostable circuit that stretches short pulses (less than 500 nsec) out to 15 msec (0.7RC) using C3 and R8. The input

of the monostable comes from the output of IC1c and is isolated from the DC level of this output by C2. The combination of R7 and D1 normally holds IC1b input high. When a negative going pulse is fed into IC1b through C2, the output goes high, forcing IC1a to go low and illuminate LED 3. Diode D1 ensures that the input to IC1b is kept low (0.7V above zero) so long as the output of IC1a remains low. This prevents subsequent pulses from re-triggering IC1b until the monostable itself re-triggers via discharge of C3 to earth through R8, and allows IC1a output to go high, switching off LED3.

Capacitors C4 and C5 (optional) confer immunity to spikes or pulses in the supply lines, which are taken from the circuit being tested.

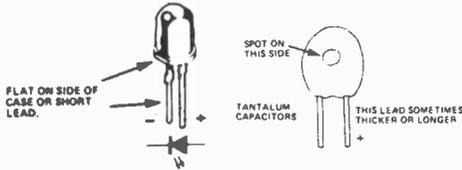
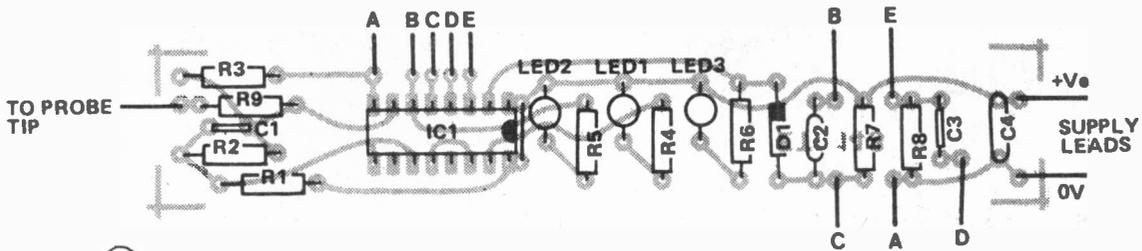
solder IC1 into position, observing all the usual precautions — shorted pins, heat sink, earthed soldering iron, pins 8 and 16 soldered first.

The probe tip housing on my prototype was turned from perspex and a 2 mm hole drilled through the centre. The probe tip wire is soldered to the end of a darning needle which is cemented into the housing with epoxy, allowing the needle to project about 15 mm beyond the end of the housing. It is not necessary to use a perspex cone, turned up as I have it. A flat-faced plug of a suitable material will suffice equally well.

Drill the 3mm holes for the LEDs at 10 mm intervals, starting 75 mm from the front of the case. The hole for the supply leads is drilled in the back of the

case and fitted with a small rubber grommet (or plastic LED housing) to prevent the case rubbing through the insulation on the leads.

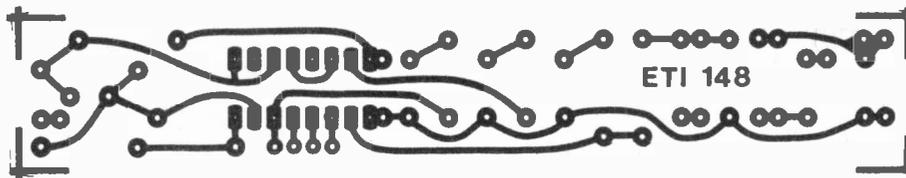
Before mounting the assembled pc board in the case check the circuit for dry joints, solder bridges, incorrectly mounted components, etc. Then test the device as follows. Connect to a five volt supply and observe the three LEDs. None should light with the probe tip isolated. If the LOW LED (LED 2) comes on or flashes, then R2 is too small and must be replaced by a slightly larger resistor (say 820 k). Touching the probe tip with the fingers may cause LED 2 to light, but this should go off when the tip is isolated. Touching the probe tip to either supply rail should light the appropriate LED, with the



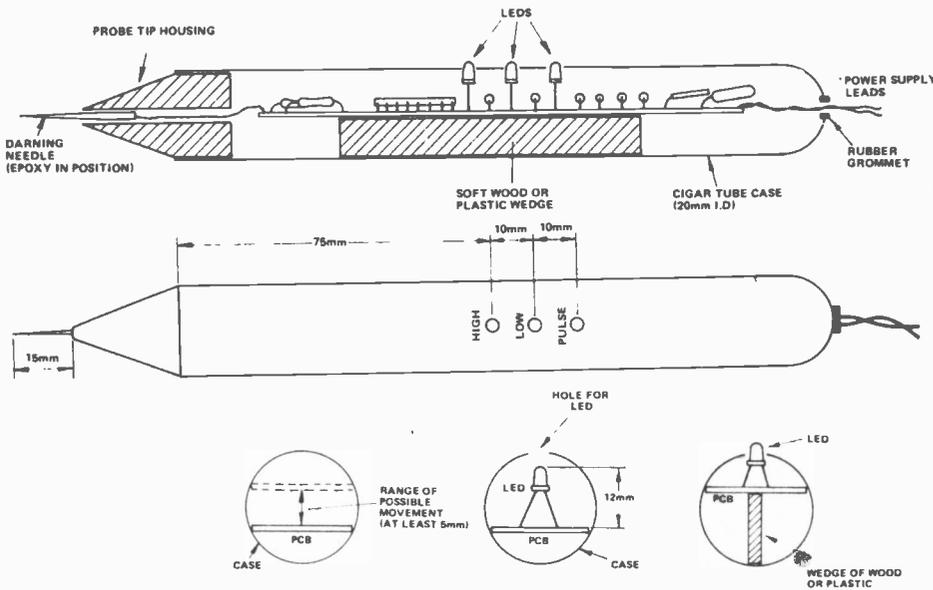
**NOTE**  
C5 IF USED IS MOUNTED  
ACROSS C4 (OBSERVE  
POLARITY)

**CONNECT RESPECTIVE  
LETTERS TOGETHER**  
ATO A B TO B etc.

Component overlay for the pc board. Refer to the construction diagrams below for correct assembling of the LEDs.



For pcs for this project, contact: Spectrum Electronics, P. O. Box 4166D, Hamilton Ont., L8V 4L5, or B & R Electronics, P. O. Box 6326F, Hamilton Ont L9C 6L9. Spectrum also has available a kit of parts.



## PARTS LIST

### Resistors all 1/4W, 5%

- R1,7 . . . 2M2
- R2 . . . . 680k\*
- R3 . . . . 560k\*
- R4,5,6 . . . 820R
- R8 . . . . 220k
- R9 . . . . 1k

### Capacitors

- C1,2 . . . 100p Ceramic
- C3 . . . . 100n Greencap
- C4 . . . . 10n Greencap
- C5 . . . . 1μ Tantalum (Optional)

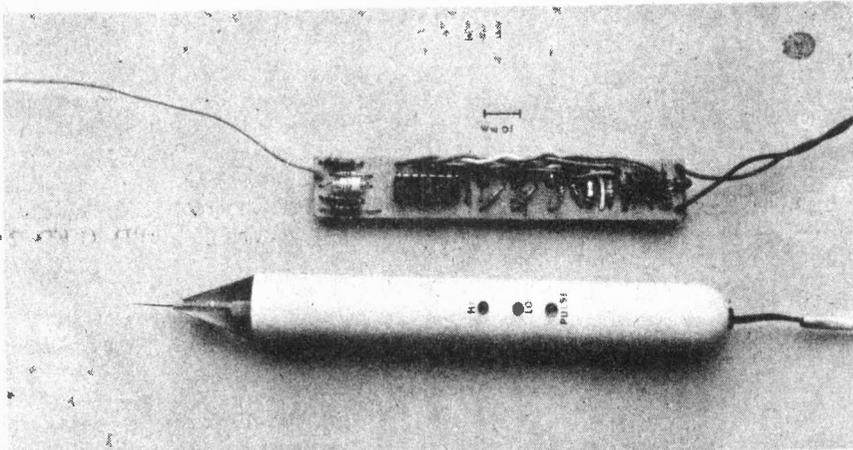
### Semiconductors

- IC1 . . . . 4049
- LED 1,2 . . 3mm red
- LED 3 . . . 3mm green
- D1 . . . . 1N4148 (or equivalent)

### Miscellaneous

- pcb; red and black leads with alligator clips or E-Z hooks;
- cigar case (or equivalent) – minimum dimensions 20mm ID, 140mm long;
- perspex rod for probe tip housing;
- darning needle.

\*Resistors R2 and R3 may have to be altered slightly (in the range 470k to 820k) to suit the transfer characteristics of IC1 – see text.



These diagrams above, and the picture left show the general construction of the probe and the drilling of the cigar tube or whatever case is used.

# Useful design ideas **MORE** **CIRCUITS** from Electronics Today.

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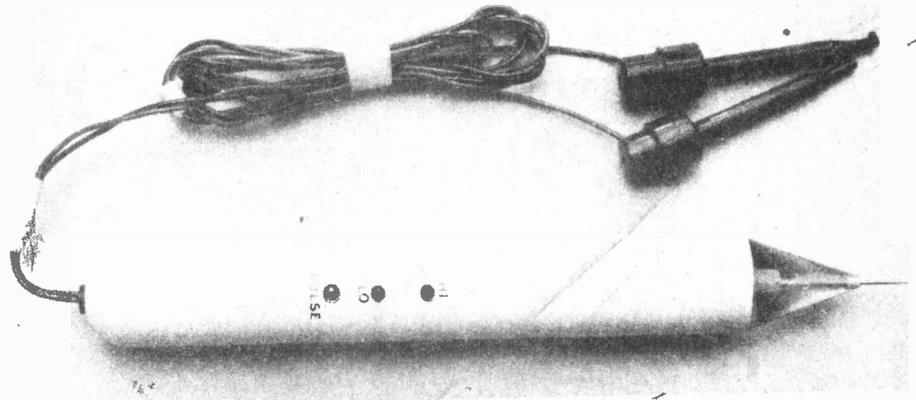
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PS. The real book is orange.

PULSE LED flashing when the tip first touches the positive rail. If the LOW LED does not light when the probe is connected to 0V, then R2 is too large. Change R2 to 560k and repeat the sequence above.

Now try a 15 volt supply. Again, all LEDs should be extinguished when the probe tip is isolated. The HIGH LED (LED 1) may glow very faintly. If this glow is too strong, reduce the value of R3 to say 470k. However, if R3 has to be altered it will be necessary to recheck the circuit at 5V to see that the low voltage performance is still satisfactory. At 15 volts repeat the process of touching the probe tip to the two supply rails. The results should be the same as in the case of the 5 volt supply, but the LEDs will be considerably brighter.

When satisfied that the circuit works correctly mount it in the case. First, cover the edges of the pc board with strips of tape to insulate it from the case and apply a thin smear of epoxy cement around the base of each LED. Feed the power supply leads through the back of the case, followed by the assembled board. Jockey the board into a position where the LEDs are directly under the



The completed logic probe.

holes in the case and then push the assembly up into a position so that the LEDs protrude through the holes in the case. The epoxy around the base of the LEDs will anchor them in position. In addition to this means of holding the board in place, a small wedge of soft wood, plastic or similar insulating material can be inserted into the space between the bottom of the board and

the case. The probe tip and its plastic housing is then inserted in the front of the case and epoxied in position.

When the epoxy has set, fit the clips or E-Z hooks to the ends of the supply leads, label the three LEDs and give the whole instrument a coat of protective lacquer. The completed logic probe is now ready for use — but don't forget to smoke the cigar!

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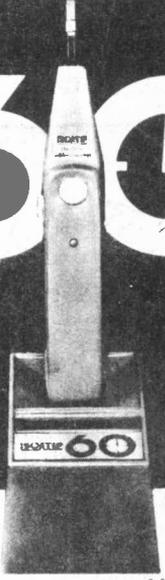
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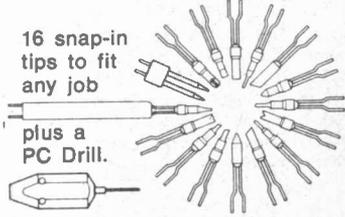
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# The LM10—Applications

Following on from last month's introduction, Ray Marston takes a closer look at the revolutionary LM10 amplifier, and comes up with a whole stack of practical applications.

THE LM10 IS A REVOLUTIONARY new type of operational amplifier device that is capable of operating from single ended supplies with voltages as low as 1V1 to as high as 40V. As can be seen from Figure 1, the device contains an op-amp, a precision 200 mV band-gap voltage reference, and a reference amplifier, all housed in an 8-pin package. We introduced basic details of the LM10 in the last edition of ETI.

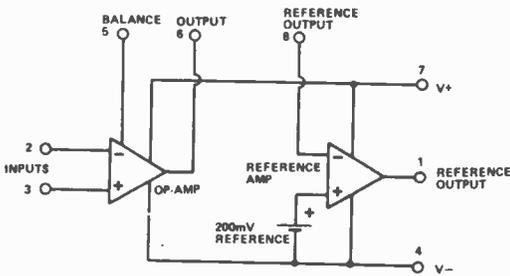


Fig. 1. connections.

In this month's article we take a look at a whole stack of practical application circuits of the LM10

## VOLTAGE REGULATOR CIRCUITS

The LM10 is, because of its built-in precision voltage reference and op-amp, ideally suited to use in voltage regulator applications. Figures 2 to 9 show a few practical circuits of this type.

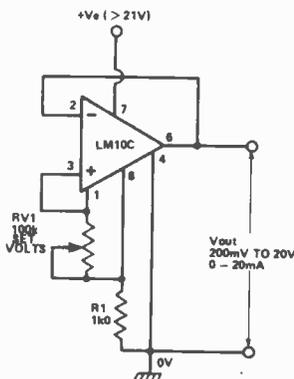


Fig. 2. The built-in reference and amplifier are used to generate a 200 mV to 20 volt potential that is fed to the input of the op-amp, which is configured as a voltage follower and boosts the available output current to about 20 mA.

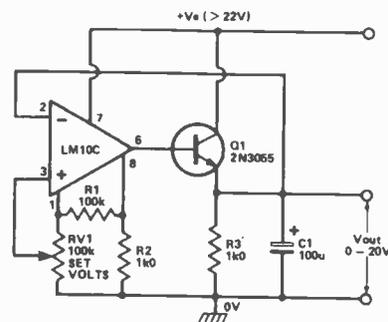


Fig 3: the reference and amplifier produce a fixed 20 volts, which is fed to pot RV1. The op-amp and Q1 are configured as a voltage follower, which boost the 0-20 volts output to current levels up to several hundred milliamps.

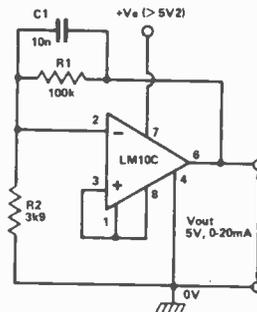
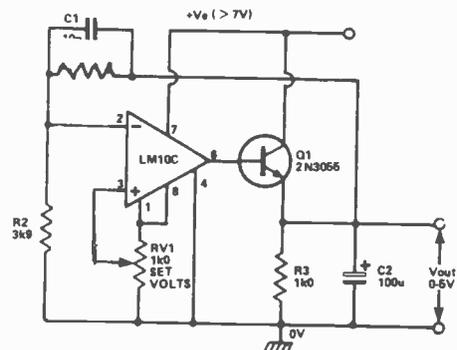
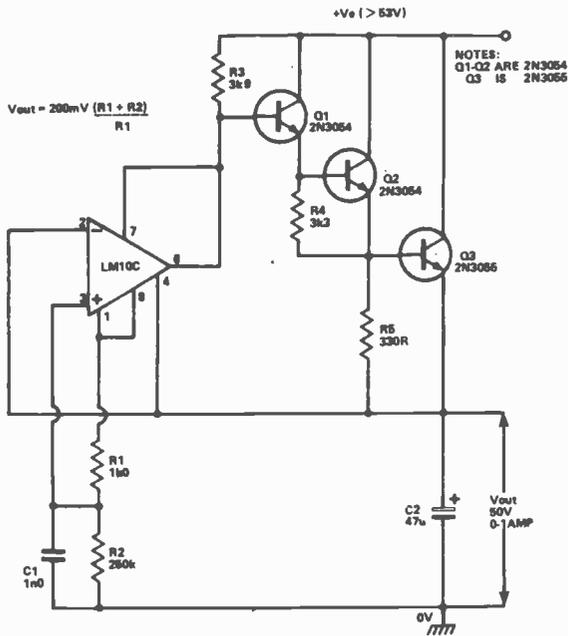
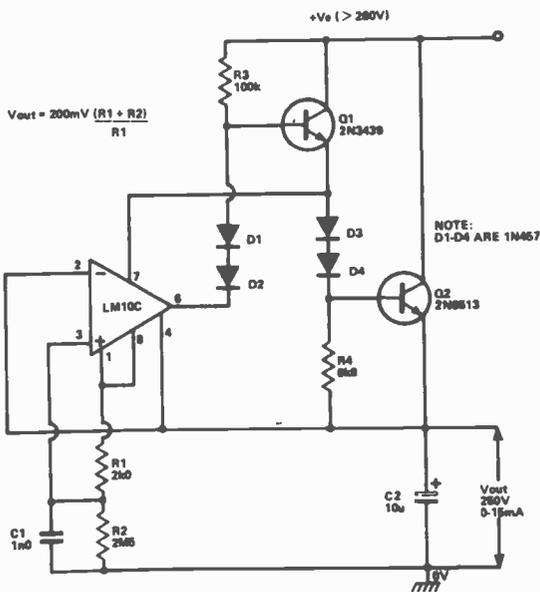


Fig 4: the op-amp input is derived directly from the 200 mV reference, to give a 5 volt output. Fig 5: the op-amp input is derived from a 0-20 mV reference, to give a 0-5 volt output.





Figures 6 and 7 show how the LM10 can be used in the 'floating' mode, to generate high output voltages. Note in both of these circuits that the IC is used in the 'shunt' mode, with load resistor R3, and that only a few volts are developed across the LM10 itself.



The LM10 can be used in a wide variety of voltage, current, and resistance-sensitive fault-indicator circuits with audible or visual outputs. Figures 10 to 23 show examples of circuits of this type.

In Figures 10 to 17 circuits, the op-amp is used as a simple voltage comparator, with its output feeding to either a LED indicator or an audible warning device via a suitable current-limiting resistor.

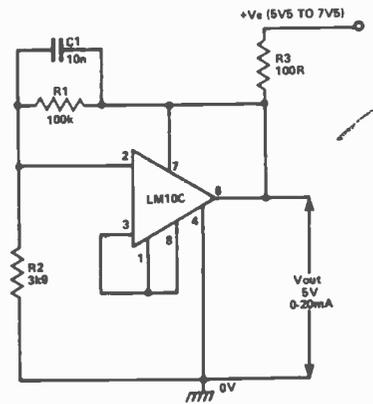


Figure 8: a simple example of the use of the LM10 as a 5 volt shunt regulator. Fig 9: how the IC can be made to act as a negative voltage regulator.

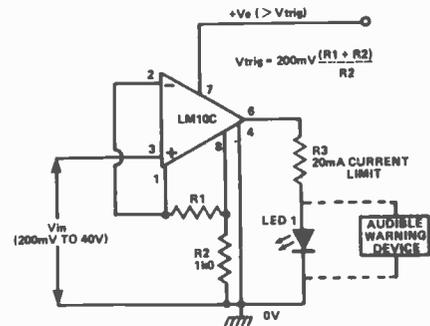
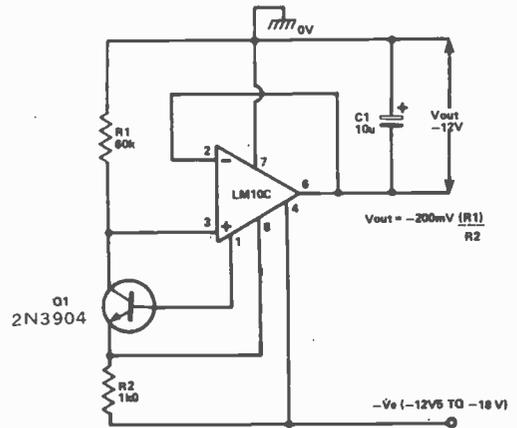


Fig 10: over-voltage indicator circuit, the test voltage is fed to the non-inverting terminal of the op-amp, and the trigger reference voltage is produced by the LM10's voltage reference and reference amplifier and is fed to the non-inverting terminal of the op-amp.

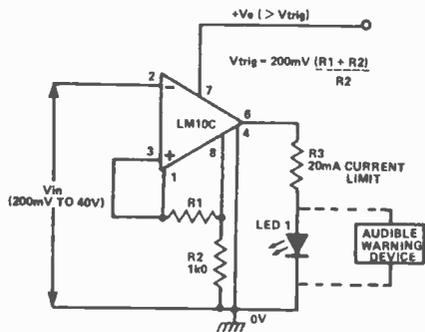


Fig 11: An alternative approach is used in the over-voltage circuit here. A 200 mV reference is fed to one input terminal of the op-amp and a potential-divided version of the test voltage is fed to the other.

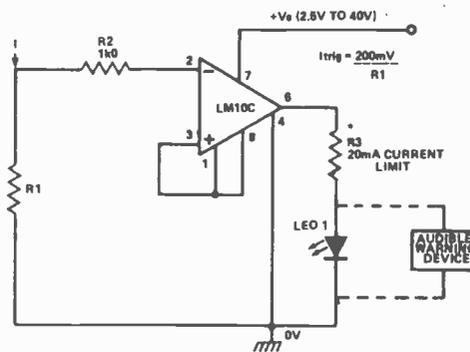


Fig 15 (above): precision under current indicator with LED or audible warning device output.

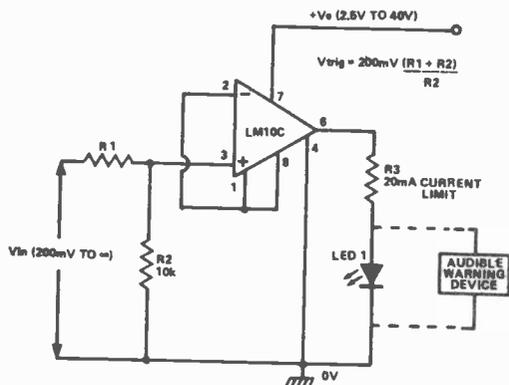
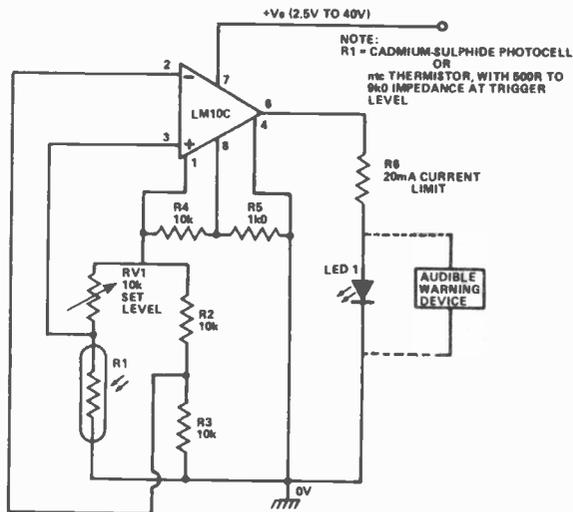


Fig 12: under-voltage circuit is similar, except that the op-amp input connections are transposed. A feature of both of these circuits is that the LM 10 supply voltage must be greater than the required trigger voltage.



Figures 16 and 17 show precision circuits that can be triggered by any parameters, such as light or temperature levels, that can be sensed by a resistive element. In these circuits, the resistive element forms part of a Wheatstone bridge that is powered from the LM10's voltage reference amplifier, and the output of the bridge is used to activate the comparator-connected op-amp. In the examples shown, the bridge is powered from a 2V2 source.

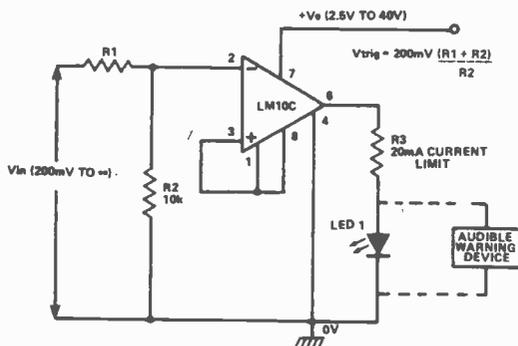
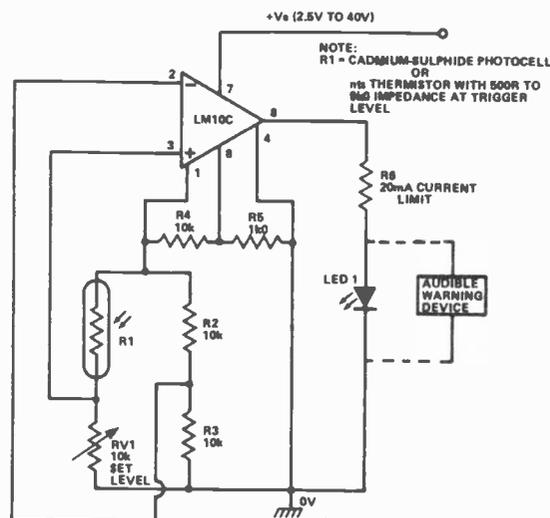


Fig 13 (above): precision under voltage indicator with LED or audible warning. Input sensitivity  $\approx 50k/v$ .  
Fig 14 (below): precision over voltage indicator with LED or audible warning.



## REMOTE AMPLIFIER AND 2 WIRE TRANSMITTERS.

One of the most interesting aspects of the LM10 is its suitability for use in remote-amplifier and 2-wire transmitter applications. The device has an output current drive capacity that is a couple of orders of magnitude greater than the devices quiescent current value, and has excellent supply-rejection characteristics. Consequently, the device can operate quite happily with its output terminal shorted to one or other of it's supply terminals, in which case the supply leads can be used to carry both supply and output signal currents.

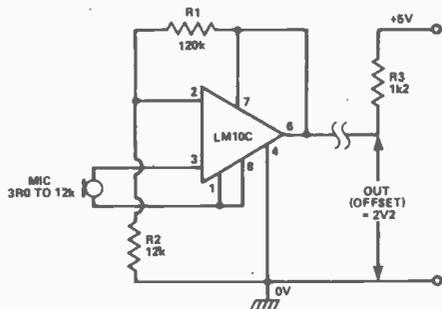


Fig 18 (above): remote 20dB voltage amplifier for use with inductive or magnetic input devices.

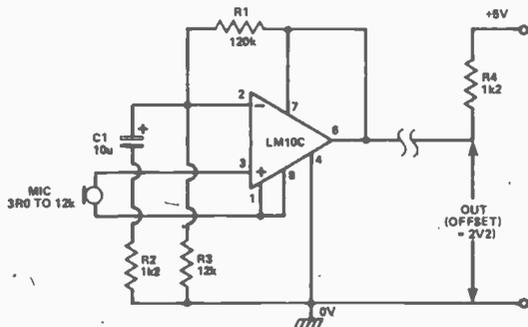


Fig 19(above): remote 40dB voltage amplifier.

Figures 18 to 21 show examples of remote linear amplifiers or 2-wire analogue transmitters. The Fig 18 and 19 circuits are suitable for use with low- to medium impedance input devices, such as moving coil or magnetic microphones, etc., and the Fig 20 circuit is suitable for use with high impedance devices such as crystal microphones or vibration sensors, etc. The Fig 21 circuit is suitable for use with resistive sensors.

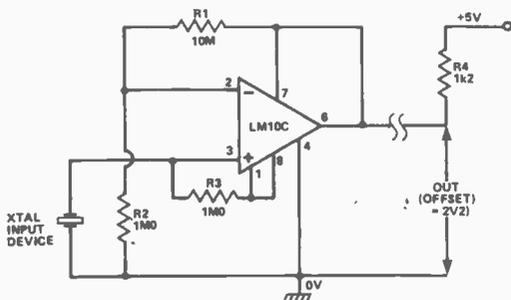


Fig 20 (above): 20dB voltage amp for use with high impedance input device.

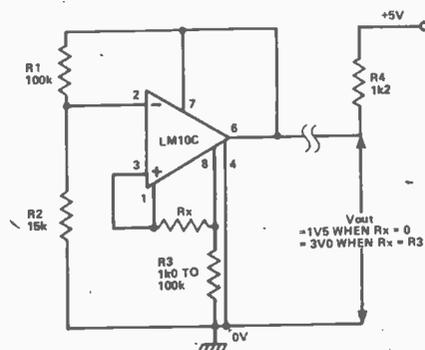


Fig 21 (above): a two-wire transmitter for use with a variable resistance sensor.

Figures 22 to 26 show the circuits of 2-level 2-wire fault-indicator transmitters with either resistor, LED, or transistor outputs at their 'receiver' ends. Figures 25 to 30 show 2-wire 'fault-indicator' transmitters with either flashing LED or monotone audio outputs.

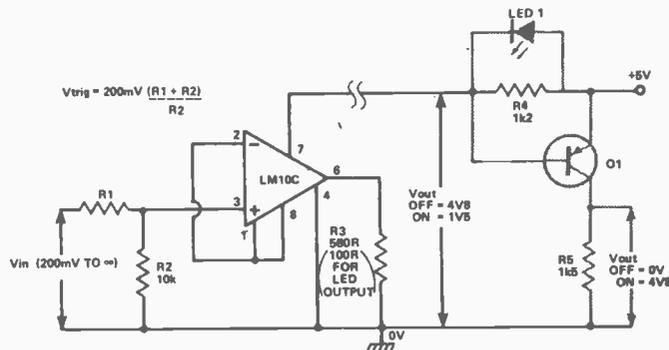


Fig 22 (above): two wire precision over-voltage transmitter with LED or resistor/transistor output.

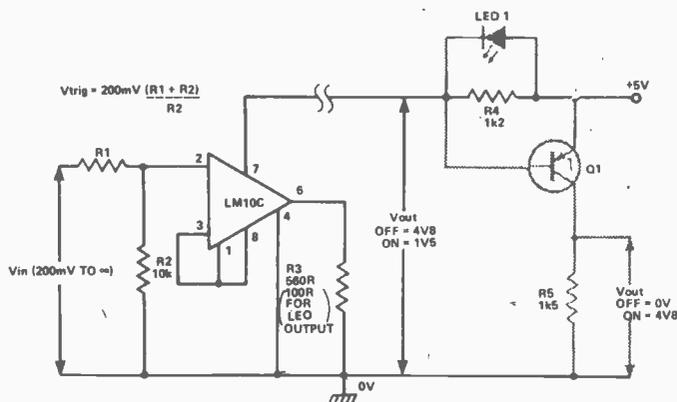
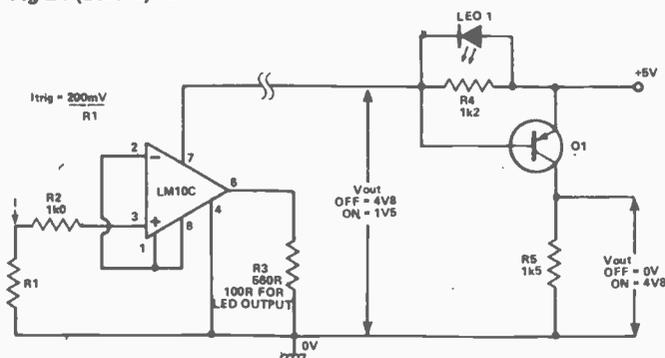


Fig 23 (above): under voltage version of Figure 22 circuit. Fig 24 (below): over current version of basic circuit.



# The LM10-Applications

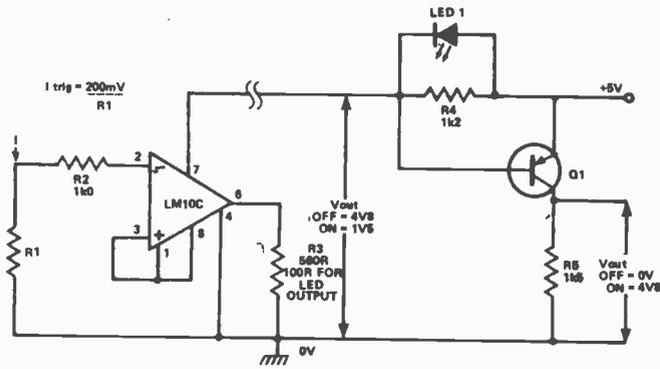


Fig 25 (above): two wire under current transmitter with LED, resistor or transistor output.

NOTE:  
R1 - CADMIUM-SULPHIDE PHOTOCELL OR  
OR THERMISTOR WITH 500R TO 9kΩ  
IMPEDANCE AT TRIGGER LEVEL

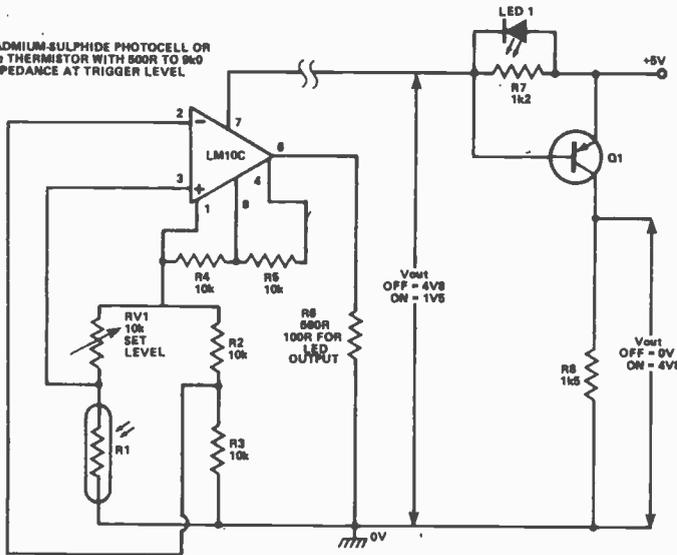


Fig 26 (above): two wire precision 'dark' or 'under-temp' transmitter with same basic outputs as previously. Transposing R1 and RV1 makes the circuit act as a 'light' or 'over-temp' alarm.

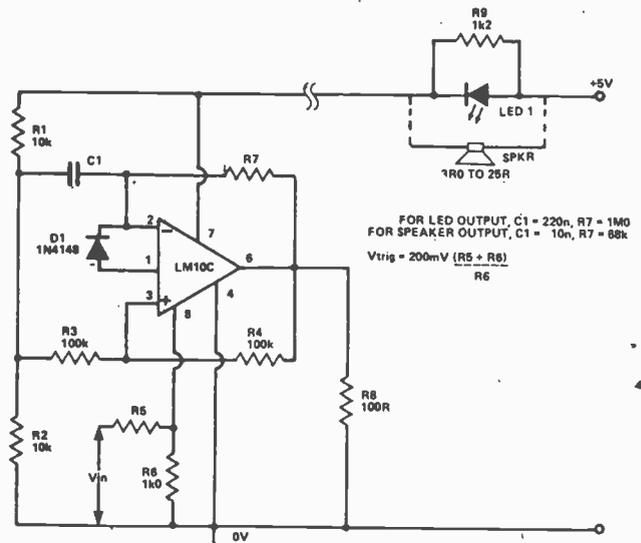


Fig 28 (above): over-voltage transmitter — output options on Fig 27.

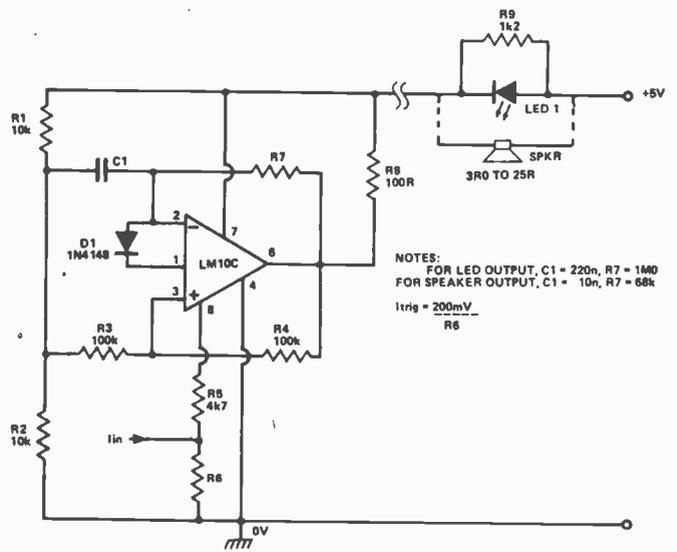


Fig 29 (above): under-current transmitter — output options as Fig 27.

Fig 30 (below): over-current transmitter — output options as Fig 27.

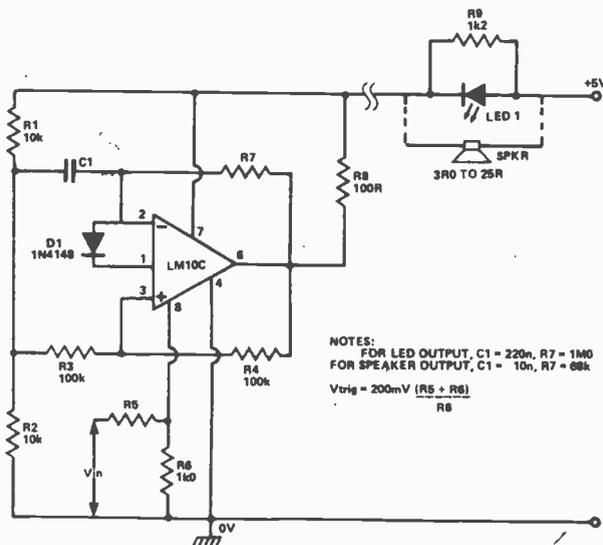
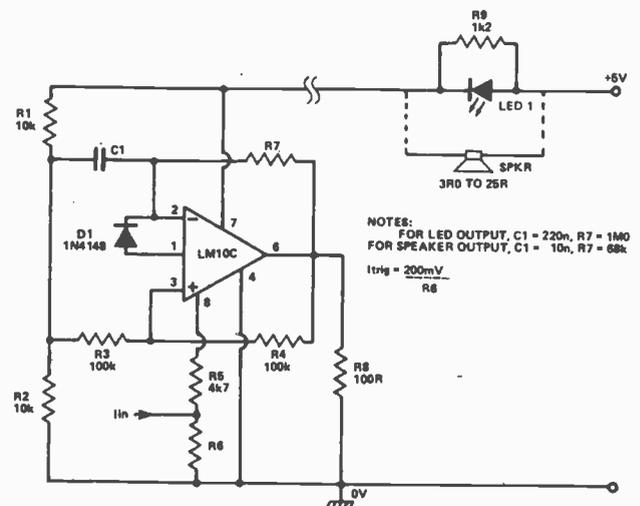
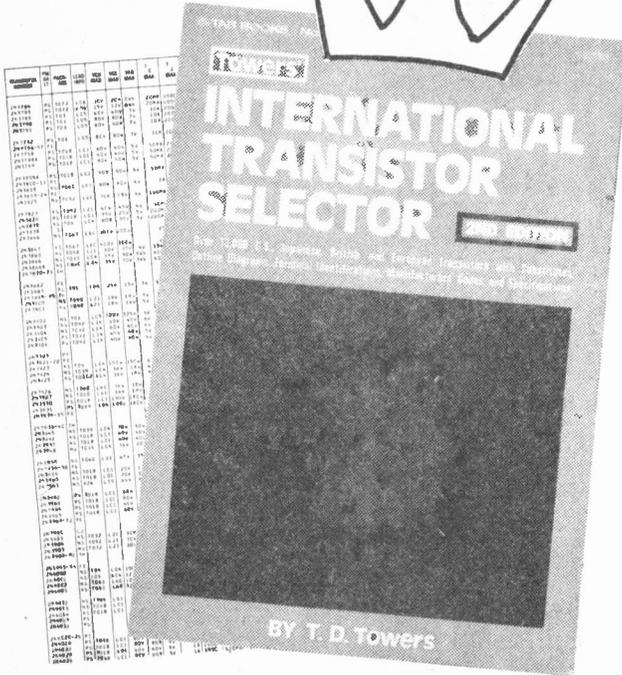


Fig 27 (above): two wire precision under-voltage transmitter with flashing LED or monotone audio output (400 HZ).

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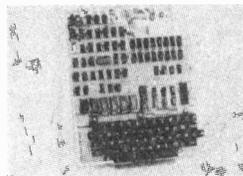
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# The LM10—Applications

## METER AMPLIFIER CIRCUITS

To conclude this look at applications of the LM10, Figures 31 to 33 show a variety of ways of using the device as a moving-coil meter amplifier.

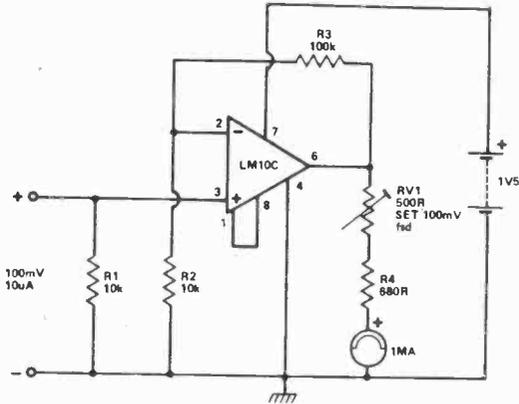


Fig 31: the op-amp is used as a simple non-inverting amplifier, and increases the meter sensitivity by a factor of about 100. This circuit has no 'set null' facility, and can give no indication of reverse-connected signals. The modified circuit of Fig 32 (below) does not suffer from this defect.

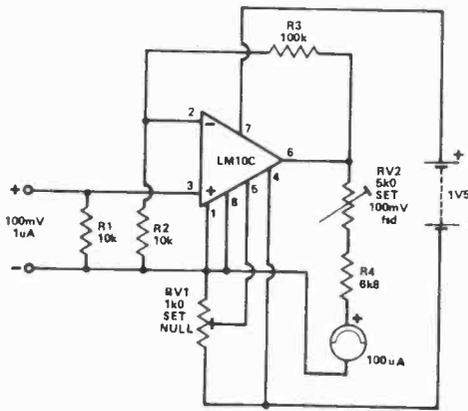
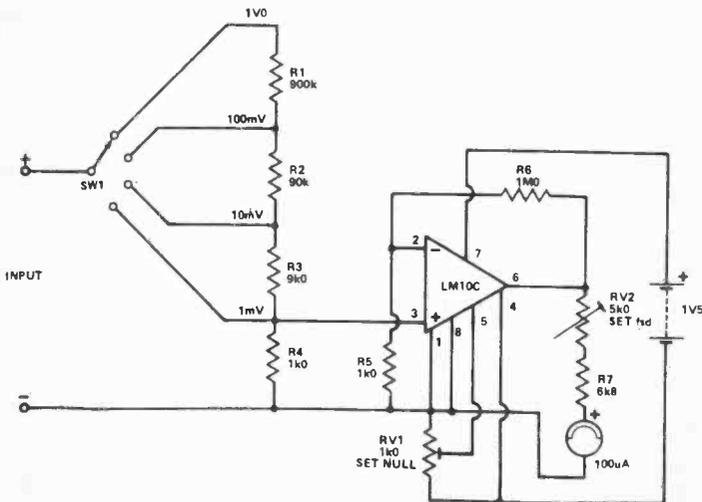


Fig 33 (below) how the basic Fig 32 circuit can be adapted for use as a four-range DC millivoltmeter. Note that these meter circuits are powered from a 1V5 cell! Not bad for an op-amp.



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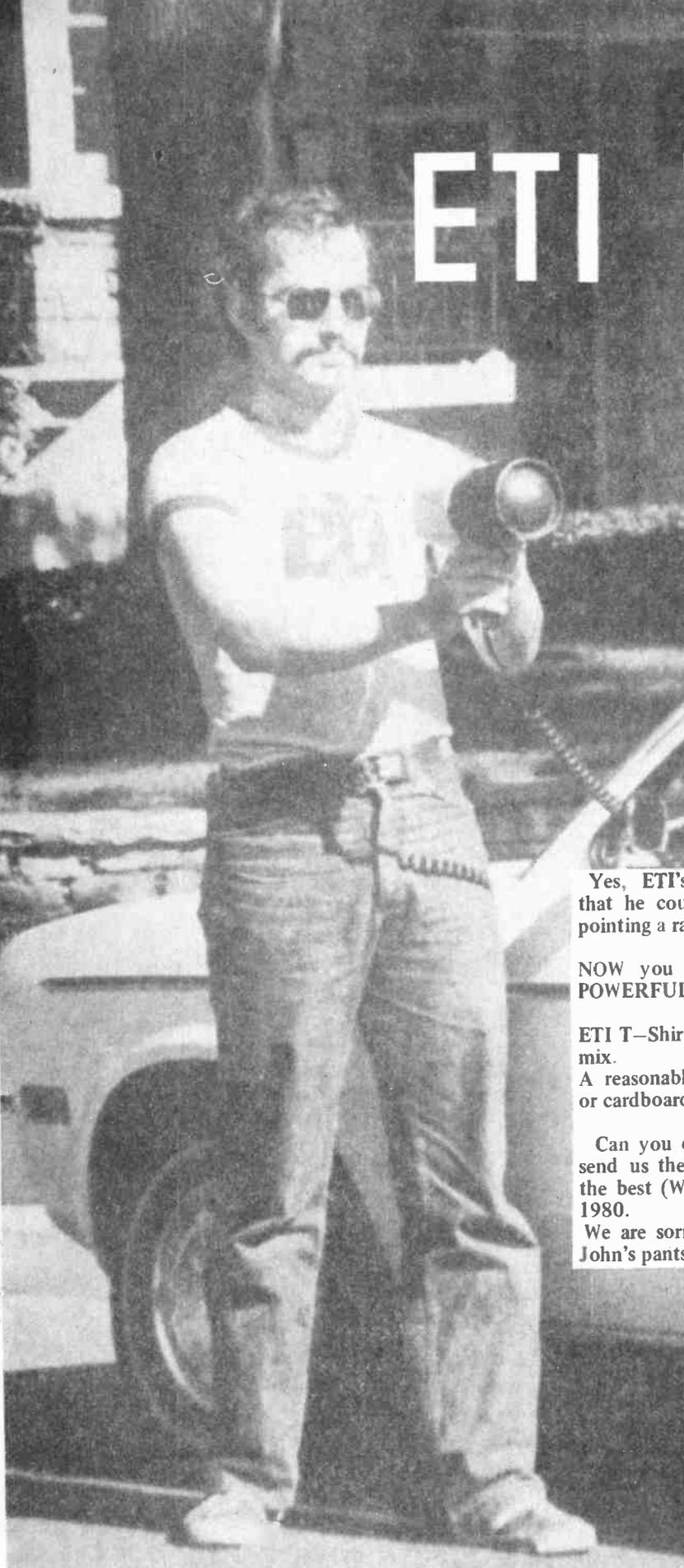
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# Practical Guide To Triacs Part II

## Part 2 - Phase control

### HOW PHASE CONTROL WORKS

A Triac can be triggered into conduction during any part of a half-cycle of applied voltage, and will *remain conducting* until the end of that half-cycle.

Thus, if a triggering signal is applied at the beginning of each half-cycle, the Triac will in effect conduct as if it were a switch that had been turned on. But if the triggering signal is applied halfway along the waveform, the Triac will conduct only for the remaining period of that half-cycle; and as the Triac conducts for only half the time, it reduces the power applied to the load by roughly the same amount (Fig. 16).

Thus the power input to the load can be set at any level simply by

**T**RIACS not only switch power on and off and thus replace mechanical contactors — they can also control the *amount* of power applied to a load.

There are two quite different ways of using Triacs for this purpose — 'phase control' and 'zero voltage switching'.

Phase control is the method used to control light dimmers, electric motors, and for voltage and current regulators.

Heating loads can also be controlled in this way — but, for reasons outlined later in this article, zero voltage switching is a better technique.

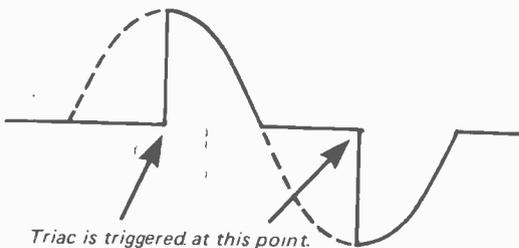
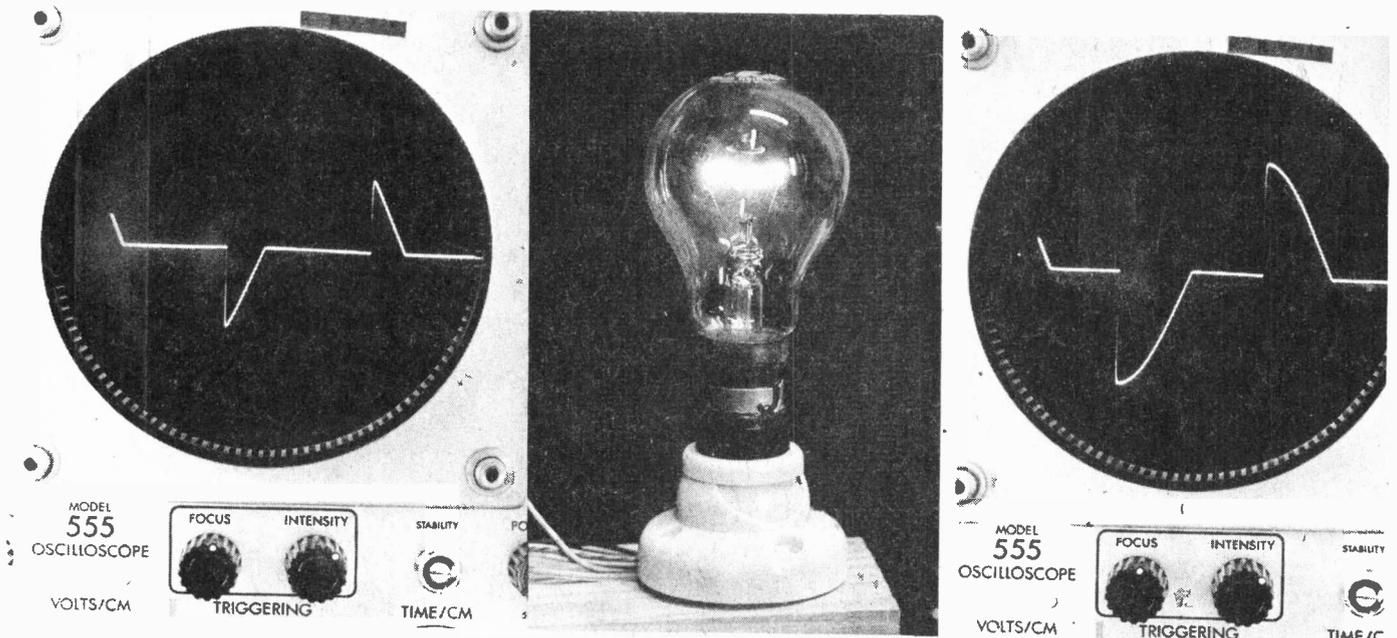


Fig. 16  
Drawing shows Triac triggered at half-way point.

Fig. 17  
Actual waveforms of a domestic light dimmer showing triggering at  $\frac{1}{4}$ ,  $\frac{1}{2}$  &  $\frac{3}{4}$  points. Note corresponding changes in lamp brightness.



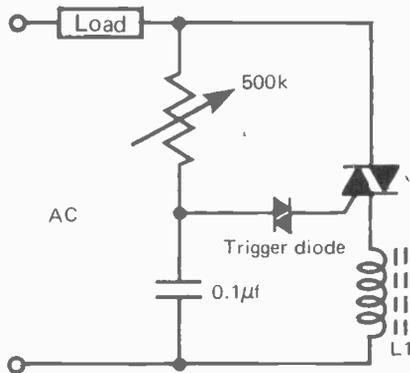


Fig. 18  
Basic phase control circuit.

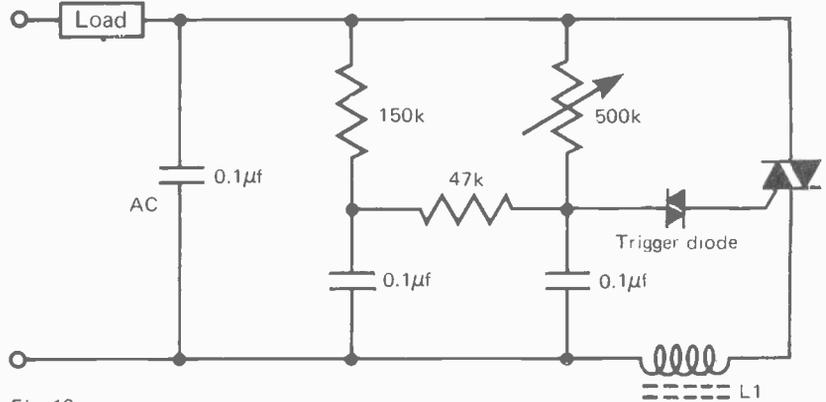


Fig. 19  
Simple versatile phase control circuit is suitable for domestic light dimming and other resistive loads.

controlling the point at which the triggering signal is applied. Oscilloscope pictures (Figs. 17a, b, c) show the 60Hz waveform triggered at three different points. Notice the corresponding change in brilliance of the lamp used as a load.

## LIGHT DIMMER

The circuit of a commercially produced light dimmer is shown in Fig. 18.

During each half-cycle the 0.1  $\mu\text{f}$  capacitor charges up (via the control potentiometer) until it reaches 30-32 volts. At this voltage the trigger diode conducts and the voltage across the capacitor 'gates' the Triac into conduction. (A neon lamp is

sometimes used instead of a trigger diode).

The time required for the 0.1  $\mu\text{f}$  capacitor to charge to the diode triggering voltage is determined by the resistance of the control potentiometer. When this is reduced to zero, the capacitor will charge to the trigger voltage instantaneously and the Triac will be gated into conduction for practically the complete half-cycle. At maximum potentiometer resistance the capacitor may not reach the diode triggering voltage until the end of the half-cycle, and the Triac will conduct for only a very short time.

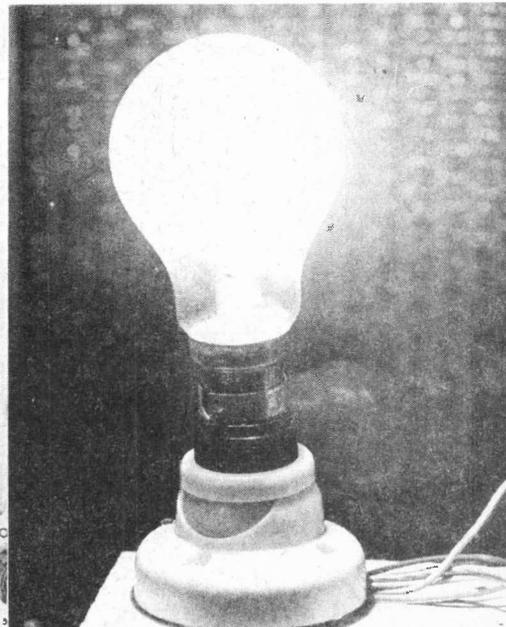
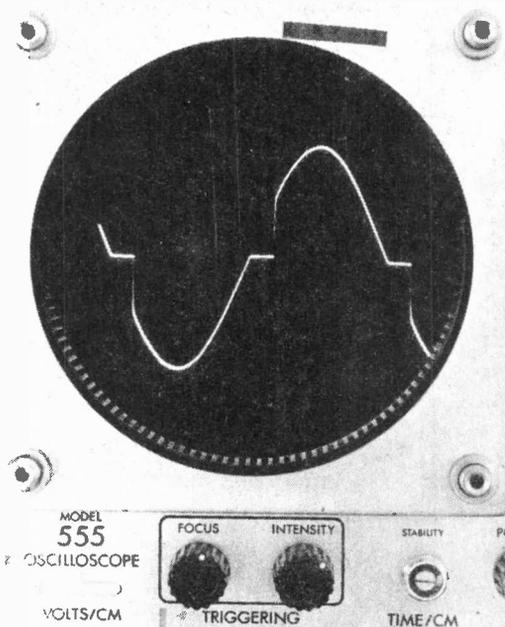
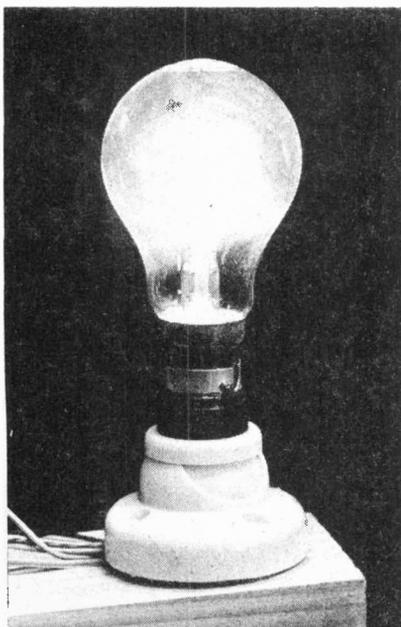
The circuit shown in Fig. 18 is very simple and cheap to make but has one major limitation — namely, that power cannot be controlled smoothly from

zero to maximum. As the potentiometer control is advanced, the load current will jump quite suddenly from zero to some intermediate value from which it can only then be controlled smoothly in either direction.

If the power supply is momentarily interrupted while the lights are dimmed below this 'jump' (hysteresis) level, the lights will remain off when power is subsequently restored.

## REDUCING HYSTERESIS

The hysteresis effect is considerably reduced in the circuit shown in Fig. 19. This circuit is ideal for use as a domestic light dimmer. All components can be mounted behind a wall switch plate — and if the load



does not exceed 200 watts, the Triac will not require a heat sink. Almost total freedom from hysteresis

is required for theatrical light dimmers. This can be achieved by using the circuit shown in Fig. 20.

## WHAT SIZE TRIAC?

Incandescent lamps draw a very heavy current during the time taken for the filament to reach operating temperatures. This on-rush current may exceed the working current by 10 to 12 times. Fortunately domestic light bulbs reach working temperature within a cycle or two, and the short-term overload is absorbed by the Triac.

This does not apply to theatrical lighting equipment, where the larger wattage bulbs take longer to reach working temperature. For this type of use the Triac must be rated to carry at least five times the normal maximum load.

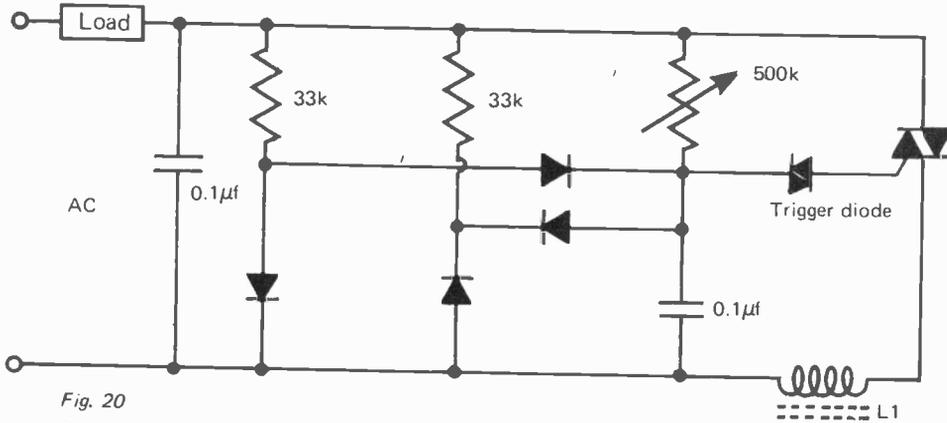


Fig. 20

Suitable for theatrical light dimming, this circuit has very low hysteresis.

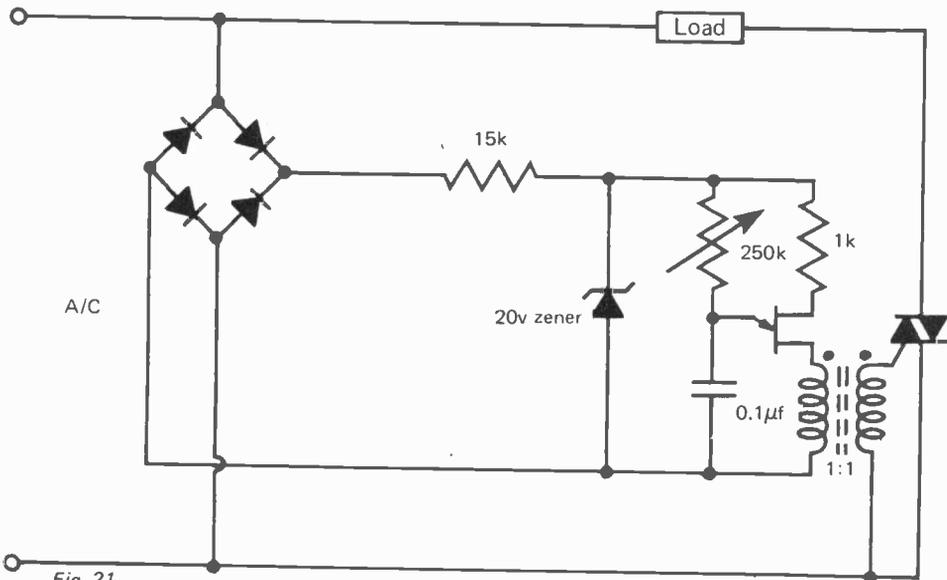


Fig. 21

Zener stabilised circuit maintains constant pre-set output despite changes in line voltage.

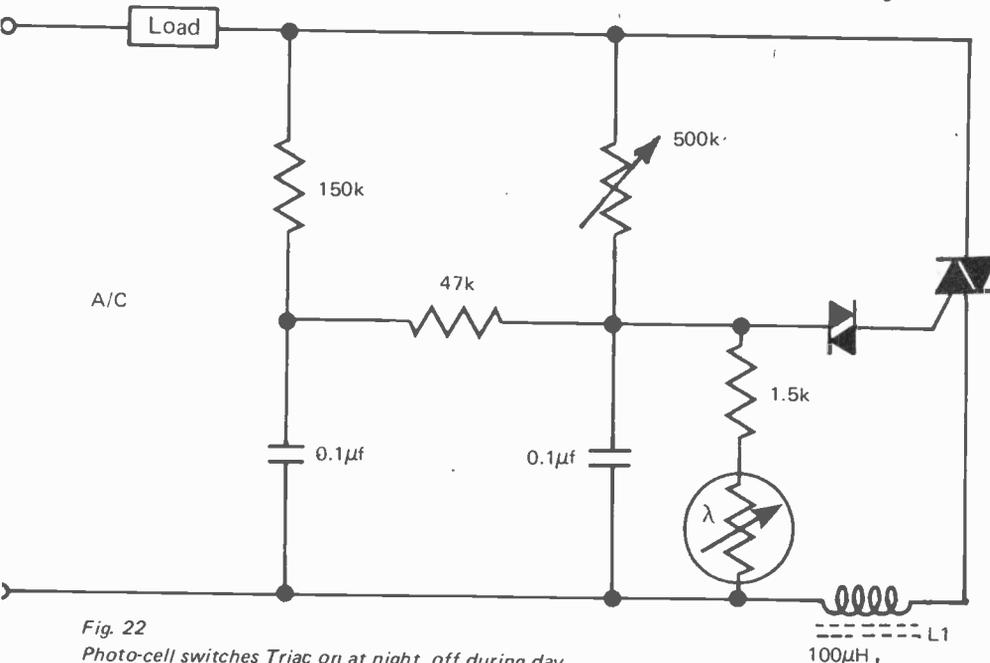


Fig. 22

Photo-cell switches Triac on at night, off during day.

## VOLTAGE FLUCTUATIONS

All the control circuits shown so far are voltage dependent — that is, the output voltage changes if the input voltage changes. This voltage dependence can be overcome by using a circuit in which a zener diode stabilizes the voltage across the timing capacitor (Fig. 21).

This arrangement will maintain practically constant output despite substantial changes in line voltage. It is frequently used in photographic and other applications where a constant light level is required.

## FLUORESCENT LAMPS

With all the phase control circuits shown so far, incandescent filament lamps can be controlled with no further modifications to the house lighting system. Fluorescent lamps can also be dimmed by this type of control unit

Quartz iodine and similar lamps using a regenerative halogen cycle should not be dimmed for any length of time. If the envelope temperature of the lamp drops below 250°C, the regenerating halogen cycle ceases. Tungsten from the filament will be deposited on the wall of the lamp, reducing filament life and decreasing the light transmission of the glass.

A modification which can be used with any of the circuits discussed so far is shown in Fig. 22. This arrangement turns lights on as darkness falls and turns them off again at daybreak. The photo cell must see ambient light and be shielded from the controlled light.

## MOTOR SPEED CONTROL

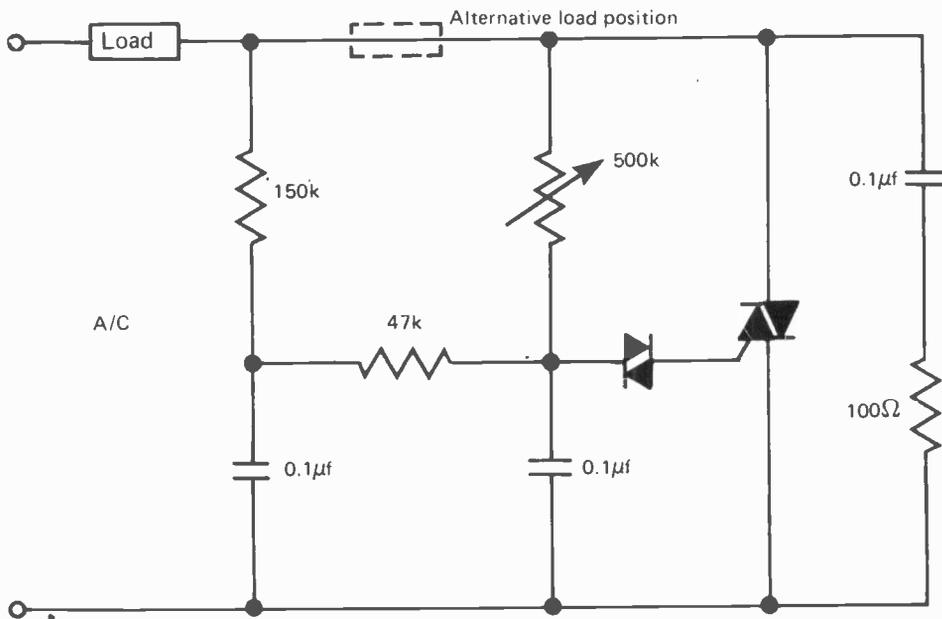
Triac phase-control can be used to vary the speed of electric motors.

The universal type of series-wound motor may be controlled by circuits

similar to those used for light dimming — except that, to ensure reliable commutation, a capacitor and series resistance must be connected in parallel across the Triac (Fig. 23). With this arrangement the speed of the motor will vary with changes in load and supply voltage, but for non-critical applications (such as fan speed control), where the load is constant at any given speed, the circuit may well be adequate.

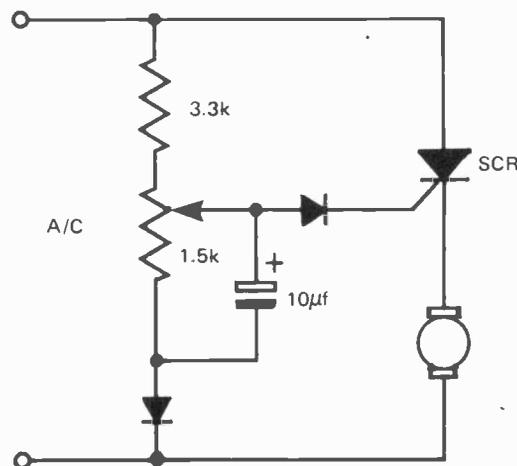
Motor speed which, once pre-set, is maintained despite load changes is a useful characteristic for power tools, laboratory stirrers, watchmakers' lathes potters' wheels, etc. To obtain this 'load sensing' characteristic, an SCR is commonly used in a half-wave configuration (Fig. 24). The circuit works quite well over a limited range of speed but is prone to low-speed 'cogging' and the half-wave operating principle precludes controlled operation much beyond half speed.

A load sensing phase-control circuit in which a Triac provides full zero to maximum control is shown in Fig. 25. This circuit is described in detail on page 33 of this issue.

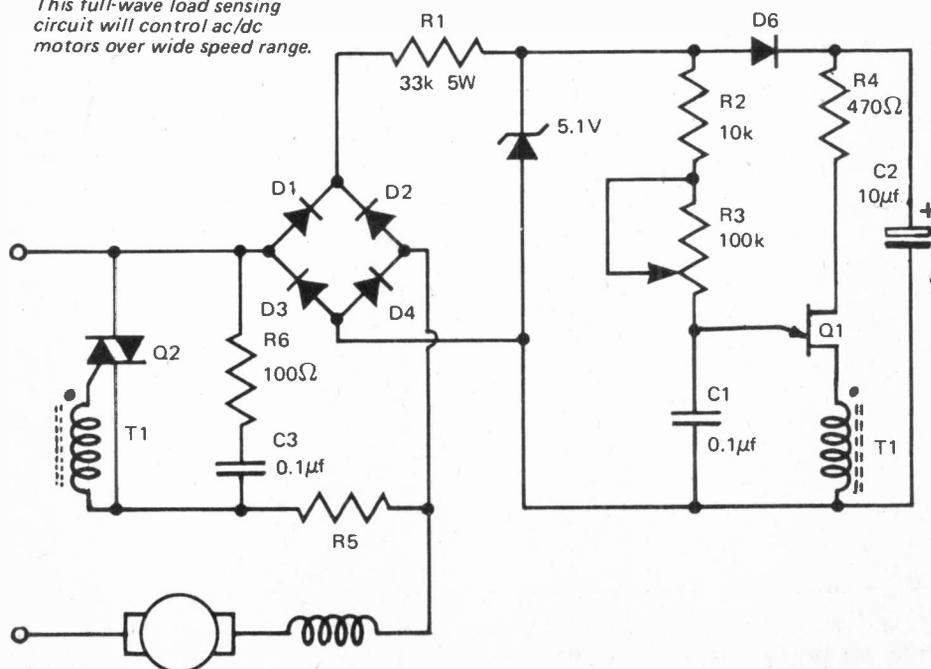


**Fig. 23**  
Phase-control circuit for inductive loads, it may be necessary to connect the load in alternative position shown to obtain adequate control.

**Fig. 24.**  
Half-wave SCR circuit provides feedback speed control.



**Fig. 25**  
This full-wave load sensing circuit will control ac/dc motors over wide speed range.



## INDUCTION MOTORS

Induction motors can also be Triac controlled — but some problems may be encountered, especially with split-phase or capacitor start motors.

In general, induction motors can be controlled between full and half speed, providing they are not run at full load. A reasonably reliable guide is motor operating temperature. This must not exceed the manufacturer's rating at any speed.

Once again, the modified light dimmer circuit shown in Fig. 23 can be used, but the load should be connected in the alternative position shown in dotted lines.

## VARYING TRANSFORMER VOLTAGE

The circuit arrangement described above can also be used to vary the voltage in the primary winding of a transformer and thus obtain an adjustable secondary output.

This arrangement was used in a range of microscope lamp controllers designed by the writer some years ago. An adjustable zero-set was obtained by replacing the 47K resistor by a 100k potentiometer.

## HEATING LOADS

Any of the Triac phase-control circuits shown so far can be used to control heating loads, although the

# Practical Guide To Triacs Part II

temperature of the controlled load will vary with changes in line voltage and ambient temperature.

A circuit which compensates for these changes is shown in Fig. 26. Theoretically this circuit can maintain temperature to within 1% of the set point despite line voltage changes of  $\pm 10\%$ . Actual performance depends upon the design and construction of the system in which the controller is used.

This circuit provides proportional control—that is, full power is applied to the heating elements while the load is warming up, until, at some intermediate state, the power is reduced by an amount proportional to the difference between the actual load temperature and the required load temperature. The proportional band is adjustable by a 'gain' control.

The circuit is simple yet effective, but it has one major failing which restricts its use to all but light loads. This is radio interference.

## RADIO INTERFERENCE

All phase control systems generate large amounts of radio interference, primarily at low and medium frequencies. It seriously affects the long and medium wave reception of radio transmissions and will also be picked up by audio equipment, when it is heard as a raucous buzz. This rfi can also interfere with laboratory apparatus, especially pH meters, and has been known to cause erratic operation of digital computers and other equipment.

The radiated energy can be reduced by including an rf choke in series with the power line (shown as L1 in circuits accompanying this article). A suitable choke can be made by winding 40 to 50 turns of enamelled copper wire around a piece of ferrite aerial rod. This will provide an inductance of approx. 100  $\mu\text{H}$ . For greater suppression it will be necessary to increase the inductance to as much as

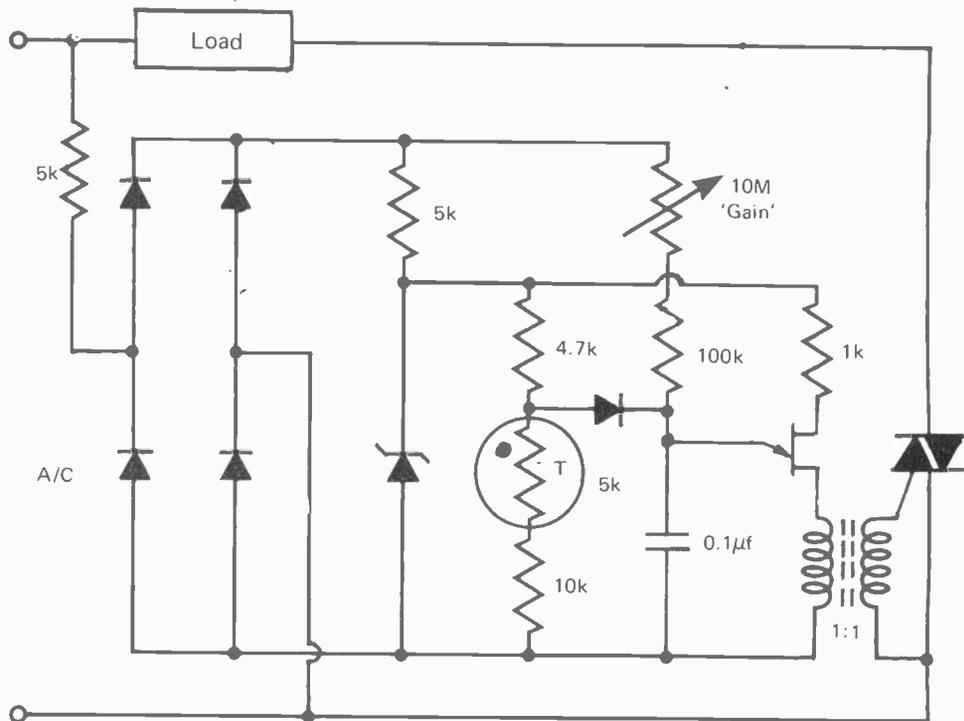


Fig. 26 This circuit provides proportional control of heating loads.

5  $\mu\text{H}$ , and this necessitates a full-size choke.

The limitation of this type of circuit is that the rf choke has to carry the full load current, and once this exceeds a kilowatt or two, the physical size of the choke becomes excessive. The larger the load, the more difficult and expensive it becomes to filter out the rf components. (The problem is not as acute for inductive loads such as electric motors, where the load itself attenuates the rfi).

Phase control also introduces another problem — namely the load power factor. This is adversely affected and is something that power supply authorities regard with less than equanimity.

## ZERO VOLTAGE SWITCHING

Virtually total freedom from rfi can be achieved by a Triac control system known as zero voltage switching.

This system differs from phase control in that line voltage is switched 'on' as well as 'off' only at the zero crossing points of the sinusoidal waveform. The power applied to the

load is controlled by varying the ratio of time that power is applied, to the time that power is switched off. For example, if only a small amount of power is required, the Triac is caused to pass just a few complete half-cycles, then remain switched off for a further 30 or 40 complete half-cycles before repeating the sequence (Fig. 27).

It will be apparent that the zero voltage switching system can only be used to control loads that have considerable inertia, such as heating elements which by their nature will average out the bursts of energy. Zero voltage switching cannot be used for controlling lighting or motor speed.

Load power factor is not affected in any way by zero voltage switching.

Until recently the drawback to zero voltage switching was that the technique required a large number of components.

Fortunately the functions necessary for zero voltage switching have been made available in an integrated circuit — and, by using this specialized ic, zero voltage switching circuits can be built that are outwardly no more complex than their phase control equivalents.

A full description of zero voltage switching techniques will form Part III of this article, to be published next month.

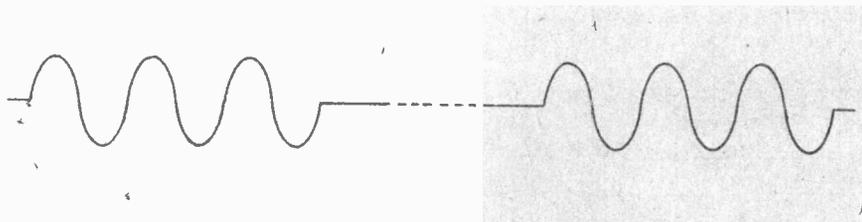


Fig. 27 Zero voltage switching waveform — power is controlled by varying the ratio of complete half-cycles 'on' to complete half-cycles 'off'.

# Hams At Mississauga Madness

Mike Goldstein, VE3GFN, has this dramatic story of the critical role of radio hams after the Mississauga derailment.

IT IS A QUIET SATURDAY evening in Mississauga, on the West side of Toronto. The hour approaches midnight, as a freight train loaded with chemicals speeds through an industrial area near Lake Ontario.

Moments later, the train, derailed, is a twisted wreck, and flames are reaching as high as an apartment building. Ken Adams, VE3BEA, calls his wife to the window of their Oakville home to observe the glow of "aurora" in the Eastern sky . . . strange for this time of year. Their house shakes, as tanks of propane begin to explode, and Ken realizes that he is not seeing aurora. The Mississauga madness has begun.

## DEADLY CHLORINE

By early Sunday morning, officials have realized that the train contains tanks of highly toxic chlorine gas, and begin evacuating the immediate area of the wreck. Chlorine gas was used with deadly effect in World War One, and it is now leaking into the air in a populated city. The large shopping plaza known as "Square One" becomes an evacuation center.

Radio amateurs across the Toronto area have been discussing the situation for hours, their radio systems covering hundreds of square miles. They begin preparations or emergency communications, for which ham radio has a 70-year tradition. The "Amateur Radio Emergency Service", a continent-wide organization, exists for this purpose, and has active branches between Oshawa and Hamilton. The coordinators begin contacting officials to offer their services.

George Jones, emergency planner for the Ontario Hospital Association, is pulled from his bed by a phone call. The amateurs have worked for George before.

Mississauga Hospital is evacuated.

Rick, VE3IFI, is sent to the area of the accident to see if amateur radio is needed, with instructions not to get underfoot. All roads are blocked in the area. There are Red Cross people on site who need communications, but they cannot be reached, and Rick cannot get past the barricades.

Rick is trapped in Square One Plaza,



Leon Giannakeff, VE3BUI, Reg Martin, VE3DHO, and Ted Dubois, VE3HOI, provide communications for the Red Cross on November 14, three days after the derailment.

as that evacuation center is itself evacuated. It is now almost noon. People living on the banks on the Credit River are warned they may have to be evacuated.

## COORDINATION

Howard Johnston, VE3ITN, calls by radio from Oakville. He is Emergency Coordinator for that area, and offers his people if needed. Two days later, Howard will be manning his own evacuation centers, as the danger area still spreads.

Aldo Galati, VE3IMR, calls from Oshawa, another Emergency Coordinator. It is a long drive from Oshawa to Mississauga; Aldo and his people will be there.

Peter Schuyffler, VE3JPP, checks in for the Pickering Radio Club, an emergency minded group. Peter is an assistant EC with the Emergency Service.

Charlie Powers is a Gulf executive from Oakville, who doubles as the overall Emergency Coordinator for all of Ontario. Operating his station VE3APK, he is in contact with Burlington, Guelph, Brampton, and other areas. Chuck has recently made an agreement with the Red Cross, and he contacts them now.

Queensway General Hospital is evacuated.

The afternoon wanes, and no officials have requested our assistance. The amateurs resist the temptation to descend in force on the area, and patiently wait by their telephones.

Interest and enthusiasm begin to fade. We have trained for twenty years to correct the problems of Hurricane Hazel, but we are not called. Incredible, but true.

The evacuation area widens, as the wind shifts. Eventually, the entire population of the city of Mississauga, a quarter of a million people, will be evacuated.

At 7:30 p.m. on Sunday, we receive the word. The Red Cross require communications between all evacuation centers, and have discovered the limitations of the telephone.

## HAMS TO THE RESCUE!

As Emergency Coordinator for Toronto area, I must set up a station at Red Cross headquarters in downtown Toronto. Peter, VE3JPP, is sent to do this, with assistance from the Pickering Club. He will not emerge from the building at Jarvis and Wellesley for 3 days.

Rod Pears, VE31XB, is the brand new

Emergency Coordinator for the evacuation area. This operation becomes his baby, and he is already manning evacuation centers at Streetsville, Brampton and Malton. The ink is barely dry on his EC certificate — what an initiation! We agree that I will back him up with manpower from Toronto, and cover downtown Red Cross. Together, we begin making up the first of many rosters that will have ham operators at emergency stations around the clock.

There is talk of evacuating Oakville and Streetsville. Oakville Hospital is evacuated. The fires continue to burn. It is decided to let the fires burn out, rather than try to contain the large amount of propane that is fueling it.

**"THIS IS VE3HRU, NET CONTROL. ALL STATIONS CHECK IN"**

This is Stan, operating as control station for a radio network that includes all evacuation centers, Red Cross headquarters, and even the accident site. Operation is on the Brampton "repeater", one of a dozen automatic repeater stations in the Toronto area that allow city — wide coverage by radio, using low-powered VHF transceivers. Other repeaters will be used for message handling, leaving the Brampton repeater for control purposes. The Toronto Police have a similar repeater system, but their repeaters were not built by the users, as ours are.

**"VE3SPC AT RED CROSS HEADQUARTERS, SORRY, WE HAVE NO FURTHER SOURCES OF BLANKETS. PLEASE ADVISE YOUR NEEDS, AND WE WILL SEE WHAT WE CAN FIND..."**

Lyle Stanway, VE3DLS, has nothing to do. Leaving his Downsview home, he eventually finds himself at CFB Downsview, where he locates 25000 blankets, and the army transport to move them. Another problem solved.

The International Centre at Malton is opened as an evacuation center, and VE3HKN and VE3HHA are sent to set up a radio link. Erindale Public School, another evacuation center, is evacuated, and VE3FEH and VE3IAC move west, to set up again.

Some people have now been evacuated three times.

## BARRICADE PROBLEMS

Lawry Purdy, VE3PPF, has reached the accident site, at Eglinton and Mavis Road. Suddenly, Red Cross find they have a direct line to the people setting up evacuation and transport. The site is assigned a priority, and will be manned throughout the operation. Of course no arrangements to clear radio hams through police barricades have been

made, and each relief operator must be negotiated into the area by the on-site operator. The lessons of Hazel have not been learned by city officials.

Bob, VE3GOY, and Paul, VE3GPB, drive from Red Cross Headquarters to Streetsville to the accident site, trying to obtain advance clearance, to no avail. They eventually get past the barricades, and Lawry goes wearily home to find his house evacuated. He operates henceforth from the Burlington area.

## MONDAY

It is now bleary Monday. I have had four hours of sleep, much more than many others. There is a new roster to be made up, and I go back to the telephone. Calling friends at 2:00 a.m. does no good; you must call them at 6:30 a.m., just as they are rising, and divert them from work. Many wives hate me.

VE3IXB, aided by Roger, VE3HGC, is going strong, and we soon have a roster. VE3GBC is now net control on the Brampton repeater. Bill Cosburn, VE3BUU, with VE3DDU, are at the accident site.

The evacuation area widens further.

**"THIS IS VE3SPC AT RED CROSS. WE NEED A HEAD COUNT OF EVACUEES AT ALL CENTERS..."**

Peter Schuyffler's Dutch accents are becoming a trademark of this operation. Although relief operators are being supplied at Red Cross Peter stays on to help. He is one of many who will drive themselves to exhaustion, freeing up other operators for duties elsewhere.

**"THIS IS WESTHEAD FOR TOM HUNTLEY AT THE SITE. I WANT TO KNOW PRESENT EVACUATION STATUS RIGHT AWAY. OVER"**

General Jim Westhead is running the show at Red Cross headquarters. He is the chairman of Emergency Services for the Red Cross Ontario Division, and he is constantly updated by radio regarding the needs of his evacuation centers. His microphone technique improves constantly as the time passes,



*The International Center, one of many refugee centers during the emergency.*

and his voice becomes hoarse. An iron man, he is always there.

Sheridan College in Brampton becomes an evacuation center; Don Browning, VE3CBA is operating there, with VE3CNZ. They will be spending a long night before being relieved.

## MISSING PERSONS

Streetsville Secondary School reports a missing person, a diabetic who was evacuated without his insulin. He must be found.

He is found. Some of these messages are literally life and death.

Missing persons traffic becomes a big part of this operation, as families are separated. A report regarding a party of students returning from a trip, and scheduled as having landed at Malton Airport, comes through. They must be located, but only the name of the teacher accompanying them is available. Not much information to go on, but the search begins.

The day wears on, the message traffic increases. The media try to get details from the Red Cross operator, but he is too busy to talk to reporters. Peter Ames, VE3DSA, volunteers as a P.R. committee of one. Pete is not well, and cannot operate for long periods, but he wants to help. He keeps radio and newspaper people updated, and out of the confusion.

Time for another roster change; by now, radio hams are calling me from all over the city, offering their help. The lists of available people quickly fill, as everyone comes home from work. We are using 20-30 people for each shift, and changing shifts every 6-8 hours ... or trying to: some people just won't go home.

## GOOD DISCIPLINE

The Burlington and Hamilton boys have their own operation going now, as evacuees begin to enter those areas. We all keep in touch by radio, and little duplication of effort takes place.

We have now been tying up ham circuits and frequencies for about 36 hours, with emergency communications. Since only one station can talk on FM repeater at any time, it is extremely easy to foul up a complete system. However, little if any deliberate interference takes place, few stations pester net controls with trivial requests, and not a single complaint about busy channels is heard. Each of these repeater stations is used by literally hundreds of ham stations: for a volunteer service, it is amazing self discipline. It is also what we are used to, and thus what we expect.

**MONDAY NIGHT**

Rod and I start on the midnight rosters. It is getting tougher to find people, and I call on the Oshawa contingent, still waiting in the wings. Aldo, VE3IMR, finds some operators, and they begin the trek to Streetsville. Chuck Powers is talking to Guelph and Kitchener, and Rod is waking up his crews for "recycling". The Georgetown and Brampton area hams are giving Rod terrific support.

The Pickering crew is manning the Red Cross station, and they keep driving back and forth between Toronto and Pickering. It is quite an effort for a small club. They will need help only after Tuesday morning.

On Monday night I take the phone off the hook after filling my roster, and go to bed. It looks like it is winding down; but on Tuesday morning we are off again, and another roster starts to fill.

Jack Argyle, VE3IDB, comes in from Barrie, and starts making 'phone calls for me. Ted Dubois, VE3HOI, is operating for the second time, in from Newmarket. Open heart surgery a few years back, (when hams lined up to give blood for Ted) has not slowed him down.

"VE3PRC IS NET CONTROL. WHO IS NEXT?"

Noreen Nimmons, VE3GOL, is operating as VE3PRC. A very smooth operator, and an experienced message handler. Noreen came back from a busy weekend at Newington, Connecticut, attending meetings at the American Radio Relay League — the "boss" of the Emergency Service. I caught her as she came in the door. Noreen claims that civic emergencies are easy, after raising teenagers. She will operate as net control, with little relief, for the whole of Tuesday, and much of Wednesday.

Jack, VE3IDB, leaves my basement to go to Red Cross headquarters, where they now use 5 operators for each shift.

The Moose Lodge Hall in New Toronto has been operating for some time as an evacuation center. Sheridan College in Oakville is serving a similar purpose. The Vic Johnston Arena in Streetsville has been a busy place for many hours. All must be provided with amateur radio operators. As each shift changes, the station equipment and antennas for each station is dismantled, and a new station is set up by the new operator. This is not as difficult as it sounds; changeover takes about ten minutes. Radio hams are quite used to arriving with a car full of equipment and cables, and "talking to the world" by radio shortly thereafter...

TORONTO RED CROSS HQ, JARVIS & WELLESLEY	VE3 SPC	INTERNATIONAL CENTER MALTON	VE3 HOI	STREETSVILLE SECONDARY SCHOOL	VE3 KXF
NET CONTROL	VE3 GBC	JS TURNER SCHOOL	VE3 FOA	BRAMPTON CENTENNIAL SCHOOL	VE3 EBC
DOLPHIN PUBLIC SCHOOL STREETSVILLE	VE3 FSI	WESTWOOD SECONDARY SCHOOL	VE3 HDH	SHERIDAN COLLEGE BRAMPTON	VE3 AKO
VIC JOHNSTON ARENA STREETSVILLE	VE3 DLW	ACCIDENT SITE	VE3 BUU		
		MORNINGSTAR HIGH SCHOOL	VE3 MDL		

VE3 TOR	VE3 MHZ	VE3 TTY	VE3 SKY	VE3 MOT	VE3 RSB	VE3 DRW
------------	------------	------------	------------	------------	------------	------------

AUTOMATIC REPEATER STATIONS IN USE

*The emergency network, November 12, 8AM to 6PM.*

We are now running a 12-station network, and a minimum of 25 amateurs must be found for each shift change. The operation has run for almost 48 hours since we were called, and the lists of available "warm bodies" are becoming shorter and shorter. As people become tired, and less experienced operators must be used, the operating procedures begin to slip, and the number of mistakes made becomes a hindrance to efficiency. This is unavoidable in a long operation, and is a sign that we are approaching the limits of our resources.

**TUESDAY EVENING ALREADY**

By Tuesday evening, the scope of the operation has crested. The first tentative indications of a return home by evacuees have appeared. Some evacuation centers have closed, their remaining people and supplies moved to other centers; now we are assisting in transport problems. Finding out who needs a bus, and trying to minimise vehicle traffic.

"... RED CROSS ADVISE THAT YOU OPEN YOUR HOUSE WINDOWS WHEN YOU RETURN. OBEY ALL POLICE DIRECTIONS. RETURN ONLY TO AREAS SPECIFIED AS SAFE. DO NOT ATTEMPT TO BYPASS BARRICADES..."

Carl, VE3FDL, and Al, VE3LF, leave after dinner for the Vic Johnston Arena. Ken, VE3BZV, heads off with VE3LCX for the accident site. VE3GAW goes to

the Dolphin Public School; when it closes, John shifts to the Arena. We are reaching the point where one operator will suffice, and our roster requirements have dropped to a third. The pressure is off.

It is reported that one operator is sitting with a Red Cross man, just waiting for blankets to be picked up; all evacuees have left. The coordinators agree that the emergency is over, and it is time to withdraw. We have little choice, for we have run out of resources ... and we must not drag it on to the point where our people no longer feel useful. Radio traffic begins to drop as midnight approaches.

**... INTO WEDNESDAY**

By Wednesday morning, many evacuees are home. The control channel is active, but carries little traffic. The radio circuits will continue through the day, but will not be renewed as operators complete their shift.

"VE3HOI FROM VE3SPC AT RED CROSS. PLEASE INITIATE A HEAD COUNT OF EVACUEES AT YOUR LOCATION AS SOON AS THEY ARE ALL AWAKE."

"THIS IS VE3HOI. PLEASE ADVISE RED CROSS THAT SLEEPING HEADS CAN BE COUNTED JUST AS EASILY."

Now, it is time to examine why it happened, and to try to prevent it from happening again. The miracle of no casualties may not be repeated next

*continued on page 50*

# TECH TIPS

Circuits from our readers.

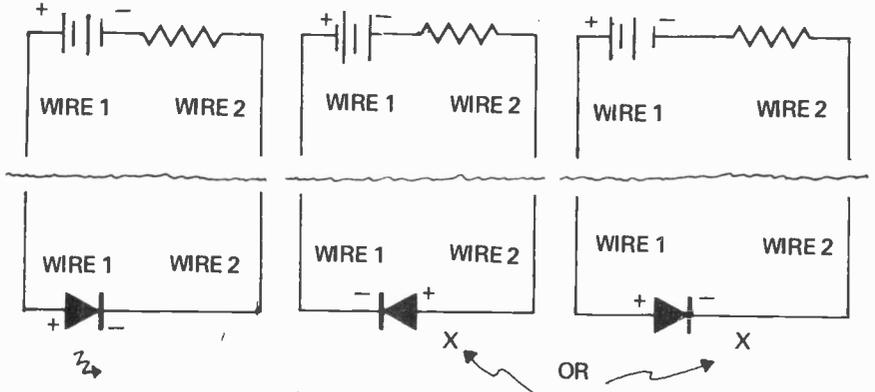
## WIRE TRACER

M. Feiffer,  
Kanata, Ont.

Two quick ideas that can save the day in certain cases.

LED's can be used to trace two or more wires of the same colour. When the LED lights up, its anode is matched to the positive lead of the battery. You can also substitute a diode in series with a buzzer for audible indication. In this case, drop the resistor and increase the applied voltage for reliable operation.

Another quick idea is to use double sided tape on your work bench as a third hand to hold down loose transistors, IC's and so on so they can be easily checked with test probes.



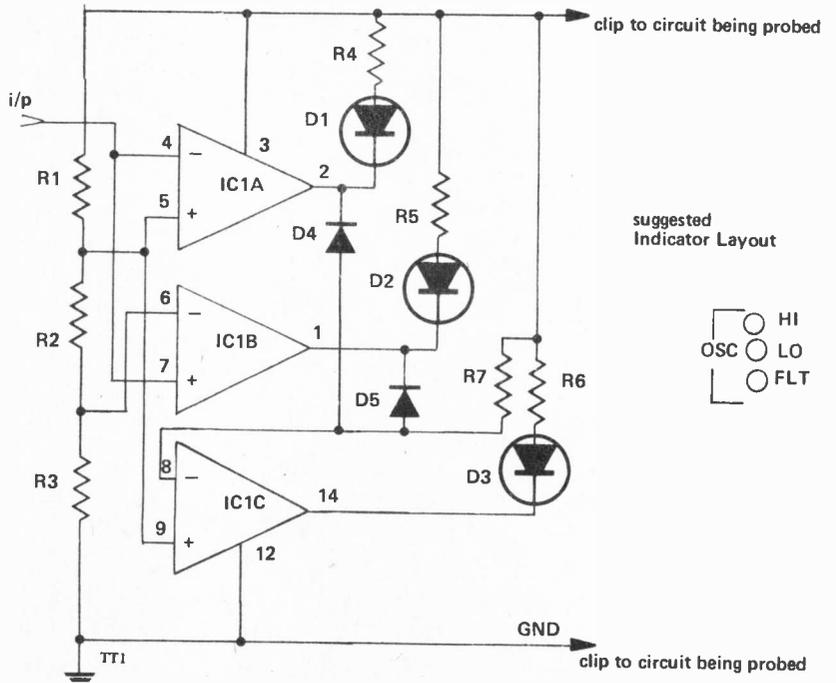
## TTL LOGIC PROBE

John Sloan C.E.T.

Although there has been no shortage of logic probe designs in recent times, perhaps some people will find this the dual threshold probe interesting.

Referring to Fig. 1, three of four comparators in a LM339 quad package are used to indicate the presence of three different input voltage levels. Resistors R1, R2 and R3 form a voltage divider so that if the input voltage is greater than 3.0V the output of IC1A is low, turning on the "HIGH" LED indicator. A voltage less than 0.8V turns IC1B on, and a voltage anywhere between these two limits (a float) means the inverting input of IC1C can go high, and the "FLOAT" LED is lit. Oscillations are detected by both the "HIGH" and "LOW" indicators being on at the same time.

Naturally, changing the resistors in the voltage divider network will yield any threshold levels desired, and the wide operating range of the LM339 (VCC maximum is 36V) means the probe can be used for more than just TTL levels.



IC1-LM339 Quad Comparator  
D1, D2, D3 - any suitable LED  
D4, D5 - any switching diodes

R1-20k  
R2-22k  
R3-8k2  
R4, R5, R6-680R  
R7-10k

ETI CANADA—JANUARY 1980

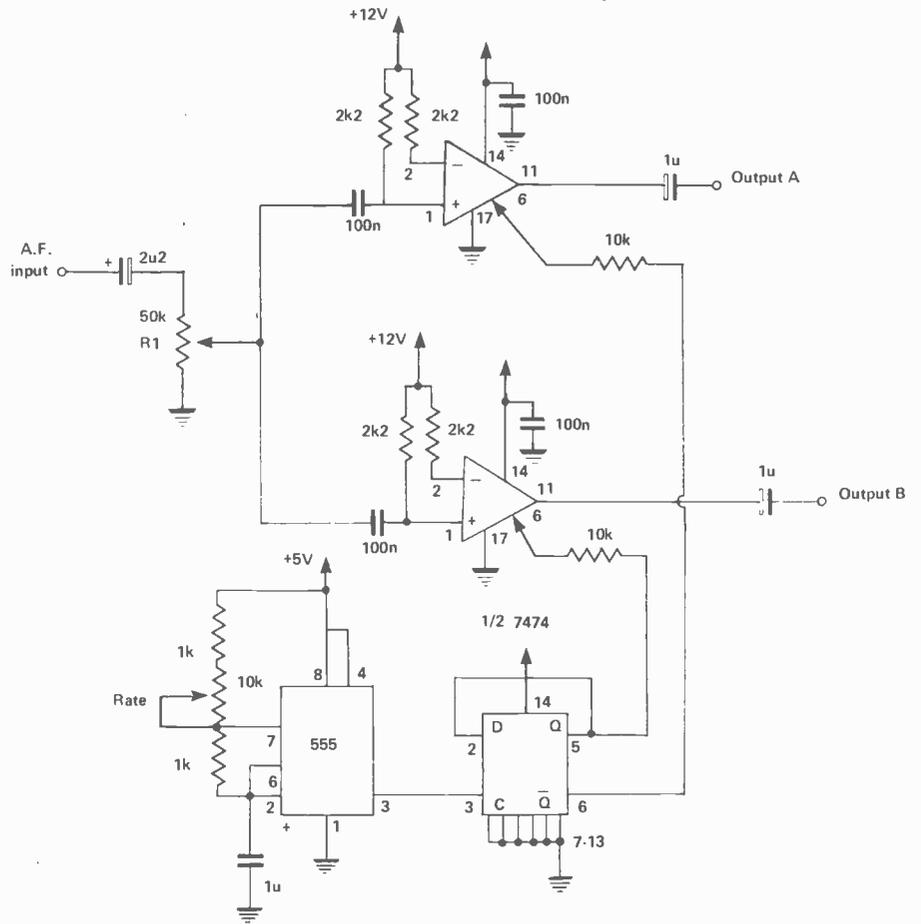
## PING-PONG SWITCHES

Michael Black,  
Montreal, Quebec.

This device is connected between the output of an electronic musical instrument and the inputs of a stereo amplifier. It switches the input signal alternately between the two outputs. If the speakers connected to the amplifier are placed at opposite ends of a room, it sounds like the signal is bouncing from one wall to the other.

When there is no voltage on pin 6 of the LM370 the input signal is amplified and passed onto the output. The 555 is the clock which determines the rate of the switching. The 7474 divides the clock frequency by two and assures that the duty cycle of the LM370 is 50%.

Adjustment is very simple. Connect the input to the signal source and connect the outputs to the stereo amplifier. Adjust R1 for no distortion on the output. The switching rate can be adjusted by turning the pot marked 'rate'.



Note: LM370 pin connections are for the DIP.

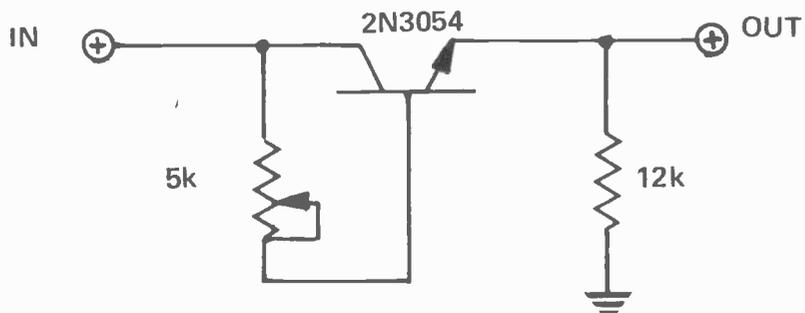
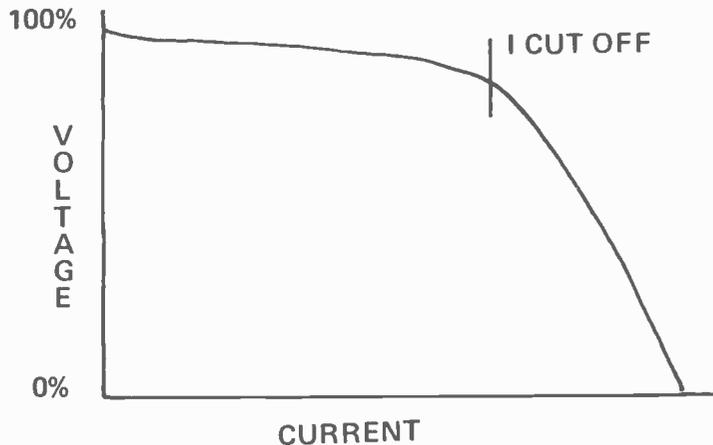
## SIMPLE CURRENT LIMITER

C. Fox  
Vancouver, B.C.

This circuit is basically a common collector amplifier with the base drive for the transistor going through a 5k potentiometer. The pot is used to vary the cut-off current and with the components shown it is variable from about 5ma to 500ma.

As you can see from the graph above the cutoff is not particularly steep but it should be enough to save your power supply in case of accidental short circuit or to protect proto-type circuits from excess currents while being tested.

Note however that current gain varies with temperature of the transistor, so the transistor should be mounted on a heatsink, or other allowances made.



# Service News

**MANUFACTURERS... REPRESENTATIVES... ORGANISATIONS... DISTRIBUTORS... SERVICE**  
Send us your news ideas for the upcoming seminars, new products, releases on the successful shop. Address them to Service News, Electronics Today Magazine, Unit 6, 25 Overlea Blvd, Toronto, Ontario, MAH 1B1. Please note that your information must be received at least six weeks before the first of the month of the issue in which it is to appear. Any material published at our discretion.

This month Dick Cartwright interviews Bill White, General Manager of CEASA.

I recently had the opportunity to interview Bill White, General Manager of the Canadian Electronic & Appliance Service Association, about many subjects of interest to the Canadian servicer. I chose Bill for this interview as I know he has been directly involved with the service industry for some 40 years, and with the exception of myself I know of no other individual who has been actively engaged in our particular industry for so long. The following is part of that interview.

**RHC:** In your daily contacts with service technicians and service businesses, what factors contribute most often to a successful service operation?

**BILL:** Well, Dick, the service business, as you know, is made up of so many related parts it is difficult to single out one item as being the most important to success. Knowledge of the products you service, knowledge of business fundamentals, knowledge of the consumer needs are all very basic. Public relations and the ability to relate to people are essential also. The best advice is — believe in yourself, respect the consumer and have an ideal that is realistic, then work like a beaver to achieve your goal.

**RHC:** From the factors you mentioned, I assume that knowledge ranks high on the list of ingredients essential to success in the service business!

**BILL:** Yes, I would say so! Without knowledge you have little to work with! But knowledge to be useful must be up-to-date. Yesterday's training isn't good enough in the servicing of today's products.

**RHC:** What I understand you to say is that technicians, to make it in today's service business, must have training on current product designs.

**BILL:** Yes. Training on current electronic and major appliance products is most essential for several reasons. The

consumer invests more money in today's products, consumer circuitry has a high profile in electronic products and is coming into appliance designs. A service technician, to make it today, must have a knowledge of micro-processor functions, using solid state circuits and components. Gone are the days when you could pull and substitute questionable assemblies. Gone are the days of the VOM for testing modern circuits. You just can't get by with the "trial and error" method of servicing. Today you have to be able to troubleshoot circuit faults to a satisfactory conclusion.

**RHC:** Changing the subject, I understand there is a drop in the number of service calls on TV receivers and, if this trend continues, there will, no doubt, be a surplus of TV technicians. With this prospect, do you foresee the day when TV technicians will be endangered species?

**BILL:** Endangered species — no. A surplus of TV technicians — well that could happen but I don't foresee it. It's true that the introduction of solid state circuitry to colour TV reduced the average incidence of service from 1.6 to 0.4 calls per year. Reliability soared and service took a nosedive. However, the drop in TV service was offset to some extent by the demand for other product service, such as Hi Fi audio, CB, etc. And by the mid 1980's, electronic controls will be common in major appliances, such as automatic washers and dryers. These developments will tend to replace the drop in TV service demand.

**RHC:** How would you suggest the service technician go about updating his technical knowledge?

**BILL:** One of the best places to update technical knowledge and skills is the local community college. Every province has several colleges strategically

located to serve the community. They provide courses in both electronic and major appliance servicing. Enrollment costs are reasonable and the quality of training is excellent. Then there are seminars and workshops conducted by product manufacturers and distributors. These are not complete training programmes but rather an update on that manufacturer's latest designs. They give a good technical explanation of the circuit functions and troubleshooting techniques. And last but by no means least, the home study school.

**RHC:** As General Manager of the Canadian Electronic & Appliance Service Association, just what are you trying to accomplish?

**BILL:** The Canadian Electronic & Appliance Service Association (CEASA for short) was founded by electronic and major appliance manufacturers, retailers and importers for the purpose of improving the quality of service in the marketplace and to improve the image of service in the eyes of the consumer. Starting off in May 1977 with 14 members, CEASA now boasts 21 members, including 3 Provincial Service Associations. Our main objective is to help the servicer better himself and his customer. To this end, CEASA has been working with community colleges across Canada to develop upgrading courses in subjects such as Microwave Oven Servicing, Business Management and Electronics in Appliances. Last September, CEASA introduced its Planned Protection Programmes for the Canadian Service Industry. These programmes, which are available to service businesses and technicians who are members of Provincial Service Associations affiliated with CEASA, provide, at favourable group rates, Income Protection Insurance, Family, Life and Accident Insurance, Income Tax Sheltered Investment and Retire-

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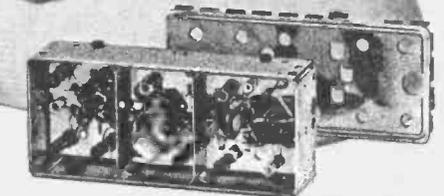
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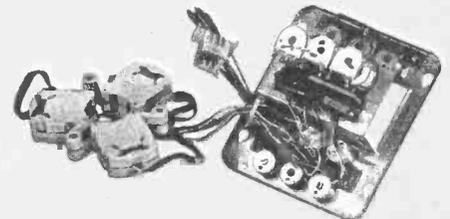
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ment Programmes. For the first time in Canada, the security needs of the servicer have been considered by an association totally committed to the Canadian Service Industry.

RHC: How about the consumer — Is CEASA interested in his needs?

BILL: As I mentioned before, one of the aims of CEASA is to improve the quality and image of service in the marketplace. To do this we must develop a good consumer relations programme so the consumer can better understand what the service industry is doing for him. To accomplish this objective, we have taken several steps that directly relate to the consumer. For example, we introduced a consumer complaint-handling programme called RSVP. Any consumer with a complaint against a Canadian electronic or major appliance servicer can use the RSVP programme to air the problem and obtain a resolution of his case. CEASA keeps the Ministers of Consumer Relations in the ten provinces and the Federal Ministry of Consumer and Corporate Affairs as well as Better Business Bureaus, Consumer Association of Canada offices and other consumer action groups, updated on the latest service promotions available to the consumer. For example, early in the New Year, CEASA plans to announce its registered identification logo. This Logo will then appear on all

materials issued by CEASA. Three consumer help booklets will also be released in the New Year for distribution to the Canadian consumer by consumer action groups and the individual services.

RHC: What do you foresee in the future for the Canadian Electronic and Major Appliance Service Industry?

BILL: Growth is the most dominant factor in the future of the industry. In 1978, Canadian service businesses grossed over \$400 million. We are forecasting a doubling of annual gross revenue in the next five years. Do you realize, Dick, that within five years Canadian electronic and major appliance service will be a \$1 billion business? It's hard to believe but the trend figures point that way! Is it any wonder that the CEASA Board of Directors have pulled out "all the stops" to assist the Canadian servicer to update his knowledge and relate more closely with one another through Provincial Service Associations.

RHC: I'm sure we could spend another hour discussing the present and future plans for the Canadian service industry but time doesn't permit that luxury. However, before I go would you care to give any advice to our readers — many of whom are in the service business?

BILL: Yes, Dick, at the expense of sounding like a broken record, I cannot

repeat too often that service is big business. There is a great future for good servicers in electronic and major appliance service. That knowledge of product designs and the latest servicing techniques is the key to success and caring for the consumer pays off in rich rewards.

Well there you have it from the General Manager of CEASA, an association that is fast becoming the spokesman for Canadian service businesses to industry, consumers and government. For over 30 years I have looked forward to the time when all servicemen, both industrial and domestic, would be members of associations, or even one national association, that would be in the position not only to look after them but also to protect the consumer.

So, to all practising electronic technicians, take an old pro's advice and join your local association. If you don't have one, form one. Advice, knowhow, etc., on how to form an association are readily available from CEASA. The advantages, as I have stated so many times before, are not only technical and political, but the social benefits ensuing are well worth the little time and effort involved.

Wishing all our readers a very Happy and Prosperous New Year.

All the best.

Richard H. Cartwright.

continued from page 45

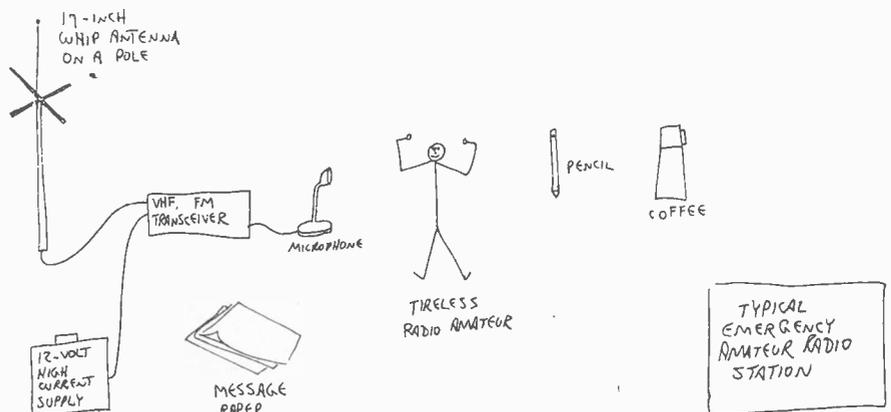
time. The Emergency Coordinators will hold briefing sessions: we, too, made errors that can be corrected. We, too, have learned a great deal.

One thing is clear. Amateur radio continues to be a tremendous resource of emergency communications. Radio amateurs have again shown they are resourceful, and generous of their time. New technologies have made the efforts of Hurricane Hazel seem pale, in comparison to what was done on the week of the Mississauga madness.

RADIOGRAM DATED NOVEMBER 15, 0045 UTC  
FROM: CANADIAN RED CROSS ONTARIO DIVISION  
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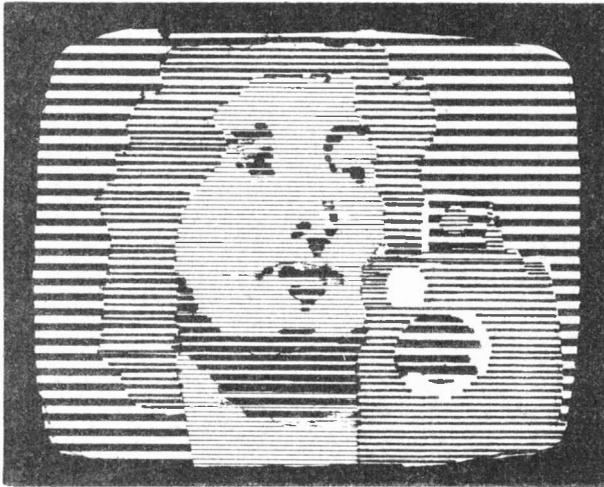
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# WHAT'S ON

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You've got your home video system all set up, but no camera. Steve Rimmer tells you what to do.

---

## HUNGRY EYE

DUNGEON VIDEO... the pursuit of all poor and demented troglodytes with a couple of somewhat antiquated VTRs tucked unobtrusively away in the back of the family cave, behind the mastodon skulls, several extras wires running into the rear of the communal 1959 Marconi console, and a peculiar, Byzantine aluminum totem atop the thatch to pull in sporadic skip from L.A. . . . it's all, usually, something the average Neanderthal gets into sideways. You come across a large electronic thing in a second hand shoppe bedecked with a sign reading "Device with knobs. \$10.00 U Muv it". Alternately, the office decides to upgrade the AV works, and someone presents the irresistible offer (buy this or you're fired). In appreciation for bringing the children over to visit, and eliminating any further concern with her prize winning Bohemian carnivorous orchids, Aunt Remora wants to give you whatever it was that finally drove Uncle Frankphobe into the big aquarium in the hall. Somebody leaves a one hundred pound foundling on the doorstep.

Alternately, there are a few fortunate souls who have become fabulously well to do over the years, and, having already taken six tropical vacations this season, have chosen to sink some of the family fortune into one of the newer home video systems, the ever present, over priced video cassette recorders. These illustrious Members of Parliament, while arriving at the objective of video mobility with a bit more savoir faire than the poor wretch of a paragraph ago, (although their savoir faire is only worth about eighty five percent of some other, more southerly savoir faire,) are in largely the same

position in terms of equipment capabilities and limitations.

For, you see, friend Neanderthal, while video tape recorders are fairly easy to come by surplus, or justify new, there are other odd scraps of hardware that are a bit more elusive. Chief among these is the mighty TV camera, the medium by which your very own living room can be turned into a video studio . . . without necessarily telling the occupants. Old cameras get the boot far less frequently than do old recorders. The state of the art for cameras is such that obsolescence overtakes them at a rather more dignified rate. New cameras, at least those offered for sale in the consumer market, are, as a lot, rather dismal, especially in light of the prices being asked for them. Therefore, a whole area of potential for basement video goes unexplored for many owners of video recorders.

Will we stand for this? Is such a gross injustice to be tolerated? Are the technological fruits of our society to be withheld from the masses? Alright, who said "Yes"?

This month, we're going to have an extended look into the different ways around acquiring a television camera for home use without having to sell off the home to do it.

## GENERICALLY SPEAKING

There are, essentially, two types of TV cameras, studio cameras, which produce the pictures one sees on the box, and surveillance cameras, which produce the pictures many security guards see simultaneously on eighteen boxes. The former type are somewhat huge, very expensive, and produces really marvellous pictures. They have built in CRT monitors, so that the camera person can see what the lens

sees, rear mounted controls for zoom and focus, great resolution, and a high degree of control of the grey scale over their, albeit limited, contrast ranges. This comes, in part, as a result of their being fairly insensitive to light, thus requiring high scene illumination to get their tubes going. It is highly unlikely that any of us are ever going to own one, so we won't bother with these things.

Surveillance cameras are the other end of the spectrum. They are relatively inexpensive, small, and really quite simple. They are very sensitive to light, but aren't all that linear with it once they find some. They have no rear mounted zoom controls because they don't have zooms, and focussing is usually done in the conventional manner, up at the front. They don't have built in monitors, or, in fact, any viewfinders at all, because mounted up on the corner of an office building somewhere, the only camera man the average surveillance camera is likely to see is the fellow who cleans the lens twice a year.

There are several gradations between these two extremes, and, in having a quick scan among them, it seems that there are several classifications of hungry eyes that could be used, or adapted, for the high and noble purpose of feeding pictures of the cat into a surplus VTR. In all cases, this may also be read as directing images of the family Albanian ocelot into a rhinestone encrusted RCA 400, depending upon whether or not that little dodge with the income tax got through or not. Cameras used in telecinis, that is, to transfer films to video tape, small, cable TV studio cameras, educational cameras, industrial process monitor cameras, microscope cameras, and AV cameras are all among the types suitable for providing video for your

box. When stumbled upon in a surplus state, all are available quite cheaply ... say in the range of fifty to one hundred and fifty dollars, and, in most areas, cameras in this category are pretty common on the back shelves of video dealers, industrial systems suppliers, and electronic surplus gnomes.

The camera in figure one, a PHILIPS EL 8000/12, is a good example of this type of beast. Although its manual does not state specifically what it was originally intended for, it seems to be suitable for any one of a number of the above applications, or simply as a surveillance instrument. Built in the mid sixties, it is almost all solid state (two tubes, including the camera tube), and produces pictures which are indistinguishable from those coming over the airwaves ... except that they're black and white. It cost a hundred dollars at a Toronto area audio-video firm.

The camera is, in virtually all its specifications, quite superior to any of the commercial home monochrome cameras, and, with a little work, can be interfaced with any system.

## TO BUILD OR NOT TO BUILD

Way back last year, upon doing this column on consumer cameras, I thought it essential that a way be found to come up with home video cameras at fairly humane prices. The first approach to this was going to be building one. As we've just seen, the circuitry involved is not particularly complex, and, with a few suitable IC's to do the time bases and video amps, quite a simple camera could have been produced. A variation on this theme was to have a look at a camera kit. In the November issue, you may recall that the kit survey included a bit on ATV Research, which offers several camera kits, which, although a bit on the primitive side, do produce quite acceptable little boxes when complete. However, with both approaches, the result was going to be up in the one hundred and fifty dollar range. Furthermore, vidicon tubes are, electrically, extremely fragile. A lack of scanning voltage, for instance, for even a brief period of time will ruin one. Thus, the cost of getting a home made design together seemed a bit prohibitive.

The "re-roll yer own" surveillance camera approach seems to be the most cost effective. Although they tend toward the obnoxious scuzzies, fifty buck cameras are not at all scarce. For up around a hundred, quite excellent hungry eyes are simply screaming at one from all directions. At one fifty, there are even a few viewfinder types around. Firms that deal with broadcast

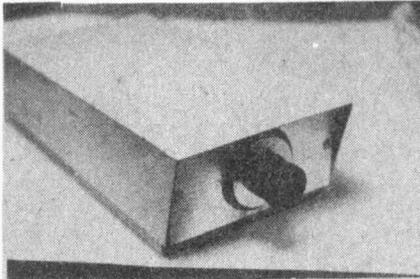


Fig. 1 Philips EL8000 CCTV camera

video equipment, educational audio-visual supplies or surveillance systems will all probably begin slobbering uncontrollably at your inquiry regarding a camera, as quite a number come in as rental returns, and they're usually a bit swamped with them.

There are all sorts of things to check out when considering a specific camera. This is a good state of affairs for me, as, if there weren't, I'd have to end this column here, and spend the rest of the space talking about video discs ... which by now we all know is quite impossible. So, in a way, it's really quite fortunate that there are so many things that can be wrong with a camera. However, this is a highly literary point of view, and you need not share it.

One of the fine things about buying a camera from a guy who spends his days selling cameras is that there is no way he will not have a monitor available. If you get a come on like "Listen. It works real good. It's just that all our monitors were swiped an hour ago by a tribe of Bedoin junkies." there probably aren't any parts inside. Thus, the first thing to do is to feed the signal from the camera into a monitor. Alternately, use a TV set and the camera's internal RF modulator, should it have one. While the resolution isn't as great with this latter approach, it is a quick way to make sure that the modulator hasn't been subverted to the purpose of running someone's TV game.

First, let's hope the camera produces a clean, stable picture on the picture tube of its associated television. Next, let's hope that the picture is of the same thing that the lens is focussing on the vidicon faceplate. These two criteria having been met, we'll move on to the subtleties.

Vidicon tubes cost between thirty and fifty bucks, making them about the most expensive component in a camera. Thus, some pains should be taken to check out the condition of the one in yours. If there is a distinct vertical or horizontal line running through the centre of the picture, the tube has been run without one or the other scanning voltage at some time ... which sort of

scarfs it up a bit, unless you happen to like the line. An odd shaped black blotch on the screen, having fairly sharp and regular edges, indicates that a piece of material from somewhere else in the tube has fallen onto the photo conductive layer of the target. I am told that these things do become dislodged from time to time, thus clearing up the problem ... but I've yet to see it come to pass myself, so this sort of blemish should also be considered fairly permanent. If the camera is focussed on a dimly lit scene, or the lens cap is stuck over the lens, an indistinct "blacker than black" blotch may be detected in the picture. This indicates that the camera has been trained on a bright light for an extended period of time somewhere along the line, thus burning the tube. However, as should be apparent, marginal burns only make themselves known under conditions of abysmal illumination, so you may find yourself quite willing to live with one if it isn't too severe.

Once a tube is installed, and it starts scanning, the faceplate gets burned in. Unlike an oscilloscope tube, there is no inherent orientation of a vidicon when new. However, if the tube is used for awhile, and then rotated, whatever margins of the original scanning protrude into the new raster will be visible as lines. These are fairly permanent. If the tube is rotated back to its original position, a similar effect will take place using the second scanning as seen over the first.

Like all tubes, vidicons do have finite lives. Unfortunately, the visible effect of a dying camera tube, the inability to resolve clean whites, is very easily confused with several other things, like a misadjustment of the beam control. If you suspect a vidicon of being a bit geriatric, it might be wise to adjust the beam and target potentials to see if the condition persists.

Aside from the notable power transformer frazz, hassles in the rest of the camera, scanning non-linearities, video clipping or distortion, sync instability, and so forth, are not really major drawbacks, especially if the price is right, because a half hour with a soldering iron and a scope will usually clear up any circuitry trolls that might have crept in in the dark. Probably the worst thing that can happen, in this area, would be a blown vidicon focus coil or e price is right, because a half hour with a soldering iron and a scope will usually clear up any circuitry trolls that might have crept in in the dark. Probably the worst thing that can happen, in this area, would be a blown

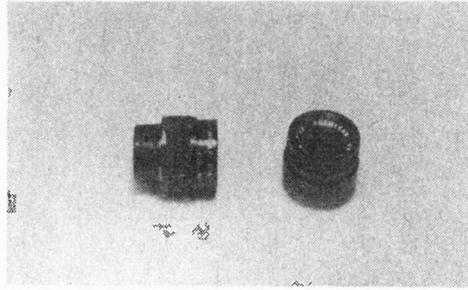
# What's On

vidicon focus coil or deflection yoke, but these things are pretty standard, and suitable replacement parts usually aren't hard to come by.

## BEING LENS WARY

The things to be on the lookout for, at the present time, is a curious phenomenon known as the insidious Cosmimar lens switch. Now, Cosmimar lenses, at least, the ones in question (see figure 2) are very cheap; they cost about twenty bucks new. They're found, for instance, on the front of the consumer type monochrome cameras. However, they're really pretty terrible lenses for this application, having, as they do, no irises and only the most rudimentary of focussing mechanisms. They can be used in TV cameras because of the existence of ALC circuitry to adjust the exposure, however, this limits the camera to use in fairly middle of the road lighting situations.

Since all TV cameras have the same "C" thread mount (as do, in fact, most 16 mm film cameras), these hairy little



*Fig. 2 Beware the ultra cheapo Cosmimar lens.* brutes are mechanically interchangeable with whatever lens is supplied with a camera, which is, regardless of manufacture, bound to be a better trip. Inasmuch as these cameras cost anywhere from five hundred to a thousand dollars new, it is reasonable to suspect that a manufacturer would not fit such an instrument with dime store optics. In fact, to my knowledge, nobody building industrial cameras uses these things.

However, there are a few dealers who do. Preying upon the weak, the ignorant, the poor and humble scum of the Earth . . . and anybody else with

money . . . a few of these insidious cads have taken to swapping the factory installed lenses on second hand cameras with Cosmi-cheaps. Therefore, be warned! Hark! Gadzooks, and like that.

Probably the worst situation in the used camera scene is when you come across a hungry eye that's closed; no picture. As far as an on the showroom floor evaluation goes, there isn't very much that can be done. It is usually best to assume that the vidicon is at least partially shot. It is also a good idea, if you're contemplating a surprise package of this sort, to check out the internals. Sometimes one will find some of the niceties of the system, such as circuit boards, power supplies, deflection coils or even the old tube itself reduced to insignificance by their very absence. In no case should one pay more than about fifty dollars for a treasure such as this.

Next month we'll be talking about how to get your newly acquired old decrepit video camera working. In the meantime stay tuned, keep clean, and don't take any wooden Tories.

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# A History Of Car Ignition

Ian Sinclair takes the clouds of time (and exhaust) to the beginning of ignition, and sparks some interest on the way.

EVER SINCE the first motor car made its first coughing movements, designers have had the problem of ignition. Perhaps that's what encouraged the development of steam cars for so long, it's worth remembering that the Stanley Steamer held several speed records in its day, and was still being manufactured in the twenties.

The gas engine still works in the same way as it then. As the piston descends, a valve opens and lets the mixture of gas vapour and air enter the cylinder. At about the end of this induction stroke, the valve closes and then the piston starts to rise, compressing the mixture (compression stroke). Near the top end of its travel, the mixture has to be fired—and that's the job of the ignition department. Firing the mixture is what provides the power, driving the piston down, and keeping things going. At the next upward movement of the piston another valve opens, letting the exhaust gases escape. This four-stroke scheme has survived pretty well unaltered in principle, though with many improvements in details. The ignition of the mixture is one of the rather important details which has changed quite a lot since the first four stroke petrol engines were tried out.

## PILOT FLAME IGNITION

The first gasoline engines used for ignition a scheme which had been quite acceptable for large gas engines. A small hole is drilled at the top of the cylinder (into the cylinder-head) and a lamp flame is allowed to burn close to the hole. This is easily done in a gas-engine by having a pilot-jet burning near the hole.

On the compression stroke, mixture is driven out of the hole, meets the flame, ignites, and the burning mixture blows back through the hole to ignite the rest of the mixture. Primitive, certainly, but quite effective for a large gas engine as long as you're not looking for high performance. The main problem here is that much of the mixture is lost, and it's very difficult to be sure that ignition won't be too soon.

## HOT TUBES

For gasoline engines, this was soon replaced by hot-tube ignition. As the name suggests, the end of the cylinder-head was formed into the shape of a sealed tube

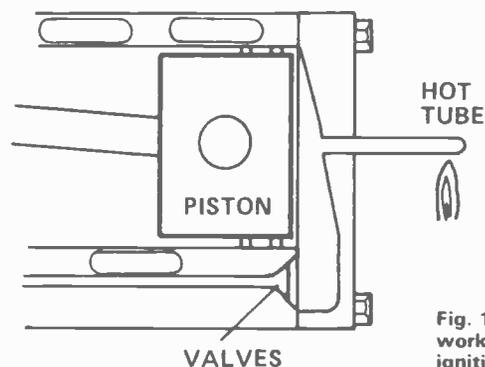


Fig. 1. Diagram of the workings of hot tube ignition.

the end of which was kept hot by a small blowlamp. The timing of the ignition still isn't under much control, but at least no mixture is lost, and the hot tube ignition was used on a lot of famous cars of the veteran period (before 1904).

Modern times start with electric ignition systems, and there are still plenty of cars running around with electrical ignition systems which would have been familiar to a mechanic seventy years ago. Oddly enough, it's not all that well understood so let's take a close look at it.

## HIGHS AND LOWS

There are two parts to the ignition system, the LT and the HT (sparks). The LT circuit consists of the contact breaker and the primary winding of the ignition coil and the HT of the secondary winding of the coil, the distributor (which ensures that the spark goes to the correct plug) and the plugs themselves.

The contact breaker is a switch operated by a cam which runs at half of engine speed and has as many bumps (lobes) on it as there are cylinders in the engine. The spark occurs just as the switch contacts (the points) open, so that we can alter the timing of the spark by rotating the switch assembly slightly.

When the contact points are closed, current flows in the circuit through the primary of the coil and the points. The primary winding of the coil has a large inductance, and obeys exactly the same laws as any other large inductance—if we want the current through the coil to

# A History Of Car Ignition

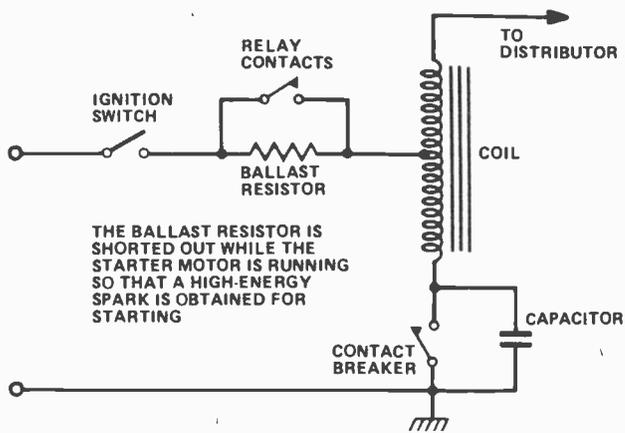


Fig 2. Simple electrical ignition

charge rapidly we need a high voltage; if we cause the current to charge rapidly, the coil will generate a very high voltage.

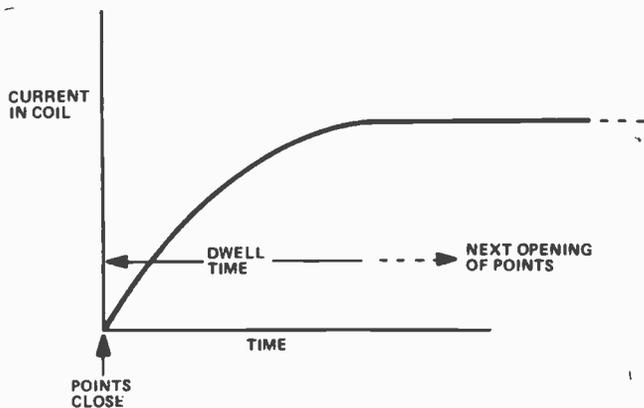
## MAKE A POINT OF IT

When the points close, the current through the coil increases following the graph of Fig. 3. This time is called the dwell time, and the points must remain closed for long enough to give the current time to reach its final value. When the points open, the current is rapidly broken, causing the coil to generate a high voltage pulse from the collapsing magnet field.

This high voltage pulse is then stepped up by the transformer action of the secondary winding, giving about 20-25 kV to send a good spark cracking across the gap of the spark plug — we hope.

With such a simple system the life of the points can be rather short, and the spark at the plug low in voltage because of sparking at the points. The reason is that the voltage pulse which occurs whenever the points separate is enough to cause a spark at the points. This keeps some current flowing in the coil, so that the change is not so rapid as it should be. We can avoid these problems to some extent by connecting a capacitor (they still call it a condenser in garages) across the

Fig 3. Graph of current through coil.



points. When the points open, the voltage pulse produced by the coil (Fig 4) starts charging the capacitor, giving the points time to open and so avoid the worst of the sparking. Because this also results in a more rapid charge of current, the spark at the plugs is very much better when a capacitor is used.

## BAD POINTS

The whole system works very well indeed, and is remarkably reliable but suffers from two disadvantages. One is that a fast revving engine with a large number of cylinders may not permit enough dwell time to allow current to build up fully before the next opening of the points. The other problem is that there is still some sparking at the points, so that the contacts wear unevenly and have to be reset at intervals, and ultimately replaced.

Electronic ignition systems use the same coil and HT equipment, but a different method of obtaining a quick charge of current through the coil. Most modern systems

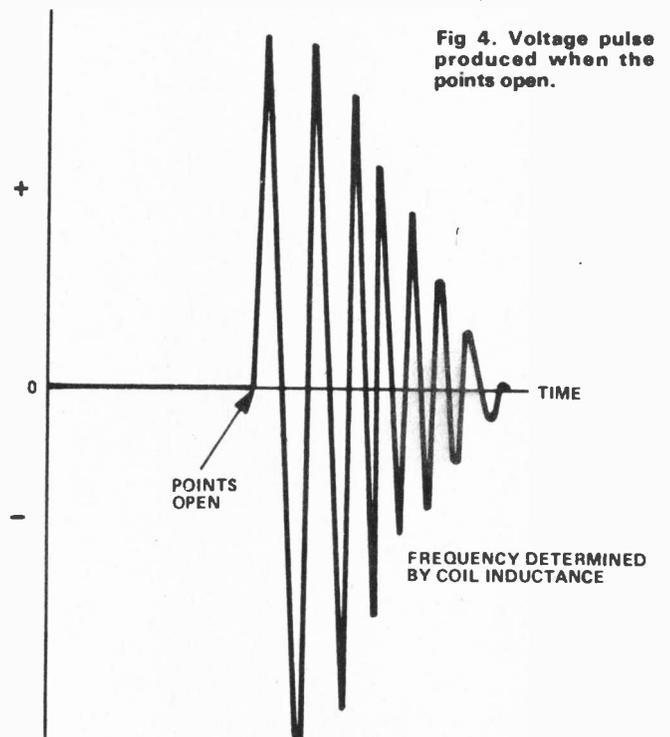


Fig 4. Voltage pulse produced when the points open.

use capacitor discharge in which an inverter circuit is used to generate about 400 V DC to charge a capacitor.

When the points open the capacitor is discharged through the primary winding of the coil, and this voltage pulse is stepped up by the transformer action of the coil to provide the high voltage from firing the plugs. Because the capacitor can be recharged quickly, the dwell time that is needed is reduced, and because the contact points only have to cause a thyristor to fire, they need carry only a fairly small current and because they do not carry current to the coil, there is no voltage pulse across them.

The points still need periodic adjustment though, because the rubbing of the cam against the fibre peg which operates the points causes wear, altering the

# A History Of Car Ignition

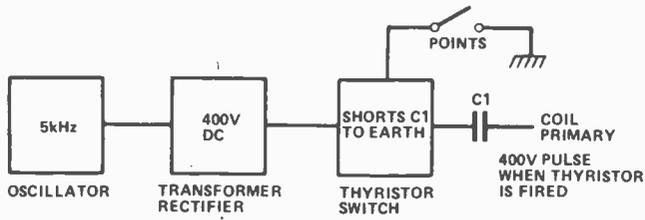


Fig 5. Typical modern system.

timing. To avoid such mechanical problems the cam can be replaced with a slotted cover rotating around an infra-red source (an LED), and so interrupting a beam which strikes a photocell. This then triggers the thyristor. Using this system, no adjustments are needed to compensate for mechanical wear until the gears on the shaft which drives the ignition system wear down—by which time the rest of the engine will have worn out anyway.

This is the system which enables car manufacturers to offer five year guarantees, and to promise 100,000 miles between adjustments of the ignition system.

## POINT OF NO RETURN

Unfortunately, all this ingenuity does not ensure reliability, and electronic ignition systems have obtained a very bad name for causing accidents. The most common heart-stopper is that the ignition simply ceases—and if you're overtaking at the time it can be fatal. The other is completely erratic timing, with the engine knocking horribly and the sparks happening at any old time in the cycle—I limped home several miles like this once.

These problems can be solved, and car manufacturers who have gone over to electronic ignition have solved them. Nothing on earth, however, would persua-

ade me to use an electronic ignition system unless each component was marked with a manufacturer's name and the ratings. A lot of DIY systems seem to use Brand X components—and that's asking for trouble.

The components which are critical are the inverter circuit, the transformer for the inverter, the charge-discharge capacitor, and the thyristor itself Fig 6. The inverter circuit must keep oscillating (though the frequency may change) even as the thyristor fires, shortcircuiting the output of the transformer. This is, in turn, possible only if the transformer is correctly designed for the job.

The charge-discharge capacitor has to provide large pulses of current, and must be rated to take much more than the normal 400 V to allow for surges. The thyristor must also be able to withstand the full voltage of the inverter, plus any surges, and to pass the pulses of current to the coil. A 1000 V 10 A thyristor may seem excessive, but is very much more reliable than the usual 600 V 1A component.

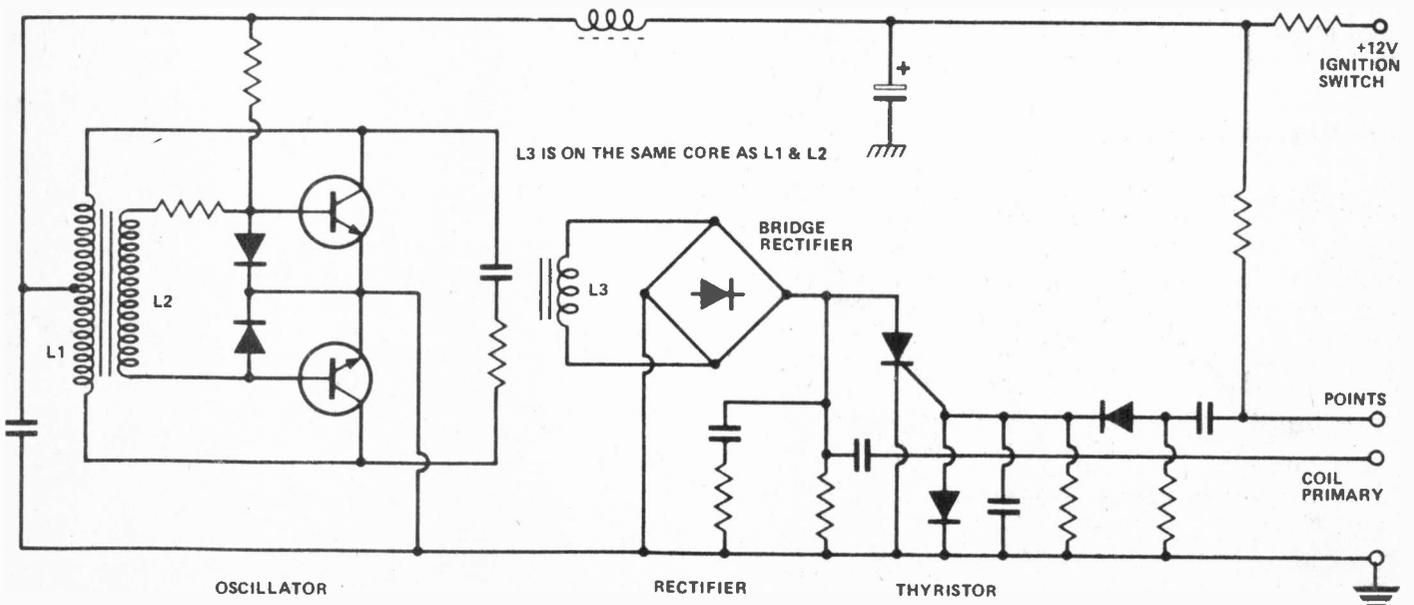
## GOOD POINTS

Many exaggerated claims are made for electronic ignition system, but the hard facts are that the main advantage is a longer time between ignition setting, particularly if the infra-red beam system is used. Cold starting can be better but only if the inverter uses a voltage regulator, which is rather rare.

Against this, reliability may be less, unless the whole circuit is built from top-grade military-specification components, rated to work at temperatures from well below freezing (you want it to start in the winter) to near boiling point (after it has stood out in the blazing sun for several hours).

However, there's little doubt that the well designed electronic ignition systems now being designed into cars by the manufacturers are quite definitely up to the job, with very great reliability and freedom from adjustment.

Complete Ignition system. Note the position of critical components.



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# FEEDBACK

In your Dec. 78 issue of ETI Canada Magazine on page 66 "Tech Tips" there is a project called BCD Tone Generator. I would like to know if there is a misprint on the "note; IC1-2 are 74141" or is this the actual No. of the chip. If this No. is actually true can you please tell me where this chip can be purchased. Preferably a location in my area.

Tony Antillon  
Elkhorn, WI 53121

*The 74141 BCD to decimal decoder/NIXIE driver with open collector outputs. Cost is in the range of \$2.00 and a random survey of catalogues indicates availability is good.*

*As far as dealers in Wisconsin are concerned, I'm afraid we can't help you (being Canadian). Check the ads in this issue if you feel up to buying across the border.*

I bought a TI58 calculator some time ago, and although I got a very good instruction book with it it still seems hard to program and also to find uses for the programs.

Your Softspot Department has had some interesting problems. But this month's hasn't any. Please continue the feature, I am sure others like it too.

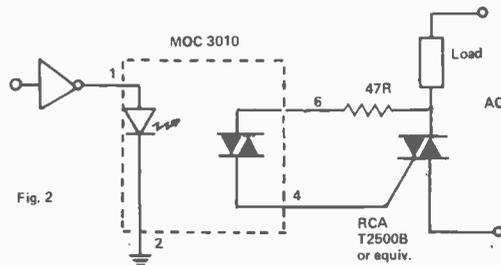
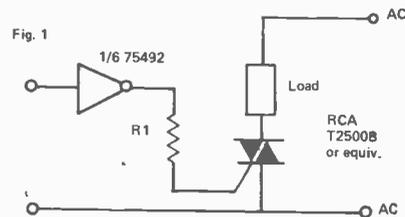
John Savinkoff  
Tahsis, B.C.

*Gosh John, I don't know how to tell you this but we've decided to drop Softspot. Among other things our studies indicate that interest wasn't as high as we had hoped, and this combined with severe space restrictions has forced us to make this decision (when was the last time you saw ETI Data Sheets?). We will be sending contributors back with suitable (we hope) apologies and thanks.*

I've constructed a small light chaser kit which has a 74154 demultiplexer which drives 16 LED's in sequence. Can I make it trigger a 5 Amp TRIAC gate by using several 75492 hex digit drivers directly, or would I have to use opto-isolators to protect the demultiplexer?

Would this idea work also to turn a household 7 segment digital clock into a giant size clock such as seen at service centers along highways?  
Brent Ilan  
Smiths Falls, Ont.

*Normally we don't do technical queries not related to our projects, but it seems that the art of firing triacs is largely unknown. In your case you can drive the triac directly from the output of the driver, as shown in Fig. 1. A value of 100R is recommended for R1. If you use this circuit be sure to isolate it electrically from everything in sight. With this in mind, we recommend*



*some form of opto isolation device, such as Motorolas MOC 3010 or MOC 3030 (Fig.2).*

## You've heard

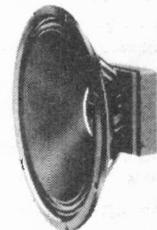
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by *Forrest M. Mims III*. Describes all kinds of LED applications—from digital displays and logic tester probes to communication systems and travel aids for the blind. Discusses LED installation, operating hints, LED detector circuits, multiple-color LEDs, diode laser theory and operation, and much more. Lots of photos, graphs, tables, and drawings. 176 pages; 5½ x 8½; softbound. (ISBN: 0-672-21006-1) © 1973

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ONT.	.45	.35	.20	.14	.12
N.S.					
N.B.					
P.É.I.	.50	.40	.20	.15	.12
NFLD.					
MAN.	.55	.45	.25	.18	.15
SASK.					
ALB.	.60	.50	.25	.20	.17
B.C.	.65	.55	.30	.22	.19
YUKON	.80	.60	.35	.25	.21
NWT	.60	.55	.55	.60	.55

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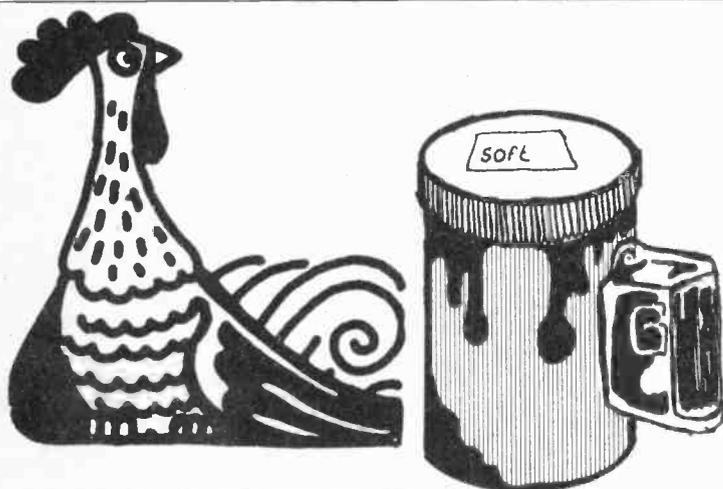
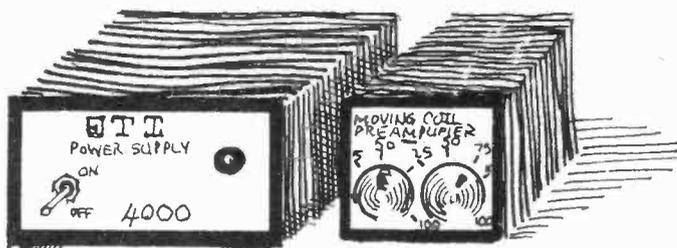
# NEXT MONTH

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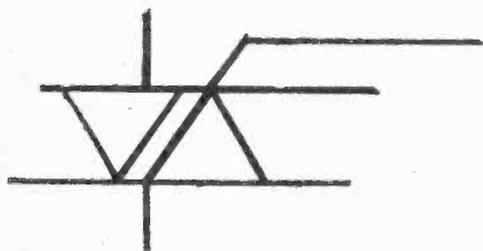
## Series 4000 Moving Coil Preamplifier.

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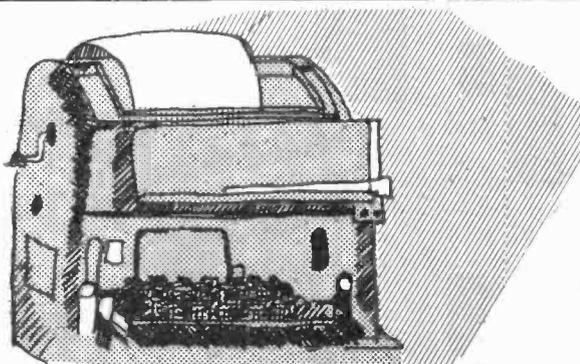


## Practical Guide to Triacs Part III

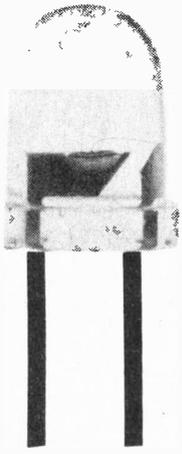
Zero crossing doesn't mean a triac circuit isn't going anywhere, it's just generating less RF interference. Next month Collyn Rivers explains how to use triacs with large loads.

## Teletype Receiver.

A quick and easy to build way to get into radio teletype (provided you can get a teletype).



The articles mentioned here are in an advanced stage of preparation. Circumstances may dictate changes in the final contents.



# Teachers' Topics

This month we take a close look at an educational "lab" system, designed to teach logic and computer fundamentals by "hands-on" experiments. A very complete manual-textbook for students is part of the system.

WE ARE ALWAYS on the look-out for products which would be particularly useful in learning electronics, and so we were happy to hear about a "Computer Logic Lab" from Tektron Equipment Corporation.

We should mention that Tektron is located near Hamilton, Ontario, and is run by Eugene Tekatch, who is actively involved in various educational endeavours. One of his best known efforts is probably the TEC 1802 microprocessor kit, and associated course offered by the IEEE.

## THE LOGIC LAB COURSE

Back to the Logic Lab, - what's it intended to help teach? Well, logic of course! But to put it in more detail, a look at the very complete 150 page manual is in order. In fact, this is not just a manual, but a complete course text for students. The subject areas covered include: basic boolean algebra, binary number system, memory devices, shift registers, serial and parallel counters, serial and parallel addition and subtraction, binary multiplication, binary codes and conversion and system synchronization.

Each of the above subject areas is covered as one or two chapters in the text, wherein a description of the area is given, followed by a series of experiments with various hook-ups for the Logic Lab apparatus, and questions on its operation to be answered.

## THE EQUIPMENT

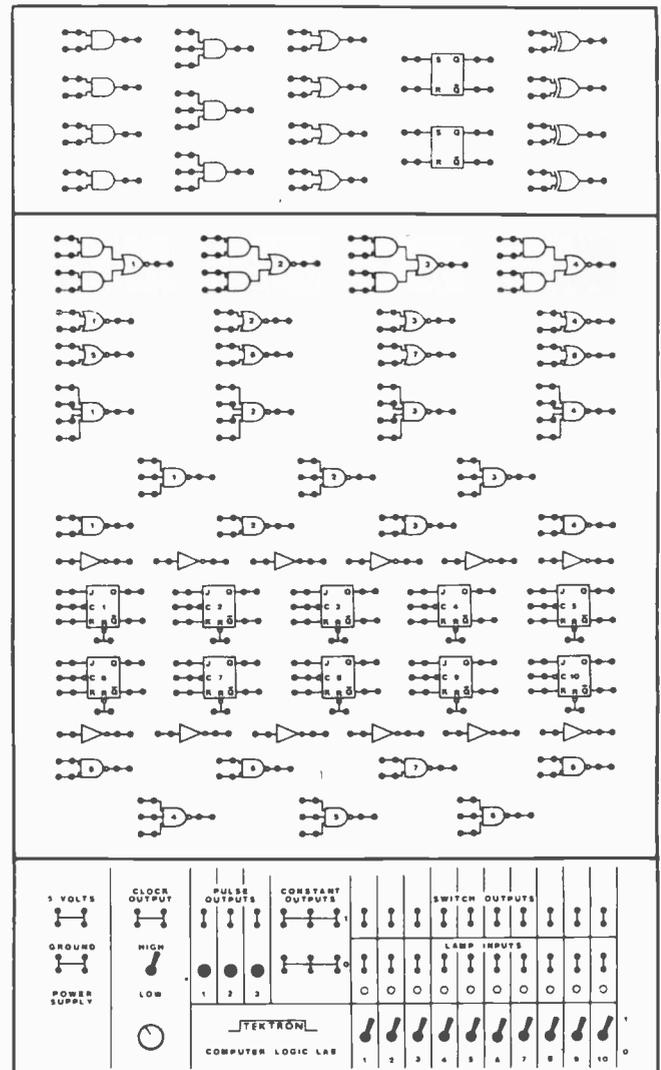
Shown in Figure 1 is the front panel of the Model 100 "Main Unit", which comprises a "Main Logic Module" and an "Auxiliary Logic Module", containing the logic gates with inputs and outputs brought out to front panel connectors, "Switching and Display Module" which provides switches for inputs and LEDs for output indicators, and of course, finally a Power

Supply for the whole lot. Interconnection is via patch-cords. Using this array of logic, the student can attack all the subjects in the text.

We found the text to be quite clear and concise, in fact an impressive piece of work. Thankfully, it stayed clear to a great extent of the actual electronics of the situation. That is, very little mention was made of voltages,

transistors, resistors and so on. The student is treated to a "higher level" discussion, that is at the logic symbol level. This is quite a sensible approach, since the knowledge gained from this set-up (which happens to be TTL) is generally applicable to all logic-information processing and does not confuse the issues by dealing with the peculiarities of any one logic family.

Fig. 1. Here's the main unit, showing logic "console", switches, indicators, power supply etc. This diagram provided in the text can be photocopied and used for drawing patching arrangements.



## ACCESSORIES

To augment the Model 100 just described, there is available a Breadboard Module, which allows you to easily interface your Logic Lab to whatever integrated circuits you wish. This might be useful for experimenting with many of the special and complex function ICs available.

There is also a patch-cord-to-edge-connection adapter module.

## FROM THERE?

As can be seen by looking at the list of subjects covered in the "Basic" set, it leads the user in the direction of real computer logic functions. To go further in that direction you progress to the "Central Processing Unit" which is shown in Figure 2. This unit contains all the registers, counters, latches and data routing logic that a microprocessor has, plus an adder to represent arithmetic logic, and a 256 byte memory.

In short, it contains all the constituents to put together the equivalent of a (somewhat unsophisticated) microprocessor, with all inputs and outputs, usually hidden inside an mpu, now available to view.

While we have not seen the manual for this unit, we understand it is written in the same excellent form as the basic manual. It leads the student through combining the circuits in various ways to the final experiment of connecting the whole lot together into an 8 bit parallel bus computer.

## AND THEN?

Once at this stage, it would be difficult to move on up with this format of experimental unit: just too many wires! And so we find we have really arrived at the point where the student can progress to the aforementioned TEC 1802, and the IEEE course mentioned, dealing in great detail with microprocessor matters.

## WHO'S IT FOR?

This series of lab style learning equipment is suitable for high schools, colleges and universities. Thus far, Tekatch notes that very few high schools have bought his systems, although many have found their ways into colleges and universities. He says it appears to be a case of funding. We agree with him that it's a pity that the money, representing only a small

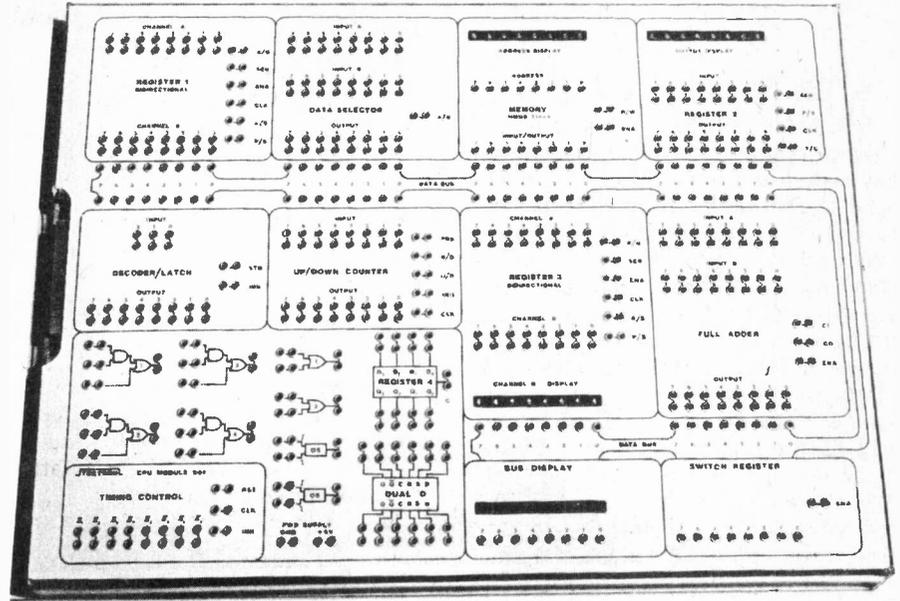


Fig. 2. The next step up the ladder to complete knowledge of computer operation, is this "central processing unit". It may ultimately be used to make a demonstration computer.

fraction of a teacher's salary, is not there to enable students to get a grip on the technology we must live with. And surely such educational aids as this logic lab must be worth their proportionate cost in communications-teaching power.

One wonders how long auto-shop students would maintain interest if all that their teachers could afford to do was come in each day and just show them pictures of '65 Valiants.

## INFORMATION

For full details write to: Eugene Tekatch, Tektron Equipment Corporation, 263 Barton St. E., Stoney Creek, Ontario L8E 2K4. Phone (416) 662-7820. To get an idea of the depth of the overall course, send \$6.50 for the new (still at the printers as we write this) expanded textbook for the main logic lab plus central processor unit.

## CONTRIBUTE!

Teachers and students are encouraged to send material for this column on any area involved with the teaching or learning about electronics. We welcome news about what your school, board, or association is doing. (If you wish to contribute news of upcoming events, please note that we need to receive notice, at least 45 days before the first of the issue month.) Send your letters to:

TEACHERS' TOPICS, *Electronics Today Magazine*, Unit 6, 25 Overlea Blvd., Toronto Ont., M4H 1B1.

If we publish your letter or ideas we will award your department or school library a free subscription to ETI.

## 28 Tested Transistor Projects

R. TORRENS

Mr. Richard Torrens is a well experienced electronics development engineer and has designed, developed, built and tested the many useful and interesting circuits included in this book.

Some of the circuits are completely new and, to the best knowledge of the author, unlike anything previously published while others may bear similarity to more familiar designs.

The projects themselves can be split down into simpler building blocks, which are shown separated by boxes in the circuits for ease of description, and also to enable any reader who wishes to combine boxes from different projects to realize ideas of his own.

Most of the circuits are very economical on the use of components and in many cases the semiconductors employed are non-critical, commonly available and inexpensive types.

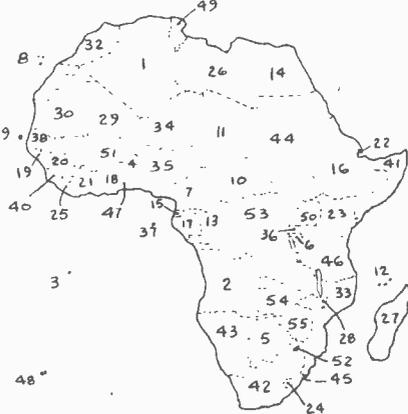
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# Listening To The Dark Continent

## LISTEN TO AFRICA

THE MAP OF AFRICA has changed considerably since my high school days when there were forty countries on that continent. Of those forty only seventeen still have the same name as they had 32 years ago and there are many more countries. Listed this month are fifty-five African nations with shortwave services. Some of these will be very difficult to hear and will require much patience on the part of the listener. Countries are referred to on a map by the number appearing by the country's name in the text. Good Luck!

So there you have a little geography with your Shortwave News. Good luck in your search for the African stations.



- 1. Algeria** — The short wave broadcasts from Algeria have been quite erratic. Some frequencies reported in recent months are 7195, 9509, 11633, 11810 and 15160 in French; 9685 and 9705 in Arabic. English has been heard at 1145 and at 2000-2030 on 9610 Radiodiffusion-Television Algerienne, Radio Algiers, 21 Blvd des Martyrs, Algiers.
- 2. Angola** — Sometimes heard here, their schedule shows weekdays from 0630-0800, 1100-1200 on 7245, 9535, 11955 and from 1430-2200 on 7245 and 9535. Sunday from 1800-1800 on 7245 and 9535 — This includes English at 1130-1200, French 1100-1130 and Spanish 2030-2130. Various Liberation organizations operate in English and vernaculars between 1630 and 1800. Other times Portuguese is used. Also try 3375 at 0400 and 7215 at 0700. Radio Nacional, C.P. 1329, Luanda.
- 3. Ascension Island** — The BBC operate their Atlantic relay from this island. It is usually heard very well here in Central Canada. Many times and frequencies are used for this service. Some to try are 15400 from 1430-1745, 9580 from 2300-0330, 11820 from 1800-2030 and 15260 from 2000-0230 BBC, Bush House, P.O. Box 76, London WC 2B 4PH, England.
- 4. Benin** — They sign on at 0415 daily on 4870 mostly in French. English has been reported at 1940 but isn't too likely to be heard here at that time and frequency. La Voix du Revolution Populaire, B.P. 366, Cotonou.
- 5. Botswana** — Try 3356 between 0400 and 0630 or 5965 between 0530 and 1400. Some transmissions include relays of English news from the BBC. Radio Botswana, P.O. Box 52, Gaborone.
- 6. Burundi** — The languages used on this station are French, Swahili and Kirundi. You might try 3300 (or 3330) from 0330-0600 or 6140 from 1000 to fade out. La Voiz de la Revolution, B.P. 190, Bujumbura.
- 7. Cameroon** — Often heard quite well here on 4850, 9745 and 17750 between 0430 and 0730 and 1000-2200. English and French are used. Radio Yaounde, B.P. 281, Yaounde.
- 8. Canary Islands** — Radio Nacional de Espana operates from the Canary Islands in Spanish on 6090 from 1730-1930 and on 11880 (or 11815) from 1730-1930 (Sunday 2045-2300). Sometime Spanish music is sometimes heard here. Radio Nacional de Espana, Centro Emisor de Atlantico, via RNE, General Yague 1, Madrid 20, Spain.
- 9. Cape Verde** — Two frequencies are listed here, 3930 and 7155 although I've never heard them. Their schedule shows Monday to Friday at 0700-0830, 1500-1630, 2030-2400. Saturday 1600-2400 and Sunday 1100-1400 and 1800-2400. Radio Voz do Sao Vicente, C.P. 29, Mindelo, Sao Vicente Island.
- 10. Central African Empire** — Reported by North American listeners now and then, they are on the air from 0430-0700 and 1830-2300 on 5038, and from 0730-1630 on 7220. La Voix de l'Empire Centrafricaine, B.P. 940, Bangui.
- 11. Chad** — The schedule for Chad shows 0430-0630 and 1800-2200 on 4904.5, and from 1045-1800 on 7120. English language lessons are listed at 1850 on Monday to Friday. Radiodiffusion National Tchadienne, B.P. 892, Njama.

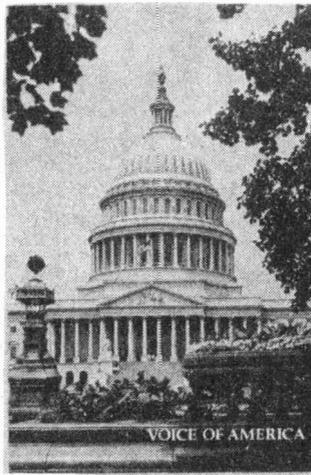
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We are pleased to confirm your reception of our broadcast from **Monrovia** on **November 4, 1975**

*John J. Garner*  
(Signature)

Close-up view of the United States Capitol Washington, D.C.



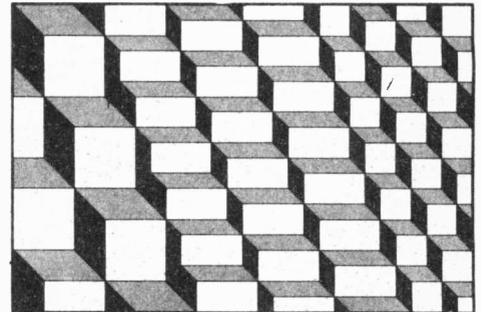
- 12. Comoro State** — A tough one. They are on the air from 0300-0400 and 1600-2000 on 3331 and from 0300-1500 on 7260. Both stations are four kilowatts so you will need a lot of luck for this country. Radio Comores International, B.P. 250, Moroni.
- 13. Congo** — This one is heard frequently. English used to be used but it apparently has been dropped from their transmissions. They are now in French and some African languages. Their latest schedule shows 0400-0700 on 3264; 0700-1100 on 7105 and 9715; 1100-1700 on 7105, 9715, 15190; and from 1700 to 2300 on 3264 and 15190. Radiodiffusion Television Congolaise, (La Voix du Revolution Congolaise), B.P. 2241, Brazzaville.
- 14. Egypt** — Radio Cairo is a fairly easy African station to hear. They have English directed to North America from 0200-0330 on 9475 and 12050. They also broadcast throughout the day to other areas in English and 31 other languages. Radio Cairo, Engineering Dept., P.O. Box 1186, Cairo.
- 15. Equatorial Guinea** — Two low power stations operate from here in Spanish and vernaculars on 6250 from 0500-2300 and on 4926 from 0430-2130 (Sunday 0700-2130). Radio Malabo, Apto. 125, Malabo, Fernando Poo. Radio Equatorial, Apto. 57, Bata, Rio Muni.
- 16. Ethiopia** — The voice of Revolutionary Ethiopia took over the religious station "Radio Voice of the Gospel" a few years ago after the revolution there. English is listed from 1600-1700 on 7165 and 9615. Although not listed they have been reportedly heard on 9615 between 1800 and 1845.
- 17. Gabon** — A station identifying itself as "Africa Number One" began test transmissions from Gabon last fall. They were trying a number of different frequencies and as I write this report, I don't know which they finally settled on. They were awaiting listeners reception reports in order to determine which frequencies proved best for reception. Some frequencies used were 11755, 11835, 11910, 11945, 15125, 15200, 15270, 15325, 15415, 17820, 17835, 17845, and 21635 between 0400 and 2100. They are using four 500 kilowatt transmitters so they should be heard quite easily. Africa Number 1, Mailbox No. 1, Libreville, Gabon.
- 18. Ghana** — Radio Ghana's external service operates on 6130 with English from 0700 to 0900; 1600-1700 and from 2000-2300. The domestic service from Accra has been reported on 4915 in English at 0600. Radio Ghana, P.O. Box 1633, Accra.
- 19. Guinea-Bissau** — This is occasionally reported by North American listeners. You might try 5041 between 0600-2400. This is a 10 kilowatt station. Radiodifusora Nacional, C.P. 191, Bissau.
- 20. Guinea (Rep.)** — Radio Nationale is often reported on 15310 around 1200-0830 (these are both 18 kilowatt transmitters); 7125 from 1600-0830; 9650 and 15310 from 1230-0830 (100 kilowatts for these three frequencies). They have occasional broadcasts in English. Radiodiffusion Nationale, La Voix du Revolution, B.P. 617, Conakry.
- 21. Ivory Coast** — This one is quite well heard here in French around sign on time of 0600 on 4940 and 7215. 11920 is heard around 2100 hours. All three frequencies are listed from 0600-2400. English is scheduled from 1845-2000. Radio Abidjan, B.P. 2261, Abidjan.

Thank you for your reception report on our transmission  
Muchas gracias por su informe de recepcion sobre nuestra transmision

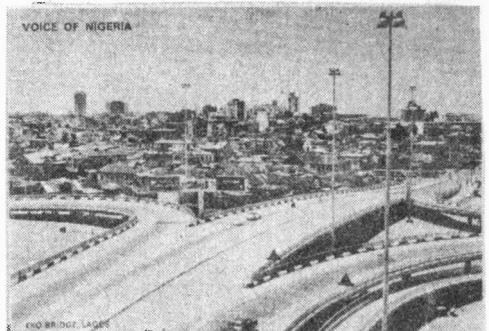
via \_\_\_\_\_  
date \_\_\_\_\_ 1975  
fecha \_\_\_\_\_  
frequency 15120 KHz  
frecuencia: 15120 KHz  
time 1902-1930 GMT  
hora 15 Nov 1975

HAPPY STATION  
ESTACION DE LA ALEGRIA  
RADIO NEDERLAND  
PO BOX 222  
HILVERSUM  
HOLLAND

May this QSL card symbolize your life organized, varied and full of perspective, whichever way you look at it!  
Le deseamos una vida simbolizada por esta QSL como quiera que la mire organizada, variada y llena de perspectiva!



**22. Jibuti** — The only shortwave frequency used by Jibuti is 4780. The languages used are Somali and Afar from 0300-0600 (Fri, 0500-0900), 0900-1300 and 1600-1900. This one is difficult partly because of the language but mainly due to the low transmitter power of only 4 kilowatts. Good luck! Radio of the Republic of Jibuti, B.P. 97, Djibouti.



VOIX OF NIGERIA  
Nigerian Broadcasting Corporation  
P.M.B. 12504  
Lagos  
Nigeria

We thank you for your report on reception of our International Service which is hereby updated.

4th Dec 1975  
Frequency: 15120 KHz.  
Time 1902-1930 GMT.  
Date 15 Nov 1975

ENG/PROP/AM/75/2284  
John J. Garner  
Minder Bay, Ontario, Canada  
P7E 3H7

John J. Garner  
Chief Listener

23. **Kenya** — The Voice of Kenya uses a number of frequencies, some of 100 kilowatts and are often reported as being heard in North America. Their General Service in English is scheduled on 4804 at 0300 (Sun, 0330) to 0620; 1300 (Sat & Sun 1330) to 2010 (Sat, 2110) and on 7125 from 0900 to 1100 (Sat, & Sun, 0630-1320). 4934 has also been reported recently with English on Sundays starting at 0400. African languages are used on this frequency on other days. Voice of Kenya, Box 30456, Nairobi.

24. **Lesotho** — A ten kilowatt station broadcasts on 4800 from 0400 to 2100 in Sesotho and English. They expect to have two 50 kilowatt transmitters in service soon. Radio Lesotho, P.O. Box 552, Maseru.

25. **Liberia** — The religious station ELWA in Monrovia can be heard here quite easily. Their English schedule shows 0700-0800 (Sat.) and 0700 to 0730 (Sun.) on 11830; 1345-1630 (Sun.) and 2015-2130 daily on 11860.

The Liberian Broadcasting Corporation operates station ELBC on 6090 between 0528-1000 and 1200-1830. They expect to increase power from 10 to 50 kilowatts soon and also to add 3255 kilohertz.

The Voice of America also operates a well-heard relay station in Monrovia on many frequencies. Try 6035 around 0430; 7280 between 0330 and 0700; 9670 about 0500; 12010 at 2200; 15235 at 0100; 15445 about 2000 and 17860 from 0300-ELWA, Box 192, Monrovia.

Liberian Broadcasting Corporation (ELBC), Box 554, Monrovia.

Voice of America, Public Information Office, Washington, DC 20547, USA.

26. **Libya** — Radio Mediterranean from Cyclops, Malta carries programming from Libya at 0700-0800 on 5980 and 7135 and 1900-2000 on 5960. They also have English on Saturday and Sunday on 5960 from 1000-1045. People's Revolutionary Broadcasting Corp., Planning and Training Department, Ministry of Information, P.O. Box 333, Tripoli.

27. **Madagascar** — Radio Madagasikara broadcasts in Malagasy and French on 2495 from 0300-0500; on 3285 from 0300-0600; on 5010 from 0300-1630; 6135 from 0300-1600; 7155 from 0600-1300 and on 9690 from 0600-1300. 3285 is a 100 kilowatt transmitter. The others are low powered.

A much easier station to listen to from Madagascar is the Radio Nederland's relay there. Their English transmissions from this African island are: 21480 and 17855 from 1430-1525; 11730 and 6020 from 1830-1920; 15270 and 11730 from 2030-2130.

RTV Malagasy, B.P. 442, Tananarive.

Radio Nederland, P.O. Box 222, Hilversum, Holland.

28. **Malawi** — The International Service is heard between 1600 and 1800 in English and Chichewa on 3380, 5995 and 7130. The same frequencies are also used for the home service in English and Chichewa languages between 0300 and 2200 (Not all three are on at the same time). Malawi Broadcasting Corporation, P.O. Box 30113, Chichiri, Blantyre.

29. **Mali** — 4825 and 5995 are scheduled between 0600 and 0800 on weekdays; 7110, 7275, 9635 and 11960 are listed from 1200-1500 (Fri., Sat. & Sun. 0800-1800, Thurs. 1200-1800) and 4825 and 5995 from 1800-2400. Most of the programming is in French with English news listed at 1830 on Sunday. Radiodiffusion du Mali, B.P. 171, Bamako.

30. **Mauritania** — Three 100 kilowatt transmitters here operate on 4845 from 0600-0900 and 1800-2310 (Fri., Sat., Sun. 2400); on 6120 from 0600-0900, 1200-1600, 1800-2310 (Sun. 0600-2400) and on 9610 from 0900-1200 and 1600-1800 (Sun 0700-2000). English is broadcast from 1900 to 1930 with French, Spanish, Arabic and vernaculars at other times. Probably the most likely is 4845 from 0600-0900 if you're up at that time. Mauritanian Radio, B.P. 200, Nouakchott.

31. **Mauritius** — Certainly not a powerhouse but occasionally heard in North America from their ten kilowatt transmitters on 4850 from 1300-1830 (Sat. to 1900) and on 9710 from 0200-1300. English and French are listed from 0300-1030 (Sun., Tues, Thurs, to 0930) and from 1430-1830 (Sat. to 1900). Indian languages and Chinese are used at other times. Mauritius Broadcasting Corporation, Broadcasting House, Forest Side.

32. **Morocco** — Arabic from Tangier may sometimes be heard from these 50 or 100 kilowatt transmitters: 15360 from 1000-1700; 15335 from 1000-1900; 21735 from 1100-0100, 9540 from 1700-2100; 15155 from 1900-0100; and on 8095 from 2100-2400.

The Voice of America also has a relay in Morocco on about two dozen frequencies. Some are 7220 at 0430; 7295 at 0615; 11760 about 2000; 15155 at 2300; 15245 at 0430, and 21735 around 0000.

Radiodiffusion Television Marocaine, Royaume du Maroc, Ministère de l'Information, 1 Rue al Brihi, Rabat.

Voice of America, Public Information Office, Washington, DC, 20547, USA.

33. **Mozambique** — Most of the programming here is in Portuguese and vernaculars. Try the following: 7240 and 9610 from 0255-2210; 3210 from 0255-0515; 4865 from 0255-0545; and on 11820 from 0500-2210. Radio Mozambique, C.P. 594, Maputo.

34. **Niger** — This is another of the countries which is only heard occasionally here. You might try 3280 on weekdays between 0530 and 0630. Don't get your hopes up! Radio Niger, (La Voix du Sahel), B.P. 361, Niamey.

35. **Nigeria** — The Voice of Nigeria is easily heard here in North America. The best time is from 0455-0600 on 7255 and from 0455-0630 on 15120. There are a number of low powered regional stations which many DXers like to hunt. A 50 kilowatt station in Lagos is often reported on 4990 which is on the air from 0430-1000 and 1700-2305. Voice of Nigeria, External Service, P.M.B. 12504, Broadcasting House, Lagos.

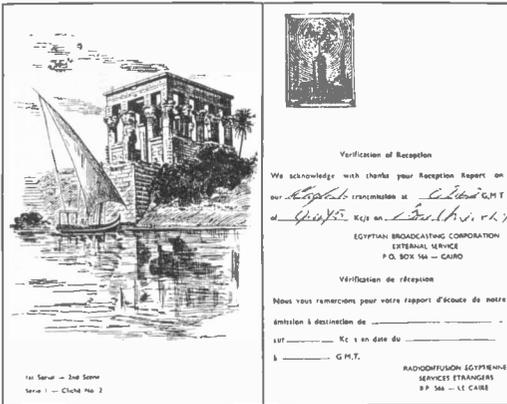
36. **Rwanda** — Radio Rwanda operates with 5 kilowatts on 3330 and 50 kilowatts on 8055 in French, Swahili and Kinyarwanda (I wonder how many of our readers understand this language) at 0300-0600 on weekdays; 0900 to 1200 (Sat, Sun, to 1330); 1330-2100 and on Sunday from 0300-2100.

The Deutsche Welle relay at Kigali is heard frequently with German at 1800-2150 on 6160, 9735; 2200-0150 on 9700 and 15410. English from 0430-0515 on 7225 and 9565; 0930-1030 on 17800 and 21540; 1045 to 1115 on 11785 and 15410; 1200-1245 on 15410 and 17785; 1715-1745 on 9735 and 11965. French at 0515-0545 on 7225 and 9565; 1315-1400 on 15410 and 17765; 1515-1615 on 9735 and 11965. Radiodiffusion de la République Rwandaise, B.P. 83, Kigali.

37. **Sao Tome & Principe** — I don't remember ever seeing this station reported by listeners in North America. They are listed on 4807.5 with ten kilowatts from 0530-2300 in Portuguese. Give it a try. Radio Nacional do Sao Tome, C.P. 44, Henriques, Sao Tome e Principe.

38. **Senegal** — You might hear some French or vernaculars from Senegal between 0600 and 0800 on 4890. Some other times and frequencies are 3336 from 0600-0800; 4952 from 0400-0100; 7170 from 1000-1800; 7210 from 0600-1800; and 11895 from 1000-2400. Radiodiffusion du Senegal, B.P. 1765, Dakar.

39. **Seychelles** — The FEBA missionary station on this island in the Indian Ocean is often heard here. English is listed on 11805 from 0400-0445; 15180 from 0700-0800; 15325 and 11855 from 1530-1630. A number of other languages are also used. Far East Broadcasting Association (FEBA), P.O. Box 234, Victoria.



40. **Sierra Leone** — Sign on from this station is at 0600 with English and vernaculars. The frequencies used are 3316 and 5980 between 0600 and 1030. Sierra Leone Broadcasting Service, New England, Freetown.

41. **Somalia** — Radio Mogadishu is often reported with their 50 kilowatts of power. Most programs are in Somali and vernaculars with some English and Arabic. The frequencies in use are: 6095 from 0300-0500 (Fri, 0400-0600), 0900 (Fri, 1000-2100), and 9585 from 0700-1930. Around 1700 GMT has recently been reported on both frequencies. Radio Mogadishu, Ministry of Information and National Guidance, Private Bag, Mogadishu.

42. **South Africa** — This is, no doubt, the most listened to of the African stations because of their high power transmissions directed especially to North America. English to North America is on the air from 0200-0250 on 15220, 11900, 9610 and 9585. Other English programs are aired at 0300-0426 on 5980, 7270, 9585, 11900 and 15220; 0600-0658 on 17780, 21535 and 25790; 1100-1156 on 15220, 21535 and 25790, 1300 to 1500 on 15220, 17780 (Sun), 21535 and 25790; 1500-1550 on 15220, 21535 and 25790; 2100-2150 on 15155, 17780 and 21535. They also broadcast in other languages. Radio RSA, P.O. Box 4559, Johannesburg 2000.

43. **South West Africa/Namibia** — The South West Africa Broadcasting Corporation has taken over from the South African Broadcasting Corporation and expect to broadcast from this area by the end of 1980.

44. **Sudan** — This is another country heard infrequently here. Some times and frequencies to try are: 5039 and 6150 from 1600-2200 in Arabic or Somali and occasionally English, although the English portion is at 1630 which is too early to propagate to North America. Sudan Broadcasting Service (Radio Omdurman), P.O. Box 572, Omdurman.

45. **Swaziland** — Trans World Radio, a religious broadcaster, has English from Manzini at 0430-0630 on 5055 and 9640; 0645-0835 on 9640 and 11910, 1200-1415 on 9640; 1530-1545 on 11840; 1630-1800 on 15410; and 1800-1920 on 7260. Trans World Radio, P.O. Box 64 Manzini.

46. **Tanzania** — The latest schedule I have for Radio Tanzania has English from 0300-0430 on 5050; 0430-0530 on 15435; 0930-1030 (Sat. & Sun. to 1538) on 9750; 1600-1945 on 4785 & 15435. They also have an outlet from Zanzibar on 3339 reportedly on the air in Swahili from 0300-0500, 0900-1100 and 1430-2000. Radio Tanzania, P.O. Box 1178, Dar es Salaam.



Thank you for your report on the reception of our transmission from the

H F Verwoerd Shortwave Station

DATE 25-6-76 TIME (GMT) 2230

FREQUENCY 95.5 kHz

**RADIO RSA**  
The Voice of South Africa  
Box 4559, Johannesburg, 2000, South Africa

Mr. J. J. Garner,  
Thunder Bay,  
Ontario,  
CANADA P7E 3 M7

South Africa  
The above program was a Reception in a part of the world where the  
South Africa  
The above program was a Reception in a part of the world where the

47. **Togo** — French and vernaculars are heard from here on 5047 from 0530-0800 and 1700-2400, 7265 from 0800-1700. Radiodiffusion du Togo, B.P. 434, Lomé.

48. **Tristan da Cunha** — A nice catch if you can get it, and you can get it if you try... and try. 3290 with 40 watts of power is scheduled on Sunday, Wednesday and Friday from 1900-2205. Tristan Radio, Tristan da Cunha, c/o Capetown, Republic of South Africa.

49. **Tunisia** — Three 50 kilowatt transmitters are in use here — 7225, 11970, and 15225 from 0430-2330 in Arabic. Some French may also be heard. Radiodiffusion Television Tunisienne, 71 Avenue de la Liberté, Tunis.

50. **Uganda** — The external service is beamed to North America on 15325 from 0305-0400 in English and from 0400-0430 in French. Also try 15250 between 1800 and 1900. Radio Uganda, Uganda Broadcasting Corporation, P.O. Box 2038, Kampala.

51. **Upper Volta** — Two low power stations here operate on 4815 from 0700-0800 and 1700-2400, and on 7230 from 0800-1700 in French and vernaculars. Radio TV Voltique, B.P. 511, Ouagadougou.

52. **Venda** — This is a new state in northeast South Africa which just became independent in September. The government are setting up a station but details aren't known at this writing.

53. **Zaire** — French and vernaculars are used by several regional stations here on 3405, 4750, 3030, 5995, 6085, 6125, 7115, 7205, 7265 and 7295. Most sign on at 0400. The Voice of Zaire uses 7255 and 11720 for 24 hours a day. La Voix du Zaire, B.P. 3171, Kinshasa. Radio Kisangani, B.P. 1745, Kisangani. — Radio Lubumbashi, B.P. 7296, Lubumbashi. — Radio Bandundu, B.P. 100, Bandundu.

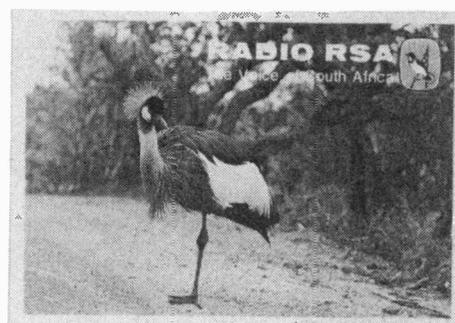
54. **Zambia** — Try the following times and frequencies — 6060 from 0500-1615; 7220 from 0600-1530; 6185 from 0500-1700; 7250 from 0600-1630; 9580 from 0630-1400; 7235 from 0530-0730; 17895 from 1045-1245 (Sunday only). 9580 has also been reported around 0500. Zambia Broadcasting Service, P.O. Box RW 15, Lusaka.

55. **Zimbabwe-Rhodesia** — Some frequencies used here are 3396 from 0355 (Sun. 0500) to 0545; and 6020 from 0545-1515. Both are in English. Zimbabwe-Rhodesia Broadcasting Corporation, P.O. Box 2696, Salisbury.

**Note** — All times listed in the above are in Co-ordinated Universal Time (UTC) which is the same as Greenwich Mean Time (GMT). UTC is equal to EST plus 5 hours. All frequencies listed are in Kilohertz. Stations often change frequencies to suit propagation conditions and to avoid interference from other broadcasters so some of the above frequencies may change before you read this. Most of them, however, will still be in use.

Before closing this month's column, I would like to wish all of our readers a very Happy and Prosperous New Year.

Until next month all the best and good listening.



Thank you for your report on the reception of our transmission from the

H F Verwoerd Shortwave Station

DATE 25-6-76 TIME (GMT) 2230

FREQUENCY 95.5 kHz

**RADIO RSA**  
The Voice of South Africa  
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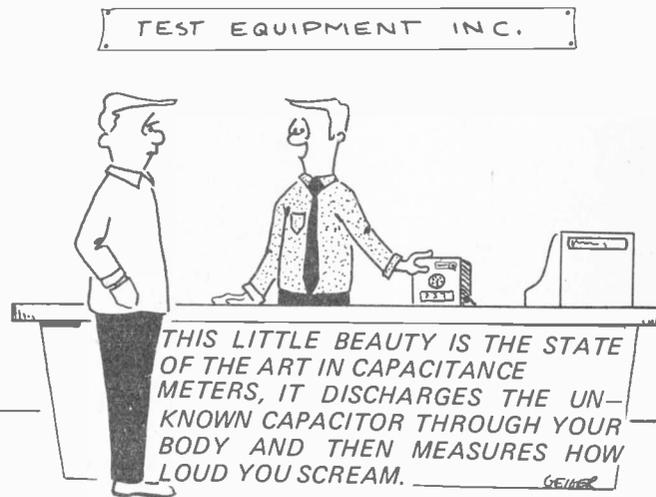
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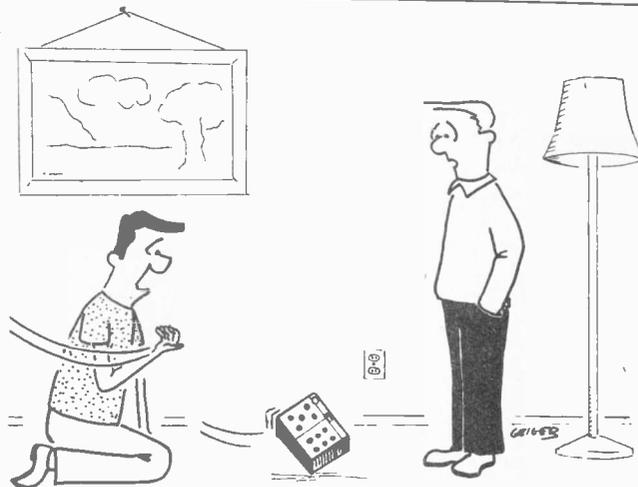
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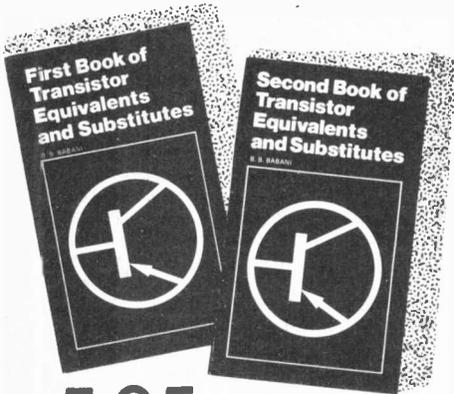
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# ETI Project File

PLEASE NOTE: WE CANNOT ANSWER PROJECT QUERIES BY TELEPHONE.

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

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

## KITS, PCBs, AND PARTS

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

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

## READER'S LETTERS AND QUESTIONS

We obviously cannot troubleshoot the individual reader's projects, by letter or in person, so if you have a query we can only answer it to the extent of clearing up ambiguities, and providing Project Notes where appropriate. If you desire a reply to your letter it must be accompanied by a self addressed stamped envelope.

Updates, news, information, ETI gives you project support

PROJECT FILE is our department dealing with information regarding ETI Projects. Each month we will publish the Project Chart, any Project Notes which arise, general Project Constructor's Information, and some Reader's Letters and Questions relating to projects.

## PROJECT NOTES

Since this magazine is largely put together by humans, the occasional error manages to slip by us into print. In addition variations in component characteristics and availability occur, and many readers write to us about their experiences in building our projects. This gives us information which could be helpful to other readers. Such information will be published in Project File under Project Notes. (Prior to May 78 it was to be found at the end of News Digest.)

To find out if there are project notes for a project you are interested in, simply refer to Project Chart (see below). If there are project notes listed, they will have appeared in Project File (note, prior to May 78, project notes appeared at the end of News Digest.)

Project notes can be ordered one of two ways. You can order the complete back issue, or you can order a photocopy from the appropriate issue. In either case consult General Information For Readers. If you order a copy of a construction article, specify the issue where the project note can be found and we will include them at no cost. You must specify from which issue those project notes can be found.

## PROJECT CHART

This chart is an index to all information available relating to each project we have published in the preceding year. It guides you to where you will find the article itself, and keeps you informed on any notes that come up on a particular project you are interested in. It also gives you an idea of the importance of the notes, in case you do not have the issue referred to on hand.

## 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

ISSUE DATE	ARTICLE	ISSUE DATE	ARTICLE
Sept 78	Audio Oscillator	Apr 79	Solar Control
Nov 78	Neg.	Apr 79	Audio Compressor
Sept 78	Shutter Timer	Apr 79	Wheel of Fortune
Nov 78	Neg.	May 79	Light Controller
Sept 78	Rain Alarm	May 79	AM Tuner
Oct 78	CCD Phaser	May 79	VHF Ant.
Nov 78	Neg.	June 79	Easy Colour Organ
Oct 78	UFO Detector	June 79	LCD Thermometer
Nov 78	Neg.	July 79	Light Show Seq.
Sept 79	C,D	July 79	Note C
Oct 78	Strobe Idea	June 79	VHF Ant. 2
Apr 79	Note:N	June 79	Bip Beacon
Nov 78	Cap Meter & Neg.	July 79	STAC Timer
Nov 78	Stars & Dots	July 79	Two Octave Organ
Nov 78	CMOS Preamp & Neg.	July 79	Light Activ. Tacho
Dec 78	Digital Anemometer	Aug 79	Audio Power Meter
Feb 79	Neg	Aug 79	Two Octave Organ
Mar 79	Note:C, D	Aug 79	Light Act Tacho.
Dec 78	Tape Noise Elim	Sept 79	Field Strength Meter
Feb 79	Neg	Sept 79	Sound Effects Unit
Dec 78	EPROM Programmer	Sept 79	Digital Wind Meter
Feb 79	Neg	Sept 79	Up/Down Counter
Jan 79	Log Exp Convert.	Oct 79	Simple Graphic Eq
Feb 79	Neg	Oct 79	Digital Dial
Jan 79	Digital Tach.	Oct 79	Variwiper
Feb 79	Neg	Oct 79	Cable Tester
Jan 79	FM Transmitter	Nov 79	60W Amplifier
Feb 79	Neg	Nov 79	Model Train Controller
Feb 79	Phasemeter & Neg	Nov 79	Curve Tracer
Feb 79	SW Radio	Dec 79	High Performance
Feb 79	Light Chaser & Neg	Dec 79	Stereo Preamp.
Mar 79	Tape-Slide Synch	Dec 79	Development Timer
Mar 79	Synth. Sequ.	Dec 79	Logic Trigger
Mar 79	Tape-Slide Synch		
Mar 79	Synth. Sequ.		
Mar 79	Dual Dice		

## ETI Project Chart

### PROJECT CHART

This chart is an index to all information available relating to each project we have published in the preceding year. It guides you to where you will find the article itself, and keeps you informed on any notes that come up on a particular project you are interested in. It also gives you an idea of the importance of the notes, in case you do not have the issue referred to on hand.

### Canadian Projects Book

Audio Limiter	Metal Locator
5W Stereo	Heart-Rate Monitor
Notes N, D May 79	GSR Monitor
Overled	Phaser
Bass Enhancer	Fuzz Box
Modular Disco	Touch Organ
G P Preamp	Mastermind
Bal. Mic. Preamp	Double Dice
Ceramic Cartridge Preamp	Reaction Tester
Mixer & PSU	Sound-Light Flash
VU Meter Circuit	Burglar Alarm
Headphone Amp	Injector-Tracer
50W-100W Amp	Digital Voltmeter
Note N May 79	

### 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

# General Information For Readers

## Editorial Queries

Written queries can only be answered when accompanied by a self-addressed, stamped envelope, and the reply can take up to three weeks. These must relate to recent articles and not involve ETI staff in any research. Mark your letter ETI Query.

## Projects, Components, Notation

For information on these subjects please see our Project File section.

## Sell ETI

ETI is available for resale by component stores. We can offer a good discount and quite a big bonus, the chances are customers buying the magazine will come back to you to buy their components. Readers having trouble getting their copy of ETI could suggest to their component store manager that he should stock the magazine.

## Back Issues and Photocopies

Previous issues of ETI-Canada are available direct from our office for \$2.00 each. Please specify issue by the month, not by the features you require. The following back issues are still available for sale.

1977	1978	1979
February	<del>January</del>	January
May	February	February
June	March	March
July	<del>April</del>	April
September	May	May
November	June	June
	July	July
	August	August
	September	September
	October	October
	November	
	December	

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

**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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# Active Component Sales Corp.

## Zilog

Z8001	\$195.00	16 Bit CPU with segmented address space to 8 Megabytes.
Z8002	\$150.00	16 Bit CPU with non segmented address space to 64K bytes.
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Z80A-CPU	4.0 MHz	11.95	Z80A-DMA	4.0 MHz	33.60
Z80-PIO	2.5 MHz	7.20	Z80-SIO/O	2.5 MHz	36.00
Z80A-PIO	4.0 MHz	8.40	Z80A-SIO/O	4.0 MHz	39.50
Z80-CTC	2.5 MHz	7.20	Z80-SIO/1	2.5 MHz	36.00
Z80A-CTC	4.0 MHz	8.40	Z80A-SIO/1	4.0 MHz	39.50
			Z80-SIO/2	2.5 MHz	36.00
			Z80A-SIO/2	4.0 MHz	39.50

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Part No.	Price	Part No.	Price	Part No.	Price
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8085	12.95	6802	11.95	6504	9.95
				6505	9.95
8212	3.45	6810	3.95		
8214	3.95	6820	3.95	6520	6.95
8216	3.25	6821	3.95	6522	9.95
8224	2.95	6850	4.25	6532	13.95
8226	2.25	6852	3.95	6551	13.95
8228	3.98				
8238	4.75				
8251	5.75	1802LE	9.95	1854LE	6.95
8253	14.95	1824LE	3.50	1856LE	1.95
8255	5.75	1852LE	1.50	1858LE	1.95
8257	10.95	1853LE	1.45	1859LE	1.50
8259	14.95				

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2N3055	.69	70V	NPN	TO-3
2N3442	1.50	160V	NPN	TO-3
2N3771	1.95	50V	NPN	TO-3
2N3772	1.95	100V	NPN	TO-3
2N3773	2.50	160V	NPN	TO-3

**Universal SCR**

C106D	.34	400V	5.0 AMP	TO-220
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### MOS MEMORIES

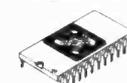
Part No.	MOS Static RAM's	Price
2101	1K (256 x 4) 350ns 22 PIN	\$1.95
2102LFFC	1K (1K x 1) Low Power 350ns 16 PIN	1.19
2102LHPC	1K (1K x 1) Low Power High Performance 250ns 16 PIN	1.29
2102-1PC	1K (1K x 1) 450ns 16 PIN	0.94
2102-2PC	1K (1K x 1) 650ns 16 PIN	0.89
P2111-25	1K (256 x 4) 250ns 18 PIN	2.25
P2112-35	1K (256 x 4) 350ns 18 PIN	2.25

**MOS Dynamic RAM's**

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TMS4060-30	4K (4K x 1) 300ns 22 PIN	2.95
TMS4060-20	4K (4K x 1) 200ns 22 PIN	3.95

### EPROM'S

C2708	1K x 8	450 ns	\$ 9.95
TMS2716	16K (2K x 8)	450 ns	\$24.95
	(3 power supplies) T.I. Version		
C2716/TMS2516	16K (2K x 8)	450 ns	\$29.95
	(Single 5V supply — Intel version)		



### LINEAR I.C.'s

LM324N	.59	LM741CN-8	.29
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LM555N-8	.29	TBA810DAS	1.29
LM556N-14	.59	LM1458N-8	.49
LM723CN-14	.49	LM3403N-14	.99
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LM739CN-14	.29	LM4136N-14	.99

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**4K CMOS RAM**

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18 PIN	.22	40 PIN	.48
20 PIN	.24		



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LED211	T-1 3 mm Green	.14
LED212	T-1 3 mm Yellow	.14
LED220	T-1 5 mm Red	.11
LED222	T-1 5 mm Green	.19
LED224	T-1 5 mm Yellow	.16

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FND367	360' Common Cathode (high brightness)	1.29
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FND507	500' Common Anode	1.09
FND560	500' Common Anode (high brightness)	1.29
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DL707	300' Common Anode	1.29
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4N26	Opto Isolator	2500V	.59
4N28	Opto Isolator	500V	.59
4N29	Opto Isolator	2500V	.69
4N32	Opto Isolator	2500V	.69

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