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August 1982

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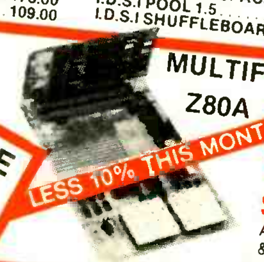

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ETI

The Magazine for Electronics & Computing Enthusiasts

AUGUST 1982 VOL. 6 No.8

ISSN 0703-8984

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Features

Projects

Our Cover: It's yellow. Cluttering up the yellow are bits from articles on 30 years of Canadian TV (p. 10), the Osborne Computer Review (p. 15) and the sign on message for our own ETI Bulletin Board System (p. 44). Enjoy these, and many other fine writings behind the cover and remember, it could have been purple. Drawing by Terry Fletcher

30 YEARS CANADIAN T.V.

Columns, News and Information

ADVERTISERS' INDEX

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Previous issues of ETI Canada are available direct from our offices for $3.00 each; please specify by month, not by feature you require. See order card for issues available.

We can supply photocopies of any article published in ETI Canada; the charge is $2.00 per article, regardless of length. Please specify both issue and article.

COMPONENT NOTATION AND UNITS
We normally specify components using an international standard. Many readers will be unfamiliar with this but it's simple, less likely to lead to error and will be widely used everywhere sooner or later. ETI has opted for sooner!
Firstly decimal points are dropped and substituted with the multiplier: thus 4.7uF is written 4u7. Capacitors also use the multiplier nano (one nanofarad is 1000pF). Thus 0.1uF is 100nF, 5600pF is 5n6. Other examples are 5.6pF = 5p6 and 0.5pF = 0p5.
Resistors are treated similarly: 1.8Mohms is 1M8, 56kohms is the same, 4.7kohms is 4k7, 100ohms is 100R and 5.6ohms is 5R6.

PCB SUPPLIERS
ETI magazine does NOT supply PCBs or kits but we do issue manufacturing permits for companies to manufacture boards and kits to our designs. Contact the following companies when ordering boards.
Please note we do not keep track of what is available from who so please don't contact us for information on PCBs and kits. Similarly do not ask PCB suppliers for help with projects.

K.S.K. Associates, P.O. Box 54, Morriston, Ont. N0B 2C0.
BR Electronics, P.O. Box 6326F, Hamilton, Ont., L9C 6L9.
Wentworth Electronics, R.R.No.1, Waterdown,Ont., L0R 2H0.
Danocinths Inc., P.O. Box 261, Westland MI 48185, USA.
Arkon Electronics Ltd., 409 Queen Street W., Toronto, Ont., M5V 2A5.
Beyer & Martin Electronic Ltd., 2 Jodi Ave., Unit C, Downsview, Ontario M3N 1H1.
Spectrum Electronics, Box 4166, Stn 'D', Hamilton, Ontario L8V 4L5.
Dacor Limited, P.O. Box 683, Station Q, Toronto, M4T 2N5.

POSTAL INFORMATION
Second Class Mail Registration No.3955. Mailing address for subscription orders, undeliverable copies and change of address notice is: Electronics Today International, Unit 6, 25 Overlea Blvd., Toronto, Ontario, M4H 1B1.

News

Portable WWV Receiver

The WWVT Mark V has been specifically designed for protection against weather, transportation hazards and rough treatment. The receiver is housed in a deep drawn seamless aluminum case, in bake-finished enamel. It features a fully gasketed lid and sturdy carrying handle that collapses to a compact 9 inch total height.

Receiving frequencies of 5 MHz, 10 MHz and 15 MHz are supplied as standard on the Mark V, with others available on special request. Push button selection of these frequencies allows for positive selection with no user trimming required. These three frequencies will allow reception of WWV (Ft. Collins, Colorado), WWVH (Kauai, Hawaii), JJY (Koganei, Japan), MSF (Rugby, United Kingdom), ZUO (South Africa) as well as others world wide. A complete listing of these stations is available from the True Time Application Note "Time Signals".

Optionally available is a time code stripper to recover the 100 hz time code broadcast by WWV and WWVH. This stripper converts the code to a level shift format usable on strip chart recorders.

For more information, contact Tele-Radio Systems Limited, 121 Hanlan Road, Woodbridge, Ontario L4L 3P5, telephone (416) 851-2231.

Looking Back

Last month's feature on "The 'Scope" used a Scopex 4010A as an example instrument, but inadvertantly called it a Philips 3232. Sorry if anyone was confused; they're two completely different beasts.

Ion Transformer

Last month's ion generator project was missing the winding directions for the transformer. Here they are; go forth and ionize.

Potocore: FX2242
Secondary: 125 turns of 0.2 mm dia. enamelled copper wire.
Primary: 10 turns, centre-tapped, of 1.0 mm dia. enamelled copper wire.

The secondary is wound on the potcore bobbin first. Wind it in five or six neat layers. Slip thin plastic spaghetti over the start and finish leads so that the spaghetti is held well inside the bobbin. As you finish winding each layer, insulate it with 1 mm mylar sticky tape (if you can obtain it) or electrical insulation tape (a bit heavy, but it will do the job). Wind the next layer on the insulation of the previous layer, etc., until you finish the winding. Wind several layers of insulation over the completed secondary. Leave the start and finish wires protruding from different sides of the bobbin so that they exit via different slots of the assembled potcore.

Wind the primary over the secondary; it can be wound bifilar (two wires together, five turns, connect finish of one to start of other to provide centre tap) or in one winding, but don't forget the centre tap. Wind the primary so that its wires exit the potcore opposite the secondary wires.

In operation, if you have breakdown problems (arcing sounds inside the potcore) it means you have not wound or insulated your secondary carfully enough and you'll have to rewind the transformer.

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Also....

Starting October 1982 an Ottawa TV Cable company, Ottawa Cablevision will be offering 30 different software programs over their system. This is being run in conjunction with Nabu who developed the system and will manufacture the $800 computer which is necessary. Cost to the consumer is $8.00 a month. Plans are already underway to expand this system to other areas of Canada.

•

Northern Telecom have announced a new facility, costing in all $40 million, for Calgary. The plant will manufacture telephones and other communications products.

•

General Electric in the US have recently made the world's largest and most complex power semiconductor, a three-tenth-inch square silicon chip with 60,000 seperate but interconnected circuit elements. This is three times as many elements as the previous record.

•

The first annual '1802 Microcomputer Conference' sponsored by the Association of Computer-Chip Experimenters (ACE) will be held August 7th 1982 in Welland, Ontario. Details from M.E. Franklin, 690 Laurier Ave, Milton, Ontario, L9T 4R5, (416) 878-0740.

•

Canada's biggest-ever satellite, Telesat Canada's 24-channel Anik D-1, has been delivered by Spar Aerospace. It is due to be launched August 12th by NASA using a Delta rocket.

•

The Department of Industry, Trade and Commerce have published the second edition of a Directory of Canadian suppliers in the field of CAD (Computer Aided Design) and CAM (Computer Aided Manufacturing). Copies are free from The Business Centre, DITC, 235 Queen St, Level 01, Ottawa, K1A 0H5.

•

The British telephone system, British Telecom, is starting trials next year of 'Telewriting' whereby handwritten material at one location can be sent down the 'phone line for reproduction at the other end.

•

The IBM Personal Computer, until now only available from IBM Product Centres and Computerland Stores, is now available from six additional dealerships: Compucentre (Montreal-based), Computer Innovations (Ottawa), Compu-Group Business (Toronto), ComputerWorld (Vancouver), PARMIC Corp (Montreal) and the Information Connection (Milton, Ont.).

Video games are expected to be a $6 billion industry in 1982 in North America alone. This compares to the movie business which is worth only half that figure.

•

According to a report from the Ontario Ministry of Labour, jobs in the computer field are growing by 8% a year and will continue to grow at this rate for some time.

•

British Telecom are closing down 70% of the 20 computers used for their Prestel Service, the British equivalent of Telidon. Users of the system, which currently offers 200,000 pages of information, number just 15,000, far less than the hundreds of thousands anticipated by this time.

•

Semiconductor technology developed at the University of Toronto under a research contract from the DOC has been transferred to Linear Technology Inc. of Burlington; transfer of the technology, said to worth $793,000, has been funded by PILP (Program for Industry/Laboratory Projects).

•

A conference entitled 'Robot Research, Developments and Applications in Canada' is planned for September 20th and 21st 1982 at the Delta Inn, Mississauga, Ontario. It is sponsored by the Central Ontario Chapter of Robotics International Society of Manufacturing Engineers and the NRC. Details from RI-SME Conference, 6535 Mississauga Rd., Mississauga, Ont., L5N 1A6.

•

A couple of handsome catalogues have just been received from Double Dollar Paks, P.O. Box 2068, Bramalea, Ontario, L6T 3S3. Volume 1 (costing $3.00) contains details of 600 different 'Paks', all costing $2.00. Volume 2 ($2.00) has 300 diferent 'Paks' also each costing $2.00. Prices for Ontario residents are plus 7% P.S.T.

•

One of the few high spots in the US economy is Robotics. Sales are currently 50% ahead of a year ago and growth is expected to be 30% a year until at least 1990 when sales are expected to be $2 billion.

•

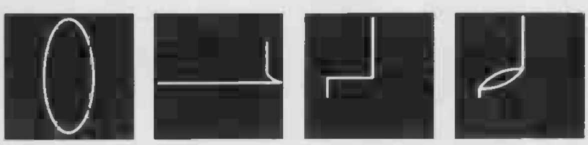
For audiophiles who feel that cables really make a difference, Kitstronic offers "Interconnect Cables" by Namiki in 1 and 1.5 metre lengths. The cables are double sheilded, with centre conductors of Oxygen free pure Copper. Plugs are gold plated, and the prices start at $69.95 per cable. Kitstronic International, Box 557, Station J, Toronto, Ontario M4K 4Z2.

Continued on page 21

From HAMEG...

HM307

The first portable scope with a component tester.



Capacitor 33 uF | Transistor E-C | Transistor B-E | B-E 1 uF + 68 ohms

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Y Deflection

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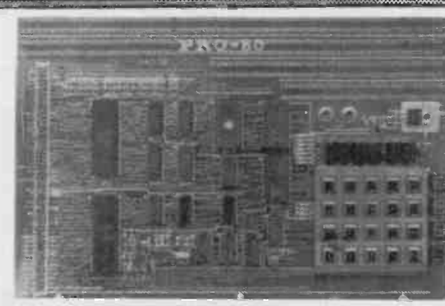

A COMPLETE Z-80 BASED MICROCOMPUTER KIT:

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IT INCLUDES: • 2 parallel I/O ports • 1K byte RAM, socket for a second K • 1K powerful monitor • An other Kbyte EPROM available to the user • S-100 bus • Wire wrap area • Hex keyboard • Hex digit display • Voltage regulator • Audio cassette interface. A detailed assembly and test manual (English or French) is also included. It explains all monitor functions, with several examples, diagrams, schematics and the integral listing of the PRO-80 monitor • (power pack: add $9.00) prepaid order can be mailed to:

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Or to our authorized distributor:
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VISA

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ETI

READER OFFER

There can only be a handful of ETI readers who don't already own a calculator; in fact most of you probably own several. We wouldn't dare offer one unless we thought that it had sufficient 'Gee-Whiz' appeal.

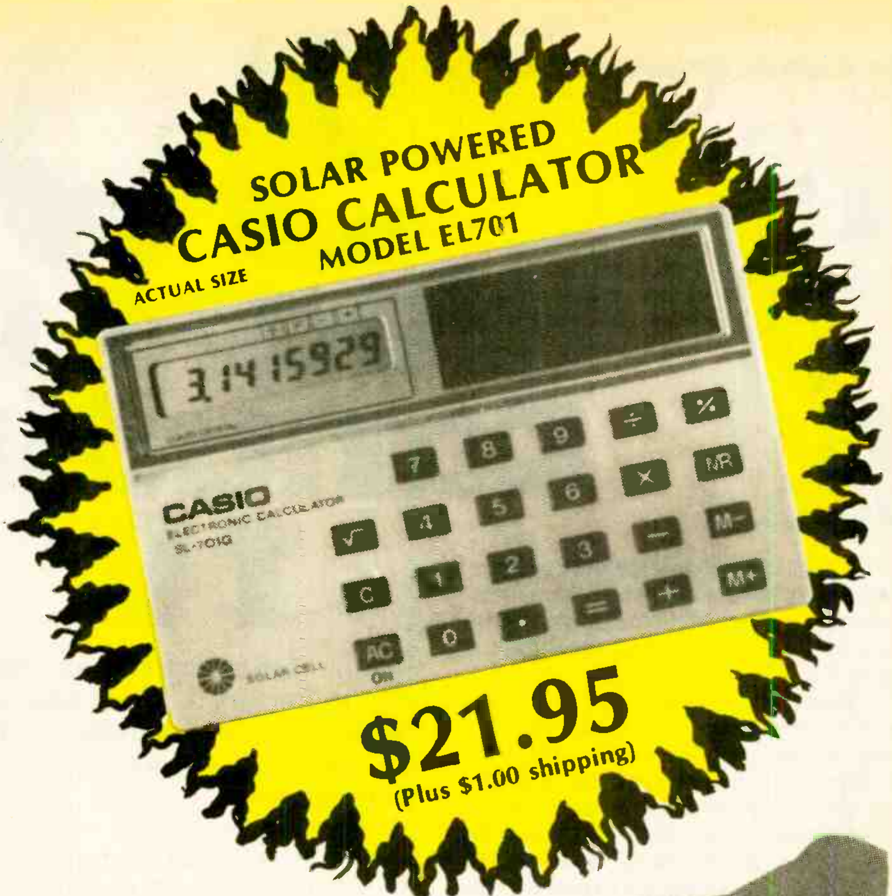
The Casio SL701 offered here is entirely light-powered; it's called solar powered but that underestimates its ability to work in practically any light you'd care to read by. In fact it requires only 150 Lux! In normal artificial lighting levels you can even cover the cells with white paper as thick as the cover of ETI and it still works!

OK, some of you will reply, LCD calculators are so efficient they don't use many batteries. True, but have you checked out what they cost? You'll be lucky to get away with six bucks!

The Casio SL701 is a super small type (90x58x5mm). It comes with a carrying case that will also take your credit cards and of course it's made by Casio, a company who have a reputation to protect.

The functions? Normal by today's standards: Memory, Square Root and Percentage. The Warranty? One year parts and labour plus a **lifetime guarantee** on the solar cells.

Casio do not have recommended prices so we're not going to quote some silly 'percentage off' figure. As this is a very, very recent model we couldn't find many on sale but the **best price** we found was $29.95. However through ETI, for a limited period we have made arrangements to market this to readers for just **$21.95** (plus $1.00 shipping) making it a remarkable value.



ACTUAL THICKNESS

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If, within 7 days of your receiving the Casio SL701, you are dissatisfied in any way, you may return it to ETI (in original condition and original packaging) and your money will be refunded. You may do this for any reason or no reason. Refunds will be made promptly and cheerfully. This guarantee of satisfaction is in addition to Casio's own warranty.

HOW TO ORDER

1. Complete the order form on the right; please write clearly.
2. The goods will normally be sent within 48 hours of our receiving the order except where payment is by personal cheque in which case we will await clearance before sending the goods.
3. Sorry, no orders from outside Canada.
4. This is a limited time offer; orders must be post marked before September 15th.
5. Readers can inspect, play with and buy direct from our offices (Mon-Thursday 9.00-5.00 pm, Friday 9.00-2.00pm). For security reasons only a limited stock will be held at our offices.

**To: Solar Powered Calculator Offer,
ETI Magazine, #6, 25 Overlea Blvd, Toronto, Ontario
M4H 1B1.**

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☐ I enclose my cheque/M.O.

☐ Bill Visa/Mastercard

A/C No .... ☐ Expiry Date ....

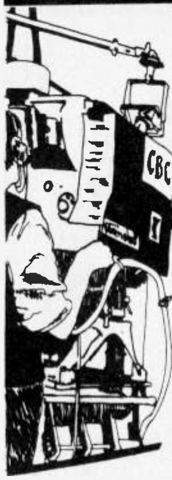
Name ....

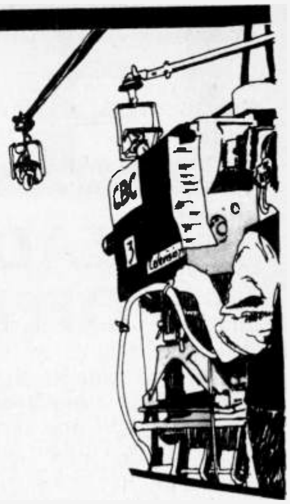
Address ....

City .... Province ....

Post Code .... Date ....

Offer expires September 15th, 1982





30 Years of Canadian TV

TV in Canada predates even Pierre Berton, if such a span of time can be conceived. The chronicles, by John Brickenden.

THE WONDER of television came to Canada officially 30 years ago this September. The real wonder given the size of this country and the limited population is that it came at all.

Back in the early 1930's, what was known then as "radio vision" was already being transmitted in Montreal. It was primitive but it worked; the picture was in red and black. The television receiver you have in your living room today scans 525 lines; the "radio vision" receiver of 1931/32 scanned about one-tenth of that. It was a bit like viewing a moving picture through a partially-opened venetian blind.

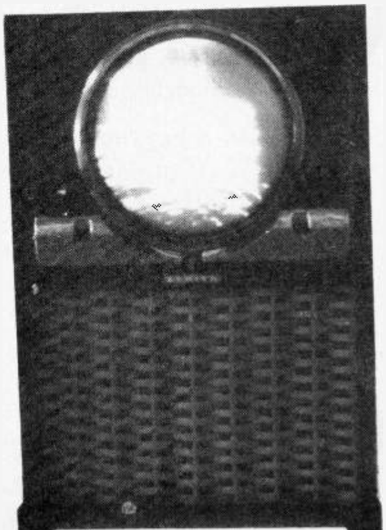
The shoe-string company responsible for producing this ancient mechanical-system signal was called Canadian Television Limited and a name emerged from that early experimental period in Canadian television: J. Alphonse Ouimet. Remember the name. Despite the technical success of the Canadian Television Limited, the organization lacked the money to finance the actual broadcasting of their TV signals and they went broke.

TV or not TV

As early as 1925 the British had demonstrated "radio vision" with some success. By 1936 the British Broadcasting Corporation was running the world's first regular TV service, providing scheduled programmes for about 50 receivers in Britain. But the Second World War came along and British television shut down for the duration, initially because the powerful 40MHz transmitter would become an excellent direction finding beam for German bombers. By this time there were about 10,000 TV sets.

The Americans had also been conducting experimental TV in the early thirties. It cost a lot of money. By the time RCA, for example, had progressed from the early stages to the "commercially possible picture" to the present 525-line electronic system and introduced it to the public in 1946, the company had spent $50,000,000. Canada wasn't in this financial league despite the brilliant pioneer work done by Alphonse Ouimet.

Ouimet was one of those far-sighted young men in the early part of this century who could foresee the role television would play in modern society. He designed and built the first TV receiver intended for commercial distribution in Canada. He has been associated with the development of television in this country from the beginning. After Canadian Television Limited went broke, he was hired by the Canadian Radio Broadcasting Commission in 1935 *"for investigation into present state of television"*. His salary was $2000 per annum. Under his guidance, television developed in Canada. By 1958 the national service was within reach of nearly 90% of the population . . . the fastest growth of television of any country in the world.



Al Ouimet progressed through CBC Engineering to become president of the Corporation and, ultimately, he became chairman of the Board of Directors of Telstat, from which he retired recently as chairman, though remaining a member of the board.

Canada could have had its own TV in the forties. Back in 1946, when TV became available to the general public South of the border, the Canadian government adopted a "wait-and-see" policy. It wasn't in a hurry to commit large sums of money to launch an untried TV system in this country. So, while the Americans were spending millions of dollars to solve key technical problems, Canada waited. The decision to wait was economically sound but universally unpopular. It created a vast hue and cry from the public as well as from dealers and manufacturers. The public wanted this new toy and it wanted it right away.

By 1949 nearly 10,000 TV receivers had been sold in Canada to watch border U.S. stations. Some of the more ardent fans would sit cheerfully by the hour, endangering their eyesight while they strained to watch dim figures move in and out of the heavy snow on sets whose pictures were being brought in from enormous distances with the assistance of sky-high aerials.

By late 1951, with Canadian television still a year away, more than 60,000 TV receivers had been sold here. By mid-1952, still before Canadian television was functioning, this figure was approximately 150,000. Today the sets-in-use figure is close to 12,000,000. That's about one TV set for every two people in Canada.

Finally, with the CBC grunting and puffing from the effort, Canadian television was born. Officially TV came on the air on September 6, 1952, with CBMT Montreal. Two days later, CBLT Toronto came on the air with its now famous upside-down station identification slide.

Television had arrived.

From that moment on, no-one's life was quite the same again. Since TV first burst upon the Canadian scene it was cheered, condemned, hated, enjoyed, feared, worshipped, blamed for every crime and medical ailment in the book, praised by those who got what they wanted when they wanted it, and criticised by those who wanted something else. Medical experts talked wisely about *"TV squat"*. Some Canadian newspapers, such as the *Winnipeg Free Press*, refused in a state of terror to carry TV listings (until public pressure forced them to change their policy and admit that TV was indeed a part of everyone's life).

The viewing public's appetite for television was insatiable. Canadians wanted everything the Americans had and more. The government's stance from the beginning had favoured the long view. Unfortunately this was like telling your child that you understood that he thought candy tasted good but wouldn't he like it better if he didn't have very much right now, so that the little boy next door could have some too!

CBC's single-station policy was undoubtedly the best thing for the most people, but it didn't sit well with the people who had one station in their city and wanted more.

The policy of the day was that no private stations would be licenced until the CBC had created a national service of television programming, and that all future private stations be required to serve as outlets for the national service. Translated, this meant one station per city until the majority of the population was within range of a Canadian television signal. Cities like Montreal, Toronto, Halifax, Winnipeg and Vancouver took this as a curtailment of their God-given rights and mentioned this point-of-view to the CBC and to their MPs from time to time. The private broadcasters seeking "second stations" weren't all that thrilled either.

J. Alphonse Ouimet

Young Al Ouimet was a research engineer with the fledgling Canadian Television Limited in the early 1930's. Shown here with the first television receiver built for commercial distribution in Canada (built, by the way, with his own two hands . . . cabinet included) he represents the one single person in Canada who has been identifiable with TV from the beginning to the present. He progressed through Engineering in CBC to become president of the Corporation and ultimately became Chairman of the Board of Directors of Telstat from which he has recently retired as chairman, remaining a member of the board.

Says Ouimet: "We produced in those early days a very coarse picture which showed just enough detail to barely recognize one's own mother on a full face close-up."

At that time the different experimental systems around the world used a variety of dummies or models to test their systems. NBC had Felix the Cat, BBC had a papier mache head of some kind. Canadian Television Limited couldn't afford a dummy so the staff used to take turns acting as "test pattern" while the others worked. Ouimet was in the greatest demand because he had something the others didn't have: a close-up of Ouimet's face revealed a great canyon between his two upper teeth that was the perfect focal target for TV.

"Not only am I one of Canada's first television pioneers," says Ouimet, "but I was certainly its first test pattern!"

No one in Canada had properly anticipated television's appetite for staff and money. (Is there another country in the world that is serving a public distributed spottily over seven time zones across one fifth of the girth of the world and including communities north of the Arctic Circle?) There were, nonetheless, certain far-sighted Canadians who had a feel for what was coming. One of those was Sir John Aird, grandfather of the present Lieutenant Governor on Ontario. Sir John was head of the Aird Commission whose report led to the creation of public broadcasting in Canada. Back in 1932 Aird said: *"It is coming, gentlemen, and we should be prepared in dealing with this question of radio broadcasting to keep this question of television well before us."*

In 1949 the Canadian government made its first official pronouncement on TV policy. The general direction of the new medium was to fall under the jurisdiction of the CBC Board of Governors. CBC was instructed to establish production centres in Toronto and Montreal as early as possible as the basis for a future national network. Private broadcasters would become involved at some future date. About that same time the Royal Commission on National Development in the Arts, Letters and Sciences was appointed . . . the famous Massey Commission.

This commission's specific recommendation relating to TV included an expression of concern about the possible domination of American programming in Canadian TV. Massey recommended that the control of TV be left with CBC because the considerable financial investment required would otherwise force private stations in Canada to become *"mere channels for American commercial material"*. That was when it was suggested that no private stations be licenced until CBC had set up a TV service that would serve the majority of the Canadian public. And that's what happened.

Years later Austin Weir noted in his book *"The Struggle for National Broadcasting in Canada"* that the issue of television was complex and had important cultural implications. Said Weir: *"The government saw the rapid expansion of television as of potential value to industry and employment too. It also glimpsed the irresitable pressures that must inevitably develop for the importation of American commercial programs as the new medium asserted itself. It was important that this should be adequately counter-balanced. The inherent capacity of the new medium for human as well as material development for information, entertainment, and education must be conserved and developed for Canadians."*

Some of these humans alluded to in Weir's comments should belong in a *Who's Who* of Canadian television. Names like Mavor Moore, Norman Jewison, Alphonse Ouimet, Lorne Greene, Joyce Davidson, Percy Saltzman, J. Frank Willis, Larry Henderson, Earl Cameron, Henri Bergeron, Amanda Alarie, Arthur Hailey, Rene Levesque, Stan Harris, Andrew Allan, Fergus Mutrie, and Uncle Chichimus graced the first years of TV in Canada. Then there was Patrick Watson, Robert Homme, Juliette, Ross McLean, Norman DePoe, Pierre Nadeau, Wayne and Shuster, Peter Trueman, Don Messer, Charlie Chamberlain, Nathan Cohen, Fletcher Markle, Gordon Pinsent, The Hewitts, Wally Koster, Ed Russenholt, Max Ferguson, John Hirsch and even Uncle Bobby.

Television marched relentlessly on.

Those were heady days. Enthusiastic and dedicated people worked under unbelievable conditions to produce our first home-grown TV. In Winnipeg for the first year of television, an overworked and undertrained staff produced 16 live TV programs a week out of a radio studio with only one camera. In Toronto, the building housing the Graphics Department was an old school that had been condemned by the city fire department as unsafe for human habitation.

The Last Post

Toronto was the site of that classic make-shift studio dating back to the hey-days of radio in the forties when an old abandoned church on Elizabeth Street had been rented by the Corporation as a studio for the production of live symphony concerts for the network. Unfortunately, and probably unbeknownst to the radio crews taking part, the basement of that same building had been rented to the Banting Institute. As a result, as soon as Geoffrey Waddington tapped his baton on the lecturn to bring the orchestra to attention, the sound would wake up the rabbits and chickens in the basement, and throughout the concert the CBC Symphony Orchestra would be accompanied by a chicken obbligato from the lower regions, live coast to coast.

With this tradition to set the pace, it was no wonder that the earliest TV studio operated by CBC Toronto was an old RCAF barracks building that was being required to

The Plouffe Family

Probably the only completely successful bi-lingual program series to appear on Canadian television was The Plouffe Family. The series was presented in both French and English . . . same cast but separate productions. In La Belle Province these were the real stars of the fifties and people waited outside the stage door in Montreal to greet them as them emerged after each week's show. And in English Canada, during a coast-to-coast tour for the famous television family, the Anglos also turned out in force at every stop to greet and adore the Plouffes. Superstar for the program, however, was ex-opera-singer Amanda Alarie who played the warm and vital role of Mama Plouffe and may have done more for national unity in that day than all the Bi-and-Bi Commissions this country has ever seen or will ever see.

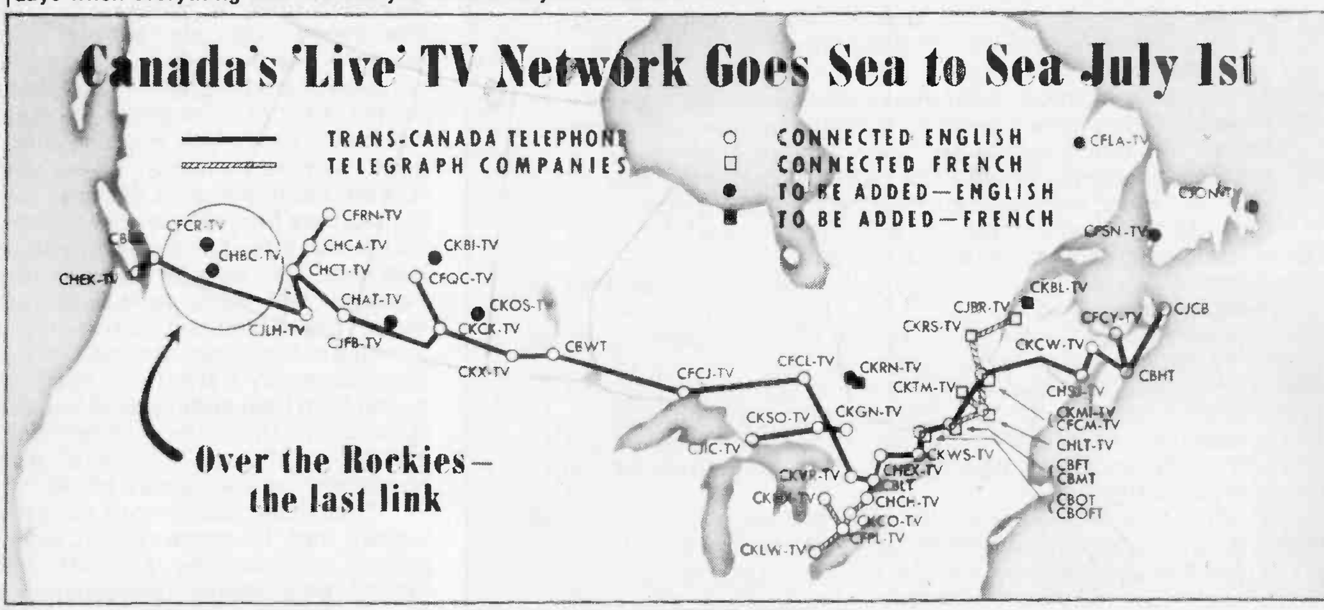
Lorne Greene

It's a long way from a CBC Radio announcer booth to the Ponderosa and Lorne Greene made some interesting stops along the way. Another prominent Canadian who was involved in the first days of television, Greene had left CBC prior to the coming of TV to set up his own broadcasting school across the street from the famous Jarvis Street headquarters. His students were forever dropping in on the Radio Newsroom to borrow file copies of bulletins so they could practice reading the real thing. Greene dropped in too, in early 1953, to play in the Corporation's first TV production of Shakespeare. Here's Pa Cartright as Othello back in the days when everything was live and you lived with your mistakes.

develop another life-style for the age of communications. Unfortunately there was a pillar in the middle of the only open floor space in the building. It had to be there, as it held up the roof. This pillar appeared in every production from the studio and sorely tested the ingenuity of the early production people as they gamely wrote it into the script. Sometimes it was a tree; sometimes a telephone pole; sometimes a post holding up a verandah facade. But, like the sponsor's brother-in-law, it was always there.

Montreal was probably better off, having the use of part of the old Ford Hotel, which had been taken over some years earlier by Radio Canada and the CBC International Service.

The construction of the CBLT tower was a social highlight on Toronto's Jarvis Street in early 1952. Pedestrians lingered by the hour to peek through the boardings as the grid mounted higher and higher to become the city's tallest structure of that day. They watched in awe as workers swarmed over the massive structure like ants on a peony, hooking together the huge mechano set that was to dominate the Toronto skyline for years to come. They weren't quite so enthusiastic, though, when the tower was painted in its alternate red and white sections. Despite extensive posted warnings to keep away, both humans and machines that strayed within range began to discover tiny red or white dots all over themselves, particularly when the gentle winds of summer wafted the miniscule droplets in



The Microwave Network

Six years after TV came to Canada, the country was linked from coast to coast by a series of microwave towers . . . one every 30 miles, on the average. . . and Canadians were finally able to receive live programming from sea to sea. The occasion was marked with an artifical but well-intended program confection called MEMO TO CHAMPLAIN whose co-hosts have gone on to greater things . . . Joyce Davidson to international TV fame; Rene Levesque to politics. Prior to the microwave network, CBC had what it termed "the nonconnected" TV network . . . not unlike a semi-detached house which, in reality, is attached. The link in this non-structure was Air Canada, which delivered misty kinescopes of network programs to network stations across the country on a daily basis. Quite over and above the generally bad quality of the films, the delivery service also left something to be desired. It was not uncommon in Winnipeg, for example, in the mid-fifties for the program planners to sit down at 9.00 am to discuss what would be broadcast when CBWT went on the air in the afternoon. There just wasn't any point in planning until the Air Canada flight arrived if it arrived. On the days when the expected programs didn't show up the viewing public became a little bit testy and usually accused the Corporation of deliberately removing wrestling or Bishop Sheen or whatever from the air because of a deep-seated bias against whatever the public really preferred. Once, as a result of some pretty effective lobbying from the pulpits, CBC Winnipeg received more than 1,000 letters accusing the Corporation of religious prejudice because someone thought Bishop Sheen was going to be taken off. The public was very interested in television.

CHRONOLOGY OF CANADIAN TV EVENTS

1930-31	First Canadian television experiments. Montreal.
1949	Government announced interim plan for development of Canadian TV. 10,000 TV receivers sold in Canada for viewing border United States stations.
1952	150,000 TV receivers sold in Canada before actual start of Canadian TV service. Opening of Canadian television service: CBFT Montreal on Sept. 6; CBLT Toronto on Sept. 8
1953	First private TV station to go on the air in Canada . . . CKSO-TV Sudbury.
1954	TV comes to British Columbia, Manitoba and Nova Scotia.
1958	Opening of Calgary delay centre with videotape recording facilities to delay network programs for western time zones. Completion of microwave network connecting Victoria with Sydney, Nova Scotia . . . the longest TV network in the world Occasion marked by special July 1 feature program to full network entitled MEMO TO CHAMPLAIN, with co-hosts Joyce Davidson and Rene Levesque.
1959	Microwave network extended to Newfoundland.
1960	Second TV stations licenced for Halifax, Montreal, Ottawa, Toronto, Winnipeg, Calgary, Edmonton and Vancouver
1961	Second network arrives: CTV network opened October 1.
1962	First Telstar communications satellite transmission from North America to Europe, with CBC taking part.
1966	First regular color TV programming.
1967	International CBC telecast by space satellite of EXPO '67 official opening. First Frontier Coverage Package in operation, bringing taped TV service to Northwest Territories.
1969	The Telstat Canada Act was passed to "establish a Canadian corporation for telecommunication by satellite."
1970	Opening of first UHF television station in Canada. CICA-TV Toronto, broadcasting programs of the Ontario Department of Education. CRTC's Canadian-content regulation in force for CBC-owned TV stations: Minimum 60% Canadian content. Private stations to reach same minimum within two years.
1971	Opening of Canada's first French-language private TV network, with member stations in Montreal, Quebec City and Chicoutimi.
1972	Canada's third English network, Global Television, licenced by CRTC to serve five Ontario cities. Launch of Anik I, Telstat Canada's domestic communications satellite, from Cape Canaveral, Florida.
1973	Official start of CBC network television transmission to the north by Anik satellite.
1974	Accelerated Coverage Plan announced in Ottawa to bring CBC television and radio in English and/or French to unserved communities of 500 or greater population.
1975	With start of fall TV schedule CBC removed all commercials from TV programs directed at children of 12 years and under. (Pre-school TV programs were already free of commercials.)
1976	TV and FM Radio transmissions commenced from the CN Tower in Toronto. This included both CBC and private stations.
1981	Television households in Canada totalled 11,855,000, of which 7,708,000 had colour receivers.

every direction for blocks around. There was a regular stream of angry citizens, displaying what appeared to be a hybrid strain of red and white pox, marching into the CBC building to demand restitution.

The real behind-the-scenes story of how television was brought to Canadians is well illustrated by a simple list of the strange facilities that were made available for television crews of the day as TV grew across the country. CBC was not the exclusive force behind the development of Canadian TV, but the public corporation was charged with the responsibility of serving the total Canadian population. Therefore, a unique measurement of how television evolved in those early days can be noted through a glimpse at the quixotic CBC production facilities from coast-to-coast.

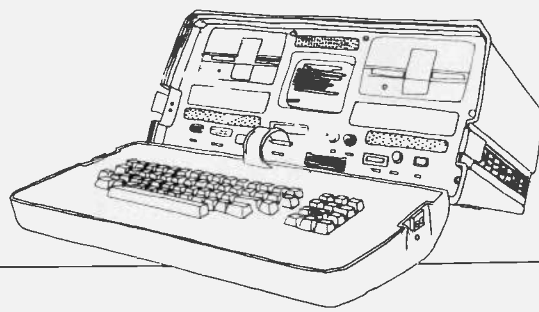
Take Halifax. The first CBC television studio in Halifax was in an abandoned separate school. The building was beyond value as an institution of learning, so CBC was able to rent it for TV. The price was right but the floors weren't. In order to dolly a camera, without giving the viewers the impression one was taking pictures from the deck of a World War II corvette during a typhoon, it was necessary to build tracks for the cameras. Not unlike railway tracks, these pre-determined streets and avenues in the studio floor carried the cameras evenly and without vibration to and from their appointed tasks. Unfortunately, they also limited considerably the naturalness and sponteneity of the camera shots.

Then there was Toronto. With the sudden and, for some reason, unexpected mushrooming of staff and facility requirements connected with the onslaught of television, CBC Toronto found it necessary to range about frantically for work space. The Four Seasons Hotel had been buying up property on Jarvis Street, across from Mother CBC, in anticipation of the day soon to follow when it would build a hotel on the location. Four Seasons bought out several old houses on Jarvis. Two of these had been what grandmother would have called house of ill repute. Ill repute they may have been, but close to the scene of operations they most certainly were, and CBC immediately rented them on a short lease.

Then, in its wisdom, the Corporation assigned one of the houses as office space for Sports . . . the other to Women's Interests.

Continued on page 30

Osborne Review



Not so portable as a ZX-80, yes, but does it have a membrane keyboard? I thought not. A look at the Osborne 1, by Steve Rimmer.

UNLIKE MOST COMPUTERS, which just sit there, the Osborne 1 has a very portable aspect to it, and offers one the impression that it's ready to leave at a moment's notice. Designed, perhaps, for the digital midget on the go, it does not look like every other system around. If you collect stuffed computers for your trophy room, you'll certainly want to bag one of these.

The case of the Osborne is, to be sure, it's most immediately noticeable feature. A two piece moulded affair, it snaps together to form a rather large briefcase-like thingy, making it about the most moveable complete system going. The case contains the keyboard, which lives in the lid, two 5¼ inch disk drives, internals and devices as one might expect, and even a teeny little TV screen which, while perhaps better suited for use as a contact lens, is quite readable if you have to, and is a world better than no screen at all. Whereas moving most computers around requires the transporting of a variety of boxes and cables, followed by a lengthy plugging and re-cabling session, the Osborne is ready to rip as soon as the plug's in the wall. It even has little cubby holes to store some disks.

However, might you exclaim, one doth not buy yonder computer solely to trundle it about upon the street. 'Tis true. Let us, then, sallee forth into the workings.

The Wizard of Os

The Osborne we received came with a box of disks, which contained an extensive array of useful software in addition to the operating system. We also got a full size Zenith monitor and an external video adaptor for the thing. This is mucho essential, and anyone planning to buy the Osborne is urged to spring for the spare tube. The Zenith monitor is light enough to sit on top of the computer without any fear of squashing it, and having two screens to look at is kind of a trip.

The Osborne uses a Z80 processor, which, in turn makes it a friendly environment for CP/M. The CP/M bits and bytes come on two disks, the "System", with AUTOST(art), COPY, HELP, MOVCPM, PIP, SETUP, STAT, SYSGEN and XDIR (extended directory), and "Utilities", with DDT, XSUB, LOAD, XDIR, INSTAL (Wordstar Installer), SYSGEN, DUMP, SUBMIT, ASM, STAT and MOVCPM. Between these two is everything you'd get on a single 8 inch disk based system.

Each disk can hold 102 kilobytes, with 92 kilobytes free when using CP/M.

When you first turn on the system and boot the system disk, you get dumped into HELP, which offers a menu of topics you can ask about. Each will bring up a one page detailed explanation of whatever strikes your fancy. Included are the CP/M functions, and such peculiarities as a "self portrait" of the machine rendered in characters. This points up two interesting features of the video circuitry of the Osborne; first off, it's 52 x 24 character screen is capable of producing grey, as well as white characters, and, secondly, the characters from decimal 127 to 159 are actual graphics symbols, and permit the drawing of pretty pictures right there on the tube. There aren't as many symbols available as can be found on, say, a PET, but there's sufficient stuff to do borders and crude games.

Another curiosity about the screen is that it is arranged to be able to scroll over a block of display RAM much larger than itself. The virtual screen that the machine writes to is 32 lines of 128 characters. The actual screen is moved over this via four screen/cursor movement keys.

When one gets tired of the screen, it is useful to note the other attributes of the machine's front panel. There's a 9 pin D connector for a special Osborne Modem, a standard RS-232 serial port, an edge connector which permits access to an IEEE 488 bus (it's trying to be a PET, you know), an external video connector and another 9 pin D connector for external power. There are also contrast and brightness knobs for the tube, and a reset button. No cigar lighter.

Aside from CP/M, the Osborne comes with a host of other trendy CP/M based software. Included therein are Wordstar/Mailmerge, Supercalc and Interpreter and Compiler BASIC's. We'll check these out briefly in a sec.

The Osborne documentation is, like the machine, slightly funky. Contained in a paperback-sized black binder, it has a folksy style to it, and is fairly readable. It says of itself that it was written by Osborne users, as opposed to technicians, that it was compiled several months after the computer hit the streets, and that it was, in fact, written (at least in part) on an Osborne running Wordstar. It is fairly nicely produced, with the exception that the index is quite insubstantial and that, at least in our copy, the chapters were out of order.

On to the included software.

Softspot

One may, in fact, be wont to gripe a bit about the software included with the Osborne. . . i.e., that it's included. It's all first rate stuff, but it's in there whether one likes it or not. Wordstar alone costs five or six hundred dollars, and this is an expensive addition to the system if you don't need it. If all you plan to do is run CP/M, a lot of this stuff is going to stay in the box.

All of the software is, first off, autostarting. When you boot it up the Osborne logo hits the screen and the

program takes over a second later. The files can, however, by accessed in the usual ways as well if you're just in CP/M.

Wordstar, the word processor, is *the* ultimate collection of bells and whistles. . . a highly powerful and flexible troll which we aren't even going to begin to cover here. With it, one can create and edit documents, as well as printing them out, formatting them, and doing programmed changes on them. Thus, for instance, a letter could be created with different aspects for each of a hundred copies. The software provides on screen justification for both margins, and this happens when printing the text out, as well.

If one has a sufficiently sophisticated printer, such things as superscripts, bold type, underlines and so on can be included in a document.

Text files can be saved on disk. . . a single disk can hold about the equivalent of thirty single spaced typewritten pages. Wordstar is not quite so efficient of disk space as it could be, as it installs a lot of blank space in a document for line justification.

Wordstar is extensively menu driven, the menus being called "Help Levels". The menus can be called up whenever you need them. The one drawback to them is that they're wider than the screen, which entails moving the screen window around to read the whole menu.

The system is capable of doing intense things with a decent printer. It can do pagination, variable widths, headings and will compensate for different character pitches and such like. Platen control is in 1/48 inch increments. It can micro-justify. . . move the letters around to effect a neater looking justification, and, in fact, produce better looking type than some typesetting systems. (Not ours, of course; we don't dare hurt its feelings.)

Using Wordstar requires quite a bit of browsing through the manual, and, while you can do quite a bit after having digested just the first few pages, it takes a while to realize the full potential of the system. However, once you've got it, it can do amazing things. We didn't actually have a printer to try it out with, so its hard copy aspects remain a matter of faith. However, the Xerox word processor, a very close relative of this Wordstar, which we looked at a few months back, was certainly capable of everything it claimed.

Wordstar's formatting facilities are very versatile, but also fairly involved for use with specific jobs, of which doing mailings is about the most common. Thus there has come unto mankind the son of Wordstar, known to all as Mailmerge.

Mailmerge is essentially an enhancement of Wordstar, and does several specific jobs easier and makes them look prettier. It will create form letters and type the envelopes to put them in so the post office can damage them in transit. Several printers now come with automatic envelope feeders. so this operation can be done totally without supervision.

Mailmerge is ideal for small businesses, authors who like to flog their stuff to every magazine in the country and chain letter freaks. Especially the latter, who can, by the use of this simple two thousand dollar system be forever relieved of having to shovel quarters into the photocopier down at the library.

Further Adventures

Supercalc will already be familiar to users of Visicalc. . . it's quite similar. If you have a problem to work out with a raft of variables, you can install all the parameters on a grid, or "worksheet", and, thereafter, alter them, having the machine recalculate the whole works with each modification.

Heady stuff.

The Supercalc worksheet is 64 columns by 254 rows, which, of course, you scroll over using the screen as a window. The scrolling isn't blindly fast; it's adaquate, although it will prove to be a bit of a hassle when using a large worksheet.

At any time while messing about with the sheet, you can hit "?" for help or "/" for the access to the system instructions. To make the instructions easier to use, "?" provides an instruction menu. However, if you just type a letter, provided it designates a viable instruction, the instruction will appear on the screen and ask you if you want it executed. If you answer "no", you get dumped back into the main worksheet.

The worksheet can contain data, equations and literals. Thus, a column of meaningless figures can be made, easily enough, into a column of annotated meaningless figures. Obviously, the literals are skipped over during the calculation phase of things.

Supercalc has a vast array of editing features which permit one to muddle about with the worksheet contents. As it is often useful to install a standard set of parameters on a sheet and then try several permutations of associated variables, one can protect just the core data, and use the "ZAP" command to wipe out all the unprotected sheet contents.

There are several formats available in Supercalc which are tailored to specific applications. For example, EXPONENTIAL NOTATION suits scientific stuff. DOLLARS AND CENTS is cool for finance and computerized money grubbing and GRAPHIC DISPLAY prints out bar graphs to make it easier to view trends and changes.

When you've finally calculated your brains out, the entire worksheet can be stored on disk, such that you can return to calc another day. Likewise, you can instruct the program to reproduce the sheet on a printer to show your friends or preserve for future generations.

Like Wordstar, using Supercalc to its best advantage requires extensive perusal of the manual. It is not only useful in business; it's one of those things that you find applications for the more you use it.

The third major software disk for the Osborne is the one containing the two BASICs. First, ze compiler. Engarde!

The BASIC compiler takes BASIC text, as created by some sort of editor, e.g., Wordstar or ED in CP/M, and creates a block of Z80 code that you actually run. It's a lot faster than Interpreter BASIC, but not nearly so easy to use. It has most of the statements that the more familiar BASIC has, plus CALL, CONSOLE, INITIALIZE, LPRINTER, PRINT USING, SAVEMEM and WHILE-WEND.

Once one has a CBASIC text file, it must be translated into an intermediary file by part of the compiler, CBAS2, and then, if there are no errors (there will be), this file can go on to be converted to machine code. Highly useful, all told, but a great deal of work. A lot of file moving is entailed.

MBASIC, or Microsoft Basic is the friendly familiar BASIC interpreter known to all. It boots up automatically with the autostarter. There's probably not that much to say about this software; it is a very rich BASIC, with plethorae of useful functions and commands. The editing facilities are not great; line editing, as opposed to screen editing as on the CBM machines, but this can be coped with if you get into some meditation or zen.

The documentation for both BASICs is a bit on the sleezy side, and neither will get you going if you don't already know what you're doing. The manual directs you to two other works which will be necessery for anyone without some programming experience.

Terminal Zone

There are several things about the structure of the Osborne system that are worth looking at for those souls crazy into assembly programming. The machine has three banks of memory, the first with 64K of user RAM, the second with 4K of system ROM and the memory mapped I/O and the third with 4K of "video attribute RAM". The video RAM lives from F000H to FFFFH on each page. With CP/M in place, there's actually about 56K to play with.

The major weirdity of the Osborne is in its I/O. The peripheral interfacing is handled by a 6850 instead of an 8251, which means that the I/O is memory mapped instead of being under direct software control. This will cause hassles with some CP/M software, which will want minor revisions to work with the Osborne. Osborne.

The serial interface (RS-232 connector) for the Osborne does not provide quite the versatility of baud rates as might be found on other systems. You get two pairs of possible baud rates, 1200 and 300 or 2400 and 600 which are jumper selectable. This is probably adaquate, though, as most of the freaky rates, 134.5, for instance, are rarely, if ever, used.

The Osborne's IEEE interface is designed for use with anything that desires a parallel communications capability. The connector is not the IEEE 488 standard, although the signals themselves are. Fancy software makes it into a Centronics printer interface.

The Osborne documentation is quite good in the area of memory locations and ROM calls, wherein others have fallen miserably short. If you want, you can do such things as direct disk drive manipulation, as well as fooling with all the ports and the screen RAM. This latter is quite nice if you're up for high speed video changes, a difficult thing for terminal driven systems. Of course, you give up some user RAM in the bargain.

All in all, the Osborne is an impressive little troll, oozing with innovative thought and good ideas. Even as these words appear before me on the screen, an updated Osborne is being unveiled with a more robust case and a longer keyboard connection cable. There are also, we are told, trunks of nifties and accessories on the horizon for the system.

As a final note, it should be stated that at least one Osborne owner that we know of has had a heavy gripe about the disk drives, although our own experience didn't reveal any difficulties.

The Osborne 1 and the software package is $2395.00, plus another $290.00 for a human sized tube and the external video adapter. ETI

Light Memory

Light memory is more than just filling your head with Helium, as Roger Allan explains.

FIBER OPTICS today can be compared to the early days of electronic devices; discrete components connected together to produce a complete circuit that can do something, usually the transmission of data, whether audio, video or digital bits. But electronics progressed, producing smaller and smaller discrete components, until the IC chip was developed, with single chips functionally equivalent to very large numbers of discrete transistors, diodes, capacitors, etc.

In a number of laboratories, both in Canada and in the United States, but particularly in Japan, researchers are emulating the history of electronics by developing a field known as *integrated optics*. Essentially, the long-term objective is to produce circuitry that operates on light. Although no commercially usable devices have as yet been produced, several integrated optical devices have been developed that give credibility to Japanese researchers' belief that an integrated optical computer, operating at twenty-four times the theoretical maximum speed of current computers, will be functional by the end of the decade.

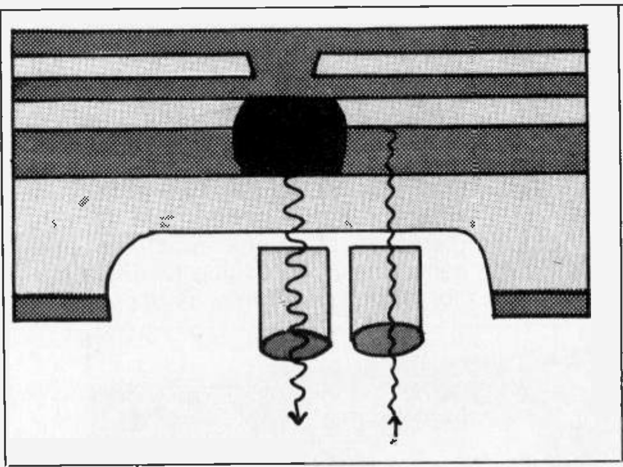


Fig. 1. Repeater. Based on the Shockley diode, this vertically integrated circuit regenerates incoming light signals for further transmission.

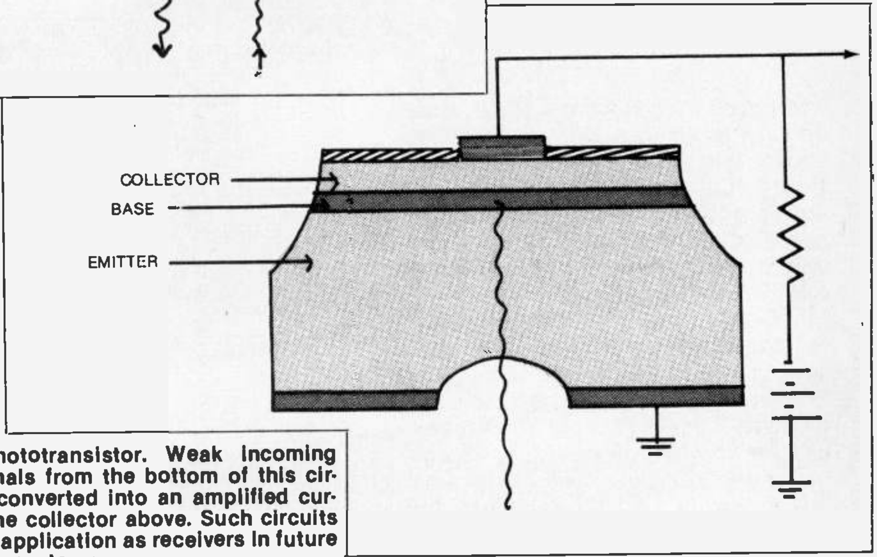


Fig. 2.Phototransistor. Weak incoming light signals from the bottom of this circuit are converted into an amplified current at the collector above. Such circuits may find application as receivers in future lightwave systems.

Hybrid and Monolithic ICs.

The development of integrated optics began about ten years ago with the development of hybrid circuits. These combined materials such as organic compounds, lithium niobate and magneto-optic garnets to produce a number of desirable functions. Currently, monolithic integrated circuits, constructed of semiconductor alloys from a single family, are being used. Such devices can contain a wide range of circuits such as lasers, waveguides, detectors, prisms, filters, couplers and photodetectors.

Both hybrid and monolithic integrated circuits are based on the thin-film waveguide; typically about one ten-thousandth of an inch thick. Within this thickness, researchers have been able to develope laser diodes that can deliver light of greater directed intensity than the surface of the sun, as well as switches capable of operating at five gigahertz (5×10^9 cycles per second).

Lasers

The power for an integrated optical device's operation is generated by a heterostructural III-V semiconductor laser, which utilizes elements from Group III of the periodic table (such as Indium, Aluminum and Gallium) combined with elements from Group V (such as Phosphorous, Antimony and Arsenic). A heterosturctural laser's operation is dependent on its band-gap energy. Band-gap energy is the energy needed to excite an atom's outermost charge-carrying electrons from their bound (or valence band) state to their conduction state. The electrons are driven to the active area and release their energy in a lasing action.

A typical heterostructural semiconductor laser, composed of Gallium Arsenide, is constructed by first building on a very small rectangular substrate of Gallium-Arsenide. A waveguide is then created by the deposition of layers of Aluminum-Gallium-Arsenide. The additional lower-refractive-indexed compounds are required to confine the generated light to the central waveguide layer.

Waveguide Layers

The highest-refractive-indexed waveguide layer, the active layer, lies below the positive or P-layer. The P-layer is created by adding elements such as Zinc: these atoms are electron accepting. Layers below the active layer are the negative or N-type layers, and are created by the addition of Sulfur, Tin or Tellurium: they are electron donating substances. When a voltage is applied, the intense electric field produced through these layers forces electrons from the N-type layers and the holes from the P-type layers into the central active layer. Their recombination releases energy in the form of light.

Lasers of this type are extremely efficient, primarily because the active volume is kept very small and hence heat generation is minimized. Furthermore, they can operate at wide environmental temperature extremes for prolonged periods. And they are tiny, typically 300 by 50 micrometers.

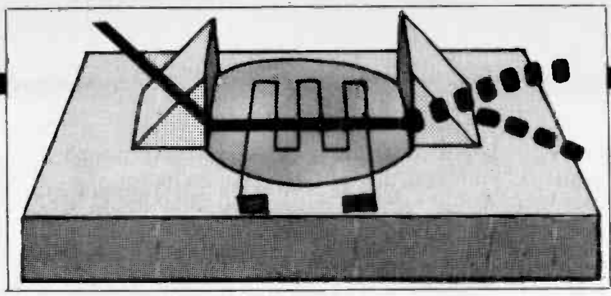


Fig. 3. Magneto-optic switch. Incoming light from the left is polarized by a magnetic field around the serpentine electric circuit. A prism, right, can separate the light into one of two paths, according to its direction of polarization.

Light IC's

Having created a light source small enough to fit into an integrated optical circuit, the next step is to decide what to do with the light. Essentially, the problem is to design light-operated devices that can do all the things that electronic components can do.

One of the simplest integrated optical devices is designed to pass light from one waveguide to another. There are several ways that this can be done. The simplest is to taper the ends of the two waveguides. As light reaches the end of the first waveguide, it will pass into the substrate if there is no second waveguide, or will pass into a second waveguide if they are overlapping. Alternatively, the tapered waveguides can be positioned end to end, with a coating of a material whose refractive index is greater than that of the substrate.

Encoding

For practical use, an integrated optical system must be able to encode, or modulate, the lightwave such that it can carry information. There are a number of ways that this can be done. Only one, the mageneto-optic switch, will be discussed here.

The physics of the magneto-optic switch depends on the principle of Faraday rotation: unpaired electrons, spinning about their own axes, determine a material's direction of magnetization. In the presence of a magnetic field, the electron spin is re-oriented, thereby rotating its plane of polarization. In a magneto-optic switch light will exit from a prism in one of a number of different paths depending on the the lights' plane of polarization.

To construct a magneto-optic switch, magnetic iron-garnet is deposited on a thin film guide, creating a waveguide of sufficient breadth to permit the lightwave to bend. Over or under the magnetic iron-garnet material is placed an electrical circuit, usually of serpentine configuration. Light enters the magnetic iron-garnet material by way of a prism, passes through the waveguide and exits via another prism. The angle at which it exits depends on its plane of polarization as it first enters the switch. If an electrical current is passed through the serpentine shaped electrical circuit, the lightwave's plane of polarization is changed, and the light exiting through the second prism will therefore follow a different path. Depending on whether the electrical current is on or off determines which of two paths the light wave can exit from the switch, and hence its modulation.

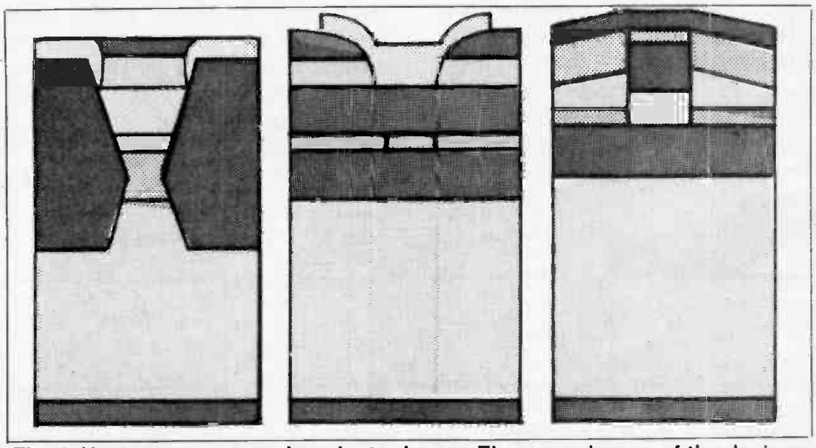


Fig. 4. Heterostrucure semiconductor lasers. There are dozens of the designs, the above being designed by Hitchi (left), Mitsubishi (centre) and Bell Labs (right).

Switching

Another important need, and also one basic to any all-lightwave communication network, is a switching device such that a number of inputs can be directed into a number of waveguide outputs.

The physics underlying this device is that if there are two parallel waveguides lying very close to each other, then light from one waveguide will pass across into the second waveguide, and then back into the first waveguide. For the light to make a complete transfer without passing back into the first waveguide, the two waveguides must lie side by side for the correct transfer length. Transfer length is a specific distance, different for every wavelength, which is determined by the distance between the waveguides, the width of the waveguides themselves and the frequency of the light.

If the two waveguides are lying parallel for exactly one, three, five or some other odd multiple of transfer lengths, then light from one waveguide will completely transfer to the second waveguide without passing back. Conversely, if the two waveguides are parallel for some even-numbered transfer lengths, then the light will pass from one waveguide into the other and back again. The difficulty with this basic design is that the length and separa-

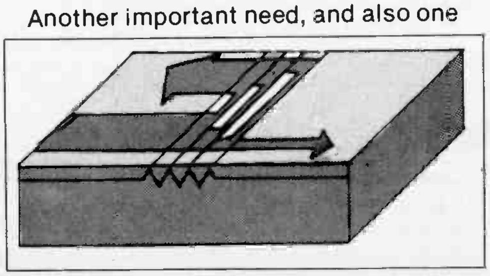


Fig. 5. Bragg reflector. By corrugating one of its film surfaces, a simple waveguide is transformed into a reflector. Only light whose wavelength is exactly twice the distance between corrugations will reflect with any strength. The Bragg reflector serves in a waveguide circuit as both reflecting mirror and filter.

tion of the two waveguides must be extremely accurate; in fact accurate to tolerances not technologically possible outside research laboratories.

Delta-Beta Reversal Switch

One way in which precision can be improved by means of a delta-beta reversal switch. The physics of this device is the fact that waveguide refractive indices can change in the presence of an electric field, as explained above.

Essentially this device consists of two closely aligned waveguides. Two electrodes are mounted parallel to the waveguides, one extending from the beginning of the waveguide coupling region to its middle, the other from the middle to the end.

If the switch is in its open state, that is, when the lightwave is not to pass from the first to the second waveguide, then no voltage is applied to the electrodes. The light from the first waveguide transfers into the second waveguide and then back into the first waveguide. Conversely, if the switch is to be in a closed state, that is, the lightwave is to pass from the first waveguide into the second waveguide, then a positive voltage is applied to the first electrode and a negative voltage is applied to the second eletrode. This changes the refractive indices of both waveguides and forces the complete transfer of light from one waveguide to the other.

Repeaters

Currently, repeaters are necessary to amplify the light signal as it degenerates over distance. They are constructed by first transforming the lightwave into an electrical signal, which in turn is then amplified and reconverted into a light signal. These devices are, by the standards of integrated optics, grossly huge, being in the order of cigarette package.

A simple device to regenerate a signal is based on the Shockley diode. Its underlying physics is the P-type electron-accepting and N-type electron-donating Indium-Gallium-Arsenide-Phosphide layers which can produce electrical currents in the presence of light. It consists of two waveguides inserted into the bottom of the device which consists of layers of the P- and N-type layers with a modified Shockley diode in the middle. The weak incoming signal produces a weak electrical impulse which triggers the Shockley diode into a conductive state. An externally supplied electrical current powers the diode. The combination of the two electrical currents then releases energy in the form of light, which is directed outwards by way of the second waveguide. This device can regenerate the input light by as much as thirty times.

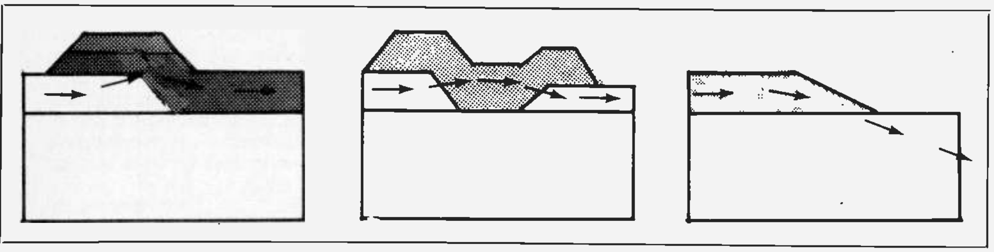


Fig. 6. Junctions. A beam of light can be made to pass from one thin-film device to another simply be overlapping the tapered ends of both films (left). Alternatively, (centre), the tapered devices can be positioned end to end, with both ends and the intervening space coated with a material whose refractive index is greater than that of the substrate. Or the lightwave can be made to pass into the lower-refractive-index substrate (right).

Optical Filters

A necessary device for filtering, and therefore demodulating a carrier wave of several frequencies, each frequency carrying separate data, is the optical filter.

Essentially, lightwaves can be defined in two ways, either by reference to the wavelength in a vacuum or by reference to their apparent wavelength, which is measured along the plane through which they are passing. A Bragg reflector is dependent on a lightwave's apparent wavelength.

In a Bragg reflector, a waveguide is constructed so that it consists of a diffraction grating; that is, a set of parallel grooves set at right angles to the direction of the incoming light. It is so constructed that the distance between two parallel ridges is one half the apparent wavelength of a specific, predetermined frequency. As light strikes the first of the ridges, some of the light is reflected backwards. Similarly, when the remaining light strikes the second ridge a little more of the light is reflected backwards. These two reflected lightwaves will be in phase with each other, thereby increasing the reflected lightwave's amplitude. As the input light strikes more and more of the parallel ridges, an ever greater proportion of light of the one specific frequency is reflected backwards until, after hitting several hundred ridges, all the light of one apparent wavelength is reflected.

Thus input light, which may consist of light of many apparent wavelengths each of which may have previously been modulated to carry information is effectively stripped of light of the predetermined wavelength and all the information carried by that specific wavelength. All light of other apparent wavelengths is not filtered out, and merely continues to pass through the Bragg reflector without interference.

A more refined version of a Bragg reflector is an optical resonator. Essentially, it consists of a number of Bragg reflectors assembled to produce an oscillation effect in the carrier lightwave. It can also be used in a switching device.

Photodetectors

Another filtering device is the vertically integrated dual-wavelength photodetector. Its underlying physics is that different layers of Indium-Gallium-Arsenide are differentially responsive to light of different wavelengths. Light of two frequencies enters from the bottom and strikes the first layer. If the light's frequency (and hence its energy) is high enough, it will excite that first layer, producing an electrical current. This

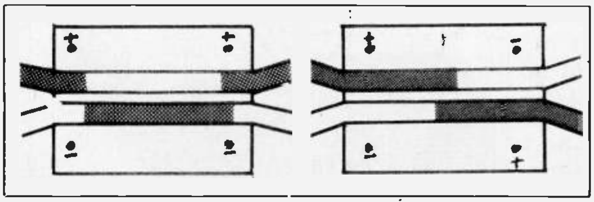


Fig. 7. The Delta-Beta stepped reversal switch. By adjusting the current on the two electrodes (left above) two waveguides can have their refractive indices modified such that they lay exactly one transfer length long parallel to each other.

Continued on page 28

Continued from page 6

News

CMOS RF/Video switch

A new CMOS high-speed dual monolithic switch designed for RF and video system high-frequency applications is now available from Intersil Inc.

The IH5341 is unique because it precisely matches the 75-ohm impedance of video communications systems and handles signal frequencies up to 100 MHz with a loss of less than 3dB.

Features of the Intersil dual, single-pole, single-throw switch include:

- "Off" isolation rejection ratio of 60dB minimum at 10MHz
- Cross-coupling isolation rejection of 60dB minimum at 10 MHz.
- Switching speeds (typical) of 150 ns "on" and 80 ns "off".
- Guaranteed break-before-make switching
- Power supply current of less than 1mA.
- Power supply range of ±5V to ±15V.

For further information, call Roger Hatfield (408) 996-5249.

Connectors

The Belden Corp. Electronic Division has introduced a line of Mag-Master™ connectors as an interface for flat cable and discrete wires.

The Mag-Master06TM connector is available in 10 to 60 pins. It has a temperature range of -55°C to +105°C; a current rating of 3A DC; a contact resistance of 20 M maximum at 6V DC, 0.3A; and an insulation resistance of 1000 M minimum at 500V DC. It has a dielectric withstanding voltage of 500V AC for one minute and a UL voltage of 30V DC. The 0.64 mm (.025") contacts are selectively gold-plated.

For additional information, contact White Radio Limited, 940 Gateway Drive, Burlington, Ontario L7L 5K7. Telephone (416) 632-6894.

Touch-sensitive Display

A simple-to-use touch-sensitive display which interfaces operators to a computer is available in Canada from Allan Crawford Associates Ltd.

The new model 1780 Infotouch display incorporates a transparent switch overlay providing 60 distinct sensing areas. The operator simply reads the message displayed on the Infotouch low profile 7.6 cm x 19 cm CRT screen, then touches the screen at the appropriate location.

A standard ASCII character set is resident in PROM, while an alternate mode allows for an additional 117 characters. Even highly pictorial character sets such as Kata-Kana Japanese, are relatively simple to incorporate with the Infotouch Display. Any combination of character highlighting including blinking, reverse video, and underlining is available by software control.

Please forward reader inquiries to Miss Sindy Van Wieren, Allan Crawford Associates Ltd., 6503 Northam Drive, Mississauga, Ontario L4V 1J2 (416) 678-1500.

8085 Micro Trainer

Etronix has announced the 8085AMT Micro Trainer. The 8085AMT includes a fully tested and assembled 8085 Microcomputer with 1K RAM, 1K PROM, 2K EPROM, programmable I/O, power supply, and case.

The 8085AMT software includes step-by-step instruction manual, a complete user's manual with programs included, and a sub-routines manual describing many of the sub-routines used with a listing.

The single unit introductory price for the 8085AMT is $199.95. For additional information contact C. Larsen, Etronix, 14803 N.E. 40th, Redmond, Wa. 98052.

64K Dynamic RAM

Motorola MOS Integrated Circuits Group announces availability of the second generation 64K dynamic RAM with pin one refresh, the MCM6664A.

As with the MCM6665A, the MCM6665A can do either RAS/CAS or RAS-only refresh cycles, yet also has two additional refresh methods available to the user. These special functions are incorporated on pin 1 of the device.

They are the auto refresh and self refresh modes. The auto refresh mode is accomplished by simply making pin 1 active (V_{IL}) during the time interval when a refresh cycle is desired. The refresh address is generated internally and is automatically incremented for the next refresh cycle.

The second refresh method is intended primarily for battery backup applications where pin 1 will be active longer than two microseconds. This self refresh mode generates internal refresh pulses in addition to the internal refresh addresses.

For further information contact your local Motorola sales office or distributor.

Home TVRO Package

Winegard Company has announced the introduction of a new TVRO earth station system for consumer installations.

The SC-5014 includes a 9-foot square fiberglass dish, a home satellite 24-channel video receiver; 120° LNA, single-base polar mount, rotating feed horn, cable and hardware.

Winegard's one-piece 9-foot square fiberglass dish has the efficiency of a 13-foot parabolic. By eliminating the edges of a round 13-foot parabolic, engineering has created a low-cost yet highly efficient antenna. The unique design of the feed provides a sturdy mount for the LNA and behind-the-dish mounting of the rotor.

The SC-5014 complete home TVRO earth station lists for $3995.00.

For more information contact Gil. S. Cunningham, (319) 753-0121.

Robot Conference

"Robot Research, Developments and Applications in Canada" is the title of conference jointly sponsored by the Central Ontario Chapter of Robotics International of Society of Manufacturing Engineers and National Research Council of Canada.

This conference will be held at Delta Inn, Mississauga (Toronto), Ont. on September 20, 21, 1982.

A variety of technical papers and presentations will include topics on robot research and developments, applications, controllers, programming languages, sensory feedback, education and training.

Further details of the conference can be obtained from: RI—SME Conference Secretariat, 6535 Mississauge Road, Mississauga, Ont. Canada L5N 1A6.

Image Intensifier Tubes

The Light Sensing and Emitting Division of Varian Associates today announced a third generation of 18mm image intensifier tube products. The new generation gives an approximate threefold increase in white light sensitivity over the second generation tubes, significantly increasing the capabilities of the night vision devices in which they are used.

The second generation intensifiers required the light of a quarter moon, whereas the third generation can be used in overcast, starlight conditions. The initial starting sensitivity of the new device combined with an improved, hermetically sealed microchannel plate result in a longer lifespan for third generation tubes.

All three generation products are currently available, with 90 days lead time. For further information, contact: Varian Associates, LSE Division, 611 Hansen Way, Palo Alto, CA 94303, telephone (415) 493-4000.

Printer

Hi-G Incorporated has announced a new addition to its line of high-quality, affordable dot matrix printers. Designated "9/80PSF," the new 80-column model has been specifically designed for the requirements of forms printing.

Featuring a reversable tractor paper feed system and demand printing function, the HI-G 9/80PSF performs reliably and accurately with no forms waste or special forms required, reducing overall costs. With its graphics capability, it can accomplish oversized character presentations without a second pass or added programming.

Major performance characteristics include: 150 cps, bidirectional, logic seeking, 9 x 9 matrix, Centronics-compatible parallel, RS232C serial or current loop interfaces and a 9-wire ballistic-type printhead rated at 600 million characters.

For complete information write HI-G Co. Inc., Printer Products, 580 Spring Street, Windsor Locks, CT 06096.

High Current Power Supply

A new, double slot power supply is being offered which provides a choice of two switch-selectable DC voltages: 5 ± 1½V and 13V ± 1½V. It has a current capability up to 7.5 amperes at each voltage.

The WP-709 has two 3 digit LED displays for continuous monitoring of both voltage and current during application. A single knob permits fine adjustment of the voltages over the adjustable ± 1½V range.

The output is laboratory quality, ripple being less than 10mV peak to peak. Line and load regulation is better than 0.1%. Each output has adjustable current limiting up to 7.5A with instant pushbutton reset.

For more information, contact H.W. Cowan Canada Ltd., Box 268, Richmond Hill, Ontario L4C 4Y2, telephone (416) 773-4331.

Introduction To I-Ching

The *I Ching* came out of the far East even before transistor radios. If you're planning to build our I Ching computer, you may want to know why. Danny Bakan offers enlightenment.

IN SOME CIRCLES the *I Ching* (translated it means *Book of Changes*) is a common reference text for all life situations. At least a third of the world is aware of its validity as a valuable and useful work. But most electronics and computer enthusiasts in the western world, lost in their "Dragons and Dungeons" rulebook and up to their ears in diodes, have never heard of this vital work of Chinese wisdom. Not that there aren't connections between electronics, binary codes, modern physics and ancient Oriental mysticism.

In this issue of ETI you'll find an article on how to make and use the I Ching computer, basically an inovative method for randomly selecting one of the 64 hexagrams (six lined figures) of the Book Of Changes. The hexagram is selected in response to a question asked of the *I Ching.* Traditionally, *I Ching* has been used as an oracle and as a means of divination (foretelling the future and receiving advice). One asks a question of *the I Ching* as if the *I Ching* were a wise and informed person. Then, in a contemplative and meditative state of mind, one uses one of several methods to randomly select one or more of the 64 hexagrams. The hexagram is then examined, and the accompanying text is read and interpreted to form the answer of the question asked. The *I Ching* in this way is seen as a "living text". The book is considered as one would a person who is an avid conversationalist. The conversation can be on a cosmic scale or about trivia, about the colour of one's shoes or news of state. On all of these things the *I Ching* is considered a giver of information. The information is essentially contained within the lines of the hexagrams themselves. The commentary upon the hexagram in the form of written words is the interpretation of generations of Oriental contemplation upon the hexagrams and the lines of which they are made.

History

The *I Ching* is one of the prime examples of the genius of Oriental thought. Its antiguity dates back at least three thousand years. Confucious, who lived two thousand five hundred years ago, considered the *I Ching* even then to be an ancient text. It is told that he once said, "If additional years were added to my life I would give fifty to the study of the *I Ching*, and might then escape falling into great errors.". At a time when the Greeks, to whom Western civilization owes so much, were still living a semi-civilized nomadic lifestyle in the foothills of the Mediteranean, the Book of Changes was already established in its authority and antiguity. The text is probably the oldest we have in extant. When Emporer Chin Shih Huang Ti ordered all the ancient books destroyed in 213 B.C. he spared the *I Ching.* Since then, the Book of Changes has been used as one of the prime books of wisdom for both Confucian and Toaist thought for centuries.

The basic binary concept of the *I Ching* is said to date back to before the dawn of pre-history. It is said that the philosophies of the Book of Changes and the images of the hexagrams did not arise out of civilization, but civilization arose out of the sage's contemplation of the hexagrams. The hexagrams are made out of six lines which represent either "Yin" or "Yang". Yin is characterized as a broken line (- -). Yang is represented as a solid line (—). These two concepts and the dialectic they form is at the very foundations of Oriental thought.

Yin and Yang can be decribed in various word pairs: male/female, heaven/earth, creative/receptive, firm/yielding, etc... All existance consists of a fine balance between these two basic energies. The 64 hexegrams arise out of all the possible variations of combinations of Yin and Yang within a six lined figure. In his book, *Tai Cai Ch'uan and I Ching,* Da Liu writes:

> Each of the hexagrams consists of two 3-lined figures called trigrams. There are eight basic trigrams constructed from a combination of unbroken and broken lines. The trigrams, like the mathematical symbols *x* and *y*, can stand for many things. For instance, the trigram *Ch'ien* can mean heaven (the natural world), leader or king (the social realm), father (family relationship), head (part of the body), strength (quality), and other things as well. Combined in a hexagram, the symbols acquire a distinct composite meaning. Each line shows a different aspect of the situation pictured by the hexagram.
>
> The creation of the eight trigrams is attributed to Fu Shi, the legendary Chinese sage who reputedly lived during the age of

hunting and fishing around 5,000 years age. By studying and observing heaven, earth, animal tracks and his own body, he devised the broken and unbroken line as symbols of the fundamental nature of the universe. From these, he constructed eight trigrams, each of which stood for an aspect of nature, society, and the individual.
(*Tai Chi Ch'uan and I Ching*, Da Liu, Perennial Library, Harper & Row.

Yin and Yang do not represent good and bad in the way Western morals and philosophy tends to view the duality. Yin and Yang are equal energies. The Tai Chi diagram (Fig. 1) is the symbolic representation of Yin and Yang. As one can see, Yin and Yang are *of* each other. The black and the white define and create the other.

Originally, before the establishment of the hexagrams, when one consulted the *I Ching* the answer was in terms of a yes or a no as defined by either a solid or broken line. This was later expanded into four possible line pairs:

The lines of these pairs further differentiated the *I Ching.* The Yin or Yang line could now be defined as either "young" or "old". The young line is in transition to an old line; the old line is in transition to a young line of the opposite polarity. All lines are in a constant state of flux. All Yin lines are in transition to Yang lines, and all Yang lines change back into Yin lines. All the line pairs are constantly changing yet they are connected by an underlying pattern. The pattern represents eternal change. Like the phases of the moon, there is consistancy in the changes.

Out of this early development arose the concept of change, from which comes the title, "Book of Changes." All things and energies are in a constant state of eternal transition as represented by the hexagrams. Any or all lines in any given hexagram may be young or old lines. Since all lines are in transition to their opposite, each hexagram is in transition to another. According to the *I Ching*, this is one of the most fundamental truths in life; all things change. Change is one of the few things we can rely on. The text of the Book of Changes helps one to perceive where one stands in the cycle of change. Various hexagrams represent times of increase or decrease, preponderance of the small or the great, or whether it is a time for creative movement or receptive stillness. The *Superior Man* is the term the text gives to the one who is able to work with the changes of existance so as to bring prosperity and supreme success. The *Superior Man* is concerned for the well being of all things and energies in creation. He maintains his humbleness and his inner strength. The text of the *I Ching* points one to follow in his steps.

Questions

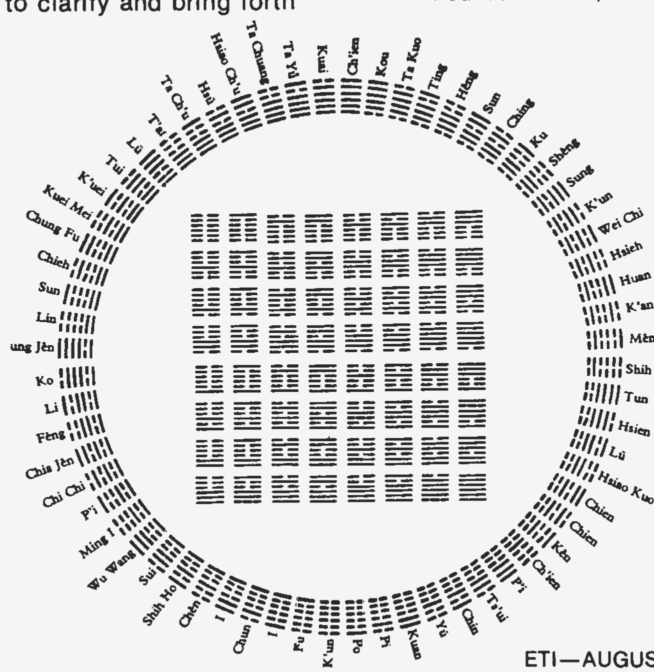
When one makes an enquiry of the *I Ching*, using either traditional methods such as the throw of three coins or the use of fifty yarrow sticks, or "updated" methods such as the I Ching Computer, the information required is contained within the lines of the hexagram (or hexagrams, in the case of moving lines) itself. The balance of Yin/Yang energies in each hexagram gives rise to a unique symbolic meaning. The text of the Book of Changes is to clarify and bring forth the meaning of the hexagram itself. It is then for the reader to interpret the text for the specific situation, although many have found the response to the question asked to be awesome in its clarity. Although its validity as an oracle may be doubted by some, the powerful imagery and complex symbolism of this ancient text cannot be denied.

The only true way to experience the *I Ching* is through direct contact. It contains much wisdom and complicated subtlety. The most widely recognized English translation is the Richard Wilhelm /Cary F. Baynes version. This also contains the famous forward by psychologist Carl Jung. But the best teacher for the student of the Book of Changes is the *I Ching* itself.

The Changes is a book
From which one may not hold all of...
Alteration, movement without rest,
Flowing through the six empty places;
Rising and sinking without fixed law,
Firm and yielding transform each other.
They cannot be confined within a rule;
It is only change that is at work here...

They also show care and sorrow and their causes.
though you have no teacher,
Approach them as you would your parents.

From Book Two of the *I Ching* "The Great Treatise" pg. 348-9 Wilhelm/Baynes translation
Princeton University Press
copyright 1950 by Bollingen Foundation Inc., N.Y.



I-Ching Computer

PROJECT

The I Ching is older still than even Pierre Trudeau's last rational thought (and probably as hard to understand). For a more complete explanation of the background for this project, consult page 22.

DUE TO THE mathematical and essentially binary nature of the I Ching, the medium of digital electronics is ideal for generating the random hexagram patterns with the authentic probability structure of the yarrow stalks. Also, by using solid state indicators, a visual display taking the form of the original Chinese hexagram can be produced.

Each line of the hexagram can be in one of four states (as described above); a moving (old) yin, a moving (old) yang, a young yang or a young yin. In terms of their probabilities, all six lines can be considered as totally independent of each other.

A moving yin has a probability of occurrence of 1/16, a moving yang 3/16, a young yang 5/16, and a young yin 7/16. Adding these probabilities in different ways we find a probability of ½ that a line will be yang (ie there is a 50-50 chance between yin and yang), and a probability of a ¼ that any line will be moving.

On the I Ching generator the hexagram is displayed on an array of red rectangular LEDs; an additional column of green LEDs indicates any moving lines that are present. There is a push-button which must be pressed six times to create the hexagram; each press randomly throws up one line, with the probabilities described above being derived from a fast binary counter and logic decoding gates.

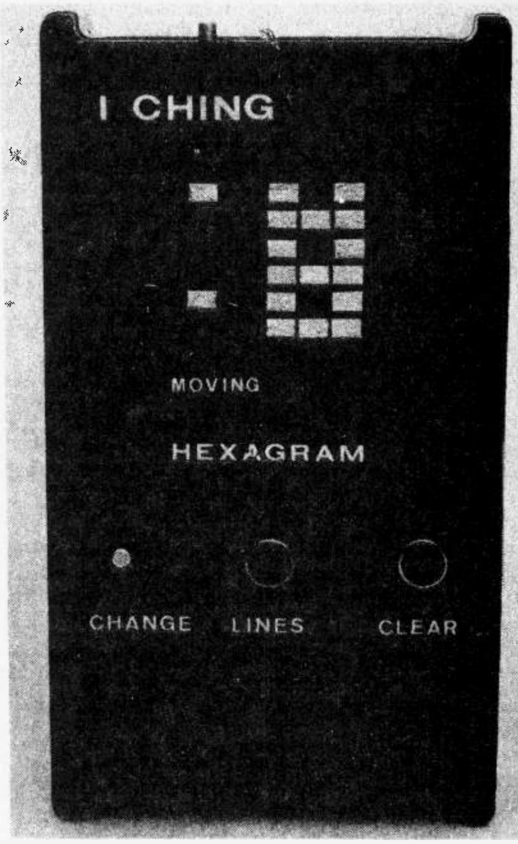
The lines remain invisible until the last one is complete; the display then illuminates the entire hexagram pattern. A 'clear' button is provided for removing the hexagram, enabling further hexagrams to be created, but it is not considered advisable to cast doubt on the oracle's answers by re-questioning. A frivolous attitude to the I Ching will result in meaningless answers to your questions. The hexagram that is cast can be found in the Book of Changes, and the test that accompanies it should be carefully studied before interpretation. There are further descriptions for each line that may be moving; these should be studied also. Finally, if moving lines are present, the 'change' switch should be operated and any lines that are moving will change into their opposite, thus forming a new hexagram. This hexagram should also be looked up to complete the prediction.

Construction

By using two separate PCBs the machine can be made quite compact, most of the room being taken up by the battery. A smaller battery cannot be used as the current consumption with all the LEDs on is about 40 mA. As these PCBs are not double-sided there are quite a few links which must be soldered in first: 11 on the logic board and six on the display board.

When soldering in the LEDs on the display board take a very careful look at the internal photo and the overlay diagram. This display produces the actual form of the hexagram; the LEDs should all rise to exactly the same height (1.5 cm from the board surface to the top of the LED). Observe also their polarity; all the cathodes should be on the right.

The rest of the display board is straighforward, but it is worthwhile double-checking the transistor pinouts before soldering them all in circuit (perhaps you should build an ETI component tester). A length of ribbon cable can then be wired to the nine lead-out points as marked on the overlay.



When assembling the logic board don't forget to use IC sockets; there is adequate room on the board for these. One problem area may be the zener diode, ZD1. The holes for this diode are very close to the socket for IC7. On our board the end of the socket was filed off. Make sure that both the socket and the diode will fit before soldering them in.

Twisted pairs of wires for connecting the switches should be

TABLE 1

The Eight Trigrams with their commonly accepted equivalents

Chinese name	Chinese meaning	Natural element	Corresponding direction	Moral or Mental quality
Ch'ien	heaven	heaven	NW	strength
K'un	earth	earth	NE	weakness
chen	activity	thunder	E	being active
sun	bending	wind	SE	flexibility
K'an	pit	water	N	being in danger
li	brightness	fire	S	elegance
kên	to stop	mountain	SW	firmness
Tui	pleasure	collection of water	W	joyfulness

Table 1. the commonly accepted equivalents and cardinal points according to King Wen.

soldered as indicated on the overlay diagram. The switches PB1, PB2 and SW1 should be temporarily connected up for testing purposes when assembly is complete. The leads of the ribbon cable from the display board should now be wired to the corresponding points marked on the logic PCB.

Test Patterns

The circuit is now ready for testing, and this is easier if it is done before mounting the boards in the case.

Connect a 9V battery to the supply leads and operate the 'clear' switch PB2. The display should be completely blank. Now press the 'lines' switch PB1 six times; on the sixth press the display should illuminate in a random pattern. The two outside columns of red LEDs should be fully illuminated, and the centre column will consist of any combination of on or off LEDs. Some of the green LEDs might be on; if so, then operating the 'change' switch will change the state of the centre red LED in the corresponding row (from on to off or vice versa). Pressing the clear switch again should blank the display ready for another pattern.

When testing the prototype machine it was discovered that the switching threshold of the Schmitt trigger gates (IC1) can vary considerably from one pack to another. This affects the frequency of the main clock built round IC1d, and the frequency of this clock will affect the brightness of the outside columns of red LEDs. Our clock had a frequency of 6 kHz with the first chip we tried, giving a well-lit display, but only 800 Hz with a different chip, causing rather dim LEDs. If the brightness of the outside LEDs does not match the centre column LEDs, then alter the value of C6 until they are of uniform brightness.

If all is well the circuit boards can now be assembled into the case.

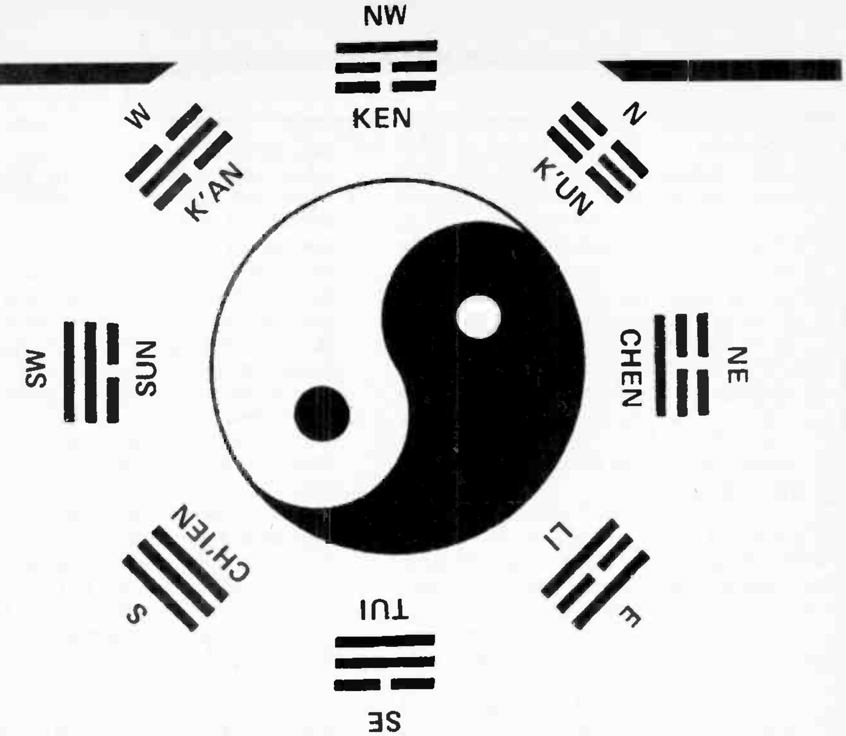
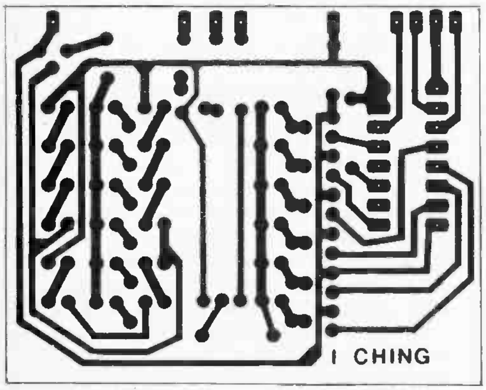
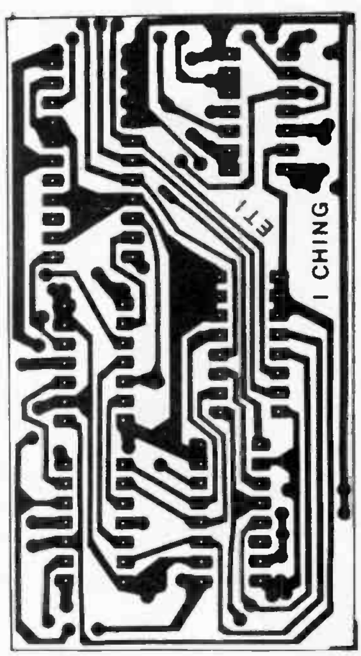


Fig. 1 The arrangement of the eight trigrams according to the legendary emperor Fu Hsi. The diagram is not upside down; south is traditionally shown at the top.





PARTS LIST

Resistors (all ¼W, 5%)

R1	100k
R2,3	10k
R4,6	47k
R5	68k
R7,8,12,13	4k7
R9	270R
R10,11	220R
R14	1M0

Capacitors

C1	22n ceramic
C2,3,6	1n0 ceramic
C4	2n2 ceramic
R5	10n ceramic
C7	100n ceramic
C8	100u 10V tantalum

Semiconductors

IC1	4093B
IC2	4520B
IC3	4011B
IC4	4053B
IC5	4070B
IC6	4051B
IC7	5101
Q1-6,9	MPS6523
Q7,8	MPS6515
ZD1	6V2 400 mW zener
LED1-6, 13-24	rectangular red LED
LED7-12	rectangular green LED

Miscellaneous

PB1,2	push-to-make switch
SW1,2	miniature slide switch

PCBs; battery and clip.

HOW IT WORKS

The overall circuit operates in two distinct modes. Initially, the user presses the 'lines' button PB1 six times and during this time two random binary bits are written into six sequential address spaces of a memory. On the sixth press, after recording the last two bits, the circuit switches to its other mode of operation. Here, a binary counter is clocked continuously and its outputs are used to scan the addresses to the memory. The previously recorded data is read out to a multiplexed LED display scanned by these same address lines. Essentially the two modes are; build up the hexagram pattern, then display it.

The line labelled 'control line' on the circuit diagram is used to switch the operating mode. This line is taken from the output of IC3a, a NAND gate whose inputs are wired to the B and C outputs of the slow binary counter IC2a. Thus the line is normally logic high and will go low when IC2a reaches a count of six. This control line is used to switch the address lines of the memory (IC7) and display decoder (IC6) from the slow counter IC2a to the fast counter IC2b. This is achieved with IC4 (a triple one-of-two CMOS switch) whose switch-select lines on pins 9, 10 and 11 are wired to the control line.

When power is first applied to the circuit, the slow counter IC2a is reset to all zeroes by the C4/R4 network. PB1 is the 'lines input' button. When pressed, it takes the input of IC1a (pin 12) high; this input is normally held low by R1, with C1 providing switch debouncing. The pin 13 input of IC1a will be held high by the control line; thus the output on pin 11 will go low while the input switch is pressed. This signal must initiate the following actions: first the random bit generator must be stopped, allowing the data to become stable, then this data must be written to the memory, and finally IC2a must be clocked to its next count position.

The random bit generator is implemented by driving the binary counter IC2b from a 6 kHz clock and decoding the four bit output with the logic gates IC3b, IC3c and IC5a. This provides two bits with the correct interdependent probabilities of occurrence; the truth table for these gates (Table 2) shows how these probabilities are derived. For example, when the counter is stopped, the D output has a 50-50 chance of being either high or low; this is the yin-yang indicator. The output of IC3c on pin 11 determines whether the line is moving or not; a logic low signifies a moving line. The counter is stopped by disabling the clock oscillator built around Schmitt trigger IC1d, C5 and R5. The pin 9 input to IC1d is wired to the push-button signal on pin 11 is high and disabled when low (i.e., when PB1 is pressed).

The two random bits which are selected when the clock is stopped are fed directly to two data inputs of the memory IC7 (a CMOS 5101). The data will be stored when the write line is wired to the output of IC1c where a 10 uS negative-going pulse arrives 10 uS after the clock has been stopped.

This pulse is again derived from the logic low push-button signal; the delay is provided by R2, C2, and Schmitt inverter IC1b, and the short negative-going pulse by C3, R3, and inverter IC1c. After the data has been stored, the positive-going edge of this same pulse is used to clock the slow counter IC2a which sets the next address for writing to memory.

This circuit action takes place on each operation of the switch, the memory location being incremented when the button is depressed and the free running clock generating random bits when it is released. On the sixth press of the button, when the last line of the hexagram is written to memory, IC2a then clocks to count 6, thus switching the control line from high to low.

The control line puts a low on the pin 13 input of IC1a, so inhibiting further operation of PB1, and allowing the fast clock to oscillate continuously. The control line also enables NAND gate IC3d via inverter IC5b; and by placing a logic low on the inhibit pin of IC6, the diplay decoder is also enabled. These controls allow the display to illuminate.

The address lines for the memory and display are now switched to the A, B and C outputs of the binary counter IC2d. For each three bit binary address that is routed through switch IC4 from the counter IC2b, one sequential output of the decoder IC6 is selected in conjunction with the corresponding memory word. (The 5101 chip is a 256 word by four bit memory, but in our application only six words of two bits are used; it's still the cheapest and simplest method though!)

The 1-of-8 line analogue decoder IC6 connects the base of the corresponding PNP transistor (Q1-6) via R8 to ground; this switches on the transistor which in turn takes the anode of the associated red and green LEDs to the positive supply rail.

The two bit memory word selected by the address lines A5, 6 and 7 of IC7 is available on the data output pins 10 and 12.

The moving line information from pin 12 is fed via inverter IC5d and R13 to the base of NPN transistor Q8. The collector of Q8 is connected via R11 to all the cathodes of the green LEDs (LEDs 7-12). Thus when a moving line is present the output of IC5d will be high, turning on Q8 and providing a ground return for the selected LED.

A yang line is represented by a logic low on the data output pin 10; this provides one input to an EXOR gate IC5c. The other input is normally held high via R14, which makes the gate act as an inverter, thus driving Q8 and the red LEDs in the same manner as the moving line indicators. Since the address lines are driven by a continuous binary count, each line of the hexagram is repeatedly displayed in turn, giving the effect of acomplete display. The outside columns of red LEDs must also be on continuously to complete the hexagram pattern. They are driven by a pulse waveform derived from the main clock using C6, R6 and IC3d to produce a train of negative-

Inside the I Ching computer. Everything fits in neatly if the recommended case, battery and PCBs are used.

going pulses. These pulses turn on Q9 for a short period in each clock cycle, allowing a current burst to illuminate the series-parallel combination of LEDs (LEDs 13-24). Driving the LEDs in this way reduces the current consumption required for the same brightness.

SW1 is the 'Change' switch; when closed it has the effect of turning any moving lines into their opposite state; yin for yang and vice versa. The 'moving line' data output on pin 12 of IC7 will be conected to one input of EXOR gate IC5c, which then acts as a logic-level-controlled inverter, to produce the desired effect.

To create another hexagram the 'RESET' switch PB2 can be pressed. This resets the counter IC2a back to zero, which is turn switches the control line high again, blanking the display and returning the circuit to its first operating mode. The 'Lines' push-button now becomes operational again, allowing new hexagrams to be determined.

TABLE 2

	COUNTER OUTPUTS				GATE CONNECTIONS		
	D	C	B	A	E	F	G
	0	0	0	0	1	1	1
	0	0	0	1	1	1	0
	0	0	1	0	1	1	1
	0	0	1	1	1	1	0
YANG	0	1	0	0	1	1	1
	0	1	0	1	1	1	0
	0	1	1	0	0	0	1
	0	1	1	1	0	0	1
	1	0	0	0	1	0	1
	1	0	0	1	1	0	1
	1	0	1	0	1	0	1
	1	0	1	1	1	0	1
YIN	1	1	0	0	1	0	1
	1	1	0	1	1	0	1
	1	1	1	0	0	1	1
	1	1	1	1	0	1	0

D = 0 indicates yang, D = 1 indicates yin.
G = 0 indicates a moving line

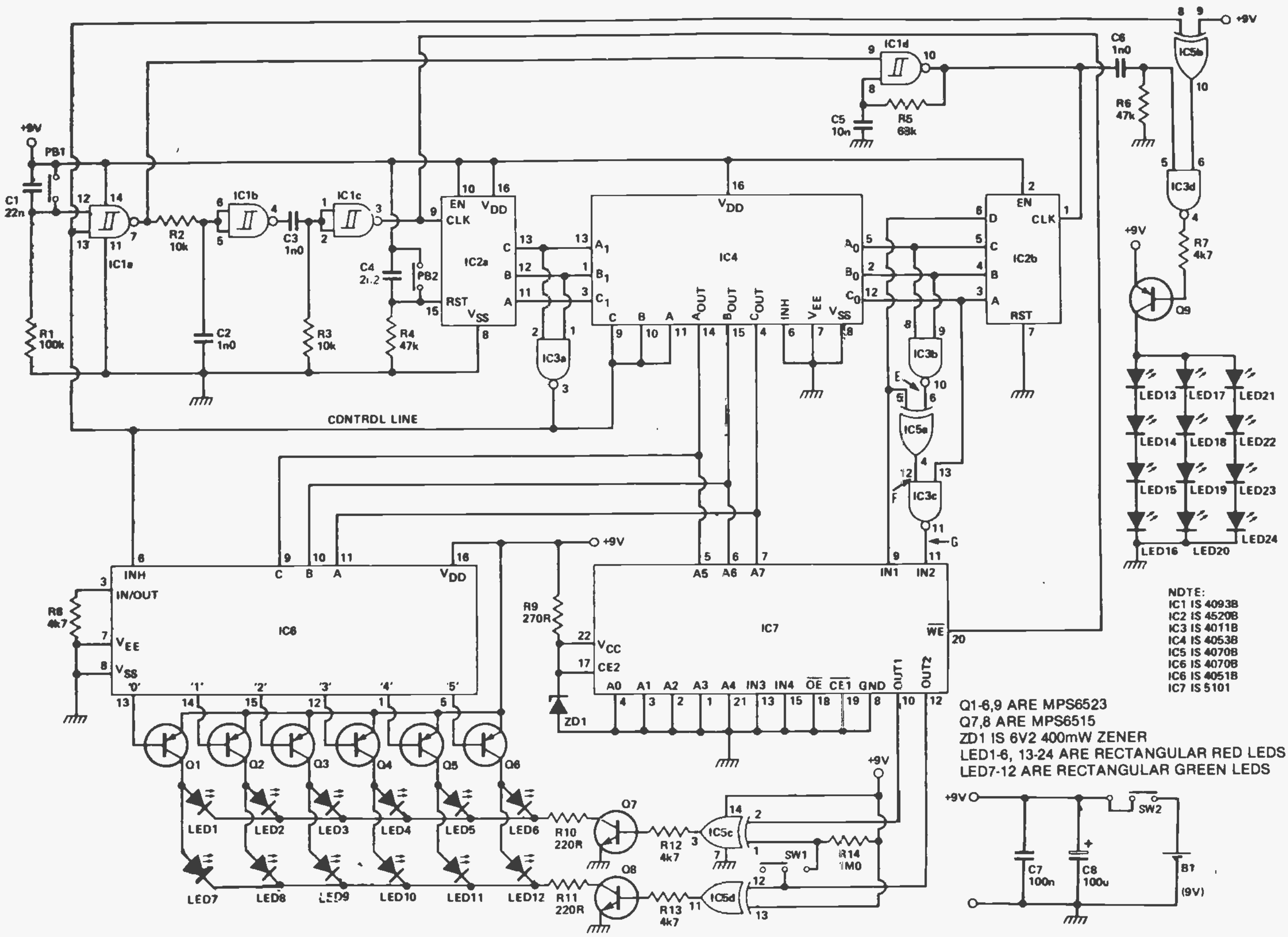


Fig. 2. (Above) Complete circuit diagram of the I Ching oracle.

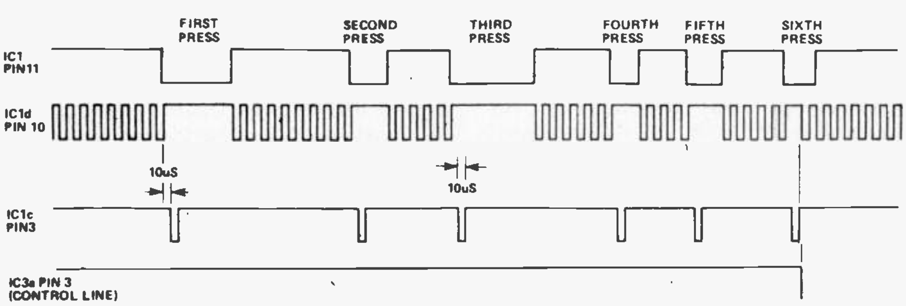


Fig. 3 (Left) Timing diagram for the logic.

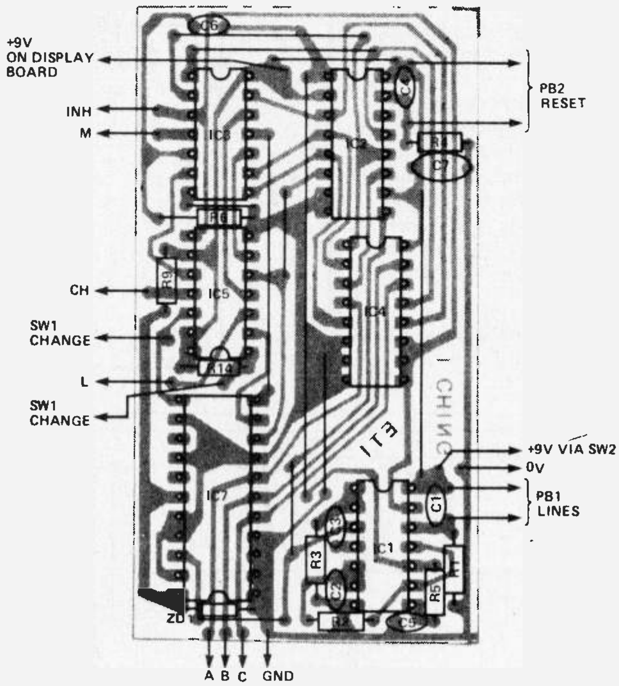


Fig. 4 (Above) Component overlay for the main board.

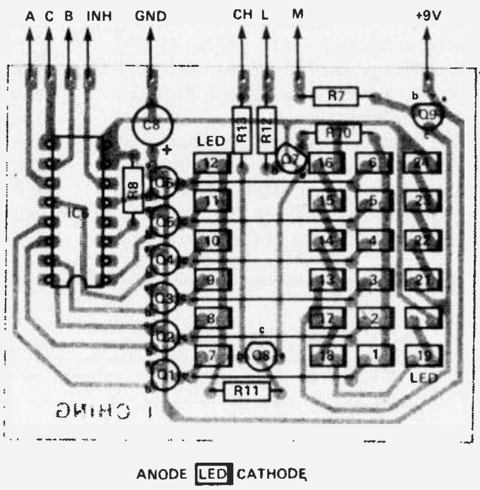


Fig. 5 Component overlay for the display board.

Continued from page 20

current is bled out of the device through a circuit. If the light's frequency does not excite the first layer, it passes into the second layer, where it will excite that layer to produce an electrical current. This current is in turn bled out of the device through a second circuit. Thus, this device can demultiplex light of two frequencies.

When a signal reaches the end of a circuit, it has to be detected. There are a number of ways this can be done, one of the most elegant being the phototransistor.

In this device, a lightwave is absorbed by a vertically layered device consisting of Indium-Phosphide and Indium-Gallium-Arsenide. As the light is absorbed in the bottom of the device electrons are removed and bled out of the system leaving holes. These holes then produce current proportional to the light energy initially received.

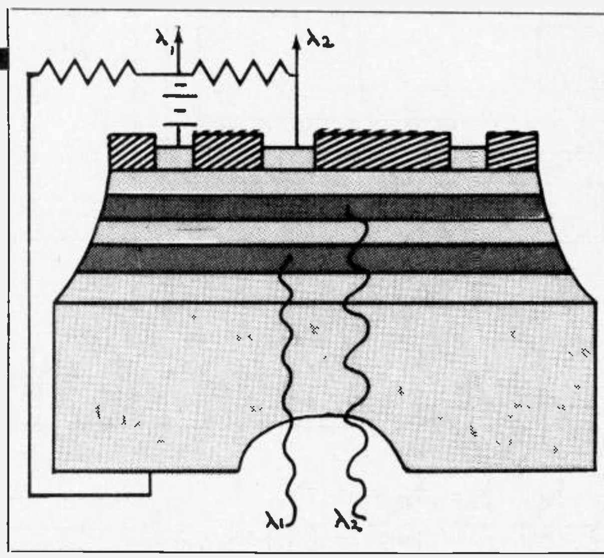


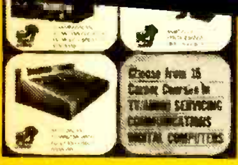
Fig. 8. Photodetector. This integrated circuit, on an indium phosphide substrate, detects light (entering from the bottom) of two different wavelengths (X_1 + X_2) simultaneously. The circuit separates the signals and converts them into electrical form for further processing.

The Practicalities

While the foregoing is interesting in itself, it can unfortunately be considered as yet just another piece of 'gee whiz' science. The difficulty facing integrated optics researchers is that they are still in their laboratories and have as yet not turned over their devices to the commercial arms of their corporations or governments. It is all very well for Japanese researchers to talk of computers run on lightwaves, but those of us sometimes misled by scientists' predictions of the potential of various technologies may be tempted to joke about the candlepower of a computer's RAM!

While it would be misleading to suggest that integrated optics will have a comparable effect on the everyday world as the IC, one would not be wrong to suggest that the speeds to which we have become accustomed in computer technology will be substantially shortened with the large scale implementation of integrated optics.

Furthermore, because integrated optical devices (like other fiber optic devices) can operate at wide temperature and humidity extremes, and are impervious to environmental background radiation, the cost of large-scale computing devices operating on this technology will become substantially cheaper.



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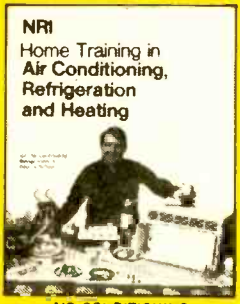

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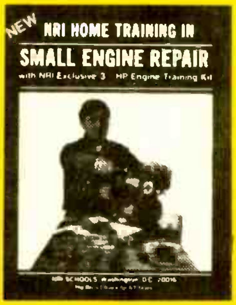

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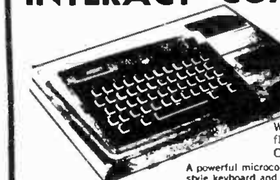

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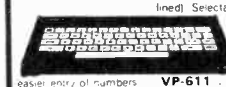

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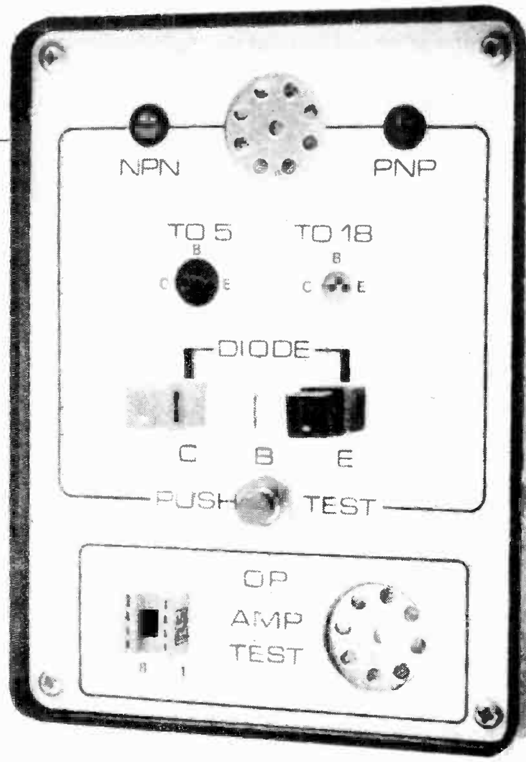
Semiconductor Tester



Check out your semiconductors with this cunning but simple project. It's brilliant, even if we do say so ourselves (and we do). Design by Rory Holmes. Development by Tony Alston.

When you've completed your latest design, a brilliant project which not only solves the world energy crisis but proves that Einstein made a small mathematical error as well, it can be very frustrating if you rush to your junk box and discover that you can't breadboard the circuit because the markings have rubbed off your transistors. To help with this problem we've come up with our latest design, a brilliant project which tells you which lead is which, whether the transistor is OK, what polarity it is and its approximate gain. Diodes and LEDs may also be tested, and for good measure we've thrown in an op-amp checker. The world energy crisis you'll have to figure out for yourself.

Construction

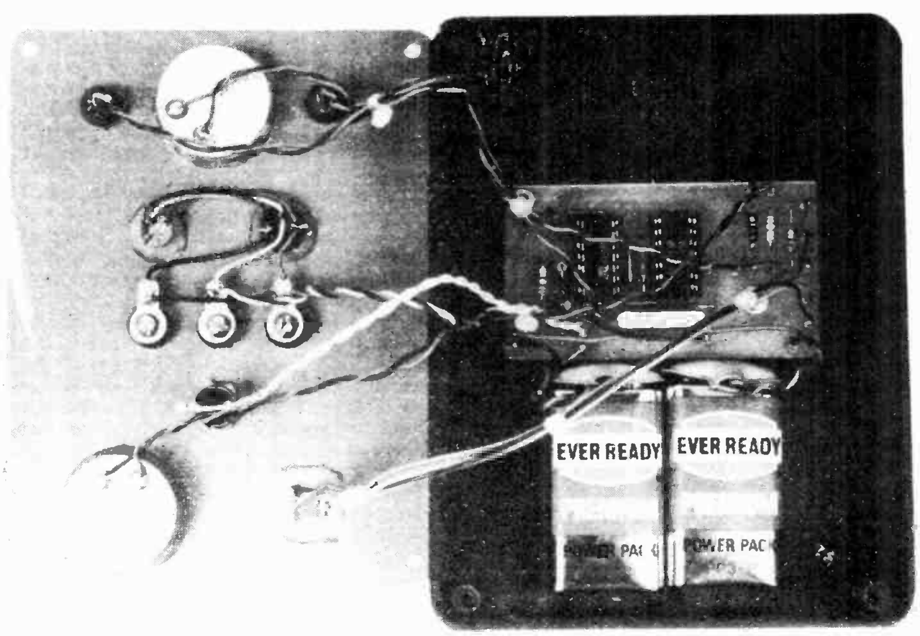
Assembly is straightforward if the recommended PCB is used. Make sure to orientate IC1, IC2, D1 and D2 correctly and use sockets for the ICs to avoid damage by soldering them. Remember to put the three wire links on the PCB!

Although there are quite a few off-board connecting wires, these should not be a problem if the circuit diagram, overlay and internal photos are studied carefully. Only one transistor test socket is shown on the circuit diagram but several types can be wired in parallel (as we did) to accommodate various types of transistors. The T0-5 and T0-18 types were epoxied to the front panel, as was the eight-pin DIP socket for the op-amp tester. Three insulated test terminals were also included for testing other types of transistors, diodes and LEDs.

TX1 and TX2 are crystal mike inserts. Warning; most inserts have one terminal connected to their case and as we've used a metal front panel for this project, TX2 should be insulted from this panel. Otherwise, TX1 and TX2 will be common linked and as the circuit diagram shows that TX1 is connected to 0V, TX2's connection to IC1, IC2 and C2 will be incorrectly taken to 0V. We got round the problem when we glued a circular fibre washer to one insert before fixing it to the front panel.

Testing Times

Transistors are plugged into the appropriate socket, and any type may be tested; NPN, PNP, small signal or



power. No selection of NPN or PNP is necessary as this is done automatically by the tester. When the push-to-test button is pressed, an intermittent tone is produced. The frequency of the tone is proportional to the gain of the transistor, giving a rough guide. The LEDs also flash alternately in time with the pulsing tone; the LED that is on at the same time as the tone indicates the polarity of the transistor. If the transistor has no gain or is open circuit there will be no tone, although the LEDs will still flash. If the transistor has a large leakage current or is shorted, there will be a 'two-tone' sound. If the transistor has been inserted the wrong way there will be either no tone or a very high-pitched tone.

Diodes and LEDs may be tested across the 'C' and 'E' terminals. If it is OK, the LED under test will flash, accompanied by an intermittent high-pitched tone and flashing indicators. Ordinary diodes require a series resistor (any old value) and should then produce an intermittent tone and flashing LEDs as before; the coincidence of flashing LED and tone indicates the anode.

Op-amps are plugged into the IC socket and no push-switch is required; power is only applied when the IC is inserted, and a good IC produces a continuous tone from the second insert

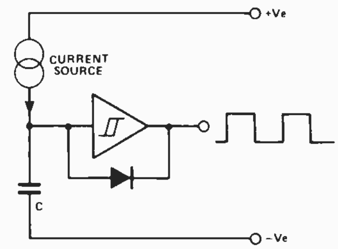


Fig. 2 Principle of the CCO.

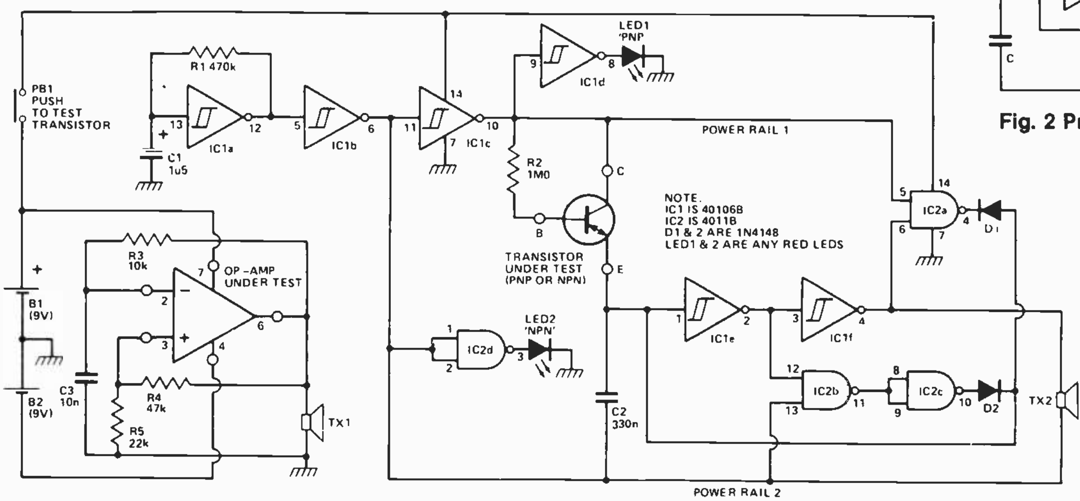


Fig. 1 Circuit diagram of the Component Tester.

PARTS LIST

Resistors (all ¼ W, 5%)

R1	470k
R2	1M0
R3	10k
R4	47k
R5	22k

Capacitors

C1	1u5 25V tantalum
C2	10n disc ceramic
C3	330n polyester

Semiconductors

IC1	40106B
IC2	4011B
D1,2	1N4148
LED1	0.2" red LED
LED2	0.2" green LED

Miscellaneous

PB1	momentary push-button
TX1,2	crystal mike inserts

2 9V batteries and clips; transistor sockets; IC sockets; case to suit.

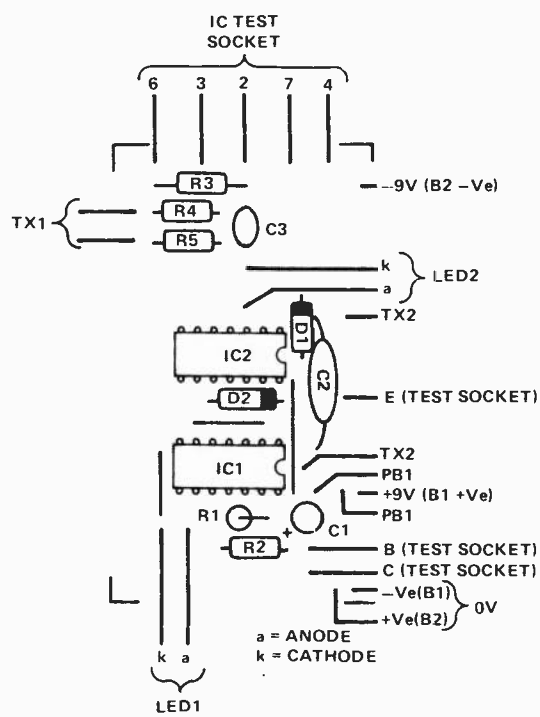
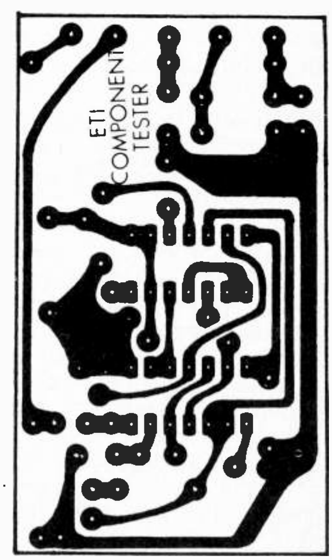


Fig. 3 Component overlay.



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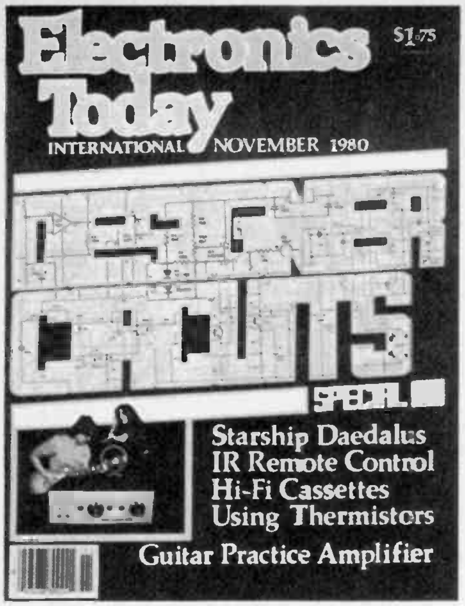
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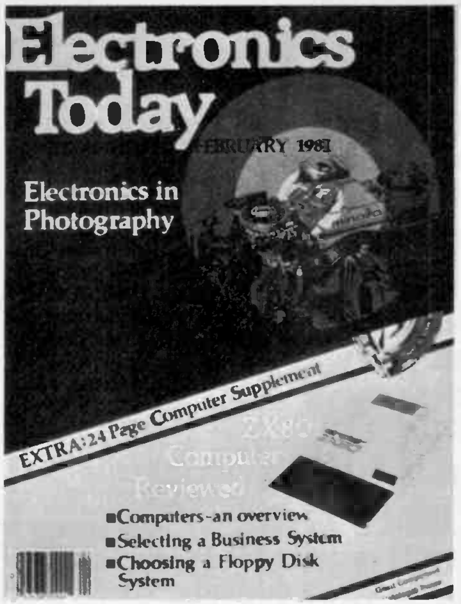
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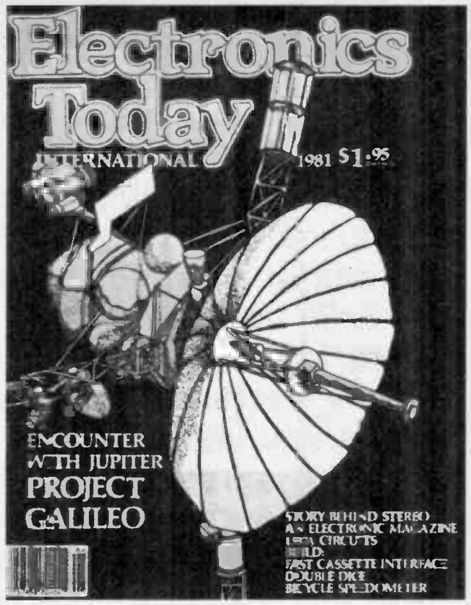
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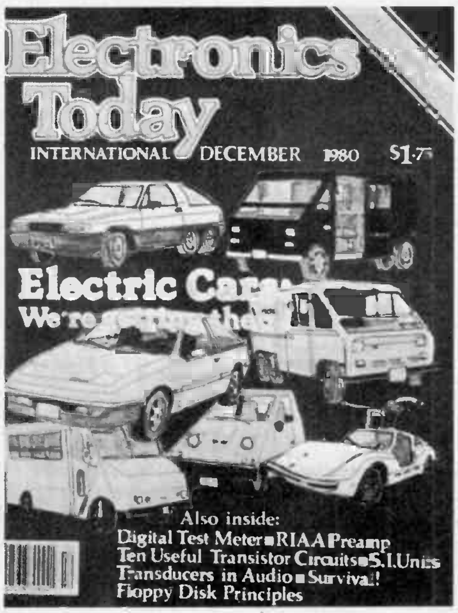
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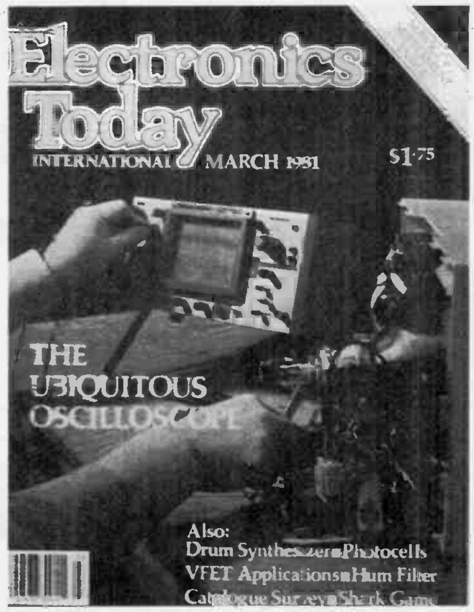
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This survey is completely confidential, and we'd prefer that you don't put your name on it. If you have any additional comments that you can't fit in the space provided, please attach a separate sheet of paper.

Help us to improve ETI.

A The Magazine

1. Please rate this month's features on a scale of 1 (abysmal) to 10 (splendid).

Feature	Read	Not Read	Score
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2. Please rate our regular features, also on a scale of 1 to 10

Feature	Score	Comments
News Digest		
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3. Please indicate, in order of preference, the types of projects you'd like to see, with 1 being foremost. Don't use the same number twice.

_____-Test equipment
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Complex projects
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B Computers

There is a great deal of interest in these things; we'd like to know more about yours. If you are not interested in computers, do not be concerned that we have a lot of questions on this: it does not mean we are planning any shift of emphasis. We already have (from previous surveys) a lot of data on non-computing interests.

What do you think of ETI's current coverage of computing?
☐Too much ☐About right ☐More, please

Do you own a computer? ☐Yes ☐No ☐Plan to buy
If so, which;

☐TRS-80 Model I
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☐Apple II
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☐KIM
☐PET
☐CBM
☐VIC-20
☐ATOM
☐Sinclair ZX-80
☐Sinclair ZX-81
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☐Osbourne
☐Imsai
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Other (Please Specify)____________

How many K of RAM are on your system? ____________

If you own a computer, how many people other than yourself use your computer? ____________

READER SURVEY

Survey

Do you own	Yes	No	Plan to buy
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8 inch disk	☐	☐	☐
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Daisy Wheel printer	☐	☐	☐
Modem	☐	☐	☐
Expansion RAM	☐	☐	☐
Software			
Visi-calc (or similar)	☐	☐	☐
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Wordstar (or similar)	☐	☐	☐
Languages/Operating Systems			
MBASIC (Interperter)	☐	☐	☐
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FORTRAN	☐	☐	☐
CP/M	☐	☐	☐
ASM (or other assembler)	☐	☐	☐

What do you use your computer for? (Check any boxes appropriate)

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☐ Graphics
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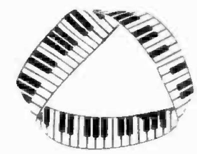
Synthesizer I

This month, the beginning of the ETI Modular Synthesizer project. . . Switch On some Bach (or Brahms. . . or the Grateful Dead. . .) By Steve Rimmer



WE LOOKED AT several approaches in designing the ETI synthesizer. All revolved around the E*u* dedicated synthesizer chips, as these handle all the tricky bits which otherwise require legions of trim pots. We eventually chose an entirely modular format as it offers the most flexibility, and should be able to do the most stuff. Readers interested primarily in performance synthesizers should be able to arrange these modules into "normalized" switching patterns. (If you do this, though, you're on your own; we cannot provide advice or information on other configurations).

All the modules in our prototype are built on Hammond steel panels, most being 4 X 6 inches. The jacks are all ¼ inch phone jacks. This results in a rather large synthesizer, to be sure, and readers who are after compactness can probably use mini-phone jacks, miniature pots and panels a quarter of the size. However, our choices have the advantages of easy wiring, easily available panels and very durable connectors.

The first module we'll be looking at is the Voltage Controlled Oscillator, or VCO. This is the most critical component of a synthesizer, as any weirdities in its response will manifest themselves in the intonation of the keyboard. Ours is based around the E*u*2030 chip, which, while ghastly expensive, is easily worth whatever it costs. The result is a first class VCO that's better than most of the ones found in them newfangled store-bought systems.

Buylines

Most of the parts are pretty easy to get. A few are real nasty. The VCO chip is being supplied by Exceltronix, 319 College Street, Toronto, Ontario, M5T 1S2, as is the TEMPCO resistor. *Buy 'em quick!* Once they're gone, there may or may not be any more, and E*u* does not, at present, have a regular Canadian distributor.

Exceltronix also sells AP products for the PSU connectors.

We recommend that you assure that you can get the difficult parts before you begin construction of this project. Please don't contact us for alternate parts sources; if we find 'em, we'll publish 'em, but, if you don't see 'em, we ain't got 'em. And that's the truth, pardner.

Construction

The VCO is quite easy to get together. If you want to use our panel layout, keep in mind that the PWM pot is a two section concentric deal, or drill an extra hole for two singles. We bought a box of H.H. Smith angles to bolt the boards to the panels; this is imminently worthwhile.

Stuffing the board should be fairly easy. Do all the usual ritual; make sure the diodes are in right. Take a lot of care wiring the panel to the board. There are a lot of wires, and it's real easy to get them tangled. We managed to blow a regulator in the PSU doing this.

The power connects are just metal pins spaced at a tenth of an inch. The best trip is to get AP headers and cut three of them off. Similarly, the power cables can be made with AP female headers. Note that the PSU pins on the various module boards will not always correspond to the ones on the PSU board, so the interconnect cables must be made up carefully. Also, note that the cables do not have an inherent polarization, and can be stuck on the wrong way at either end. . . which will probably cause the module to fry. Mark both the PSU and the modules as to connector positions, and check everything twice.

Once the module is together, before the chips are in, power it up and make sure that the correct polarity and voltage appears at the various socket pins. If all is well, power down and plug in the ICs.

Tunes?

With the VCO running, you should be able to get the appropriate waveforms out of it on a 'scope. . . assuming you have a 'scope. If you feed the outputs into an amplifier (turned way down), you should get sounds, probably highly distorted unless you attenuate the signals quite a bit. We've yet to get anything but the intended waveforms out of this thing, so if you get a tone on all the jacks, you're laughing.

Touching the control voltage jacks with your finger should induce enough hum into the CV input to vary the pitch of the tone a bit. If this happens, the CV inputs are cool too.

HOW IT WORKS

The 2030 chip handles most of the oscillating and control voltage processing; the all-important exponential converter is in there, assuring thermally stable transistors.

The two dual op amps are simply buffers. The trimmer in the feedback circuit of the CV input pot allows its gain to be varied. The trimmer associated with the triangle buffer permits its offset to be adjusted to place the triangle waveform in the centre of its swing.

The sine shaper consists of a CA3080 OTA used as a level shifter and clipper and a buffer with some high frequency limiting to remove the upper harmonics of the clipped triangle. This results in a pretty fair approximation of a sine wave.

It isn't really worthwhile adjusting the volts per octave and the high frequency trim pots at this point, as it becomes much easier once you've got a working keyboard. . . this to come, probably next month. However, the waveform controls can be twiddled now.

Getting the waveforms perfect will entail the use of a 'scope, although, as it goes, if you can't hear your error it's probably good enough, and un-scoped souls may get by tuning by ear.

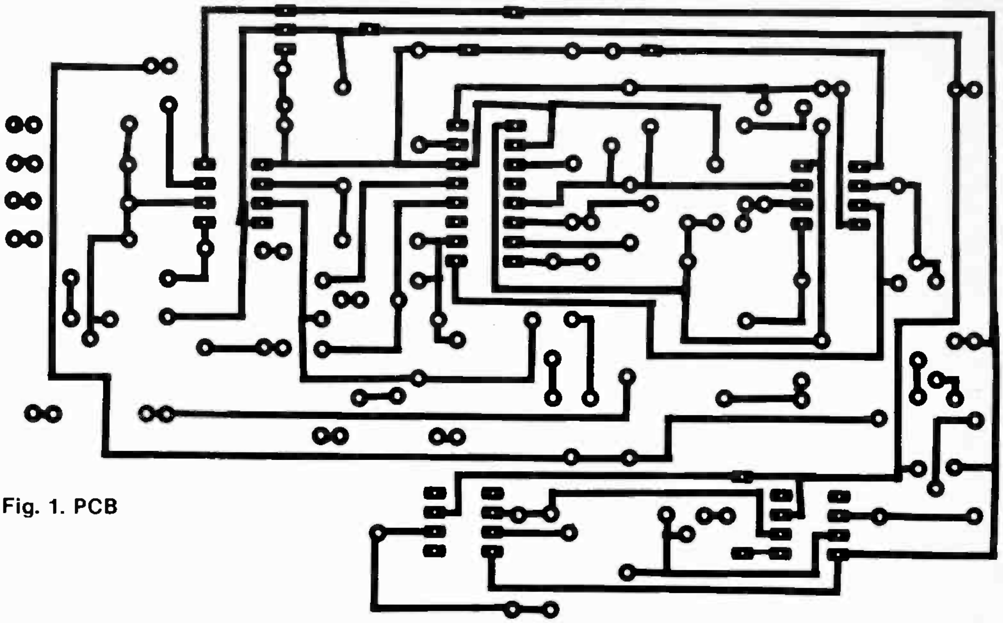
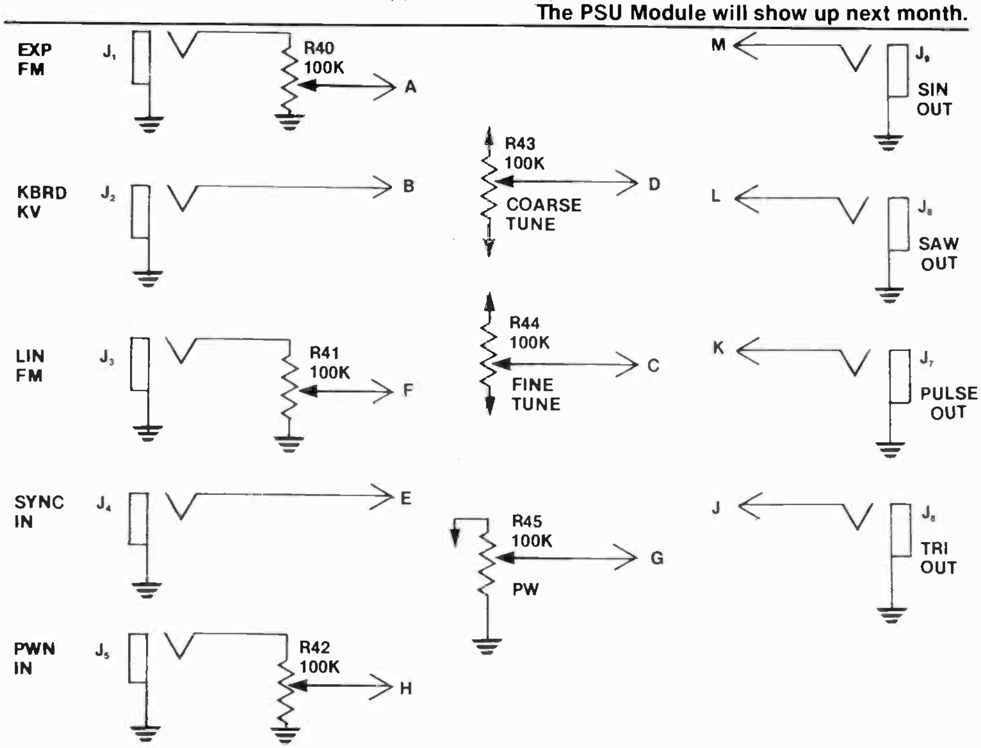


Fig. 1. PCB

First, adjust the triangle for symmetry. This will be the point between clipping (or going spikey) on both the top and bottom of the waveform. Next, do the second harmonic trim of the sine wave. This will entail having the third harmonic trimmer up most of the way, which will cause the 3080 to clip. Adjust the second harmic trimmer for symmetrical clipping, then back off the third harmonic trimmer 'til the waveform is at its maximum amplitude before clipping. The sine wave has about three percent THD when it's properly set up, which is fairly meaningless for a single tone. If you need a purer tone (assuming you can tell the difference), you can run it through a VCF.

Obviously, aside from frequency sweeps and suchlike, you can't do much with an unadorned VCO. You may, however, want to take the time 'til the next month to build a couple more. Three of them makes for a fairly powerful instrument, and provides for a lot of chorusing and polyphonic stuff once you get some bits to do all this with.

NOTE:
The PSU Module will show up next month.



PARTS LIST

Resistors

R1	2K2
R2	257K 1%
R3	10M
R4	100K 1%
R5,17,18,35	100K
R6	47K
R7	90K9 %
R8	20K TRIM POT*
R9	54K9 %
R10	1K0 3600 ppm TEMPCO (see buylines)
R11	121R 1%
R12	470K
R13	2M2
R14	1M5
R15	10K TRIM POT*
R16	150K
R19,20	22K
R21,22,30,33 34,37	1K
R23	15K
R24	7K5
R25,38	47K
R26,31,32	100K TRIM POT*
R27	10K
R28,29	20K
R36	25K
R40-45	100K POT

Capacitors

C1,4,5	1000 pf
C2	100 pf
C3	.1 uf
C6	22 pf
C7,8	.5 uf

Semiconductors

D1,2	1N914
IC1	2030 (see buylines)
IC2,3	LF353
IC4	CA3080E
IC5	LM307

Miscellaneous

Hammond panel 1431-8 Angle brackets
H.H. Smith 1446
¼ phone jacks (5)
PSU Pins
*The PCB is designed for trimmers with a TO-5 package style, e.g. Bournes 3329

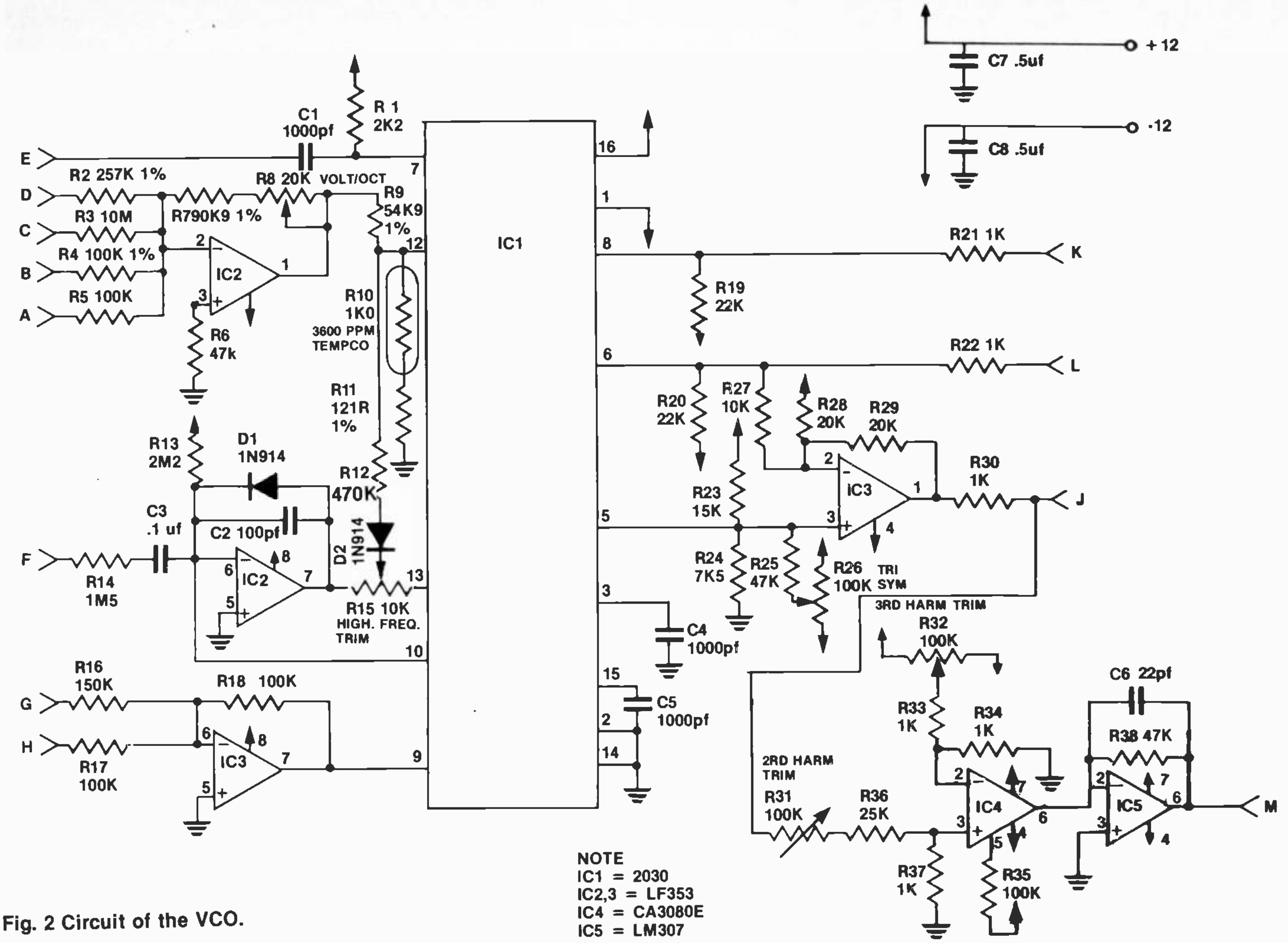


Fig. 2 Circuit of the VCO.

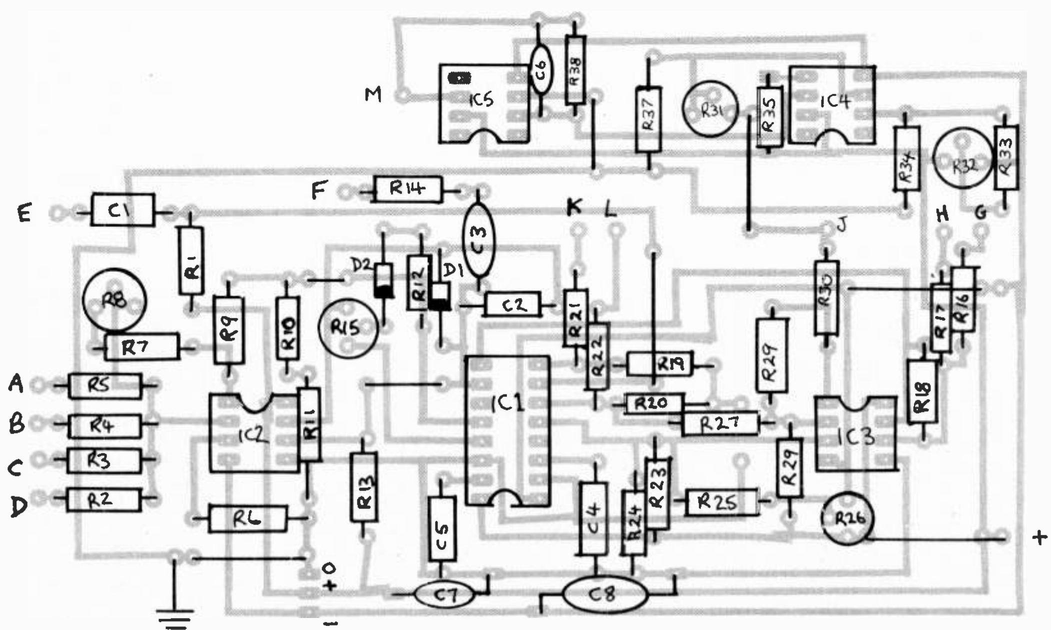


Fig. 2 PCB overlay.

ETI

Continued from page 34

HOW IT WORKS

The op-amp tester and transistor tester are completely separate circuits; we shall deal with the transistor tester first. IC1a, a Schmitt trigger inverter, forms a low frequency square wave oscillator with a period (determined by R1 and C1) of about 1 second. This square wave is used to switch the polarity of the 'power rails' (labelled 1 and 2 in the diagram) of the test transistor and its associated oscillator circuitry.

IC1b is used to buffer the square wave, and its output (on pin 6) is used to drive 'power rail 2'. This switching signal from IC1b is also fed to the input of IC1c, which inverts it and drives 'power rail 1'. Thus for half a second in each cycle rail 1 will be positive (high) and rail 2 (low); for the other half second rail 1 goes negative and rail 2 positive. Each power rail drives an LED (LEDs 1 and 2) via inverter gates IC1d and IC2d, such that an LED will be illuminated if its associated power rail is at 0 V. These LEDs will therefore flash alternately when the circuit is operating, providing an indication of the state of the power rails.

The oscillator circuit that is connected across these power rails is essentially the simple current-controlled oscillator shown in Fig. 2, but with some adaptations to enable it to work with either supply polarity. The oscillator of Fig. 2 works as follows. Assume C is initially discharged, so that the input to the Schmitt inverter is low; the output is thus high and the diode, being reverse biased, is effectively out of circuit. Capacitor C will now begin charging up from the current source and the input voltage to the Schmitt will be increasing. When the input passes the Schmitt threshold the inverter output will switch low; the diode is now forward biased and will rapidly discharge the capacitor. The process then repeats, producing a square wave output from the inverter with a frequency that is proportional to C and the current from the souce. The bigger the current from the source, the faster C will charge and the higher the frequency will be.

The current source in our actual circuit is provided by the transistor under test, R2 supplies a small base current to the transistor, and the current flowing from the emitter will be proportional to the gain of the transistor. If the transistor is PNP it will only supply current to the CCO (current-controlled oscillator) when power rail 1 is negative with respect to power rail 2. Similarly, power rail 1 must be positive for the oscillator to function if the transistor is NPN. Thus the CCO will produce an intermittent frequency for either transistor polarity (assuming the transistor is a good one) with a frequency roughly proportional to the gain. If the frequency is audible when LED1 is on, the transistor is PNP, and if LED2 and the tone coincide then it is NPN.

Going back to the oscillator of Fig. 2, we see that if the oscillator is to work when the supply connections are reversed, then the diode polarity must also be reversed. In our circuit this is achieved by using two diodes, D1 and D2. When power rail 1 is at 0V, and NAND gate IC2b will be disabled and its output (pin 11) will be high. This output is inverted by IC2c, thus reverse biasing D2 which is now effectively out of circuit. At the same time power rail 2 will be high, enabling NAND gate IC2a whose output (pin 4) will follow the logic level on the output of the Schmitt trigger IC1e via IC1f. Thus when IC1e goes low during an oscillation cycle, the cathode of D1 will also go low, forward biasing the diode and discharging C2 for the next cycle.

When the voltage on the two power rails is reversed a similar action occurs, but with D1 switched out of circuit and D2 providing the discharge path. The intermittent square wave produced at the output of IC1f is fed to crystal transducer TX2 which gives an audible note.

If an LED or diode is connect between the C and E terminals of the test scoket, it appears to be a large-value current source in one direction only. Hence the circuit reacts as if a high-gain transistor were in circuit, and polarity is indicated as before.

The op-amp under test is configured as a simple RC relaxation oscillator. When the op-amp is plugged in, assume that its output (pin 6) is high (positive saturation). Then C3 will begin charging up to +9V through R3 with a time constant C3.R3. When the voltage on C3 reaches one-third of the positive supply (this fraction is set by R4 and R5), the op-amp output will switch low, with R4 and R5 providing positive feedback for Schmitt trigger action. C3 will then discharge towards —9V, until the op-amp switches back to positive saturation. This cycle repeats indefinitely, producing a square wave at the op-amp output which is fed to transducer TX1. This produces an audible note if the op-amp is good. ETI

Computer Bulletin Boards

The unseen world of the computer BBS is full of untold wonders, exotic locals. . . and busy signals from far away. The 300 baud saga, by Steve Rimmer.

THREE IN THE MORNING is one of the ideal moments to get on a bulletin board system. A bit bleary, perhaps, but the systems usually aren't too crowded, and the time restrictions aren't as tight. The long distance rates are real low, and, if nothing else, no one will interupt your data by picking up the phone to call for a pizza. These are the concerns of a BBS junkie.

Bulletin board systems, these here BBS's, are a rather anonymous aspect of the computer revolution. . . not widely known of, they wait, dormant and breathing softly, at the ends of over two hundred phone lines across North America. They can be accessed by anyone with a terminal, and they get into a hitherto unexplored aspect of computers. . . communication. Offering message exchanges, news and equipment information, movie and record reviews, software exchanges, classified ads and, of course, directories of other boards, these mysterious phone numbers are just waiting, chuckling to themselves, for your call. Except when they're busy (which is frequent).

To begin, type a carriage return.

Menu

To get on a bulletin board, the minimum hardware required is a terminal and a modem of some kind. The terminal need not be anything elaborate for basic interactive communication: 300 baud is cool, and you don't even need lower case. Printing terminals, like Whisperwriter or the Silent 700 are okay too, although you'll eat a lot of paper. The modem can be either a direct connect or accoustic coupler type.

Some aspects of bulletin board use, such as getting software sent to your system from the board, entail more complex toys, i.e., usually a proper computer with a communications interface of some kind. Many potential BBS users will be up for doing this trip at the onset, as, for most souls, a computer is more easily come by than a terminal.

The modem used can be a really uncomplicated one; originate only is fine.

This stuff all up and working. . . notice how we deftly skipped over that little detail. . . one is now ready to access a BBS. Refering to table 1, you will find a list of bulletin board system numbers which are currently active. Some of these, like THUG, for instance, are run by companies which use their phone lines for human communication by day, so the boards are only up at night. Others, like RCP/M, are on 24 hours a day, except for infrequent down time for repairs or modifications. Dialing an operating board, providing someone else hasn't done so a few minutes before you, thus providing you with a busy signal, will produce one or two normal rings, followed by a click and a whine. When you hear the whine either activate your modem or stick the headset in the accoustic coupler, as is appropriate. At this point, you're ready to rock.

The first thing to do is to hit a return. . . some systems prompt you to do this. The board will then sign on, telling you what it is, and usually hit you with some stuff to read. Somewhere along the line it'll ask your name and location, which it will compare to a user log. If you are new to the system, it'll either give you some introductory dogma or lay a questionaire on you. However, eventually you'll get to the point wherein you are offered a menu of options and a prompt.

There are three or four variations on the initial menu, depending upon the system you're on and who wrote its software. Usually, though, you will get a list of commands or a string of letters to choose from. If you get a string of letters, these being command codes, a "?" will bring up a command menu.

The functions of the commands

```
B.B.S.'s  in the Toronto dialing area
      (* Needs password to use)

Apple-Can B.B.S..(24)..........781-1796
M & W - A.B.B.S..(9P-9A).......Pending
Conn.-80, North York..(6P-9A)..667-9981
Conn.-80, Willowdale..(24)....*226-9260
Heath RCP/M..(6P-9A)...........273-3011
Mississauga RCP/M..(24)........826-5394
PSI-WordPro B.B.S..(7P-9A).....624-5431
Pet Users Group..(8P-9A)......*223-2625
Atari..(24)...................*535-2501

110 Baud QBF Test..(24)........966-3994
                             U/D 04/03/82
```

```
LOCATION             TYPE    A/C  NUMBER
=========================================

Edmonton, Alta.,(RBBS).....403-482-6854
Georgetown, Ont.,..........416-877-0933
Hamilton, Ont.,(Packett)...416-355-6620
Ottawa, Ont.,..............613-725-2243
Surry, B.C.,(Pals-80)......604-591-6975
Thunder Bay, Ont.,.........807-345-7199
Vancouver, B.C.,(ABBS).....604-437-7001
Whalley, B.C.,(RCPM).......604-584-2543

                            U/D 02/20/82
```

Table 1. Some normal BBS numbers, as scarfed from AppleCan.

are determined by what the board will do, and this varies somewhat. Boards may be run by individuals, computer stores, computer companies, computer user groups, special interest groups and, as we'll get to, electronic perverts. As such, their board applications aren't all the same. However, cental to all BBS is is the message board. . . we'll look at this first.

Messages on a message board can be deposited there by any user, and there after looked at by any other user or only by the addressee or only by those knowing the password. Messages can also be left for the board's management, called the SYSOP. If you leave a message, the board will ask you its subject, who it's going to (type ALL if it's for general viewing) and a password. . . a RETURN will bypass this. From here on, you've usually got sixteen lines of sixty three or sixty four characters to play with.

The exact syntax of messages varies. CBM based boards use a software package written by Steve Punter, who also wrote Wordpro, the CBM word processor. As such, they are heavily into text formatting, and do automatic line ending and left and right margin justification right there on your screen. RCP/M lets you type merrily away and informs you when you've exceeded your line length, and prints out the truncated line. Several other systems just bounce you down to the next line, with or without automatic ending. In all cases, though, the completed message can be edited (or scrapped, if you want) before putting it on the disk.

N. HOLLYWOOD GBBS	(213) 980-6743
THE GREEN MACHINE	(305) 965-4388
THE MATCHMAKER #4	(213) 704-9819
COMMUNIQUE -80 (TRS)	(201) 992-4847
CBBS/LAMBDA BERKELEY	(415) 658-2919
<<<KINKY KUMPUTER>>>	(415) 647-9524
'MIDWEST UNDERGROUND'	(314) 227-4312
HORNY MESSAGE SYSTEM	(415) 845-2079
DIAL-YOUR-MATCH (MIXED)	(213) 842-3322

Table 2. Some perverted BBS numbers, as scarfed from Micro-Smut.

The messages on a board are numbered, although there are usually many blanks. Thus, it's common to find sixty or eighty messages, but have them start at number 1200. Most boards will notify you, upon logging on, if you have any messages waiting. However, you can also use the (S) command to scan through all the messages looking for subjects of interest. Some boards use (Q) for this function. Boards using the Connection-80 software permit each message to be "marked" as you scan, such that, after having a scan, the system can automatically bring up the complete text of just the marked messages. With other systems, you can write down the numbers of the interesting sounding messages and bring them up, post scan, with the (R) command.

It is considered good BBS etiquette, along with typing with your little finger sticking out, to delete any messages addressed to you after you've read them. The (D) function tells the SYSOP that you're finished with the message in question, and that it can be killed.

Variations

Most boards are based around specific systems. For example, TPUG is CBM, Connection-80 is TRS-80, THUG is Heath, AppleCan is Apple (I guess that's obvious) and RCP/M is tor Z80/8080 systems running CP/M. This does not mean that users of other computers can't access them, but, rather, that there is some stuff on them which will be most useful to owners of their particular genres of hardware. We'll heretofore and like that have a look at the basic capabilities of the popular existing BBS structures.

```
Function:

A,B,C,D,E,G,H,K,L,N,Q,R,S,T,V,W,X,?,
DOWNloac,NEWS,CONFerences,
Enter your choice: ??

Functions Supported:

A=Apple 40 Column
B=Print Bulletins
C=Case Switch
D=Duplex Switch (Echo/No Echo)
E=Enter Msg into System
G=Good-Bye (Leave System)
H=Help with Functions
K=Kill (Erase) a Message
L=Line Feed (On/Off)
N=Nulls (Set as Req'd)
Q=Quick Summary of Msg's
R=Retrieve Msg
S=Summary of Msg's
T=Time of day
V=Toggle Video/Printer Terminal mode
W=Print Welcome Message
X=Expert mode toggle
? = Prints Functions Supportec

CONFerences = Switch Conferences

DOWNloac = Download software to your    Apple

NEWS = Info of interest to System Users
  Function:

  A,B,C,D,E,G,H,K,L,N,Q,R,S,T,V,W,X,?,
  DOWNload,NEWS,CONFerences,
  Enter your choice: ?R
```

AppleCan's Function Menu.

```
* Switching Conferences Please Standby *

Loading: FOR SALE Conference


There are 24 items in this Conference
Last item enterec on: 06/17/82


Quick Scan of most recent items:

 Msg #29 Subj.: PAPER TIGER FOR SALE
 Date: 06/10/82

 Msg #30 Subj.:   B.P.I. General Ledger System
 Date: 06/10/82

 Msg #31 Subj.: SALE
 Date: 06/11/82

 Msg #34 Subj.: game software for sale
 Date: 06/12/82

 Msg #35 Subj.: software for sale
 Date: 06/16/82

 Msg #37 Subj.: 2 GAMES FOR SALE OR BARTER
 Date: 06/17/82
```

A FOR SALE scan listing.

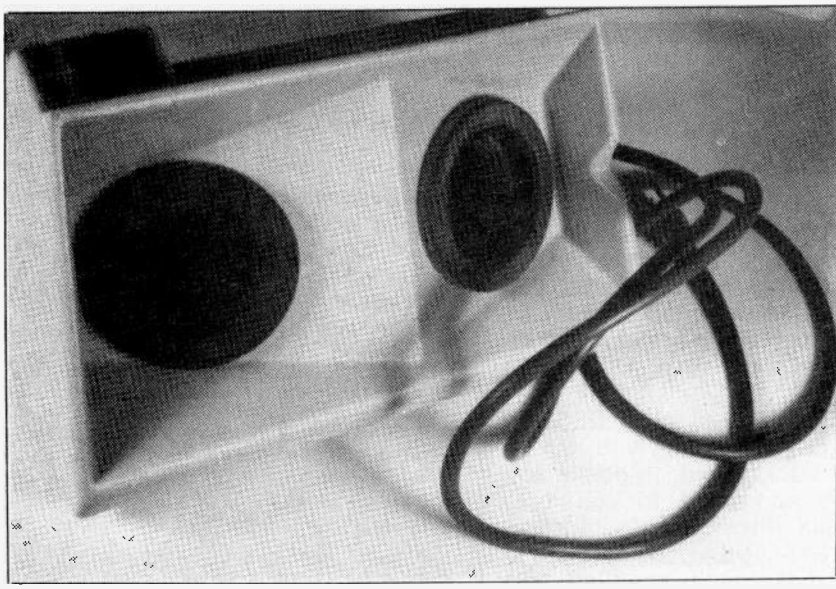
My current favourite is RCP/M, of which there is at least one running in Canada. This board requires a low level entry code, usually a skill testing question about CP/M. From here on, there is an initial menu, which offers the following options.

S-- Scan messages
E-- Enter messages
Q-- Quick summary
R-- Retrieve messages
K-- Kill messages
B-- Read software bullitens
G-- Go to CP/M
C-- Leave a comment and go to CP/M

Making much use of the CP/M functions requires a bit of understanding of CP/M itself. However, there is some prowling around to be done, and considerable good stuff to be picked up. The CP/M prompt is

A0►

If you type DIR, you will get a listing of what files are on disk A, area 0. DIR B: will be area 0 of disk B. Most



A typical 300 Baud accoustic coupler MODEM.

systems have between two and four hard disks. If you type USER and then a number from 0 to 4, you'll get onto another area of the disk. You can look at files by using the TYPE command. You can't, however, TYPE "COM" files. See this month's Computing Today for an explanation of CP/M files.

The best thing to do on a CP/M board, if you are new, is to type HELP. HELP is usually a Menu driven information file which, if read, will deal with most of your questions. You can also leave a message to the SYSOP for particular queries.

As with any board, it is civilized to sign off by doing the proper song and dance. . . typing BYE, in this case. . . as it allows the board to reset itself in an orderly fashion.

More BBSs

The CBM based systems seem to be the friendliest of the lot, incorporating record reviews, movie guides and other such niceties. They are also often the most crowded. . . the price of fame. They offer PET/CBM software to download as well, and there is considerable documentation floating around to assist in this. The message sections seem to be quite lively with witty repartee and occasional stupidities. . . this latter being quite refreshing, actually.

Connection-80 is devoted to Radio Shack in all its forms. There are two of these boards up at the moment. Of them one, Connection-80 Willowdale, has produced a considerable furor and karmic upset by requiring a $35 user fee to get an entry password. At the time of this writing it was just about to go over to this system, and will most certainly have done so as you read this. The other TRS-80 board, Connection-80 North York, is free, but only runs at night. Both boards are stuffed full of bits of interest to TRS-80 users.

The Apple boards seem to be about on par with the CBMs, oriented for Apple machines. THUG is very Heath oriented, and is a small RCP/M system.

Atari requires an access code which, as of this writing, they haven't given us. Such is life.

Exotics

No bulletin board system could be considered complete without a look at the real weirdies. . . the freaky computers, mostly of California. Most notable of these are the Kinky Kumputer and Micro-Smut. A list may be found in Table 2. Now, for the price of a late night long distance call these things can be quite a trip. The Kinky Kumputer, for instance, logs on with a warning that you have reached a gay computer, and goes on to suggest that if you aren't up for some sexually explicit data you should hang up.

The message sections of these things are great at parties. Regretfully, most of the text is unprintable here, but the souls involved, with names like "Whips 'n leather", "Deisle Dikes" or "Ultrajugs" should offer some insight into what's coming down. Since none of this stuff is traceable. . . they ask you who you are, but one doubts they expect the truth. . . it's a great place to unburden some fantasies or acrue a lifetime supply of dirty jokes.

Homegrown

Our cover this month featured the screen of a rather new system. By the time you read this, the ETI BULL BBS system, replete with all the lies and falsehoods absent from so many of the other boards, should be on line. We are struggling with the software even now.

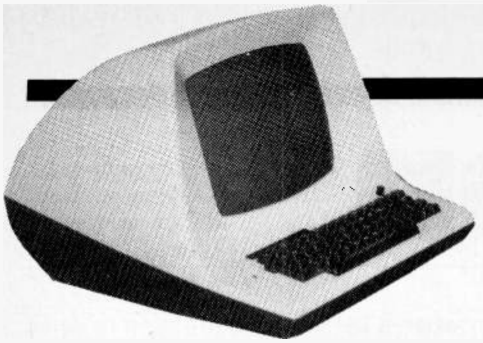
Obviously, the entry part is running.

The system will be on line from 6.00 pm to 8.00 am Monday to Friday, and all day on the weekend (and any other holidays during which our offices are closed). It will be reachable at 416-423-3265. Please note that this is one of our regular voice lines during the day, and if you call it during business hours you will *not* get a carrier tone.

The BULL is an experiment at the

```
Function:

A,B,C,D,E,G,H,K,L,N,Q,R,S,T,V,W,X,?,
DOWNload,NEWS,CONFerences,
Enter your choice: ?S

Starting Msg# (1/37) ?1

Msg #1 Subj.: Welcome to 'For Sale'!
To: ALL CALLERS From: SYSOP
Date: 04/03/82

Msg #8 Subj.: EPSON-80 FT FOR SALE
To: ALL From: RICHARD RICE
Date: 04/12/82

Msg #9 Subj.: EDUCATIONAL SOFTWARE
To: ALL From: MAHMOOD KARA
Date: 04/13/82

Msg #10 Subj.: SANYO MONITOR FOR SALE
To: ALL From: THOMAS MALCOLMSON
Date: 04/19/82
Msg #12 Subj.: SPACE ADVENTURE
To: ALL From: MARCEL WIDMANN
Date: 04/20/82

Msg #13 Subj.: Monitor FOR SALE
To: ALL CALLERS From: RICK MILI
Date: 04/24/82

Msg #14 Subj.: ***PIANO*** for sale
To: << ALL >> From: ED YIU
Date: 04/29/82

Msg #16 Subj.: GAME
To: ALL From: HASNAIN KARA
Date: 05/02/82
```

Message scan.



moment, and while we hope it will become a permanent fixture at ETI, we are not promising that it will always be up.

The system will either be running with the RCP/M or CNODE BBS programs, working examples of which can be found on some systems at the moment. Unlike most other boards, we hope to be non-sectarian; we will try to be equally hospitable to all systems.

Here is a partial menu of what should be on the BULL.

—Message board.

—ETI Index from 1977 to the present.

—Cinema directory, initially for Toronto, expanding as we get information from other burgs.

—Concert guide.

—Book, movie and record reviews.

—ETI Editorial query service and erratta listings.

—For Sale listings.

We probably will not have a software exchange going right at the onset, as we don't really have the disk space right yet. However, we may do a software library, wherein we leave a catalog of whats we gots on de system, and you ask for specific titles, which can then be downloaded the next day.

Check us out! If the modem doesn't answer your call in two rings, we're probably not on line yet. If you do call us, please be patient with the system if it freaks out a bit for the first little while. . . these things will do that.

Prospective BBS users will also be interested in knowing that an upcoming issue of ETI will be containg a construction project for a very low cost terminal, suitable for, among other things, accessing the boards.

Thanks goes to Bob Schultz, who has been labouring away on the BBS software, working towards getting the BULL on its feet.

```
WHICH NUMBER 70

-----------------------------------
Message #:        70
Subject:          SPECIAL OFFER!
From:             ERIC GREENE
Date Time:        06/14/82 09:01:26

FOR A LIMITED TIME ONLY (OFFER EXPIRES DECEMBER 34, 1997.)
YOU VERY OWN HARD COPY OF ALL THE "TEST" FILES!  YES, YOU
CAN HAVE THIS BEAUTIFUL COLLECTORS EDITION OF THE COMPLETE
WORKS OF THE "TEST" SECTION.  INCLUDED IN THE COLLECTION
ARE SUCH GREAT WRITINGS AS, "TEST" (THE ORIGINAL), SON
OF TEST, THE END OF "TEST", COUP D'ETAT AND ALL THE REST.
THIS IS NOT A SHORTENED VERSION, BUT CONTAINS OVER

40 KILOBYTES OF UNMITIGATED TRASH.  READ SUCH GREAT LINES
AS "THROW MARSHMALLOWS IN THE CANAL", "OVERTHROW THE TYRANT"
AND THE FAMOUS "UTA DECLARATION OF INDEPENDENCE".  YOU CAN
SPEND HOURS LOOKING UP ROBB'S REFERENCES TO OBSCURE BATTLES
DAYS TRYING TO DECIPHER THE WRITINGS OF ST. FAN TOM THE
OBSCURE AND ST. RICK THE VERY OBSCURE.  THESE WORKS WILL
PROVIDE YEARS OF INSPIRATION FOR YOU AND YOUR FAMILY AND
WILL TAKE A TREASURED PLACE AT THE BOTTOM OF YOUR
BIRD CAGE OR YOU CAN FINALLY REPLACE THE SEARS CATALOG IN
THE FAMILY OUTHOUSE!  SO, ORDER NOW, THIS OFFER IS NOT
AVAILABLE IN ANY STORE AND ONCE THE 25,000,000,000 COPIES
ARE SOLD , THE OFFER WILL NOT BE REPEATED.  DON'T MISS
OUT ON THIS FANTASIC OPPORTUNITY!  SEND YOUR MONEY
(CASH ONLY) TO-
               VISTA MARKETING
           PALM BEACH COUNTY LANDFILL
              WEST LANTANA ROAD
               LANTANA, FLA.
THE ENTIRE COLLECTION IS AVAILABLE FOR THE LOW, LOW PRICE
OF ONLY $1995.95!  SO HURRY AND ORDER   TODAY!!!!!!
```

A message on The Greene Macnine (a bit strange, but. . .)

```
                W A R N I N G

THIS SYSTEM MAY CONTAIN GAY, SEXUALLY ORIENTED MESSAGES
 OR PROGRAMS. IF THIS OFFENDS YOU SIGN OFF NOW.

    YOU HAVE REACHED 'KINKY KUMPUTER' THE WORLD'S
    FIRST GAY  B B S  SYSTEM. ONLINE SINCE MAY 1980
    SYSTEM IS A DOUBLE DENSITY NORTHSTAR HORIZON
    LOCATED IN SAN FRANCISCO, ABOUT A MILE FROM
    18TH & CASTRO STREET, THE GAY CAPITAL OF
    THE WORLD.

 *** PRESS "S" OR "CTRL-S" TO PAUSE ***

Some BBS's have imposed online time limits for their users.
Kinky has never done this and we have no desire to do so.
Whereas other BBS's kick the user off after the maximum amount
of online time, Kinky and a few others only kindly remind you
of the maximum time, but still keep you online.  Some users
have in the past abused this privilege.  A user would do a
retrieval or summary, press "S" to pause, and then walk away
from his terminal leaving the system frozen.  Therefore, a time
limit for temporary pauses only shall be implemented.   RAYMOND
```

The log on message of the Kinky Kumputer (different, ain't it).

ETI

A FREE Advertising Service! If you've got a home computer there's a pretty good chance that you've written a piece of software of which you are proud. If you are in this category and want to swop or sell this for a nominal sum, ETI will run your message FREE OF CHARGE in a new feature: SOFTWARE EXCHANGE.

There are conditions: sums requested must not exceed $10 ($20 where material is offered on a disk); the message must not exceed 35 words including name and address and you must sign the warranty that the material is your copyright or in public domain.

Readers may offer listings, tapes or disks or make specific requests. Exchanges where no money changes hands are acceptable.

If you wish to charge more than the sums given you may still use this service but then there is a charge of 50c per word (which must be prepaid). Minimum payment is $15 but there is no maximum word length.

Use the form below and send to

ETI Software Exchange, ETI Magazine, Unit 6, 25 Overlea Blvd., Toronto, Ont. M4H 1B1. Please publish the following message FREE in ETI. Any material offered is my own copyright or in public domain

Signed . . . .

Please Write Clearly			

ETI SOFTWARE EXCHANGE

VIC20 Programs: Snails' Trails, Astrofield, The Shrine.* Send $7.50 each to: Peter Lear, 3137 Bentworth Drive, Burlington, Ontario L7M 1V9. *(The Shrine requires an extra 8K of memory).

TRS-80 Models I and III. Don't lose instructions, keep them on the program tape. Loading instructions won't ever destroy current programs. Bits of paper will disappear. Only $10.00. S. Shadoff, 3581 Logmoss Cres., Mississauga, Ontario, L4Y 3T1.

DISASSEMBLER 8080 Like memonics with some Z-80 extensions for north star. Disassembles memory locations or machine language files. Written in northstar basic. Program on D/D disk $20. S Gac, 30 Pearson Ave., Toronto, Ontario, M6R 1G1.

GAMES for Radio Shack Model II. 20 dollars for minimum 5 games on 8 inch disk plus bonus basic enhancements. Send 50 cents for catalog to Chris Snell, RR1 Utterson, Ont., P0B 1M0.

Hex Notation

Of course it's inexplicable; if everybody could understand it computer programmers would all be driving taxis. Robert Traub offers entrance to the elite.

MICROCOMPUTERS and microcomputing can be very difficult for the beginner. One of the first things that we get hit with is all the different codes that can be used with these machines. This article is intended for those who are new to the world of digital microcomputers, and would like an insight to the variety of codes currently being used with digital microcomputers. Of all the different codes currently used (binary, octal, hexadecimal, ASCII etc.) only one is used by the digital microcomputer. This is the binary code. Only this one elementary code can the digital microcomputer understand. All the rest are codes devised in order for man to more easily understand and communicate with the digital microcomputers. We shall take a look at the binary, octal, ASCII and hex codes.

Binary

First let us look at the binary code which is the most basic code, and the only code that your digital microcomputer can use. Binary means *two state*; in this case the two states referred to are either a "1" or a "0". Binary notation is referred to as having a base of 2 or simply base 2. The decimal system, remember, has a base of 10. This binary notation is the writing of a number using only the digits "1" and "0" with each digit position representing a power of 2 instead of 10 as is the case in decimal notation. Thus 1 and 0 may also be referred to as on and off, or as true and false, as high and low or as open and closed. However you wish to refer to it is fine, as long as you understand that this is the only code that the digital microcomputer uses; a Binary digit is called a bit, a bit may be either 1 or 0 as stated. If you were to take 8 bits, (called a byte), as in the case of an 8 bit microprocessor chip such as the 8080, you could have a possible 256 different states. These states would range from all 0's (00000000) to all 1's (11111111). The digit on the far left is referred to as the MSB (most significant bit) while the digit on the far right is referred to as the LSB (least significant bit). The position that the 1 occupies in the 8 bit byte will determine its weight or value. Briefly, if we had an 8 bit byte such as 11111111, then going to the left, that is, starting from the far right, the first digit or (LSB) has a weight of 1, the next 2, then 4, then 8, then 16, then 32, then 64, and finally 128 (MSB). If you add all of these up you will find that you get a total of 255; add to this the one state where all bits are zero, 00000000, and you get the grand total of 256. Each bit which is represented by a 1 is counted according to its weight or position in the byte; the zeros are used as place holders only. Now, if all the 1 bits, in the following examples, are added according to their weight or position, you would arrive at the decimal representation of the binary notation, such as:

00000000 represents the decimal number 0
00000001 represents the decimal number 1
00000010 represents the decimal number 2
00000011 represents the decimal number 3
00000100 represents the decimal number 4
00000101 represents the decimal number 5
00000110 represents the decimal number 6
00000111 represents the decimal number 7
00001000 represents the decimal number 8

The above example also demonstrates clearly how the binary numbers are built or incremented from one value to the next sequential value. This 8 bit code could be used by the microcomputer to select one of its internal instructions and would perform certain actions depending on the state of each of the bits in this 8 bit byte. Each microprocessor has an instruction set; it is this instruction set that is used to create and run programs. The microcomputer knows when a byte is an instruction or when it is data; just how it knows is a topic for another article. This 8 bit code is read into the microcomputer via the 8 bit data buss. The digital microcomputer also makes use of a 16 bit code. If you were to take two 8 bit bytes, one after the other, you would have a 16 bit code. This two byte 16 bit code would allow up to 65535 different combinations. The two byte code is used by the microcomputer on the address buss, in order to address or access any one of the possible 65535 different memory locations (64k RAM).

It is important to note that the 16 bit code mentioned above consists of two 8 bit bytes, which is very different than a single 16 bit byte. Most of the digital microcomputers currently in use are of the 8 bit variety. It is designated as 8 bit because of the number of bits that are used by the internal instruction register and accumulator. Also, these microprocessor chips have only 8 external data lines and 8 bits are all they can handle at one time. The 16 bit digital microcomputers are starting to make their way onto the market at this time. Of course their internal instruction register and accumulator will handle the larger 16 bit byte, and they will have 16 external data lines. For the purposes of this discussion though, we will stick with the 8 bit notation.

With this basic knowledge about the binary code, it is not at all hard to see that a programmer would have a great deal of trouble trying to trace down a bad byte if all he could look at were a group of 8 bit 1's and 0's such as:

11101001 01001101 01001011
01001101 01011010 01101001
01110111 11001010

First he would have to check each 1 and 0 to make sure that they were in the correct position within each byte. Next he would have to check that each byte was then itself correct. This method of checking and correcting can be highly error prone, and not very reliable at all. Some way had to be found to make the checking easier and thereby less prone to error. One such way was the introduction of the octal, or in this case, split-byte octal code (More on this split-byte octal later).

Octal

The octal code or notation uses the digits 0 to 7. This notation is referred to as having a base of 8 or simply base 8. The octal notation can range from 0 (00000000) to 377 (11111111). The largest digit you can use in an octal number is the digit 7. With an 8 bit binary code you can break up the bits into groups starting from the right hand side; this will give you two groups, each with three bits and one final grouping of only two bits, such as 11 111 111. This is the binary representation of the 8 bit octal code. The first group of three bits on the right represents the digit 7; that is, the first 1 but has a weight of 1, the second 1 bit has a weight of 2 and the third 1 bit has a weight of 4, then 1 plus 2 plus 4 equals 7. The second group of three bits also represents the digit 7, for the same reason as for the first group. The final group of two bits represents the digit 3; that is, 1 plus 2 equals 3 for a total octal number of 377. Such as:

```
11 111 111
 3   7   7
```

This is the largest octal number that can be obtained with a single 8 bit byte. The octal byte 00 000 11 would represent the octal number 007; if one is added to this byte we get 00 001 000 or the octal number 010. This is:

```
00 001 000
 0   1   0
```

There is no 8, or 9 digit in octal notation, remember. Also keep in mind that each group of binary digits are added individually in order to arrive at the 3 digit decimal representation of the octal number. In the octal numbering system, the number is usually followed by the letter "Q" or "O" in order to designate it as "octal" or base 8. This octal numbering system can now be used by programmers in order to better follow each binary byte in the program. That is, the binary byte such as 11000011 is converted to the octal representation 303. A programmer can easily see that the octal number 303, for instance, is a jump instruction for the 8080, it would be much harder to recognize this if in the binary notation of 11000011. The digital microcomputer can be programmed to convert each binary number to its octal equivalent for display. This programming method is also true for any of the codes used - octal, hexadecimal, ASCII or whatever. The octal code referred to thus far is called the split-byte octal code. Why split-byte octal? Well, the octal code was originally devised for the minicomputer and was a 16 bit code. This resulted in a binary notation such as:

```
1 111 111 111 111 111
1  7   7   7   7   7
```

If this code were to be used by the 8 bit microcomputers, then it would have to be cut in half (8 bits). This would leave two bytes each with two bits at the far left end instead of one bit as in the 16 bit byte above, such as:

```
11 111 111     11 111 111
 3   7   7      3   7   7
```

The 8 bit byte on the left is referred to as the high order byte and the 8 bit byte on the right is referred to as the low order byte. When two bytes are required, as is the case with the 16 bit addresses, the full octal notation could not be used as the first byte (low order byte) ended with two binary digits representing decimal "3". This effectively cut two bits out of the former three bit digit representing decimal "7". Therefore, all that was required was to split the 16 bit byte into two separate 8 bit notations, as shown, and stay with that notation for both bytes. This resulted in a split-byte octal notation. With this notation the 16 bits would consist of two consecutive 8 bit bytes, and would be displayed as such, for example:

```
00 100 000     01 000 000
 0   4   0      1   0   0
```

Where 040 is the high order byte, and 100 is the low order byte. To separate the two bytes, a period or slash character can be used such as:

040.100 or 040/100

This split-byte notation is the notation referred to in this article with both the 8 bit and the 16 bit octal numbers. Next we will take a basic look at the very popular and widely used hexadecimal code.

Hexadecimal

The hexadecimal code or notation is treated much the same as the octal except in this case the 8 bit binary number is split into only two parts, each with 4 bits. This notation is referred to as having a base of 16 or simply base 16. This representation would then vary from 00 (0000 0000) to FF (1111 1111). The hexadecimal notation makes use of the digits 0 to 9, and the letters A to F in order to cover the 16 possible positions. Remember, 0 to 9 represents 10 positions and the letters A to F represent another 6 positions for a total of 16 positions. The letter "A" represents the number 10, "B" the number 11, "C" the number 12, "D" the number 13, "E" the number 14 and "F" the number 15. Therefore if you had the hexadecimal number representation 0000 1001, which is equal to 09 decimal, and added one more to it, you would get the number 0000 1010 or "0A" such as:

```
0000 1010
  0    A
```

Counting from right to left, the first digit is a 0 and is not counted, the next digit is a 1 which has a weight of 2, the next is a 0 and holds a weight or value of 4, but is not counted. The last digit (in the first group of four) is a 1 and has a weight of 8. Add these up and we get 2 plus 8 (the only two positions that are 1) equal 10 decimal. However, we can not use any number with more than one digit, or in the case of hexadecimal, one letter, for each group of four binary digits. The hexadecimal code will change this 10 to the letter "A". This change will also occur for the decimal numbers 11,12,13,14 and 15, as noted above. As can be seen each group of four digits can represent the digits from 0 to 9 and the letters "A" to "F", with "F" being the largest character possible with 4 bits. Therefore the largest hexadecimal number that can be represented by an 8 bit byte is "FF" such as:

```
1111 1111
  F    F
```

Also keep in mind that each group of four binary digits are added individually in order to arrive at the two digit (or letter) representation of the hexadecimal code. A 16 bit byte in hexadecimal would then simply be two 8 bit bytes such as:

```
1111 1111 1111 1111
  F    F    F    F
```

As is the case with the octal code, it is easier for a programmer to recognize the hexadecimal number of 'C3' as a 'JMP' instruction than the binary bite 11000011. Hexadecimal notation is noted by adding an "H" for "HEX" to the end of the number. The hexadecimal number "FF" would be written "FFH", and "09" would be written as "09H".

ASCII

Another code that is commonly used by the digital microcomputer is the ASCII code. This is the American

Continued on page 62

High Performance Op Amps

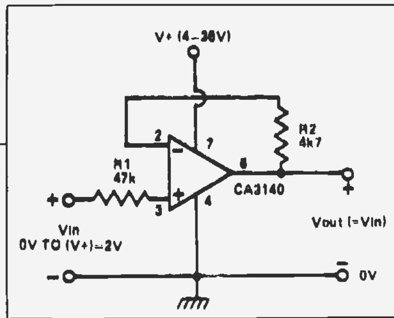


Fig. 1 Zero-referenced DC voltage follower.

CA3140 and LF351 op-amps can be used in some special-purpose single-supply applications that are quite impossible with simple 741-type devices. Ray Marston explains.

MOST OP-AMPS can be used with either dual (split) or single-ended supplies, so long as the contraints of their input terminal limits are not exceeded. Specifically, op-amps have a parameter known as 'common-mode input voltage limit' which, in practical terms, defines how close their input terminals can be taken to the positive and negative supply rails without impairing circuit operation. Table 1 illustrates the general input constraints of the 741, CA3140 and LF351 op-amps.

Note here that the input terminals of the 741 op-amp cannot be usefully taken to within closer than a couple of volts of the positive (pin 7) or negative (pin 4) supply rails. Thus the device cannot be used as a true voltage follower in single-supply circuits, for example. The inputs of the CA3140, on the other hand, can swing all the way down to 500 mV below the pin 4 negative voltage, but can only swing within a couple of volts of the positive supply rail. This chip can thus be used as a true voltage follower in single-supply circuits.

Finally, the LF351 inputs can only swing down to within a couple of volts of the negative rail, but can go as high as 100 mV above the positive supply rail. In this way, this chip can be used in some quite unique applications in which input signals are referenced to the positive supply terminals. Let's look at some practical single-supply applications of the CA3140 and the LF351.

CA3140 Applications

The CA3140 op-amp has PMOS/FET inputs, giving the device a virtually infinite input impedance. The device uses the same pin configuration as the 741 op-amp and can be used with any supply voltage (between pins 4 and 7) from 4 to 36 V. Outstanding characteristics of the device are that its input terminals can swing as low as 500 mV below the pin 4 voltage as already mentioned, and its output can swing to within a couple of millivolts of the pin 4 voltage. A notable defect of the device is that its output can source far more current than it can sink; when used with a single-ended 5 V supply, it can source 10 mA but sink a mere 1 mA.

OP–AMP TYPE	POSITIVE INPUT LIMIT, REFERENCED TO THE PIN 7 VOLTAGE	NEGATIVE INPUT LIMIT, REFERENCED TO THE PIN 4 VOLTAGE
741	(V+) – 2V	(V–) + 2V
CA3140	(V+) – 2V	(V–) – 500mV
LF351	(V+) + 100mV	(V–) + 2V

Table 1. Common-mode voltage limits of the 741, CA3140 and LF351 op-amps.

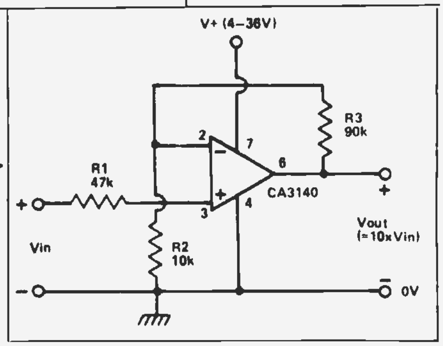


Fig. 2 Non-inverting DC amplifier with a gain of 10.

Figure 1 shows how the CA3140 can be used as a true voltage follower with a single-ended supply. The input can swing all the way from zero to within 2V of the positive supply value and the circuit has a virtually infinite input impedance.

Figure 2 shows how the device can be used as a x10 non-inverting DC amplifier that will accept inputs all the way down to 0V. Again, the circuit has a virtually infinite input impedance.

Figure 3 shows how the above circuit can be modified as a three-range (100mV — 1V — 10V) DC voltmeter or multimeter adaptor with an input impedance of 11M on all ranges. Offset control PR1 should be trimmed initially to make the meter read correctly at one-tenth of full scale. The two output diodes protect the meter against damage if excessive input voltages are applied. Note in the Fig. 2 and 3 circuits that the 90k resistor can be made by wiring a 100k resistor in parallel with 1M0.

Figure 4 shows how the basic Fig. 1 circuit can be modified to give a boosted current-driving capacity (up to about 100 mA in this case). Note that the output voltage across emitter resistor R3 is identical to the circuit's input voltage. If Q1 is replaced with a Darlington power transistor, the circuit can easily be made to func-

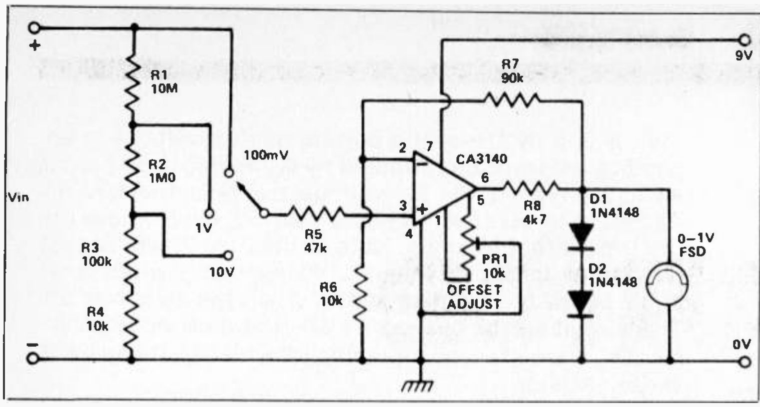


Fig. 3 Three-range DC voltmeter/meter adaptor with 11 M input impedance on all ranges.

tion as a variable voltage DC power supply with an output that can swing all the way down to 0V.

Figure 5 shows how the Fig. 4 circuit can be modified for use as a unity-gain DC level translator that converts a zero-referenced input into an identical positive-referenced output quite independent of supply-line variations. The gain of this circuit is determined by the ratios of R3 and R4, so the circuit can be given a gain of 10 (for example) by simply giving R4 a value of 10k. A minor defect of the Fig. 5 circuit is that the output cannot swing below half-supply voltage. Figure 6 shows how the circuit can be modified to enable the output to swing over roughly 85% of the supply voltage range. Here, the input voltage is simply attenuated by 20 dB by R1-R2 and the actual translator is wired in the x10 mode, to give an overall gain of unity.

Figure 7 shows the circuit of a voltage-controlled constant-current generator with a sensitivity of 10

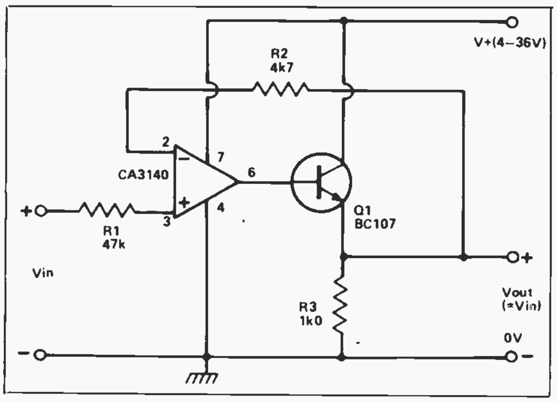


Fig. 4 Zero-referenced voltage follower with boosted output.

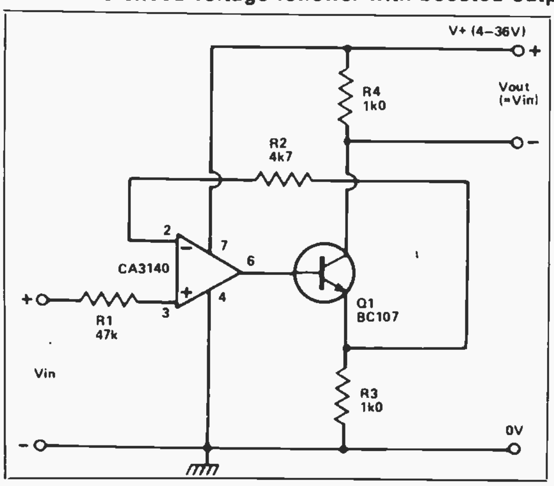


Fig. 5 This unity-gain DC level translator shifts a zero-referenced input to a positive-referenced output.

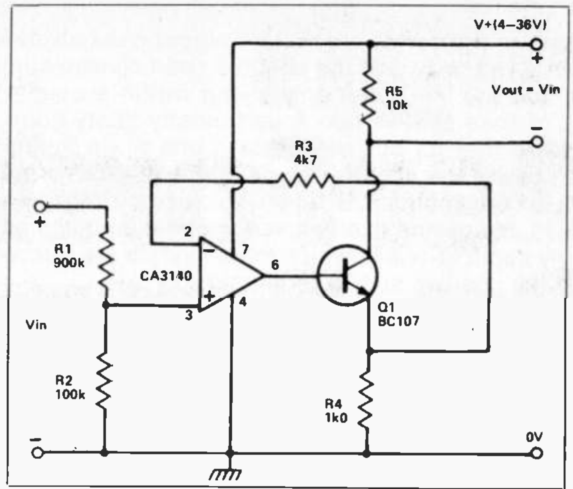


Fig. 6 Unity-gain wide-range DC level transistor.

mA/V. Here, the CA3140 and Q1 are wired as a basic voltage follower, in which the voltage across R2 is identical to the input voltage. Consequently, since the emitter and collector currents are virtually identical, the output current is equal to $V_{IN}/R2$, virtually independent of the value of the output load resistance. The maximum available output current of this circuit is limited by the power-handling capacity of Q1.

Finally, Figs. 8 and 9 show how the CA3140 can be used as a precision 0-6V8 over- and under-voltage indicator. In both of these circuits the op-amp is used as a simple voltage comparator, with its output feeding to an indicator LED via an 820R limiting resistor; the reference voltage is fed to one input terminal and the sample or test voltage to the other. In the Fig. 8 over-voltage circuit the sample is fed to the non-inverting input terminal, and in the Fig. 9 under-voltage circuit the sample is fed to the inverting terminal.

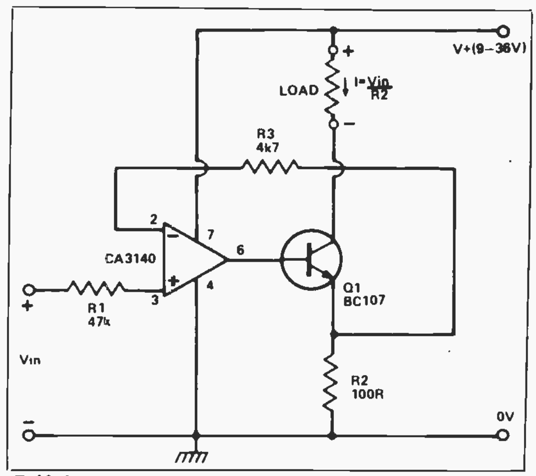


Fig. 7 Voltage-controlled constant-current generator, with a sensitivity of 10 mA/V.

LF351 Applications

The LF351 op-amp has JFET inputs, giving the device an input impedance of about a million megohms. The device uses the same pin configurations as the 741 op-amp and can be used with any supply voltage (between pins 4 and 7) from 9 to 36V. An outstanding feature of the device is that its input terminals can swing as high as 100 mV above the pin 7 positive supply voltage.

Defects of the device are that its output can only swing within a volt or two of the positive and negative supply rails and the input can only swing within a couple of volts of the negative rail. A particularly nasty quirk of the IC is that its output inverts if one of its inputs is taken below the negative common-mode limit, or goes high if both inputs are taken below the limit. Nevertheless, the device can be used in some unique single-supply applications in which input signals are referenced to the positive supply terminals.

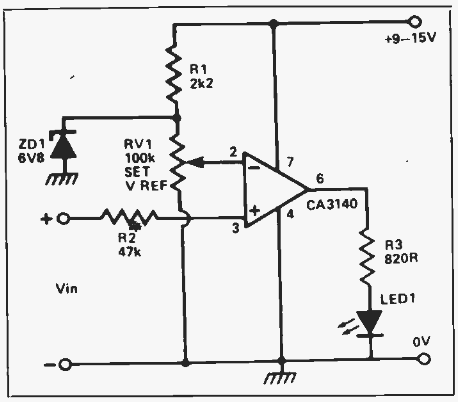


Fig. 8 Precision over-voltage indicator spanning 0 to 6V8.

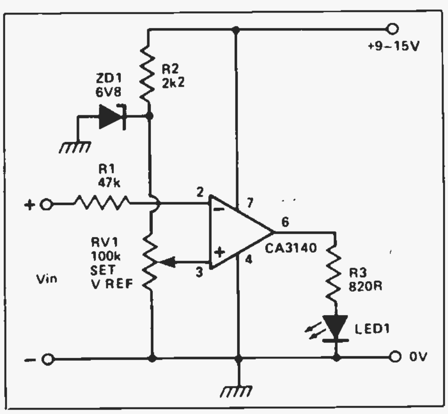


Fig. 9 Precision under-voltage indicator.

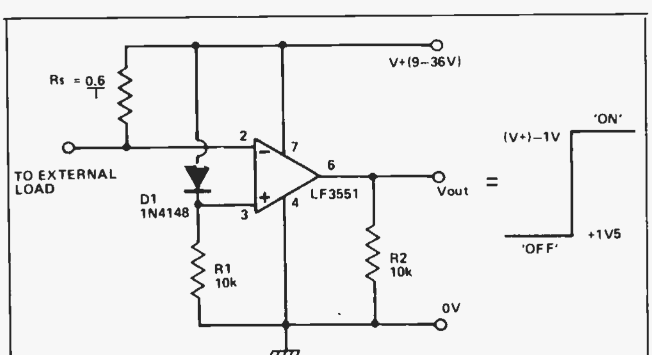


Fig. 10 This over-current switch monitors the current that an external load draws from the positive supply line.

Figure 10 shows how the LF351 can be used as an over-current switch, in which the op-amp output switches high if the current drawn from the supply by an external load exceeds a preset value. Here, a reference voltage of 600 mV is set on the non-inverting terminal of the op-amp by D1, and a current-related voltage is applied to the inverting terminal by R_S; the op-amp output switches high if the R_S voltage exceeds the 600 mv reference level, so R_S needs a value of 0.6/I, where I is the trip current in amps. Note in the Fig. 10 circuit that the output (into a 10k load) is 1V5 when the switch is off or 1V below the positive supply when the switch is on. This circuit can be used as a LED-output over-current indicator, if required, by replacing R2 with a LED and 820R series resistor.

Figure 11 shows how the LF351 can be used as either a positive-referenced voltage follower or as a voltage-controlled constant-current generator. Here, the op-amp is wired as a standard follower-with-booster output-stage (using PNP transistor Q1); zener diode ZD1 is used to enable the follower output to swing all the way down to 0V (referenced to the positive line). The circuit can be used as a constant-current generator by breaking the Q1 collector line as shown, the output current then being equal to V_{IN}/R2.

Finally, Fig. 12 shows how the LF351 can be used as a unity gain level translator that converts a positive-referenced input into a zero-referenced output. The gain of the circuit is determined by the ratio of R2 and R3, so the circuit can be given a gain of 10, for example, by simply giving R3 a value of 10k. Thus if, as an example, the translator is used in the x10 mode and has its input taken from a 1R0 (1 V/A) current-sensing resistor in the positive supply line, the circuit will give a zero-referenced output voltage of 10V/A, thereby simplifying current monitoring problems in power supply circuits.

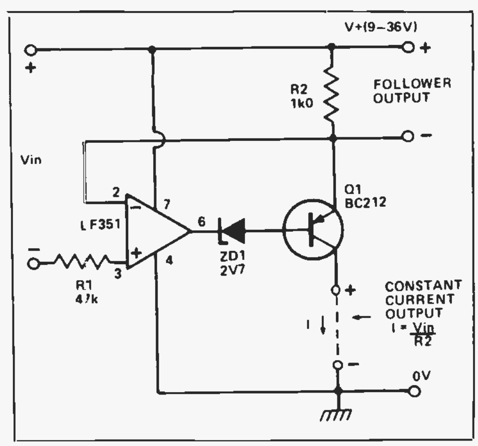


Fig. 11 This circuit can be used either as a positive-referenced voltage follower or as a voltage-controlled constant-current generator.

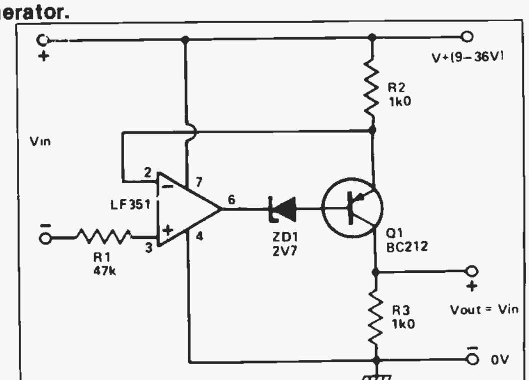
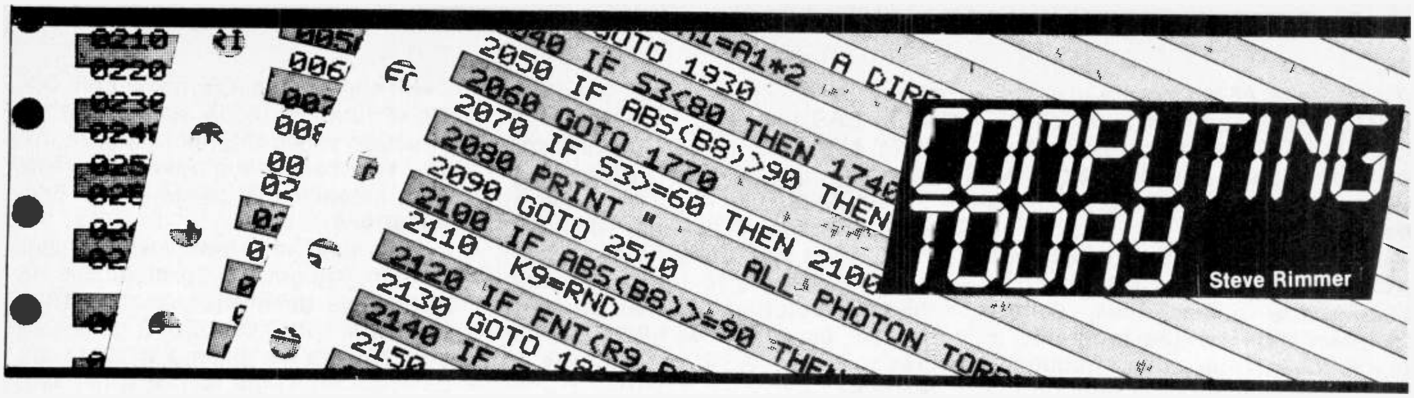


Fig. 12 This unity-gain DC level translator shifts a positive-referenced input to a zero-referenced output.

ETI



IF YOU OWN A PET, an ATOM or a 1958 Buick LeSabre (with or without bucket seats), this month's column will hold only academic interest for you at best. This month, we're going to look at the all pervading, only partially understood myth of CP/M. There have been several articles published about this, all easily digestible by a white mouse (mine liked them). . . few, however, have been much good if you didn't already understand half the subject. If you are a complete baboon. . . well, as far as CP/M goes, anyway. . . read on. (If you're a complete baboon with no exceptions, may we recommend Byte magazine, as it has no staples to get between your teeth).

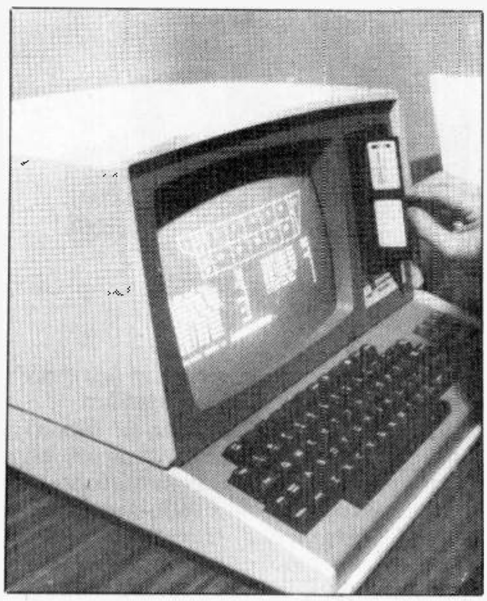
Okay, first the usual stuff: CP/M means Control Program for Microcomputers, and is made by Digital Research. It is usually adapted for each specific system by the manufacturer, or, in the case of systems whose manufacturers are trying to flog their own DOS systems, such as for our TRS-80 Model II, by large software houses such as Lifeboat Associates and Pickles and Trout (really). It generally costs about $200.00.

CP/M can run on most any system based on an 8080 or Z80 procesor, or on anything else software compatible with these. It is of no use on 6502's, 6809's, etc.

CP/M can be seen in a number of ways. First off, it is a system which makes your 8080 based system compatible with anyone else's . . . if they have CP/M. Consider this. The differences between your computer and that of Max (who lives in my basement) is that (a) Max's is hot and (b) the I/O assignments for yours are different. Thus, if Max's printer were to be connected to port A2 and yours to port FF, software which entailed printing on your machine would be talking to a blank port if Max pirated it. Sad, too, since Max is a bit of an idiot when it comes to actually changing stuff.

CP/M has four I/O devices, called the Console, the List, the Reader and the Punch. All of these can be assigned to anything you like. Where the actual devices are, in hardware, is spelled out in a "BIOS" (Basic Input/Output System), which is unique to your machine. Thus, when a program wants to send a character to the console, it hands it to the BIOS, which is the only thing that has to know where the console is. The actual software you're running can remain blissfully ignorant. As such, it can also remain blissfully un-dedicated.

The standard storage medium for CP/M programs is Single Sided Single Density 8 inch floppy disks. If you were to show up here with a CP/M



program on such a disk, we could run it without even knowing what system had written it. Well, most likely, anyway.

This universality of CP/M has created a huge amount of public domain . . . and somewhat public domain . . . software. It has also produced a number of very useful conventions in terms of software exchange and file creation. We're a' gonna check a few out.

SYSBOOM.BAS

First off, let us propose a hypothetical system. It has a screen, a keyboard, innards (of course), a printer, an RS-232 port and two disk drives, A and B. If you were to boot up CP/M on it, you'd see

A >

this being a prompt, telling you you're logged onto drive A. Typing "B:" will log you to B drive, and the prompt will reflect it. Typing DIR (directory) will avail you of a list of files on the disk you're logged to. The files have names like COPY.COM and BYE.ASM. These are CP/M file designations, and, while the letters mean nothing to the operating system, they do follow a convention of sorts.

Most of the following is generally true.

If you type a CP/M command, like "PIP" (which happens to be a command for moving files around, usually from disk to disk), you are invoking a machine language routine. Actually, what you are doing is calling a directly executable file, refered to as a COM file. Somewhere on the disk is a file called PIP.COM.

In CP/M, machine code programs are called assembler programs... (mostly true), and are written in a way quite different from doing them byte by byte with a monitor. The mnemonics and lables are assembled as text, written out in a specified format which looks pretty much like the way you'd write down source code, and then converted to machine code by two routines, called ASM, or assembler, and LOAD. ASM takes a file of machine language text, called an ASM file, and creates several new files, one of which is a HEX file. This is still a text file, but it looks like a hex dump . . . the source code has, in fact, become op code. The op code HEX file is then converted to a COM file by LOAD. The COM file can thereafter be run by typing its name.

Because ASM files are just text, they can be created with a text editor, such as ED (the basic text editing routine usually associated with CP/M), or a word processor, such as Wordstar.

Because there so much software exchange going on in CP/M, much of it over the phone lines, written documentation for the programs is impractical. Thus, one frequently finds the documentation right on the disk in a DOC file. A DOC file can be displayed on the screen by entering TYPE *filename*.DOC. If, prior to this, one enters a Control P the printer echo function will be toggled on, and the file will also be listed to hard copy.

A fair amount of documentation is frequently found in ASM files. If one has an ASM file, as opposed to a COM file, one can readily make changes to the text and reassemble it. Thus, there are usually many versions of any given routine around, and, tacked onto the beginning of an ASM file one will usually find a history of its changes and modifications.

The other sort of file one encounters frequently on a CPM disk is a BAS file, and, if you TYPE one, it will turn out to be... good Lord, ghastly BASIC text. BASIC lives!

There are two BASICs usually associated with CP/M systems, MBASIC and CBASIC. MBASIC, or Microsoft BASIC, is the usual BASIC interpreter one frequently comes across in some guise in almost every home computer in creation. CBASIC is a BASIC compiler.

Remotes and Fonez

The BBS article elsewhere in the issue touches on remote CP/M . . . We're going to touch a little harder, trying not to get our faces slapped in the process.

If you decide to fool around with a remote CP/M system, you will discover several additional conventions involved with these boards. The first is squeezing.

Squeezing is a technique for compacting data files. A squeezed file takes up less space, and can be sent over the phone lines quite a bit quicker than an unsqueezed one. At 300 baud, large ASM or BAS files will take quite a while, and, since most BBS's have time limits, a lot of files are squeezed . . . or squozen, as you prefer. Squeezed files have a Q as the second letters of their file extensions, hence a squeezed ASM becomes AQM, BAS becomes BQS, etc. You don't see CQS because you can't generally download COM files.

Squeezed files don't assemble in their squozen state, nor do they TYPE. They want unsqueezing, which requires, yes... give the troll in the third row a stuffed tree sloth... an unsqueezer, usually called USQ. USQ will create a new ASM or BAS file of readable text.

But, you ask, peering around your stuffed tree sloth, how do you get files over the wire in the first place, squozen or not. Ah hah. Not bad for a troll. You need a modem routine, you see.

A modem routine handles all the comings and goings of file transfer. These are all descendant from the same program, and are known as MODEM, MODEM7, MODEM77X, etc. They are pretty common, are in the public domain, and can usually be scarfed from any CP/M user's group. Once you have one, the world is your

biscuit.

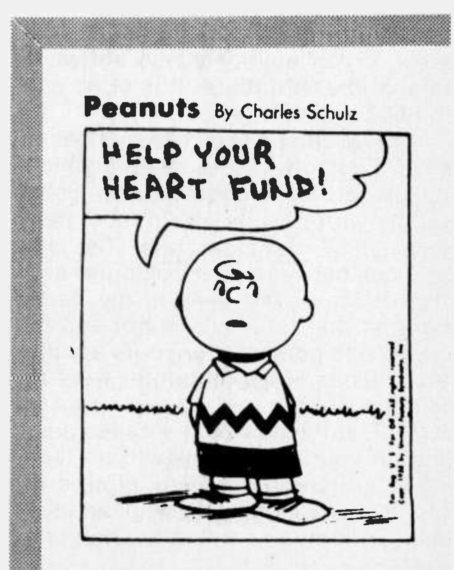
There are several options available when using a modem program, but we're just going to look at the two most common ones which one invokes when communicating with a remote CP/M based system.

Calling your friendly modem routine up, you can give it several commands. T is the simplest, making it into a dumb terminal. From T, it is possible to make a file out of the stuff that comes over the wire at you and save it to disk. First off, for the command you type T and a filename, like T ETIBULL.DOC. This will open file ETIBULL.DOC to the disk. If you then type Control Y (it won't show up on the screen) the program's internal RAM buffer will open and begin engulfing data. Another Control Y will toggle it closed. It can be opened and closed as often as you wish. Control Z will end the file. Control E gets you out of terminal mode, and a WRT instruction sends the file to disk.

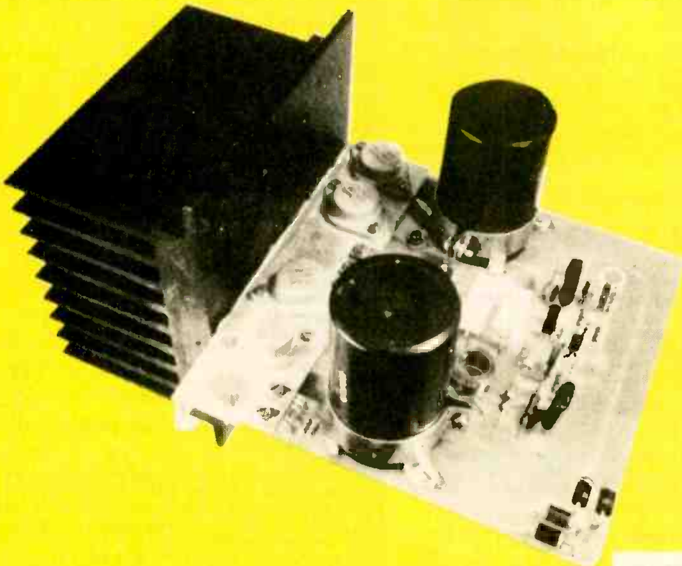
You can use modem with any BBS, actually, just to store your conversations.

To send a file from a BBS to your modem, you get into Terminal (no file name, this time) and call the BBS's XMODEM with XMODEM S (for send) and then the file name. XMODEM will do some stuff, the last of which will be [Control X to Abort]. Type control E to get out of terminal mode (this will not break your contact with the BBS) and then R (for receive) and a file name that the file coming down can occupy on your disk. This can be the same as the file name on the BBS. Your modem will then say that it's waiting for the first sector of data, and, when it comes, the second, third, and so on, until the transfer is complete. When all the sectors are on your disk, type T to get back into terminal mode and you'll be back on the BBS. You'll probably be looking at a blank prompt, so type DIR or something else harmless to see where you are.

There is a lot more to learn about CP/M, of course . . . we've just gotten into a few of the conventions which aren't explained in the usual texts. However, if you do wish to get into this very powerful operating system, this should provide you with a start. As we now have several systems around that will run CP/M, and many of the machines we're reviewing use it, further forays onto the mysterious eight inch disks are even now in the offing. And, speaking of offing, I think it's time to reset 'til next month. ETI



ETI next month

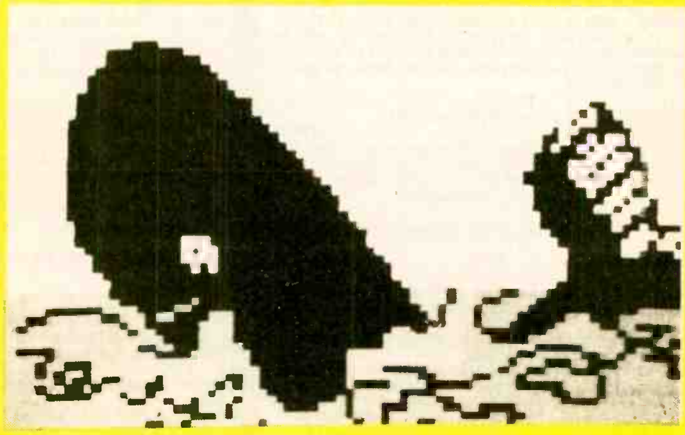


150 Watt MOSFET AMP

This is the headphone amp for you, especially if you use those new 35 pound headphones. Or, be dull, drive your speakers with it. Next month.

Telidon

This rapidly expanding Canadian technology is actually among the most sophisticated in the world. Takes a simple TV and displays. . . well, pictures on it. Find out which ones, next month.



Technical Aspects of the 'Scope

Anybody can understand an oscilloscope; you turn it on, slow down the trace and tell your friends it's an electrocardiograph that's monitoring the vital signs of your pet slug. Or you can read this article.

Synthesizer II

Oh, so you actually want to play *music* on your oscillator. Some people are never satisfied. You'll probably want a keyboard interface then. Also included is a white and pink noise source. Build six and pretend you're Rick Wakeman.

Plus!!!

- XR2206 Function Chip Circuit & Elephants
- Body work Checker & Elephants
- Crossover Networks Explained with Elephants
- TRS-80 Model III reviewed on an Elephant
- Startling example of micro-miniaturization

(four elephants in an eighty page magazine)

ETI book shelf

COMPUTERS
(HARDWARE)

THE ESSENTIAL COMPUTER DICTIONARY AND SPELLER
AB011 **$9.45**
A must for anyone just starting out in the field of computing, be they a businessman, hobbyist or budding computerist. The book presents and defines over 15,000 computer terms and acronyms and makes for great browsing.

A BEGINNER'S GUIDE TO COMPUTERS AND MICROPROCESSORS — WITH PROJECTS.
TAB No.1015 **$13.45**
Here's a plain English introduction to the world of microcomputers — it's capabilities, parts and functions . . . and how you can use one. Numerous projects demonstrate operating principles and lead to the construction of an actual working computer capable of performing many useful functions.

BP66: BEGINNERS GUIDE TO MICROPROCESSORS AND COMPUTING **$7.55**
E.F. SCOTT, M.Sc., C.Eng.
As indicated by the title, this book is intended as an introduction to the basic theory and concepts of binary arithmetic, microprocessor operation and machine language programming.
There are occasions in the text where some background information might be helpful and a Glossary is included at the end of the book.

BP72: A MICROPROCESSOR PRIMER **$7.70**
E.A. PARR, B.Sc., C.Eng., M.I.E.E.
A newcomer to electronics tends to be overwhelmed when first confronted with articles or books on microprocessors. In an attempt to give a painless approach to computing, this small book will start by designing a simple computer and because of its simplicity and logical structure, the language is hopefully easy to learn and understand. In this way, such ideas as Relative Addressing, Index Registers etc. will be developed and it is hoped that these will be seen as logical progressions rather than arbitrary things to be accepted but not understood.

BEGINNERS GUIDE TO MICROPROCESSORS
TAB No.995 **$10.45**
If you aren't sure exactly what a microprocessor is, then this is the book for you. The book takes the beginner from the basic theories and history of these essential devices, right up to some real world hardware applications.

HOW TO BUILD YOUR OWN WORKING MICROCOMPUTER
TAB No.1200 **$16.45**
An excellent reference or how-to manual on building your own microcomputer. All aspects of hardware and software are developed as well as many practical circuits.

BP78: PRACTICAL COMPUTER EXPERIMENTS **$7.30**
E.A. PARR, B.Sc., C.Eng., M.I.E.E.
Curiously most published material on the microprocessor tends to be of two sorts, the first treats the microprocessor as a black box and deals at length with programming and using the "beast". The second type of book deals with the social impact. None of these books deal with the background to the chip, and this is a shame as the basic ideas are both interesting and simple.
This book aims to fill in the background to the microprocessor by constructing typical computer circuits in discrete logic and it is hoped that this will form a useful introduction to devices such as adders, memories, etc. as well as a general source book of logic circuits.

HANDBOOK OF MICROPROCESSOR APPLICATIONS
TAB No.1203 **$14.45**
Highly recommended reading for those who are interested in microprocessors as a means of a accomplishing a specific task. The author discusses two individual microprocessors, the 1802 and the 6800, and how they can be put to use in real world applications.

MICROPROCESSOR/MICROPROGRAMMING HANDBOOK
TAB No.785 **$14.45**
A comprehensive guide to microprocessor hardware and programming. Techniques discussed include subroutines, handling interrupts and program loops.

BP102: THE 6809 COMPANION **$8.10**
M. JAMES
The 6809 microprocessor's history, architecture, addressing modes and the instruction set (fully commented) are covered. In addition there are chapters on converting programs from the 6800, programming style, interrupt handling and about the 6809 hardware and software available.

AN INTRODUCTION TO MICROPROCESSORS EXPERIMENTS IN DIGITAL TECHNOLOGY
HB07: **$15.85**
SMITH
A "learn by doing" guide to the use of integrated circuits provides a foundation for the underlying hardware actions of programming statements. Emphasis is placed on how digital circuitry compares with analog circuitry. Begins with the simplest gates and timers, then introduces the fundamental parts of ICs, detailing the benefits and pitfalls of major IC families, and continues with coverage of the ultimate in integrated complexity — the microprocessor.

DESIGNING MICROCOMPUTER SYSTEMS
HB18: **$15.85**
POOCH AND CHATTERGY
This book provides both hobbyists and electronic engineers with the background information necessary to build microcomputer systems. It discusses the hardware aspects of microcomputer systems. Timing devices are provided to explain sequences of operations in detail. Then, the book goes on to describe three of the most popular microcomputer families: the Intel 8080, Zilog Z-80, and Motorola 6800. Also covered are designs of interfaces for peripheral devices, and information on building microcomputer systems from kits.

S-100 BUS HANDBOOK
HB19: **$22.75**
BURSKY
Here is a comprehensive book that exclusively discusses S-100 bus computer systems and how they are organized. The book covers computer fundamentals, basic electronics, and the parts of the computer. Individual chapters discuss the CPU, memory, input/output, bulk-memory devices, and specialized peripheral controllers. It explains all the operating details of commonly available S-100 systems. Schematic drawings.

BASIC MICROPROCESSORS AND THE 6800
HB06: **$21.45**
Provides two books in one: a basic guide to microprocessors for the beginner, and a complete description of the M6800 system for the engineer.
Each chapter is followed by a problem section.

DIGITAL INTERFACING WITH AN ANALOG WORLD
TAB No.1070 **$14.45**
You've bought a computer, but now you can't make it do anything useful. This book will tell you how to convert real world quantities such as temperature, pressure, force and so on into binary representation.

MICROPROCESSOR INTERFACING HANDBOOK: A/D & D/A
TAB No.1271 **$14.45**
A useful handbook for computerists interested in using their machines in linear applications. Topics discussed include voltage references, op-amps for data conversion, analogue switching and multiplexing and more.

COMPUTER TECHNICIAN'S HANDBOOK
TAB No.554 **$17.45**
Whether you're looking for a career, or you are a service technician, computer repair is an opportunity you should be looking at. The author covers all aspects of digital and computer electronics as well as the mathematical and logical concepts involved.

HOW TO TROUBLESHOOT AND REPAIR MICROCOMPUTERS
AB013 **$10.45**
Learn how to find the cause of a problem or malfunction in the central or peripheral unit of any microcomputer and then repair it. The tips and techniques in this guide can be applied to any equipment that uses the microprocessor as the primary control element.

TROUBLESHOOTING MICROPROCESSORS AND DIGITAL LOGIC
TAB No.1183 **$13.45**
The influence of digital techniques on commercial and home equipment is enormous and increasing yearly. This book discusses digital theory and looks at how to service Video Cassette Recorders, microprocessors and more.

HOW TO DEBUG YOUR PERSONAL COMPUTER
AB012 **$10.45**
When you feel like reaching for a sledge hammer to reduce your computer to fiberglass and epoxy dust, don't. Reach for this book instead and learn all about program bug tracking, recognition and elimination techniques.

COMPUTERS
(SOFTWARE)

HOW TO PROFIT FROM YOUR PERSONAL COMPUTER: PROFESSIONAL, BUSINESS, AND HOME APPLICATIONS
LEWIS
HB01 **$17.00**
Describes the uses of personal computers in common business applications, such as accounting, managing, inventory, sorting mailing lists, and many others. The discussion includes terms, notations, and techniques commonly used by programmers. A full glossary of terms.

PROGRAMS FOR BEGINNERS ON THE TRS-80
BLECHMAN
HB02 **$13.05**
A valuable book of practical and interesting programs for home use that can be understood and used immediately by the beginner in personal computer programming. You'll learn step-by-step how 21 sample TRS-80 programs work. Program techniques are described line-by-line within the programs, and a unique Martri-Dex™ matrix index will enable you to locate other programs using the same BASIC commands and statements.

THE JOY OF MINIS AND MICROS: DATA PROCESSING WITH SMALL COMPUTERS
STEIN AND SHAPIRO
HB03 **$15.85**
A collection of pieces covering technical and management aspects of the use of small computers for business or science. It emphasizes the use of common sense and good systems design for every computer project. Because a strong technical background is not necessary, the book is easy to read and understand. Considerable material is devoted to the question of what size computer should be used for a particular job, and how to choose the right machine for you.

BEGINNER'S GUIDE TO COMPUTER PROGRAMMING
TAB No.574 **$16.45**
Computer programming is an increasingly attractive field to the individual, however many people seem to overlook it as a career. The material in this book has been developed in a logical sequence, from the basic steps to machine language.

USING MICROCOMPUTERS IN BUSINESS
VEIT
HB04 **$14.45**
An essential background briefing for any purchaser of microcomputer systems or software. In a fast-moving style, without the usual buzz words and technical jargon, Veit answers the most often asked questions.

BASIC FROM THE GROUND UP
SIMON
HB15 **$17.00**
Here's a BASIC text for high school students and hobbyists that explores computers and the BASIC language in a simple direct way, without relying on a heavy mathematical backbround on the reader's part. All the features of BASIC are included as well as some of the inside workings of a computer. The book covers one version of each of the BASIC statements and points out some of the variations, leaving readers well prepared to write programs in any version they encounter. A selection of exercises and six worked out problems round out the reader's experience. A glossary and a summary of BASIC statements are included at the end of the book for quick reference.

BASIC COMPUTER PROGRAMS FOR BUSINESS: STERNBERG (Vol. 1)
HB13 **$15.85**
A must for small businesses utilizing micros as well as for entrepreneurs, volume provides a wealth of practical business applications. Each program is documented with a description of its functions and operation, a listing in BASIC, a symbol table, sample data, and one or more samples.

BP86: AN INTRODUCTION TO BASIC PROGRAMMING TECHNIQUES **$8.25**
S. DALY
This book is based on the author's own experience in learning BASIC and in helping others, mostly beginners, to program and understand the language. Also included are a program library containing various programs, that the author has actually written and run. These are for biorhythms, plotting a graph of Y against X, standard deviation, regression, generating a musical note sequence and a card game. The book is complemented by a number of appendices which include test questions and answers on each chapter and a glossary.

THE BASIC COOKBOOK.
TAB No.1055 **$9.45**
BASIC is a surprisingly powerful language . . . if you understand it completely. This book, picks up where most manufacturers' documentation gives up. With it, any computer owner can develop programs to make the most out of his or her machine.

PET BASIC — TRAINING YOUR PET COMPUTER
AB014 **$16.45**
Officially approved by Commodore, this is the ideal reference book for long time PET owners or novices. In an easy to read and humorous style, this book describes techniques and experiments, all designed to provide a strong understanding of this versatile machine.

PROGRAMMING IN BASIC FOR PERSONAL COMPUTERS
AB015 **$10.45**
This book emphasizes the sort of analytical thinking that lets you use a specific tool — the BASIC language — to transform your own ideas into workable programs. The text is designed to help you to intelligently analyse and design a wide diversity of useful and interesting programs.

COMPUTER PROGRAMS IN BASIC
AB001 **$14.45**
A catalogue of over 1,600 fully indexed BASIC computer programs with applications in Business, Math, Games and more. This book lists available software, what it does, where to get it, and how to adapt it to your machine.

PET GAMES AND RECREATION
AB002 **$12.45**
A variety of interesting games designed to amuse and educate. Games include such names as Capture, Tic Tac Toe, Watchperson, Motie, Sinners, Martian Hunt and more.

BRAIN TICKLERS
AB005 **$8.00**
If the usual games such as Bug Stomp and Invaders From the Time Warp are starting to pale, then this is the book for you. The authors have put together dozens of stimulating puzzles to show you just how challenging computing can be.

PASCAL
TAB No.1205 **$16.45**
Aimed specifically at TRS-80 users, this book discusses how to load, use and write PASCAL programs. Graphic techniques are discussed and numerous programs are presented.

PASCAL PROGRAMMING FOR THE APPLE
AB008 **$16.45**
A great book to upgrade your programming skills to the UCSD Pascal as implemented on the Apple II. Statements and techniques are discussed and there are many practical and ready to run programs.

APPLE MACHINE LANGUAGE PROGRAMMING
AB009 **$16.45**
The best way to learn machine language programming the Apple II in no time at all. The book combines colour, graphics, and sound generation together with clear cut demonstrations to help the user learn quickly and effectively.

ALL PRICES INCLUDE SHIPPING

Z80 USERS MANUAL
AB010 **$14.45**
The Z80 MPU can be found in many machines and is generally acknowledged to be one of the most powerful 8 bit chips around. This book provides an excellent 'right hand' for anyone involved in the application of this popular processor.

HOW TO PROGRAM YOUR PROGRAMMABLE CALCULATOR
AB006 **$10.45**
Calculator programming, by its very nature, often is an obstacle to effective use. This book endeavours to show how to use a programmable calculator to its full capabilities. The TI 57 and the HP 33E calculators are discussed although the principles extend to similar models.

Z-80 AND 8080 ASSEMBLY LANGUAGE PROGRAMMING
SPRACKLEN
HB05 **$14.25**
Provides just about everything the applications programmer needs to know for Z-80 and 8080 processors. Programming techniques are presented along with the instructions. Exercises and answers included with each chapter.

BASIC COMPUTER PROGRAMS IN SCIENCE AND ENGINEERING
GILDER
HB08 **$15.85**
Save time and money with this collection of 114 ready-to-run BASIC programs for the hobbyist and engineer. There are programs to do such statistical operations as means, standard deviation averages, curve-fitting, and interpolation. There are programs that design antennas, filters, attenuators, matching networks, plotting, and histogram programs.

GAME PLAYING WITH COMPUTERS SECOND EDITION
SPENCER
HB11 **$31.25**
Now you can sharpen programming skills through a relaxed approach. Completely devoted to computerized game playing, this volume presents over 70 games, puzzles, and mathematical recreations for a digital computer. It's fully illustrated and includes more that 25 game-playing programs in FORTRAN or BASIC complete with descriptions, flowcharts, and output.

MICROCOMPUTERS AND THE 3 R'S
DOERR
HB09 **$14.25**
This book educates educators on the various ways computers, especially microcomputers, can be used in the classroom. It describes microcomputers, how to organize a computer-based program, the five instructional application types (with examples from subjects such as the hard sciences, life sciences, English, history, and government) and resources listings of today's products. The book includes preprogrammed examples to start up a microcomputer program; while chapters on resources and products direct the reader to useful additional information. All programs are written in the BASIC language.

GAME PLAYING WITH BASIC
SPENCER
HB10 **$15.25**
The writing is nontechnical, allowing almost anyone to understand computerized game playing. The book includes the rules of each game, how each game works, illustrative flowcharts, diagrams, and the output produced by each program. The last chapter contains 26 games for reader solution.

SARGON: A COMPUTER CHESS PROGRAM
SPRACKLEN
HB12 **$25.00**
"I must rate this chess program an excellent buy for anyone who loves the game." Kilobaud.

Here is the computer chess program that won first place in the first chess tournament at the 1978 West Coast Computer Faire. It is written in Z-80 assembly language, using the TDL macro assembler. It comes complete with block diagram and sample printouts.

A CONSUMER'S GUIDE TO PERSONAL COMPUTING AND MICROCOMPUTERS, SECOND EDITION
FREIBERGER AND CHEW
HB14 **$14.45**
The first edition was chosen by Library Journal as one of the 100 outstanding sci-tech books of 1978. Now, there's an updated second edition!

Besides offering an introduction to the principles of microcomputers that assumes no previous knowledge on the reader's part, this second edition updates prices, the latest developments in microcomputer technology, and a review of over 100 microcomputer products from over 60 manufacturers.

THE BASIC CONVERSIONS HANDBOOK FOR APPLE, TRS-80, AND PET USERS
BRAIN BANK
HB17 **$11.75**
Convert a BASIC program for the TRS-80, Apple II, or PET to the form of BASIC used by any other one of those machines. This is a complete guide to converting Apple II and PET programs to TRS-80, TRS-80 and PET programs to Apple II, TRS-80 and Apple II programs to PET. Equivalent commands are listed for TRS-80 BASIC (Model I, Level II), Applesoft BASIC and PET BASIC, as well as variations for the TRS-80 Model III and Apple Integer BASIC.

SPEAKING PASCAL
BOWEN
HB16 **$17.25**
An excellent introduction to programming in the Pascal language! Written in clear, concise, non-mathematical language, the text requires no technical background or previous programming experience on the reader's behalf. Top-down structured analysis and key examples illustrate each new idea and the reader is encouraged to construct programs in an organized manner.

BP33: ELECTRONIC CALCULATOR USERS HANDBOOK **$4.25**
M.H. BABANI, B.Sc.(Eng.)
An invaluable book for all calculator users whatever their age or occupation, or whether they have the simplest or most sophisticated of calculators. Presents formulae, data, methods of calculation, conversion factors, etc., with the calculator user especially in mind, often illustrated with simple examples. Includes the way to calculate using only a simple four function calculator: Trigonometric Functions (Sin, Cos, Tan): Hyperbolic Functions (Sinh, Cosh, Tanh) Logarithms, Square Roots and Powers.

THE MOST POPULAR SUBROUTINES IN BASIC
TAB No.1050 **$10.45**
An understandable guide to BASIC subroutines which enables the reader to avoid tedium, economise on computer time and makes programs run faster. It is a practical rather than a theoretical manual.

PROJECTS

BP48: ELECTRONIC PROJECTS FOR BEGINNERS **$5.90**
F.G. RAYER, T.Eng.(CEI), Assoc.IERE
Another book written by the very experienced author — Mr. F.G. Rayer — and in it the newcomer to electronics, will find a wide range of easily made projects. Also, there are a considerable number of actual component and wiring layouts, to aid the beginner.

Furthermore, a number of projects have been arranged so that they can be constructed without any need for soldering and, thus, avoid the need for a soldering iron.

Also, many of the later projects can be built along the lines as those in the 'No Soldering' section so this may considerably increase the scope of projects which the newcomer can build and use.

221: 28 TESTED TRANSISTOR PROJECTS
R.TORRENS **$5.50**
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. The projects themselves can be split down into simpler building blocks, which are shown separated by boxes in the circuits for ease of description, and also to enable any reader who wishes to combine boxes from different projects to realise ideas of his own.

BP49: POPULAR ELECTRONIC PROJECTS **$6.25**
R.A. PENFOLD
Includes a collection of the most popular types of circuits and projects which, we feel sure, will provide a number of designs to interest most electronics constructors. The projects selected cover a very wide range and are divided into four basic types: Radio Projects, Audio Projects, Household Projects and Test Equipment.

EXPERIMENTER'S GUIDE TO SOLID STATE ELECTRONIC PROJECTS
AB007 **$9.45**
An ideal sourcebook of Solid State circuits and techniques with many practical circuits. Also included are many useful types of experimenter gear.

BP71: ELECTRONIC HOUSEHOLD PROJECTS **$7.70**
R. A. PENFOLD
Some of the most useful and popular electronic construction projects are those that can be used in or around the home. The circuits range from such things as '2 Tone Door Buzzer', Intercom, through Smoke or Gas Detectors to Baby and Freezer Alarms.

BP94: ELECTRONIC PROJECTS FOR CARS AND BOATS **$8.10**
R.A. PENFOLD
Projects, fifteen in all, which use a 12V supply are the basis of this book. Included are projects on Windscreen Wiper Control, Courtesy Light Delay, Battery Monitor, Cassette Power Supply, Lights Timer, Vehicle Immobiliser, Gas and Smoke Alarm, Depth Warning and Shaver Inverter.

BP69: ELECTRONIC GAMES **$7.55**
R.A. PENFOLD
In this book Mr. R. A. Penfold has designed and developed a number of interesting electronic game projects using modern integrated circuits. The text is divided into two sections, the first dealing with simple games and the latter dealing with more complex circuits.

BP95: MODEL RAILWAY PROJECTS **$8.10**
Electronic projects for model railways are fairly recent and have made possible an amazing degree of realism. The projects covered include controllers, signals and sound effects: striboard layouts are provided for each project.

BP93: ELECTRONIC TIMER PROJECTS **$8.10**
F.G. RAYER
Windscreen wiper delay, darkroom timer and metronome projects are included. Some of the more complex circuits are made up from simpler sub-circuits which are dealt with individually.

110 OP-AMP PROJECTS
MARSTON
HB24 **$11.75**
This handbook outlines the characteristics of the op-amp and present 110 highly useful projects—ranging from simple amplifiers to sophisticated instrumentation circuits.

110 IC TIMER PROJECTS
GILDER
HB25 **$10.25**
This sourcebook maps out applications for the 555 timer IC. It covers the operation of the IC itself to aid you in learning how to design your own circuits with the IC. There are application chapters for timer-based instruments, automotive applications, alarm and control circuits, and power supply and converter applications.

110 THYRISTOR PROJECTS USING SCRs AND TRIACS
MARSTON
HB22 **$12.05**
A grab bag of challenging and useful semiconductor projects for the hobbyist, experimenter, and student. The projects range from simple burglar, fire, and water level alarms to sophisticated power control devices for electric tools and trains. Integrated circuits are incorporated wherever their use reduces project costs.

110 CMOS DIGITAL IC PROJECTS
MARSTON
HB23 **$11.75**
Outlines the operating characteristics of CMOS digital ICs and then presents and discusses 110 CMOS digital IC circuits ranging from inverter gate and logic circuits to electronic alarm circuits. Ideal for amateurs, students and professional engineers.

BP76: POWER SUPPLY PROJECTS **$7.30**
R.A. PENFOLD
Line power supplies are an essential part of many electronics projects. The purpose of this book is to give a number of power supply designs, including simple unstabilised types, fixed voltage regulated types, and variable voltage stabilised designs, the latter being primarily intended for use as bench supplies for the electronics workshop. The designs provided are all low voltage types for semiconductor circuits.

There are other types of power supply and a number of these are dealt with in the final chapter, including a cassette power supply, Ni-Cad battery charger, voltage step up circuit and a simple inverter.

BP84: DIGITAL IC PROJECTS **$8.10**
F.G. RAYER, T.Eng.(CEI),Assoc.IERE
This book contains both simple and more advanced projects and it is hoped that these will be found of help to the reader developing a knowledge of the workings of digital circuits. To help the newcomer to the hobby the author has included a number of board layouts and wiring diagrams. Also the more ambitious projects can be built and tested section by section and this should help avoid or correct faults that could otherwise be troublesome. An ideal book for both beginner and more advanced enthusiast alike.

BP67: COUNTER DRIVER AND NUMERAL DISPLAY PROJECTS **$7.55**
F.G. RAYER, T.Eng.(CEI), Assoc. IERE
Numeral indicating devices have come very much to the forefront in recent years and will, undoubtedly, find increasing applications in all sorts of equipment. With present day integrated circuits, it is easy to count, divide and display numerically the electrical pulses obtained from a great range of driver circuits.

In this book many applications and projects using various types of numeral displays, popular counter and driver IC's etc. are considered.

213: ELECTRONIC CIRCUITS FOR MODEL RAILWAYS **$4.50**
M.H. BABANI, B.Sc.(Eng.)
The reader is given constructional details of how to build a simple model train controller; controller with simulated inertia and a high power controller. A signal system and lighting for model trains is discussed as is the suppression of RF interference from odel railways. The construction of an electronic steam whistle and a model train chuffer is also covered.

BP73: REMOTE CONTROL PROJECTS **$8.60**
OWEN BISHOP
This book is aimed primarily at the electronics enthusiast who wishes to experiment with remote control. Full explanations have been given so that the reader can fully understand how the circuits work and can more easily see how to modify them for other purposes, depending on personal requirements. Not only are radio control systems considered but also infra-red, visible light and ultrasonic systems as are the use of Logic ICs and Pulse position modulation etc.

BP99: MINI — MATRIX BOARD PROJECTS **$8.10**
R.A. PENFOLD
Twenty useful projects which can all be built on a 24 x 10 hole matrix board with copper strips. Includes Doorbuzzer, Low-voltage Alarm, AM Radio, Signal Generator, Projector Timer, Guitar Headphone Amp, Transistor Checker and more.

CIRCUITS

BP98: POPULAR ELECTRONIC CIRCUITS, BOOK 2 **$9.35**
R.A. PENFOLD
70 plus circuits based on modern components aimed at those with some experience.

BP80: POPULAR ELECTRONIC CIRCUITS — BOOK 1 **$8.25**
R.A. PENFOLD
Another book by the very popular author, Mr. R.A. Penfold, who has designed and developed a large number of various circuits. These are grouped under the following general headings: Audio Circuits, Radio Circuits, Test Gear Circuits, Music Project Circuits, Household Project Circuits and Miscellaneous Circuits.

SEE ORDER FORM ON PAGE 61

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The GIANT HANDBOOK OF ELECTRONIC CIRCUITS
TAB No.1300 **$24.45**
About as twice as thick as the Webster's dictionary, and having many more circuit diagrams, this book is ideal for any experimenter who wants to keep amused for several centuries. If there isn't a circuit for it in here, you should have no difficulty convincing yourself you don't really want to build it.

BP39: 50 (FET) FIELD EFFECT TRANSISTOR PROJECTS **$5.50**
F.G. RAYER, T.Eng.(CEI),Assoc.IERE
Field effect transistors (FETs), find application in a wide variety of circuits. The projects described here include radio frequency amplifiers and converters, test equipment and receiver aids, tuners, receivers, mixers and tone controls, as well as various miscellaneous devices which are useful in the home.
This book contains something of particular interest for every class of enthusiast — short wave listener, radio amateur, experimenter or audio devotee.

BP87: SIMPLE L.E.D. CIRCUITS **$5.90**
R.N. SOAR
Since it first appeared in 1977, Mr. R.N. Soar's book has proved very popular. The author has developed a further range of circuits and these are included in Book 2. Projects include a Transistor Tester, Various Voltage Regulators, Testers and so on.

BP42: 50 SIMPLE L.E.D. CIRCUITS **$3.55**
R.N. SOAR
The author of this book, Mr. R.N. Soar, has compiled 50 interesting and useful circuits and applications, covering many different branches of electronics, using one of the most inexpensive and freely available components — the Light Emitting Diode (L.E.D.). A useful book for the library of both beginner and more advanced enthusiast alike.

BP82: ELECTRONIC PROJECTS USING SOLAR CELLS **$8.10**
OWEN BISHOP
The book contains simple circuits, almost all of which operate at low voltage and low currents, making them suitable for being powered by a small array of silicon cells. The projects cover a wide range from a bicyle speedometer to a novelty 'Duck Shoot'; a number of power supply circuits are included.

BP37: 50 PROJECTS USING RELAYS, SCR's & TRIACS **$5.50**
F.G.RAYER, T.Eng.(CEI),Assoc.IERE
Relays, silicon controlled rectifiers (SCR's) and bi-directional triodes (TRIACs) have a wide range of applications in electronics today. This book gives tried and practical working circuits which should present the minimum of difficulty for the enthusiast to construct. In most of the circuits there is a wide latitude in component values and types, allowing easy modification of circuits or ready adaptation of them to individual needs.

BP44: IC 555 PROJECTS **$7.55**
E.A. PARR, B.Sc.,C.Eng., M.I.E.E.
Every so often a device appears that is so useful that one wonders how life went on before without it. The 555 timer is such a device. Included in this book are Basic and General Circuits, Motor Car and Model Railway Circuits, Alarms and Noise Makers as well as a section on the 556, 558 and 559 timers.

BP24: 50 PROJECTS USING IC741 **$4.25**
RUDI & UWE REDMER
This book, originally published in Germany by TOPP, has achieved phenomenal sales on the Continent and Babani decided, in view of the fact that the integrated circuit used in this book is inexpensive to buy, to make this unique book available to the English speaking reader. Translated from the original German with copious notes, data and circuitry, a "must" for everyone whatever their interest in electronics.

BP83: VMOS PROJECTS **$8.20**
R.A. PENFOLD
Although modern bipolar power transistors give excellent results in a wide range of applications, they are not without their drawbacks or limitations. This book will primarily be concerned with VMOS power FETs although power MOSFETs will be dealt with in the chapter on audio circuits. A number of varied and interesting projects are covered under the main headings of: Audio Circuits, Sound Generator Circuits, DC Control Circuits and Signal Control Circuits.

BP65: SINGLE IC PROJECTS **$6.55**
R.A.PENFOLD
There is now a vast range of ICs available to the amateur market, the majority of which are not necessarily designed for use in a single application and can offer unlimited possibilities. All the projects contained in this book are simple to construct and are based on a single IC. A few projects employ one or two transistors in addition to an IC but in most cases the IC is the only active device used.

BP97: IC PROJECTS FOR BEGINNERS **$8.10**
F.G. RAYER
Covers power supplies, radio, audio, oscillators, timers and switches. Aimed at the less experienced reader, the components used are popular and inexpensive.

BP88: HOW TO USE OP AMPS **$9.35**
E.A. PARR
A designer's guide covering several op amps, serving as a source book of circuits and a reference book for design calculations. The approach has been made as non-mathematical as possible.

IC ARRAY COOKBOOK
JUNG
HB26 **$14.25**
A practical handbook aimed at solving electronic circuit application problems by using IC arrays. An IC array, unlike specific-purpose ICs, is made up of uncommitted IC active devices, such as transistors, resistors, etc. This book covers the basic types of such ICs and illustrates with examples how to design with them. Circuit examples are included, as well as general design information useful in applying arrays.

BP50: IC LM3900 PROJECTS **$5.90**
H.KYBETT,B.Sc., C.Eng.
The purpose of this book is to Introduce the LM3900 to the Technician, Experimenter and the Hobbyist. It provides the groundwork for both simple and more advanced uses, and is more than just a collection of simple circuits or projects.
Simple basic working circuits are used to introduce this IC. The LM3900 can do much more than is shown here, this is just an introduction. Imagination is the only limitation with this useful and versatile device. But first the reader must know the basics and that is what this book is all about.

223: 50 PROJECTS USING IC CA3130 **$5.50**
R.A.PENFOLD
In this book, the author has designed and developed a number of interesting and useful projects which are divided into five general categories: I — Audio Projects II — R.F. Projects III — Test Equipment IV — Household Projects V — Miscellaneous Projects.

224: 50 CMOS IC PROJECTS **$4.25**
R.A. PENFOLD
CMOS IC's are probably the most versatile range of digital devices for use by the amateur enthusiast. They are suitable for an extraordinary wide range of applications and are also some of the most inexpensive and easily available types of IC.
Mr. R.A. Penfold has designed and developed a number of interesting and useful projects which are divided into four general categories: I — Multivibrators II — Amplifiers and Oscillators III — Trigger Devices IV — Special Devices

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AUDIO

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F.G. RAYER
Covers in detail the construction of a wide range of audio projects. The text has been divided into preamplifiers and mixers, power amplifiers, tone controls and matching and miscellaneous projects.

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BP35: HANDBOOK OF IC AUDIO PRE-AMPLIFIER AND POWER AMPLIFIER CONSTRUCTION **$5.50**
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This book is divided into three parts: Part I, understanding audio IC's, Part II, Pre-amplifiers, Mixers and Tone Controls, Part III Power Amplifiers and Supplies. Includes practical constructional details of pure IC and Hybrid IC and Transistor designs from about 250mW to 100W output.

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M.K. BERRY
Electronic music is the new music of the Twentieth Century. It plays a large part in "pop" and "rock" music and, in fact, there is scarcely a group without some sort of synthesiser or other effects generator.
This book sets out to show how electronic music can be made at home with the simplest and most inexpensive of equipment. It then describes how the sounds are generated and how these may be recorded to build up the final composition.

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Although one of the more recent branches of amateur electronics, electronic music has now become extremely popular and there are many projects which fall into this category. The purpose of this book is to provide the constructor with a number of practical circuits for the less complex items of electronic music equipment, including such things as a Fuzz Box, Waa-Waa Pedal, Sustain Unit, Reverberation and Phaser-Units, Tremelo Generator etc.

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M.K. BERRY
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If you're fascinated by the potential of electronics in the field of music, then this is the book for you. Included is data on synthesizers in general as well as particular models. There is also a chapter on the various accessories that are available.

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BP75: ELECTRONIC TEST EQUIPMENT CONSTRUCTION **$7.30**
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This book covers in detail the construction of a wide range of test equipment for both the Electronics Hobbyists and Radio Amateur. Included are projects ranging from an FET Amplified Voltmeter and Resistance Bridge to a Field Strength Indicator and Heterodyne Frequency Meter. Not only can the home constructor enjoy building the equipment but the finished projects can also be usefully utilised in the furtherance of his hobby.

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RADIO AND COMMUNICATIONS

BP79: RADIO CONTROL FOR BEGINNERS $7.30
F.G. RAYER, T.Eng.(CEI),Assoc.IERE.
The aim of this book is to act as an introduction to Radio Control for beginners to the hobby. The book will commence by dealing with the conditions that are allowable for such things as frequency and power of transmission. This is followed by a "block" explanation of how control-device and transmitter operate and receiver and actuator(s) produce motion in a model.

Details are then given of actual solid state transmitting equipment which the reader can build. Plain and loaded aerials are then discussed and so is the field-strength meter to help with proper setting up.

The radio receiving equipment is then dealt with which includes a simple receiver and also a crystal controlled superhet. The book ends with the electro-mechanical means of obtaining movement of the controls of the model.

BP96: CB PROJECTS $8.10
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SHORTWAVE CIRCUITS & GEAR FOR EXPERIMENTERS & RADIO HAMS
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Covers constructional details of a number of projects for the shortwave enthusiast and radio "Ham". Included are: an add-in crystal filter, adding an "S" meter in your receiver; crystal locked H.F. Receiver; AM tuner using phase locked loop; coverter for 2MHz, 40 to 800 MHz RF amplifier, Aerials for the 52, 144MHz bands, Solid State Crystal Frequency Calibrator, etc.

BP92: ELECTRONICS SIMPLIFIED—CRYSTAL SET CONSTRUCTION $7.30
F.A. WILSON
Aimed at those who want to get into construction without much theoretical study. Homewound coils are used and all projects are very inexpensive to build.

AUDIO AND VIDEO INTERFERENCE CURES
KAHANER
HB21 $9.05
A practical work about interference causes and cures that affect TV, radio, hi-fi, CB, and other devices. Provides all the information needed to stop interference. Schematic wiring diagrams of filters for all types of receivers and transmitters are included. Also, it supplies simple filter diagrams to eliminate radio and TV interference caused by noisy home appliances, neon lights, motors, etc.

Book Of The Month

Crystal Set Construction .... BP92 .... $7.30

How often have you leaned back from your twelve giga-dollar microcomputer, switched off your 10,000 watt national debt stereo, told the robot to go kill compact cars and thought how long it's been since you've built a crystal radio? Not very often, right? You need this book. It's therapeutic, practical and, at the very least, it will help you build something you can actually understand.

This book is ideal for both the beginner just getting into electronics and the experienced soldering iron cavalier who just wants to stop slaying IC's for a while. All the aspects of crystal sets are covered, from simple circuits to multiband sets, plus their history and some radio theory. Simple, easy to get parts are specified throughout.

BP46: RADIO CIRCUITS USING IC's $5.90
J.B. DANCE, M.Sc.
This book describes integrated circuits and how they can be employed in receivers for the reception of either amplitude or frequency modulated signals. The chapter on amplitude modulated (a.m.) receivers will be of most interest to those who wish to receive distant stations at only moderate audio quality, while the chapter on frequency modulation (f.m.) receivers will appeal to those who desire high fidelity reception.

REFERENCE

THE BEGINNER'S HANDBOOK OF ELECTRONICS
AB003 $9.45
An excellent textbook for those interested in the fundamentals of Electronics. This book covers all major aspects of power supplies, amplifiers, oscillators, radio, television and more.

ELEMENTS OF ELECTRONICS — AN ON-GOING SERIES
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Although written especially for readers with no more than ordinary arithmetical skills, the use of mathematics is not avoided, and all the mathematics required is taught as the reader progresses.

Each book is a complete treatise of a particular branch of the subject and, therefore, can be used on its own with one proviso, that the later books do not duplicate material from their predecessors, thus a working knowledge of the subjects covered by the earlier books is assumed.

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BOOK 2: This book continues with alternating current theory without which there can be no comprehension of speech, music, radio, television or even the electricity utilities.

BOOK 3: Follows on semiconductor technology, leading up to transistors and integrated circuits.

BOOK 4: A complete description of the internal workings of microprocessor.

BOOK 5: A book covering the whole communication scene.

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This book will help the reader to find possible substitutes for a popular user-orientated selection of modern transistors. Also shown are the material type, polarity, manufacturer selection of modern transistors. Also shown are the material type, polarity, manufacturer and use. The Equivalents are sub-divided into European, American and Japanese. The products of over 100 manufacturers are included. An essential addition to the library of all those interested in electronics, be they technicians, designers, engineers or hobbyists. Fantastic value for the amount of information it contains.

BP1: FIRST BOOK OF TRANSISTOR EQUIVALENTS AND SUBSTITUTES $2.80
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This guide covers many thousands of transistors showing possible alternatives and equivalents. Covers transistors made in Great Britain, USA, Japan, Germany, France, Europe, Hong Kong, and includes types produced by more than 120 different manufacturers.

BP14: SECOND BOOK OF TRANSISTOR EQUIVALENTS AND SUBSTITUTES $4.80
B.B. BABANI
The "First Book of Transistor Equivalents" has had to be reprinted 15 times. The "Second Book" produced in the same style as the first book, in no way duplicates any of the data presented in it. The "Second Book" contains only additional material and the two books complement each other and make available some of the most complete and extensive information in this field. The interchangeability data covers semiconductors manufactured in Great Britain, USA, Germany, France, Poland, Italy, East Germany, Belgium, Austria, Netherlands and many other countries.

TOWER'S INTERNATIONAL OP-AMP LINEAR IC SELECTOR
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MISCELLANEOUS

BP68: CHOOSING AND USING YOUR HI-FI $7.25
MAURICE L. JAY
The main aim of this book is to provide the reader with the fundamental information necessary to enable him to make a satisfactory choice from the extensive range of hi-fi equipment now on the market.

Help is given to the reader in understanding the equipment he is interested in buying and the author also gives his own opinion of the minimum standards and specifications one should look for. The book also offers helpful advice on how to use your hi-fi properly so as to realise its potential. A Glossary of terms is also included.

BP101: HOW TO IDENTIFY UNMARKED IC'S $2.70
K.H. RECORR
Originally published as a feature in 'Radio Electronics', this chart shows how to record the particular signature of an unmarked IC using a test meter, this information can then be used with manufacturer's data to establish the application.

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INTERRELATED INTEGRATED ELECTRONICS CIRCUITS FOR THE RADIO AMATEUR, TECHNICIAN, HOBBYIST AND CB'ER
MENDELSON
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This book provides a variety of appealing projects that can be constructed by anyone from the hobbyist to the engineer. Construction details, layouts, and photographs are provided to simplify duplication. While most of the circuits are shown on printed circuit boards, every one can be duplicated on hand-wired, perforated boards. Each project is related to another projects so that several may be combined into a single package. The projects, divided into five major groups, include CMOS audio modules, passive devices tohelp in benchwork, test instruments, and games.

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Into Linear ICs part 8

To sleep, perchance to dream; Ay, there's the transistor (just under your shoe). The final hour upon the stage for Into Linear IC's, by Ian Sinclair.

ONE TYPE OF IC we haven't mentioned so far, mainly because it's used so much more for digital circuits than for linear types, is the CMOS IC. The letters CMOS mean Complementary Metal Oxide Silicon; the complementary part of the title means that some of the silicon is P-type and other parts N-type, and the metal-oxide part of the name indicates that the currents through the silicon are controlled by the voltage of bits of metal which are separated from the silicon by the insulator silicon oxide. A CMOS IC is an IC made from field-effect transistors, rather than the familiar junction (or bipolar) transistors, and for some purposes these ICs can provide features which can't be equalled by the more common types of bipolar ICs.

Two features of CMOS ICs are valuable in linear circuits. One is the very high input resistance which can be obtained, and the other is the use of these circuits as resistors which change value as the voltage bias changes. Before we look at some practical circuits, though, a warning is needed. Because of the very high input resistance, a CMOS input cannot discharge the voltages caused by electrostatic charging. Your body can be charged to several thousand volts by simply walking over a dry nylon carpet, and such a voltage applied across two pins of a CMOS IC from your fingers will destroy the IC completely. A bipolar IC such as the 741 is unaffected because its input resistance is low enough to discharge the voltage harmlessly. CMOS ICs should be kept in the holders in which they are supplied, and connected into the circuit only after all the other components are in place. Many constructors prefer always to use CMOS ICs in holders rather than soldering into place. Certainly if these ICs are soldered in, a grounded iron must be used, and the other components must be connected in place first. When several CMOS devices are on one IC, then no inputs must ever be left unconnected. In the diagrams which follow, the unused inputs are grounded by wire links which must be in place before the IC is plugged in, and which must not be removed while the CMOS IC is in place. Similarly, the IC must never be plugged in or out while the supply voltage is switched on, and the pins of the IC must never be touched; you soon develop the habit of holding the body of the IC and transferring it from its wrapping to the board or back again without letting the pins come into contact with anything else.

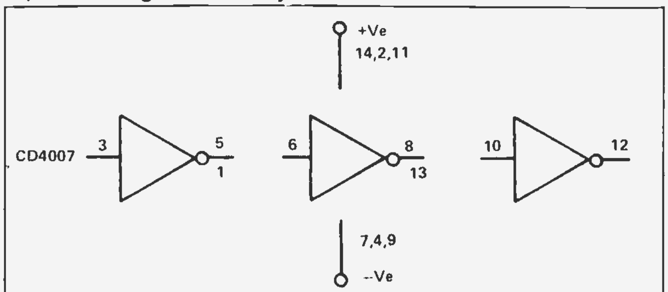

Fig. 1. The three inverters contained in the CD4007 CMOS IC.

The CD4007 is a versatile circuit which consists of three pairs of complementary MOSFETs inside one package, with enough separate connections to allow the unit to be used for a variety of purposes. The most useful connection for linear circuits is as three separate inverters, as shown in Fig. 1. These can each be used as common-drain amplifiers, as shown in Fig. 2 making use of the very high input resistance and the fact that no bias is needed.

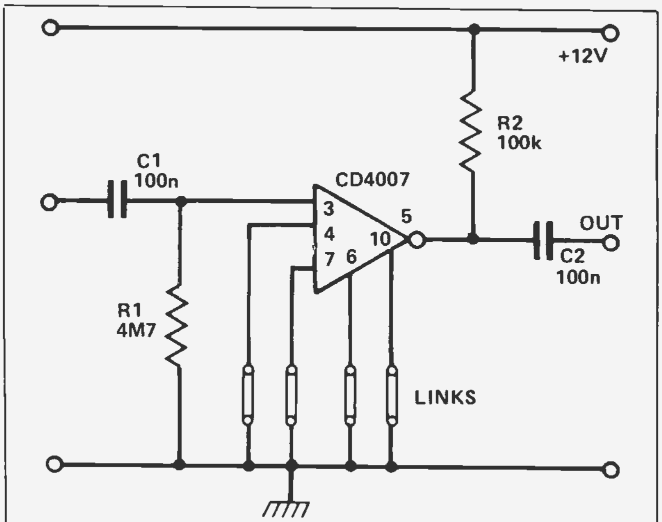

Fig. 2. Using one section of the CD4007 as an inverting amplifier.

Phase-Locked Loops

The phase-locked loop is a type of IC which is rather more specialised than the ones we've looked at earlier in this series, but it's a circuit which is nowadays used to such an extent that we can't ignore it. The block diagram of a phase-locked loop (PLL) is shown in Fig. 3; it consists of an oscillator whose frequency can be controlled by a steady (DC) voltage, along with a phase comparator (or phase-sensitive detector). The phase comparator does pretty well what its name suggests — it compares the phase of two signals and gives an output whose amplitude and sign depends on the phase difference. Let's make that a bit clearer. Suppose we have two inputs A and B to a phase-sensitive detector, and we have sine-wave signals of the same frequency at each input. We can arrange the detector so that if the phase of the signal at A is earlier than the phase of the signal at B, the output of the detector is a positive DC voltage whose size depends on the amount of the phase difference, perhaps 200 mV for every 20° of phase difference.

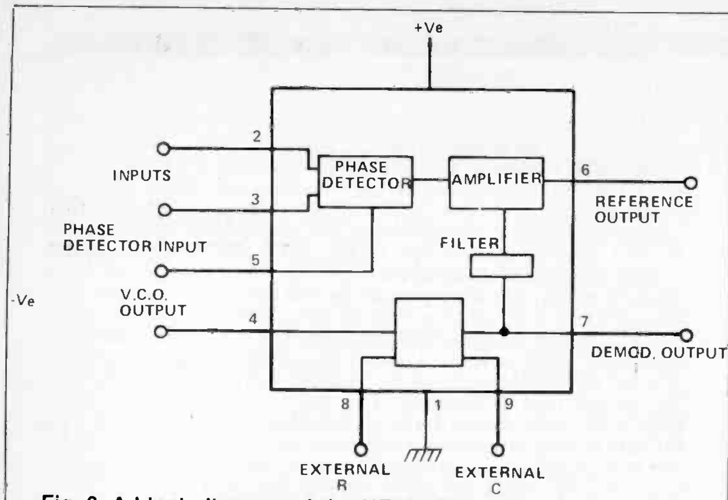

Fig. 3. A block diagram of the NE565 PLL.

Similarly, if the phase of the signal at A is later than the phase of the signal at B, the output of the detector is a negative voltage whose size depends on the amount of the phase difference. The output is zero only when the phases of the two signals are identical, or when the frequencies are so different that the detector can't operate.

What happens in a phase-locked loop is that external components, usually a resistor and a capacitor, are used to set the frequency of the oscillator inside the PLL IC. Another signal applied to the input will, if its frequency is sufficiently close to that of the oscillator, cause the phase detector to generate a voltage. This voltage, the correction signal, is then used to change the frequency of the oscillator (it's a voltage controlled oscillator, remember) so that it is 'pulled in' to be equal to the frequency of the input signal.

How can we use this? One use is in 'cleaning-up' signals. If we have a signal which started as a sinewave but which has been affected by noise, tape drop-outs, or interference, then using it as the input to a PLL will cause the PLL to generate a 'clean' output waveform of exactly the same frequency, and in the same phase as well. This can, incidentally, also be used to remove all traces of amplitude modulation from a signal.

Another application is FM demodulation. If the signal into a PLL is an FM IF at a reasonably low frequency (the normal IF for an FM receiver is 10.7 MHz, which is a bit high for most IC PLLs), then as the frequency of the input signal changes, the voltage of the correction signal will also change to make the oscillator keep in step. We can make use of this correction voltage — it's the audio signal from the demodulated FM and its voltage is exactly proportional to the frequency of the input.

Other uses? Metal detectors are another obvious use for the PLL, and they are also being seen more and more in the application which they were designed for (the PLL, that is) which is cleaning up the signals from tape recorders to feed into computers, and to convert computer signals into a form which can be transmitted along telephone lines.

We've covered a lot of ground (and circuit board) since we started on Part 1 of this series, and looked at a lot of linear ICs. But now, you should be able to identify how a linear IC is used in any circuit, and your practical experience now lets you construct linear IC circuits with complete confidence. What more do you want? Digital ICs? Watch this space! ETI

Continued from page 49

Standard Code for Information Interchange. Like all the other codes, it can be represented with an 8 bit byte. The standard ASCII code requires only 6 bits. Using these 6 bits, a total of $2^6 = 64$ different alphanumeric characters is possible. These include decimal numbers, upper-case letters and special punctuation characters as well as control characters. Note that not all the characters in the ASCII code can be printed or displayed; control characters for instance cause certain functions to occur, but are not seen by the user. Only the result of the function may or may not be detected. Also, there is the more common communications type USASCII. USASCII is an extended ASCII code and uses 7 bits. With 7 bits we can have $2^7 = 128$ different characters, including lower-case and more of the specialized characters. The eighth bit in a 7 bit ASCII (USASCII) code is used for what is called the parity check. This bit may or may not be required. It is used as a simple means for the communications system to check that the data coming in is correct. Briefly, *even parity* means that the total of all of the bits that are a '1', including the parity bit, result in an even number. *Odd parity* means that the total of all the bits that are '1', including the parity bit, result in an odd number. Most microcomputers use a method called stripping to get rid of this eighth bit in order to ignore it for general terminal (crt) input and output. This is the standard code used to communicate to the microcomputer with the keyboard and view the results on the CRT or picture tube. Also, it is the code most often used to drive printers.

All the codes that we have talked about are 8 bits, either 1's or 0's. If the digital microcomputer contained the binary number 01000001, then this byte could be represented by any one of the following computer codes:

01 000 001
101Q (OCTAL)
0100 0001
41H (HEXADECIMAL)
01000001
"A" (ASCII)
01000001
MOV B,C (8080 INSTRUCTION)

But the digital microcomputer only knows that it is the 8 bits 01000001.

In order to represent the byte as either octal or hexadecimal or ASCII, the programmer must write a program that will take that byte and convert it to the representation that he would like. Therefore, this one byte could be displayed as either an octal number, as a hexadecimal number or as the ASCII letter A, or even as the binary number 01000001, but it takes special software or programs in order to do this.

End Bit

All of these conversions will require software routines which may be written for one notation or the other; it is not important, at this point, which notation is chosen. What is important is the fact that a conversion routine is required regardless of the notation being used. Therefore if a microcomputer program, such as an assembler, were to print out the assembly routine with all the data displayed in hexadecimal notation, it is because someone chose to include a hexadecimal conversion routine in the assembler and not an octal conversion routine. But, the octal conversion routine could have been included in the very same assembler and display octal notation data equally well. The same thing is true of the type of data that is entered on the keyboard; some programs require that all input be in hexadecimal notation while other require that octal notation be inputted. This data input is also software controlled, and any microcomputer that requires hexadecimal notation could just as easily have had an octal input routine instead. These routines will take the ASCII data in the notation required (hex or octal) and convert them to binary data to be stored in the microcomputer. Later, the output routines will take these binary bytes and convert them back to the required notation and display them on the system console.

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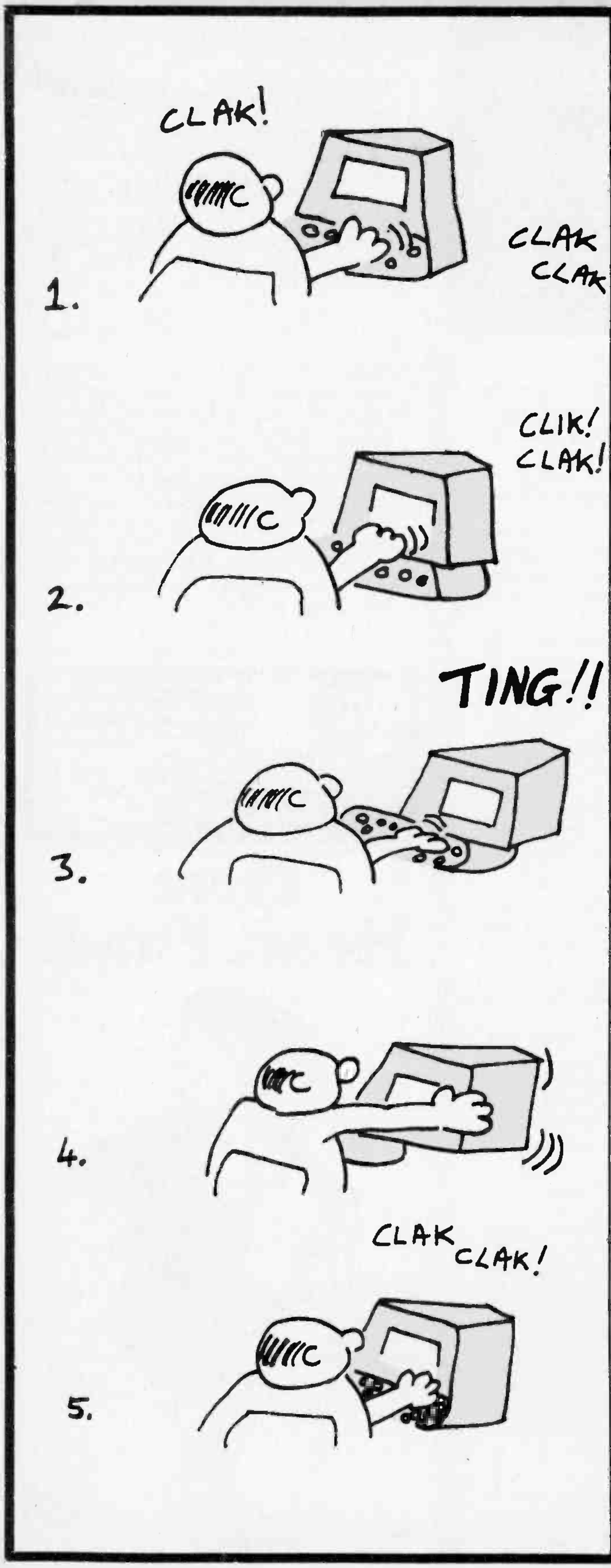

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OK, that should do it, except for this addendum that says not to assemble the antenna inside your house because it won't fit through doorways.

Rogers

For many, he is just a name stamped on the backs of old radios found at flea markets. However, were it not for Ted Rogers, millions of people might even still be enslaved by Eveready. By Roger Allan.

Pioneers of Electronics Series

FEW CANADIANS today realize that one of the keys to the world wide popularization of home radio consisted of the development of the batteryless radio, or that this invention, "Rogers' Batteryless", is included in the acrostic of one of Canada's largest radio stations, CFRB in Toronto.

Seventy years ago home radio reception was plagued with difficulties. If one were lucky, and everything was working as it should, then from ones maze of amplifying horns and earphones, wires, tubes and dry batteries, one might be able to hear a sound reminiscent of music. But in those days people had one advantage over radio enthusiasts today; everything was so new that anyone with a bit of ingenuity and a bit of spare time could not only build a receiver or transmitter, but could develope devices which could and frequently did advance radio transmission or reception capabilities.

The House of Rogers

Such was the case with Edward (Ted) Rogers, and his invention of the AC tube, which forever liberated radios from the vagaries and expense of battery dependence.

The Rogers family were Pennsylvania Quakers who had immigrated to the area around Newmarket, Ontario during the American Revolution. For several generations they were successful in business, initially in lumber and farming, later in coal and fuel oil. The Elias Rogers Coal Company in Toronto, for instance, was founded by Ted Rogers' grandfather.

Rich, successful and socially prominent, the Rogers family had every intention that young Ted should enter the business world in some rapidly rising capacity as per family custom. But it was not to be. The then magical world of radio intrigued Rogers too much. A servant, for instance, is quoted as recalling that the young lad's bedroom when he was about eleven years old, "was so covered with wires and gear that it was almost impossible to step around it."

He built a crystal set, and later a selective tuner with a sliding contact and two variable condensers connected to a tuned circuit. One of his earliest detectors, similar to Fessenden's, consisted of a thin platinum wire dipped into a small glass bottle containing dilute nitric acid with a thicker platinum wire mounted on the bottom. By heating the liquid, changes in resistance could be obtained. Whenever the thin platinum wire burned off, Rogers merely lowered the remainder until it touched the nitric acid again.

Like many another successful inventor, Rogers was not a particular success in the conventional school system. Educated at Pickering College, near Newmarket (built on land donated by Timothy Rogers and once part of the Rogers' farm), Rogers eventually entered the University of Toronto's School of Electrical Engineering. He quickly tired of academia, particularly as he appeared to have a better grasp of electronics than his professors, and soon dropped out. Refusing to follow his family's wishes that he take a job in business, Rogers remained firmly entrenched in the family garage tinkering with his radios. He built a transmitter. With the call sign 3BP and broadcasting on a frequency of three hundred meters from the by then abandoned Pickering College building, he radiated a half-kilowatt spark. This was sufficient for his signal to reach the Pacific and Maritime coasts.

In 1921 the American Radio Relay League (ARRL) sponsored a test in radio signaling across the Atlantic. While the ARRL technical restrictions were stiff (wave lengths of 200 meters or less, power output less than 1 kilowatt, limited transmission duration) on December 9, with a power output of fifty watts, Rogers succeeded in being heard in Scotland, the only Canadian to achieve the objective. As Scientific American reported, "For the first time in the annals of radio, short wave low power trans-Atlantic communication became a fact." One of the other twenty nine successful operators

Continued on page 67

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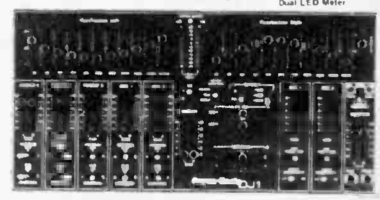

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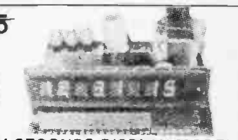

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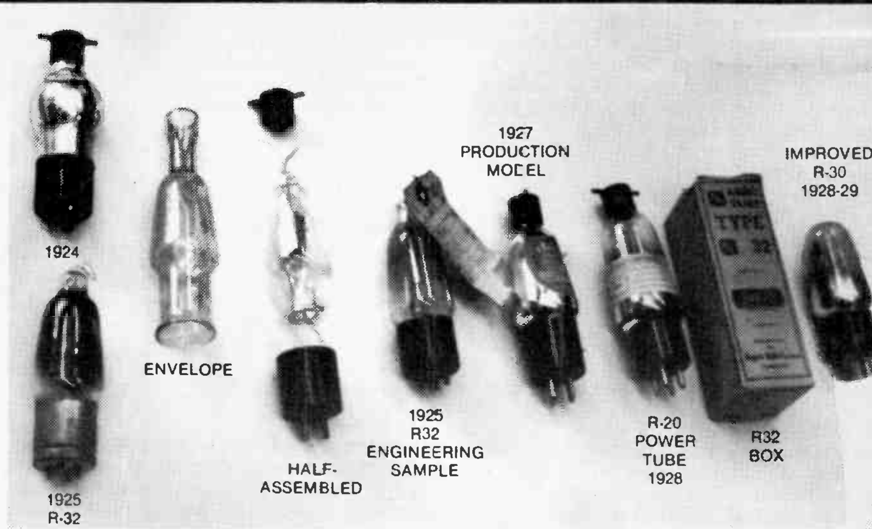
Continued from page 65

was the American Edwin Armstrong broadcasting with a ninety nine watt set. Armstrong later developed the regenerative circuit and is credited with being the 'father' of FM radio.

Kill the Batteries, Ted

In 1924 Rogers decided that batteries must go. They were big, bulky, expensive, unreliable and wore out quickly. He felt that if radios were to become truly universal, then they should be reliable enough to be operated by any member of the family, and operated on ordinary household current. For this to occur, the radios needed an AC tube.

By this point in history there was a form of AC tube on the market developed by the American McCullogh. It was not very good and only succeeded in removing the 'A' battery from the set. One still needed the 'B' and 'C' batteries. While in Pittsburgh, Rogers had the opportunity to examine the McCullogh tube, complete with horn like filaments sticking out its top. Despite disuasive arguments from the American engineers that it would be impossible to design a totally AC powered radio tube (due to interference from the filament inside the tube), Rogers bought the Canadian rights to the McCullogh tube. In the family garage on Chestnut Street in Toronto, Rogers set out to prove



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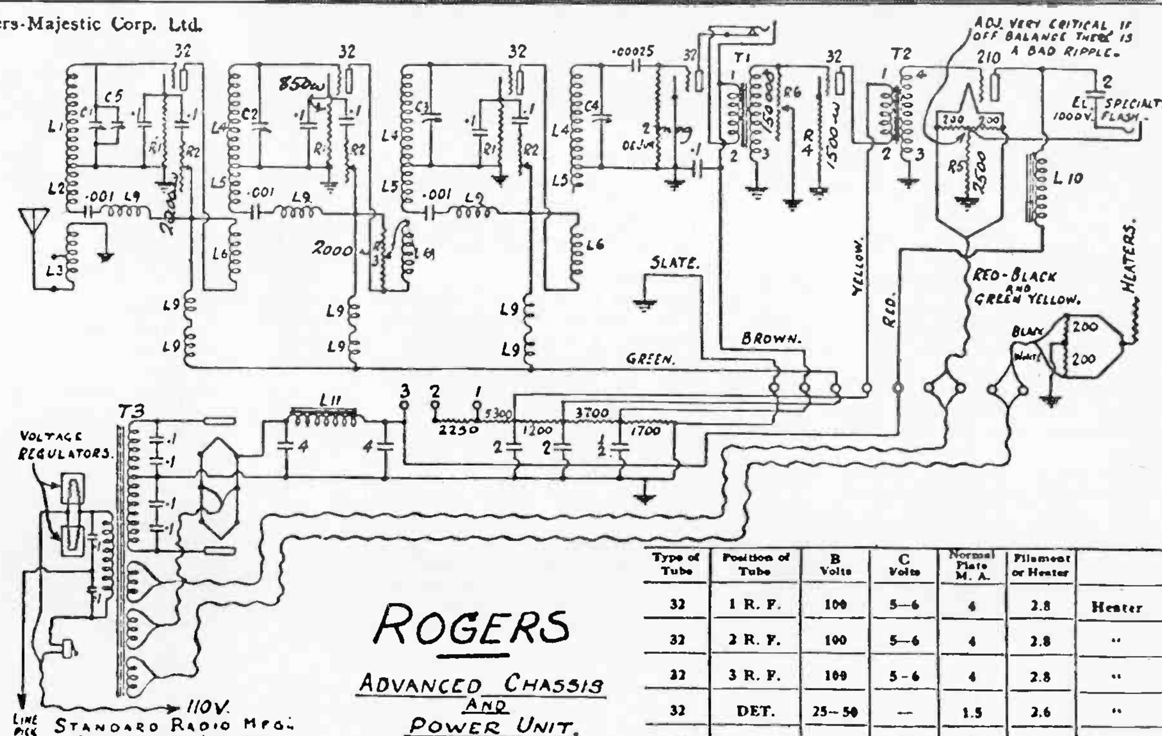
ROGERS—5



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32	3 R. F.	100	5 - 6	4	2.8	"
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Features: Canada in Space, Digital Design Handbook, Maxwell, POKEing the ZX80, VIC-20 Review, PWM Explained.
Projects: Alien Attack, Headlight Delay, Drum Machine, Computer Joysticks.

December 1981
Features: Bandpass Circuits, Tubes, Early Radio in Canada, Speaker Design (pt.1).
Projects: Universal Counter, Musical Doorbell, 4-Input Mixer.

January 1982
Features: Speaker Design (pt.2), Big Bang Theory, Acorn ATOM Review, SLR Cameras, Micropower Circuits.
Projects: 4-Way Loudspeaker, Movement Alarm, Temperature Controlled Iron.

February 1982
Features: 50 Circuits, ATOM Review, Electronic Signs, Industrial Robots, Amplifier Class, dBx, SW Aerials.
Projects: Flash Sequencer, Enlarger Timer, Sound Bender.

March 1982
Features: Printers, Ni-Cads, ZX81 Review, Perfect Sound, Gluons, CMOS Circuits.
Projects: Music Processor, Crystal Marker, Ni-Cad Charger, Reaction Tester.

April 1982
Features: Satellite Applications, 4066B Circuits, TRS-80 Model II Review, Fessenden, Electric Pencil.
Projects: Ten Simple Projects Special.

May 1982
Features: Shroud of Turin, Faster than Light Travel, CMOS Circuits, Modems, Drone Speaker, 6809 Computer Review, Optical Disk Recorders.
Projects: AF Signal Generator, Super Dice, LED Level Meter.

June 1982
Features: Fibre Optics, Lasers in Hi-Fi, Leptons, Xerox Computer Review, Hertz, 50 More Circuits.
Projects: Phono Preamp, Roulette Game, Light Wand, Stylus Organ.

The Back Issues listed here are still available. A few others (listed on the order form) are also available but in very limited quantities. Our Back Issues are not unsold copies: each month about 500 are held in reserve for this service.

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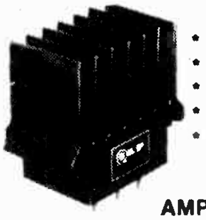

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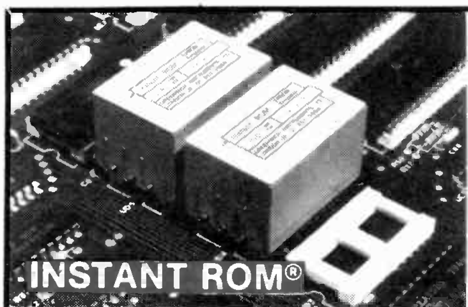

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Continued from page 67

the Americans wrong.

The first step was to design a satisfactory 'B' battery eliminator for the sets. At this stage, the 'A' and 'B' substitutes were in separate units. Then came the problem of assembling them in the same cabinet as the receiving set. The first efforts to do so were unsatisfactory, due to the heavy fields set up by the various transformers and chokes. It was found that both the RF and audio circuits were grossly influenced by the alternating current. In addition to this, after the alternating current had been rectified and filtered, the direct current was modulated in the choke by the field from the transformer.

To reduce AC hum, Rogers brought the filament leads out of one end of the tube and the grid leads out of the other. This provided as much separation as was possible within the physical construction of the tube.

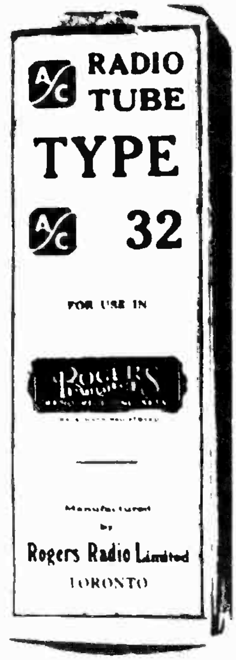
By the careful placement of the various parts, the use of proper shielding, the re-designing of the cores for the transformers and chokes, Rogers progressively invented the AC tube. In April of 1925 he filed a patent application on his invention, which was granted as number 269205 in March of 1927. In Rogers words:

"My invention comprises producting a rectifier which may be used to supply the anode potential of thermionic tubes directly from a source of alternating current of commercial frequencies such as 25 or 60 cycle without causing any disturbance in the radio reception or transmission circuits in which the tubes are used."

Capitalizing on his inbred business acumen, Rogers promptly founded a company to manufacture his invention, Standard Radio Manufacturing Company, later known as Rogers Majestic Corporation, which in August 1925 produced the first commercial AC tube. Within the day, Rogers' Batteryless Radios were on display at the Canadian National Exhibition.

By 1927 Rogers had upgraded the power of batteryless transmitters to the point where they could be used for commercial broadcasting. In 1927 he founded radio station 9RB, which latter became CFRB. Broadcasting on a wavelength of 291 meters from two 100 foot masts supporting a 4 wire flat top antenna, the station was powered by four 1 kilowatt water cooled tubes. It was located in Aurora, north of Toronto, therby sidestepping in-city regulations governing power output.

Rogers died in the spring of 1939 of a hemorrhaging ulcer.



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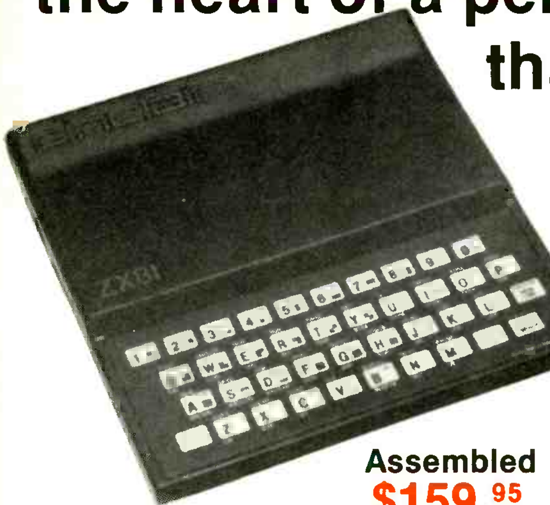

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Designed exclusively for use with the ZX81 (and ZX80 with 8K basic ROM), the printer offers full alphanumerics and highly sophisticated graphics. COPY command prints out exactly what is on screen. At last you can have a hard copy of your program listing and results. Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch. Connects to rear of ZX81 — using a stackable connector so you can use a RAM pack as well. A 65 ft paper roll, instructions included. Requires 9 volts, 1.2 amp power supply (option extra).

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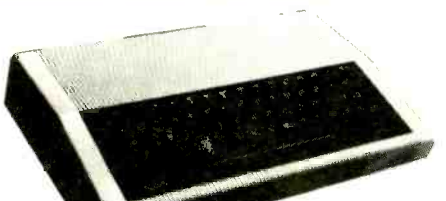

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