ELECTRONICS IN '78 US AUTOMOBILES

electronics today INTERNATIONAL

APRIL 1978

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UHF FREQUENCY COUNTER
AUDIO ANALYSER II
RAIN ALARM
Propagation

New Video Display Unit

PLUS
News, Microprocessors, Communications Section . . .

JVC offers flexibility in sound reproduction...

Your current hi fi system most likely has a vital, but highly versatile element missing. A JVC SEA-20 graphic equalizer. Take a close look at your current amplifier or receiver and you'll notice it only offers bass and treble controls, and some include a third for midrange, but none approach the accuracy and flexibility of the SEA graphic equalizer system developed and patented by JVC.

Over 400,000 ways to hear better sound.

By adjusting the seven tone controls covering the frequency range at 60Hz, 150Hz, 400Hz, 1,000Hz, 2,400Hz, 6000Hz and 15,000Hz you can create over 400,000 different sounds. A feat normally not achieved (with a stereo amplifier or receiver) outside a professional recording studio. But, then the SEA-20 is a true JVC professional.

Get better performance from your components and listening room.

Why do you need such tremendous variations in tone? Quite simply, they help you to overcome the shortcomings of the acoustics in your listening room; they also help you to compensate for the deficiencies in old or poor recordings.

Finally, they can do wonders for the frequency response of your speakers, and where you place them. SEA is really quite easy to use. For example, the 60Hz switch reduces record hum or rumble, and it can add greater clarity to the ultra low bass of an organ. The problem of booming speakers is simply handled with the 150Hz switch, while boosting the 400Hz switch it adds clarity to the upper bass. And in the important midranges, the 1,000 control adds new dimension to the vocals of your favourite rock performers, while the 2,400Hz controls the upper midrange. The 6,000Hz switch brings out the best in strings. You can even reduce tape hiss and diminish the harsh sound of a phono cartridge at high frequencies, with the 15,000Hz control. Then, to double check any adjustments SEA works with a tone cancellation switch which permits you to instantly compare your setting with a perfectly flat response.

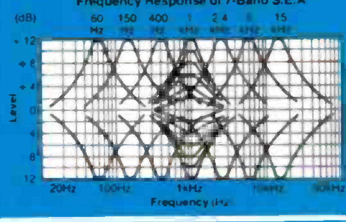
SEA equalized recording.

You'll enjoy an infinite number of practical applications for SEA in home tape recording. SEA equalized responses may be reflected on your tapes as you record them. With SEA it's easy to eliminate record scratch and surface noise, reduce tape hiss, and emphasize vocals or the highlights of any musical instrument. The Monitor and SEA Defeat Switches are also provided to enhance the SEA versatility and utility.

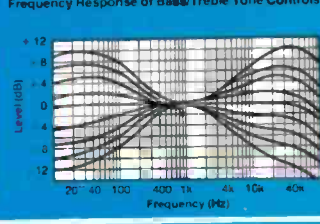
For around $170 JVC offers flexibility in sound reproduction.

Do yourself a favour . . . listen to the SEA-20 versatile performance at your nearest JVC dealer, we believe for around $170, you can afford the accuracy and flexibility which this JVC graphic equalizer offers. Listen . . . you'll find it quite an experience.

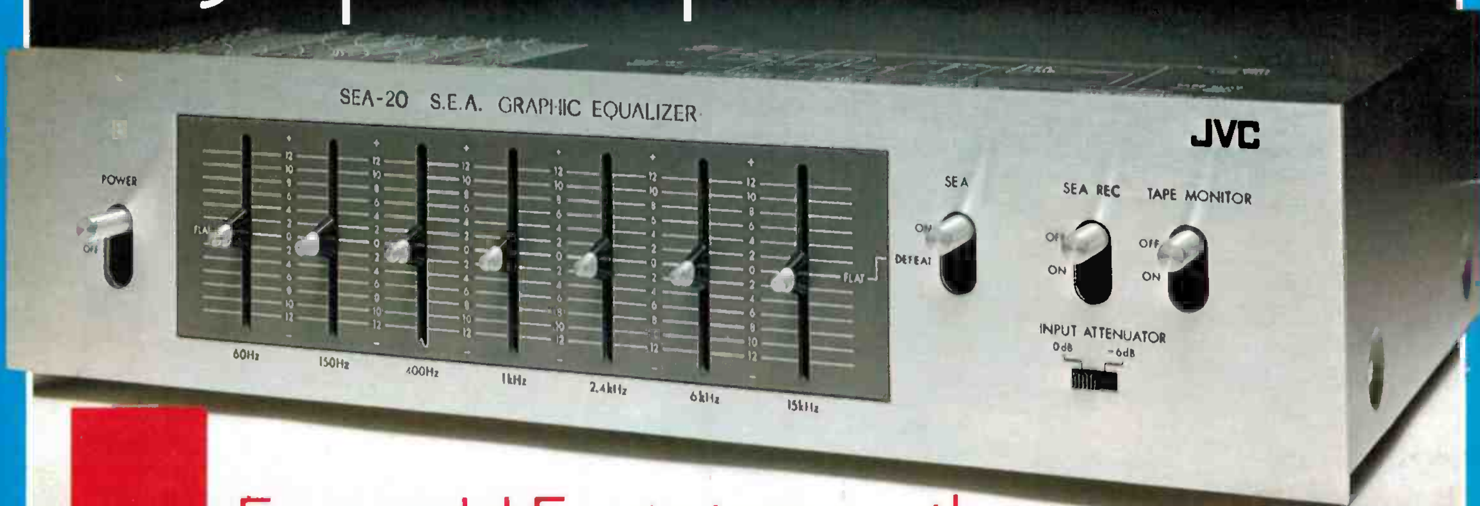
Frequency Response of 7-Band S.E.A



Frequency Response of Bass/Treble Tone Controls



a graphic equalizer!



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the right choice

For pure Hi Fi entertainment!

For details on all JVC Hi Fi Equipment, write to:
JVC Advisory Service, P.O. Box 49, Kensington, N.S.W. 2033

WT15/78

AUSTRALIAN OWNED AND PRODUCED

April 1978, Vol. 8 No. 4

electronics today INTERNATIONAL

Editorial: Les Bell

Publisher: Collyn Rivers

PROJECTS

FEATURES

NEWS & INFORMATION

Regular readers probably won't recognise the central figure in our cover as Roger Harrison, dressed up in style to play some computerised wargames. Of course, the real star is one of the prototype ETI 640 VDUs. Photograph by George Hofsteters.

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* Recomended retail price only.

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News Digest

Binary Clocks

WHEN AMERICAN Eugene Amazon was accused by his boss of being antiquated, it didn't take him long to do something positive about remedying the situation. He designed, built and then installed a binary clock in his superior's Geneva office, along with the unappreciated antique furniture. It went down well and Eugene has been building binary timepieces ever since.

Mr. Amazon now works as a computer programmer in Geneva, concentrating on pipe stress analysis for nuclear power plants. After designing more of these clocks for friends, he put together an exhibition which was very well received. Now he makes them for sale as well.

Binary clocks tell time by pattern recognition, based on quartz crystal technology. As our picture illustrates, they can take many different forms, like the lightning rod or the 'pinocchio' hat. The latter is made of brass. The lower line of lights register the seconds and are therefore constantly changing. The higher horizontal line shows the minutes and hours are shown on the vertical illuminations.

It may appear somewhat complicated to tell the time by this method at a glance. Apparently it just takes a little practice, once you are used to an entirely different time rendering concept. It has been found that children, who have not been saturated by traditional methods, pick it up very quickly.

Eugene Amazon's hobby has been so successful that he himself has very little spare time on his hands. His clocks have sold internationally and the United Nations have also bought them. Perhaps one day all clocks will look like these.

Photograph by Ralph Crane, Camera Press, London.

Dick's '78 Cat

This year is Dick Smith Electronics' 10th Anniversary. In keeping with his "think big" philosophy, Dick has produced a monster 100 page catalogue of items sold in his 8 electronics enthusiasts' stores.

The Dick Smith catalogue has been on every electronics enthusiast's "must have" list for quite a few years now. This year's is bigger than ever before, with 100 pages of which 8 are in full colour. Also included is a special section on icebergs.

It lists and gives prices for nearly 3,000 items with many of them illustrated and described. There is also an 8 page data section full of semiconductor specs and base connections, data for amateurs and CB'ers, useful circuits and component colour codes.

The Dick Smith 1978 catalogue is priced at 75 cents at all Dick Smith Stores and Dealers or by mail order from *Box 747, Crows Nest, 2065.*

US CB Tariffs Up

Late in March, President Carter ordered tariffs on imported CB radios to be more than tripled. The move follows vigorous campaigning on the part of E.F. Johnson and other companies for tariff increases.

Towards Future System

Looks as though transistors in logic circuits are going to become outmoded, thanks to the Josephson junction, according to IBM. Their experimental logic and memory circuits are much faster and dissipate less heat than current circuits. Typical switching speeds are 50-100 picoseconds, while memory circuits have access times of 7 ns.

New Wollongong Store

A new store called Madjenk Lighting and Electronics has now opened at Shop 5, 246 Princes Highway, Dapto, Wollongong. The shop will sell electronic components, microprocessors, electrical accessories, and will hire out all types of lighting for entertainment purposes. Unusually, in the electronics business, the owner and proprietoress is a lady, by the name of Rhonda Jenkins. We wish her every success in her new venture.

1 Amp DIL Bridge

The latest addition to Soanar Electronics' extensive range of Bridge Rectifiers is the VM48, a 400 Volt 1 Amp Dual In-Line Bridge, manufactured by Varo Semiconductors Inc., USA.

Mechanical construction includes glass passivation of the diode chips which are then housed in a compact moisture-resistant epoxy casing. Lead configuration and spacing conform to the standard 0.1" grid giving the added advantage of complete compatibility with integrated circuits (e.g. Two VM48s will fit into the normal 14 pin I.C. socket). In addition the AC connections are placed together on one side of the device with the DC connections on the opposite side. This simplifies circuit layout.

Rated at 1 Amp, the VM48 is capable of withstanding surge currents of 11 Amps for 1 second and 25 Amps over one half cycle on 60 Hz frequency.

DC blocking, working peak reverse and peak repetitive reverse voltages are all specified at 400 Volts.

In line with company policy, Soanar will be maintaining large stocks of VM48 Rectifiers at all their interstate branches and agents.

Further information including technical specifications is available from: *Soanar Electronics Pty. Ltd., 30 Lexton Road, Box Hill, Vic, 3128.*

6A, 400V Diode

Soanar Electronics now include a 400 volt 6 amp plastic encapsulated rectifier in their comprehensive range of discrete diodes and silicon bridge rectifiers.

Designated type P600G, this 6 amp diode has a uniformly moulded plastic case and is lead mounted. Polarity is indicated by a silver coloured band at the cathode end of the casing.

P600G can withstand a 400 amp surge current and provides a 400 volts DC blocking voltage when operating at rated load. Average forward rectified current is 6 amps at ambient temperature (Ta) of 60°C.

This diode is immediately available from Soanar branches and agents in all states and costs only a fraction of the price of 6 amp stud mounted rectifiers.

Further information is available from *Soanar Electronics Pty. Ltd., 30-32 Lexton Road, Box Hill, Vic. 3128.*

Talking Machine

Speech synthesis researchers at UCLA have moved one step nearer a practical, useful application for these devices by combining one with a computer and a typewriter to aid stroke victims and other persons with speech disabilities. Words or sentences typed into the machine are translated into understandable speech, and the computer can also track down words by semantic or phonetic associations, or rhyming words. This machine could make writing poetry a snap!

Sony VTR Case

In the continuing case between Sony and the Universal and Disney film studios over claimed copyright infringement, five major Hollywood studios and several independent producers and unions are seeking to file amicus curiae briefs in support of Universal and Disney. The studios are charging Sony and their codefendants, three large department store chains, with copyright infringement because Sony Betamax video tape recorders are used to tape tele-vision shows.

Columbia Pictures, 20th Century Fox, Warner Brothers, MGM, United Artists, Allied Artists, Avco Embassy Pictures, Bud Yorkin Productions, Tandem Productions, TAT Communications, Viacom International, Desert Book Co, Movies En Route, Inc, Swank Motion Pictures, as well as the Writers Guild, the Screen Actors Guild and the international Alliance of Theatrical Stage Employees intend to support Universal and Disney in the case. Curiously, several of these companies are also planning to sell software for the video tape recorders.

Tilting at Windmills

Strong prairie winds, for years a nuisance to the small town of Clayton, Nex Mexico, are now helping supply the town with up to 15 per cent of its electrical power thanks to a new wind turbine generator installed recently.

The generator is equipped with two 60½ft aluminium blades built by Lockheed Aircraft Service Company under contract with NASA.

Officials from NASA and Lockheed gathered on an appropriately gusty Saturday morning as a big red button was pushed to activate the system and the blades began their first revolution, making Clayton the first US town served by wind energy.

At their standard speed of 40rpm, the blades, which form a 125ft. rotor, produce 200 kilowatts of power at wind speeds measuring between 18 and 34 mph. To protect the equipment, the turbine shuts off automatically when winds exceed 35 mph.

Produced with Lockheed technology developed for the Cheyenne helicopter, the blades, and the attached generator, are mounted on a movable platform atop a 100 ft tower that "tracks" – or swings – with the direction of the wind. The blades are also capable of feathering, or turning at right angles into the wind to prevent equipment damage in high winds.

The wind turbine is especially welcome to the townspeople of Clayton, who have seen their power bills skyrocket recently due to increasing fuel costs.

Talking Computer

The IC's used in modern US phones to generate the audio tones which have replaced dialling pulses can often be put to other uses. US amateur radio operators, for instance, use the tones when accessing repeaters in order to perform command instructions. One of the latest applications for these chips is in a system called ROTE (Remote Order Terminal Entry), being operated by Pfizer, Inc., a US pharmaceutical company.

Their sales reps each carry a small key pad and acoustic coupler which fits over the telephone mouthpiece. From a client's office, the reps can dial the Pfizer office and talk to 'Joanne', who is the alter ego of an IBM System/7 with audio response and is the central 'character' in ROTE. After entering an ID number, the rep can enter the customer's account number and the quantity and product code for each product ordered, guided through the process by 'Joanne's' doubtless soothing and patient voice. If the salesman enters invalid data, 'Joanne' will put him on the right track.

TI Patent

US Patent 4,074,351 has been awarded to M J Cochran, of TI's Dallas staff, and G W Boone, a former TI staffer, for their digital microcomputer.

Sinclair DMMs

Foreseeing the demise of the calculator market, Uncle Clive, of Sinclair is moving more into the instrument field, and will soon announce several new digital multimeters.

The DM235 is a bench-type meter with five functions and 21 ranges. 3½ digit resolution with 1% accuracy make it a good choice for the hobbyist. It also features auto polarity, over-range indication and automatic decimal point, runs on batteries or AC adapter and is expected to retail in Australia for around $145.00.

The provisional spec on the DM350 shows it to be a similar instrument, but with 0.2% +/- 1 digit accuracy.

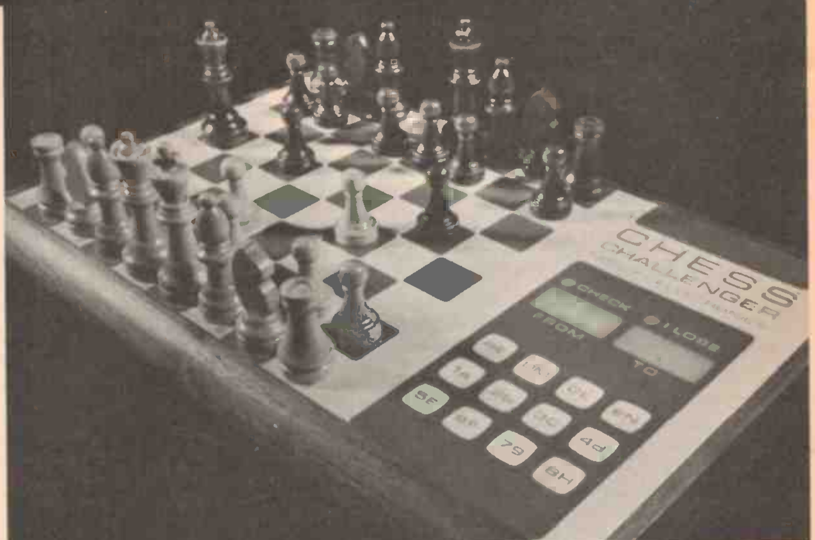
The top-of-the-line DM450 is a 4½ digit autoranging instrument with true RMS reading. Basic accuracy is 0.05% of reading. The DM450 is expected to sell for around $350.00 when it becomes available in Australia in July.

COMPUTER BACKGAMMON

Futuretronics have done it again. The World's first microprocessor based Backgammon game is here right now. It's you against the computer. A sophisticated, totally computerized Backgammon game, utilizing a Motorola 6800 microprocessor with 2K ROM and 6K RAM, designed for excitement and ease of play. It will defeat the average player more often than not, and compete evenly with experts. When you play against the computer, each move is displayed and recorded electronically. The position of every piece on the board can be verified at any time and since the dice are "rolled" electronically at random, each game is different.

The computer plays an aggressive offensive game, but will change its strategy depending on how you choose to play. Running game, block and hit, back game, it know them all, and plays them all well. Playing against the computer is a true measurement of skill. If you are a beginner it is a remarkable learning instrument. **This beautifully finished, top-quality product complete with Its own carrying case is available now. for $299.00 delivered free anywhere in Australia.**

COMPUTER CHESS



It's you against the computer.

The first microprocessor based chess game, using an 8080A C.P.U. It utilizes and 8224 clock generator/driver, 8228 system controller, 512 8-bit bytes of random access memory, that stores the position of the chess pieces, and a 16,384-bit read only memory. Software contains such elements as the rules of chess, the relative importance of the pieces, allowable moves and strategies. The micro computer plays by the book, working on the weighed value of the pieces, and completely scanning the board for the best available move each time. It plays aggressively, tries to control the centre of the board, and, if it's in trouble, will try for a stalemate.

The keyboard can be used to verify the position of each chess piece at any time during the game.

User selectable 3 levels of difficulty, choice of black or white pieces. **New shipment just arrived, new low price $345.00 delivered free anywhere in Australia.**

To order or for information contact:

Futuretronics pty. ltd.

1 Dallas Crt, Hughesdale 3166, VIC.
Phones: (03) 823732 — (03) 579297

- ☐ **Please send Gammonmaster. I enclose $299.00**
- ☐ **Please send Chess Challenger. I enclose $345.00**
- ☐ **Please send both games. I enclose $599.00**

NAMES ....

ADDRESS ....

STATE ....

AWA Hearing Aid Advance

A lightweight hearing aid developed in Australia sets new standards in miniaturization and battery life.

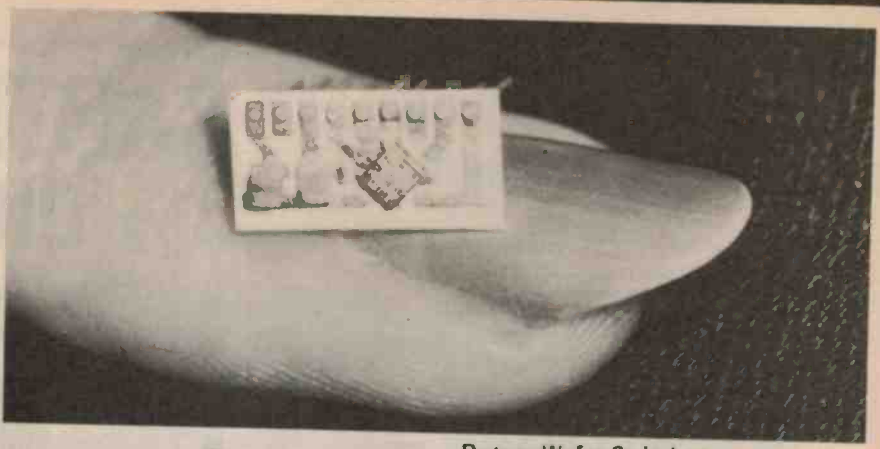
The aid uses an integrated circuit about the size of a matchhead, developed by AWA Microelectronics, under contract to the National Acoustic Laboratories. The chip contains 38 transistors and 27 resistors. It is mounted on a hybrid microcircuit smaller than a one cent piece, developed by STC Components Division, also under contract to NAL.

The aid is a Class B type which means that significant power is only drawn from the battery when a signal – a human voice or other sound – is picked up. This is a distinct advantage in terms of battery life when compared with Class A aids, which draw constantly from the battery.

Because of the sensitive nature of the device, AWA engineers had to pay great attention to background noise, which is far more critical than in a normal hearing aid.

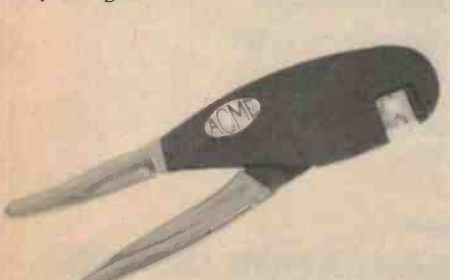
A modern miniature electret microphone, with its wide frequency response, is used with the amplifier. A special design feature also enables a two-wire speaker to be used, making the device simpler than most overseas made hearing aids of this type and also permitting external earphones to be attached.

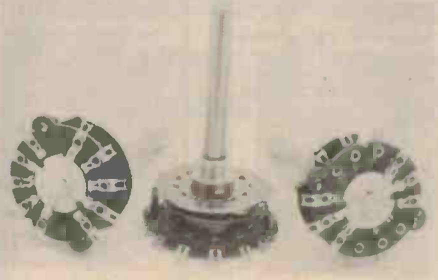
The aid is now in production, and a number of patients have reported that it gives them new standards of hearing.



VHF Ferrite-rod Antenna

By winding a single wire onto a ferrite rod in alternate groups of left- and right-handed turns to resonate at a quarter wavelength, the backroom boys at Britain's Royal Military College of Science have been able to make a VHF ferrite rod antenna. Lab tests have shown that the antenna is almost as effective as a whip when utilised without a ground plane, as is the case with hand-held equipment. If a ground plane is available for the whip to work against, however, the ferrite antenna has markedly less gain.





New Riston Process

The Riston Products division of Du Pont has introduced a new dry film photopolymer series which offers lower costs. The new series includes two types of solvent film, Series 1000 and Series 1200, and two acqueous films, Series 3000 and Series 3300. The four films are light green in colour and turn a vivid blue when exposed, which makes board inspection easier.

ACME Crimp Tools

When it comes to terminating RF connectors, the crimp method has proved to be the fastest and most economical method. Acme Engineering company now offers a range of hand or power operated crimp tools to suit ENC, TNC, UHF, N and SMA series connectors.

In the Acme hand crimping tool range there are two varieties available which are designed to accept a common range of interchangeable crimping dies. The Acme hand crimping tools terminate a wide variety of coaxial connectors by crimping contact pins, and sockets and outer ferrules used to crimp the braid shield of coaxial connectors.

For comprehensive literature on the ACME range of crimping tools, please write to the ACME Engineering Office or agent in your state or contact ACME Engineering Company Pty. Ltd., 2-18 Canterbury Road, Kilsyth, Victoria, 3137. Phone 729-6211.

Rotary Wafer Switches

Soanar Electronics are pleased to announce that they are now stocking a range of top quality rotary wafer switches manufactured by Noble of Japan.

Unlike the shorting type of wafer switches that are normally available on the Australian market, these are non-shorting (break-before-make) switches that have previously been available only to special order.

Soanar will be maintaining large stocks of the single wafer varieties at their own and agents branches throughout Australia. Multiwafer and special requirements however, will continue to be supplied on an indent basis.

Noble switches are well constructed and use a particularly robust detent plate to ensure positive switch selection The wafer is made from high grade phenolic and features silver plated contacts having a contact resistance of less than .02 ohms at 6 V 1 amp DC.

Overall switch rating is 30 V DC at ½ amp and insulation resistance between terminals and shaft is considerably better than 100 Meg ohms. Shaft length is 50 mm FMS with the standard 6.35 mm (¼") diameter.

Switch types readily available at Soanar branches include:–

1 pole	11 positions
1 pole	6 positions
2 poles	4 positions
2 poles	5 positions
3 poles	3 positions
4 poles	2 positions

Further information is available from *Soanar Electronics Pty. Ltd., 30-32 Lexton Road, Box Hill, Vic, 3128.*

Price rise shock

A 30% import duty has been applied to CB transceivers since the first week of March and prices are expected to rise very soon as the stocks of pre-duty rigs are sold off.

The duty will mean a price increase ranging from $30 to more than $100 on transceivers and will probably put a further damper on an already depressed CB market, industry sources say.

COMMUNICATION DEVICES present

THE

SABTRONICS 3½ DIGIT DM M

SPECIFICATIONS:

DC volts in 5 ranges: 100uV to 1000V; AC volts in 5 range: 100uV to 1000V; DC current in 6 ranges: 10n A to 2A; AC current in 6 ranges: 10n A to 2A; Resistance in 6 ranges: 1 to 20M; Input Impedance: 10M; Display: 9mm (36") LED; Power requirements: 4.5 VDC to 6.4 VDC (4 "C" cells — not included); Size: 8 "W" x 6.5" D x 3.0"H (203W x 165D x 76H mm).

PRICE (KIT) **$97.75** incl. sales tax

PRICE (FACTORY ASSEMBLED AND TESTED) **$129.75** incl. sales tax

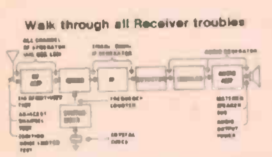
ABOVE PRICES INCLUDE DELIVERY WITHIN AUSTRALIA

COMPLETE 40 CHANNEL CB SERVICE CENTRE

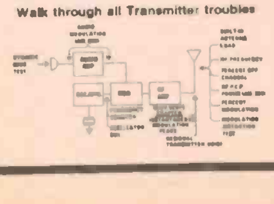
PRICE **$1,350** plus 15 percent sales tax

NB: INCLUDING DELIVERY ANYWHERE IN AUSTRALIA

Walk through all Receiver troubles



Walk through all Transmitter troubles



This service monitor provides all functions for the complete service alignment and test of all Australian CB rigs.

Features:

- RF Power Meter
- Audio Generator
- Digital Frequency Counter
- Digital Mod Read
- Digital Off Channel Read
- Digital Percent Mod Read
- Audio Power
- Sig/Noise Measure
- RF Generator to .1NV
- Built-in Mic Test
- Built-in Load & Speaker

Australian Agents:

COMMUNICATION DEVICES
271 Goulburn Street, Darlinghurst, NSW 2010
Phone: (02) 211-3399, 211-3652, 212-3712

Akai VCR

A compact, lightweight three-hour video cassette recorder has been introduced by Akai Electric Co. Ltd., of Japan.

The new video cassette recorder, VHS-format VS-9300 uses economical half-inch tapes, soon to be available in one-hour, two-hour and three-hour lengths. Three versions are available: VS-9300EG for the PAL system on the European continent, VS-9300EK for the PAL system in the United Kingdom and VS-9300S for the SECAM system.

The system, equipped with built-in TV tuner, can record a program being watched on TV or another program being broadcast on a different channel simultaneously, or, by use of a video timer, a program aired when no one is at home. The video camera can be used to make one's own programmes.

Close Encounters

Philips Electronic Components & Material Product Marketing Manager, Kevin Gest, had a close encounter of the aural kind, recently. He was called in by Ron Ferguson, Projection Engineer of Hoyts in Sydney to solve a sound problem.

It seems that all the action in the film "Star Wars" just wasn't getting across to the audiences as it should have been. The sound system couldn't cope.

"Part of the trouble", says Kevin, "was that the speakers were in small enclosures and this was distorting the sound, for example, in the laser sword fight.

"Hoyts were looking around for something to fit in with the decor of their new cinema complex in George Street, but naturally they wanted something at a good price."

After visiting the theatre and spending some time in the projection room, Kevin suggested a loud-speaker kit system (Model ADI 2K12 – no relation to R2D2) which was not only easy to assemble and install, but also comparatively inexpensive.

On that advice Ron Ferguson decided to install 12 pairs down the side walls of the theatre – all within public view. "They certainly improved the bass end in 'Star Wars'," he says.

Low Energy House

A team from Salford University in Britain have developed a method for storing heat in ice to reduce bills for space heating. A prototype house is being built for Salford Borough Council, and it is claimed that an ice container 1/10 the size of the swimming-pool sized tank required for water heat storage will be used. Latent heat can be extracted from the ice by a heat pump, and exhaust air from the house reverses the process by melting the ice.

Viewdata in US

The British Post Office developed Viewdata system may soon be operating in the States. The PO has teamed up with Insac Data Systems Ltd, a government-sponsored software export company, in negotiations with AT & T, the US telephone system. The US is a huge potential market for Viewdata, which gives telephone subscribers, both private and commercial, access to a large database as well as computing facilities. Insac have already set up a demonstration computer in their New York office, linked to London, and are surveying potential commercial users of the system. The word we have is that Telecom Australia are also interested in Viewdata, especially in view of the forthcoming introduction of Teletext.

ETI/Unitrex Calculator Contest

Well, we really blew it in February! A typographical error crept into the puzzle, and instead of referring to 'the weight of the weight and the weight of the rope and the weight of the monkey', we had 'the weight of the weight and the weight of the weight and the weight of the monkey'. Fortunately, as far as we can make out, all the entrants took the puzzle as printed, and not as they thought it should be, so after a great deal of brain-wracking to work out the correct answer to the amended problem, we were able to choose a winner – J.T. McLeod, of E. Bentleigh, Vic. The correct answer to the problem as printed is 5 ft, and if you work out the answer to the problem as we should have printed it, you will get 5½ ft.

For this month's problem a deck of cards will prove useful. Take a suit of 13 cards, face down, in your hand. Remove the top card and slide it into the bottom position. Then remove the new top card and turn it face up beside you. Next slide the new top card to the bottom of the pack, turn over the next top card and lay it down, and carry on repeating the process, alternately returning the top card to the bottom of the pack and turning the next one over until all the cards have been turned up.

The question is: in what order would the cards have to be originally for them to be played out in the order A, K, Q, J, 10, etc. down to 2?

Seal an empty envelope, write your answer on the back of it, with your name and address, and send it to: Unitrex Calculator Contest (April), ETI Magazine, 15 Boundary Street, Rushcutters Bay, NSW 2011. The closing date is 19th May.

Errata

In the Sound Level Meter (Feb '78), some nonlinearity occurs in the meter circuit due to the offset current of IC3. It is recommended that this IC be replaced with a CA3140 (same pinout) and C14 be deleted (it is not required with this IC).

Looking back even further, to Feb '77, a few errors in the 132 Power Supply slipped past us (and all but one of the readers who built it!). In the parts list, ZD1 and ZD2 have been transposed, and RV1 should be 10k. On the overlay diagram, R1 and R2 have somehow been transposed, but they are of the same value, so the operation of the circuit is unaffected.

A few errors crept into the Sheridan Electronics ads in the Dec. and Jan. issues. In January, Cat. No. CP19, disc ceramics were shown as .01mf, but should have been .001mf. Cat. No. CP33 should have read 5 pos. 2 pole and not 10 pos, 2 pole, and CP25 should have read 12 V DC and not 240 V AC. In the February issue, the reed switches CP53 and CP54 are normally open and not normally closed as described.

In the last two issues the address of Semcon Microcomputers was mistakenly omitted from their advertisement. Their showroom address is 1 Chilvers Road, Thornleigh, 2120, and mail orders should be addressed to P.O. Box 61, Pennant Hills, 2120. Phone 848 0800. Apologies to Semcon for the error.

MAD MAL'S MAD SALE!

THIS MONTH ONLY... OR WHILE STOCKS LAST!

MAL

CB SPECIALS

MAD MAL'S GOT THE CB BUG NOW AND HE'S LINED UP THESE BARGAINS

LESON BASE STATION Microphone Were $49 **$44** SAVE $5

CAR AERIAL to CB Aerial CONVERTOR Reduced from $17.50 **$11** LIMITED QUAN. AVAIL. with SWR adjustment.

½ Wave RINGO Style Aerial $35 LOOK!

POWER SUPPLY KITS

13·8V 4A (Peak) 2 Amps continuous. Power switch & LED on front panel, terminals at rear, regulated & filtered, hum-free, easy to build yourself and save $$$

MAL'S CRAZY PRICE... **$19**

CO-PHASE AERIAL CABLE 20ft long, for twin aerials. **$9**

RG-8U CO-AX CABLE Just arrived, best quality. **$1/m**

HELICAL ¼w AERIAL KITS 5FT **$9** 6FT **$11** Complete, wire, fiberglass, insts. etc.

NI-CAD BATTERIES

TOP GRADE

2 FOR **3·50** ONLY..

Voltage: 1·44
Capacity: 450mA
Charge at 45-50mA for 14-16 hours.

CHARGING CARTRIDGE WITH TRANSFORMER just **9·95** Charges 4 batteries all at same time!

GENERAL PURPOSE SPEAKER BOXES

SIZE 1 17"x12"x9" deep **$10** EA

TEAK COLORED VINYL Suit 6"+3" Speakers DE-LUXE GRILLE CLOTH FRONT — Few only avail.

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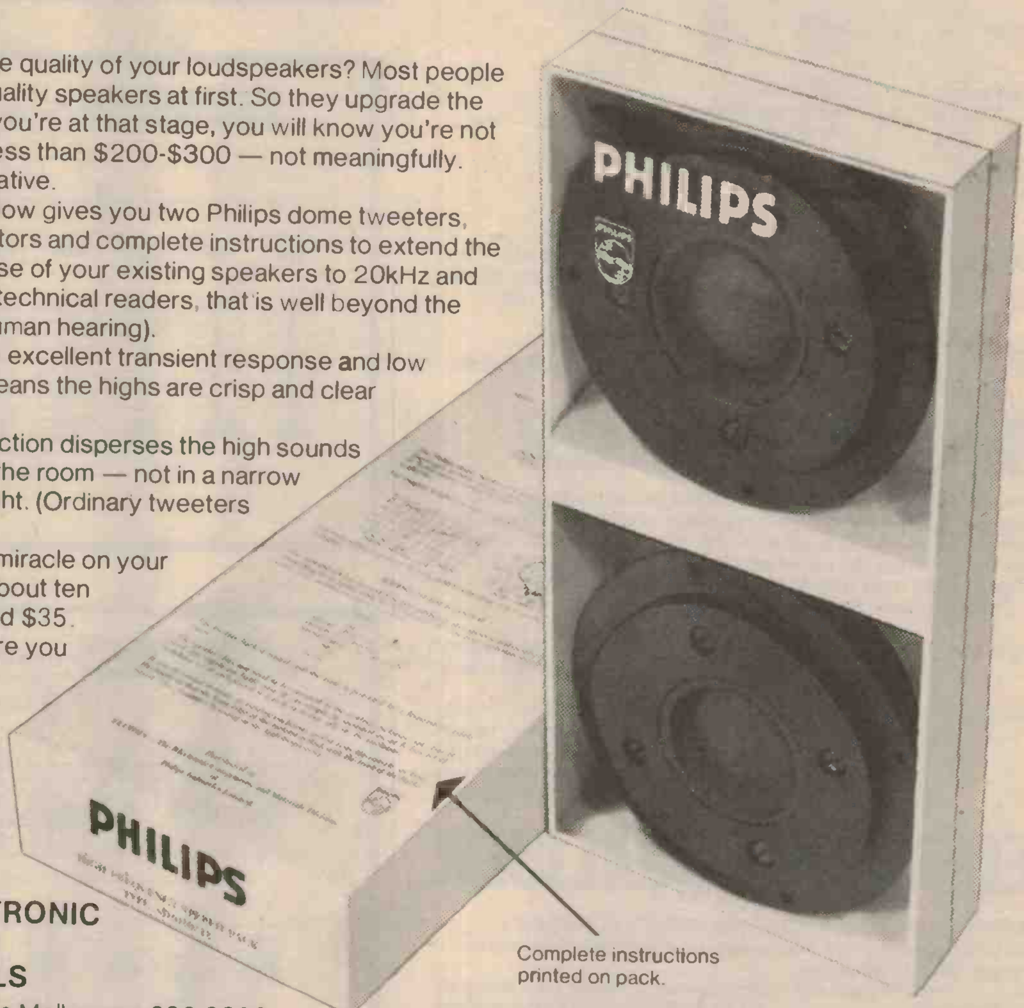

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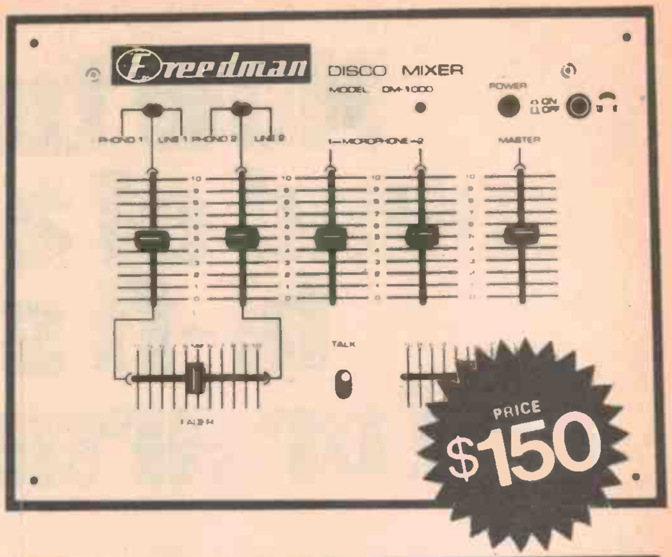
Built-in low noise preamplifier for magnetic phonos and low impedance microphones.
Headphone circuit to monitor each input.
Talk switch to attenuate music volume 14 dB so mics can be used without re-adjusting music levels.

Input Sensitivity	MIC	0.5mV
	PHONO	3mV
	LINE	150mV
Input Impedance	MIC	10K ohms
	PHONO	50K ohms
	LINE	50K ohms
Maximum Input Level	MIC	45mV
	PHONO	140mV
	LINE	35V
Rated Output	AMP.	1V
	REC.	1V
Output Impedance	100 ohms	
Harmonic Distortion	At Rated Output	0.2%
	At 6V Output	0.3%
Hum and Noise	MIC	−52 dB
	PHONO	−62 dB
	LINE	−65 dB
Frequency Response	MIC	30 to 16000 Hz (−1 dB)
	PHONO	30 to 20000 Hz (RIAA ±2 dB)
	LINE	20 to 30000 Hz (−1 dB)
Headphone Output (CUE)	50 mW at 75 ohms at 0.5% T.H.D.	
Talk Switch	−14 dB at Phono or Line at TALK Position	



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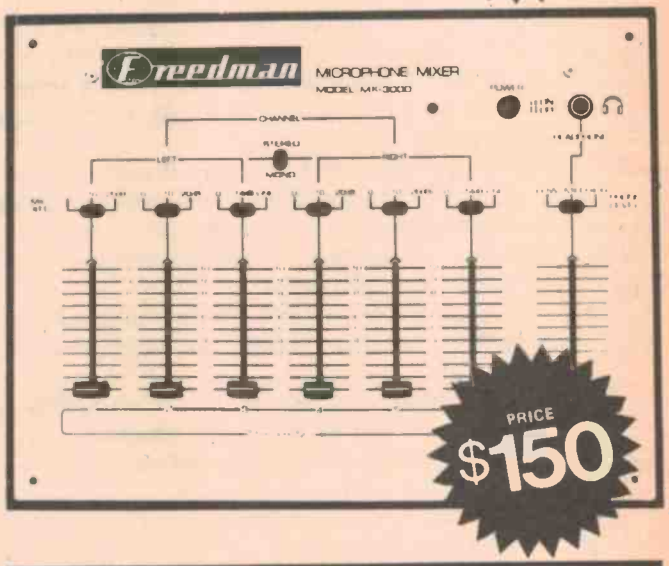
MICROPHONE MIXER MODEL MX-3000 is a sound studio control unit incorporating the most advanced integrated circuits and precision components in its design and is capable of handling any quality high power amplifier, without the use of an external pre-amplifier. It is flexible enough to be used with almost any auxiliary input in a pre-amplifier, integrated amplifier, or receiver.

Input Sensitivity	MIC 0.5mV
	LINE 65mV
Maximum Input Level	MIC 500 mV (Att. 20 dB)
	250 mV (Att. 14 dB)
	160 mV (Att. 10 dB)
	50 mV (Att. 0 dB)
	Line 30 Volt



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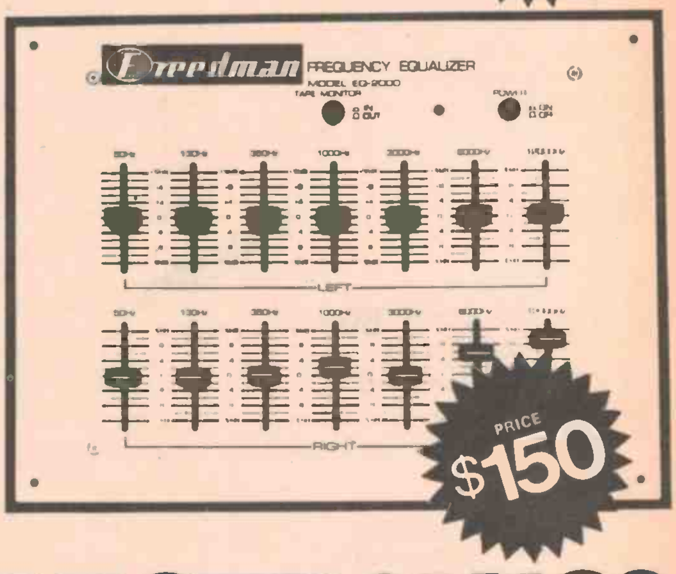
Inter Modulation Distortion	At 2 Volt output 0.05%
Harmonic Distortion	At 2 Volt output 0.05%
Hum & Noise	Shorted input −80 dB below 2 Volt output.
Output Level	Maximum 10 Volts



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Automotive Electronics for 1978

Before it's been just a trickle. Now in the '78 US models a flood of new electronics applications points the way toward the intelligent car of the next decade. By Karl Ludvigsen.

THE SMART CAR is coming. It was only a matter of time before it arrived. A brain and nervous system are all that today's cars are missing. Muscles, sinews, a digestive system – they're all present. But automobiles have been relatively simple hydromechanical machines, without the intelligence that powerful electronic systems could provide. That simple era is about to end. The first advanced intelligence devices are being installed in today's automobiles, devices that will point the way toward the smart car of the early 1980's.

At all the Big Three (Ford, General Motors and Chrysler) the electronic revolution is dramatically on display in the 1978 models. Chrysler has expanded its Lean Burn program, introduced a radio with a memory, and put the finishing touches on an electronic fuel control system. Ford offers a miles-to-empty fuel range computer, a closed-loop fuel mixture control and the first combined spark and EGP adjustment system. GM has added a second and third spark control method, a closed-loop fuel control of its own, an automatic leveler, and a powerful travel guidance computer with a numerical dashboard display. In the way they are made, as well as the things they do, these ingenious innovations indicate what the automotive electronics of the near future will be like.

With but one or two exceptions, these are electronic systems of types that have been predicted widely for auto use over the past decade. Until recently, their adoption has been mainly

Automotive Electronics for 1978

dependent on the value they could offer the car buyer in relation to their cost. Engineers looked for applications in which this payoff would be most convincing. This, together with the dramatic advances in the design of small computers, assured steady progress in auto electronics. Now, however, there's a forced draft under the fire. The demands of tighter emissions standards in 1981, combined with the need for fuel economy at any cost, have directed a spotlight at electronic engine control systems. Micro-computers are being rushed into the cars of 1978 to serve as prototypes for the across-the-board applications of 1980 and beyond that will represent new sales to the auto industry soaring into the billions of dollars.

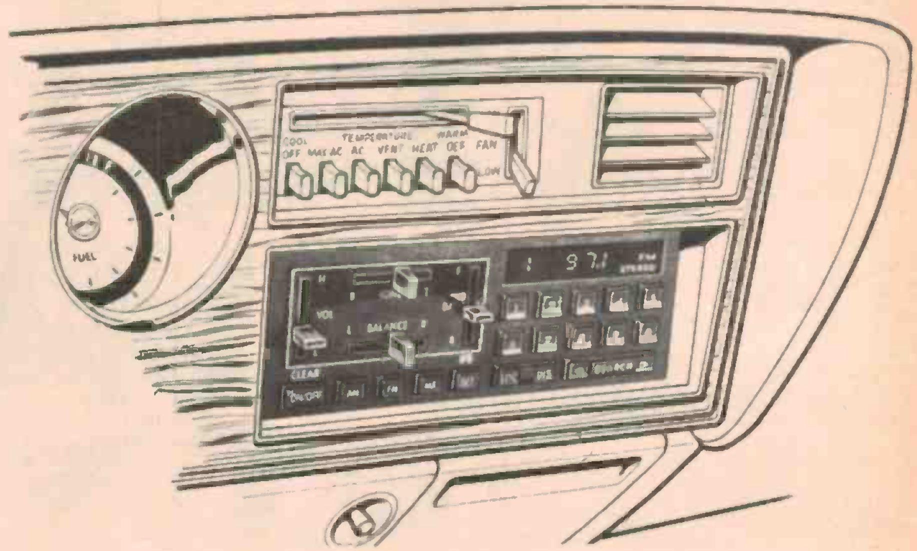


Fig. 2. Microprocessor control circuitry allows Chrysler's new AM/FM stereo electronic search radio to recall as many as ten stations from its internal memory. A LED display shows the frequency and selected band.

Shotgun Weddings

It all seems very sensible, but it has not been easy sailing so far. Sometimes a shotgun has been at the ready at the weddings of auto and electronics engineers. In 1974, the president of Rockwell's electronics operations, Donn L. Williams, told the Society of Automotive Engineers (SAE) how, "some time back", they'd put a crew to work on truck brake anti-lock systems:

"We assigned a team of electronics engineers to work with a team of automotive engineers. That was easy. But it was the only easy part of the entire project. The two teams of engineers talked different languages. They thought differently, and often approached problems from entirely alien points of view. And in some cases, the differences were so startling that each group of engineers thought the other group was 'putting them on'". They found out that they had to know a lot more about how air brakes really worked before they could create an electronic system that would apply them properly.

Abortive though it turned out to be, this industry-wide work on anti-lock braking for trucks was one of the first sharp spurs to large-scale vehicle uses of advanced electronics. The revolution had begun quietly enough. The first use of an electronic device as a basic subsystem of the car came in 1960, with the solid-state diode rectifiers in Chrysler's alternators. Custom integrated circuits were first applied in production to cars in 1972 by GM in a voltage regulator and in the unitized ignition built by Delco-Remy for Pontiac. And the first major electronic logic system used across the board by the industry was part of the short-lived seat belt interlocks.

Each of these programs helped prove the suitability for production of different electronic concepts. And less visibly, researchers inside and outside the auto companies worked hard on other electronic applications. As the space program wound down, Chrysler put its Huntsville Electronics Division to work on auto uses. Its first automotive product was an AM radio for 1971 Plymouths and Dodges. Then it came up with the solid-state ignition used first in 1972, on all V-8's in 1973, and across the Chrysler U.S. range in 1974.

At GM, an electronic control systems group was set up in 1970, under the direction of Trevor O. Jones, to help put electrons to work in General Motors cars. It pushed pioneering work ahead in several greek-letter groups. Alpha programs explored the integration of complete systems into the automobile. Beta covered systems related to the driver's physiology, such as the 'Phys-Tester' for drunkenness. Under Delta diagnostic methods were studied, and dash displays under Sigma. Complete central processors for cars were in the

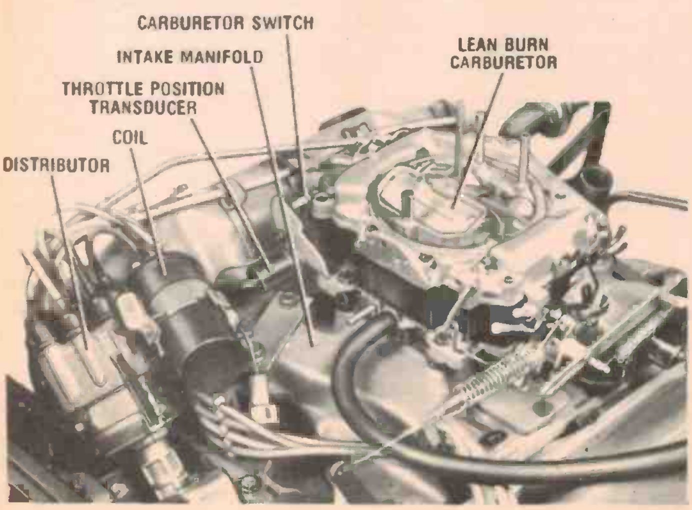


Fig. 3. The Chrysler Electronic Lean Burn engine control system mounted on the 400-CID engine.

Omega series. From this work, many of GM's new electronic applications have been derived.

Ford, which as always tracked electronic developments closely, moved in October, 1975, to make them an official part of the company structure by setting up an Electrical and Electronics Division. Under chief engineer Frederick Z. Herr, an engineering team was brought together from Ford's product development group and former Philco-Ford personnel. The new division can draw on manufacturing facilities in Michigan, Ohio, Pennsylvania, Indiana, Ontario and Brazil.

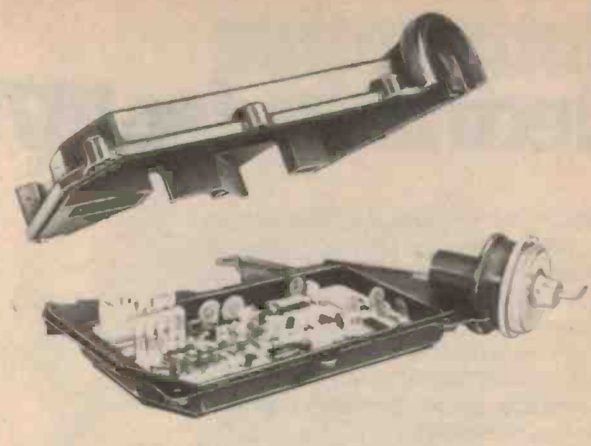


Fig. 4. The Spark Control Computer is part of the Chrysler Lean Burn system.

Reliability Problems

In each of these groups the advocates of electrons and mechanics butted heads in the way Donn Williams described. Some of their most bitter arguments were over the issue of reliability. Electrical systems were well-known as sources of failure in existing cars; wouldn't complex electronics be even more failure-prone?

At first sight it seemed that failures would be inevitable. Cars offered an environment far more hostile to computers than the air-conditioned and dehumidified chambers they had been used to. underhood temperatures range from −40°C to 140°C. Salt spray, dust and vibration are constant menaces. And the car has a power supply "which, by computer industry standards, has limited capacity, minimal regulation, and is quite noisy," as a GM engineering report put it. The odds against success seemed heavy at first.

Gradually techniques were worked out that promised success. Manufacturing methods became exacting — and expensive. When building the Lean Burn electronics package, said Chrysler's Huntsville general manager, Arthur E. Douyard, "We actually try to make the unit fail during assembly. We expose it to 185-degree temperatures three times, including a final period up to 10 hours. We also pass-fail the unit by computer five times. Finally, we audit ten percent of the units we ship to grade our quality control standards".

The ten-hour test figure was not casually arrived at. "Any malfunction with an electronic device should show up quickly — usually within the first ten hours," says Sidney L. Terry, vice president for public responsibility and consumer affairs of Chrysler. "After that the electronic components should never wear out. Chrysler engineers estimate that for every dollar the industry has invested in electronic voltage regulators, the customer has saved nine dollars in replacement costs, and that customers have saved four dollars for every dollar we have invested in electronic ignition."

This is a good record — for relatively simple devices. For more complex systems, serviceability suited to the auto repair shop will have to be worked out. "Repair of computer-type equipment will of necessity be at the module replacement level to be practical," the SAE was told by Frank P. Caiati and James F. Thompson of GM's Engineering Staff. "Isolation to a failed module will be the technological challenge. It is very necessary that a high percentage of module failures be self-indicating," so the usual vagaries of trial-by-replacement troubleshooting could be avoided.

"The MSI and LSI semiconductor technology of today lends itself to modularity," Caiati and Thompson added. Like car radios, the first complex electronic system used in a production car — the Bendix fuel injection of 1957 — used vacuum tubes. Soon thereafter the vacuum tube was replaced by the transistor, much smaller and less power-hungry, while back in the semiconductor labs, the age of the integrated circuit was being ushered in.

"In 1959," explains Chrysler's Terry, "a commercially available chip contained only one component of a circuit. By 1964, the number of components per chip was one to ten. By 1970, the number of components was up to about 1000, and by 1976, up to 82,000. At the same time, the cost per unit dropped sharply."

The electronics industry soon discovered that the most efficient way to use those 80,000 components was to organise them into a computer-like general purpose logic chip — the microprocessor. With that much power available in a very small package, the auto industry had to pay attention to microprocessors. "These new LSI microprocessor chips, as used in calculators, started the industry looking at applications in which their added cost could be handled," says Donald E. Colvill, staff engineer for electronic engine controls of GM's Delco Electronics Division. "To an engineer," he adds, "a computer is always attractive from a technology standpoint".

It was one thing to decide to use this know-how of the semi-conductor industry, and quite another to decide exactly how to use it. There are two main types of computer, analogue and digital, and each has its strengths and limitations. The auto industry started with analogue computers, and it is moving rapidly and irrevocably toward digital computers today.

The analogue computer was initially the most popular because it is simpler and well suited to doing many of the jobs that the automobile system requires. As its name hints, it works through the setting up of an electronic circuit that is analogous to the conditions in the mechanism that it's controlling. In an analogue computer, multiplication by a constant, for example, would be done by an amplifier of fixed, pre-set, gain. Analogue circuitry 'mimics' the motions of the machine and/or the mathematical equations that describe what it does. Analogue computers can be quite versatile, but for use in cars they're usually tailored in design to suit just the job they have to do.

Analogue Circuitry

Analogue circuits started strong in cars and are still doing many important jobs in them. The Bosch and Bendix electronic fuel injection systems use analogue computers, for example. Analogue designs were chosen because they're fairly easy to change and adjust during vehicle development and during the

Automotive Electronics for 1978

evolution of the fuel injection system. For similar reasons Chrysler chose an analogue computer to control its Lean Burn spark-adjustment system. First launched in the 1976 model year, this functioned with 99.9% reliability on the initial field of 60,000 cars. Now in 1978 it's available on all Chrysler's eight-cylinder engine families.

Analogue circuitry also does the computing in the black boxes used in the closed-loop Lambda-sensing controls that make the so-called three-way catalysts work in the cars now on the U.S. roads. Such systems were first marketed by Volvo and Saab at the end of 1976, using Robert Bosch electronics. Now for 1978 Ford's Pintos and Bobcats with automatic transmissions for the California market have such closed-loop or feedback controls. Both Motorola and Ford's own plant supply their analogue electronics. GM's Delco Electronics Division makes analogue controls for the similar air/fuel ratio control being fitted to some Buick, Oldsmobile and Pontiac subcompact models, also for the California market. Ford uses Bosch exhaust pipe sensors, while GM's come from the AC Spark Plug Division.

Two 1978 GM models have new spark control systems that also have analogue computer circuitry. One is Delco Electronics' Electronic Spark Control, which is called the Turbo Control Centre by its user, Buick, which employs it on its turbo-supercharged V-6 engines in the Regal and LeSabre sports coupes. This ingenious device uses a Delco Remy vibration sensor mounted on top of the inlet manifold to tell when the engine is detonating. Electronic filters on the sensor's output pass the high vibration peaks in the range of five to seven kilohertz that GM considers to be the signature of pinging or detonation. Analogue circuitry in the Electronic Spark Control modifies the spark dwell, and thus the spark timing, by a signal it sends to a special electronic module in the High Energy Ignition. Working every other crank revolution, it can retard the spark up to 20 degrees in two-degree increments until the detonation stops. It is designed to cope with extreme conditions in the running of this sensitive supercharged engine, such as a very heavy load on a very hot day.

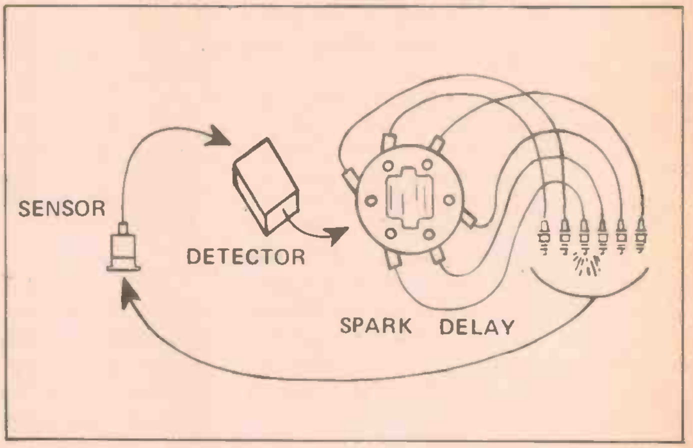


Fig. 6. The Delco Electronic Spark Control system is used on Buick turbo-supercharged V-6 engines.

This spark control system is a closed-loop device, the first of its kind to be placed in volume production. Delco Electronics' other new spark controller is an open-loop design, the Electronic Spark Selector used on 1978 Cadillac Sevilles (except for the diesels, of course). This has sensors that tell it engine speed, manifold vacuum, coolant temperature and the engine cranking condition. From these, an analogue computer advances or retards the whole spark curve to suit the running conditions. During engine warmup, for example, it retards the spark so the catalyst will reach working temperatures more quickly. Like the detonation sensor, this too allows the engine to be run with a greater spark advance under most conditions, favourably affecting mileage. Cadillac expects an overall improvement of about one mile per gallon from its use. And the Electronic Spark Selector is built to "fail soft". Should it stop working, the engine simply keeps running with the last spark curve it was using before the failure.

Both Cadillac and Buick offer yet another engineering feature that combines analogue-type electronics with a simple logic chip. The new GM application is in the Automatic Level Control for the rear suspension, developed jointly by Delco Electronics and Delco Products. It uses an Optron diode sensor to measure the distance from the axle to the frame, and the, through the analogue and logic circuits, it adds or subtracts compressed air (from a 150 p.s.i. supply) in the special shock absorbers to bring the rear of the car to the correct level.

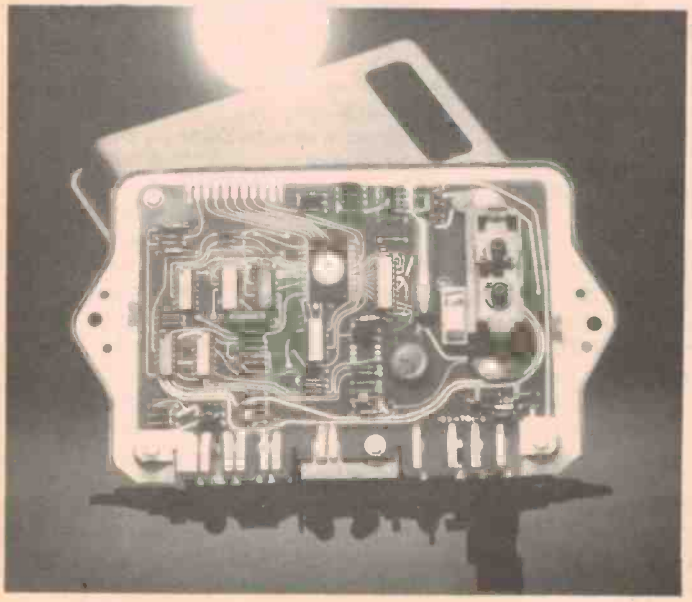


Fig. 5. This module, manufactured by Delco Remy, is an electronic controller for the GM 3-way catalyst system.

Number Crunching

With all these applications, analogue computation is well established in the electronic systems of today's cars. But it has a strong and promising competitor: digital computation. It reaches similar ends in a different way. While the analogue system is computing by making comparisons between different voltage and/or current levels, the digital system is carrying out the various calculations mathematically, just as you would on a scratch pad or calculator. You might say that digital computation is to analogue as a desk calculator is to a slide rule. Actual physical relationships play a part in the analogue circuit's findings, while the digital computer gets its results by doggedly doing the actual math — very quickly.

Each method has its pros and cons. Advocates of each claim that the other is more likely to be thrown off the track by spurious bleeps that drift into its wiring from outside sources. The analogue circuit works in "real time"; changes in its inputs are instantly reflected in its outputs. In contrast, a digital computer needs a finite amount of time to carry out its calculations. The more complex they are, in relation to the power of the computer, the longer it takes. In some automotive situations, such as very high engine speeds, this could limit the utility of the digital computer.

While the digital device gives results that are inherently accurate, the electronic components of the analogue device must be "trimmed", during assembly and testing, to make sure that the complete circuit gives the right answers. This seems to show an edge for the digital device, but that's not necessarily so. Many of the inputs to digital computers will begin as analogue signals, such as a varying voltage from a temperature or throttle position sensor, and will need to be converted into digital language that the computer can understand. Such an analogue-to-digital converter will also need to be trimmed, or calibrated, for accuracy. And digital-to-analogue converters for the computer's output will also be needed so it may perform automotive tasks.

The choice between analogue and digital for automotive computers was moot until recently. It was simply unthinkable to fit a digital computer into a production car, because it was too big, too expensive, or both. Now, with the arrival of the microprocessor that limitation is beginning to be removed. A digital computer needs a central processing unit (CPU) to do the work. It also needs a fixed or permanent memory (known as ROM for read-only memory) of substantial size to tell it what to do and when to do it, and in addition to that a temporary memory, or RAM (random-access memory), in which it can store data it needs for continuing its calculations. All this can now be etched on one or more small LSI chips, forming a microcomputer.

Fig. 7. The small size of the 2,000-transistor microprocessor contrasts with the mechanical system it controls.

Small and powerful though it may be, such a microprocessor doesn't come cheaply. It costs tens of thousands of dollars just to tool up to make the special masks needed to etch them in production. Also, to avoid needless waste they must be tailored as closely as possible to the applications for which they're needed. A nervous period of courting between the auto and semiconductor industries is now ending, as each better understands the needs of the other, and microprocessor uses are increasing rapidly. From one in 1977 the number of applications has jumped to five in 1978, and there'll be many more in 1979, after the technique proves its value and reliability.

MISAR Sparks It Off

The beachhead for microprocessors in cars was established in the "77 model year by Oldsmobile and Delco-Remy with their MISAR spark control system used in the Toronado. Standing for Microprocessed Sensing and Automatic Regulation, MISAR senses crankshaft rotation, manifold vacuum and coolant temperature, and from these decides which of more than 200 ignition advance points on a "map" of possibilities suits the engine best at that instant. These points are stored in a ROM with a capacity of 1024 ten-bit data words. Two LSI chips are at the heart of the Rockwell CPU that computes which point will be used at any moment. It completes the 335-odd instructions its program requires in about 12 milliseconds giving a fresh spark timing at that interval. MISAR works by switching the HEI distributor's own electronic module on and off.

MISAR enters its second year in 1978, and is joined on the market by an even more competent engine control from Ford. This is Ford's first-generation Electronic Engine Control, or EEC I. In addition to the parameters sensed by MISAR, the EEC I picks up the throttle position, inlet air temperature, barometric pressure and EGR valve position. With this information it

Automotive Electronics for 1978

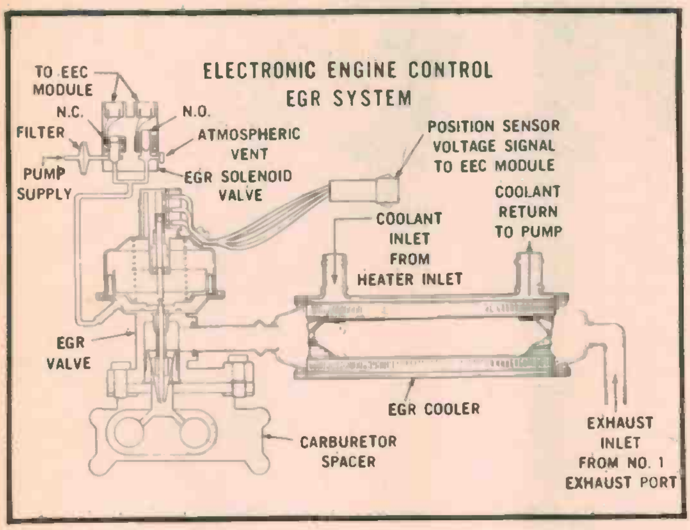


Fig. 8. The 1978 Lincoln Versallles features this control system.

controls not only the spark timing but also the flow through Ford's new sonic EGR valve. Called an "interactive" control by Ford, since it simultaneously juggles two interrelated engine variables, the EEC I is used on the 1978 Lincoln Versailles. Parts for its microcomputer are supplied by the Ford Aerospace & Communications Corp., by Toshiba of Japan, and by the Essex Group of United Technologies Corp.

Three other microprocessors are used to do jobs that are less vital to the running of the car. One is another Chrysler Huntsville development, an advanced solid-state search-tune radio. It has a ten-digit keyboard that can be used to choose stations directly by their frequency, or from the radio's computer memory by a push of a single button. Automatic searching for other stations, at two sensitivity levels, can be initiated by a foot switch. The frequency chosen is shown by a light-emitting diode display. This 'thinking' AM/FM stereo radio is offered in such top-line models as the Dodge Diplomat and Magnum and the Chrysler LeBaron, Cordoba, Newport and New Yorker Brougham.

The fourth microprocessor available in the '78 models is an option on the 1978-1/2 Cadillac Sevilles, those without diesel engines. It's at the heart of a system called Tripmaster, which uses a large LED display made by AC Spark Plugs in place of the conventional speedometer and introduces LED displays for the fuel level and, at the right of the dash, for engine speed, coolant temperature or time of day — whichever the driver selects by pushing a button. A small panel holds a dozen push-buttons for selecting operating modes or entering data into Tripmaster.

Its CPU, a Motorola 6800 microprocessor, allows the Tripmaster to do many navigational tasks. It can handle time, distance and average speed calculations, and it can relate them to the rate of fuel consumption and the amount of fuel left in the tank. Drawing information from the electronic fuel injection, it can read out the instantaneous fuel mileage and the average mileage for the journey. Its present ROM capacity of 4000 eight-bit words is enough to let the Tripmaster handle these jobs, and it can be expanded by several multiples in the future, using the same CPU, to permit it to take over all engine functions and many other control tasks in the car.

Fifth among the digital microprocessors in the 1978 cars is the miles-to-empty system used, as an option, in the Lincoln Continental Mark V. Its LSI chip carries the equivalent of 3600 transistors on a surface less than a quarter-inch square. Picking up indications of car speed and fuel tank level, it calculates the distance traveled, fuel used and the resulting miles per gallon. Then it multiplies fuel mileage by the amount of fuel left in the tank to get the miles-to-empty reading shown on the dash in a bright gas-discharge numerical display supplied by Beckman Instruments.

Looking Forward

This is a promising array of digitally-controlled auto systems. Many more are waiting on the sidelines. We can expect, for example, that most and perhaps all of the present analogue car computers will be converted to digital operation in the course of the next several years. Speaking to the SAE about electronic fuel injection in 1976, Jerome G. Rivard, then of Bendix and now with Ford, said that "In the interests of cost reduction

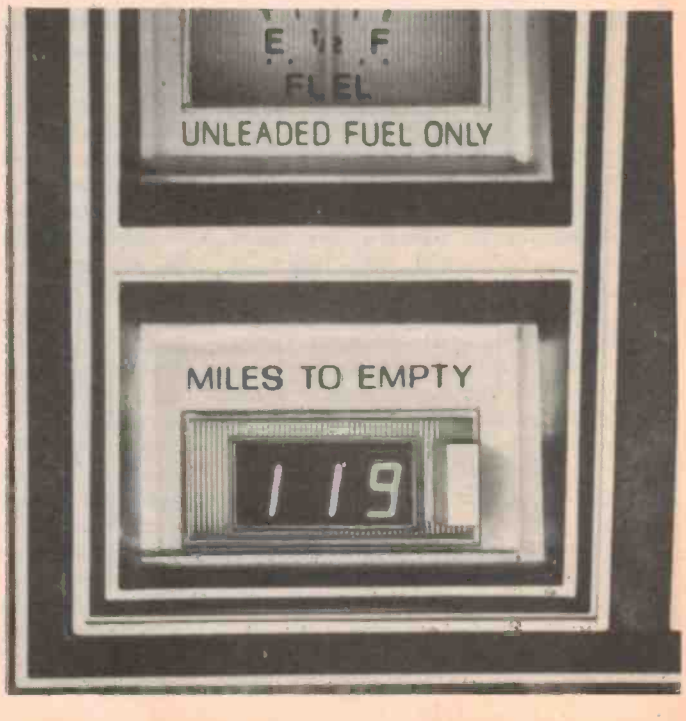


Fig. 9. This miles-to-empty gauge is an option on the Lincoln Continental Mark V.

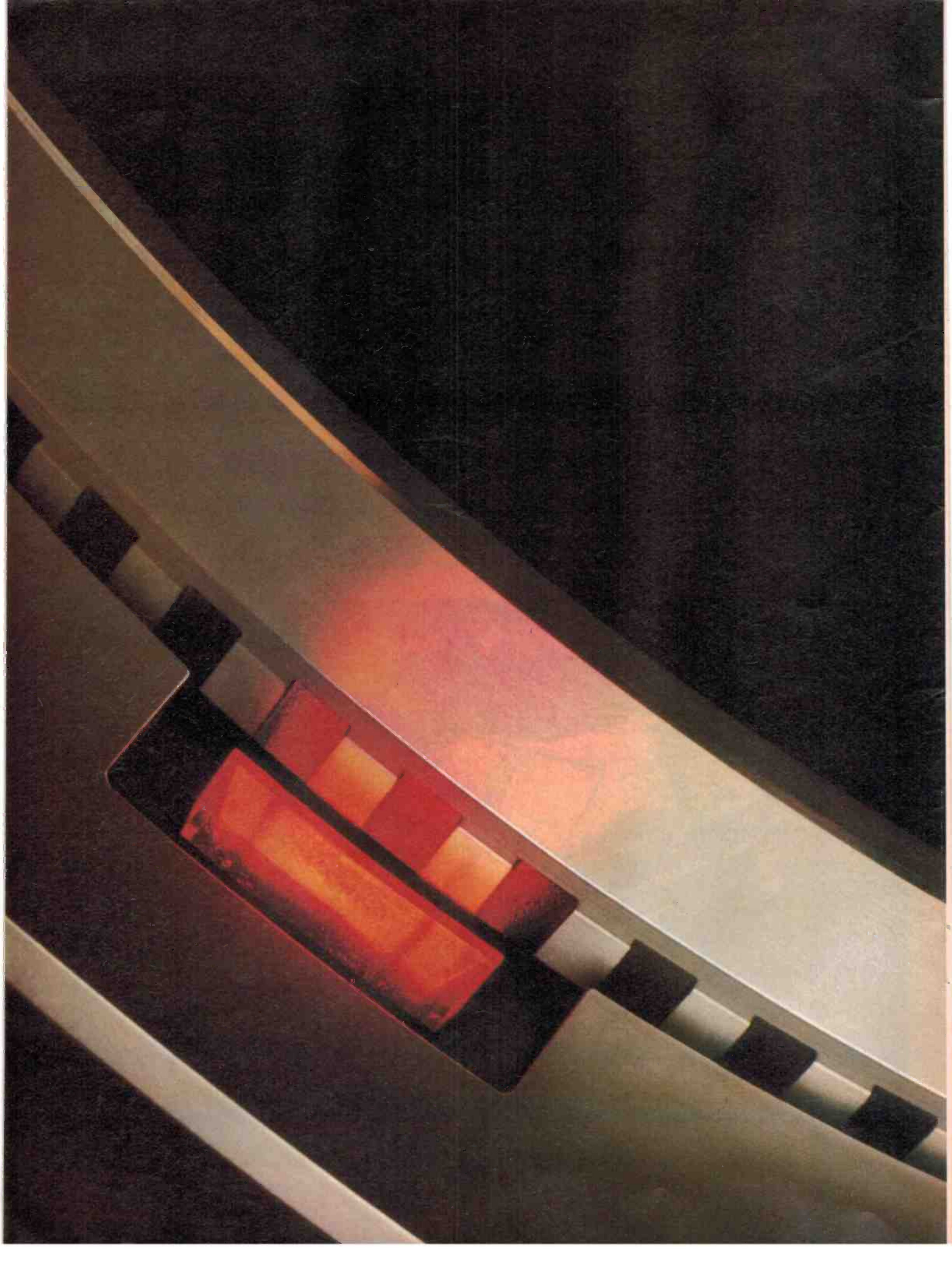
and higher production volume, the current hybrid analogue design will undoubtedly be replaced ultimately by a design based on digital EFI controller to be in production for the 1979 model year and to be in wide use in 1980. United Technology's Essex Group has also built and tested a digital injection computer, while Chrysler will use such a controller with its forthcoming Electronic Fuel Metering system. Its key microprocessor suppliers are expected to be the RCA Corp. and Texas Instruments.

The systems on the 1978 cars are the exploratory first wave for the mass invasion of microprocessors that's coming on the 1981 models. To meet the tougher emissions and economy standards then, the tiny LSI chips will take over control of all main engine variables: spark timing, EGR valve flow, choke control on carbureted cars, fuel preparation and fuel/air mixture control. The Motorola 6800 microprocessor, used already in Tripmaster, will be the key CPU for General Motors and, apparently, for Ford as well.

Those resppnsible for developing these new systems make no secret of the fact that the central brain, the CPU, has raced far ahead, in design, of the sensors and actuators that are the eyes and muscles of the brain. These are still relatively primitive, and all too susceptible to inaccuracy or failure under automotive operating conditions. Also many of them produce analogue outputs instead of the digital data that the microprocessor would prefer to receive. This is the area in which the auto and electronics engineers will have to cooperate most genially if good results are to be achieved.

Before long there'll be no conflicts between those two engineering factions, because they'll be indistinguishable one from the other. Like the experts on electricity, hydraulics and pneumatics before them, the semiconductor specialists will be absorbed into the motor industry. And the computers, the intelligence systems that will build the first brainy cars, will be taken for granted too. They'll only be of interest when they fail — and there'll be a computer to detect that too.

Fig. 10. The Aston Martin Lagonda features an integrated electronics system designed by Cranfield Institute of Technology and manufactured by a specially set up company, Aston Martin Electronics. Even the driver's seat is computer controlled through servomotors and can be pre-programmed with two sets of adjustments for husband and wife drivers. Extensive use is made of fibre optics in the control panel, which displays revs and speed in both analogue and digital forms. The speedo can be switched to read in either km/h or mph.



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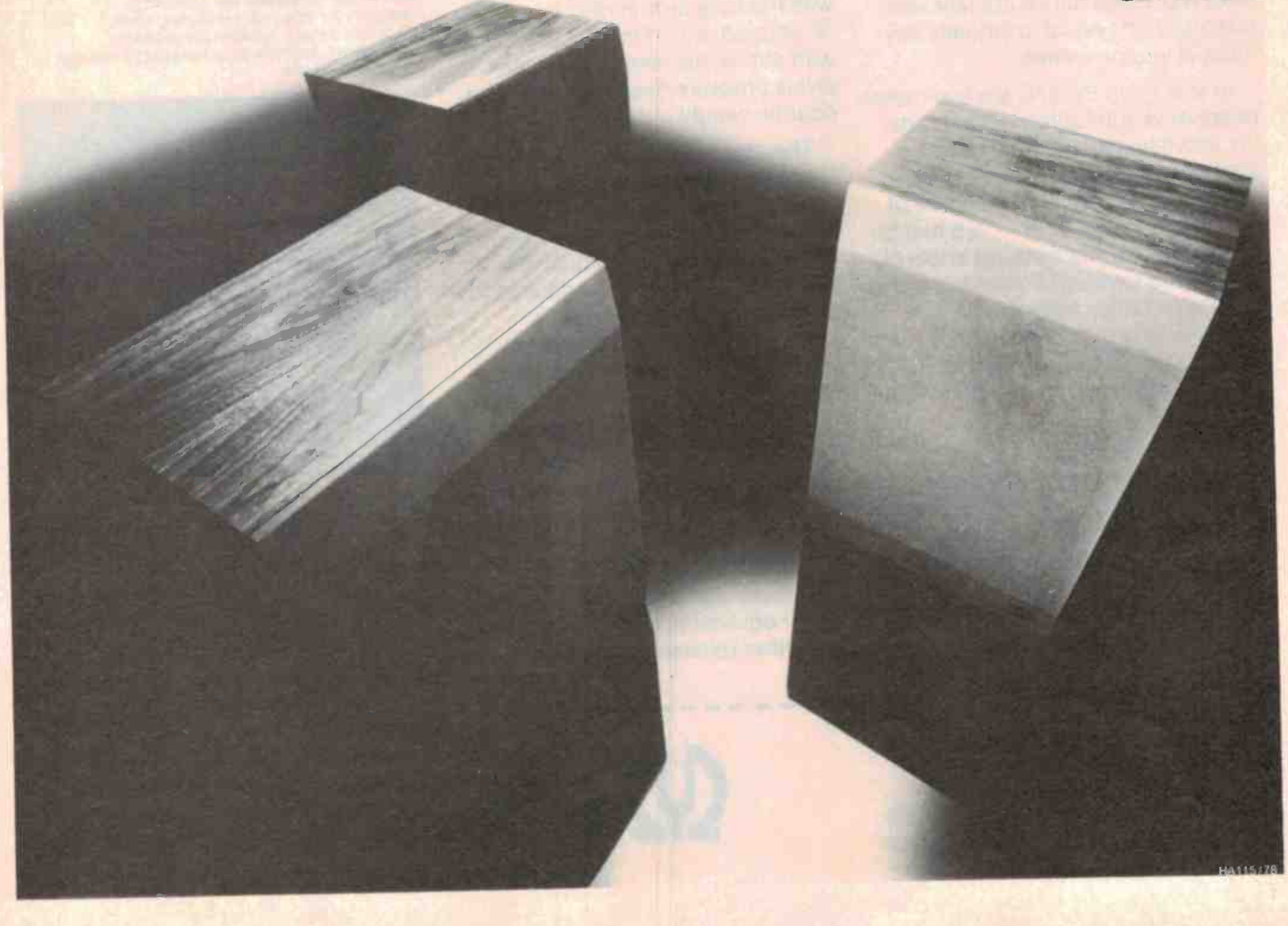

HA115/78

SOUND

Electro Research Class 'A' Amplifier

There can really be no argument that the inherent characteristics of Class 'A' amplifiers make them the best choice for handling audio signals in a hi-fi system. However not many solid-state Class A amplifiers have actually materialised, largely because of their gross inefficiency and consequent heat output, with potential unreliability.

One of the first successful transistorised Class A amplifiers was the J.E. Sugden A21, an integrated design with an output power of about 15 watts per channel. This amplifier wasn't very popular because it wasn't sufficiently powerful to drive the then new generation of infinite baffle loudspeakers. The C51/P51 preamp/power amp system was better able to do this but was probably disregarded by many listeners because of its fairly high price relative to its power output.

Yamaha and Stax have both ventured into the field of Class A power amplifiers, Yamaha with the optional Class A operating mode for the CA1000 amp yielding 10 watts per channel as opposed to 70 watts in Class B; Stax with the DA300 and DA80 power amps.

And now we have the Electro Research A75V1 from America. This power amplifier, rated at 75 watts RMS per channel, an enormous output for a Class A device, has been given enthusiastic accord by sections of the American 'underground' audiophile press — which, we must hasten to add, doesn't automatically imply to us that the equipment is necessarily the best.

In appearance the amplifier can only be described as a brute. Our sample was predominantly black, with chrome trim and carrying handles and white lettering. It also had a front panel unlike any other we've seen; no output meters (although a centre-zero edge-mounted meter was fitted), no level controls or any of the more usual power amplifier paraphenalia.

Unfortunately no instructions were supplied with the sample, so we're unable to say exactly what the facilities provided were intended to do, apart from the electro-mechanical counter, which was an elapsed time clock indicating the hours the amplifier had operated. The readout could not be reset.

Other facilities fell into two sections — the calibrator, consisting of the aforementioned edge reading meter, a pair of rotary controls marked input trim, four screwdriver operated presets and three non-locking pushbuttons; — and the operation monitor, consisting of four back-illuminated push buttons marked respectively, load 1/load 2 (which didn't seem to do anything at all), normal/supply (which glowed orange under normal conditions and red if mains voltage were reduced), standby (self-explanatory) and reset/frequency for switching the amplifier into operating mode from standby.

The remaining control was power on/off. When switched on, the amplifier produced a loud clunk and went into standby mode, thus necessitating operation of the reset button to select operating mode.

Rear panel fitments included RCA-phono input sockets and banana/screw binding post output terminals.

Performance

The sample was very noisy, mechanically, this resulting from inclusion of a blower fan to keep the enormous side-mounted output heatsinks cool. We have never encountered such a mechanically noisy amplifier and late-night, low-level listening was rendered virtually impossible. It would probably be necessary to place the amplifier in a different room if permanent installation were invisaged.

Compared with our reference power amplifier, the Naim NAC250, the sample seemed to have a more extended and prominent bass response, an equally neutral and uncoloured midrange response and a more distant and apparently less

Continued on p.25

Modern expertise and computer technology have created a fine piece of equipment.

The NEW
B&W DM 7

DM7 is the first of a new loudspeaker family reflecting our computer-aided research programme. It is a compact 3 unit system employing entirely new drive units in an enclosure engineered to exceptionally high standards. Many advances have been incorporated to reveal new horizons in loudspeaker performance, making possible a standard of musical reproduction unequalled in an enclosure of this size. The DM7 gives almost perfect amplitude linearity throughout the entire audio spectrum, and produces phase-coherent sound within a broad listening area. The drive units are purpose-designed and manufactured entirely in our own factory, employing new technology in order to achieve incredibly low distortion levels – typically less than 1% THD from 30Hz to 200Hz and less than 0.5% above that frequency. Another new feature in the DM7 is a variable energy control giving four frequency weightings – different to those obtainable from the control unit – to accommodate widely varying room acoustics.

Hear the B & W DM7 – you may well agree that this is the finest small speaker in the world today. Guaranteed for 5 years.

The DM7 complements a remarkable range of monitor loudspeakers from B & W.

The B & W OM6 is Britain's first linear phase loudspeaker. A dynamic system that will reproduce sound with transient accuracy usually achieved only by the very best electrostatic designs.

The OM4 is a 3-unit monitor loudspeaker system that produces high quality results from an incredibly small cabinet (20.8 litres) making it perfect for home or small studio use where space is at a minimum.

Only 28" x 9" x 9½". Despite its compact size, DM5 speakers can be rated as a system of very high quality. The design philosophy of John Bowers – "To design loudspeakers that reproduce in your home sound as you would hear in the concert hall"

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detailed treble. The Electro Research sounded powerful and spacious, giving an impression of smoothness and coherence of the sort one expects from amplifiers capable of far greater power output.

The essentially neutral tonal balance was most pleasant. However, we found dynamics seemed a little suppressed, and lacking in the sort of impact we hear from the Naim. This was largely responsible for a flat presentation of stereo images, with a shallow front/rear perspective. This effect was emphasised by the rather soft, distant extreme high frequency response; details could only be heard if one listened with concentration.

Side-to-side stereo performance was, on the other hand, very good indeed, giving the impression of plenty of space between individual elements of an ensemble to result in an easy, effortless sound which rarely became offensive.

Despite its 75 watt rating, the sample seemed capable of producing very high levels indeed, without becoming audibly distressed. It also retained an acceptable tonal balance at very low levels, although the noisy blower rather spoiled the sound.

The Electro Research A75V1 is very expensive and while its performance, as assessed from the sample, seems excellent, we feel its price is a little too high for the performance and facilities it offers. One or two more conventional power amplifiers — for example the Audiolab and the Naim — give subjective performance at least as good as our sample A75V1, using our reference loudspeakers. The sample was very well made, however, and would probably be extremely reliable in service.

Petanger parametric equaliser

Petanger Parametric Equaliser

There is, at present, tremendous interest in the field of electro-acoustic equipment specially designed for professionals. Whilst the Americans and Europeans have produced some exceptional equipment, we are always pleased to find that some Australian firms are either on par or not far behind. One piece of equipment which has recently attracted a lot of comment is a device called the Paramateric Equaliser, and it was with great interest that we received an Australian-made unit for review.

The particular unit described is a Petanger Parametric Equaliser, which is a dual channel, 4 band equaliser. This unit is both attractive in appearance, functional in its layout and relatively inexpensive considering the range of functions that it offers.

Our first questions were: *"Well what does this device do that other devices don't already do?"*, and equally important, *"How would the average amateur or professional use it?"*.

The answers to both of these questions are closely inter-related, for there are many pieces of equipment available for tailoring the response of an electro-acoustic system, particularly for musicians who move from location to location and feel the need, for a variety of reasons, to modify the frequency response of the standard equipment that they use.

Acoustic Problems

The most glaring problem that both the professional and amateur musician finds is the wide range of acoustical characteristics in auditoria and to a lesser extent in the out-of-door situations in which they find themselves. Most people are aware of the bathroom acoustics problem, where you can clap your hands and develop a flutter like sound effect. This can convert the modest baritone into an opera singer, even if only at a few spots within the audible spectrum. The problem of selective frequency enhancement is equally common in auditoria and generally manifests itself through an interaction with the PA system and loudspeakers to cause many heartaches and initial set up problems.

The most common of these problems is called feedback oscillation, where at some modest level of amplification the system "takes off" and howls in the most disconcerting manner. This problem can be overcome in many ways, the most common technique in the past being to utilise a graphic equaliser which provided a selective rejection at those frequencies where the problem manifests itself.

The second problem in auditoria is the regular need to introduce a "fold back" system whereby the musicians utilise a supplementary amplification system to provide a small portion of the sound they are feeding to the audience in order to be able to monitor their own performance. The problem with such systems is that because of the direct radiation, the short distances and the levels at which the music is being played, such a system is rapidly and readily induced to oscillate (take off). This problem could be partially compensated for by a graphic equaliser but with more difficulty than with the first example quoted.

The third problem is that most musicians like to change their sound either selectively within a narrow range of the frequency spectrum or by introducing other gimmicks. This is particularly true with electric guitars, and other instruments where there is a need to produce unusual sounds. This can be achieved in many possible ways and whilst even the ubiquitous graphic equaliser is of some use in this area it soon shows its real limitations.

What then, you might ask, does a parametric equaliser have that a graphic equaliser does not have?

The Parametric Equaliser

Firstly, the type of usage is a little different because the characteristics of the device are significantly different. Whereas graphic equalisers, excluding the best professional units, have a selectivity that is "almost as broad as the proverbial barn door" the parametric equaliser, is capable of having the shape of its response tailored from broad to narrow, and in the best units the "narrow" is extremely sharp.

Secondly, the parametric equaliser, like the graphic equaliser, is able to have its response shape converted from boost to notch (or cut) but unlike the graphic equaliser, can be varied infinitely and exactly to any frequency within the range of a given control. It is this parameter of variable frequency which is of the utmost importance and is possibly even more important than the selectivity control.

Last, but not least, by covering a range of frequencies the parametric equaliser is able to improve the performance of electro-acoustic systems and obviate some of the worst problems of room acoustics. This is especially true in the case of loop feed back problems and natural eigentones or room resonances with the audience present or absent, as the case may be.

Continued on p.26

SOUND

The Petanger Audio Developments Dual Band Parametric Equaliser is a neat unit designed for 19" rack mounting with flat black painted facia panel with white silk screening superimposed. The unit is divided into two identical sections; one for the left and one for the right channel. Each side section of this is then sub-divided into four similar sub-modules each of which covers bands of increasing frequencies. These cover respectively 20-640Hz, 60-1.9kHz, 180-8.6kHz and 540-17kHz. The frequency selecting slider control is located on the right with individually calibrated frequency markings that typically have points at 20Hz, 30Hz, 50Hz, 100Hz, 200Hz, 500Hz and 640Hz, whilst the left hand side of the panel contains an illuminated push button for switching that channel in or out as required, a cut and boost control that provides 18dB of cut or boost calibrated in 3dB steps and a band shape control that provides a continuously adjustable bandwidth from broad to narrow.

Construction

The internal construction is extremely neat with the main electronic components laid out on two identical printed circuit boards on the base of the unit. All integrated circuits are mounted in sockets. The front panel controls are laid out to make maximum use of the available panel area; less than 10% of the space behind the panel is unused. Connections between the channel select switches are by means of a second pair of printed circuit boards.

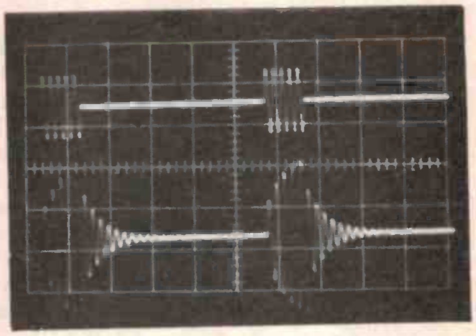
The power transformer, regulated power supply and Canon type input and output connections occupy the rear panel.

In general terms nothing could be simpler in use and in practice this proves to be the case. Our initial approach was to evaluate the performance of the unit in terms of accuracy of calibration, the range o band shape performance, its ability to handle transients and its inherent distortion characteristics.

In all of these areas as the level recordings show, the unit's performance proves to be exemplary and both the broad band and narrow band performance right across the spectrum was generally faultless.

When we came to utilising the parametric equaliser on a number of real, as opposed to contrived, situations we found the flexibility of the device to be superior to what we had envisaged. The first application involved providing signal enhancement and improved speech intelligibility for some tape recorded material which was picked up in one room by a radio transmitter and recorded in a distant location with a remote receiver. *(Ahem! – Ed)* The problem was that as well as the mains interference, the room concerned was subject to the vagaries of external traffic noise, interference of well defined frequency from an air conditioning system, selective frequency effects from a microphone located inside a drawer of a desk and the eigentones or natural frequencies of selective enhancement provided by the room itself. The signal was in something of a mess and really required considerable modification.

The first step was to produce a frequency analysis of the background noise in the signal to determine which components of broad band extraneous noise and electrical interference noise were dominant and the extent of modification required to improve these. This showed that the 50Hz signal was present but only of moderate importance, that the 150Hz component was extremely high and provided a significant masking effect and that components in the range 200Hz to 500Hz due to the effect of the room's eigentones and the selective modification of the position of the microphone in the drawer were dramatically changing the shape, response and overall intelligibility of the signals being recorded.



TONE BURST RESPONSE ONE CHANNEL OF PETANGER PARAMETRIC EQUALISER WITH CONTROLS SET TO 1kHz, 12dB BOOST, MAX. SELECTIVITY.

UPPER TRACE IS 1kHz INPUT SIGNAL.

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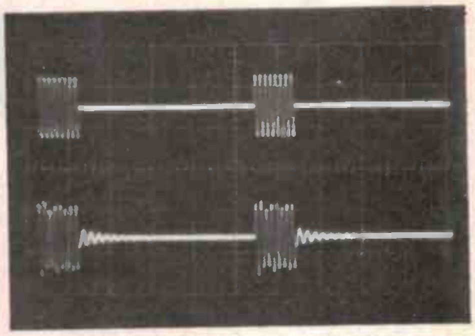
Sig : AMC



TONE BURST RESPONSE ONE CHANNEL OF PETANGER PARAMETRIC EQUALISER WITH CONTROLS SET TO 1kHz, 12dB BOOST, MAX. SELECTIVITY.

UPPER TRACE IS 1.5kHz INPUT SIGNAL.

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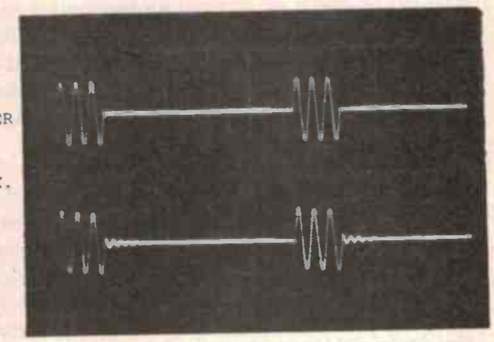


TONE BURST RESPONSE ONE CHANNEL OF PETANGER PARAMETRIC EQUALISER WITH CONTROLS SET TO 1kHz, 12dB BOOST, MAX. SELECTIVITY.

UPPER TRACE IS 500Hz INPUT SIGNAL.

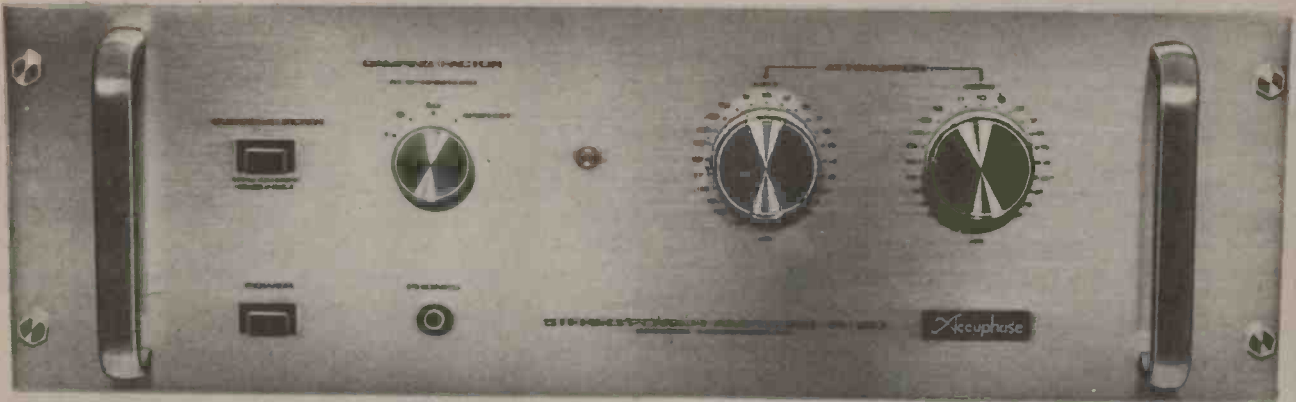
Date: 20.2.78
Sig : AMC

Louis A. Challis
& Associates Pty. Ltd.

The third and fourth frequency selective controls were utilised in the broad band position to modify the shape of the signal and the first stage of signal enhancement was achieved with a dramatic improvement in the ability to hear what was being said. On play back of the tape it was possible to determine that a number of key sections were being affected by traffic noise and a small number of vehicles whose frequency components contain both broad band acoustical energy together with discrete components at one or more frequencies. The right channel of the parametric equaliser was then connected in series with the output of the left channel and the individual controls adjusted to match the frequency selective components determined from an additional frequency analysis.

Whilst the original signal was 80% intelligible, the final signal was 99% intelligible and the quality of sound was miraculously improved.

Continued on p.28



The Accuphase P.20 Power Amplifier.

The 1977 Hi-Fi Grand Prix Awards judged it as "The Best Power Amplifier of the Year."

This Outstanding Accuphase Amplifier Is Now Available

Japan's annual Hi Fi Grand Prix is one of the most coveted and competitive Hi Fi contests in the world. Hi Fi components from around the world are stringently tested and judged on the basis of performance and design.

In 1977 the outright winner of the power amplifier category against all comers, was the new-release Accuphase P.20. It's specification of 140 Watts power output with frequency response of 5Hz to 90,000Hz (+0, −3.0dB) is impressive but to really appreciate its outstanding musical quality we invite you to test listen for yourself.

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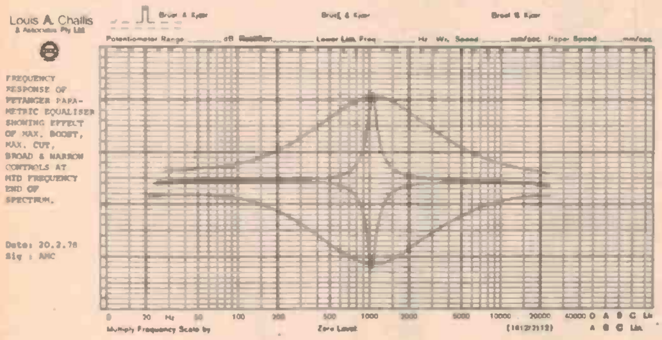
JMA4527

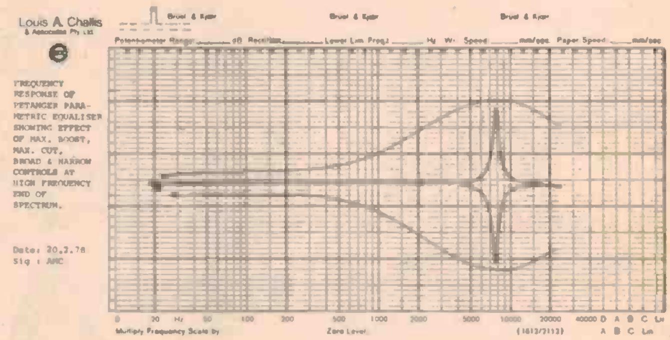
SOUND

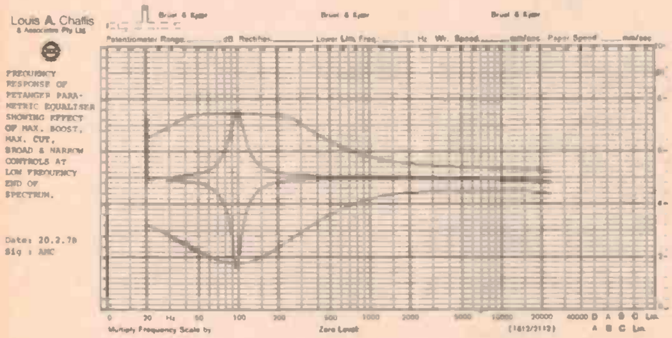
The second practical use to which the parametric equaliser was put was in the fold back system of a rock group in a small hall which featured room resonances and where a conventional graphic equaliser was still most unacceptable. Within three minutes, the parametric equaliser had notched out the dominant frequency selective characteristics of the fold back loud speaker system. The gain margin improvement was at least 15dB and the rock group was capable of providing 100dB levels at the front of an audience where before 80dB levels were hard to sustain.

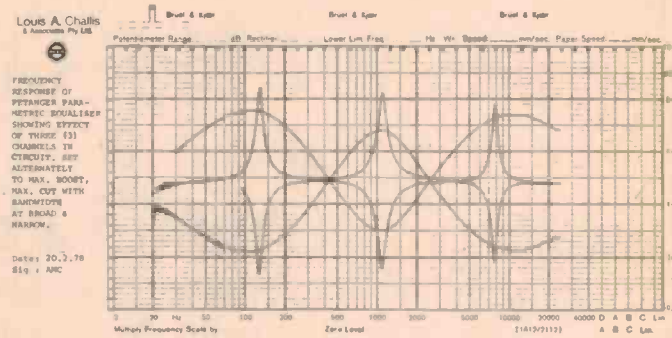
The third use in which the parametric equaliser was tried was in the amplification chain for a guitar amplifier by combining the controls to provide a series of sharp peaks in the amplification chain to exaggerate the harmonics of certain notes, the timbre of the instrument completely changed and a wide range of audible sound effects differing significantly from the norm could be provided. Because of the narrowness of the filter this only affected certain notes and not others without necessarily inducing gross feedback problems.

The Petanger Parametric Equaliser is more than a toy. Whilst the use of a parametric amplifier would require only one unit in a two channel PA system, the use of these units in a professional studio recording chain, could readily call for a number of units. There are many applications in the fields of both amateur and professional sound recording, where this instrument fills the gap by providing solutions to a range of problems which have been around for a long while.









SOUND BRIEFS

New Dynavector A new **Dynavector cartridge**, model 20C, has been introduced and will be available soon. The 20C is a low-output device, and will require transformer or head amplifier cuupling to most amplifiers.

Silver Transformer To match the new Dynavector 20C cartridge, Onlife Corporation has developed a **transformer wound using silver wire.** This is in line with recent Japanese trends of using high conductivity wiring and connectors for pickup systems.

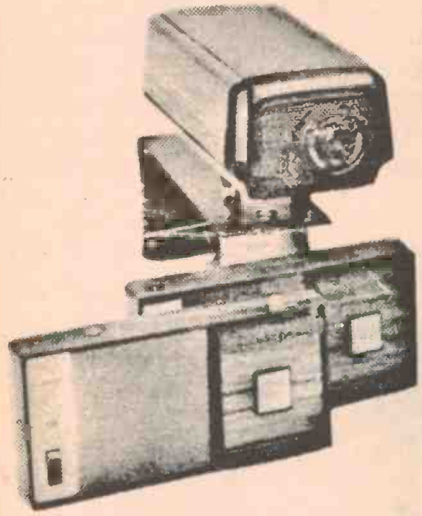
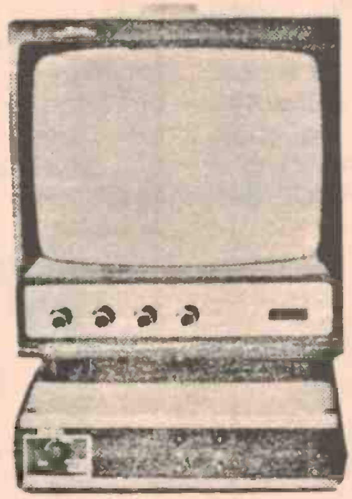
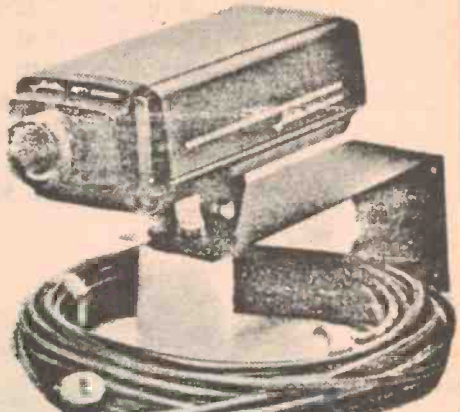
Modified Grace Riverina Hi-Fi, Brookvale, NSW., is offering a **modification service** for **Grace G707** arms to make them suitable for heavy moving coil cartridges. This involves decoupling the counterweight and adding a supplementary weight.

Dudley Harwood's Design Ex-BBC head of audio engineering, Dudley Harwood, has designed a **new loudspeaker** (see main report) called the Harbeth HL-1. Supplies should be available within a couple of months.

Beware Low-L Cables Some amplifiers are behaving badly to the extent of **blowing their output transistors** after being deprived of load inductance, thanks to the use of some of the new plaited loudspeaker cables which have virtually zero linear inductance.

Hi Fi at the Showground This year's Consumer Electronics Show will be the biggest and brightest yet. This expansion (and the fact that at last year's show all the lifts broke down!) has necessitated a **change in venue** from the Sydney Hilton to the Showground.

DO-IT-YOURSELF CCTV SYSTEM FROM JAVELIN IN A SINGLE CARTON

Javelin's JMS-30 and JMS-40 Mini Security Systems bring security back to basics. It's as easy to install as plugging in a T.V. set. The do-it-yourself security system will pay for itself in a short time. The deterrent factor alone will keep those would-be thieves away. Both the JMS-30 and JMS-40 Mini Security Systems are offered with optional two-way audio communication for those installations requiring audio, i.e., manager to shipping dock, babysitting, swimming pools to kitchen, etc. And it's all so easy to install!

AND IT'S ALL SO EASY TO INSTALL!

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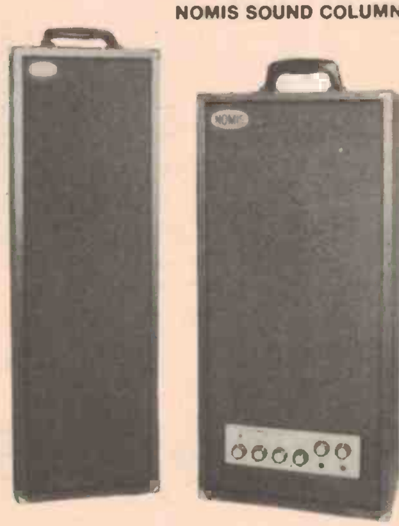

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S100 VDU

New design boasts many sophisticated features

- ☆ Upper and lower case
- ☆ 16 rows of 64 characters
- ☆ Flashing characters
- ☆ Black-on-white characters
- ☆ Graphics
- ☆ S100 plug-in card

A SOFTWARE CONTROLLED VDU (SCVDU) (otherwise known as a memory-mapped VDU) is one in which the memory that is storing the VDU's display is part of the processor's normal main memory. Hence the processor can read or write directly to any location on the screen without having to progress sequentially down the screen as in conventional VDUs.

The advantages of the SCVDU are almost limitless and new applications will keep occuring to you as you use one. For example, the processor can write to this memory as quickly as it can write to any other memory, so a complete screen of information can be output quicker than you can blink. This allows you to continually look at listings of a program as you modify it without waiting hours. If the screen is displaying the output of a game the display can be updated every few milliseconds to provide the effect of movement. It is possible also to just update one portion of the screen and leave the rest static, such as having a time count in one corner of the screen or having a 'Bytes left to load' count when reading from tape. (This is one facility I wouldn't be without.)

Any portion of the screen can be scrolled as desired, maybe three lines scrolling at the bottom with the rest of the page staying fixed, or scroll downwards just for variety. Writing across the screen and down gets dull, why not make the processor write vertically for a change? Because the processor can read back from the screen it is possible to do text editing on the screen including insertion and deletion and then simply read it back without the need to keep a scratch copy elsewhere.

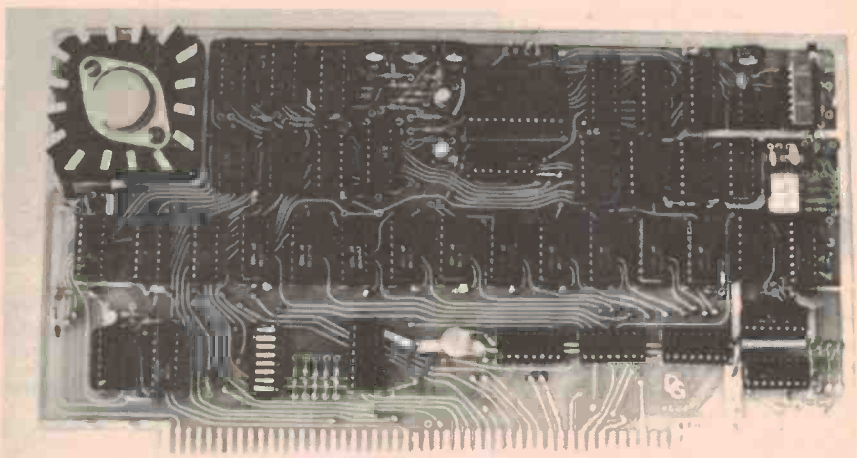


Fig. 1. The ETI 640 VDU board.

Let your imagination run wild, the display possibilities keep coming.

Screen Format

The characters are displayed as 64 characters per line and 16 lines on the screen. The character generator displays a 7 x 9 dot matrix with appropriate lower case characters (g, j, p etc) descending below the line by 3 dots effectively giving a 7 x 12 display. The font has 128 characters including upper and lower case letters and various mathematical and general symbols (see *Data Sheet*). Other fonts are also available, in pin compatible ROMs, such as Greek, French, German and Japanese letters.

Flashing Characters

With a SCVDU the processor can make a character(s) flash by writing the character then a blank after a suitable delay and then repeating this cycle. However, this keeps the processor busy when it could be away doing better things and the flash rate will vary depending on how much other work the processor is doing at the time. A much neater alternative is to have the flashing done in hardware and selected by a bit (bit 8) with each character which is how this VDU approaches it. Thus any character on the screen can be selected as flashing or not. The flash rate is set with a preset control on the board.

Black on White Characters

The area around a character is turned white and the character is seen as a black letter in this area. This is particularly useful to indicate a cursor as it can be backspaced over characters leaving the characters readable. The inverse video function can also be used to emphasize a line. As with the flashing function, Black on White is selected by an extra bit for each character. (Bit 7).

Chunky Graphics

These are low resolution graphics that are useful for large headings or borders, or for simple diagrams. The graphics are formed by taking the area occupied by one character (the same area seen as white around a Black on White character) and breaking it up, two across and four down. (See How it Works). These eight dots can be selected as White or Black by the eight bits that are stored for the character that would have occupied the space. Graphics or normal is selected by another bit for each character.

Memory Organisation

As you can see from the above points, there are quite a few bits stored for each character, ten in fact. This is how they are organised:

Bits 0-6	Seven bit ASCII code (giving 128 characters)
Bit 7	Black on white bit
Bit 8	Flashing bit
Bit 9	Graphics bit

Storing 10 bits per character presents a problem for an eight bit microprocessor. The way around the problem is to store the first eight bits of information for the 1024 characters on the screen as one kilobyte and then store the extra two bits exactly 1024 addresses above the character that they belong to. Thus the VDU occupies 2 Kilobytes of addresses but the second K only has two bits.

As an example of the above arrangements, if you locate the VDU at F000 HEX then it will occupy from F000-F7FF (2K). The character in the top left hand corner of the screen will be stored at F000 HEX and the bits to make this character flash or be a graphic are stored at F400 HEX. The last character (at the bottom right hand corner) will be stored at F3FF HEX.

S100 Bus Standard

The S100 standard is a 100 pin bus standard that was introduced by Altair and has been widely accepted in the USA. S100 was originally designed around the 8080 processor but can be adapted to virtually any processor. If your system is not S100 oriented all you need do is plug the VDU into a 100 pin socket and wire the appropriate signals out of your processor. None of the signals used are specialised and should be available on any processor or at least derivable with two or three gates.

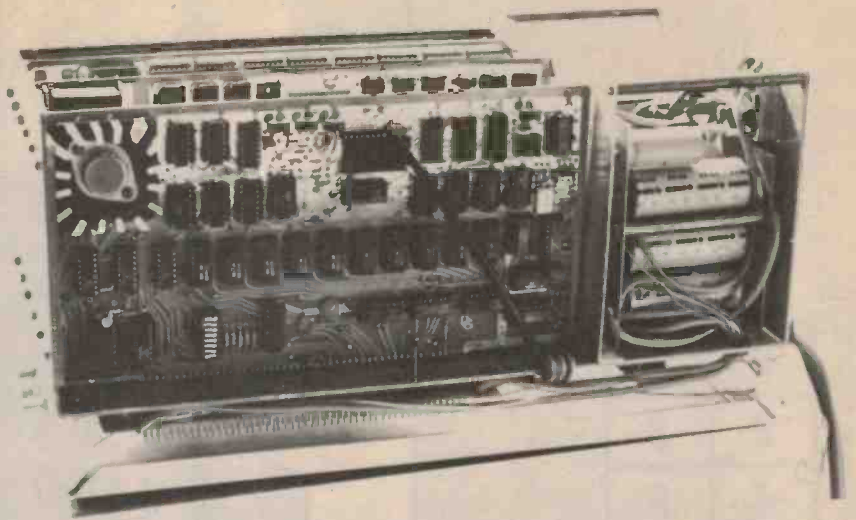


Fig. 2. The ETI 640 VDU is designed to plug into any S100 microcomputer system, as is shown here.

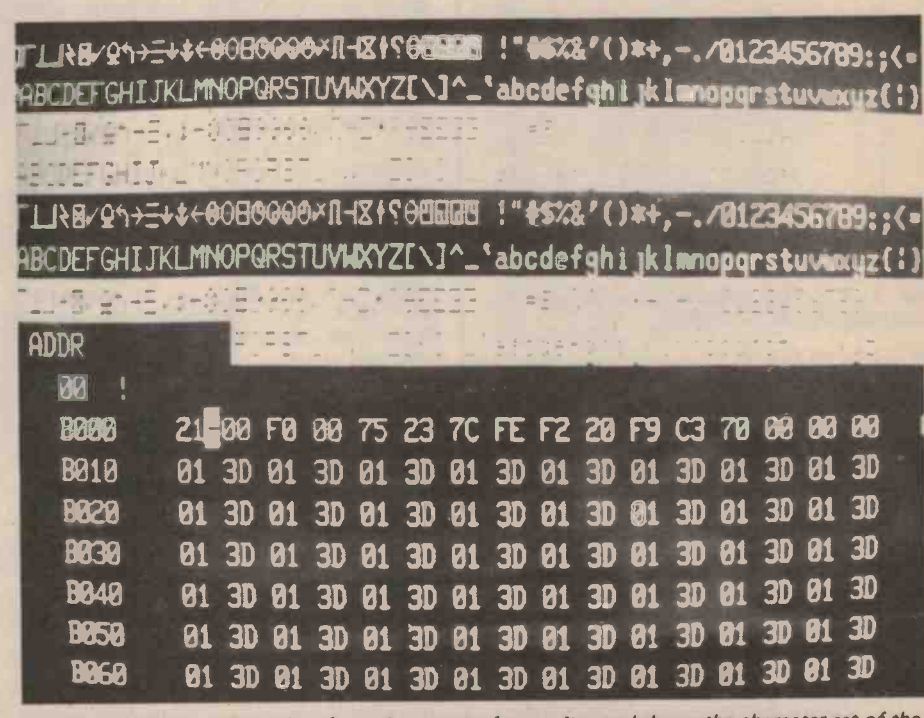


Fig. 3. This photograph is taken from the screen of a monitor and shows the character set of the 640 VDU.

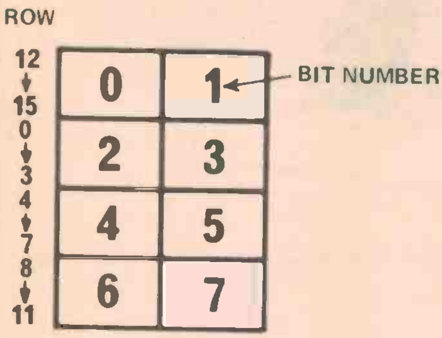
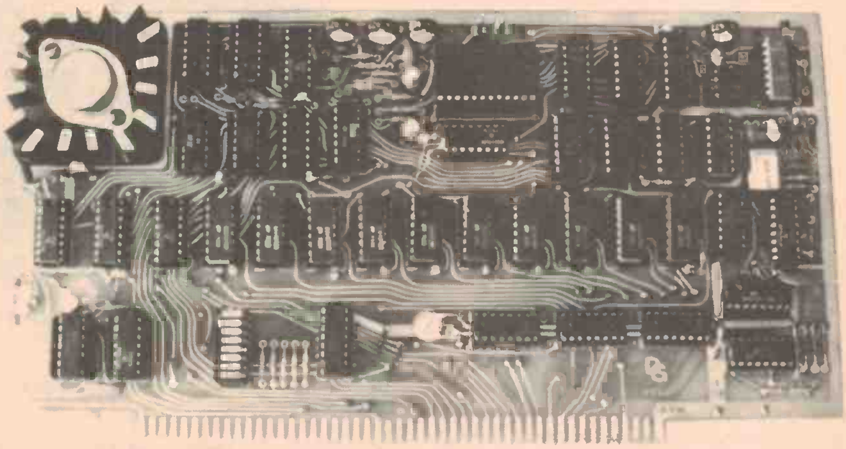


Fig. 4. Each character space is broken up for the creation of graphic characters.



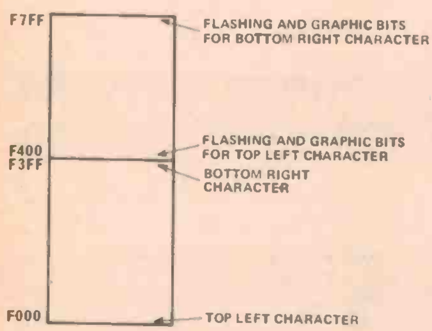


Fig 5. The VDU actually looks to the processor like 2K of memory.

We have published the 'How It Works' section this month so that it can easily be read next to the circuit diagram to be published next month. It's too big to fit otherwise.

Synchronising Pulse Generator

The start of the chain is the 12MHz crystal oscillator (IC9) which is divided down to 15,625 Hz and 50 Hz (by IC's 38, 39, and 40). The 15,625 Hz signal triggers a 5 µS monostable (IC 41A) to provide line synchronising pulses and the 50 Hz signal triggers a 300 µS mono (IC41B) for field synchronising pulses. These synchronising pulses are added to the final video signal before it leaves the board to give composite video out as well as providing a timing reference for the rest of the VDU.

Character Generation

It is not intended to give a complete explanation of how characters are generated on a screen as this has been explained in previous VDU articles and the basic principles used here are the same. The characters are displayed on a matrix 7 dots across by 9 high. The character generator ROM (IC4, MCM6574) outputs the 7 bits across each character in parallel as it is told what character is being constructed (on pins 15, 16, 12, 11, 9, 8, 4,) in ASCII code and which row of the character is selected (on pins 21, 22, 23, 24).

IC 5 and IC 6 are Quad 2 in 1 out multiplexers which simply act as an eight pole two position switch. They connect the output of the character generator ROM (IC4) or the output of the graphics multiplexer (IC14) through to the parallel inputs of the 8 bit shift register (SR) (IC7). Ignoring the graphics mode for a moment, the output of the ROM is connected through to the SR and the eighth bit is tied low (pin 14, IC5) to give black; this is the space between each character. Once the SR is loaded with this information and is clocking it out at the right rate (12 MHz) the RAMs and ROM are already looking up the information for the next character as both the RAMs and the ROM have a noticeable access time to consider.

The data out of the SR is essentially the information that goes to the screen, although there is some gating after it to invert the data for flashing characters and inverse video, as well as blanking circuitry which will be discussed later.

Counters

The above combination of RAM, ROM and SR will happily produce characters all over the screen provided the RAMs are given information about which character is being produced (ie character on the line, and line on the screen) and the ROM is told which row of the character is being produced, so there are three sets of counters which keep track of this information. The first set (ICs 11 and 12) count 0-63 for character on the line (COL). This counter is incremented by the same pulse that loads the SR (from IC13, pin11) at the end of each character. When this set of counters reaches zero (64) it sets the first 'end of line' flip flop (IC2B). IC2B enables the second 'end of line' flip flop to set after the 64th character has been clocked out by the SR. This combination of two flip flops is necessary to provide a one character delay, otherwise the screen would be blanked as soon as the counters reached zero and the 64th character would be lost. Aha! When the second 'end of line' FF has set it inhibits any further clocking

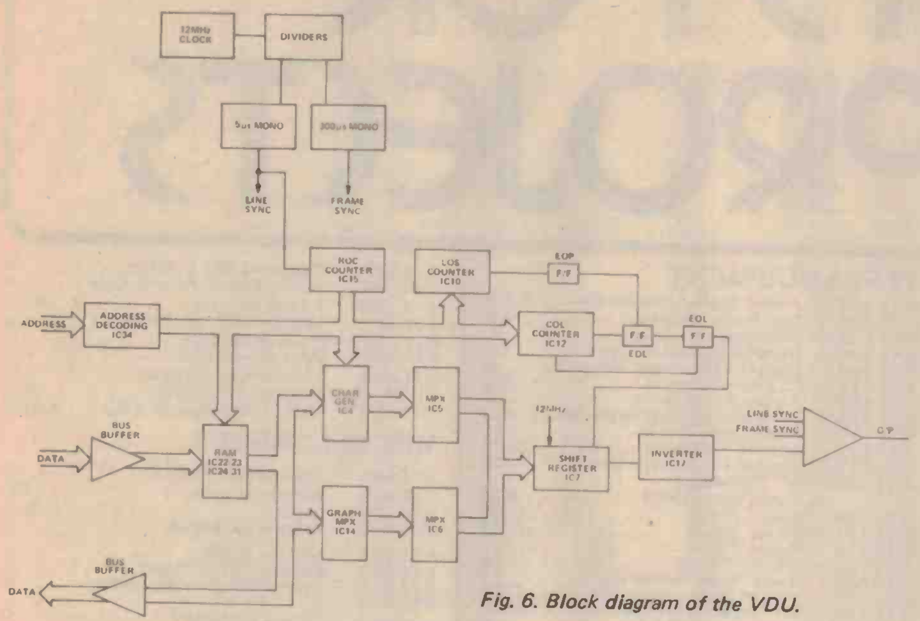


Fig. 6. Block diagram of the VDU.

of the SR and COL counters and forces the screen to black (via the diode to IC16, pin12) until the beginning of the next line. The clearing of the next FFs is discussed under 'Positioning'.

The second counter that counts the row of the character (IC15) is incremented every time the 'end of line' FF sets. One of the confusing parts of the circuit is the fact that this counter actually counts 12, 13, 14, 15, 0, 1, 2, ... 10, 11 for each character. The ROM outputs blanks for rows 12, 13, 14, 15 so this puts the four lines of blanks above the character instead of below. The result of this is that each character is centred in the character position for Black on White characters, rather than being hard up against the top of the white area. The effect of the row counter counting in this sequence is achieved by incrementing the third counter (the 'line on screen', LOS) when the row counter reaches 12. (IC 16 pins9, 10 gates C, D of Row Counter).

The LOS counter counts 0-15 for the 16 lines of characters on the screen and when it overflows to zero it sets the 'end of page' flip flop (IC2A). This will occur at the end of a line, as that is when the row counter is incremented, that then increments the LOS counter, so the 'end of line' flip flops will both be set. The end of the page' flip flop simply stops the 'end of line' FFs being cleared until the top of the next page.

Positioning

The position of the characters on the screen is determined by the time after the synchronising pulses that the EOL and EOP FFs are cleared. These two times (Vertical and Horizontal) are set by two monostables (IC3A and IC3B respectively) which are triggered off the leading edges of the vertical and horizontal synchronising pulses respectively. As each of these monos drop off they cause a negative going pulse via a capacitor to the reset pins of the appropriate FF. The EOP FF holds a reset on the horizontal positioning mono.

The final counter which wasn't mentioned earlier is the counter (IC 14) which counts the number of bits that the SR has clocked out to provide a load pulse for the next character. This counter is clocked at the same rate as the SR (12 MHz) and counts to 9 before resetting to zero, so the SR clocks out the eight bits it has been loaded with plus one more which will be whattever was on the Serial In Pin of the SR (pin 10) when it clocked out the first bit. This is arranged to be a zero (black) when making characters or whatever is appropriate when making graphics.

Graphics

The graphics circuitry only needs to be told which row of the line is being made to select which two bits to feed to the SR (via the graphics/character multiplexers). The same two bits are selected for four rows so only the two highest bits of the row counter are used by the graphics multiplexers (IC15).

Black on White Characters (Inverse Video)

The 'black on white' (BOW) bit (bit 7) is latched by a 'D' Flip Flop (IC19A) at the same time the SR is loaded. This bit is forced to normal when a graphic is being made, (IC16A) as there is obviously no point in inverting a graphic and the eighth bit (bit 7) is used by the graphic anyway. The output of the FF controls an exclusive OR gate which acts as a switchable inverter, if a '1' is held on the 'control' input (pin 10) the data on the other pin will be inverted at the output.

The XOR is in the output of the SR so when it is switched to the invert mode it simply inverts the bit stream.

Flashing

The flashing bit (bit 8 – 1st bit 2nd K) is latched in a 'D' FF (IC 18B) the same as the BOW bit described above. When a '1' is stored in the FF it forces the output to black. The flashing is generated by an oscillator (IC8) clearing the FF down at the flash rate.

On The Bus Side Of The Board

To the processor, the VDU looks just like normal memory with the exception that the upper 1 Kilobyte only has 2 bits. Thus the circuitry involved here is fairly typical of any memory board, the noteable difference is that the lower 10 address bits to the RAMs go via multiplexers so that the VDU counters can scan the RAMs when the processor is not accessing them.

The incoming data (off the bus) is buffered by IC35 and part of IC37 before going to the RAMs. The outgoing data is buffered by IC36 and IC37 which are enabled whenever the board is addressed for a read cycle.

IC34 is a comparator that looks for a match between the DIP switches and the high order address bits on the bus. When it finds a match (pin 9 = '0') it means the board is being addressed and the RAMs are taken away from the VDU temporarily. During this period the screen is forced to black (by the transistor off IC34's output otherwise a series of white flickers would be seen on the screen.

Output Circuit

The output circuit combines the digital (5 V) signal representing the black and white information with the vertical and horizontal synchronising signals to give an analogue video signal which is the output signal from the VDU board. The shift register is being clocked at 12 MHz, so the worst case output signal would be one bit on and one bit off which represents a 6 MHz video signal. The transistor used in the output stage is critical as it needs a very fast rise time. A domestic TV receiver has a sound trap at 5 MHz after the IF strip so the loss of quality by modulating the VDU signal would be considerable. For this reason it is suggested that the TV set be modified to accept video in or a proper video monitor be used. A lot of sets on the market today have video in and out facilities for VTR's already fitted.

KITS FOR ETI PROJECTS

We get many enquiries from readers wanting to know where they can get kits for the projects we publish. The list below indicates the suppliers we know about and the kits they do.

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- J Jaycar Pty. Ltd. 405 Sussex St., Sydney 2000.
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- N Nebula Electronics Pty. Ltd. 15 – 19 Boundary St., Rushcutters Bay 2011. NSW.
- O Appollo Video Games of Hornsby, NSW.
- P Pre-Pac Electronics. 718 Parramatta Rd., Croydon NSW 2132.
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ETI 413	100 Watt Guitar Amp	P,L,J,DT
ETI 413	x 200 Watt Bridge Amp	S E
ETI 414	Master Mixer	E,J
ETI 416	25 Watt Amplifier	E
ETI 417	Amp Overload Indicator	E
ETI 419	Guitar Amp Pre-Amp	P.E.DT
ETI 420	Four-channel Amplifier	L,E
ETI 420E	SQ Decoder	E
ETI 422	International Stereo Amp	S L,D
ETI 422B	Booster Amp	E
ETI 422	50 Watt Power Module	E
ETI 423	Add-on Decoder Amp	E
ETI 424	Spring Reverberation Unit	S L,E
ETI 425	Integrated Audio System	E
ETI 426	Rumble Filter	E
ETI 427	Graphic Equaliser	S L,E,J
ETI 429	Simple Stereo Amplifier	E
ETI 433	Active Crossover	J
ETI 435	Crossover Amp	J
ETI 438	Audio Level Meter	L,ES
ETI 440	Simple 25 Watt Amp	L,E
ETI 441	Audio Noise Generator	L,ES
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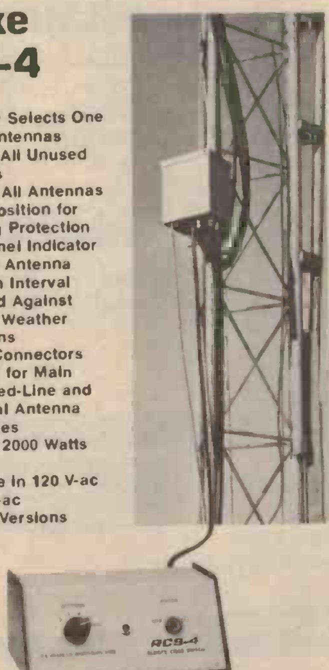

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74LS27	.32
74LS28	.42
74LS30	.32
74LS32	.35
74LS37	.46
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4023	.35
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4025	.40
4027	.80
4028	1.25
4029	1.90
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4040	1.35
4041	1.25
4042	1.25
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4044	1.50
4046	1.95
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4050	.60
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4053	1.20
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4069	.35
4070	.40
4071	.40
4072	.40
4073	.40
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4077	.40
4078	.40
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ETI data sheet

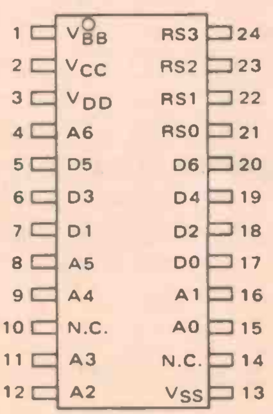
MOTOROLA MCM6574

THE MCM6574 is a member of the MCM6570 family of character generator ROMs. Each of these is an 8 Kbit ROM which contains 128 characters in a 7 x 9 matrix with additional circuitry provided internally to lower the whole matrix, thus allowing the tails of characters such as j, y and g to extend beyond the baseline.

The seven-bit address code which selects any one of the available characters corresponds, for the most part, to ASCII. Each character is defined as a specific combination of logic 1s and 0s, stored in a 7 x 9 matrix. When a specific four-bit binary row select input is applied, a word of seven parallel bits appears at the output. The rows can be sequentially addressed, providing a nine-word sequence of seven parallel bits per word for each character selected by the address inputs. As the row select inputs are sequentially addressed, the device will automatically place the 7 x 9 character in one of two pre-programmed positions on a 16 row matrix, with the positions defined by the four row select inputs. Rows that are not part of the character are automatically blanked.

The MCM6570 series are TTL and CMOS compatible, with a maximum access time of 500 ns. The power supplies required are +5 V, +12 V and -3 V, although the 12 V and -3 V supplies are at minimal currents and can be handled by charge pump supplies.

Fig. 1 Pinout



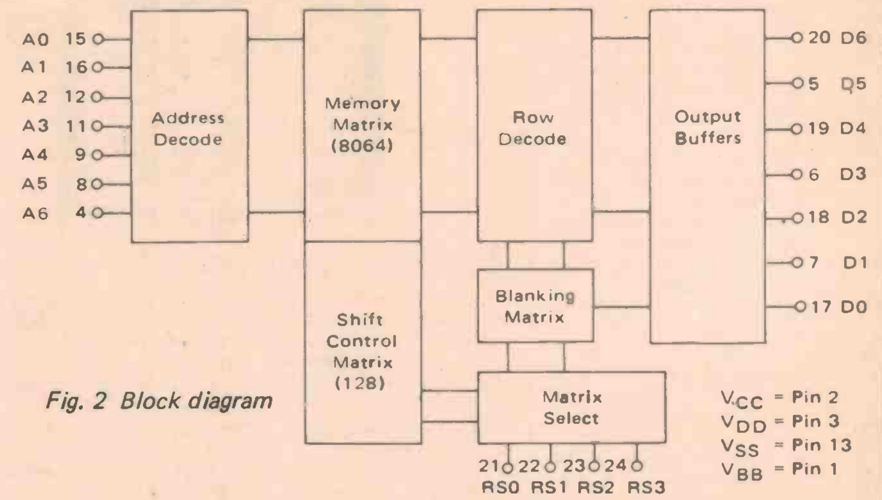


Fig. 2 Block diagram

Fig. 3 Absolute maximum ratings (voltages referred to V_{SS}).

Rating	Symbol	Value	Unit
Supply Voltages	V_{CC} V_{DD} V_{BB}	-0.3 to +6.0 -0.3 to +15 -10 to +0.3	Vdc
Data Input Voltage	V_{in}	-0.3 to +15	Vdc
Operating Temperature Range	T_A	0 to +70	°C
Storage Temperature Range	T_{stg}	-55 to +125	°C

Fig. 4 Recommended dc operating conditions (referred to V_{SS}).

Parameter	Symbol	Min	Nom	Max	Unit
Supply Voltage	V_{DD}	10.8	12	13.2	Vdc
	V_{CC}	4.75	5.0	5.25	Vdc
	V_{SS}	0	0	0	Vdc
	V_{BB}	-3.3	-3.0	-2.7	Vdc
Input Logic "1" Voltage (Driven by TTL)	V_{IH}*	3.0	–	V_{CC}	Vdc
(Driven by Other Than TTL)		4.0	–	V_{CC}	Vdc
Input Logic "0" Voltage	V_{IL}	0	–	0.8	Vdc

*A 4.0 V V_{IH} is required at the chip regardless of the type of driver used. However, internal MOS pullup devices on the chip can pull one TTL driver from 3.0 V to 4.0 V, without affecting access time. These pullup devices may not pull non-TTL drivers above 3.0 V.

Fig. 5 Dc characteristics.

Characteristic	Symbol	Min	Typ	Max	Unit
Input Forward Current (V_{IL} = 0.4 Vdc)	I_{IL}	–	–	-1.6	mAdc
Input Leakage Current (V_{IH} = 5.25 Vdc, V_{CC} = 4,75 Vdc)	I_{IH}	–	–	100	µAdc
Output Low Voltage (Blank) (I_{OL} = 1.6 mAdc)	V_{OL}	0	–	0.4	Vdc
Output High Voltage (Dot) (I_{OH} = -40 µAdc)	V_{OH}	3.0	–	–	Vdc
Power Supply Current	I_{DD}	–	–	10	mAdc
	I_{CC}	–	–	125	mAdc
	I_{BB}	–	–	100	µAdc
Power Dissipation	P_D	–	600	800	mW

Fig. 6 Timing Characteristics.

Characteristic	Symbol	Min	Typ	Max	Unit
Address Access Time (See Figure 1A)	$t_{acc(A)}$	–	350	500	ns
Row Select Access Time (See Figure 1B)	$t_{acc(RS)}$	–	300	500	ns

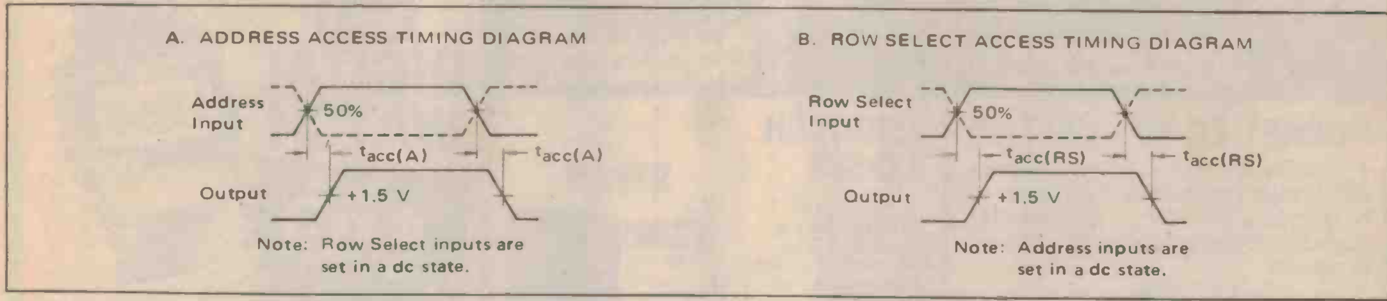


Fig. 7 Timing diagrams.

Fig. 8 Power dissipation versus V_{DD} supply voltage

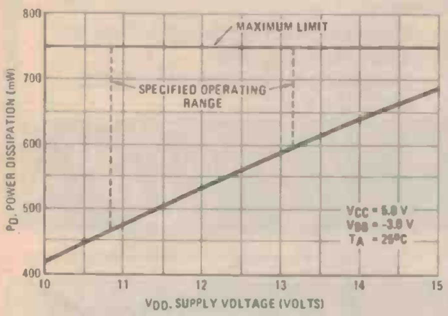


Fig. 9 V_{CC} supply current versus temperature

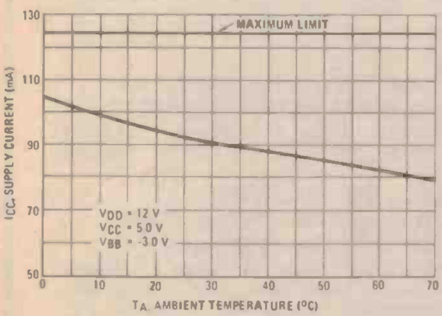


Fig. 10 Access time versus V_{DD} supply voltage.

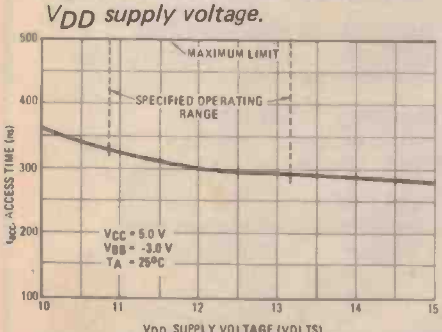


Fig. 11 MCM6571 character pattern.

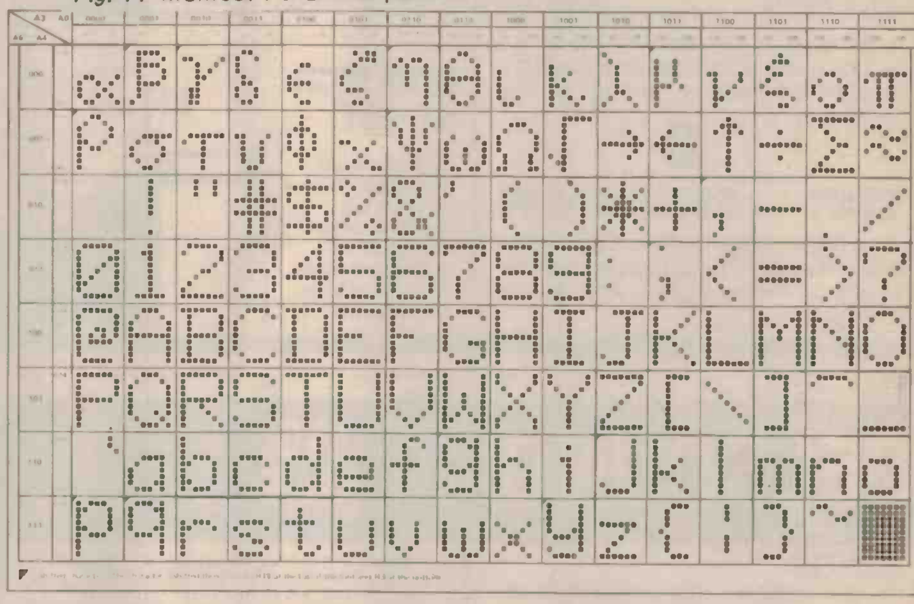
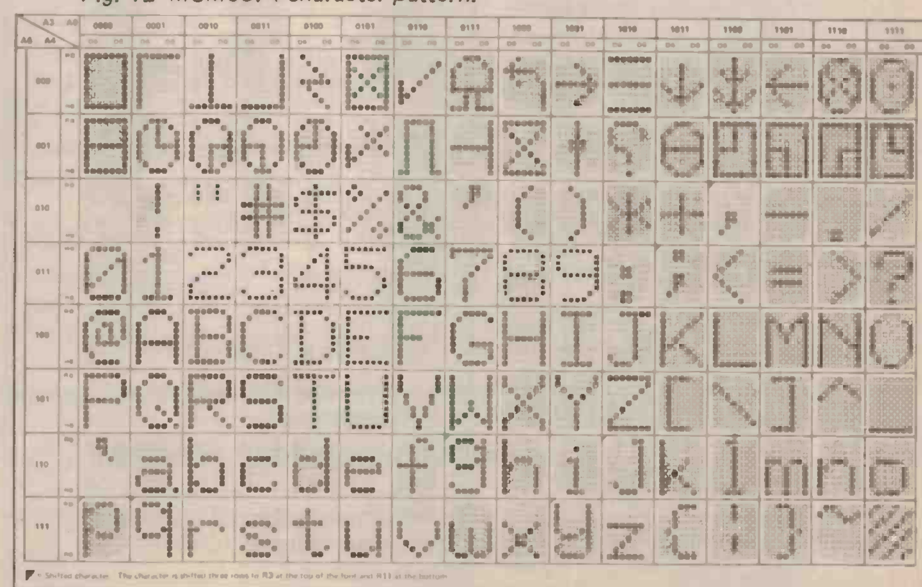


Fig. 12 MCM6574 character pattern.



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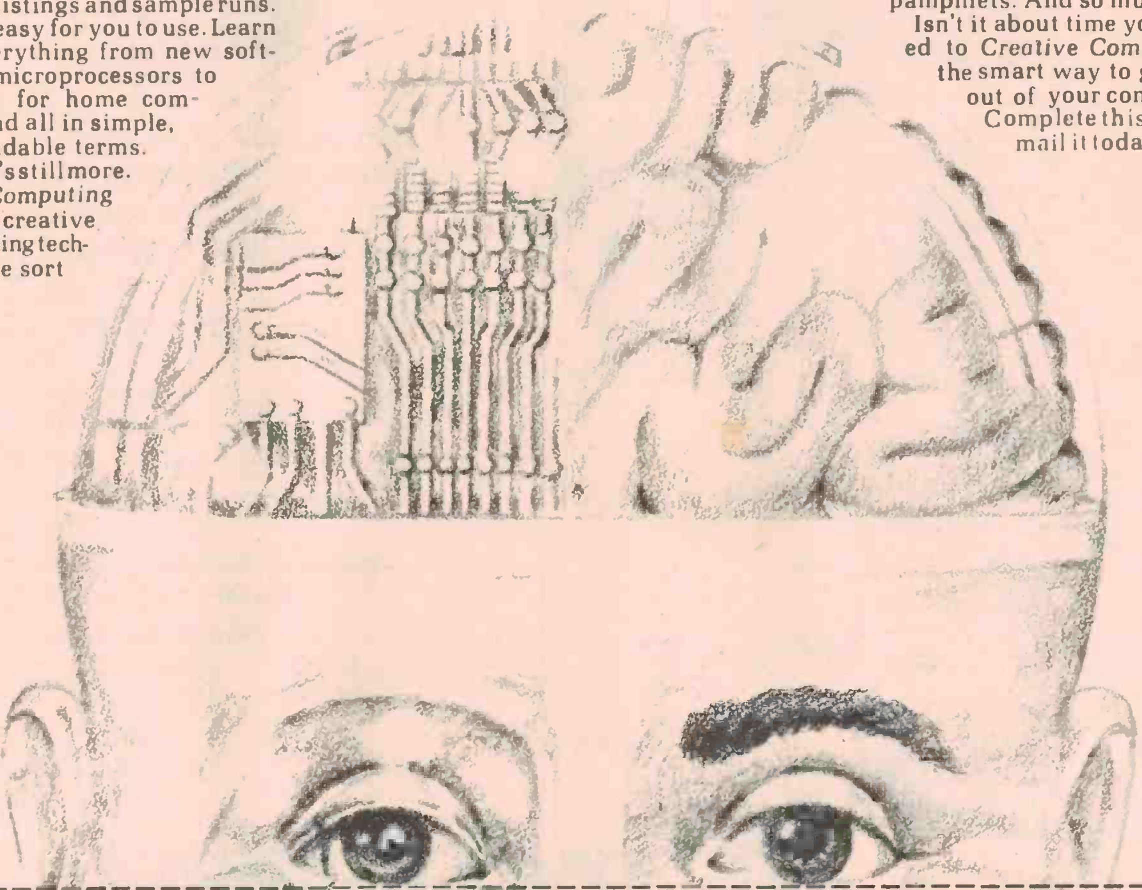

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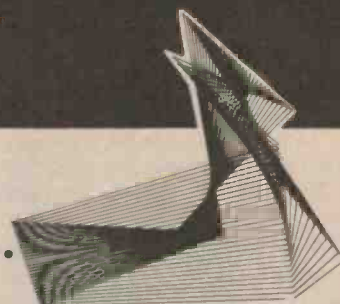

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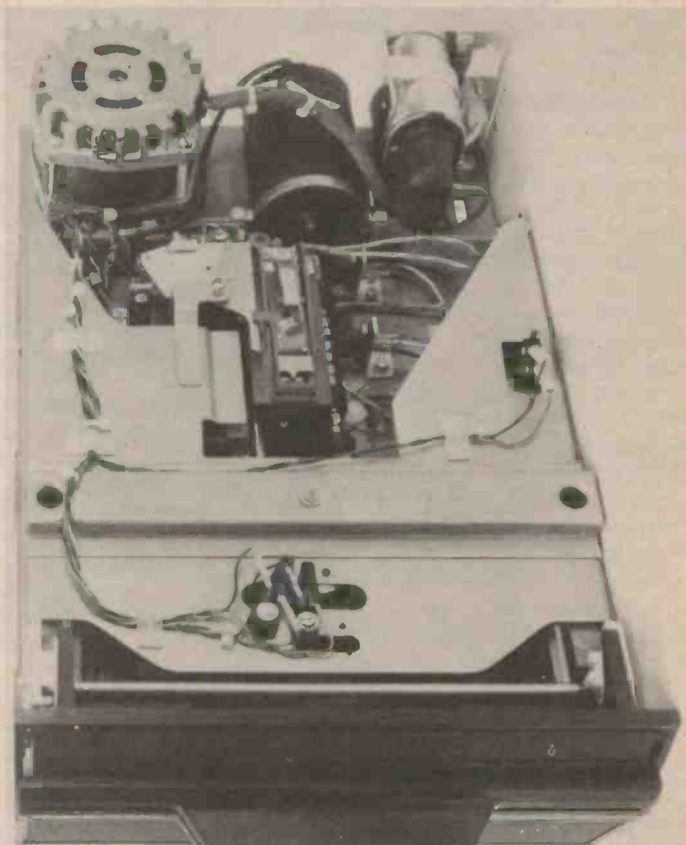

Memorex Drive

Memorex Pty. Limited has announced an expansion of its OEM disc drive family of products with the introduction of the model 552 dual-headed flexible disc drive.

The Memorex 552 incorporates two ceramic read/write heads which allow recording or reading of data on both sides of a dual-sided flexible disc. This capability significantly reduces operator handling of the disc media for better data integrity. At the same time, it offers greatly improved accessibility to stored data in comparison with single-headed drives.

It also features the same interface, dimensional characteristics and many parts as Memorex's model 550 single-headed flexible disc drive. In addition 80% of its parts are interchangeable with the 550's, so conversion from a 550 to a 552 operation is a simple factory procedure.

The 552 Flexible Disc Drive offers a recording capacity of 492 kilobytes in IBM 4964 format or up to 1,600 kilobytes of unformatted data. Access time is 3 milliseconds per track.

The data transfer rate is 250 kilobytes per second in single-density recording mode.

With an appropriate controller, the 552 can be operated in the double-density mode (MFM or M^2FM recording) without modification or additional electronics. Data transfer rate for the double-density recording mode is 500 kilobytes per second.

A Drive Select feature allows the user to select any one drive in a serial or radial configuration comprising up to four units. However, the 552 is capable of being connected in an eight-unit serial configuration if desired.

An exclusive door-controlled latch/eject mechanism on the 552 makes cartridge insertion and removal a "pop-in/pop-out" operation. In addition, a lock stop feature also makes it impossible for the user to close the door on a cartridge that is not fully inserted or removed. This feature provides further protection of the disc media.

The 552 offers exceptional reliability. For instance, data transfer reliability is 10^9 bits read/soft error and 10^{12}bits read/hard error in normal operation. MTTR is one-half hour, with MTBF of 9,000 hours. 552 options include File Busy Indicator, Program-Controlled Door Lock and Write Protection.

Further information from *Memorex Pty. Ltd., 61 Barry St., Neutral Bay, NSW, 2089.*

What Price 8080?

Intel have revealed that orders are being taken now for future delivery of 'large quantities' of the 8080 at a unit price of less than US$5. Industry observers see the price of the 8080 coming down even further to around the US$3 mark!

2708 – End of the Road?

Mid-1978 will see sampling of the first 2 Kbyte electrically alterable ROM by Texas Instruments. The 450 ns access time device is based on a floating-gate avalanche MOS cell structure. NEC already have a 1 Kbyte device and Intel are working on an EAROM based on the 2708, while GI's devices are of the slower nitride type.

Slice off Apple

Apple Computer has announced price reductions on Apple 11 computers of 15 to 23 per cent, due to increased production. Two new interface cards have also been announced, for parallel and serial communications. The A2B0002X intelligent printer interface can handle 255 characters per line at up to 5,000 characters per second though a general purpose 8-bit part. The A2B0002X intelligent communications interface is a 110 or 330 baud RS232C interface.

TI Microprocessors Seminar

TI extend an invitation to engineers to attend a 3 hour seminar covering their microprocessor families.

Main topic in the seminar will be the 16 bit TMS9900 microprocessor and its associated products including micro-computer modules. This is a highly powerful, very flexible MPU and is already being used in a wide variety of applications.

Also to be discussed in the seminar will be the 4 bit TMS1000 device and its derivatives. This is a more dedicated MPU with built-in masked read only memory ideally suited to volume production because of its cost effectiveness. Seminar dates as follows:

Melbourne 9 May 1978 – Institute of Management, St Kilda

Sydney 10 May 1978 – El Rancho Motel, North Ryde

Those wishing to attend are asked to contact Miss Virginia Bradshaw at the Sydney office, phone: 887-1122, thereby having their names registered.

National slashes 8080

National Semiconductor Corporation, a major supplier of 8080A microprocessors, has announced across the board price reductions for its version of the popular 8-bit device. According to Jack Rutherford, Managing Director of NS Electronics, National has been the price leader since introducing its INS8080A about one and a half years ago. In addition, he noted that the company offers more support circuits and peripherals in its 8080 product line than any other manufacturer.

The price of National's plastic package INS8080AN is now listed at $9.98 in 1-24 quantities, reduced from a previous listing of $15.50 each. The 100-up quantities, the device has been marked down by one-third from $10.80 to $7.10 as quoted in National's latest OEM price list.

Rutherford cited National's overall volume delivery of the devices as a major reason for the price cuts. "Our four-inch wafer fabrication is fully-on stream for all components," he said. Automated testing facilities and a high volume of plastic production were other factors mentioned.

CMOS Octal Interfaces

A Complementary MOS version of the industry-standard 20-pin octal interface family of devices has been developed by National Semiconductor.

According to Jack Rutherford, Managing Director of N.S. Electronics, the new devices are the first such integrated circuits in commercial production. Moreover, he says, they incorporate a unique circuit design that allows them – unlike standard CMOS devices – to drive high capacitive loads such as one might find when driving a bus and to have a fan-out of 1 when driving standard TTL loads.

First new parts in the family are the MM54C373/74C373 octal latch and the MM54c374/74C374 "D" type flip-flop.

Both devices, says Rutherford, feature a wide supply voltage, from 3 to 15 volts; high noise immunity, typically about 45 percent of the supply voltage; low TRISTATE[R] output current, about 5 nanoamps; and low power consumption, about 1.0 microwatt at 15 volts. Typical drive (sourcing) current on the devices is about 20 mA per output.

The new CMOS octal interface ICs also feature TRISTATE outputs, which in addition to the octal pinouts, make them ideal for microprocessor-bus-oriented systems.

Key to the versatility of the new devices in the use of unique drive transistor configuration on the output circuitry in which an NPN emitter-follower structure is used in parallel with a p-channel transistor to source the 20 mA drive current and to pull the output voltage up to the V_{cc} supply voltage rail.

Normally, says Rutherford, in standard CMOS devices the output stage is fabricated using MOS transistors 10 to 100 times the size of those in the digital logic portion of the IC. Such structures are sufficient to bring the output to the V_{cc} rail, but not to drive high capacitive bus loads. An added benefit of the increased output drive is the ability to drive LED's and other lamps directly.

The use of NPN structures in the output stage allows the device to source the necessary 20 mA, but used alone, this structure pulls up to only 700 mV to 1 volt of the supply voltage. A small p-channel MOS transistor fabricated in parallel with the NPN structure pulls the device up the rest of the way to V_{cc}.

Available now, the 54C373/74C373 and 54C374/74C374 are $1.80 each in 100-unit quantities.

COMPUTER CLUB DIRECTORY

Sydney: Microcomputer Enthusiasts Group, P.O. Box 3, St. Leonards, 2065. Meets at WIA Hall, 14 Atchison St., St. Leonards on the 1st and 3rd Mondays of the month.

Melbourne: Microcomputer Club of Melbourne, meets at the Model Railways Hall, opposite Glen Iris Railway Station on the third Saturday of the month at 2 p.m.

Canberra: MICSIG, P.O. Box 118, Mawson, ACT 2607 or contact Peter Harris on 72 2237. Meets at Building 9 of CCAE, 2nd Tuesday of month at 7.30 p.m.

Newcastle: contact Peter Moylan, Dept. of Electrical Engineering, University of Newcastle, NSW 2308. (049) 68–5256 (work), (049) 52–3267 (home).

Brisbane: contact Norman Wilson, VK4NP, P.O. Box 81, Albion, Queensland, 4010. Tel. 262 1351.

New England: New England Computer Club, c/- Union, University of New England, Armidale, NSW 2351. (New club; not restricted to students)

Auckland: Auckland Computer Club, P.O. Box 27206, Auckland, N.Z.

Computer clubs are an excellent way of meeting people with the same interests and discovering the kind of problems they've encountered in getting systems 'on the air'. In addition, some clubs run hardware and software courses, and may own some equipment for the use of members. Try one – you'll like it!

If your club is not listed here, please drop us a line, and we'll list you. The same applies if you are interested in starting a club in your area. Also, if established clubs know their programme of forthcoming events, we can publicise them.

DIODES/ZENERS

1N914	100v	10mA	.05
1N4005	600v	1A	.08
1N4007	1000v	1A	.15
1N4148	75v	10mA	.05
1N753A	6.2v	z	.25
1N758A	10v	z	.25
1N759A	12v	z	.25
1N4733	5.1v	z	.25
1N5243	13v	z	.25
1N5244B	14v	z	.25
1N5245B	15v	z	.25

SOCKETS/BRIDGES

8-pin	pcb .25		ww	.45
14-pin	pcb .25		ww	.40
16-pin	pcb .25		ww	.40
18-pin	pcb .25		ww	.75
22-pin	pcb .45		ww	1.25
24-pin	pcb .35		ww	1.10
28-pin	pcb .35		ww	1.45
40-pin	pcb .50		ww	1.25

Molex pins	.01	To-3 Sockets	.45
2 Amp Bridge		100-prv	1.20
25 Amp Bridge		200-prv	1.95

TRANSISTORS, LEDS, etc.

2N2222A	NPN (2N2222 Plastic .10)	.15
2N2907A	PNP	.15
2N3906	PNP (Plastic)	.10
2N3904	NPN (Plastic)	.10
2N3054	NPN	.35
2N3055	NPN 15A 60v	.50
T1P125	PNP Darlington	.35
LED Green, Red, Clear, Yellow		.15
D.L.747	7 seg 5/8" High com-anode	1.95
XAN72	7 seg com-anode (Red)	1.25
MAN71	7 seg com-anode (Red)	1.25
MAN3610	7 seg com-anode (Orange)	1.25
MAN82A	7 seg com-anode (Yellow)	1.25
MAN74A	7 seg com-cathode (Red)	1.50
FND359	7 seg com-cathode (Red)	1.25

C MOS

4000	.15
4001	.15
4002	.20
4004	3.95
4006	.95
4007	.35
4008	.95
4009	.45
4010	.45
4011	.20
4012	.20
4013	.40
4014	.95
4015	.90
4016	.35
4017	1.10
4018	1.10
4019	.50
4020	.85
4021	1.00
4022	.85
4023	.25
4024	.75
4025	.30
4026	1.95
4027	.50
4028	.95
4030	.35
4033	1.50
4034	2.45
4035	1.25
4040	1.35
4041	.69
4042	.95
4043	.95
4044	.95
4046	1.75
4049	.45
4050	.45
4066	.95
4069	.40
4071	.35
4081	.70
4082	.45
MC14409	14.50
MC14419	4.85

– T T L –

7400	.15	7473	.25	74176	1.25	74H72	.45	74S133	.40		
7401	.15	7474	.30	74180	.75	74H101	.75	74S140	.55		
7402	.20	7475	.35	74181	2.25	74H103	.75	74S151	.30		
7403	.20	7476	.40	74182	.95	74H106	.95	74S153	.35		
7404	.15	7480	.55	74190	1.75			74S157	.75		
7405	.25	7481	.75	74191	1.05	74L00	.25	74S158	.30		
7406	.35	7483	.95	74192	.75	74L02	.25	74S194	1.05		
7407	.55	7485	.75	74193	.85	74L03	.30	74S257 (8123)	1.05		
7408	.25	7486	.25	74194	1.25	74L04	.30				
7409	.15	7489	1.35	74195	.95	74L10	.30	74LS00	.25		
7410	.10	7490	.55	74196	1.25	74L20	.35	74LS01	.35		
7411	.25	7491	.95	74197	1.25	74L30	.45	74LS02	.35		
7412	.30	7492	.95	74198	2.35	74L47	1.95	74LS04	.30		
7413	.35	7493	.35	74221	1.00	74L51	.45	74LS05	.45		
7414	1.10	7494	.75	74367	.85	74L55	.65	74LS08	.25		
7416	.25	7495	.60			74L72	.45	74LS09	.35		
7417	.40	7496	.80	75108A	.35	74L73	.40	74LS10	.35		
7420	.15	74100	1.15	75110	.35	74L74	.45	74LS11	.35		
7426	.30	74107	.35	75491	.50	74L75	.55	74LS20	.25		
7427	.45	74121	.35	75492	.50	74L93	.55	74LS21	.25		
7430	.15	74122	.55			74L123	.85	74LS22	.25		
7432	.30	74123	.55	74H00	.15			74LS32	.40		
7437	.30	74125	.45	74H01	.25	74S00	.35	74LS37	.35		
7438	.35	74126	.35	74H04	.20	74S02	.35	74LS40	.45		
7440	.25	74132	1.35	74H05	.20	74S03	.30	74LS42	1.10		
7441	1.15	74141	.90	74H08	.35	74S04	.30	74LS51	.50		
7442	.45	74150	.85	74H10	.35	74S05	.35	74LS74	.65		
7443	.65	74151	.65	74H11	.35	74S08	.35	74LS86	.65		
7444	.45	74153	.75	74H15	.45	74S10	.35	74LS90	.95		
7445	.65	74154	.95	74H20	.30	74S11	.35	74LS93	.95		
7446	.95	74156	.95	74H21	.25	74S20	.35	74LS107	.85		
7447	.95	74157	.65	74H22	.40	74S40	.20	74LS123	1.00		
7448	.65	74161	.85	74H30	.20	74S50	.20	74LS151	.95		
7450	.25	74163	.85	74H40	.25	74S51	.25	74LS153	1.20		
7451	.25	74164	.60	74H50	.25	74S64	.20	74LS157	.85		
7453	.20	74165	1.50	74H51	.25	74S74	.35	74LS164	1.90		
7454	.25	74166	1.35	74H52	.15	74S112	.60	74LS367	.75		
7460	.40	74175	.80	74H53J	.25	74S114	.65	74LS368	.75		
7470	.45			74H55	.20			74C04	.25		
7472	.40							74C151	2.25		

9000 SERIES

9301	.85	95H03	1.10
9309	.35	9601	.45
9322	.75	9602	.45

MICRO'S, RAMS, CPU'S, ETC.

74S188	3.00
1702A	4.50
MM5314	3.00
MM5316	3.50
2102-1	1.45
2102L-1	1.75
TR1602B	4.50
TMS 4044-45NL	14.50
8080AD	12.00
8T13	1.50
8T23	1.50
8T24	2.00
8T97	1.00
2107B-4, A	4.00
2708	11.50

LINEARS, REGULATORS, etc.

MCT2	.95	LM320T5	1.65	LM340K15	1.25	LM723	.50
8038	3.95	LM320T12	1.65	LM340K18	1.25	LM725N	2.50
LM201	.75	LM320T15	1.65	LM340K24	.95	LM739	1.50
LM301	.45	LM324N	.95	78L05	.75	LM741 (8-14)	.25
LM308 (Mini)	.95	LM339	.95	78L12	.75	LM747	1.10
LM309H	.65	7805 (340T5)	.95	78L15	.75	LM1307	1.25
LM309K (340K-5)	.85	LM340T12	1.00	78M05	.75	LM1458	.95
LM310	1.15	LM340T15	1.00	LM373	2.95	LM3900	.50
LM311D (Mini)	.75	LM340T18	1.00	LM380 (8-14 PIN)	.95	LM75451	.65
LM318 (Mini)	.95	LM340T24	.95	LM709 (8, 14 PIN)	.25	NE555	.50
LM320K5 (7905)	1.65	LM340K12	1.65	LM711	.45	NE556	.95
LM320K12	1.65					NE565	.95
						NE566	1.75
						NE567	1.35

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Microcomputers underwater

Inspection of underwater pipes and oil drilling platforms, and searching for and retrieving objects from the ocean floor present many problems when they are thought of in terms of divers and manned vehicles. The main problem, of course, is man. Even equipped with elaborate life-support systems, the workday is limited, the costs are high, and the dangers great.

Hydro Products of San Diego, California, has an answer which is probably the next best thing to a porpoise with an engineering degree. It is a highly "intelligent", microcomputer-controlled undersea robot vehicle that has the eyes, ears and arms that give great flexibility in many applications. Called the RCV-150, it is probably the most sophisticated and flexible commercially-produced submersible in use today.

The key to the design is a pair of identical PACE microcomputers from the Microcomputer Systems Group of National Semiconductor Corporation, represented in Australia by N.S. Electronics. One is in the undersea vehicle, the other on the surface mother ship. Virtually all communications, display and control functions are managed by the microcomputers.

The undersea portion of the RCV-150 consists of a cable-tethered vehicle, which measures about 4 feet by 3.5 feet by 4 feet and is propelled by four 10-inch-diameter thrusters. The vehicle's small size makes it easy to launch and retrieve while a large array of equipment gives the capability of much larger submersibles. Four 250-watt lamps provide illumination for the television camera.

Only 50 percent of the available space is currently being used, allowing the addition of options such as marine magnetometers, acoustic trackers, sonar depth-finders, 35mm still cameras, search sonars, or even a second manipulator arm should it be desired.

"The microcomputer approach we took further enhances the vehicle's flexibility," explains Jim Tierney, Hydro Products Senior Electronics Engineer. "Our software and firmware approach allows us to add any number of features later on to meet the specific requirements of any customer application. Control firmware can be supplied on programmed read-only memory (PROM) for convenient field installation."

Internal depth and yaw programs referenced to depth and turnrate signals are under PACE microcomputer control. This relieves the operator of many manoeuvreing tasks, allowing him to concentrate on observation, inspection and manipulation duties.

"Using the microcomputers had made system response faster. It turns smoothly and quickly and can stop on a penny," says Tierney. "Since it automatically controls its own depth and heading, it can remain stationary in these axis without operator intervention."

The development of this advanced vehicle took some nine months to complete and about 1.5 man-years went into the software development.

Pace System

Three National Semiconductor PACE Board-Level Computer cards comprise the vehicle's microcomputer while the same three plus a second PROM board make up the surface control station microcomputer. The compact 4.5-inch boards include the 16-bit IPC-16C/100 PACE CPU, the 2K by 16-bit IPC-16C/002B PACE PROM and the 1K by 16-bit IPC-16C/001 PACE random-access memory (RAM).

The PROM memory firmware houses the operating programs for the vehicle and the control unit. The second PROM board in the control station contains the maintenance and self-test program and CRT display formats. The RAM boards temporarily store intermediate results during processing.

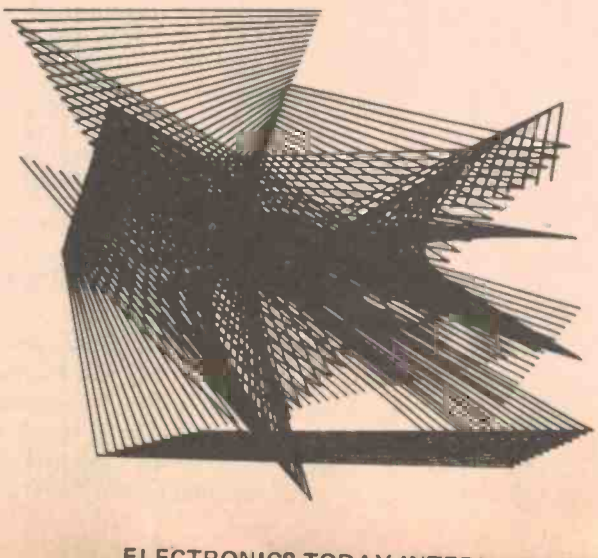
An array of standard sensors includes various depth, heading rate, roll, pitch and temperature sensors and sea-water intrusion sensors. The temperature of the electronics package and hydraulic system is constantly monitored as a safety feature. Tools can be placed on the undersea vehicle as the three-foot long manipulator which has four degrees of freedom, a cable cutter, a soft-line cutter, cleaning brush, pinger dropper, and a grabber arm.

The surface-ship control station has two monitors – one shows the video pictures from the undersea television camera, while the other displays operations data. Selected data can be superimposed on the video channel annotating video tapes with position information, valuable in later review.

Illuminated bar grapth displays on the control station indicate power levels and temperatures. Illuminated switches indicate control position and serve as warning annunciators. Problems in the vehicle are immediately reported to the operator by the RCV's microcomputer which continuously monitors vehicle performance.

The micro in the control station scans the control panel at a 20-times-per-second rate. When a control manoeuvre is given by the operator, the signal is encoded and passed through a RF-telemetry data link via coaxial cable to the vehicle micro-processor. This microprocessor then interprets the command, activates the electrohydraulic servos, continuously solving the equations of motion at a rate of 30 times per second.

Data sensed by the vehicle sensors and detectors is transferred through the microprocessors for surface display.



One of the problems that had to be overcome in designing the new vehicle software system concerned the tight time constraints for program execution. It was first thought that a surface minicomputer would make the necessary equations-of-motion calculations and transmit the data to operate the RCV servos.

"The data transmission system couldn't handle high-speed data rate from the mini to the vehicle," comments Tierney. "Using the microcomputer in the vehicle to perform its own calculations, we have less complex data transmission and a more reliable system."

System Cost Reduced

"Cost was another consideration in selecting the National microcomputers," Tierney says. "At the time we were designing the RCV-150, National Semiconductor was one of a few companies that was offering assembled, tested and guaranteed boards. Others offered only individual chips. The hardware development costs were less compared with building the system from the chips up. These application boards were small enough to fit in the vehicle's confined space.

"Another factor in our selection of National Semiconductor's PACE system was the fact that the 16-bit microcomputer offered advantages such as increased efficiency compared with some eight-bit systems. The 16-bit machine requires less memory access and it can handle 16-bit parallel data.

"National's PACE/IMP-16P microcomputer development system featured a reasonably-priced disk-operating system and could accommodate a high speed printer and other peripherals.

"The disk-operating system contained an assembler. We could create files, shuffle and change them as we wanted to. The development system was made to look just like the CPU so when the software was tested, we could use the system to burn the program into the PROM and place it in the RCV.

"The development system not only served its purpose on the RCV-150 software development, but it will continue to be used for future program changes and as a stand-alone computer performing tasks such as maintaining parts lists, running management programs, and making engineering computations.

"We received excellent support from National during the development stages. Once, for example, when we blew up the development system, we only had to make one phone call and two replacement boards were mailed immediately. They knew from our description of what happened where the fault was located," Tierney concluded.

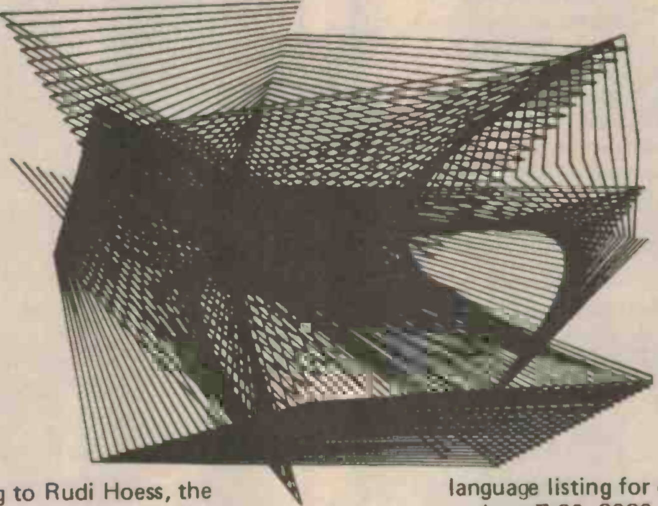
Due to shortage of space, we have unfortunately had to postpone our review of the Tandy TRS-80 microcomputer.

While visiting Computerland, 55 Clarence St, Sydney, recently, we grabbed a few pics which are reproduced below.

This is typical of the kind of system many small businesses are buying now, this one based on the Vector 1 microcomputer by Vector Graphics, with twin flopples and a terminal (or two).

Computerland also stock a range of publications, as hobby computerists have a thirst for knowledge that has rarely been equalled by any other group of hobbyists.

eti/computerland software contest



A few weeks ago, we were talking to Rudi Hoess, the principal of Computerland Australia, about the various things people were doing with their computers. We came to the conclusion that most people were writing bits of debugging software, disassemblers, monitors and the like, but not many people were really using them to create what we'll call application-oriented software (as far as we could gather). Most of the application software seems to be games software, to boot.

Well, we reckoned by now most of you have written games and disassemblers till you pretty well know the game backwards, and now you're looking for something to really get your teeth into. So, we decided to offer a little encouragement and the chance to prove you can do it.

Computerland and ETI are searching for applications oriented software, and we want you to write some, or submit some you've already written. The application you choose to implement is entirely up to you; however, here are a few suggestions which illustrate the kind of thing we're looking for:

* *Burglar alarm with police notification.*
* *Address/telephone file.*
* *Calendar/clock/reminder list.*
* *Chequebook balancing program.*
* *Applications to help the handicapped.*
* *Point of sale terminal.*
* *Recipe file.*
* *Mailing list processor.*
* *Small business accounting package.*
* *Inventory control.*
* *Circuit analysis.*
* *Amateur radio station control.*
* *Music synthesis.*
* *Computer communications set.*

The idea is to get your computer doing something that is in some way useful. The only stipulation we'd like to make is that software must be written either in BASIC or in the form of a well-annotated assembly language listing for one of the popular microprocessors such as Z-80, 8080, 6800, 6502 and 2650. This means that we stand some chance of running your software to check it out. For the same reason, specialised hardware should be kept to an absolute minimum.

The criteria the judges will use to decide upon the winning entries will be: the value of the software to the user; its complexity, i.e. the size of the program; the 'elegance' of the software; the degree of 'human engineering' in the design of software features; and the quality, amount and presentation of the documentation supplied. It is likely that other factors will also influence the judges to some extent, as different criteria will apply in varying degree to different programs. The judges will be Dr R Graham, of NSW Institute of Technology, Rudi Hoess, of Computerland, and Collyn Rivers and Les Bell of ETI.

The prizes? Overall first prize is a Cromemco ZPU Z-80 CPU card while the second prize winner will receive a Vector Graphics 8K RAM kit. Third prize is a Vector Graphics 260 x 260 graphic display generator and fourth prize is a PROM/RAM card from Vector Graphics. In addition, each of the prizewinners will receive a two year airmail subscription to the US computer magazine of their choice and a two year subscription to ETI.

There will also be three special prize categories — the awards for 'Best Documentation' and 'Most Original Application' will each be a two year subscription package, while the 'Most Marketable Software' winner will, subject to agreement, be marketed on a royalty basis. In addition, the winning entries will be published in ETI, and payment for this will be made at our usual (excellent!) rates.

The closing date for this contest will be Friday, 3 November 1978, which should give plenty of time for development of some good software. The winners will be announced in the January or February 1979 issue, but if there are a lot of entries to be checked this may be delayed.

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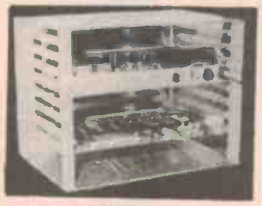

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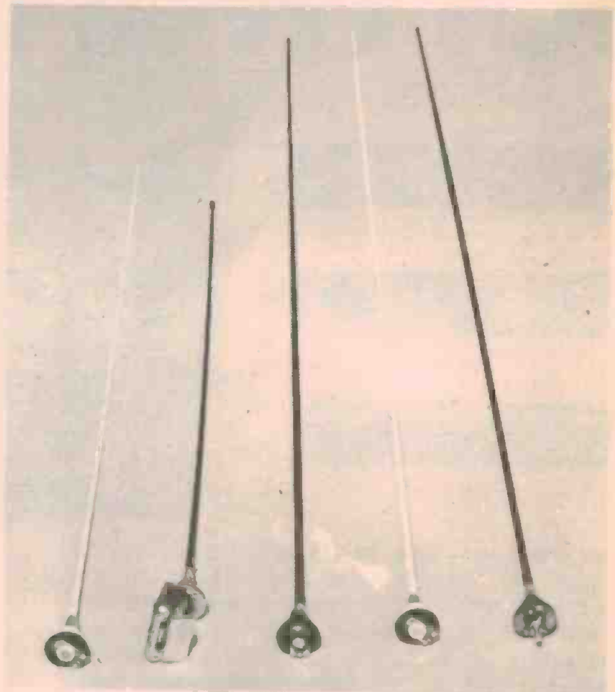

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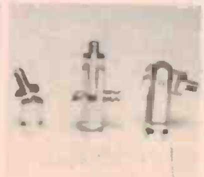

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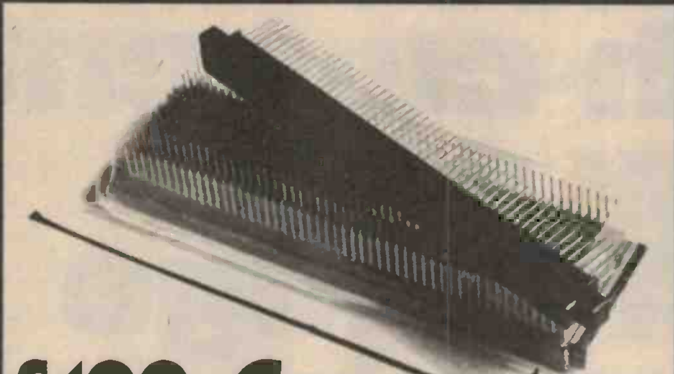

S100 Connectors

Regular readers who have any interest in microcomputers will probably be aware of the S100 bus structure used in many microcomputers. Although its opponents claim that its design philosophy is outdated, it carries a lot of redundant signals and uses large expensive edge connectors, nobody has been able to come up with another bus to usurp it in the US.

At ETI, the question of bus structures has been a particularly vexed one, but there are just too many goodies available to S100 users for us to ignore. Add to this the fact that it's not too difficult to splice S100 cards onto other systems, and you can see the advantages of the S100 approach we took to the 640 VDU which appears this month.

One of the bugbears of the system, however, is obtaining the 100-pin connectors at a reasonable price, and so, in conjunction with General Electronic Services, we have arranged a special offer on these connectors. We are offering these in packs of 5 for $29.50 ($26.30 if you claim sales tax exemption) or 10 for $54.00 ($47.60 with tax exemption).

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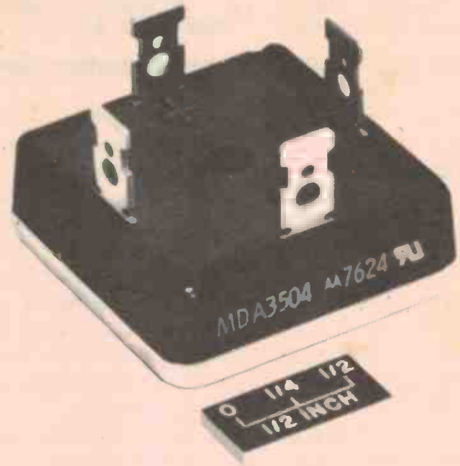

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DIGITAL ELECTRONICS BY EXPERIMENT pt2

THE IC WE HAVE CHOSEN to introduce TTL is the SN7414 Schmitt inverter, placed at the top left hand side of the blob-board. (As all the TTL series start with the letters SN, we shall omit these in future, and refer, for example, to the 7414.)

The circuit of an inverter is that of a high-gain inverting d.c. amplifier (Fig. 1), with the input at the emitter of a transistor and the output from a single-ended push-pull stage which is capable of passing of up to 16mA in either direction (to + 5 V or to earth). This type of design, typical of TTL circuits, has several important implications for us.

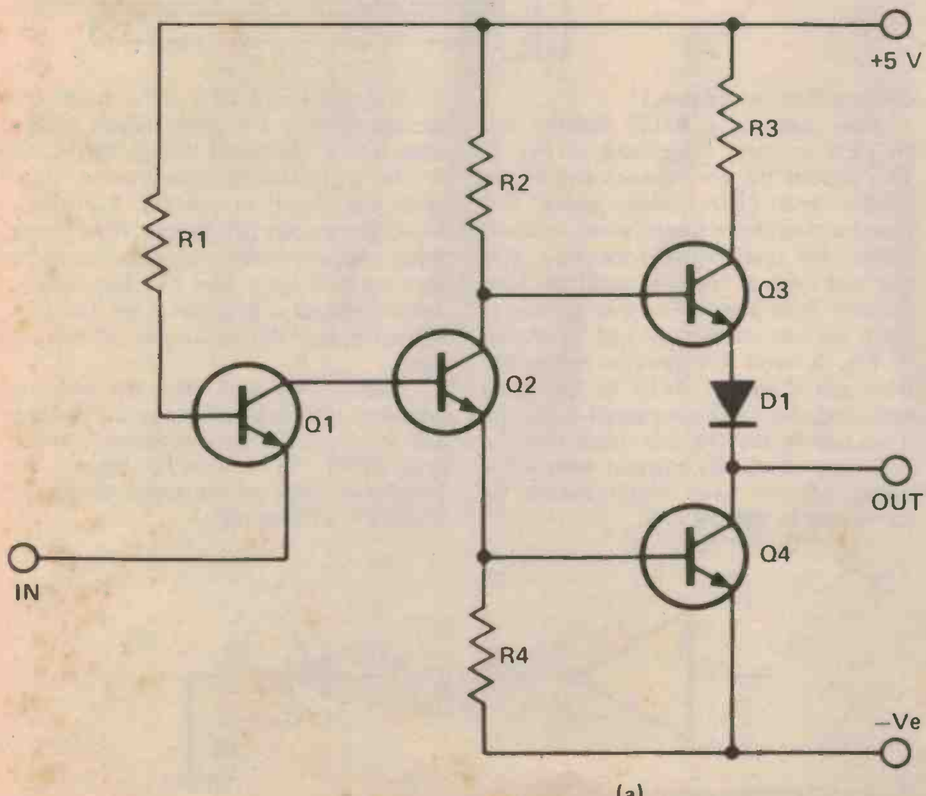
Source or sink

One important result is that the input impedance is fairly low when the input stage is conducting. If the input is left floating, the connection of the base of the first transistor to + 5 V will ensure that the emitter terminal will also be at high (+ 5V) voltage: The first transistor will be cut off in this state. The normal action of an inverter is that a high (or "1") input produces a low ("0") output, so that Q_2 is switched on by the high voltage at the collector of TR_1 and connects the output terminal to earth through Q_4. As mentioned above, this will allow a current of up to 16mA to pass from a positive source; in TTL language, the output stage will sink a current of up to 16mA.

Fanout

When we connect the input of the inverter to earth (0), what we are doing is to earth the emitter of Q_1, with the base still connected, through its current limiting resistor, to +5 V. When this is done, a current of about 1.6 mA (set by the value of the limiting resistor) will flow from base to emitter, and it is very important that any resistance between the emitter (input) and earth should be small enough to prevent the emitter voltage rising above about 0.5 V in normal use. This is ensured when we drive a TTL input from the output of another TTL device, since a TTL output can sink a current of up to 16 mA, the current from ten inputs, without the emitter voltages rising too high for reliable operation. This is referred to as a "fan-out" of ten at the output.

Since in these circuits we are interested only in high and low signal levels,



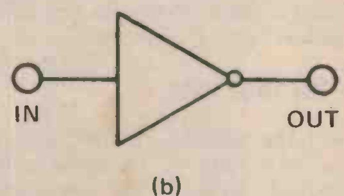


Fig. 1. A typical TTL inverter circuit (a). The value of R1 is about 3k, to limit the base current to 1.6mA. (b) Symbol.

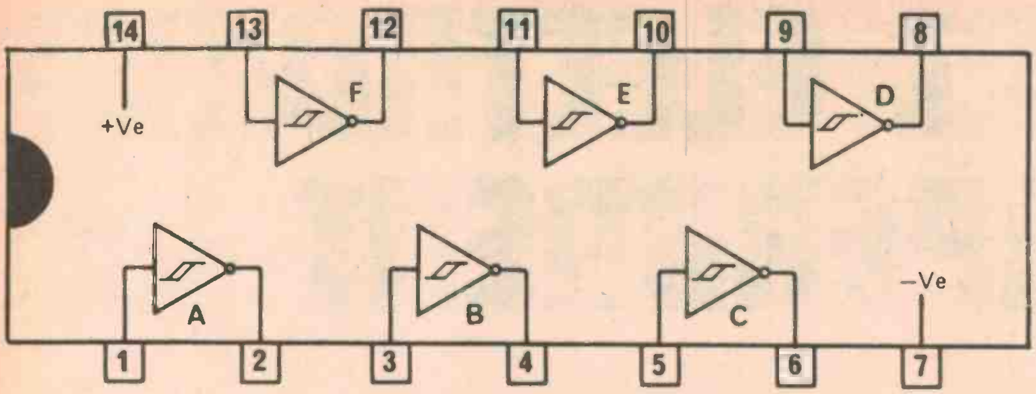


Fig. 2 Pin-out of the SN7414N Hex Schmitt inverter.

we must make sure that there is no uncertainty about either of these levels, and the usual TTL limits are; maximum of 0.8 V for the low; minimum of 2.2 V for the high. We prefer if possible not to approach these limits too closely, and if we drive a TTL input from any other type of output, we must be sure that the source impedance of the driver output will be low enough to allow a current of 1.6 mA to be sunk at a voltage level of 0.5 V or less; this corresponds to an output impedance of 300Ω or less.

Starting work

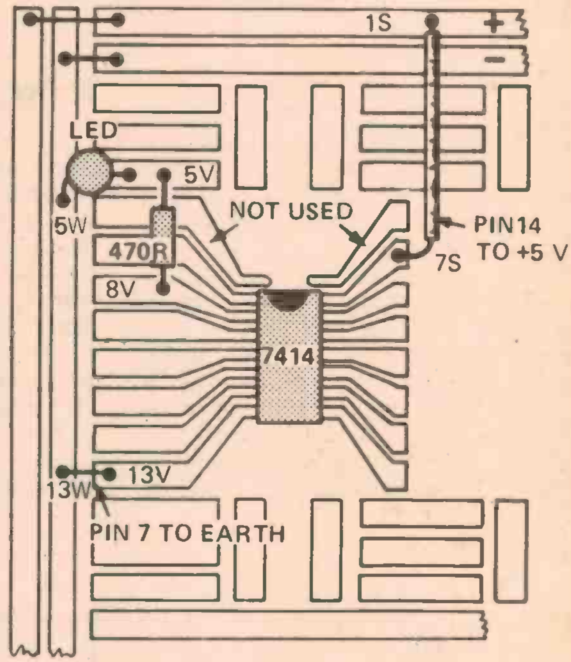
Ensure that the supply lines on your blob-board are fully linked up and, if you are using it, connected to the regulated supply. Join + and – leads to the power supply. If you have a separate supply, these regulated leads, which should be colour coded, will connect directly to the supply lines on the board. If you are using a built on regulator the leads should run to the regulator input.

With no other connections made (none of the ICs wired to the supplies) ensure that the supply voltage is between 4.75V and 5.25V with the supply on. Switch off again. This check should be repeated whenever the board is used from a variable voltage supply, since TTL circuits will be damaged if any input is taken to O with the applied voltage too high.

Four for four uses

Connect the supplies to the 7414, pin 14 to +5V, pin 7 to earth. These connections, like all the connections which follow, are made by soldering short lengths of insulated wire between pads on the blob-board, as shown in Fig. 3. The IC supply connections can be left permanently. (With no other connections made, the IC will draw a current of about 85 mA.)

Fig. 3. Connections to + and – lines using wires. This also shows the LED and its limiting resistor (Fig. 4) in place.



Now connect a 470R resistor and an LED to form the circuit of Fig. 4. This is done by tinning each end of the resistor and LED leadout wires, and then butting these tinned wires, in turn, against the blob-pad and touching wire and pad with a hot iron until the lead "blobs" into place. For this particular joint, we can use a spare pad, as shown in Fig. 3, with the resistor connected from pin 2 of the 7414 to the spare pad, and the LED connected from the spare pad to the OV line. Note that the LED case is usually marked with a flat section at the wire which should be connected to the OV line.

The LED will now light when the output of No. 1 inverter (there are six inverters in the pack) is high. Switch on – the LED should remain unlit, since with the input, at pin No. 1, floating high, the output will be low. Now check what happens when pin 1 is temporarily earthed through a wire link (no need to solder) placed with one end on the pin 1 blob-pad and the other end on the OV line.

Remove the wire, and try bridging between the blob-pad for pin 1 and the OV line with low value resistors, starting with 220R and working up. What is the maximum value of resistance which will allow the LED to light?

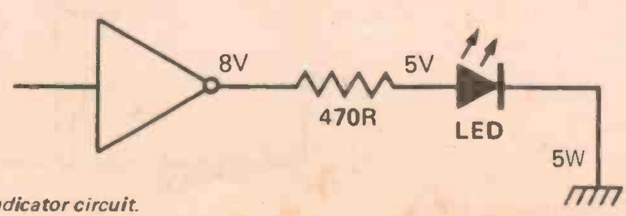
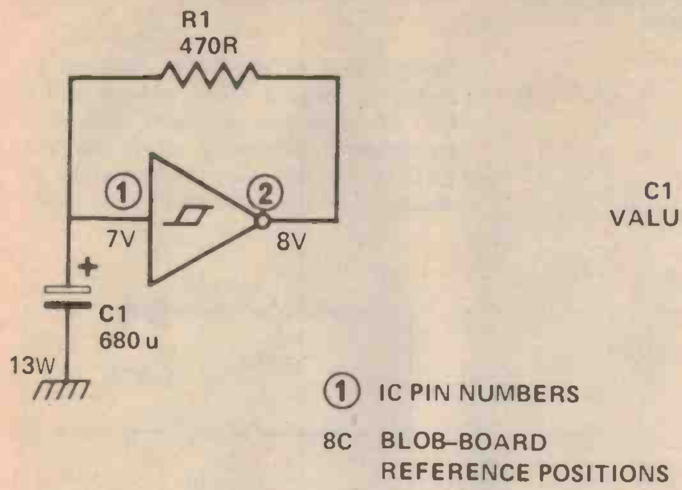


Fig. 4. LED indicator circuit.



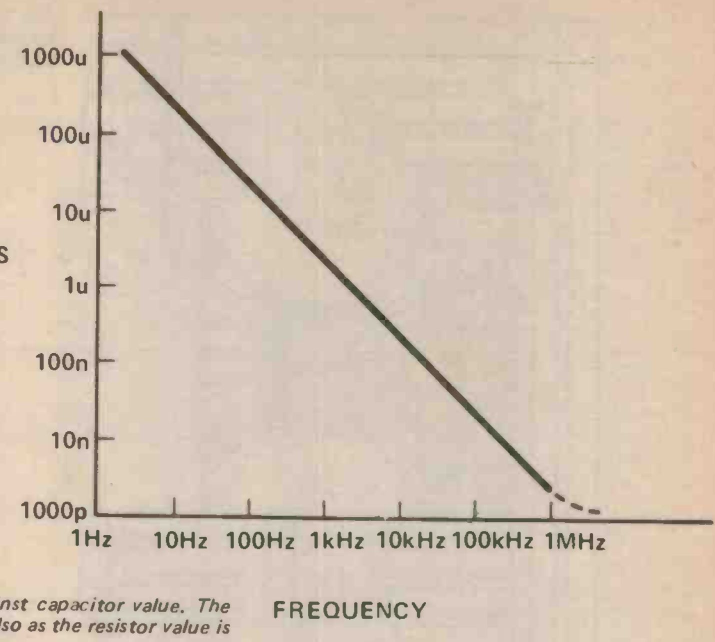
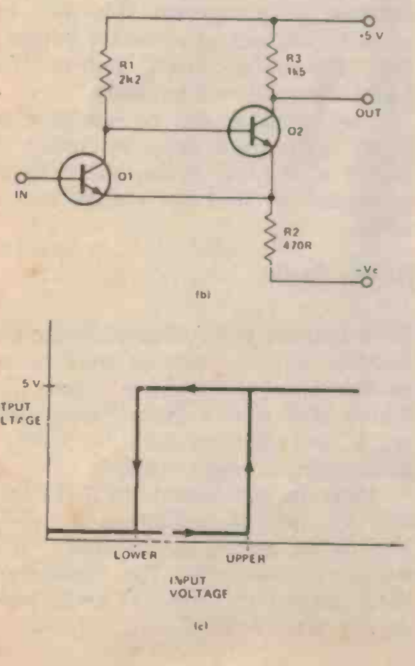


Fig. 6. Oscillator circuit, with a graph of approximate frequency against capacitor value. The frequency changes considerably when the operating voltage is changed, also as the resistor value is varied.

Schmitten with complexity

The actual circuit of the 7414 is more elaborate than the outline which has been shown in Fig. 1. These inverters are Schmitt trigger inverters, indicated by the symbol of Fig. 5(a), in which some positive feedback is used to make the changeover between 1 and 0 very much more rapid than that of an amplifier alone.

Fig. 5. Schmitt Trigger. (a) Symbol. (b) Typical circuit. (c) Graph of output voltage plotted against input voltage.



Let's examine what happens as the input rises from 0 V. When the input voltage reaches approximately 2.2 V, the current into the base of Q2 will drop to less than that needed to hold Q2 in saturation. The voltage on Q2 collector will therefore rise, reducing the current in R3 and hence R2. Herr Ohm has told us that the voltage across R2 must drop as a consequence, thus forward biasing Q1 even further, and reducing the current into the base of Q2, and so on, until Q2 is finally off. Positive feedback at work!

The voltage across R2 is maintained (at 0.6 V less than Vin) by the emitter current of Q1, which is, of course, the collector current flowing through R1 plus Q1 base current. When Vin drops below 1.48 V, the base current is too low to hold Q1 in saturation. At this point the voltage across R2 is 0.88 V. Current will now flow into the base of Q2 and the resulting current in R3 raises the voltage across R2, turning Q1 off, thus saturating Q2 again.

Slow, slow, quick quick . . .

Since the normal type of TTL circuit consists of a very high gain d.c. amplifier, there is a risk of positive feedback, causing high frequency oscillations, if the amplifier is ever operated, even momentarily, in a linear region, that is with the input biased so that the output voltage is between 1 and 0, or slowly changing. There is no problem if the change between 1 and 0 is fast, 30 ns or so, but slow in this context can mean 1 µs!

Slowly changing waveforms are most likely to be found when other circuits such as photocell amplifiers, micro-switches or tacho-generators are connected to TTL inputs. This is an interface problem. Using a Schmitt stage at the input solves this, assuming we have a low enough impedance to drive the Schmitt, since the Schmitt action will give a 30 ns rise or fall time at its

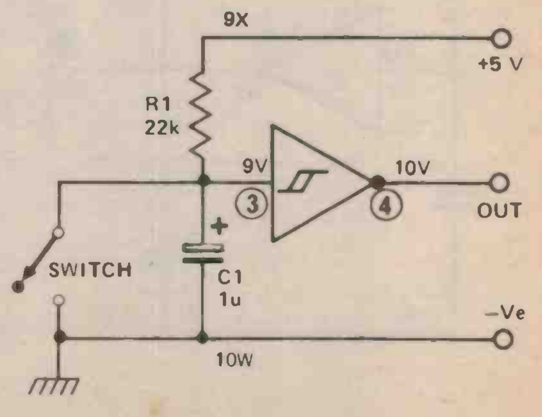


Fig. 7. Switch de-bouncing circuit.

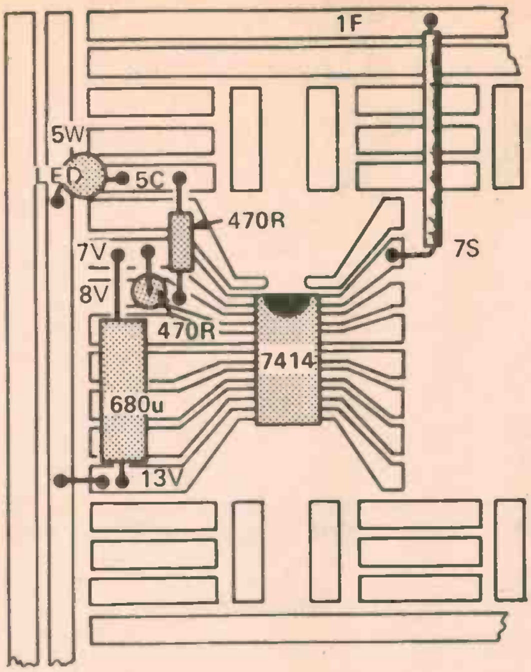


Fig. 8. Layout of the oscillator circuit on the Blob-board.

outpit for any type of input, however slowly changing. Once the Schmitt has triggered, a comparitively large voltage swing is needed to make it change back. A Schmitt stage with high input impedance is also available (SN72560).

Debouncing

One of the unique features of this type of stage is that it can very simply act as an oscillator or as a switch debouncer. Oscillating action is achieved by connecting a resistor of between 330R and 820R between output and input, with a capacitor between input and earth. The circuit is shown in Fig. 6. The output waveform is a square wave with very short rise and fall times, and unequal mark and space times.

When mechanical switches are used to provide waveforms for TTL circuits, contact bounce may cause problems. It occurs as contacts close, and cause a TTL input to be left briefly floating during the time of the bounce.

The effect of this can be to cause several output pulses from the switch where only one is intended. This is harmless if the switch is simply setting d.c. levels, but causes errors if the pulses are being counted. To de-bounce a switch, the circuit of Fig. 7 can be used. The principle is that the time constant is longer than the bounce time of the switch, so that the voltage change when the contacts bounce is small, less than than the hysteresis of the Schmitt circuit, hence no change in the trigger output when the bounce occurs.

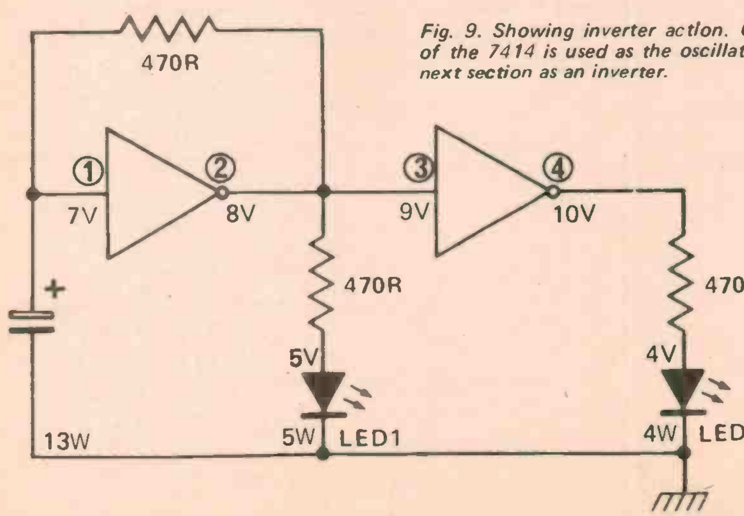


Fig. 9. Showing inverter action. One section of the 7414 is used as the oscillator, and the next section as an inverter.

Back to the Blob-Board

Using unit 1 of the 7414, make up an oscillator using a 680R resistor and a 680 μF capacitor as shown. Keep the connections previously made to the LED, since this can now be used to check that the oscillator is working.

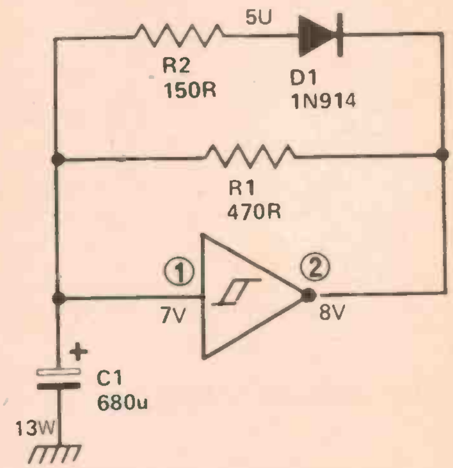


Fig. 10. Modification of the oscillator circuit for equal mark-space ratio. This is not needed for any of the applications in this series.

Estimate the frequency by counting the number of LED flashes in one minute, and then dividing the number counted by 60. Demonstrate the inverter action by using unit 2 as shown in Fig. 9. Wire a connection from pin 2 to pin 3 of the IC, and a 470R resistor from pin 4 to a spare pad. Connect another LED between this pad and earth to indicate when unit 2 output is high. Switch on again, and the two LEDs should blink alternately.

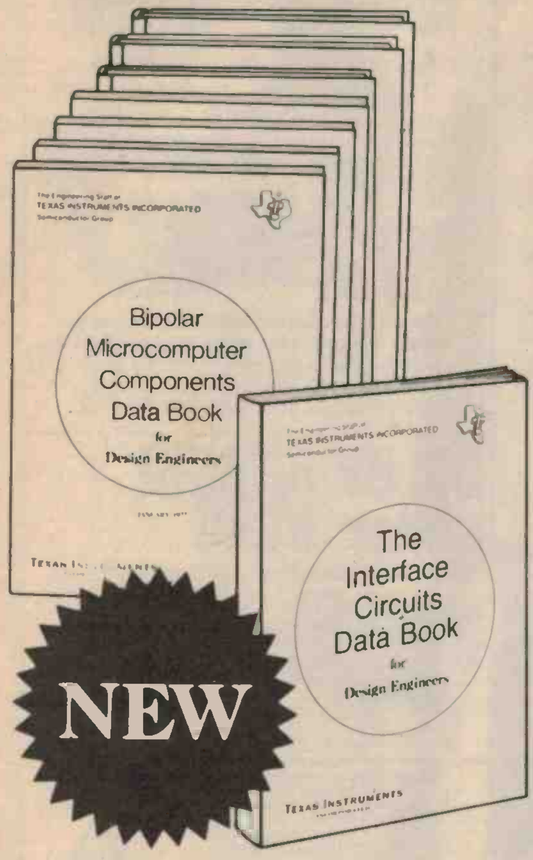
The oscillator can be modified for equal mark-space ratio by using the circuit of Fig. 10. Some trial and error is needed to find the correct resistor value.

Organ Bank

Note that the 7414, with its six separate inverter circuits, can be used as the oscillator for an electric organ. Two 7414s will give a basic twelve note scale, and dividers can be used to produce lower frequencies.

Later in this series, the 7414 units will be used as oscillators to provide slow clock pulses, as inverters, and as switch de-bouncers. The connections made during this month's experiments can be left in place.

Two valuable new additions to TI's reference library for the design engineer.



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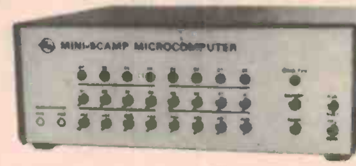

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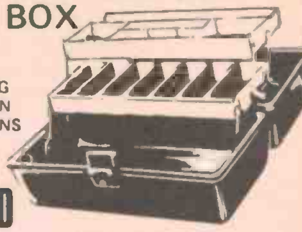

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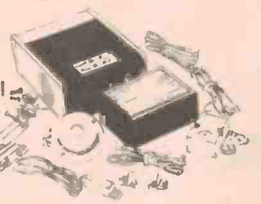

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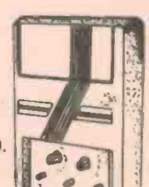

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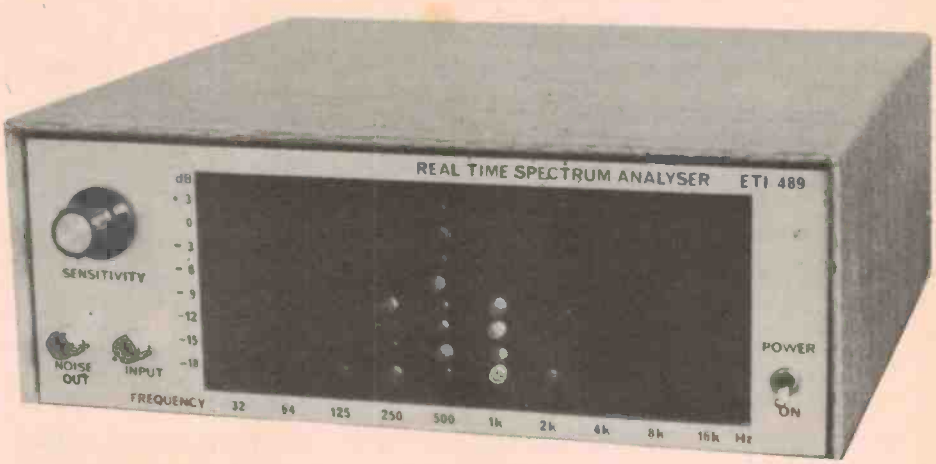
Audio Spectrum Analyser 2

LED display for compact, easy-to-build unit.

OUR PREVIOUS Real Time Audio Analyser design produced beautiful displays on the screen of an oscilloscope but this means, of course, that to use the device one has to have a scope. Not everyone has, and with this in mind, we contemplated the design of a more conventional analyser with LED bar-graph display. Urged on by reader response to our hint that this design was on the cards, we have gone ahead and produced the project in double-quick time.

This version has the great advantage of portability over the previous design, and also looks better than a scope sitting next to your brand new, 21st Century styled hi-fi! It is also easier to set up and trouble-shoot.



Design Features

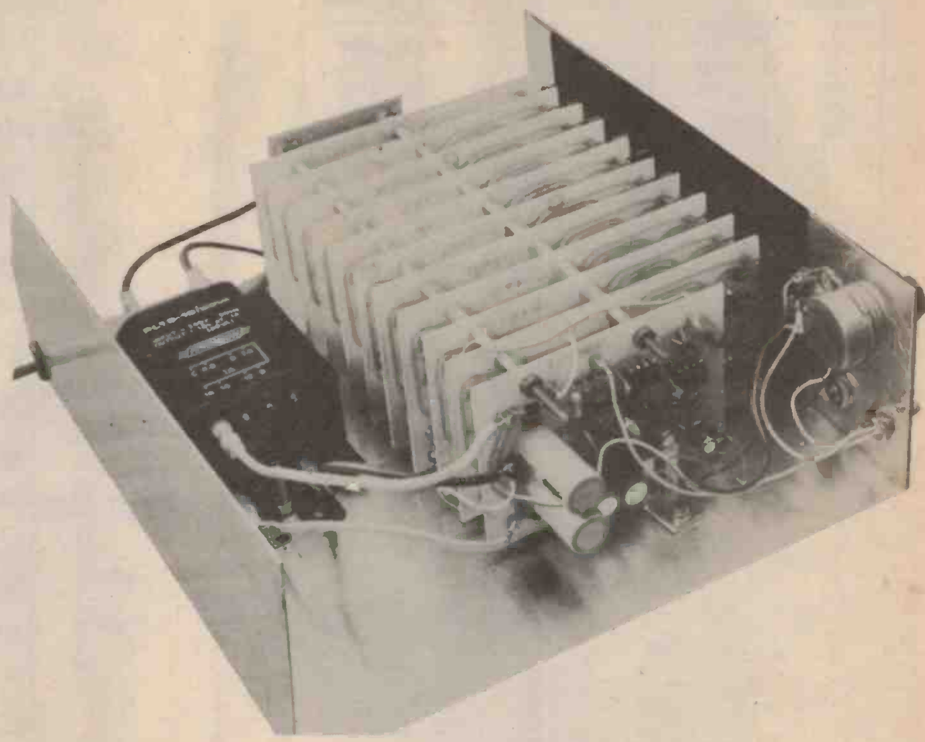
When we proposed a LED version of the spectrum analyser we initially were going to use the original filter board and design a new logic board which multiplexed the LED display. The only question at that time was whether to multiplex the LEDs as columns or as individual LEDs. The column method is easier on the power supply as the peak current is only 10 times the average current while singly the peak current is 80 times the average. This is not quite accurate because a multiplexed LED requires less average current for the same output than one continuously on. However the column method also requires one extra diode per LED to give the isolation required between columns.

SPECIFICATION – ETI 489

No. of bands	10
Frequencies	31, 63, 125, 250, 500, 1k, 2k, 4k, 8k, 16k
Filter characteristics	−12dB, one octave from nominal centre frequency
Display	LED display 3dB spacing
Input level	50mV – 10V
Input impedance	200k
Pink noise output	200mV

After struggling with the PC board layout which was developing into a double sided board similar the filter board of the previous analyser, we decided there must be an easier way to make a living! The question was then raised of whether it was worthwhile to multiplex the display at all and the answer was the project as it appears here.

The individual board approach not only makes fault finding easier and less likely, it also allows single sided PC boards to be used throughout. The system can also be expanded (or cut down) as desired simply by changing the filter components and the number of display boards. The power supply is capable of supplying up to 20 display boards without increasing the filter capacitors.



Construction

Assemble the power supply board and the ten filter display boards with the aid of the overlays. The filter components can be selected from Table 1 noting that when the tantalum capacitors are used in the three lower octaves a bias resistor R15 is needed. The LEDs should be installed as evenly as possible with the polarity correct.

We assembled the units on 1/8" brooker rod with 12.5mm spacers between the boards. Metal brackets are used at each end to support the assembly. On the filter display boards the power rails and the input are all common and for the power supply we used long lengths of tinned copper wire threaded through the holes. The input lead should be done with separate links to allow the units to be serviced later if needed.

Before assembling the unit however each board should be checked with an oscillator to check it for the correct frequency and to adjust the calibration potentiometer. This is best done by measuring the sensitivity of the 16 kHz board with RV2 set for maximum sensitivity and adjusting all the others till they are the same.

We made a metal box with a piece of red perspex for a window to house the unit. If it is to be used with an equaliser (such as the ETI 484) it could be built into the same box.

It will be found with the economical LED available that there will be a difference in brilliance between them. If desired matched LEDs are available but not for 20 cents each!

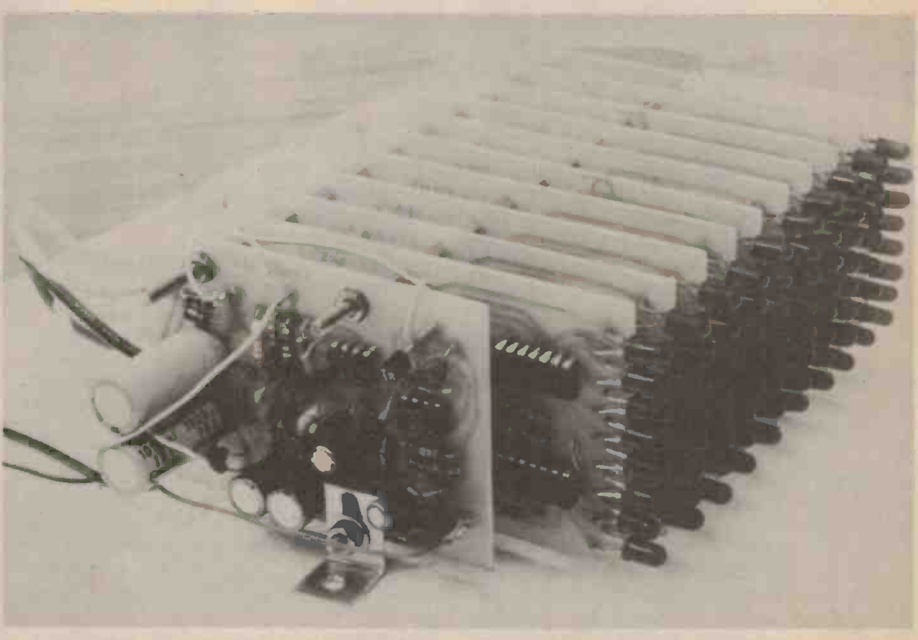


TABLE 1

Centre frequency	R15	C14,C15 tantalum	C16 polyester	C17 polyester
32	1M	3μ3	–	68n
63	1M	1μ5	–	33n
125	1M	1μ0	–	18n
250	–	–	220n	8n2
500	–	–	100n	3n9
1k	–	–	47n	2n2
2k	–	–	27n	1n0
4k	–	–	12n	560p
8k	–	–	6n8	270p
16k	–	–	3n3	150p

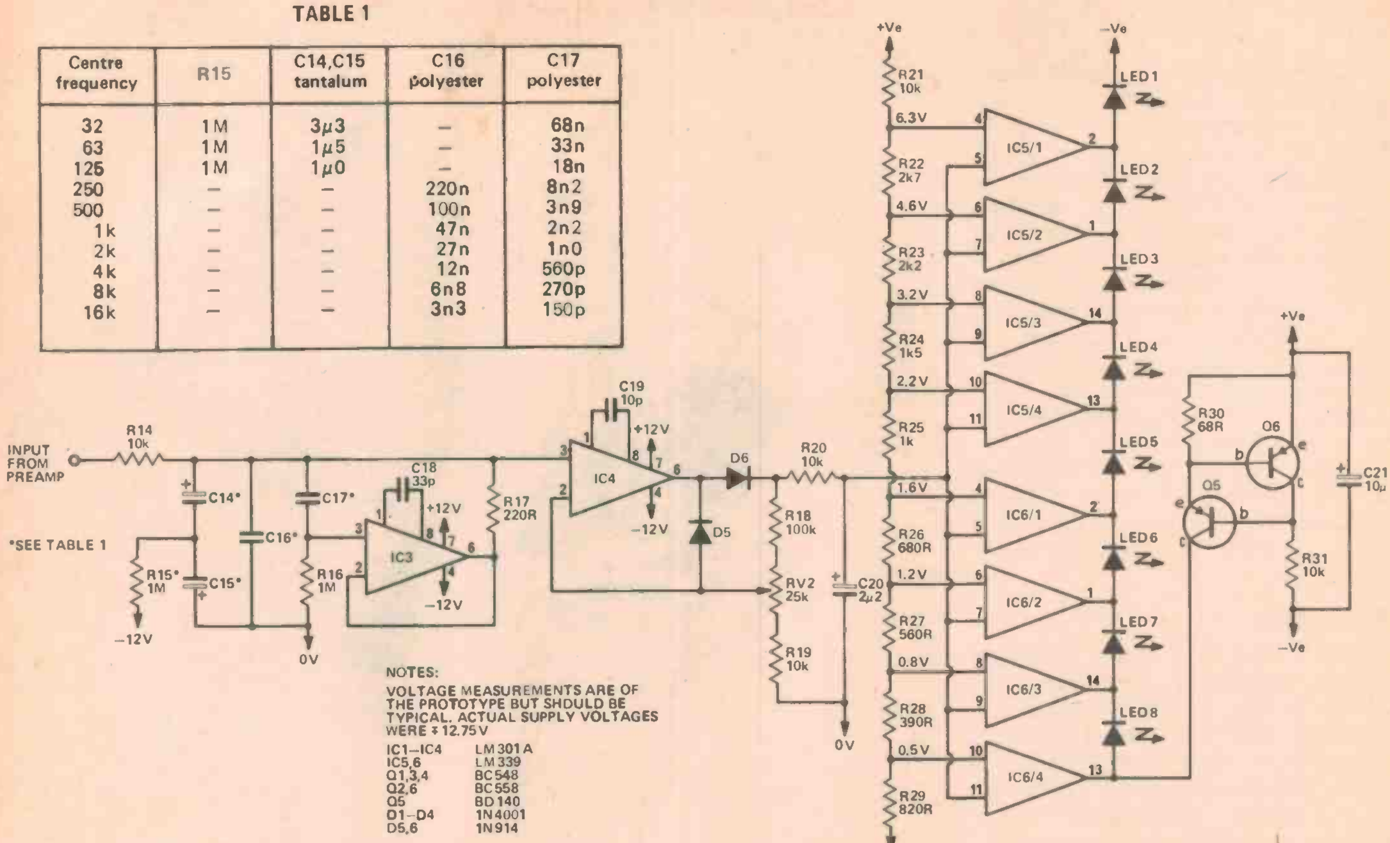


Fig. 1. The circuit diagram of the filter display board.

HOW IT WORKS – ETI 489

The input signal to the unit is initially buffered and amplified by IC1 and is then split into octave bands, rectified and displayed by a "bar" of LEDs. We have used 10 separate boards for the rectifier-display as only the component valves in the filter are different.

The filter is a parallel LC network where the inductive part is a gyrator formed by IC3, CI7, R16 and R17. The valve of such an "inductor" is R16 x R17 x C17 Henrys (C17 in Farads). This, with the parallel capacitor C16 and the series resistor R14, form a band pass filter.

The output of the filter is half wave rectified by IC4 which also provides a gain of about 5 before the signal is smoothed by C20.

The eight LEDs in each individual display are connected in a series chain which is supplied with 10 mA by the constant current source Q5, Q6. Control of how many LEDs will be on is done by IC5 and IC6. These are quad voltage comparators which have as the output stage an open collector NPN transistor with its emitter connected to the negative supply rail. These compare the output of the rectifier with the voltage set on the resistive divider R21-R29 and "short" out the unwanted LEDs.

The power supply is a simple fullwave rectified with a centre tap giving ∓12 V dc. Due to the load (about 150 mA) there is about one volt ripple on the supply rail but this does not affect the operation of the unit. As the current drawn by the filter display boards does not change with the number of LEDs on the supply voltage remains reasonably constant.

The 100 Hz ripple does however affect the noise generator and this has been changed from the 487 analyser to accommodate this. The noise generator consists of Q3 which is used as a zener diode where the noise current is amplified by Q4. The output of Q4 is white noise and to give pink noise a 3 dB/octave filter is needed. IC2 and the associated capacitors and resistors provide this filter.

PARTS LIST – ETI 489 A

Filter–Display boards 10 required

Resistors all ½W 5%
R14 . . . . . . 10k
R15 . . . . . . see table 1
R16 . . . . . . 1M
R17 . . . . . . 220R
R18 . . . . . . 100k
R19–R21 . . 10k
R22 . . . . . . 2k7
R23 . . . . . . 2k2
R24 . . . . . . 1k5
R25 . . . . . . 1k
R26 . . . . . . 680R
R27 . . . . . . 560R
R28 . . . . . . 390R
R29 . . . . . . 820R
R30 . . . . . . 68R
R31 . . . . . . 10k

Potentiometers
RV2 . . . . . 25k trim

Capacitors
C14–C17 . . see table 1
C18 . . . . . . 33p ceramic
C19 . . . . . . 10p ceramic
C20 . . . . . . 2μ2 25V electro*
C21 . . . . . . 10μ 25V electro*

Semiconductors
IC3,4 . . . . . LM301A
IC5,6 . . . . . LM339
Q5 . . . . . . BD140
Q6 . . . . . . BC558
D5,6 . . . . . 1N914
LED1–LED8

Miscellaneous
PC board ETI 489 A

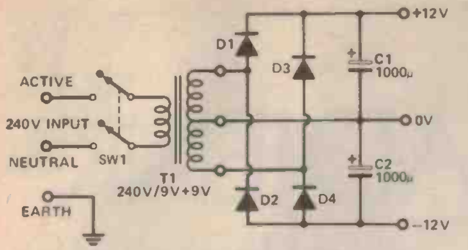


Fig. 2. The power supply circuit.

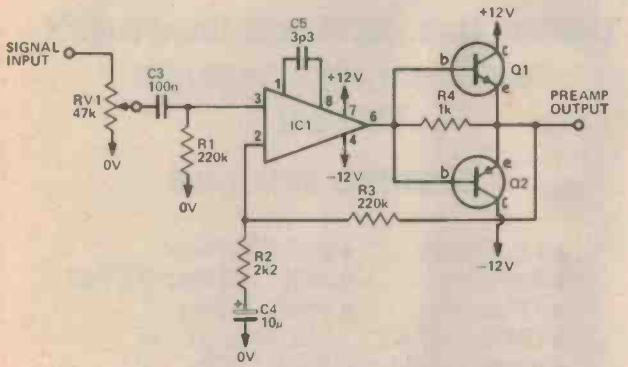


Fig. 3. The circuit of the preamplifier–buffer.

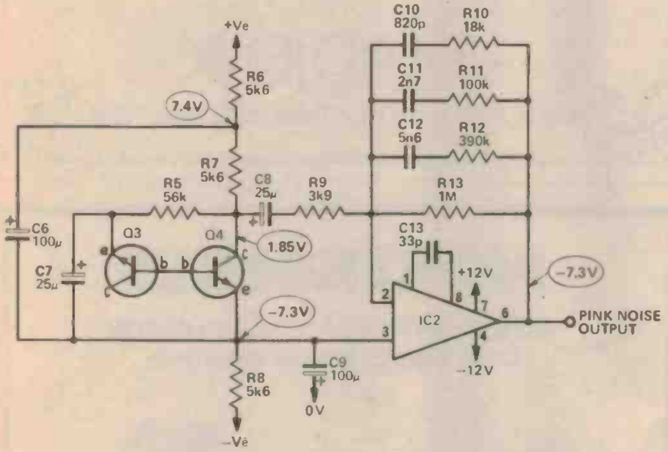


Fig. 4. The circuit diagram of the pink noise generator.

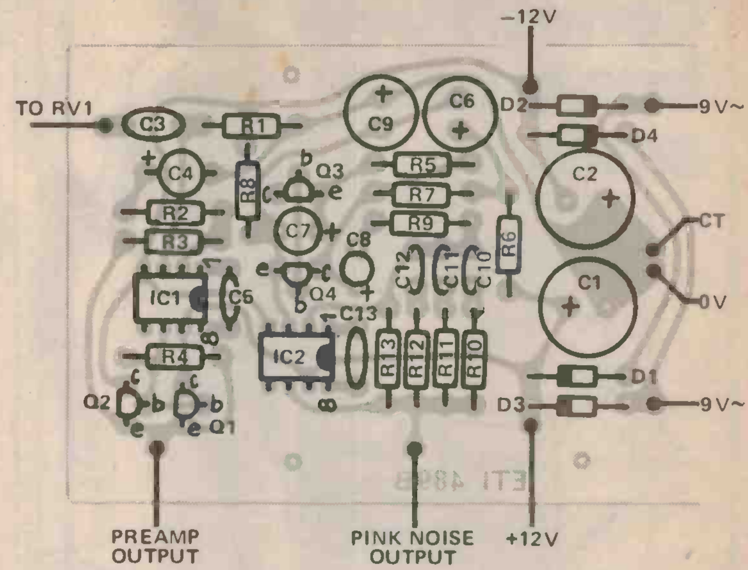
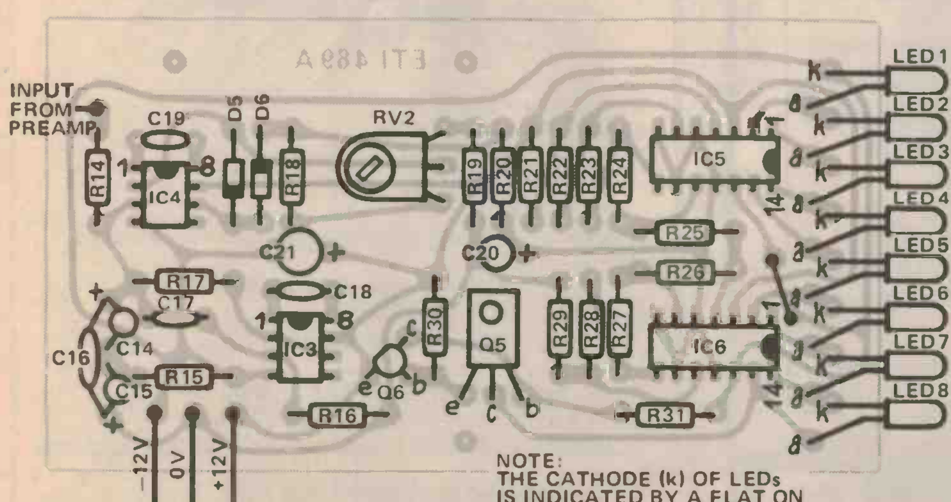


Fig. 5. The component overlay of board B.



NOTE:
THE CATHODE (k) OF LEDs IS INDICATED BY A FLAT ON THE BODY OR A SHORTER LEAD.

Fig. 6. The component overlay of board A.

PARTS LIST – ETI 489B

Power Supply board

Resistors	all ½W 5%
R1	220k
R2	2k2
R3	220k
R4	1k
R5	56k
R6–R8	5k6
R9	3k9
R10	18k
R11	100k
R12	390k
R13	1M
Potentiometers	
RV1	47k log rotary
Capacitors	
C1,2	1000µ 16V electro*
C3	100n polyester
C4	10µ 25V electro*
C5	3p3 ceramic
C6	100µ 25V electro*
C7,8	25µ 25V electro*
C9	100µ 25V electro*
C10	820p ceramic
C11	2n7 polyester
C12	5n6 polyester
C13	33p ceramic
Semiconductors	
IC1,2	LM301A
Q1	BC548
Q2	BC558
Q3,4	BC548
D1–D4	1N4001

Miscellaneous
PC board ETI 489B
Transformer 240V/9V+9V PL18/20VA
SW1 DPDT 240V toggle switch
Case to suit

*all electrolytic capacitors PC board or single ended type.

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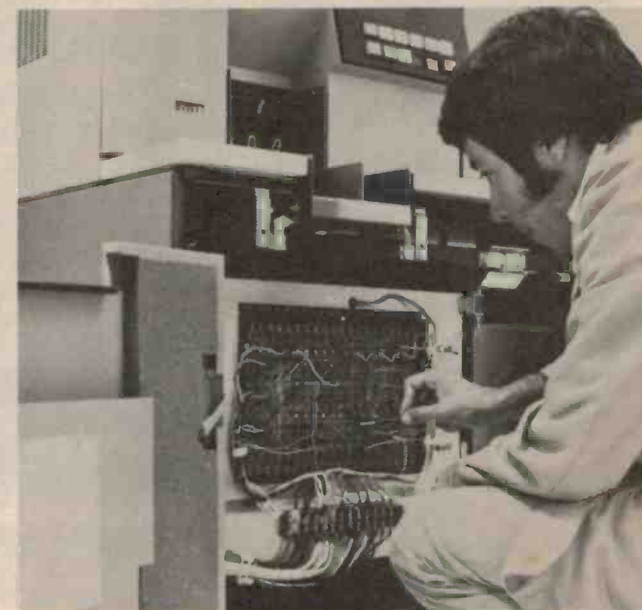

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BA182	16c	S34	16c
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BC146	25c	SIB04	8c
BC183L	15c	SV04	25c
BC183LB	15c	SP835	80c
BC183LC	20c	TI54	15c
BC184B	10c	TI55	20c
BC184C	10c	TI57	30c
BC213B	12c	TIC226D	80c
BC637	20c	TD15M	48c
BC682L	20c	TIL107	$1.00
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Project 246

RAIN ALARM

Super-simple project saves a lot of washday hassles.

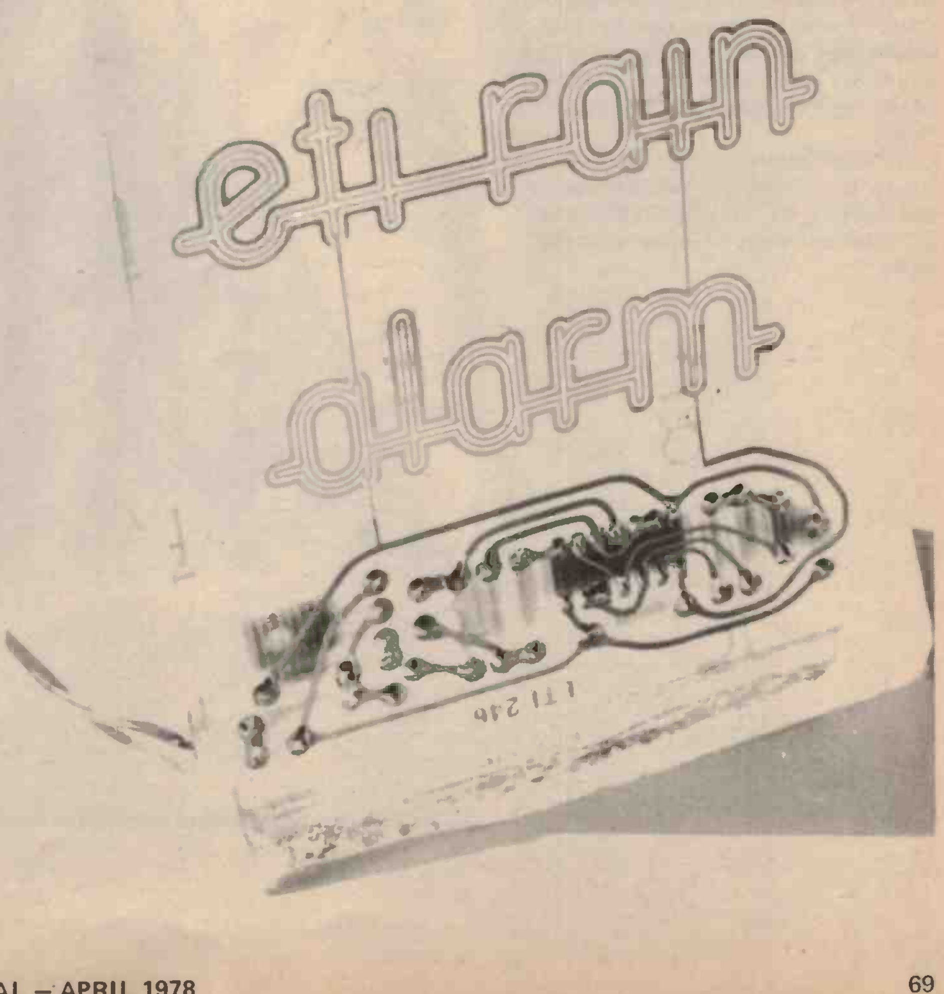
MARCH WINDS AND APRIL showers bring forth May flowers, runs an old saw which obviously applies much better to Britain than Australia. This old meteorologist's tale actually applies quite well over there, but if you require something a bit more scientific, and generally applicable, it's not so hot. Additionally the bit about April showers is likely to bring forth more than the odd May bud if one of these unpredictable periods of precipitation disrupts a busy housewife's washday by relegating her almost-dry laundry to the ranks of the wet-behind- the-eiderdown brigade.

Singin' in the...

The problem of rain showers is an annoying one, but here we come to the rescue with a Rain Alarm. This little gadget might well upstage any canine companion as a housewife's best friend, at least on washday, by giving a warning at the first sign of rain, leaving plenty of time to get the laundry in before it gets wet.

The rain alarm should be placed out in the open and a length of two core wire run between it and a box containing the battery, on/off switch and speaker. We used an old intercom substation to provide a home for our speaker but a car extension speaker or indeed any suitably boxed eight ohm device would be fine.

Any rain falling on the sensor track, which is formed as part of the PCB (neat innit?), will set off the alarm and produce a distinctive intermittent beep-beep.



Construction

Although the project is very simple, we recommend use of the PCB layout shown, as this is (we feel) much more attractive than a hacked-up piece of Veroboard.

Assemble the components onto the board using the overlay, remembering to solder pins 7 and 14 of IC1 before the others, to allow the device's internal protection circuitry to work.

In our prototype we used a value of 4M7 for R1 which acts as a sensitivity adjustment. This value leads to a 'hair-trigger' alarm and could well be reduced taccording to the level of sensitivity required.

When construction of the board is complete and the alarm has been tested, the area of the PCB that holds the components should be covered, front and back, with some suitable non-conductive potting compound to render it waterproof. We used Epirez 135 epoxy resin to encase the base of the board in a wedge shape so that it will stand up, thus obviating the need for a case.

More Power to Your...

Power consumption of the unit is so low when the alarm is not triggered that an on/off switch is not needed for that reason, but we recommend one unless you enjoy being woken up in the middle of the night by some light rain (or even mist)!

While this unit is not as effective as a device to control the weather (we're still working on that one), it should at least prevent some of those washday blues.

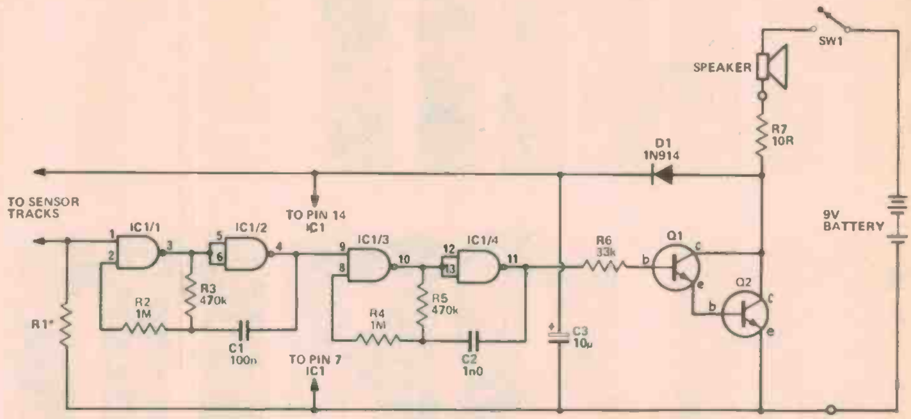


Fig. 4. Circuit diagram of the Rain Alarm.

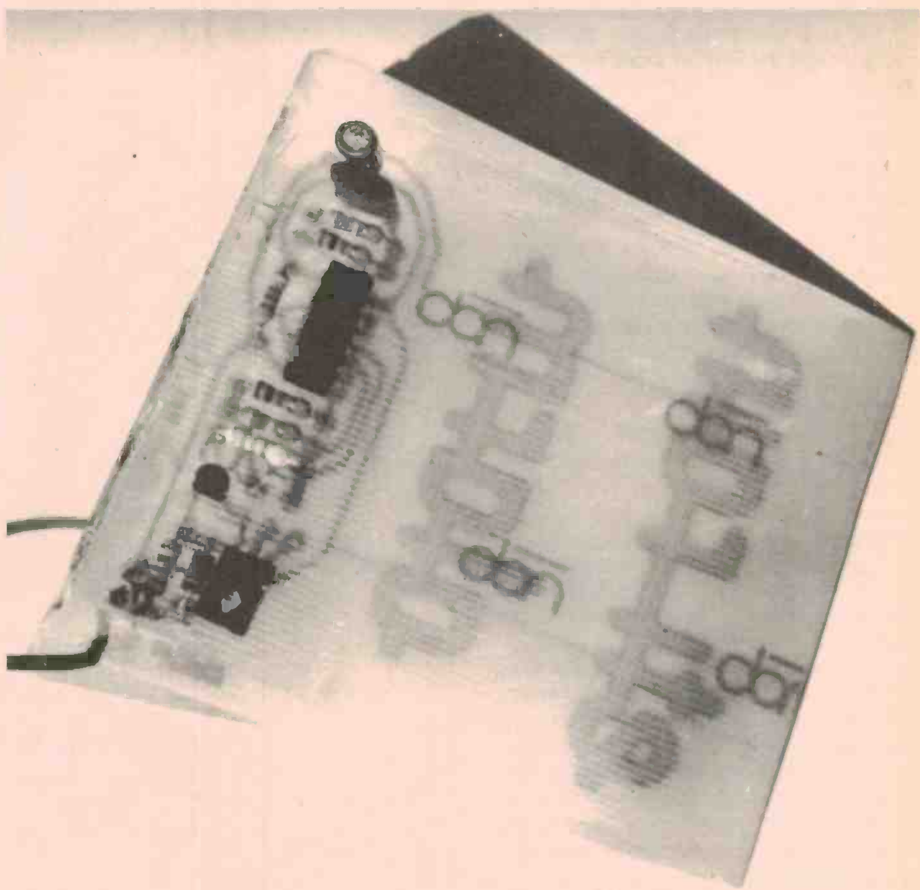


Fig. 5. The epoxy resin which encapsulates our board can just be seen in this photograph.

PARTS LIST – ETI 246

Resistors all ¼W 5%

R1 . . . . see text
R2 . . . . 1M
R3 . . . . 470k
R4 . . . . 1M
R5 . . . . 470k
R6 . . . . 33k
R7 . . . . 10R

Capacitors

C1. . . . . 100n polyester
C2. . . . . 1n0 polyester
C3. . . . . 10µ electrolytic

Semiconductors

IC1 4011
Q1 . . . . BC107
Q2 . . . . BD139
D1 . . . . 1N914

Miscellaneous

PCB as pattern, 8R speaker, switch, battery.

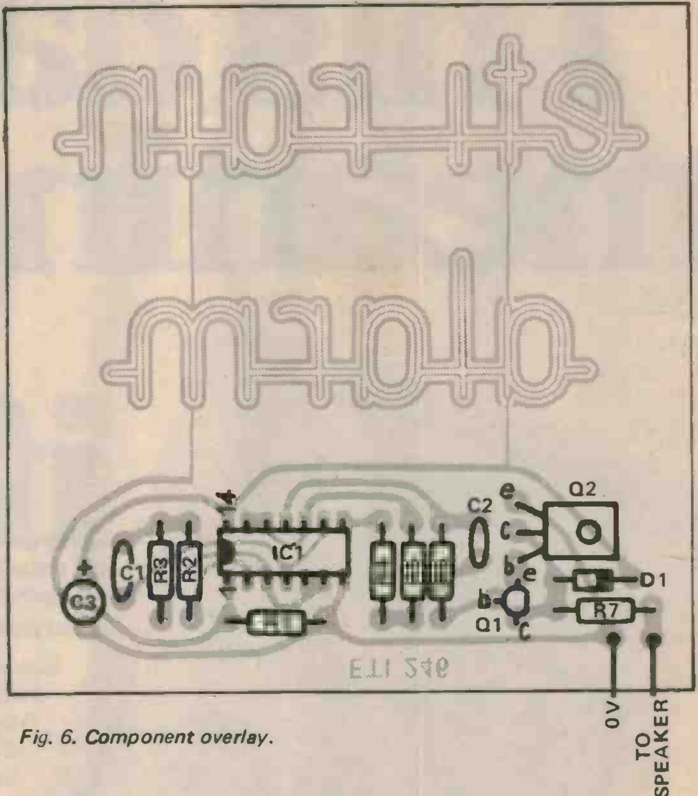


Fig. 6. Component overlay.

HOW IT WORKS – ETI 246

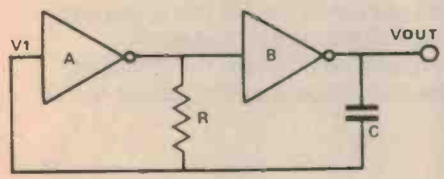


Fig. 2. A basic CMOS oscillator.

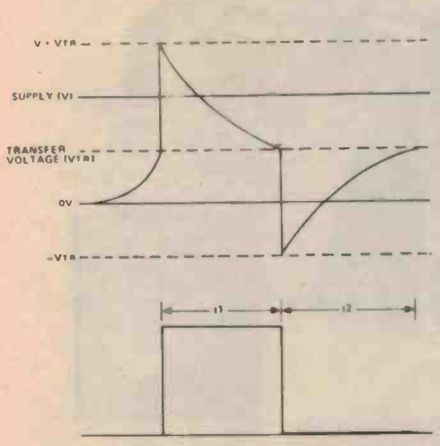


Fig. 3. Waveforms at various points in the circuit.

The rain alarm is formed by two gated CMOS oscillators and an audio output stage.

The basic CMOS oscillator is shown in Fig. 2. Upon switch on, with C discharged, the output of inverter B will be low, the input to A low and its output will go high. Capacitor C will now commence to charge towards supply, the voltage on A output, via resistor R.

We can consider a CMOS gate to be a comparator that will change output state when the level of the the input voltage reaches a specified value, the transfer voltage (Vtr), usually about half supply. Thus as the voltage on C increases due to the charge current supplied by R there will come a point when the voltage on the input of A will pass its transfer voltage and and the output of B will go high.

At this point the charge on C corresponds to a voltage level of about half supply.

As the inverters A and B change states the end of C that was held at 0 V is now at supply and the end of C that was connected to supply via R is now returned to 0 V via the same resistor.

These changes together with the charge stored on C mean that the potential across C is now supply plus the transfer voltage of gate A. This is shown in Fig. 3.

Capacitor C will now discharge via R until once again the transfer voltage of A is reached whereupon the outputs of the inverters will assume their original states.

The conditions are not quite the same as they were at switch on, as can be seen in Fig. 3, because the potential across C is now a negative value equal to A's transfer voltage.

From this point C charges via R again to repeat the cycle.

Thoe output is shown in Fig. 3 where t1 = t2 = 1.1 RC (the time taken for C to charge (discharge) via R to two-thirds of the maximum value of voltage across it).

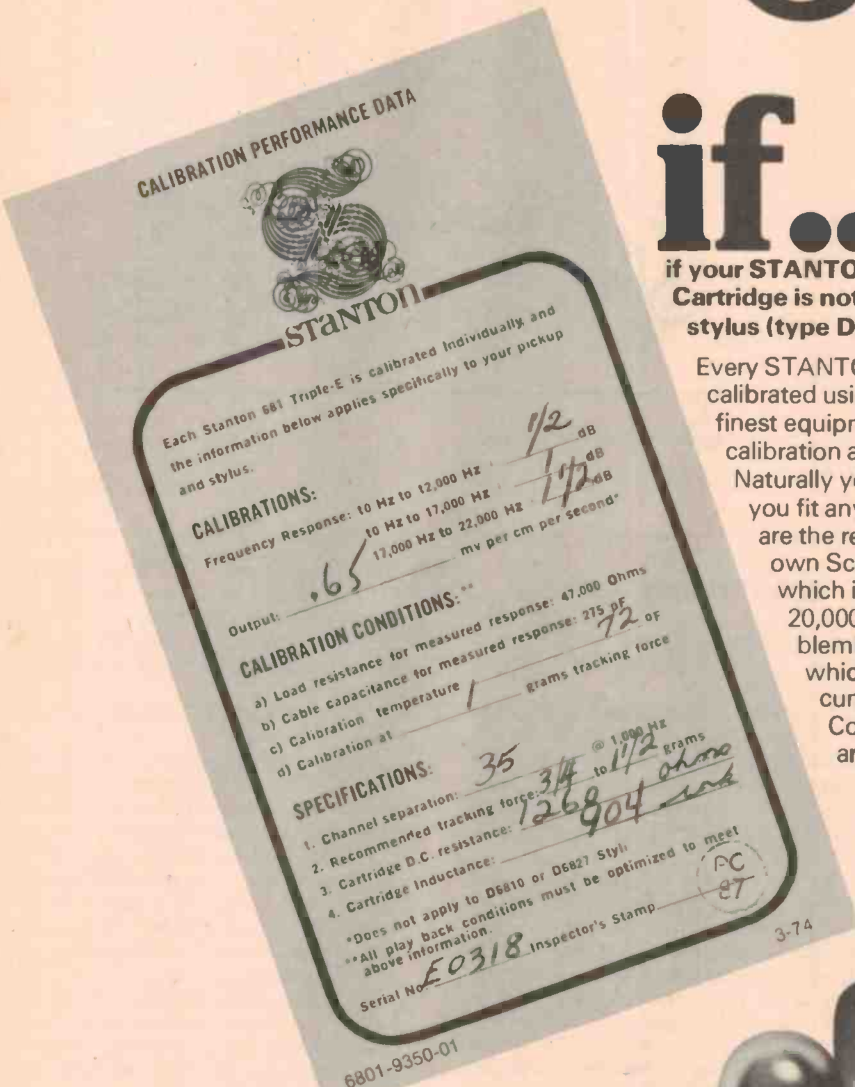
In practice, due to the protection networks built into modern CMOS devices, it is necessary to include a resistor in series with the input of A in order to ensure that the voltages across C are allowed to reach the values shown in Fig. 3.

The final circuit diagram (Fig. 1) of the unit shows that the inverters are in fact formed from the four NAND gates of a 4011 package. In each oscillator, while one gate is configured as a straightforward inverter, the other has one input that can act as a control input, oscillator action being inhibited if this input is held low.

The first oscillator (IC1a and IC1b) has this input tied low via a high-value resistor (R1) that acts as a sensitivity control, Thus this oscillator will be disabled until the control input is taken high by any moisture bridging the track, so enabling the output, which is a 10 Hz square wave. This in turn will gate the 1 kHz oscillator formed by IC1c and IC1d on and off.

The latter oscillator drives the loudspeaker via R6, the Darlington pair formed by Q1 and Q2, and resistor R7.

This data is meaningless!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stanton

Each Stanton 681 Triple-E is calibrated individually and the information below applies specifically to your pickup and stylus.

CALIBRATIONS:

Frequency Response: to Hz to 12,000 Hz 1/2 dB

to Hz to 17,000 Hz 1 dB

17,000 Hz to 22,000 Hz 1 1/2 dB

Output: .65 mv per cm per second*

CALIBRATION CONDITIONS:**

a) Load resistance for measured response: 47,000 Ohms

b) Cable capacitance for measured response: 275 pF

c) Calibration temperature 72 °F

d) Calibration at 1 grams tracking force

SPECIFICATIONS:

1. Channel separation: 35 @ 1,000 Hz

2. Recommended tracking force: 3/4 to 1 1/2 grams

3. Cartridge D.C. resistance: 1268 ohms

4. Cartridge Inductance: 904 mh

*Does not apply to D6810 or D6827 Styli

**All play back conditions must be optimized to meet above information.

Serial No. E0318 Inspector's Stamp PC ET

3-74

6801-9350-01

if...

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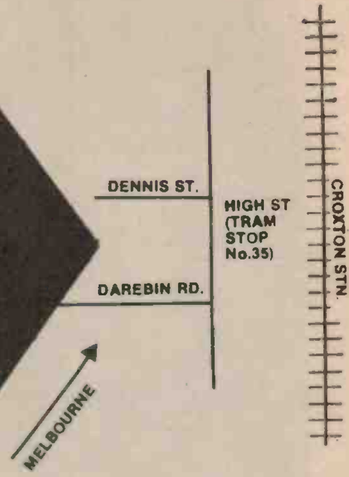

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4.7 uf	35v	0.24	0.22
6.8 uf	35v	0.27	0.25
10 uf	16v	0.23	0.21
10 uf	35v	0.30	0.28
15 uf	16v	0.30	0.28
15 uf	35v	0.50	0.45
22 uf	16v	0.32	0.30
47 uf	16v	0.55	0.50
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22 uF	16V	PCB	0.08	0.07
22 uF	35v	PCB	0.10	0.09
33 uF	16v	PCB	0.09	0.08
33 uF	50v	PCB	0.11	0.10
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100 uF	16v	PCB	0.12	0.11
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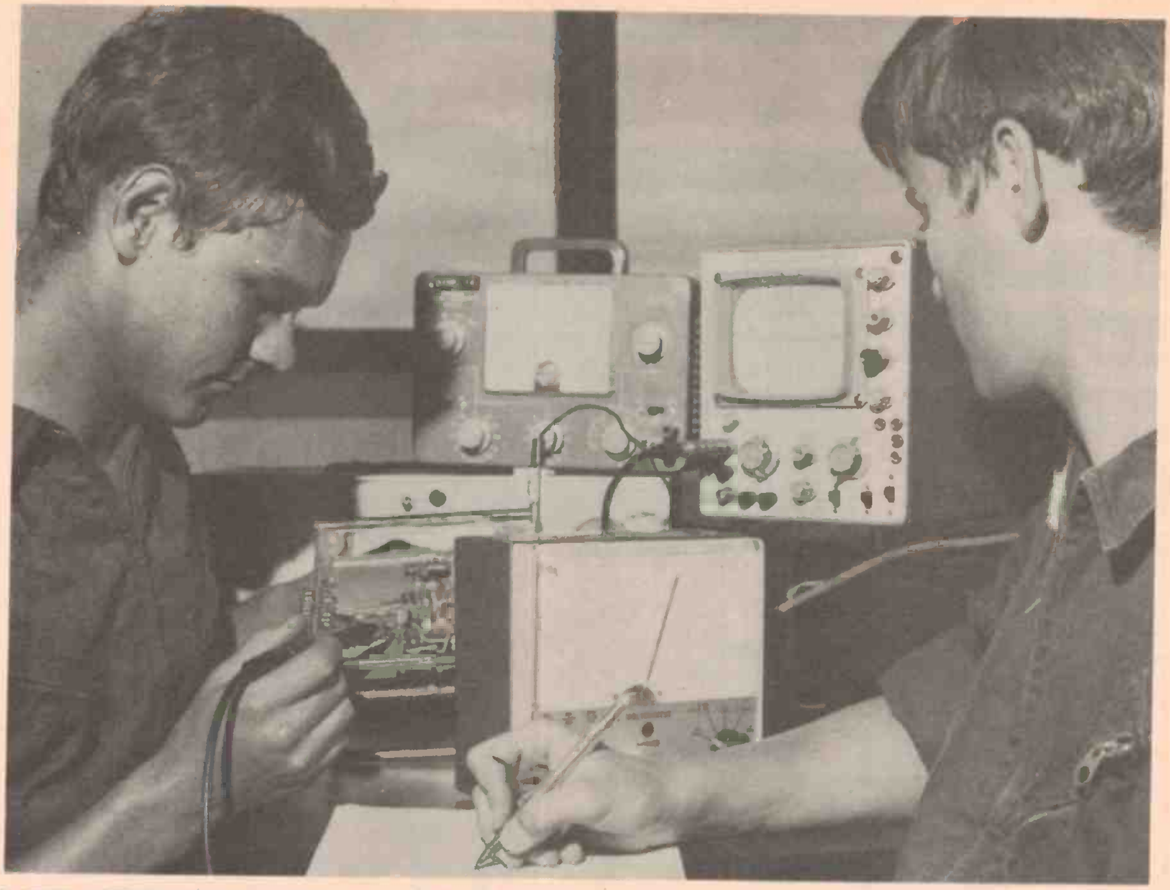

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Pt.2 Construction

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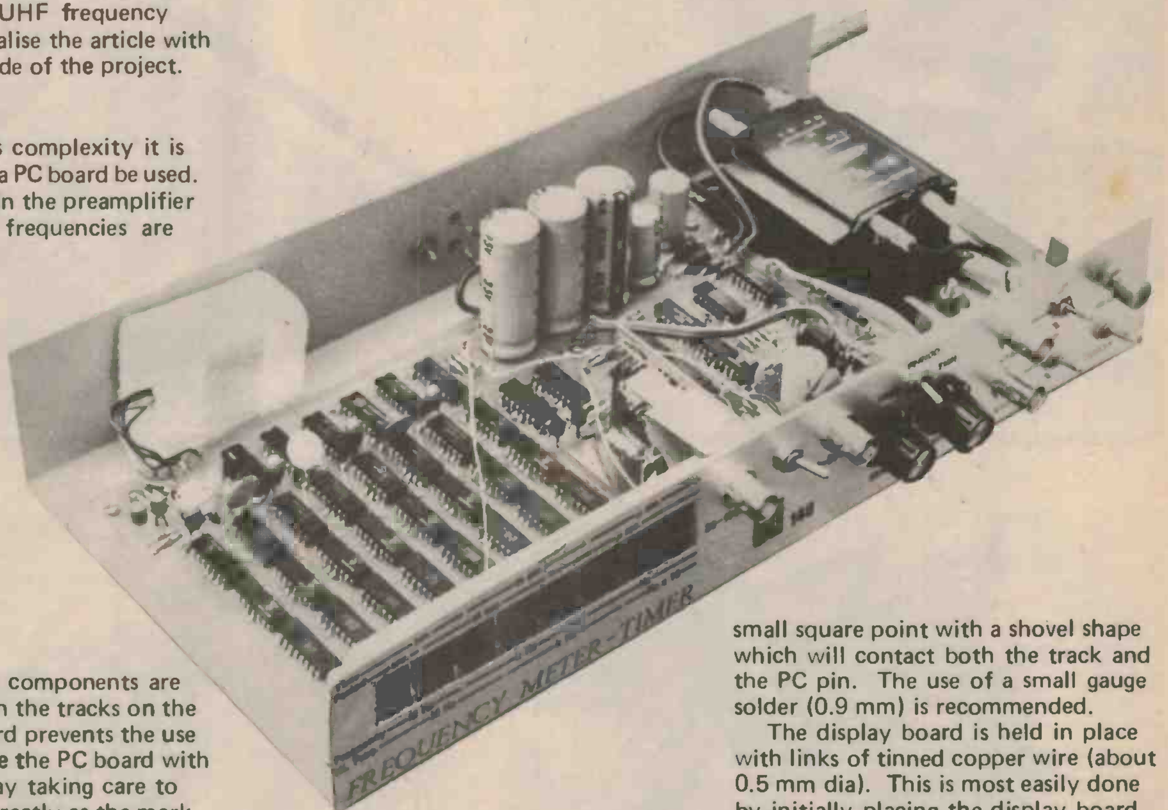
Construction

For a project of this complexity it is almost essential that a PC board be used. This is especially so in the preamplifier section where high frequencies are involved.



The fact that the components are used as links between the tracks on the two sides of the board prevents the use of sockets. Assemble the PC board with the aid of the overlay taking care to orientate the ICs correctly as the mark is sometimes difficult to pick out. As the component leads are used as feed throughs it is not practical to build and test the unit in sections. Ensure that *all* pads on the top side of the board are soldered. Soldering the top surface is easiest if the tip of the iron is filed to a small square point with a shovel shape which will contact both the track and the PC pin. The use of a small gauge solder (0.9 mm) is recommended.

The display board is held in place with links of tinned copper wire (about 0.5 mm dia). This is most easily done by initially placing the display board horizontally on the main board and inserting loops of wire through the holes provided (see photo). When all the links are in place the board can be twisted into a vertical position and by pulling on the ends of the links the display board can be pulled down flush with the main board. It can now be soldered into place. Two additional resistors are needed per digit; the photo shows their position. The potentiometers are mounted on a small bracket (see Fig.20) before being soldered onto the main board.

The prescaler, if used, is also mounted in a similar way except that due to the small number of connections the links should be passed through the holes in the prescaler, bent flush with both sides and then mated with the main board. Solder the pads on the underside of the main board only at this stage. On the prescaler board there is a tin plate shield which should be soldered into position with a fillet of solder. Don't solder the top edge yet as capacitor C15 can only be fitted after the unit is in the chassis. Also note that the capacitors C43 and C44 are mounted on the rear of the PCB as shown in Fig. 15 along with R116.

The crystal is fitted into a polystyrene box (about 50 x 40 x 25 mm) with transistor Q5, R86, 87 and TH1 being glued onto the crystal body to act as a heater and sensor.

Before mounting the unit into the chassis assemble all the front panel components, also glueing the polarised plastic into position. Note that there is an earth lug under the prescaler input socket and the nut for the socket should be in the position shown in Fig. 8 as the board fits between the nut and the earth lug which is bent back along the surface of the board.

The unit should now be temporarily mounted into the chassis to locate the prescaler board in its correct position between the nut on the input socket and the earth lug. Fix it in this position by running a small fillet of solder between the two boards. When the unit is removed run the fillet of solder the full length (where there is copper!!) on both sides of the prescaler board.

Assemble the unit finally and wire it up as shown in the wiring diagram. The transformer can be mounted and wired along with the 5 V regulator. Insulation washers should be used with this regulator even though the case is at earth potential to prevent any problem of having two earth points (the other is the lug under the prescaler input socket).

Errata

On the power supply circuit diagram last month the transformer was specified as 240 V/15 V+15 V. It should have been 240 V/9 V+9 V. Also the diodes D16 and D17 have been shown in reverse polarity. The regulator IC47 should have been marked as a 7905 not 7915.

On the control logic circuit diagram the diode D17 should have been D18.

The resistor R117 was omitted from the preamplifier circuit diagram and is connected between pin 6 of IC44 and 0 V. This is to reduce the sensitivity at high frequency and improve stability.

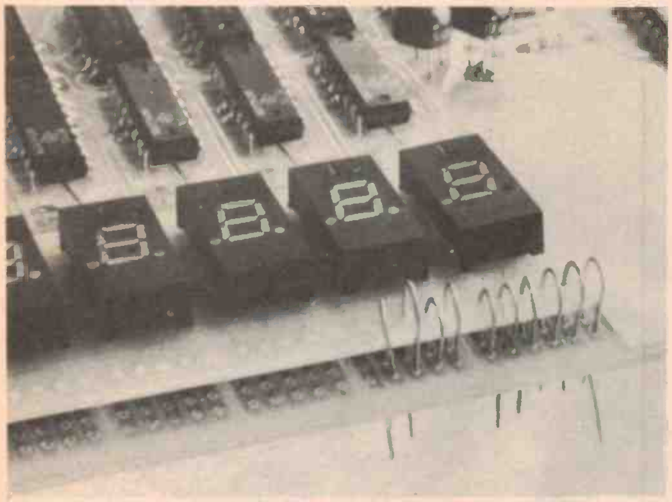
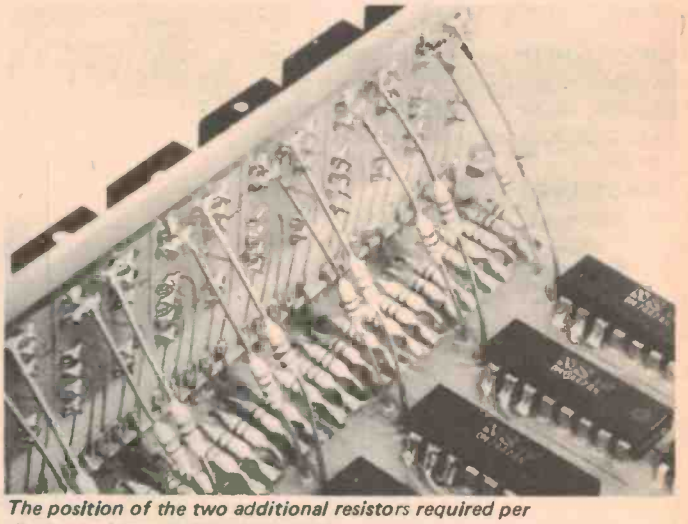
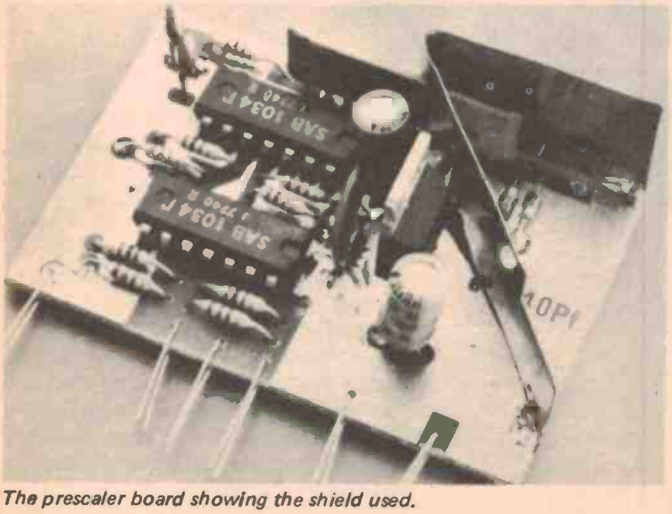


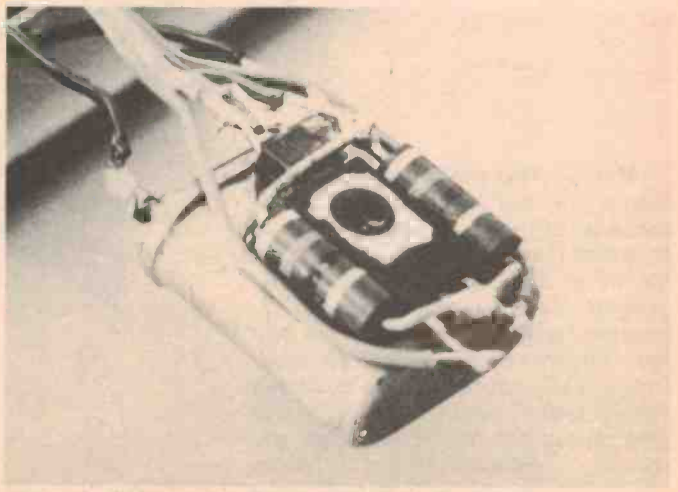
Photo showing the method of connecting the display board.



The position of the two additional resistors required per display is shown in this photograph.



The prescaler board showing the shield used.



The method of mounting the components on the crystal.

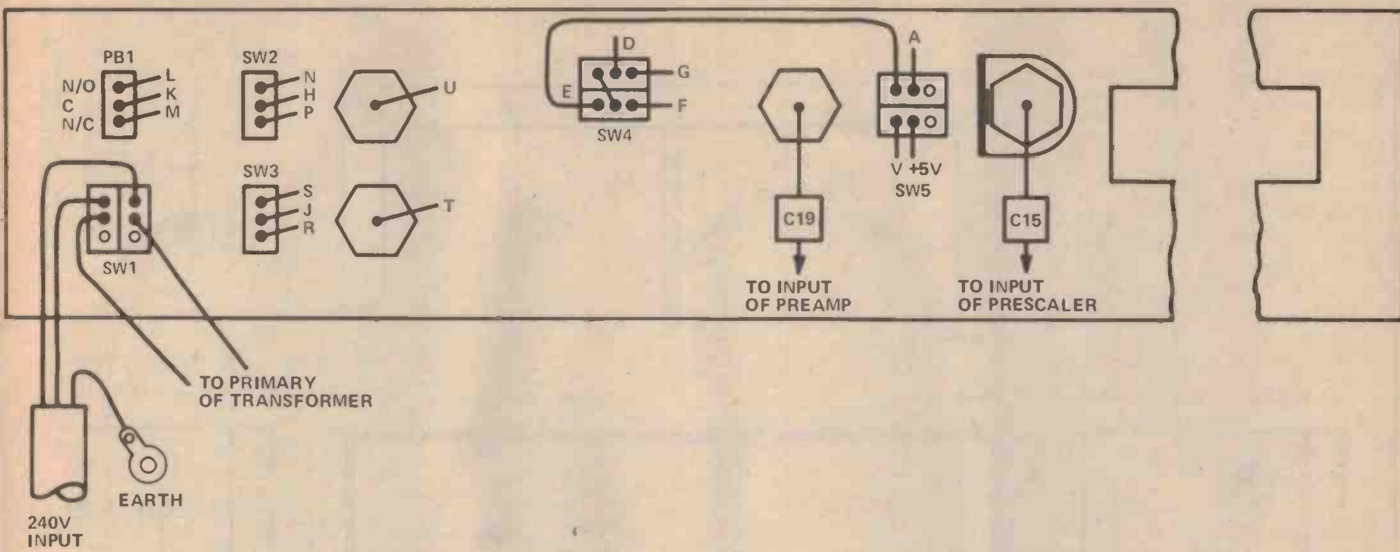


Fig. 8. Rear view of the front panel wiring.

ICs used in the prescaler.

Most of the ICs used in this project are standard TTL or CMOS and only the prescaler ICs are unusual. For this reason details of these ICs are given below.

OM335

This is a high frequency linear amplifier designed for instruments or TV amplifier.

Gain	27dB typ.
Freq. resp. ∓ 1dB	20–1000MHz
Input impedance	75ohm
Output impedance	75ohm
Power Supply	8–28V dc @ 35mA

SAB1048

This is a high frequency 4/1 divider (prescaler) and is designed to operate from a sinewave (50MHz min) or square wave (dc). The output is ECL compatable. The internal circuit - block diagram is given below. The differential inputs are internally biased and should be ac coupled. If only one input is used the other should be ac grounded.

Freq. range (sine wave)	50–1000MHz
Sensitivity	see graph
Power requirement	5.2V @ 53mA

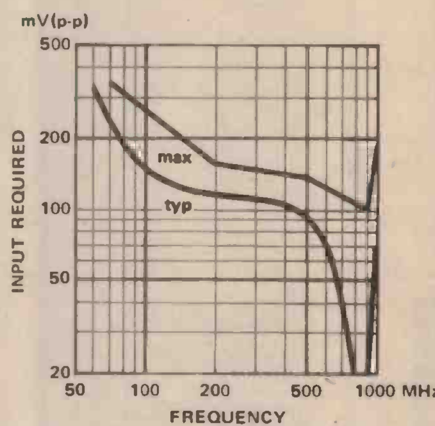


Fig. 12. Sensitivity of the SAB1048 with a sinewave input.

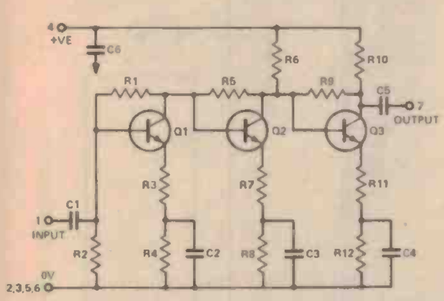


Fig. 9. Internal circuit diagram of the OM335.

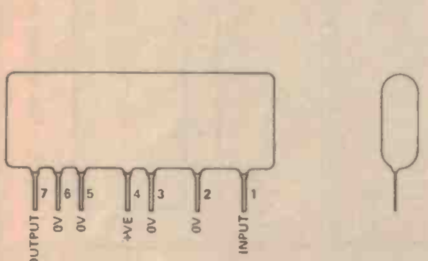


Fig. 10. Pin connections of the OM335.

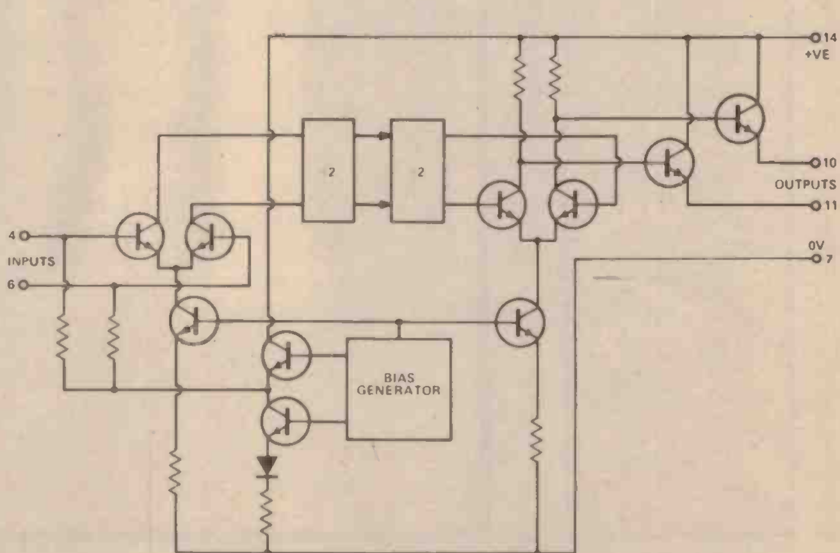


Fig. 11. Block diagram of the SAB1048.

1 GHz FREQUENCY METER — TIMER

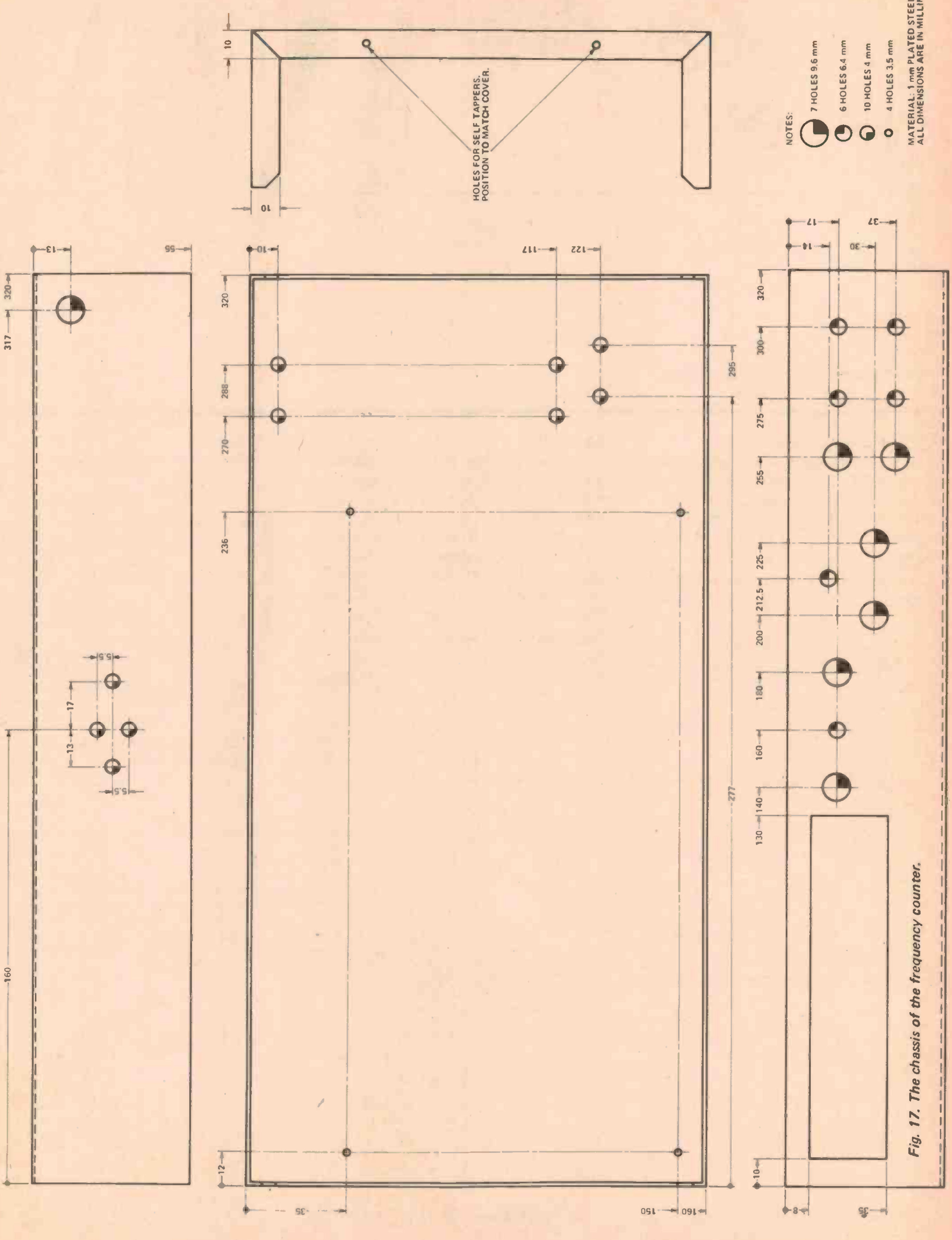


Fig. 17. The chassis of the frequency counter.

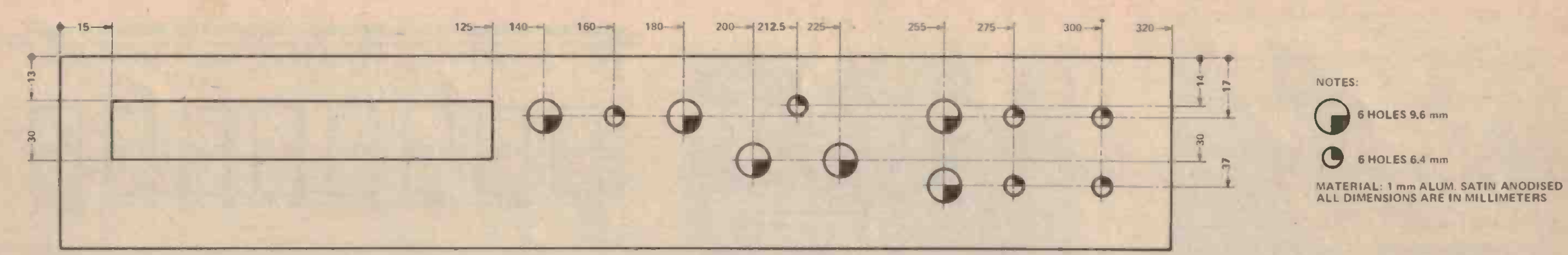


Fig. 18. The dimensions of the front panel.

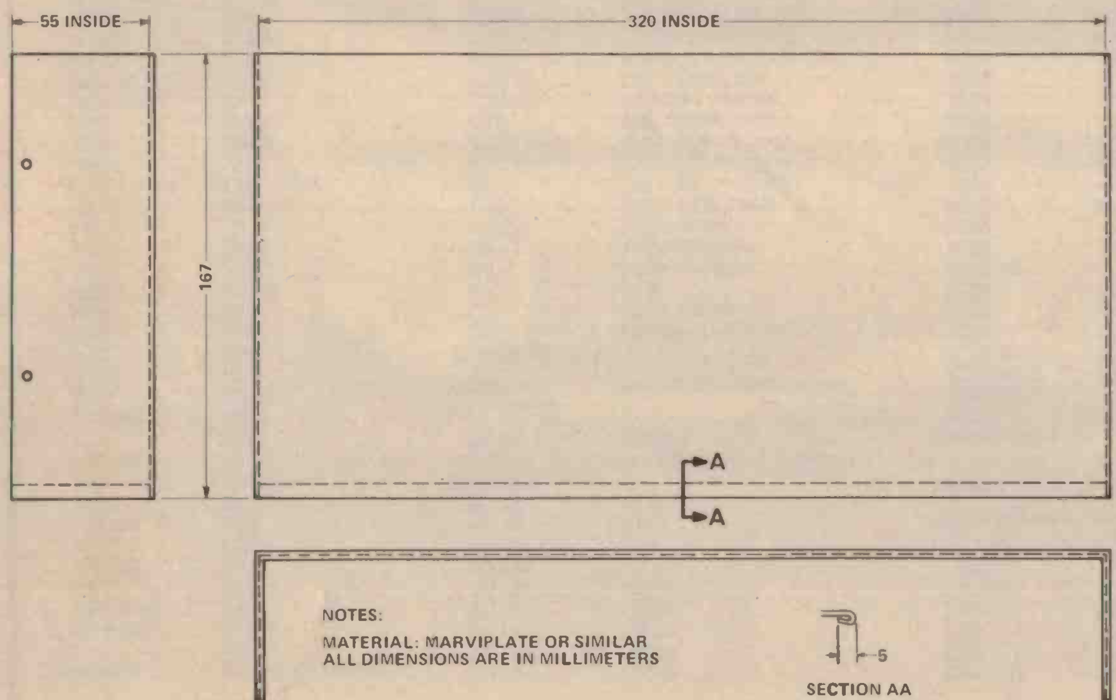


Fig. 19. The cover for the frequency counter.

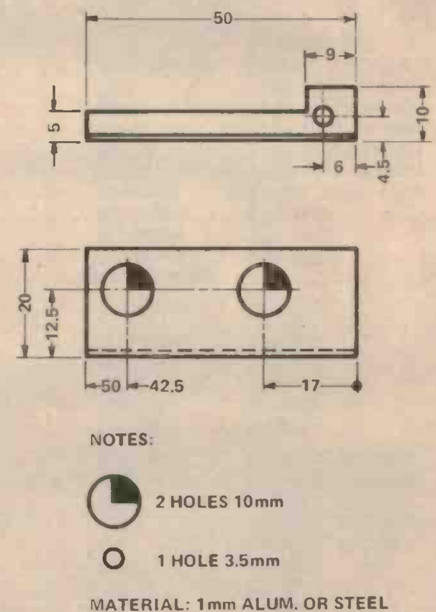


Fig. 20. The potentiometer mounting bracket.

1 GHz FREQUENCY METER — TIMER

PARTS LIST — ETI 140

Resistors all ¼ W, 5% unless stated
R1-R56 . . . . . 470R
R57-R60 . . . . 3k3
R61 . . . . 33k
R62,63 . . . . . 3k3
R64 . . . . 470R
R65,66 . . . . . 3k3
R67 . . . . 15k
R68 . . . . 330R
R69,70 . . . . . 10k
R71 . . . . 3k3
R72-R74 . . . . 10k
R75 . . . . 470R
R76 . . . . 10k
R77 . . . . 33k
R78 . . . . 10k
R79 . . . . 33k
R80 . . . . 470R
R81 . . . . 2k2
R82 . . . . 220R
R83 . . . . 1k
R84,85 . . . . . 3k3
R86,87 . . . . . 47R ½W
R88 . . . . 1M
R89 . . . . 220R
R90 . . . . 47R
R91-R95 . . . . 1k
R96-R101 . . . 220R
R102 . . . . . . 33R
R103 . . . . . . 100R
R104 . . . . . . 33R
R105,106 . . . 100R
R107 . . . . . . 150R
R108 . . . . . . 100R
R109 . . . . . . 150R
R110 . . . . . . 100R
R111 . . . . . . 150R
R112 . . . . . . 100R
R113 . . . . . . 150R
R114 . . . . . . 4k7
R115 . . . . . . 10k
R116 . . . . . . 3k3
R117 . . . . . . 4k7

Potentiometers
RV1 . . . . . . 1M log PR16PC (Plessey)
RV2 . . . . . . 1k lin "

Thermistor
TH1 . . . . Philips 2322 640 90004

Capacitors
C1 . . . . 22p NPO ceramic
C2 . . . . 10n polyester
C3 . . . . 1n0 "
C4 . . . . 100p ceramic
C5 . . . . 1n0 polyester
C6-C9 . . . . . . 100p ceramic
C10 . . . . 220µ 16V electro *
C11 . . . . 100n disc ceramic
C12,13 . . . . . 33µ 10V tantalum
C14 . . . . 100n disc ceramic
C15 . . . . 220p silver mica
C16,17 . . . . . 1n0 disc ceramic
C18,19 . . . . . 100n 100V disc
C20 . . . . 10p 100V ceramic
C21 . . . . 220µ 35V electro *
C22-C24 . . . . 2500µ 16V electro *
C25 . . . . 220µ 35V electro *
C26 . . . . 10µ 16V tantalum
C27 . . . . 10µ 35V electro *
C28-C33 . . . . 33µ 10V tantalum
C34-C37 . . . . 33n disc ceramic
C38 . . . . 10µ 35V electro *
C39 . . . . 10µ 10V tantalum
C40 . . . . 33µ 10V tantalum
C41,42 . . . . . 33n disc ceramic
C43,44 . . . . . 1n0 disc ceramic

* all electrolytic capacitors should be the single ended types.

Variable Capacitors
CV1 . . . . 2–10p trimmer

Semiconductors
IC1,2 . . . . . . 74S74
IC3-IC9 . . . . . 74LS90
IC10-IC17 . . . 74LS75
IC18-IC25 . . . 74LS47
IC26 . . . . . . 74S02
IC27 . . . . . . 74LS90
IC28 . . . . . . 74S10
IC29,30 . . . . 74LS00
IC31 . . . . . . 74LS73
IC32 . . . . . . 4518 (CMOS)
IC33 . . . . . . 4520 (CMOS)
IC34 . . . . . . 4081 (CMOS)
IC35 . . . . . . 4518 (CMOS)
IC36 . . . . . . 4011 (CMOS)
IC37 . . . . . . 74LS123
IC38 . . . . . . 4001 (CMOS)
IC39 . . . . . . 4011 (CMOS)
IC40 . . . . . . 4013 (CMOS)
IC41 . . . . . . 4011 (CMOS)
IC42 . . . . . . 9582 (ECL)
IC43 . . . . . . OM335
IC44,45 . . . . SAB1048P,SAB1034P
IC46 . . . . . . 7805 (TO3 package)
IC47 . . . . . . 7905 (500mA version)
IC48 . . . . . . 7818 (500mA version)
IC49 . . . . . . 7805 (500mA version)

Q1,2 . . . . . . PN3643, 2N3643
Q3,4 . . . . . . BC559
Q5 . . . . BD139
Q6 . . . . 2N5485
Q7 . . . . PN3643, 2N3643
Q8 . . . . PN3645, 2N3645
Q9 . . . . PN3643, 2N3643
Q10,11 . . . . PN3645, 2N3645
Q12,13 . . . . PN3643, 2N3643

D1-D9 . . . . . 1N914
D10,11 . . . . BAW62
D12,13 . . . . 1N4004
D14,15 . . . . 1N5404
D16-D18 . . . 1N4004

Displays 1-8 . . DL707

Miscellaneous
PC board . . . . ETI 140A
PC board . . . . ETI 140D
PC board . . . . ETI 140P
Crystal . . . . . 4 MHz, 30pF, 70°c
SW1 . . . . 7201 toggle switch
SW2,3 . . . . . 7101 toggle switch
SW4 . . . . 7211 toggle switch
SW5 . . . . 7201 toggle switch
PB1 . . . . 8168 push button
Transformer . . 240V – 9V + 9V @ 1A PL 18/20 VA
Metalwork to suit
4 B&C sockets
3 core flex and plug
cable clamp
Piece of polarised plastic

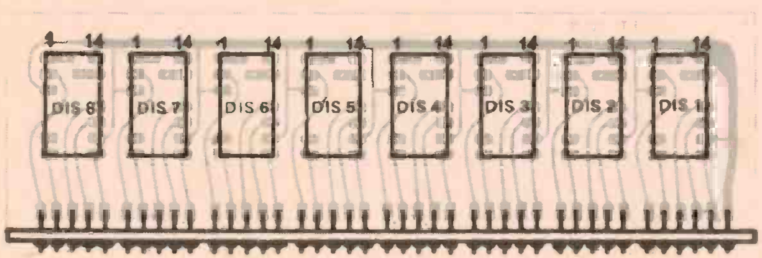


Fig. 13. Component overlay of the display board.

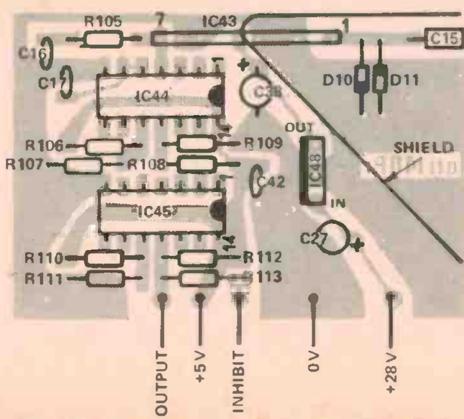


Fig. 14. Component overlay of the prescaler.

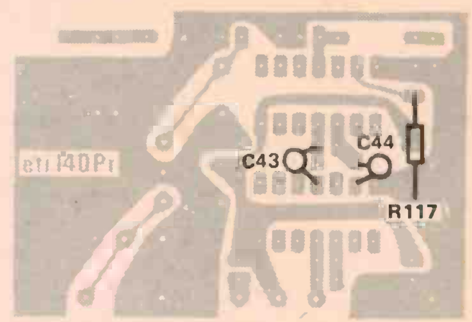


Fig. 15. View showing the position of C43, 44 and R116 on the rear of the prescaler board.

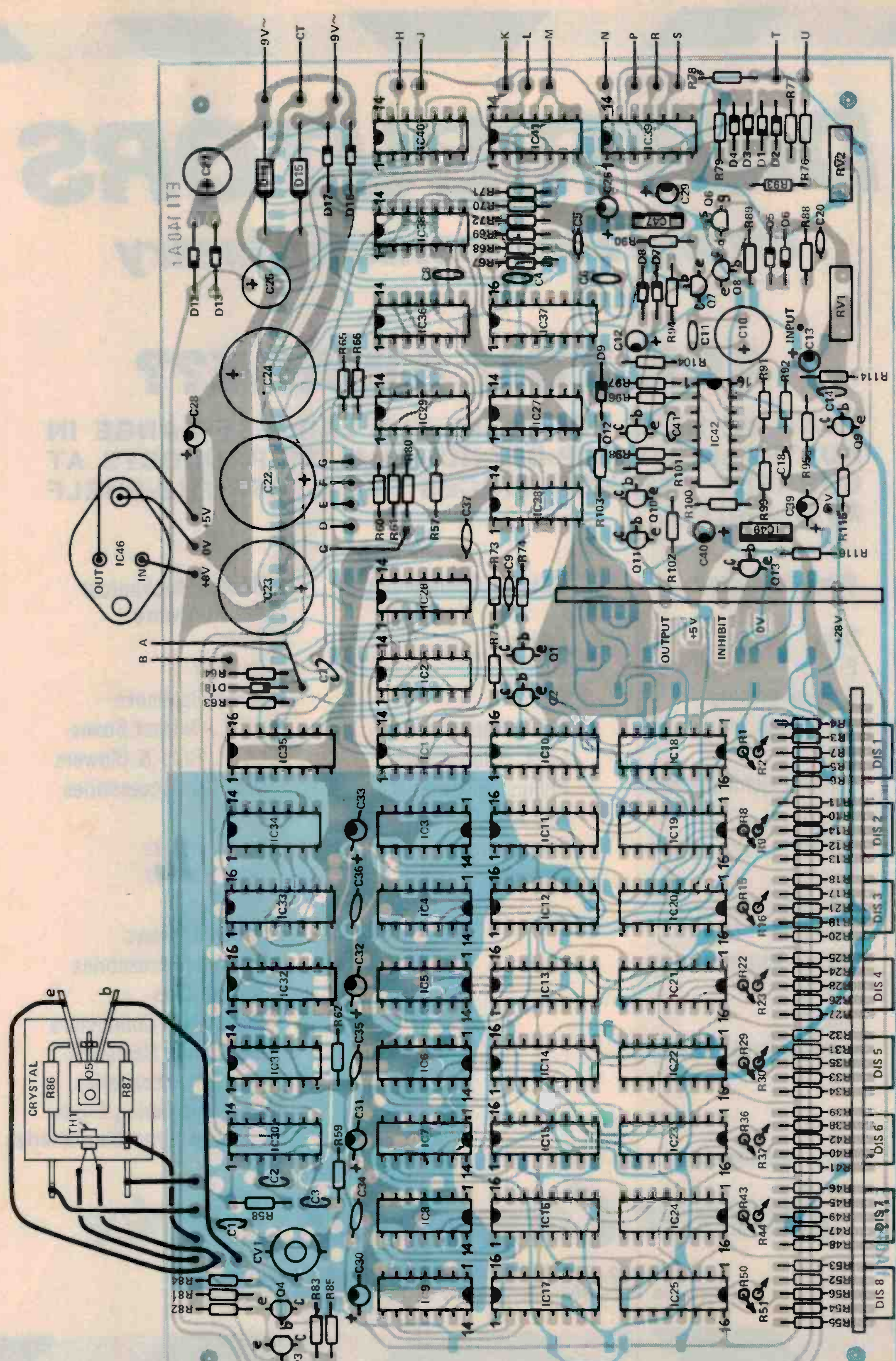


Fig. 16. The main component overlay. For the connection of wires marked A – U see Fig. 8. Wire B goes to the decimal point on DIS 5 (Pin 6) while wire C goes to the decimal point of DIS 1 (Pin 6).

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Soanar
Sprague

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Jean Renaud
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National Relays
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Switchcraft Connectors
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AMATEUR COMMUNICATIONS

Articles of Note

Apart from the already-mentioned article on narrow band voice modulation in the December issue of QST, that issue also carries a good introductory article on the subject of meteor scatter. 'VHF DX Via Meteor Scatter' should be of interest to the new crop of VHF enthusiasts that are thinking of trying something else apart from 2m FM and repeaters.

If you want to look over what's at the forefront of current amateur radio technology then you might take a peek at the January issue of Ham Radio magazine. There are five articles of note in this issue.

First up there's a 'Broadcast-Quality Television Camera', by Arthur Towslee, WA8RMC. Although built to the US 525-line standard, many of the techniques detailed in this article are directly applicable to other systems. A very detailed description of circuitry and construction together with the important design parameters is given.

Then there's 'Microstrip Transmission Lines' by the incomparable Jim Fisk, W1HR -- editor in chief of Ham Radio. Undoubtedly this will become one of the reference articles on this subject. The subject is covered in depth, including the development of the theory etc and includes a complete range of tables and graphs to enable the talented home-brew to carry on for himself. The subject is topical, of course, and will certainly be of interest to ETI readers who have followed the recent series on VHF solid state power amplifiers. An excellent bibliography of 17 relevant papers and articles is included.

FACT SYMPOSIUM

The FACT Symposium, mentioned in last month's news, is to be held at the Strata Motor Inn, 287 Military Rd, Cremorne in Sydney over the weekend of 20-21 May.

Orgaised by Roger Harrison VK2ZTB and the NSW VHF & TV Group committee, the Symposium papers have been finalised and the following topics will be covered:

- Sunspot Cycle 21 (Ken Mackracken VK2CAX)
- ATV Techniques for 420 & 1290 MHz (Peter Cossins VK3BFG and Les Jenkins VK3ZBJ)
- Solid State Power Amplifiers (Phil Wait VK2ZZQ and Roger Harrison VK2ZTB)
- Microprocessors and Amateur applications(Les Bell GM4CFM)
- Solid state SSB on 1296 MHz (Les Jenkins VK3ZBJ)
- Pulse Techniques for Amateurs (Kieth Gooley VK2BGZ)
- Using Anomolous Propagation for HF and VHF DX (Roger Harrison VK2ZTB)
- Modern Repeater Techniques (Jeff Pages VK2BYY, John Sheahan VK2ZPC and Jamie Campbell VK2YCJ)
- A Review of Antenna Systems for UHF Amateur Use (Les Jenkins VK3ZBJ)

Apart from presentation of the above a papers a number of practical 'workshops' will be presented in conjunction with the lectures. A trade show is also being organised.

Basic registration for the whole weekend , for local attendees or those with their own accommodation, is $20. This includes a copy of the symposium papers, plus lunch and morning and afternoon teas on both days.

Accommodation is available on a twin share basis for interstate attendees at $51 per person for two nights, which includes registration and all of the above items. Accommodation for one night, twin share basis, costs $35.50 per person which also includes all of the above with registration

Registration application forms and complete information can be obtained from the " FACT SYMPOSIUM ORGANISER," C/- 14 Atchison St Crows Nest 2065 NSW. Do it now!

Persons wanting accommodation will have to register by 28th April, all others by 5th May.

VFO operation for Novices

As from 15th March novice amateur licence holders will be allowed to use VFO control in their sub-bands. The usual restrictions about seeing that transmissions are confined within the band limits are applicable. Slide-on, as they say in the classics!

ATV gear

There seems to have been an upsurge of ATV activity in NSW and Victoria in recent months. However, the video side of things seems well catered for, but suitable transmitting equipment and UHF converters have been scarce. Some equipment fashioned after articles that have appeared in the German publication "VHF Communications" has been pressed into service, not to

Continued on p. 86

mention some 'bodgied up' designs intended for narrow-band operation.

Microlink P/L, a Melbourne firm of communications engineers – namely Les Jenkins VK3ZBJ and cohorts, is putting out some interesting gear for UHF ATV enthusiasts.

Microlink has an excellent little converter that can be obtained already built-up and operating for $25. You can get it for 420MHz or 580MHz operation with a nominal output on channel 3.

Also in the line of ATV goodies is a transmitter and video modulator, with 10W peak output at the sync tip. Price on application.

Custom-made antennas are also available from Microlink, reputedly having the best performance of any of the antennas currently available, bandwisth to burn and no matching problems.

If you want to know more then contact Les at Microlink, 12 Rosella Street, Frankston, 3199.

Tropo Link for Groote Eylandt

Australia's first low-power tropospheric radio link will soon be installed to link Groote Eylandt, in the Gulf of Carpentaria, with the mainland.

Systems of this type will open up new possibilities for reliable trunk line telephone communications in remote parts of Australia and other countries.

Designed and built by Amalgamated Wireless (Australasia) Limited, the system is expected to be in operation within a few months.

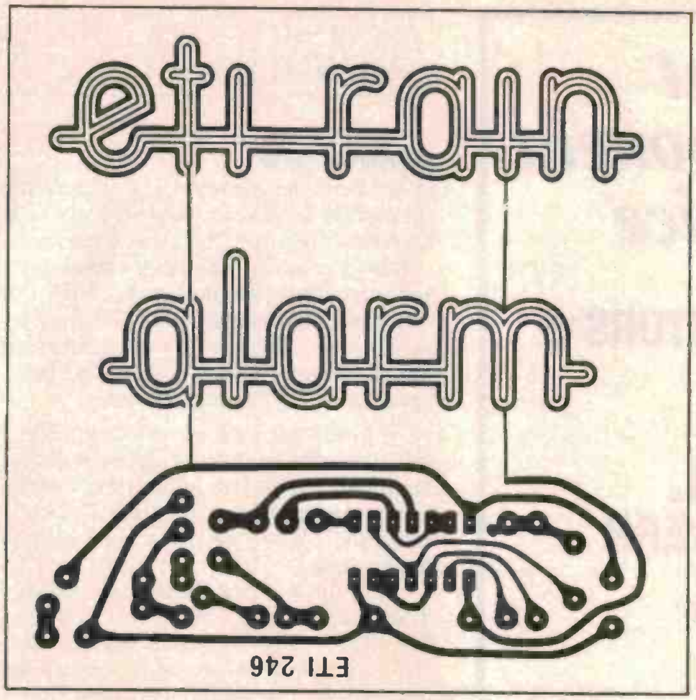
Groote Eylandt, a 2,000 sq. km. island 48 km from the east coast of Arnhem Land, has the largest single manganese mine in Australia, operated by the Groote Eylandt Mining Company a subsidiary of the Broken Hill Proprietary Company Limited. The island's total population is about 2,200.

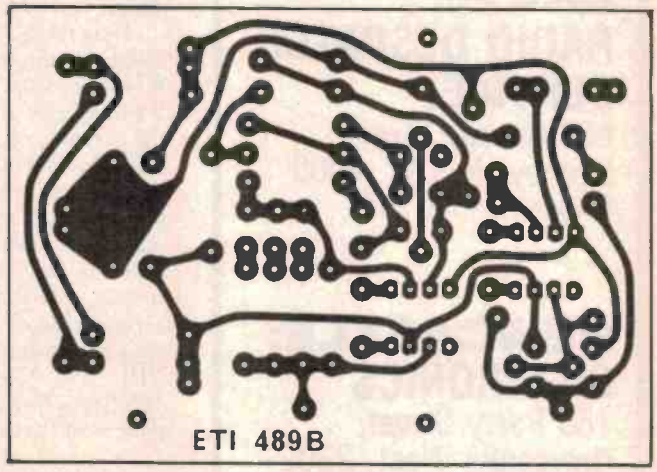
Opened in 1966, Groote Eylandt has had to rely on HF (high frequency) radio for communications with the mainland. This service has often been restricted by bad weather and adverse atmospheric conditions.

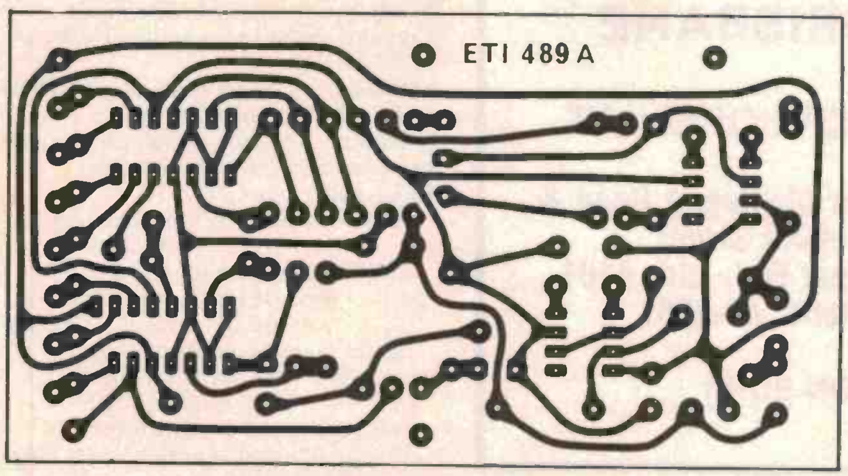
The troposphere is the layer of the atmosphere closest to the earth, extending upward for a distance of 10 to 15 km, and can be used to reflect radio beams back from a transmitter to a distant receiver.

Tropospheric communications can

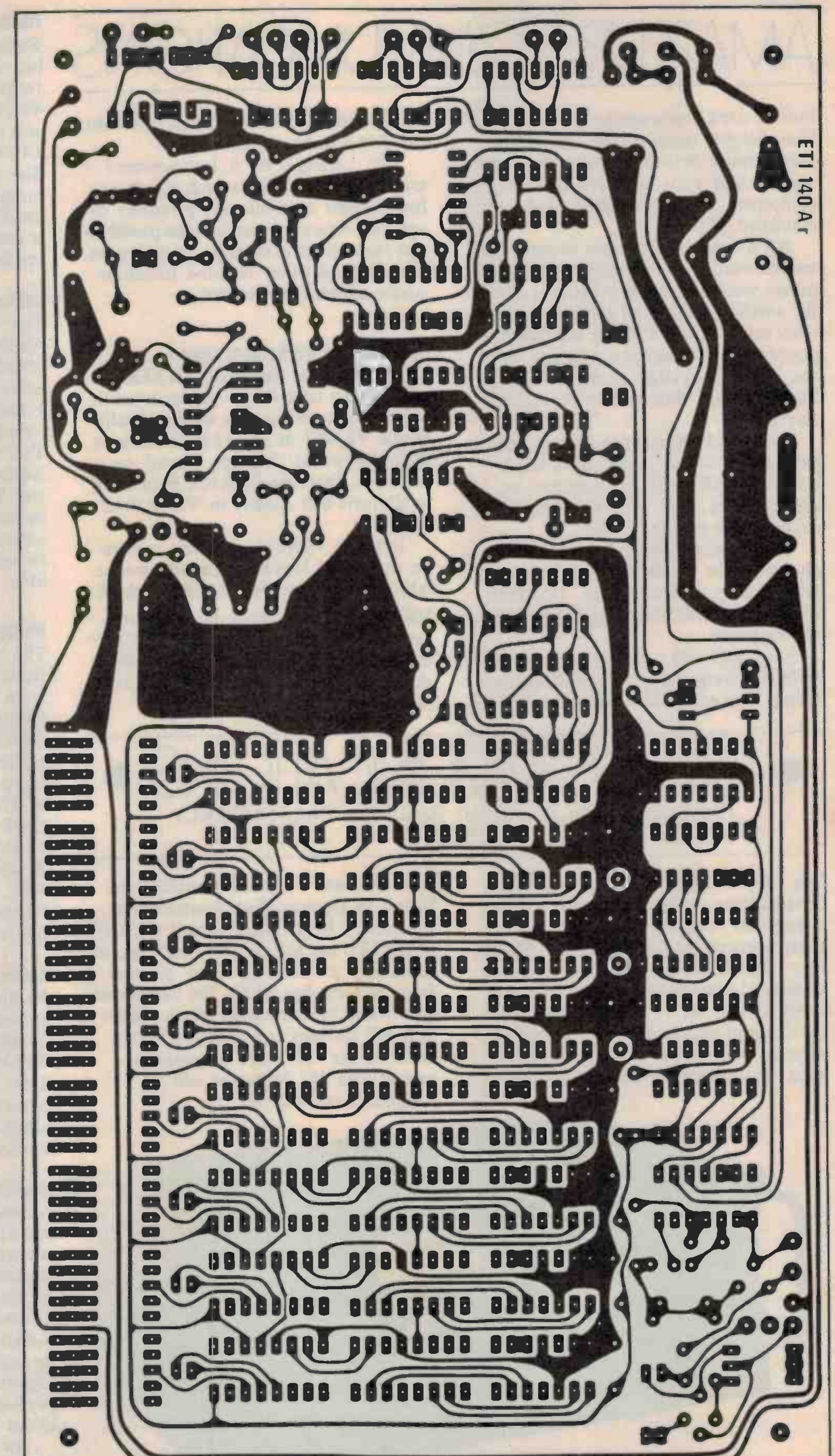
Continued on p. 88

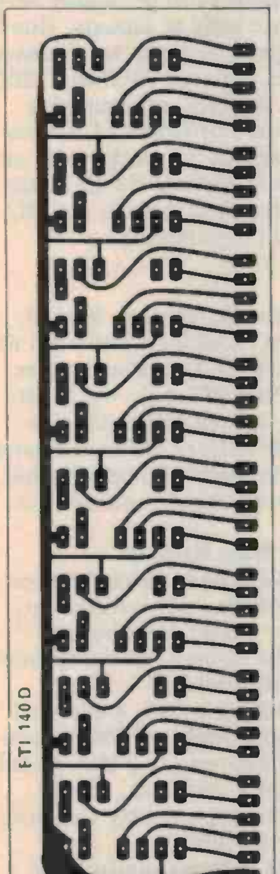






Owing to space restrictions, we have had to omit our propagation predictions this month. Normal propagation will be resumed next month.





AMATEUR COMMUNICATIONS

thus be used to eliminate the need for line-of-sight transmitters. Normally, they require extremely powerful transmitters and very sensitive receiving equipment, such as are used in Telecom's mainland system.

AWA designed a system to meet the special needs of Groote Eylandt. High power was not necessary because of th the smaller number of telephone and telex services called for by the island's population. The system will link with the Telecom system in the Northern Territory and thus with the rest of Australia.

The AWA microwave system will provide a 24-hour seven day a week service, unaffected by weather or stmospherics, and will provide 12 channels for speech or data.

The system incorporates quadruple diversity. On the island will be two seven metre dish antennae, 100 feet apart, each with matching transmitters and receivers.

Each unit will operate on a slightly different frequency, to guard against fading. This equipment will be duplicated on the mainland where it will feed into the Telecom trunk system.

The concept of a low-powered tropospheric system which needs no line-of-sight transmitters, promises to open up new communications possibilities for remote townships, mining sites, oil rigs, and other isolated locations where telephones are vital.

432MHz record broken again!

Seems like Les Jenkins (VK3ZBJ) can't take a trick lately. As reported in the February issue, Les worked Wally House VK6KZ on the 11th January to gain the world distance record on 432MHz. Distance between Frankston in Victoria and Albany in WA is 2442 km.

Les and Wally's jubilation was to be shortlived however. Several weeks later (date to be confirmed) Michael VK3ZQV at Carrajung in Gippsland, eastern Victoria, worked Orb VK6XY on 632MHz from Albany, extending the just-established record by 100 km! Nice work chaps.

• SWL COMMUNICATIONS •

Prepared by the Australian Radio DX Club (ARDXC)
PO Box 67 Highett, Vic, 3190.

The major international shortwave broadcasting stations make frequency changes at four set times each year, these being on the first Sunday in March, May, September and November. These transmission periods are known respectively as the "M", "J", "S" and "D" periods and all stations are required to register their channels in advance of each transmission period with the International Telecommunications Union in Geneva. The International Frequency Registration Board (IFRB) of the ITU has the task of international frequency co-ordination to prevent frequency clashes within the designated shortwave broadcasting bands. International stations are currently in the midst of the "M" – 78 transmission period. The "J" 78 period will commence on May 7th.

Indonesian news.

Radio Republik Indonesia at Jayapura has recently introduced two new frequencies. Jayapure has moved from 4980 to 4993 kHz for evening programs and is well heard between 1000 and 1400 GMT when transmission closes. The other new outlet is 11940 kHz, noted for morning programs from 2200 until 2300 GMT. The news from Jakarta is relayed at 2200 GMT. All programs are in Indonesian.

Ethiopa.

The Voice of Revolutionary Ethiopia, in Addis Ababa, has recently been observed on the new outlet of 7245 kHz, with good signals during a program in French at 1530 GMT. This is followed by a program in Somali at 1600 GMT. This is the International Service from Addis Ababa, scheduled between 1200 and 2000 GMT in various languages including English Afar and Arabic. This service is carried on 9610 kHz also, though best reception is noted on 7245 kHz.

Philippines

The relays of the American Forces Radio and Television Service (AFRTS) from the transmitters at Poro in the Philippines, resumed during March. AFRTS-Philippines had previously been off the air since early in January. Good reception is given by the new frequency of 21670 kHz, between 0400 and 1200 GMT. The AFRTS programming includes featured programs of various American domestic networks such as ABC, NBC and National Public Radio. Coverage of domestic sport in the USA is a feature of programming.

Spain.

Radio Exterior de Espana, Madrid, currently gives excellent signals with the Spanish service to Australia between 0800 and 1100 GMT daily on 11910 kHz. Madrid is using this channel in place of 11740 kHz, on the recommendation of the Australian Radio DX Club, in order to avoid harmful interference.

New Receiver from National

A new National DR48 ten-band communications receiver, just released in Australia by Haco Distributing Agencies, offers many advanced features for the SW enthusiast.

These include a bright, easily-read 5-digit electronic display of SW frequency and newly-developed I^2L (Integrated Injection Logic) circuitry which performs functions previously requiring about 2000 transistors.

An antenna trimmer control and 2-speed tuning are other advanced features of this new premier model in the National range.

Recommended retail price of the DR48, which is available from National Dealers in all States, is $470.00.

Uruguay

This is a difficult country to hear in Australia, and one of the few stations which may be heard is Radio El Espectador, at Montevideo, operating on 11825 kHz. Reception is possible during February and March, and again during September and October during the period 0900 until 1025 GMT following morning sign on, Uruguay time. Reception was noted in March at this time with programming in Spanish. Signals from Uruguay, and the rest of south-eastern South America must cross the Antarctic regions to reach Australia, thus making reception highly seasonal. For example the summer brings constant daylight to Antarctica, and results in signal absorption. The winter brings total darkness, meaning the maximum usable frequency for reception paths crossing the Antarctic drops to very low levels. Thus the international shortwave bands of 6 Mega-Hertz and above will not generally support Antarctic propagation in these months.

The band which provides the greatest scope for reception of stations in Brazil, Uruguay, Argentina and other centres in south-east South America is the 49 metre band, between 5950 and 6200 kHz. Many stations are audible from their early morning sign-on at 0800 or 0900 GMT, and are heard in south east Australia from about February until early May. Here are details of some of the stations currently audible:

5965kHz, Radio Guaiba at Porto Alegra (Brazil) opens transmission at 0900 GMT and remains audible until about 0940 GMT. All programming, as with all Brazilian stations, is in Portuguese.

6025kHz, Radio Nacional at Asuncion (Paraguay). Morning sign-on may be observed at 0900 GMT, with announcements in Spanish. This station may only ben noted on week-days however, as Radio Portugal uses this channel for weekend programs in the same time period.

6165kHz, Radio Cultura at Sao Paulo (Brazil) becomes audible at about 0900 GMT after signals from Switzer-land fade-out on this channel. Programming often includes classical music concerts.

African signals

The island state of Mauritius broadcasts on 4850kHz, with programs in French and English. Reception is possible in Australia between 1600 and 1830 GMT. The Mauritius Broadcasting Corporation has recently been observed with a news bulletin in French at 1730 GMT, while a bulletin of English news relayed from the BBC is audible at 1800 GMT. Station close-down is at 1830 GMT.

Finland

Radio Finland now has a daily trans-mission in English beamed to Australia. This service is scheduled for 0930-1000 GMT on 17785 kHz, and this is followed by a program in Finnish until 1100 GMT on the same channel. The popular "Sunday Best" program in English, which is heard weekly and presents highlights of Radio Finland's programs for the week plus special features, continues to be aired 0800-0930 GMT on 21495 kHz for Australian listeners. The Sunday Best program is also carried on 11755 kHz at this time, for European listeners.

Switzerland

The Swiss Broadcasting Corporation, Berne, has been using several new channels during the current transmission period. The English service to North America is now heard daily on 15305 kHz from 0145-0215 GMT and also gives good reception here in Australia. The station has moved here from the 49 metre band as the northern hemisphere summer approaches. Another new outlet from Berne is 17830 kHz which is well heard in Australia with Italian to South American at 0030 GMT, followed by Spanish at 0100 GMT.

Chile

Radio Nacional de Chile has recently installed eight new 100 kilowatt trans-mitters at Santiago, and thus its broad-casts are now more frequently and easily heard in Australia. The station has been experimenting with frequency usage. The external service, La Voz de Chile, carries an English program at 2200 GMT, and the latest frequencies used for this service have been 11950 and 15115 kHz. Other frequencies which may carry this program are 11800, 15150, and 11920 kHz, as well as 17715 kHz. La Voz de Chile is planning to introduce a regular service for Australian listeners shortly, for morning reception here in Australia, as two steerable curtain antennas have been installed for this purpose.

These notes are compiled for ETI by members of the Australian Radio DX Club. People wishing to know more of the club's activities, and about shortwave radio listening in general, should write to the General Secretary of the ARDXC, PO Box 67, Highett, Victoria 3190, enclosing a 20c stamp for return postage.

CB COMMUNICATIONS

Ban on Linears

Linear amplifiers (boosters, kickers, boots . . .etc), illegally used to boost the output of CB rigs to powers from 100 watts up to 1 kW, are to be banned very shortly in the US.

Probable date of the ban is 1st July this year. Waivers will be granted to manufacturers and dealers who can show that the date of the ban and required type-acceptacne cannot be met. The FCC in proposing the ban, decided to require type-acceptance of linears intended for sale on the amateur radio market, so that technical standards could be developed to prevent the units being used by CB operators in the 24-35 MHz range.

The FCC's action was taken to cut down interference with TV and other home appliances caused through illegal use of the linears.

One FCC commissioner, and the agency's engineering staff, opposed the ban on the grounds that type-acceptance would be enough to have the desired effect. But, other officials said the ban would help enforcement efforts.

SSB Handbook

"The New CB Sideband Handbook" by Don Stoner will be available in Australia shortly through Mobile One.

This book is a must for all existing sidebanders and those contemplating going SSB.

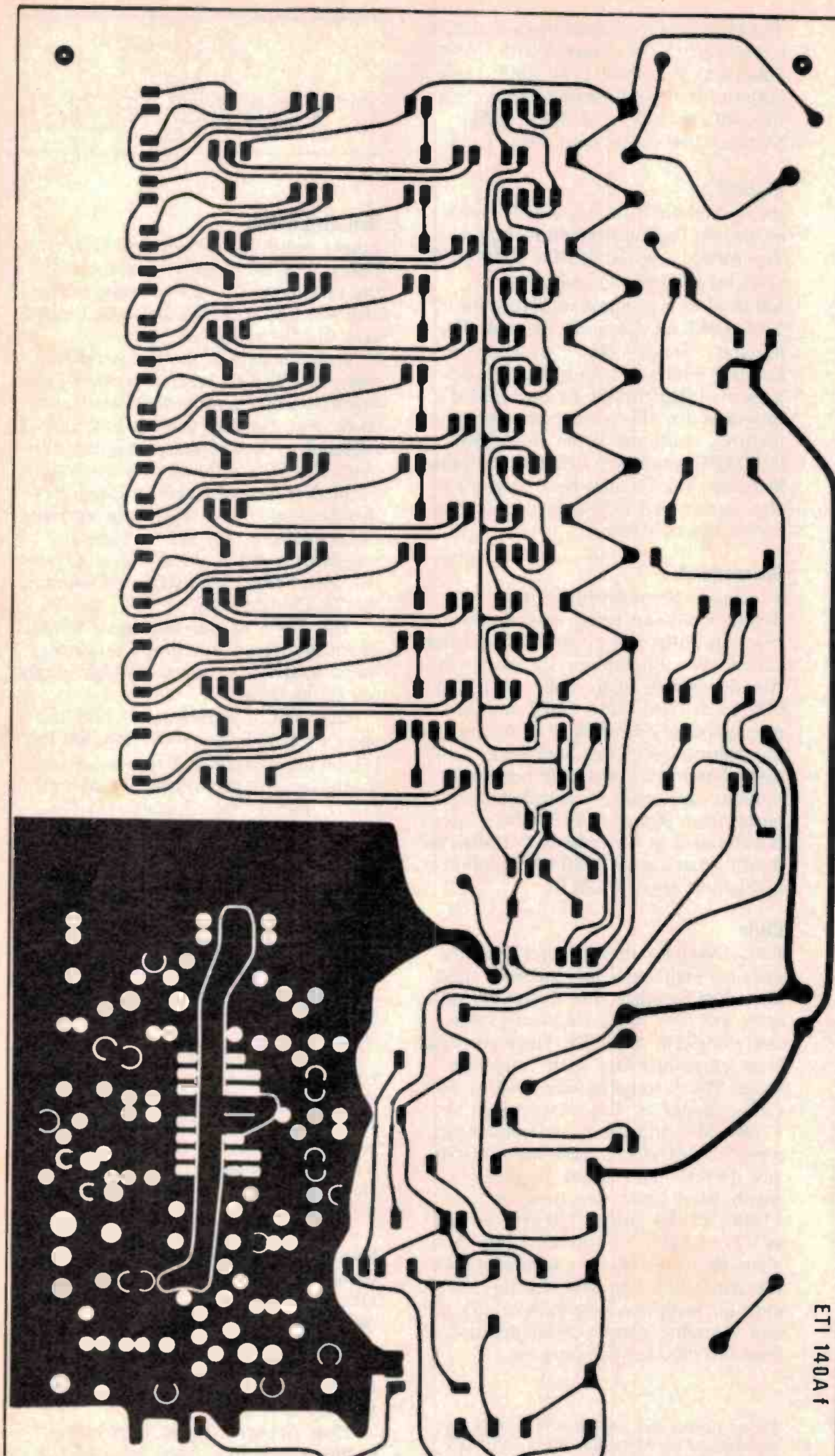
Don Stoner has been into CB in the USA since he was knee high to a PL259. His advocacy of SSB is nothing new either — he was building his own SSB ham rigs back in the early 1950s and has written a sideband handbook for hams. He should know something about the subject.

The book has eight chapters covering history, why SSB reduces airwave pollution, some theory of SSB, skip and DX, on-air etiquette, the world of ham radio and buying a rig.

Some of the material pertains specifi-cally to the CB scene in the USA but it is interesting and informative none-theless.

Don Stoner's book is reviewed exclusively in the April issue of CB Australia. Copies available through Mobile One dealers or directly from Mobile One (02) 516-4500.

Continued on p. 95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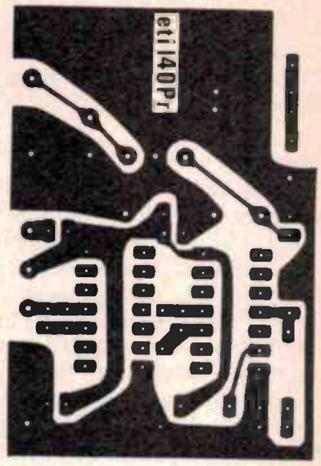
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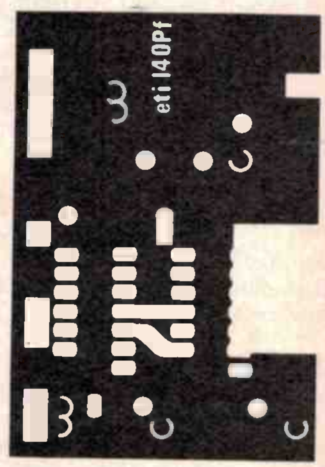
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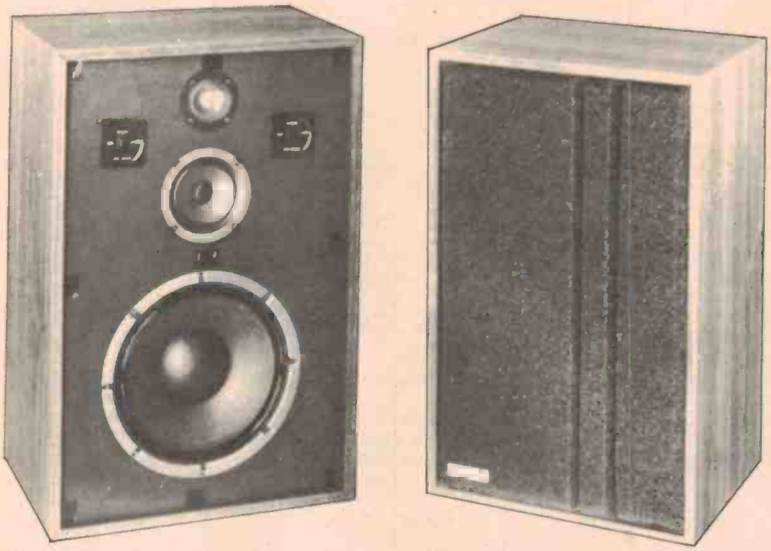

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All Playmaster speakers feature removable de-luxe foam grilles and are finished in wood-grain vinyl that's almost impossible to tell from real timber — except that it's washable and more durable.

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Speaker Enclosure:	75 litre, infinite baffle	53 litre, infinite baffle
Frequency Response:	28Hz — 20kHz	35Hz — 20kHz
Impedance:	8 ohms	8 ohms
Sensitivity:	93 dB	92 dB
Power Rating:	80 watts music	60 watts music
Crossover:	3-way (1500Hz & 5000Hz)	3-way (1500Hz & 5000Hz)
Dimensions:	71.7(H)x47.5(W)x29.3(D) cm	62.0(H)x39.3(W)x29.3(D) cm

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propagation a closer look

Radio communications beyond the horizon in the high frequency (HF) spectrum between 3 MHz and 30 MHz are carried on as the result of the bending of the radio waves in the ionosphere, that region of our atmosphere extending from about 60 km to about 1000 km above the earth.

The ionosphere can bend radio waves so that they return to earth from hundreds of kilometres to many thousands of kilometres distant.

Without the existence of the ionosphere, long distance radio communications, shortwave broadcasting, amateur radio 'DX' etc would not be possible — and one G. Marconi would probably have died an unknown pauper!

The ionosphere enables shortwave radio stations such as Radio Australia, Radio Peking, The Voice of America etc to broadcast programmes across the world. It enables radiotelephone communications to ships at sea and contact with international aircraft. Closer to home, the ionosphere enables the Royal Flying Doctor Service to operate across the wide-spread sparsely populated centres of Australia's inland. The Outback Radio Network depends on it!

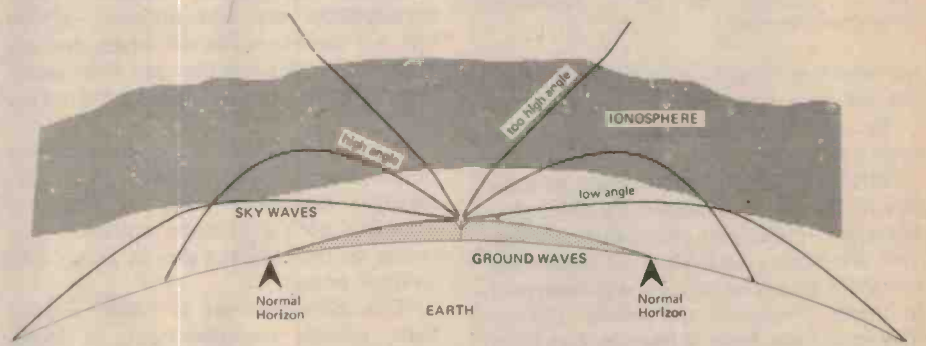


Figure 1. The ionosphere bends radio waves such that they travel great distances beyond the horizon.

The Solar prime mover

The sun, which dominates almost every phase of our lives, influences all HF radio communication beyond the horizon. The sun generates the ionosphere; solar activity has a considerable influence on this area of our atmosphere and thus affects propagation of HF radio waves.

Ionisation of the upper atmosphere is brought about largely by ultraviolet radiation from the sun, along with solar X-ray radiation. This solar radiation strips electrons from the atoms of the rarified atmospheric gases existing in our upper atmosphere.

The result is not a single, thick region or 'band' of ionisation, as you may suppose. The ionosphere separates into several readily defined regions having varying densities, located in layers at different heights.

Each layer has a relatively dense region, called the *peak* of the layer, the ionisation tapering off above and below this region. The peak is not necessarily located in the centre of the layer, nor does the ionisation always disappear completely between layers.

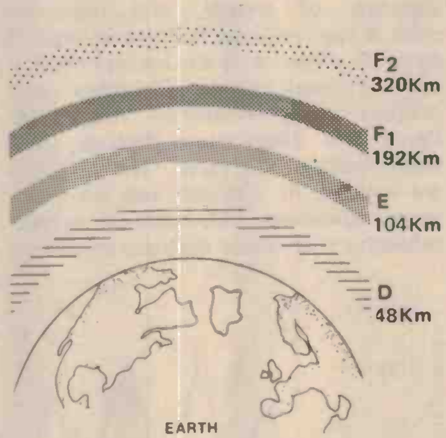


Figure 2. The ionosphere divides into readily defined regions which have been designated as illustrated here. The amount of ionisation in each layer varies diurnally (i.e.: throughout the day), seasonally (throughout the year) and through the 11-year sunspot cycle. Disturbances on the sun have a variety of effects on the ionosphere and thus on radio communications.

Spotting good propagation

The sun's UV radiation output varies over an approximately 11-year cycle, greatly influencing the behaviour of the ionosphere. For many years this cyclic behaviour of the sun has been monitored by means of *sunspots* — dark areas which appear on the face of the sun, and over the last two decades, by measurement of the *solar flux* (RF noise radiation) at 2800 MHz (10.7 cm wavelength).

Sunspots are enormous areas on the sun's surface which are cooler, and thus do not appear as bright as the surrounding area. Hence, they look like 'spots' on the face of the sun. Their size can range from several hundred kilometres across to greater than 100,000 km. By comparison, the earth's diameter is only 13,000 km.

The spots usually appear in clusters, the largest extending nearly half a million kilometres across the face of the sun on occasions.

Sunspots can form and remain visible from several days to several months, often growing in size the longer they last.

The sun rotates about its axis with a period of about 27 days. If a sunspot persists long enough, it can be seen to move across the face of the sun, taking about 13½ days to go from one side to the other (*limb to limb*, as they say). Having reached one side and disappeared, it may reappear on the other side about 13½ days later.

Man's interest in the sun and solar phenomena is clearly older than recorded history. Ancient Sumerian and Chinese cultures observed and recorded sunspots. Galileo turned his telescope,

Figure 3. The sun as viewed in the visible light region showing several small spots, a relatively large spot and sunspot groups. (Photo courtesy of the Ionospheric Prediction Service.)

the first ever made, onto the predominant celestial body and observed spots! — he was labelled a heretic for telling what he saw.

WARNING: Do not attempt to look directly at the sun, especially through a telescope — this can result in blindness. The alternative technique of projecting the sun's image onto a card is described in many books on astronomy. Galileo may not have been a heretic, but if he ever looked through his telescope at the sun, he was probably a silly old twit.

Records of systematic sunspot observations date back some 300 years. However, reasonably reliable data is only available since about 1850.

The sun is monitored continously from a number of observatories around the world. Sunspot observations are statistically smoothed to provide a continuous record — this is termed the Zurich Sunspot Number, which is a statistical 'fudge factor' on which ionospheric propagation predictions are based. More on this later.

Sunspot Number does not mean 'number of sunspots'. It is a statistical term which allows comparison with past figures and provides an index of sunspot activity.

The sunspot number has a cyclical variation with a mean period of 11 years. Periods between sunspot peaks have been as short as 9 years and as long as 13 years. The sunspot number between the peaks and minimums of the cycles also varies greatly. The sunspot cycles have been 'numbered', for the convenience of reference, back for 200 years. Cycle 18 peaked in 1947, cycle 19 — the biggest on record — peaked in 1957 with a sunspot number in excess of 200. Cycle 20 peaked in 1969 reaching a sunspot number of 120, which is about average intensity.

If you thought the DX wasn't anything spectacular in 1969-70, you should have been around in 1907 when the sunspot number barely reached 60 during the peak!

Sunspot cycle minimums don't always reach zero levels. Some minimums however have shown little or no activity for many months.

The sunspot cycle, while having an 11-year mean period as observed between peaks, has been identified in recent years as actually being a roughly 22-year period based on the magnetic field variations of the sun. Alternate sunspot cycles show a pole reversal in the solar magnetic field.

Solar Disturbances

On occasions, the surface of the sun is disturbed by sudden 'storms'. These disturbances are not normally visible but are readily detected when the sun is viewed at a particular red light wavelength, known as H-alpha, emitted by hydrogen.

These very intense, localised outbursts increase very rapidly to a peak, taking a minute or less, and then the intensity of the H-alpha emission decreases to its normal value in about half an hour or so.

This phenomenon is called a *solar flare*, usually occuring near, or associated with, a sunspot.

Solar flares generate enormous amounts of energy, and increased solar X-ray radiation from these regions cause disturbance to the ionosphere and to communications. Electrons and protons are also emitted from solar flares, and these travel through solar wind towards the earth. The particles are emitted in a stream and are much more numerous and move at greater velocities than those particles contained

Figure 4. The sun as viewed in the red wavelength region emitted by hydrogen — H-alpha emission. Two large active regions can be seen along with associated 'filaments'. (Photo courtesy of the Ionospheric Prediction Service).

in the normal solar 'wind'.

Upon reaching the region near the earth these particles have a considerable influence on the earth's ionosphere and magnetic field, producing sudden and dramatic changes as well as precipitating other events — such as aurorae — which will be described in more detail later.

Apart from flares, disturbances not associated with sunspots also cause disturbances to the ionosphere and the earth's magnetic field. *Hot Spots* — which are of longer duration than flares, are emitting regions on the sun's surface that expel streams of particles which affect the ionosphere. These, and other areas on the sun's surface which emit persistant streams of particles, have longer durations than flares but the effects of the particles emitted is less severe.

To be continued . . .

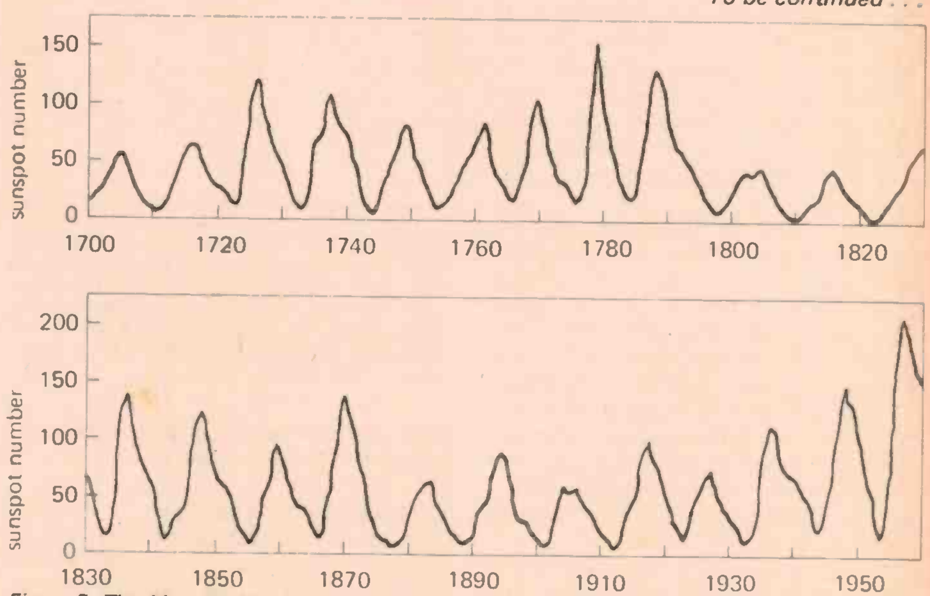
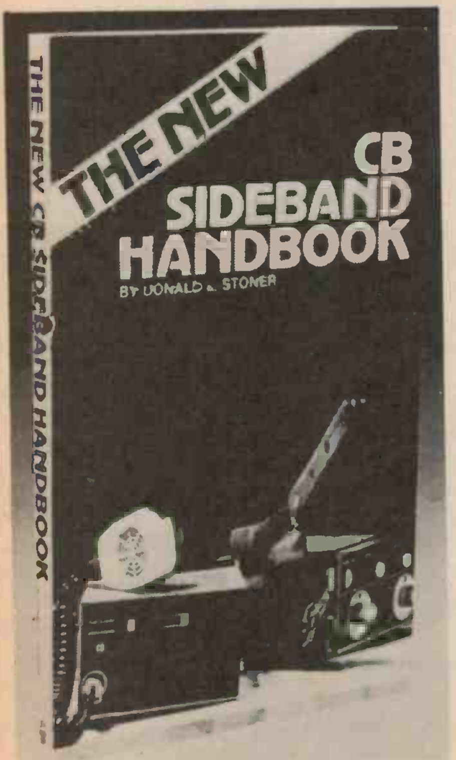


Figure 5. The 11-year solar cycle is clearly evident from this plot of the Sunspot Number from 1700 to 1960.

CB COMMUNICATIONS

Continued from page 86.



The Stoner CB Sideband handbook.

Tandy hide-away

The Tandy TRC-461 was released quietly late last year, but has only recently become generally available.

Called the "one-hander" the TRC-461 has a remote-mounting transceiver and a unique microphone with all the controls right at your fingertips.

No longer do you have to grope around under the dash while trying to keep your eyes on the road, steer, look to the right, miss the bike on the left and watch the highway patrol coming up behind!

The transceiver module is small and compact allowing it to be mounted in tight spaces — like under the dash — or unobtrusively in the boot, under a seat etc. The rig can be kept away from the prying eyes of potential thieves. A 5m long extension cable allows the transceiver and handset to be well separated for remote operation in almost any vehicle.

On the technical side, the TRC-461 incorporates a PLL synthesizer for precise frequency control as well as a noise blanker and a noise limiter that operate all the time.

Fully P & T approved, the TRC-461 retails for just under $200 and is available from any of the 111 Tandy stores throughout Australia.

FM320

PHILIPS WILL RELEASE their model FM320 UHF CB transceiver late march through early April, and judging from the performance of early production sets, both on the bench and in field trials, it seems that UHF CB will set new directions in CB operation in the near future.

The Philips FM320 is an FM transceiver covering the 40 UHF CB channels from 476.425 MHz through to 477.400 MHz. It incorporates a PLL frequency synthesizer and runs 5 watts output from the transmitter. The FM320 has received type-approval from the P & T Department as it meets their specification for UHF CB transceivers, RB250.

Controls

The volume control dominates the front panel. The large thumb-and-forefinger knob operates smoothly providing a smooth variation in the receiver volume.

The S/RF meter located on the left hand side of the front panel indicates signal strength and RF output in separate colours as is conventionally found on 27 MHz rigs.

The mic socket is a standard DIN type and is sensibly located on the right hand side of the front panel.

The channel readout is a seven segment LED display that is quite bright and easy to read over a wide range of angles. The channel change control is beneath it. This is a lever switch, as the channels are changed electronically by pressing the lever left for decreasing the channel number, right for increasing it. A single press changes the channel once, holding it down causes the transceiver to step through the channels at the rate of several per second.

Beneath the meter are the mute switch and the channel reset switch. The mute switch has a centre position (0) which opens the mute, a 'high' position where the receiver will only unmute on strong signals and a 'low' position where the re receiver unmutes on quite weak signals. Saves fiddling with a squelch knob when you're mobile!

The channel reset switch provides the facility of resetting the transceiver to Ch.11, from whatever channel you're on. Presumably, this is the 'call channel' Philips have selected. Note however, that channels 11 to 35 on UHF are not currently available for CB use.

The channel reset switch also allows selection of a channel nominated by the owner of the transceiver. This is provided by a diode ROM which is part of the PLL synthesizer control circuitry.

The power on/off switch is located right next to the mic socket and can be easily found by feel - no taking your eyes off the road -- indeed, most of the controls can be operated this way. Three LED indicators above the mic socket show power on, Rx or Tx.

The case is a three-piece plastic moulding -- front panel, top and bottom covers. The whole business is secured by four self-tapping screws and locking tabs that fit together on the three mouldings. The whole assembly is quite robust.

The front panel lettering is in fluorescent orange which is quite visible even in very low light. The model number and company name are picked out in white.

The handset to be provided with the FM320 will be a neat, palm-fitting type with a comfortable press-to-talk bar and a channel change switch. This is very co convenient as most operation with FM transceivers requires the majority of controls to be simply preset and only the channel change and Tx switch are operated to any extent. Having these on the mic is a big asset.

The overall styling, with the black matt-finish cabinet, brilliant lettering and panel layout, gives the rig a very professional look. The styling of the panel and the layout of the controls is cl clearly designed for maximum operator convenience and is streets ahead of most 27 MHz rigs.

Internal construction is also carefully thought out. The majority of the transceiver circuitry is located on one PC board, with a smaller PC board behind the front panel locating the channel display and controls.

Performance

Operationally, the FM320 is smooth and unflustered. Panel layout proves to be an operator's dream. Sound quality and clarity are excellent -- performance here is well beyond that obtained from many high-quality 27 MHz rigs. FM certainly has the edge in this department. However, it remains to be seen how the FM320 performs in a crowded band situation, but the specs are certainly encouraging in this area.

The FM320 was put through its paces on the bench with the kind assistance of the St George Communications Company of Darlinghurst in Sydney. They are specialists in VHF/UHF mobile and base station installation.

From the measurements, sensitivity is excellent and the test report noted that no blocking of the receiver was noted at high signal levels. Unlike the case with most 27 MHz rigs, good copy can be maintained between two vehicles very close together. The transmitter gave the full 5W output and the spurious emissions were well down.

Stability of the transceiver was particularly notable, however, the set submitted for test was 1 kHz higher than the channel frequency on transmit. This had no noticeable effect on the air.

In summary, we think the FM320 is an excellent first effort from Philips for UHF CB equipment. UHF may not replace 27 MHz, only time will tell, but it will certainly provide something impressively different -- vive la difference!

Reviews

Chroma-Chime

Regular readers will recall that one of our projects last month was a microprocessor-based electronic doorchime. Well, we've never known Dick Smith to be slow off the mark with a new idea, and electronic doorbells are no exception. Dick is now importing the British-designed Chroma-Chime doorbell kit, which is, like our design last month, based on a microcomputer.

The Chroma-Chime kit is about as complex as a pocket calculator kit, but with none of the problems of miniature components. The assembly manual is extremely well written and put together, with very clear photographs and drawings. All the components fit on a single board which is by no means crammed, making it easy to work on. This board then fits into the moulded plastic case and is secured by three screws.

The circuit is not very complex, with most of the work being done by a Texas Instruments TMS 1000 microcomputer, basically in the same fashion as our SC/MP-based design last month. The TMS 1000 contains the read only memory with the note patterns for 24 tunes. Apart from a transistor to latch the power on for the circuitry, and an audio amplifier, there is also some wave-shaping circuitry which allows the user to alter the tone of the music from a buzz-like square wave sound to a chime effect. In addition, the volume and speed can also be varied.

The tonal quality of the unit is quite pleasant but the initial enthusiasm of the household when the unit is installed will, in many cases, cause the owner to regret that he every bought the darned thing! However, after this honeymoon period is over, it is possible to restore sanity and 'ring the changes' by changing the selected tune periodically.

We found the kit to be very easy to assemble, and an ideal kit for the beginner. The Chroma-Chime is available from Dick Smith stores for $49.50.

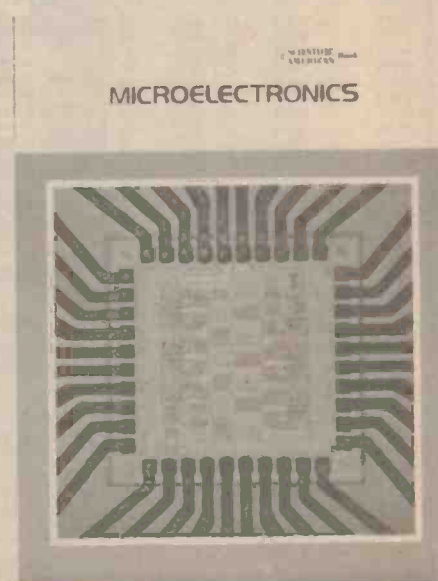
'Microelectronics'

Microelectronics. A Scientific American Book, W H Freeman, 1978, $6.75. Review copy supplied by ANZ Book Pty Ltd of 23 Cross Street, Brookvale, NSW 2100. We are delighted to see that the celebrated September '77 Microelectronics issue of Scientific American has been reprinted in book form. This magazine was rumoured for some months prior to publication, and upon its appearance in Australia, just about every copy was spoken for, leaving many disappointed would-be purchasers.

This soft cover book version of the magazine incorporates all the articles from the September '77 magazine (except the Amateur Scientist and Mathematical Games columns) with the important addition of an index. An introductory chapter by Robert Noyce, chairman of Intel, is followed by a chapter on Microelectronic Circuit Elements and one on The Large-Scale Integration of Microelectronic Circuits. The next two chapters cover the most important devices in the microelectronic revolution - memories and microprocessors. The following three chapters deal with the influence of the microprocessor on three areas of hitherto 'conventional' electronics - Data Processing, Instrumentation and Control, and Communication: firstly, the effects microelectronics advances will have on the design of large computers and secondly, the small personal computer the microprocessor makes possible.

Each of the chapters is presented in typical Scientific American style, with plenty of good photographer and clear drawings. The book is mainly written for the layman, with no heavy delving into details. A minor annoyance for some readers is the omission of adverts which appeared in the original magazine, many of which were informative and showed current personal computing hardware.

'Microelectronics' will be of great value to anyone wishing to understand the influence microelectronics will exert on electronic design over the next few years.



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7407	.28	7472	.35	74163	.95
7408	.22	7473	.35	74164	.95
7409	.17	7474	.31	74165	.95
7410	.16	7475	.49	74166	1.19
7411	.25	7476	.34	74170	1.90
7413	.43	7483	.68	74173	1.49
7414	.65	7485	.88	74174	1.19
7415	.25	7486	.38	74175	.95
7416	.35	7489	2.25	74176	.84
7417	.35	7490	.43	74177	.84
7420	.16	7491	.75	74180	.95
7423	.37	7492	.48	74181	2.30
7425	.35	7493	.48	74182	.85
7426	.22	7494	.75	74185	2.20
7427	.35	7495	.75	74190	1.25
7430	.20	7496	.75	74191	1.15
7432	.23	74100	1.15	74192	.89
7437	.25	74107	.37	74193	.85
7438	.25	74121	.37	74194	1.15
7439	.50	74122	.38	74195	.74
7440	.15	74123	.45	74196	.98
7441	.85	74125	.54	74197	.95
7442	.59	74126	.58	74198	1.69
7443	.65	74132	.75	74199	1.69
7444	.73	74141	.85	745200	3.95
7445	.65	74145	.90	74279	.79
7446	.81	74150	.98		
7447	.59	74151	.68		
7448	.79	74153	.80		
7450	.17	74154	1.20		

LOW POWER SCHOTTKY

74LS00	.36	74LS32	.38	74LS95	2.09
74LS02	.36	74LS40	.45	74LS107	.59
74LS04	.36	74LS42	1.60	74LS164	2.20
74LS08	.38	74LS74	.59	74LS193	2.20
74LS10	.36	74LS90	1.30	74LS197	2.20
74LS20	.36	74LS93	1.30		

LOW POWER

74L00	.29	74L51	.29	74L90	1.40
74L02	.29	74L55	.29	74L91	1.20
74L03	.23	74L71	.29	74L93	1.50
74L04	.29	74L72	.45	74L95	1.50
74L06	.29	74L73	.56	74L98	2.25
74L10	.29	74L74	.56	74L164	2.25
74L20	.29	74L78	.75	74L165	2.30
74L30	.29	74L85	1.09		
74L42	1.39	74L86	.65		

HIGH SPEED

74H00	.25	74H22	.25	74H61	.25
74H01	.25	74H30	.25	74H62	.25
74H04	.25	74H40	.25	74H74	.39
74H08	.25	74H50	.25	74H101	.58
74H10	.25	74H52	.25	74H102	.58
74H11	.25	74H53	.25	74H103	.60
74H20	.25	74H55	.25	74H106	.72
74H21	.25	74H60	.25	74H108	.72

CMOS

4000A	.26	4018A	1.39	4066A	.89
4001A	.25	4020A	1.72	4068A	.44
4002A	.25	4021A	1.18	4069A	.44
4006A	1.35	4022A	.94	4071A	.26
4007A	.26	4023A	.25	4072A	.35
4008A	1.52	4024A	.89	4073A	.39
4009A	.57	4025A	.25	4075A	.39
4010A	.54	4027A	.59	4078A	.39
4011A	.29	4028A	.98	4082A	.35
4012A	.25	4030A	.44	4518A	1.56
4013A	.45	4035A	1.27	4528A	1.56
4014A	1.27	4040A	1.39	4585A	2.10
4015A	1.27	4042A	1.47		
4016A	.48	4049A	.59		
4017A	1.01	4050A	.59		
74C00	.19	74C74	1.04	74C162	2.49
74C02	.26	74C76	1.34	74C163	2.66
74C04	.44	74C107	1.13	74C164	2.66
74C08	.68	74C151	2.62	74C173	2.22
74C10	.35	74C154	3.15	74C195	2.26
74C20	.35	74C157	1.76	80C95	1.15
74C42	1.61	74C160	2.48	80C97	.96
74C73	1.04	74C161	2.49		

CERAMIC DISC CAPACITORS

1pf 50V	56pf 50V	270pf 50V	01uf 1000V
5pf 50V	68pf 50V	390pf 50V	022uf 50V
7pf 50V	82pf 50V	470pf 50V	030uf 50V
10pf 50V	100pf 50V	600pf 50V	050uf 50V
22pf 50V	120pf 50V	820pf 50V	1uf 50
27pf 50V	150pf 50V	001uf 50V	
33pf 50V	180pf 50V	0047uf 50V	
47pf 50V	220pf 50V	01uf 50V	

	(each)	(Minimum 10 per value)
0-100	$.10 ea	$.05 ea
100-		$.04 ea

SPECIAL SALE

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LM308 TO-5	.59
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LM311 mDIP	.49
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340T-6V	.79
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LM723 DIP	.39
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10 EA. OF FOLLOWING VALUES — 50 VOLT

1pf	33pf	82pf	220pf	820pf	.022uf
5pf	47pf	100pf	270pf	.001uf	.030uf
10pf	56pf	150pf	470pf	.0047uf	.050uf
22pf	68pf	180pf	600pf	.01uf	.1uf

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14 pin	.20	28 pin	.59
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18 pin	.29		

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4.7V 5.5V 10V $ .15 EA.
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CARBON FILM ± 5% ¼ or ½W
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LM307H	.30	LM382N	1.75	LM747H	.79
LM308H	.89	LM385K	.45	LM747N	.71
LM309H	1.05	NE531V	2.90	LM748CN	.35
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LM311CN	.89	NE550A	.75	LM1458CN	1.29
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5 12 15	1.19	LM566H	1.39	CA3081	1.49
LM322N	1.59	LM566CN	1.19	LM3900N	.49
LM324N		LM567CN	1.29	LM7524	.79
(LM2902N)	1.52	LM567H	1.49	LM7525	.79
LM339N	1.58	LM703H	.59	8038B	4.59
LM340K		LM703CN	.39	75451CN	.35
5 6 8 12		LM709N	.25	75452CN	.35
15 18 24	1.29	LM709H	.29	75453CN	.35
LM340T		LM710N	.59	75454CN	.35
5 6 8 12		LM711N	.39	75491N	.71
15 18 24		LM723H	.55	75492N	.85
(78 — — Equiv)	1.19	LM723N	.52		

XR320	1.15	XR2567	1.99	XR4212	1.75
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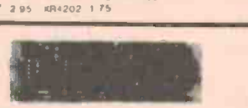

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RL209 Red diff.	.12" dig	.12
RLT-T1-03 White diff. no flange	.124" dig.	.15
RLC200 Red diff Current reg	.19" dig.	.25
RL4403 Red diff.	.19" dia.	.15
Jumbo Green, yellow amber or clear - diff.	.19" dia.	.18

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.1 mfd	35V	$ .25	10 mfd	16V	$ .40
.33 mfd	35V	.25	10 mfd	25V	.45
1 mfd	35V	.25	15 mfd	10V	.40
2.2 mfd	20V	.25	15 mfd	20V	.45
2.2 mfd	35V	.30	22 mfd	16V	.45
3.3 mfd	35V	.30	33 mfd	10V	.40
4.7 mfd	16V	.30	47 mfd	6V	.40
6.8 mfd	6V	.30	56 mfd	6V	.45
6.8 mfd	50V	.40	150 mfd	15V	1.50

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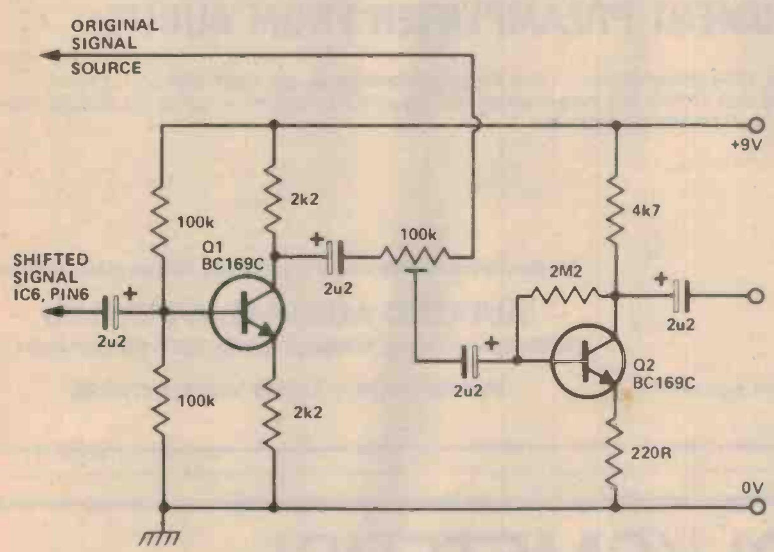
Ideas for experimenters

These pages are intended primarily as a source of ideas. As far as reasonably possible all material has been checked for feasibility, component availability etc, but the circuits have not necessarily been built and tested in our laboratory. Because of the nature of the information in this section we cannot enter into any correspondence about any of the circuits, nor can we produce constructional details.
Electronics Today is always seeking material for these pages. All published material is paid for — generally at a rate of $5 to $7 per item.



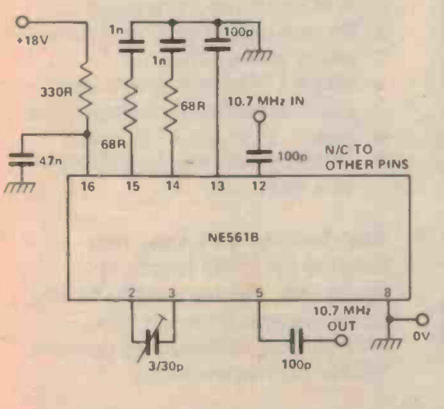
Shifty Phase Adaptor

This circuit can be used in conjunction with the Audio Phaser from December's ETI, or with any other phasing unit for that matter. The circuit provdes a complementary (antiphase) shifted waveform and amplified.

When this is fed through stereo speakers, it provides the ear with some very peculiar sounding phase information.

At slow speeds, the effect is very much like panning, except that the image is ambient irrespective of the position of the listener. At higher frequencies, where actual frequency shift occurs, a delayed tremelo effect is obtained.

This phase or frequency shifted panning would be most useful in stereo PA systems where the only place where all of the instruments can be heard is in the middle of the dance floor!



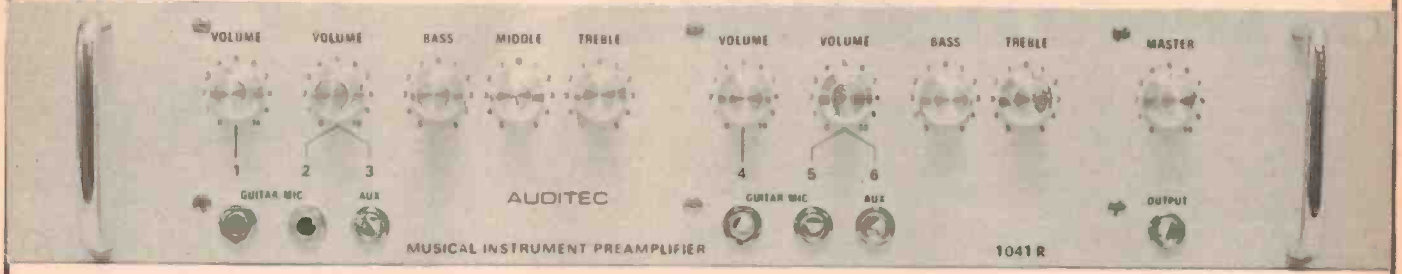
FM Signal Conditioner

As an alternative to an extra IF stage in an FM tuner, a PLL IC can be used as a signal conditioner. The VDO of the PLL tracks the input signal to provide a less noisy and stronger signal at its output.

The circuit shown in suilt around the Signetics NE561B PLL. The only thing necessary is adjustment of the 3/30 p trimmer which sets the VCO's centre frequency to 10.7 MHz.

The circuit should be effectively screened to avoid interaction with the FM front end that provides the circuit's input.

FOR THE PROFESSIONAL . . .



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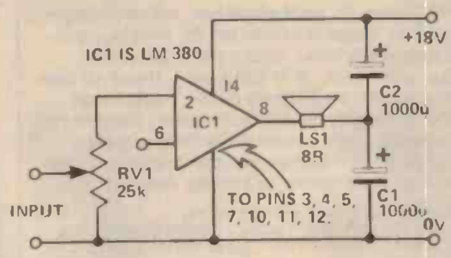
Ideas for experimenters

Novel loudspeaker coupling circuit

In most amplifier designs the speaker is fed by a high value capacitor to provide DC blocking, but this may result in a heavy switch-on surge, as the capacitor charges up.

An alternative approach, which is worthy of experiment, is shown in the diagram below. Here the ground side of the speaker is connected to the junction of two equal high value capacitors (1000 uF is typical), across the supply.

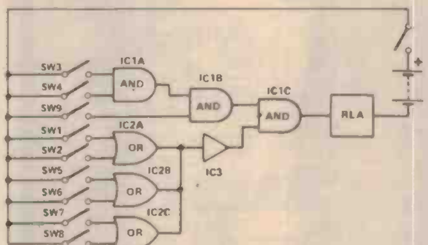
The amplifier output voltage will be at $V_S/2$, and so will the voltage across C_1 (if C_1 and C_2 are equal); so as the supply voltage builds up, the DC voltage across the speaker will remain zero, eliminating the switch-on surge. C_1 and C_2 will also provide supply smoothing. The circuit is shown with the LM380, but could be applied to any amplifier circuit, providing that the DC voltage at the output is half the supply voltage.



Selective Alarm Controller

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

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



CMOS Radio

The circuit shown is of a simple MW receiver based on the 4011 CMOS IC.

The four gates in this package are used as linear amplifiers by connecting their inputs together and applying negative feedback.

L1, 80 turns of 22 SWG enamelled wire close wound on a 3/8" diameter ferrite rod, is the pickup coil. This is tuned by the 500- trimmer and the resulting tank circuit referrred to earth at RF by C1.

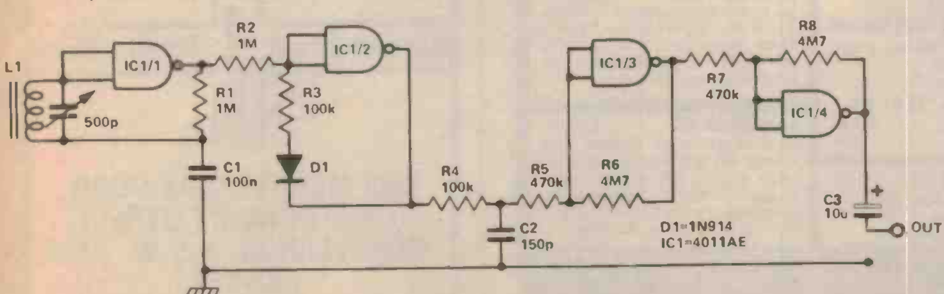
The high input impedance, that of IC1/1, 'seen' by the tank circuit ensures that little damping occurs, and thus the receiver is highly selective. The output of IC1/1 is an amplified RF signal and is passed to IC1/2 for detection.

The unwanted RF appearing at the output of the detector is removed by the lowpass filter formed by R4 and C2.

The audio signal is then fed to an amplifier formed by IC1/3 and IC1/4.

The circuit's current consumption is about 10 mA when operated from a 9 V supply.

Note that the IC used must be a 40011AE and not the 4011B whose input protection network will prevent it from operating in the linear mode.



Ideas for experimenters

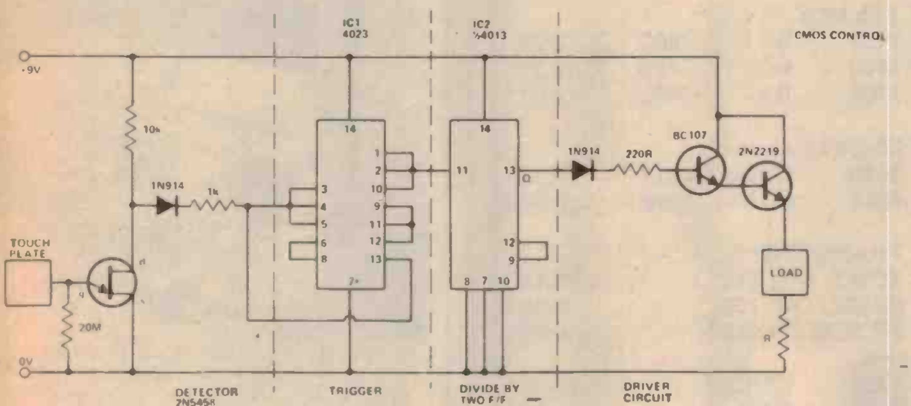
Deaf Touch Switch

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

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

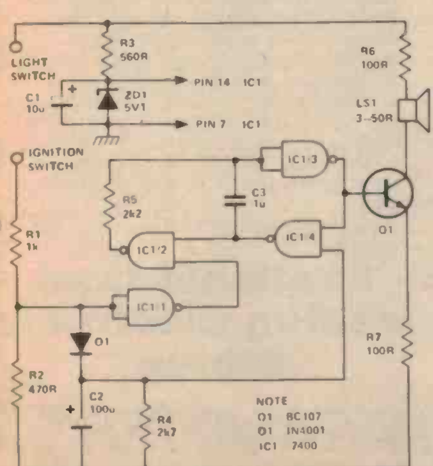
In operation, a single positive pulse sets the Schmidt trigger to its low level. (Removel of the hand causes reversion to the 'high' state). This, in turn, feeds the clock input of IC2, which changes the state of the Q output. When this is high, the output stage is driven on, enabling current to flow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

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



Car Lights Reminder

Many circuits to warn motorists that they have left their headlights on after switching the engine off have appeared in the past. I feel this circuit is an improvement over many of these in that it requires no switches, and it is only necessary to make three connections to the car's electrical system.



If the ignition is switched off while the lights are on, an audible warning is sounded for about ten seconds. This tone is produced by NAND gates IC1/2, IC1/3 and IC1/4. Operation of this oscillator is inhibited by an '0' on the gating input of IC1/2. This in turn corresponds to a logic '1' present at the input to IC1/1 while the ignition switch is on, supplying a high logic level to IC1/1, the oscillator is thus disabled.

When the ignition is switched off, the output of IC1/1 goes high, enabling the oscillator. At this stage C2, which has until now been charged up via D1, begins to discharge via R4. While the voltage on C2 is high, the gating input of IC1/4 allows oscillator operation, however as C2 discharges, this action is inhibited. This occurs after about ten seconds.

Power for the circuit is provided by R3 and ZD1 from the vehicle's 12 V rail.

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There will be, in addition, a number of workshops associated with the papers demonstrating eqipment using state of the art techniques. Papers and workshops will be presented by many well-known amateurs:- Les Jenkins VK3ZBJ, Ken MacKracken VK2CAX, Peter Cossins VK3BFG Jeff Pages VK2BYY, Roger Harrison VK2ZTB, Phil Wait VK2ZZQ, Les Bell GM4CFM.

For further information, registration forms etc, contact:
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or see page 85 this issue.

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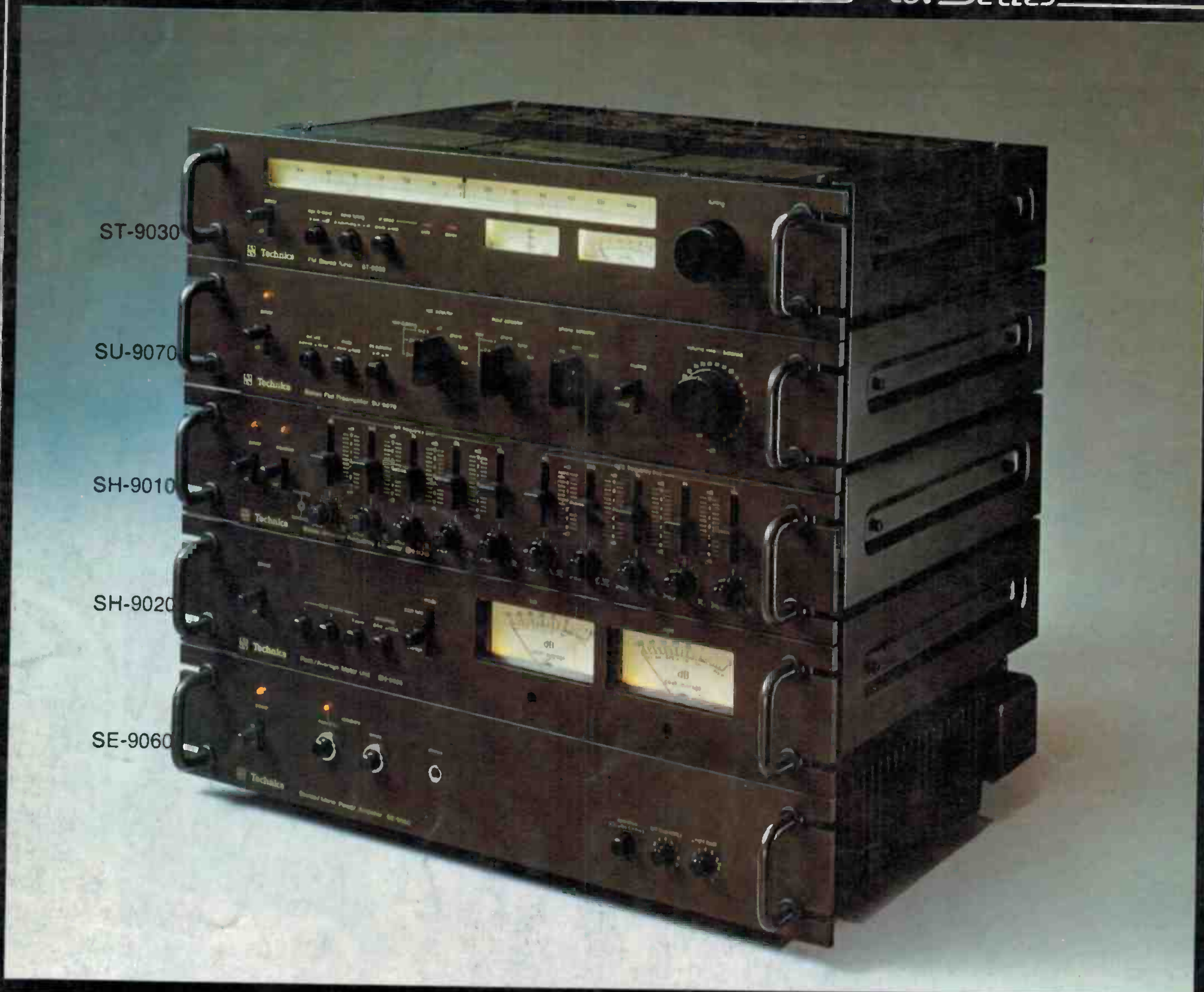

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