JULY, 1974
60c*

electronics TODAY INTERNATIONAL

HI-FI

CRIME-1974
-both sides update!

THE TRUE FACTS ABOUT COLOUR TV

SPECIAL OFFER

6 Watts = $1·50

A six watt audio amplifier I.C. for $1.50 plus postage — special limited offer

Registered for posting as a periodical—Category C

You wouldn't buy the wrong pair of shoes for your feet.

So why buy the wrong tape deck for your home?

It can happen. There are so many to choose from. Each has its own way of enticing you.

Yet the TEAC A-3300 stereo tape deck stands out. It has everything a serious amateur would want, plus many features that even the professionals love.

It accepts the big 10½ inch reels. So when you give your next party, you'll have uninterrupted music for up to six hours. Instead of having to change tapes all the time.

Your own recording technique will improve also. Because the A-3300 has TEAC's unique Edi-Q, an electronic record pause control. It eliminates the clicks and snaps that can occur when you pause and then restart. The professionals use it. Now you can also.

You'll especially appreciate the front panel bias switch for the proper selection of bias current and recording equalization. It's an important feature; it gives you the most enjoyment from the new low noise/high output tapes, as well as regular tapes.

Attach TEAC's A-180 to the deck.

It's our Dolby* Noise Reduction Unit. You'll enjoy sound perfection because the Dolby eliminates unwanted tape hiss and other noise. Music never sounded so good. We invite you to take the step and bring this TEAC package of sound into your home.

Notice how well it fits.

AN-180

TEAC
The sound of perfection

AUSTRALIAN DISTRIBUTORS: Australian Musical Industries P/L., 155 Gladstone St., South Melbourne. Vic. 3205 Phone: 69-5888 — 619 Pacific H'way., St. Leonards, N.S.W. 2065. Phone: 439-6966 — Arena Distributors, 273 Hay St., East Perth. Phone: 25-9993 — Sth. Aust. Truscott Electronics Pty. Ltd., Hindmarsh Square, Adelaide. Phone: 23-3024. Miltons Department Stores Ltd., P.O. Box 146, Norfolk Island. OCEANIC DISTRIBUTORS: New Zealand: Direct Imports (N.Z.) Ltd., 590W Southampton Street, Hastings. Phone: 89-184 — Fiji: D. Jeevan & Sons, 87 Cumming Street, (G.P.O. Box 148), Suva. Phone: 22710 — New Guinea Paul Mow & Co. Box 449, Lae. Phone: 2953.

electronics TODAY INTERNATIONAL

Vol. 4 No. 4

COVER: Modern Magazines 'burglar' Ross Little is 'caught' by a simulated infra-red technique. Cover design and execution by staff photographer John Knight. (Full story on crime – page 24 onwards – this issue).

NEXT MONTH

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  Here's what it does – and how well it does it.

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  Sophisticated robots may take over from man in our exploration of the solar system.

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PLUS—

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  Obtain perfect prints every time with ETI's simple-to-build timer.

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  Tests all commonly-available operational amplifiers.

AUGUST ISSUE – ON SALE END OF JULY

Published by MODERN MAGAZINES (HOLDINGS) LIMITED, 15 Boundary Street, Rushcutters Bay, 2011. Phone: 33-4282. Cables: MODMAGS SYDNEY. Managing Director: Jules Feldman. Advertising Director: Max Press.

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no gimmicky sales talk. just the facts.

- High-precision, polished uniform thickness POLYURETHANE BELT provides smooth revolution with minimized wow-flutter (less than 0.175) and high s/n ratio (better than 48dB).
- DIE-CAST ALUMINIUM ALLOY DOUBLE RIM PLATTER, driven by belt drive system assures precise and constant speed through optimum flywheel action.
- 4 POLE SYNCHRONOUS MOTOR assures smooth, and stable revolution.
- STATIC BALANCE TYPE S-SHAPED TONEARM with REVOLVING TYPE COUNTERWEIGHT eliminates lateral balancing weight and assures easy and stable operation.
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Colour TV

Good TV colour reception requires adequate signal strength and a ghost-free image. A poor picture that may be just-watchable in black and white will be quite intolerable in colour.

But with C-day less than twelve months away, little thought seems to have been given to ensuring good quality pictures in areas where signals are known to be poor.

It is not a new problem, nor one peculiar to Australia.

In New York, for example, the proliferation of high-rise buildings created enormous problems. But there, long before cable TV was even thought of, communal antenna systems were established. One central antenna fed a large number of households. The cost, converted to present day monetary values, was less than $50 per subscriber.

If manufacturers, retailers and broadcasters seek good market penetration in colour's early days then they must start thinking very hard indeed about the vast number of potential viewers in high density urban areas where TV reception is poor.

At $600 plus, colour TV is costly enough — having to spend several hundred dollars more (repeatable every few years) for a sophisticated antenna may be the last straw.

Communal TV antennae, as an interim alternative to cable TV could provide an answer.

It may not be too far out to suggest that owners of newly erected high-rise buildings be legally required to provide roof access for placement of communal antennae.

After all it is their buildings that are, in part, the passive polluters of local TV signals.

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main features

special projects feature

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No where in Australia have you the choice to buy everything you want without being forced to buy the particular brand the shop specializes in and at the best prices.
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• top quality equipment at competitive prices o free delivery and connections in Sydney metropolitan area • Full installation for complete systems – ask for our quotation • under guarantee service and full workshop facilities • credit sale and terms arranged • We are audio experts, so trust us • We have expanded to give better service, to give you a better purchase •

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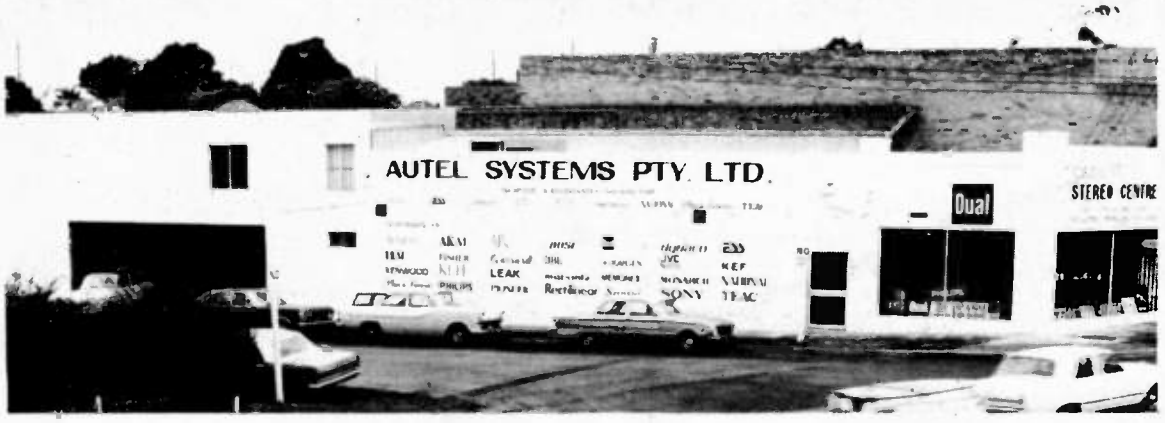

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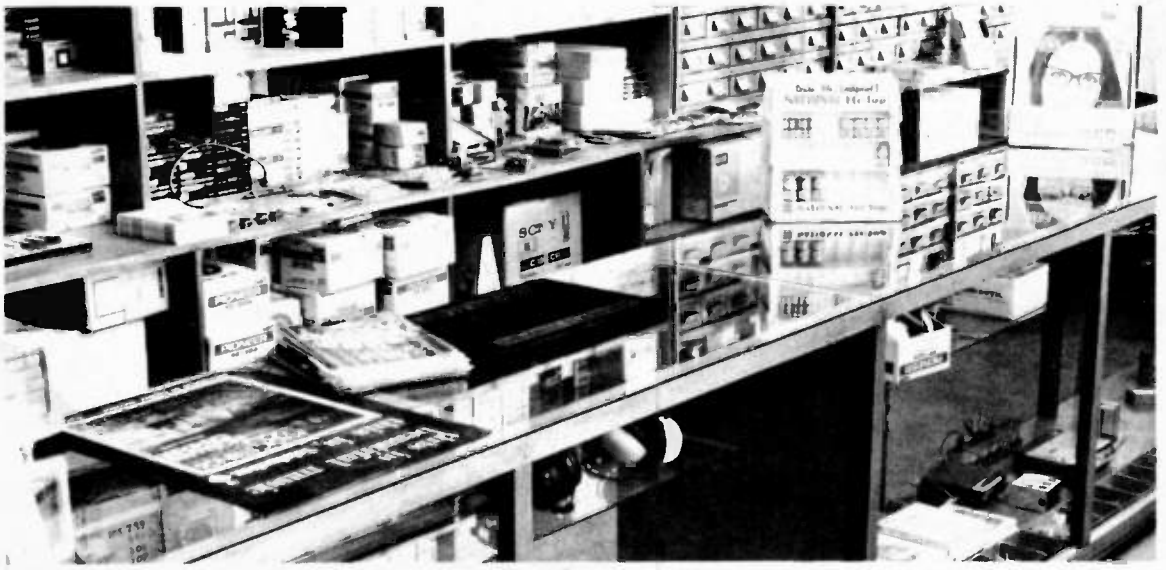

Want a lead to suit your set to match that accessory? Want any type of plug? Also, complete stocks of spare parts for National, Nivico, Teac, Jorgen, ESS, Marantz, and many others. Largest range of equivalent parts to suit those hard-to-get spare parts for rare models.

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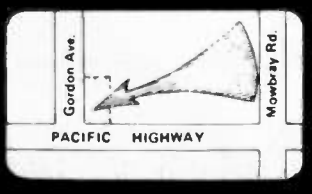

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sounds exciting

AKAI GXC 46-D

HI-FI cassette stereo tape deck

Styled right, performs superbly. With the inclusion of the famous GX Head focused-field recording system and two other top systems, Dolby Noise Reduction and Akai Automatic Distortion Reduction systems, the sound of this brand new cassette machine belies the notion that natural clear sound reproduction can only be achieved with an open reel unit. Check the features and then listen. Amazing Hi-Fi response: 30-18,000Hz at 58dB S/N (with Dolby). You'll be glad you did.

New Tariff Reduction Brings
New Lower Price
NOW ONLY

$255

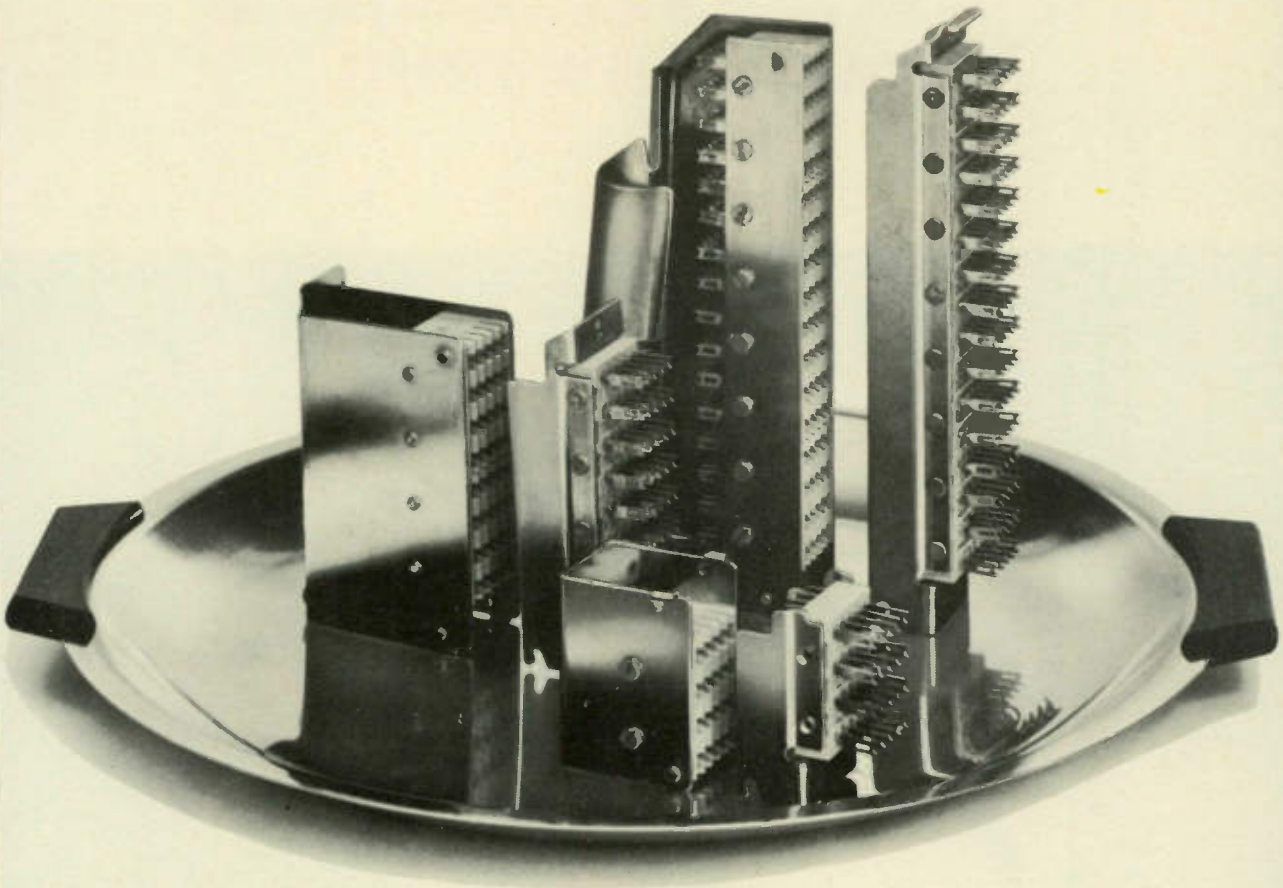
**POST YOUR CHEQUE OR ORDER TODAY!*

Douglas·hifi

185-191 BOURKE STREET, MELBOURNE – PHONE 63 9321

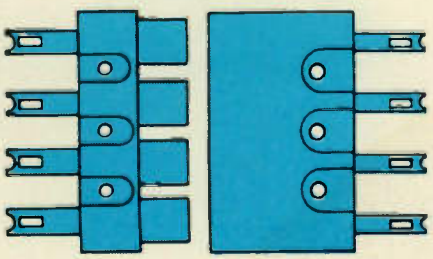
Complete range of fabulous Memorex tapes and Jensen Hi-Fi speakers

PC3



Plessey knife and fork connectors economical...rugged...versatile

Knife and fork contact units
ACTUAL SIZE



These economical multi-circuit connectors are reliability proven and of exceptionally rugged construction . . . they are available in standard 20, 40 and 80 way sizes.

Connector frames are of pressed steel finished in passivated zinc and house either 1, 2 or 4 sets of A.B.S. Green moulded modules (illustrated) each of which accommodates twenty knife or fork terminal assemblies.

The modular construction of these connectors makes them an extremely versatile means of quickly effecting multi-circuit linkage . . . Plessey offers these modular contact units as a separate item and any number of such may be arranged and housed to suit the customer's own alternative housing design requirements.

Plessey knife and fork connectors were originally designed for use in crossbar telephone switching equipment and therefore meet the highest quality standards as demanded by Post Office specifications.

Connectors and modular contact units are available ex-stock. Comprehensive literature is available on request to the Professional Components Division.

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at a price to suit the fastidious buyer

Rich, honest, discrete 4-channel sound from a record? That's what CD-4 is all about. JVC developed it, perfected it, and now the whole world is playing it. Only CD-4 can transport you to a place where you have never been before and surround you with vivid, vibrant sound waves which recreate the atmosphere of the Concert Hall with all its subtleties. If you didn't think that CD-4 has indisputable advantages over all other 4-channel systems, how come some of the largest Recording Companies in the industry such as RCA, WEA, United Artists are recording in CD-4? JVC's CD-4 is the only system which keeps the four channels separate all the way from recording studio to your living room. How good is CD-4? Until you hear a CD-4 record on JVC's new CD-4 channel equipment, you just might never know. 4 channel system.

from $495

4MM-1000 4-channel tuner amplifier 64 watts of pure power built in radio and 4-channel pin point balance will play matrix and S.Q. heads with provisions for CD-4. This is what you were looking for.

$25 deposit–$7.20 weekly

1669 — Stereo Cassette Tape deck with Exclusive Automatic Noise reduction System. Frequency response 30 — 19,000 Hz. Probably the finest cassette deck ever made, the 1669 offers professional features for superb tonal quality that put it in a class by itself. The unit has JVC's exclusive ANRS (Automatic Noise Reduction System). For supreme versatility, the ANRS can automatically activate both in recording and playback.

We are stockists of the World leading quality sound brands plus the largest range of portable radios, cassette recorders, communication receivers, transceivers and accessories. Term or Lay By welcomed. Mail order accepted.

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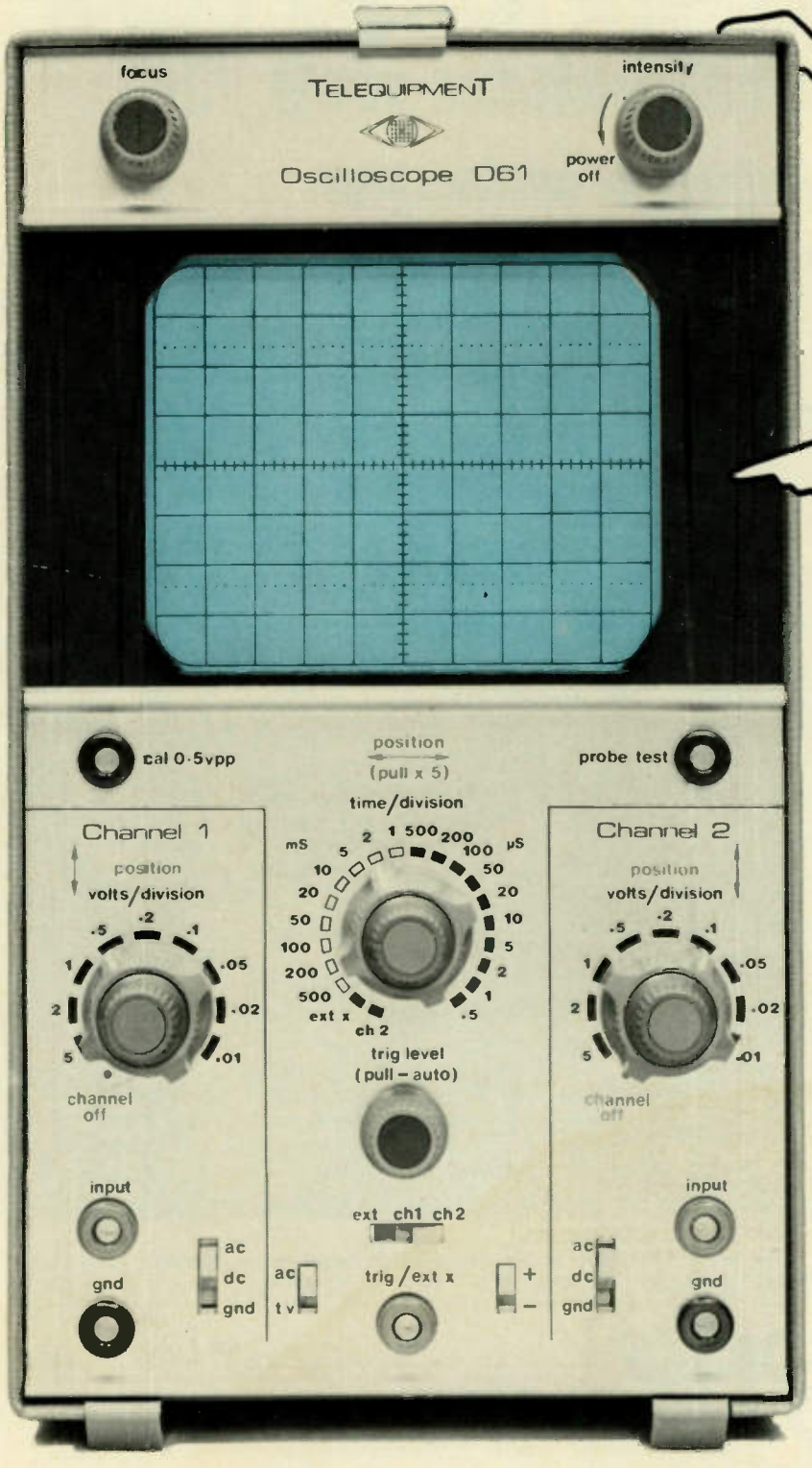
TEKTRONIX ANNOUNCES A NEW, LOW PRICE 10MHz OSCILLOSCOPE

"...it's sort of like Rolls Royce coming out with an economy model!"



Tektronix have released this new D61 model in their Telequipment range. It's been specially designed for general purpose laboratory, educational and colour T.V. servicing applications. And its only

$299 DUTY PAID*

*Delivered. Plus Sales Tax if applicable.

The D61 is a MHz dual trace oscilloscope featuring rugged, all solid state construction.
A minimum of controls make it extremely simple to use.
Superb triggering qualities make the D61 ideal for discerning test engineers.
Its compact size makes it easy to carry and it takes up little space on the busiest work bench.
A lot of performance at a very reasonable price.
Compare and you'll find the value of this unit is unequalled.

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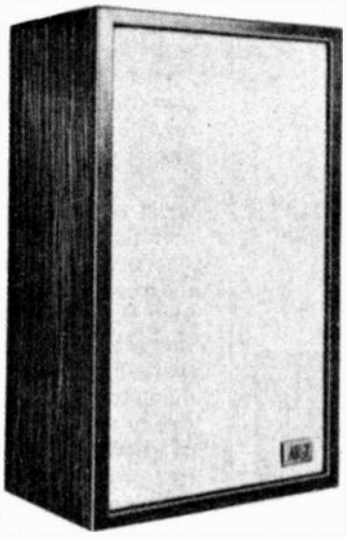
TX/2



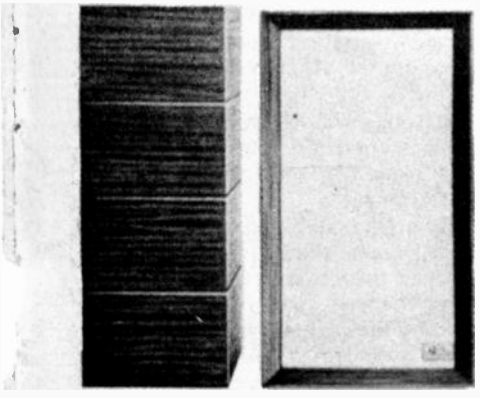
AR-7

a new standard of excellence in a speaker of small size

The AR-7 is the smallest speaker system Acoustic Research has ever designed. It is purposely small.

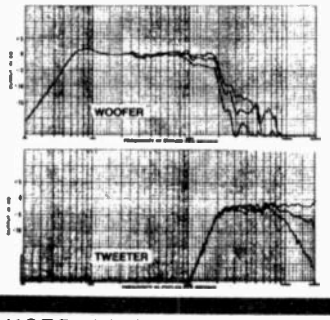
Recognizing the space demands imposed by four channel stereo music systems, AR decided to develop a small speaker to permit installation in areas where our larger speakers are not appropriate. At the same time, this speaker must offer the extended range usually associated with speakers of much larger dimensions.

That the AR-7 has achieved both design objectives is clearly evident.



The size (9¾ x 15¾ x 6¼) is such that 4 AR-7's occupy less cubic volume than a single AR-3a.

The accuracy of the sound is such that we show these power response curves and guarantee each AR-7 speaker to match the curves within ± 2dB. Such accurate, full frequency range performance from an enclosure of this size did not come easily. It required years of development and state-of-the-art technology.



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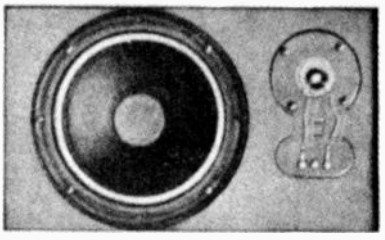
Telephone: 642 3993 642 2595

Showroom demonstration by appointment

AR systems may be purchased from:

Melbourne	B. J. D. Electronics
Perth	Arena Distributors
Brisbane	Brisbane Agencies
Adelaide	Sound Spectrum
Canberra	Duratone Hi-Fi
Hobart	Quantum Electronics



The woofer of the AR-7 uses such advanced design and manufacturing techniques that its low frequency response extends substantially below that of competitive speakers of far greater size.

The tweeter of the AR-7 is similar to the tweeter used in the highly acclaimed AR-6. It produces smooth, wide dispersion sound. Both the woofer and the tweeter use high temperature voice coils, permitting higher power handling capability.

Though the AR-7 was designed primarily with four channel stereo installations in mind, its accurate wide frequency response makes it a wise choice for high quality two channel stereo systems.

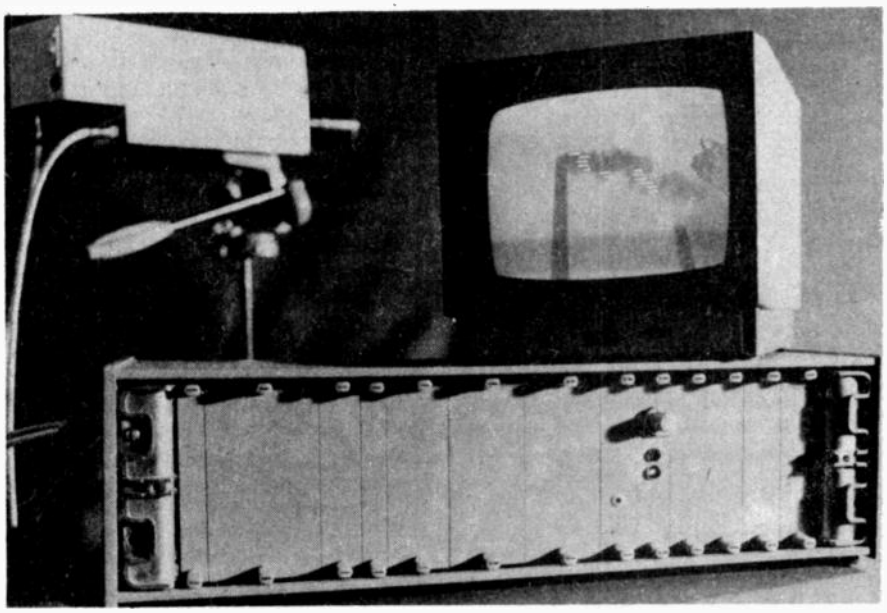
AR-7, priced at **$199** a pair*. Compare the superb sound of the modestly priced AR-7, AR 4xa and the AR-6. Even to the most critical ear, the difference is subtle.

*Recommended retail price

W1396

news digest

TV ALARM UNIT



Numerous industrial processes need to be permanently monitored, so that undesirable harmful emissions, for example smoke from chimneys or polluted water from discharge pipes, etc., may be effectively limited or prevented. A suitable device for this function has been developed by Siemens. Known as Telemet A, the device is an electronic module which can be added to closed-circuit television cameras. In this module the image recorded by a compact camera is digitally stored and constantly compared with the image which is transmitted live. If sudden changes occur in a stationary television image a visual or audible alarm is given immediately.

The image being monitored is broken down into 3200 dots and digitally stored as 64 x 50 words each of 4 bits, each in 16 shades of grey. If there is any discrepancy between the stored image and the live image, the difference signal causes an alarm to be given. In addition, the points in the image which have changed are marked by short bright dashes. Three adjustable parameters — operating sensitivity, transient disturbance suppression and sustained disturbance suppression — allow the unit to be set for the best possible configuration for the particular function.

So that variations over a long period of time, e.g. slow alterations in ambient light, do not cause false alarms, the stored image can be refreshed in a cycle which can be preselected between 2 and 20 seconds. The storage process takes approximately one second. If the image alters during the storage process, a blurred image structure is stored at the point concerned, and this causes a continuous alarm until the refreshed image is stored. The monitoring function thus continues without interruption. The operating sensitivity is so high that a level alteration of no more than 30% on a coherent surface corresponding to 0.1% of the television image will cause an alarm to be given.

If there are certain areas on the picture which should not cause an alarm signal, the relevant signal evaluation can be suppressed. Using a cross-bar matrix the television image can be divided into 256 (16 x 16) areas which can be combined in any way desired and excluded from the evaluation. For checking purposes, these sections appear darker on the screen.

Telemat A can be universally used for environmental protection purposes. For example, an essential part of the control of combustion processes is the permanent observation of the smoke issuing from chimneys. If smoke should suddenly appear as a result of irregular combustion, a difference signal causes an alarm to be given immediately. All drinking-water treatment plants can be monitored by means of the Telemat A: fish are particularly sensitive to the quality of the water, and react immediately to the most minimal changes. An alarm is given if the fish swimming in the control tank rise dying to the surface of the water. In a similar manner, the degree of cleanliness of treated effluent can be checked and its entry into streams, rivers or the sea can be monitored. As well as offering general protection to objects from theft, destruction, etc the unit can be used to prevent theft at exhibitions, in art galleries and museums, in strong rooms etc. In every case when an alarm is given, the security staff can observe the difference in the image on the screen and take appropriate counter measures.

WATTS RMS NOW OFFICIAL

The US Federal Trade Commission has now set a date for enforcing its new strict rules on audio power claims for home hi-fi equipment.

Legislation, effective November 4, 1974, specifies that amplifier power output must be quoted as continuous power capability (watts rms).

Other specifications, such as peak power or music power may still be used but must be based on recognised industry standards and must be subservient to the main rms disclosure.

UNAUTHORISED IMPORTS CAN BE SEIZED

The members of the Electronics Importers Association representing the following brands: Akai, National, Sanyo, Sharp, Sony have taken steps to lodge Bonds under Section 103 with the Department of Customs and Excise in order to protect their trade mark in Australia.

This action has been taken in order to deal with unauthorised imports of goods under these brands or others infringing the trade marks registered and used by the companies concerned. Under the arrangement with the Department of Customs and Excise, commercial imports by other than the authorised distributors are subject to being seized and forfeited to the Commonwealth.

'Q' LATEST

Columbia have just licensed Philips to manufacture and market the SQ quadriphonic system.

Prototype samples of Philips' SQ equipment were shown at the recent Paris Festival du Son.

Meanwhile RCA have announced thr release of fifty CD-4 LP's "before the end of 1974". Unlike RCA's earlier CD-4 releases their new 4-channel LP's will be marketed specifically as discrete four-channel.

Although RCA still insist that their CD-4 products will not be harmed by playing on cheap mono players, dealers invariably placed their 'compatible' recordings in the 'four-channel' sections of their displays.

Other four-channel developments include news of a titanium Shibata stylus from Panasonic. JVC are also understood to be working on a ceramic CD-4 cartridge which should be far cheaper than the present magnetic devices.

WORLD'S LARGEST SOLAR ARRAY

A photovoltaic solar cell demonstration system is being set up in McLean, Va., by the US Mitre Corp. on the roof of its building.

The system, designed to convert solar energy directly to electricity, will be completed by late summer and will generate 1500 kWh of electricity annually. Although the output isn't large by normal electricity consumption standards, the photovoltaic cell system is the biggest earth-based array of its type, Mitre says. The system is the first step in a continuing evaluation programme.

SO WHO NEEDS A CALCULATOR?

Try adding up this column of numbers. Place a piece of paper over all but the top number and move it progressively down the column, revealing and totalling the numbers as you go.

1000
40
1000
30
1000
20
1000
10

Simple isn't it?
Now turn to top right page 21.

LIFE OUT THERE

Another radio-astronomical search for intelligent life within our Galaxy began on May 8.

Astronomers P. Feldman and A. Bridle (York University, Ontario, and Queen's University, Kingston, Ontario, respectively) will spend up to two years using the 30 metre Algonquin telescope monitoring frequencies appropriate to emission in water.

Previous efforts, such as Project Ozma 15 years ago, concentrated on searching hydrogen frequencies. The rationale was that as hydrogen was the most abundant element in the Universe, this would be the frequency chosen by extraterrestrial intelligences for communication.

However feeling is now growing that any really intelligent lifeform would leave the hydrogen frequency open because of its importance to radio-astronomers — hence the choice of water-related frequencies.

'LOW-TEMPERATURE' LITHIUM CHLORINE BATTERY

A rechargeable lithium/chlorine battery that operates at 425°C — 225°C lower than previous lithium/chlorine batteries — has been developed by General Motors Research Laboratory.

The improvement is due to a special eutectic LiF/LiCl/KCl mixture that forms the electrolyte. Although the power of the battery (624 watts per kg) is satisfactory for vehicle propulsion, high-temperature corrosion problems must be solved for the battery to be commercially useful.

DESK TOP FACSIMILE

Plessey Communications Systems Pty. Ltd., have released their Remotecopier KD 111, a facsimile system with advanced capabilities and inherent flexibility which say Plessey offers a practical, fast and efficient extension to present communication networks.

The Remotecopier will send any single-sheet, printed or handwritten matter over normal telephone or radio channels to give the recipient error-free hard copy.

The Remotecopier is capable of both sending and receiving information. If required this can be a simultaneous function on private lines or on the A.P.O. switched network.

Automatic unattended "receive" operation is available on private telephone lines. This facility is also available on the A.P.O. switched network in conjunction with a Plessey Ansafonette telephone answering machine. No special cabling is required in a Remotecopier installation.

Business enquiries should be addressed to Plessey Communications Systems Pty. Ltd., 87-195 Racecourse Road, North Melbourne, 3051.

SUPERIOR STEREO TURNTABLES

CEC

5 Years Guarantee

BD 2000A

A manual player of simple trouble-free design, featuring:

- 4 pole synchronous motor.
- 30 cm aluminium die cast platter weighing 1.2 kg.
- 0.1% wow and flutter or less.
- Fitted with MC 10 magnetic cartridge with 0.7 mil diamond stylus.
- Overall dimensions: 460 mm (W) x 357 mm (D) x 185 mm (H).

Price $139

BD 6000

A manual player for the connoisseur with advanced tone arm design and extremely low rumble. Perfect for 4 channel.

- Completely isolated 4 pole synchronous motor.
- Less than .07% wow and flutter.
- Full anti skating compensation.
- Fully sprung suspension.
- Fitted with MC 20 cartridge with frequency range to 40 KHz.
- Stylus cleaner.
- Overall dimensions: 500 mm (W) x 405 mm (D) x 190 mm (H).

Price $199

BA 600

A fully automatic design with a simplified mechanism for maximum reliability, featuring:

- Belt driven 30 cm platter weighing 1.2 kg.
- Four pole synchronous motor.
- Less than 0.1% wow and flutter.
- Static balance tone arm with anti skating compensation.
- Fully automatic and manual operation.
- Fitted with MC 8 magnetic cartridge.
- Overall dimensions: 460 mm (W) x 357 mm (D) x 185 mm (H).

Price $169

Sole Australian Distributors & Importers **JERVIS AUSTRALIA PTY. LTD.** P.O. Box 6, Brookvale, N.S.W. 2100, Telephone 939 2922

news digest

NOW THE VIDEO-CARD

A flat chromium oxide card no longer than a page from an average book can provide 10 minutes playback in colour plus full stereo sound.

The new video-card, devised by the Sony Corporation, was demonstrated at a recent International Magnetic Conference (May 16, 1974) in Toronto and also a few days earlier in Tokyo.

The technique – to be known as MAVICA – has substantial advantages over more conventional video-tape systems.

The Mavicard consists of two rectangular sheets of videotape-like material measuring about 16cm by 22cm. One sheet carries the audio signal, and has a claimed 38 dB signal/noise ratio. The second sheet provides the video signal – resolution of this, Sony claim, is almost as good as the U-Matic VTR. The sheets are automatically separated as they are fed into the player.

Recording costs should be a mere fraction of the cost of normal video-tape systems. The blank Mavicards cost only a few cents each in volume and recording is virtually a mass-duplicating process similar to printing – except that the programme material is transferred thermally.

The associated recorder/player is again quite a simple device. It is expected to sell for about $US600.

Our Tokyo reporter tells us that a number of CBS/Sony Records officials were seen to be taking a great deal of interest in the machine during the Tokyo unveiling.

We understand that whilst the Mavica system has been finalised engineering wise, Sony will be conducting an extensive market feasibility study before formulating any positive marketing plans.

US SAYS NO TO METRIC

It now seems virtually certain that the US will not go metric – at least not within the foreseeable future.

Supporters of the proposed metric conversion legislation were stunned when the House last month refused even to consider the Bill (HR 11035).

The proposed conversion was to have been voluntary, but would certainly have resulted in pressure being applied to many organizations in technology and commerce.

Surprisingly, the Bill has been killed, not because of any doubts about the rationale of the metric system but simply because agreement could not be reached about who was to pay the cost!

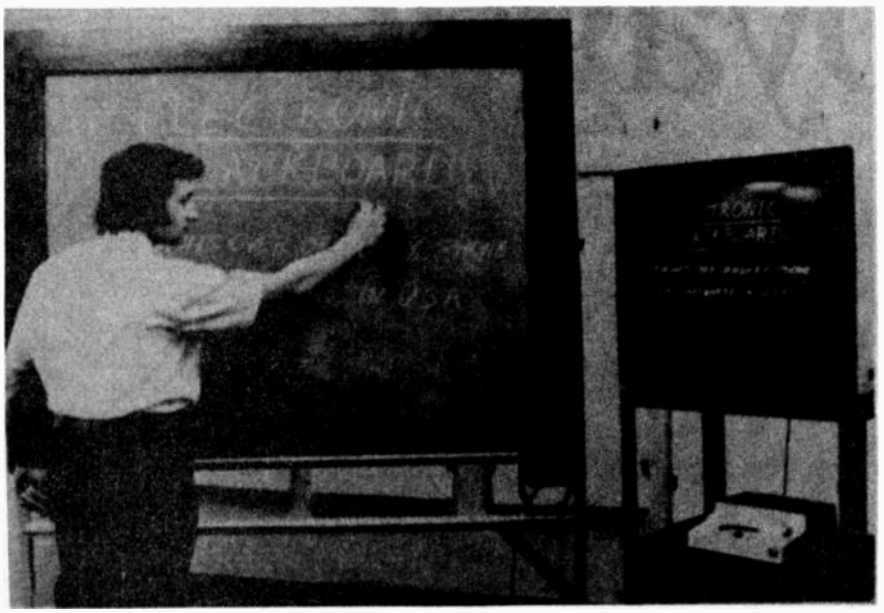
Fortunately the inch has been defined rather more accurately since its early beginnings when it was 'the length of three barleycorns, round and dry, laid together'.

ELECTRONIC BLACKBOARD

This experimental electronic blackboard devised by Bell Laboratories enables teachers to have their chalked writing or drawings displayed on a TV screen at any remote point.

The blackboard has a pressure-sensitive surface and the written information is transmitted to the point of display via ordinary telephone lines.

Bell's new system is currently under evaluation at the University of Illinois.



NEW SOUND ABSORBER

A new wall lining material, having the appearance of sandstone, has sound absorbing properties similar to acoustic lines.

The material based on resin coated foundry sand has been developed by British Industrial Sand in association with Sound Research Laboratories (Holbrook Hall, Sudbury, Suffolk).

Prototype material tested at SRL's laboratories show that the material has mid-frequency absorption of 0.8. This is similar to that obtained from a luxury-grade deep pile carpet laid on thick underfelt.

LOW COST SOLAR CELLS

A major advance toward producing low-cost solar energy was reported last month.

Researchers at USA's Tyco Laboratories (Waltham, Mass) and at Harvard University jointly reported that they had developed silicon ribbons up to two metres long – and of a quality sufficient to produce solar cells of some 10% efficiency.

The new technique may eliminate the present costly process in which thin wafers are cut from large single crystals.

Currently the new process operates by melting poly-crystalline silicon in a crucible. The disc crucible is equipped with a die into which the molten silicon rises – by capillary action. The silicon is then pulled through the die in ribbons about 2½ centimetres wide and 0.2 mm thick.

Just as we close for press it has been announced that Tyco Laboratories have licensed RCA to use the new manufacturing process.

CANDLELIGHT CAMERA

A miniature TV camera developed by General Electric's Research and Development Centre generates clear crisp images even when the available lighting is very low. The scene shown here for example had literally one candlepower illumination.

The camera uses a charge-injection solid-state imager.

SHURE

NEW ERA III BEGINS

Now after seven years of extensive laboratory research and development, the remarkable Shure V-15 Type III Phono Cartridge is ready for the connoisseur's high fidelity system. It clearly defines the outer limits of the state of the art of phono cartridge design. It is indeed the worthy successor to the world-acclaimed V-15 Type II improved!

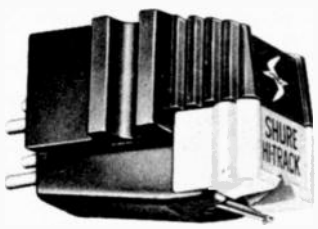
Among its brilliant innovations is an all-new laminated magnetic core structure, and an exquisitely designed stylus assembly with 25% reduction of effective stylus mass.

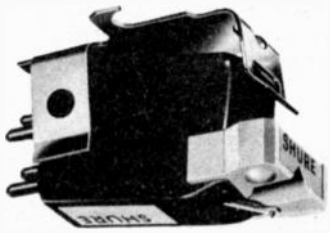
Result: (1) Higher-than-ever trackability at the ultra-light tracking forces of the 1970's; (2) an astonishingly flat frequency response with no noticeable emphasis or de-emphasis at any frequency; (3) an extended dynamic range even beyond that of our V-15 Type II Improved; and (4) all this without a reduction in output level.

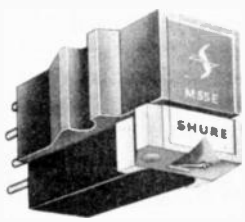
We call the Type III the Synergistic Cartridge. It maintains all performance factors in perfect equilibrium to produce a total audio effect greater than the sum of its individual improvements.

All in all, the V-15 Type III offers an extraordinary listening experience.

NEW REDUCED PRICES







CARTRIDGES WITH ELIPTICAL STYLII

$87.00 V15 Type III ¾ to 1¼ grams tracking.
$38.00 M91ED ¾ to 1½ grams tracking.
$26.00 M93E-EP 1½ to 3 grams tracking.
$19.00 M55E-EP ¾ to 2 grams tracking.
$17.00 M44E-EP 1¾ to 4 grams tracking.

CARTRIDGES WITH SPHERICAL STYLII

$80.00 V15 Type III-G ¾ to 1¼ tracking.
$17.00 M75-6S-EP 1½ to 3 grams tracking.
$16.00 M75-CS-EP 3 to 5 grams tracking,
$16.00 M44-7-EP 1½ to 3 grams tracking.
$16.00 M44-C-EP 3 to 5 grams tracking.
$16.00 M44-G-EP ¾ to 1½ grams tracking.

The above are current recommended resale prices

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2A Hill St.,
Thornbury 3071

Western Australia:
ATHOL M. HILL P/L.,
1000 Hay St.,
Perth 6000

news digest

ELECTRONIC NEWSPAPERS SOON

With newsprint becoming increasingly scarce, research is proceeding on various ways of using domestic TV receivers to receive news data.

The aim is to code newspaper transmissions onto normal TV broadcasts in such a way that they do not use any extra band-space. Two TV scan lines are normally redundant. These are lines 17 and 18 which are out of sight at the top of the picture. By encoding data onto these two lines and storing in a simple memory system within the TV set, a complete set of 99 pages can be built up within 30 seconds.

Prototype receivers incorporating this facility are currently being produced and it is expected that all existing sets could be converted to receive such a service for a cost of $75 to $150.

The home viewers will be able to watch normal TV programmes until he wishes to 'read the paper'. A push-button console will then enable him to dial-up the page he wishes to read. The 'paper' which will of course be stored within the set, will then display the required news, together with the current time.

A tremendous advantage of the proposed system is that news can be updated virtually continuously – a great advantage at election times, and also for services such as stock market reports, sports results, weather and news bulletins.

Simple line drawing can be run, also advertising.

The proposed system is by no means just a pipe dream. Both the BBC and the IBA (Independent Broadcasting Authority) have fully developed prototype systems which work well. Test transmissions are to begin later this year.

NEW STORAGE MEDIUM

A new information storage effect has just been announced by IBM. The effect, can handle phase and amplitude data over a bandwidth of 108 – 1010 Hz or higher.

The data is stored as a stable pattern of electrons trapped in a photo-sensitive piezo-electric crystal. The storage pattern is produced by inter-action between two input signals – one electrical and one acoustical.

Read-out is obtained by applying a signal of the same frequency as the original input – this caused the stored data to radiate an 'echo'. Data is erased by shining a light onto the material.

LASER DRY-CLEANERS NOW!

Many of Venice's medieval and renaissance buildings have been blackened and eroded by industrial smog. Even works of art housed within the public buildings and palazzi are under attack.

Conventional cleaning methods, such as chemical solvents or sand-blasting cause more damage than the disease itself.

Recent experiments show, however, that a laser beam can be used to remove pollutants and reveal the original natural beauty of the stone or wood beneath.

The work has been researched jointly by Dr. Ralph Wuerker of TRW (One Space Park Redondo Beach, California, USA) and Dr. John Asmus of the University of California, San Diego.

A further, vaguely allied, project of the two research workers was to create holographic images of Venetian sculptures so that thee-dimensional images of the works of art could be re created anywhere in the world.

SO WHO NEEDS A CALCULATOR?

The odds are at least five to one that your answer was 5000.

If so it's wrong!

The correct answer is 4100.

Worrying isn't it?

JAPANESE PRODUCTION DECLINES

Profits of Japanese electronics companies may fall by at least 25 per cent this year. Output of most consumer-electronic products is expected to remain static or perhaps drop.

Production of colour TV sets are expected to fall from last year's 8.7 million units to about 7.8 million units.

On the other hand, production of hi-fi equipment, particularly of amplifiers, will continue to follow the general world trends. The figure for amplifier production is expected to be 3.5 million units (compared with 2.8 million in 1973).

There are signs that this decline may not be just a short term phenomenon.

Whilst there are now no serious material shortages, prices of petrochemical products, especially plastics, has risen by 40 per cent – and salaries have risen by 30 to 35 per cent, in some areas as high as 40 per cent.

This means that the ratio of labour costs to total sales will rise from its current 15 per cent to 20 per cent or more – in line with most other advanced countries.

Many manufacturers are cutting back on production, but a few, particularly Matsushita, are switching their production lines to produce audio equipment.

Other manufacturers are currently building plants in America, Asia and Europe.

As previously stated in ETI, Sony are building colour TVs in the UK and San Diego and will shortly build a similar plant in France.

Hitachi are believed to be planning to construct a semi-conductor plant somewhere in Southeast Asia. Toko are actively planning to produce capacitors in Malta whilst Matsushita are hoping to take over America' Motorola Consumer Division, if they can obtain US government approval.

TV RECORDING BREAKTHROUGH

Researchers at Batelle (Washington USA) claim to have made a breakthrough in TV recording.

They have developed a method of using lasers to scan TV pictures and storing the resultant image on a photosensitive plate.

The pictures are converted to digital information which is then recorded as a series of dots, each one micrometre diametre. Data density is 200 million bits/sq in.

Playback is achieved by an optical scanner.

The technique's main advantage is that of cost. Whereas a 30 minute magnetic tape recording normally costs about $30. Batelle claim that their method would enable the same material to be recorded on a 120 by 170 mm record for as little as 30 cents.

LOW PRICE VERSION OF H-P 80.

Our US correspondent tells us that Hewlett-Packard are planning to introduce a low-price version of their very successful H-P 80 financial calculator.

The unit is believed to have most of the H-P 80's functions except for the more specialised functions such as trend-line analysis etc.

Look for a price around US$175 against the current US$395 – and an official announcement round about July/August.

news digest

US CALCULATORS TO SELL IN JAPAN

America's National Semiconductor company is actively marketing its Novus range of calculators in Japan.

Despite Japan's many calculator manufacturers and most complex distribution network, National Semiconductor hope to sell 100,000 to 200,000 calculators a year.

Prices set so far are US$24.64 for the NS600, US$31.78 for the NS900 and US$53.21 for the Novus 820.

Although National Semiconductor are planning to assemble the calculators in Southeast Asia, the company are believed to have no plans for assembly in Japan.

Rather surprisingly, the Japanese appear to have lost their lead in calculator production — according to a report from OVUM in London (22, Grays Inn Rd, London WC1). The £36 reports shows that the value of Japanese calculator production has actually declined, despite a huge increase in the number of units produced.

The reason appears to be that US manufacturers, realizing that their LSI (large scale integrated circuit) technology was being exploited by the Japanese decided to make 100% of the machines rather than 75%!

PERSONAL PRIVACY BILL

The US Congress may soon pass legislation preventing any business firm allowing use or misuse of computerized or other personal information files in any way that may invade a persons privacy.

If passed, the Bill (S 3418) will enable the establishment of a Federal Privacy Board with powers to police both private and official use of personal information files. Violations of the law (which would be a federal crime) would become punishable by a US$10,000 fine and/or five years jail.

An interesting provision of the Bill is a clause obliging all firms and government departments to disclose publicly the existence of the personal file system and details of how any citizen can determine if he is included on the list.

A further, and most important clause prohibits the divulgence of any personal information to a third person without the consent of the person concerned.

US POST OFFICE ORDERS ELECTRIC VANS

The US Postal Service has placed an order for 350 electric-powered light delivery vans.

The order, the largest ever for electric vehicles, was won by American Motors (Wayne, Mich.).

Also competing for the order were, Otis Elevator and Electromotion Corp.

ORGAN TONES FROM SINGLE IC

An IC that can generate all 13 tones of the highest octave in an electronic organ will shortly be released by Intermetall GmbH (the German member of ITT Semiconductors).

The chip will be known as the SAH 200. It is an MOS device needing just one -22 volt supply. Stability is claimed to be very good with the greatest deviation from the tempered-tone scale being a mere ±0.011 per cent.

CALCULATOR PRICE CUT

There are indications that scientific calculators may soon by as cheap as four-function units were a year or so ago.

Texas Instruments are expected shortly to drop the price of their SR-50 unit from US$169.50 to $US149.50. The company's hexadecimal calculator (used mainly by computer programmers) was slashed last month from US$295 to US$249.50.

LASER FUSION SUCCESS

A major advance toward controlled nuclear fusion was made last month by KMS Industries Inc. (Ann Arbor, Mich).

The company announced late last month that they had (four times) succeeded in obtaining high energy neutrons from laser-driven compression and heating of a deuterium pellet.

As far as we are aware, this is the first time that thermonuclear neutrons have been produced by laser fusion.

NEW 115 MHZ – WIDE BAND FOR COMMUNICATIONS

The US Federal Communications Commission have allocated a 115 MHz-wide band between 806 MHz and 947 MHz for land mobile radio serwies, (a 26 MHz-wide band between 902 MHz and 928 MHz is reserved still for industrial-medical-scientific purposes).

Usable as from now, the new frequency allocation may be used by anyone — or any organisation — eligible to use any of the existing radio services; non-profit shared-cost systems such as those run by public safety departments, doctors, or small fleet owners; a third category opens the band to communications companies seeking to establish nation-wide 'cellular' radio-telephone services. ●

Magniamplification...

SONAB offer the P4000 as a masterpiece in amplification to comply with your own choice of components or to combine with the SONAB range of quality sound equipment that has made them world famous. Sweden is proud of SONAB and SONAB are proud of their product, so proud in fact that they give you a 5-year guarantee.
Put your money where the sound is — SONAB.

For literature on SONAB turntables, amplifiers and the rest of the SONAB range — and the name of your nearest dealer, phone or write to us:

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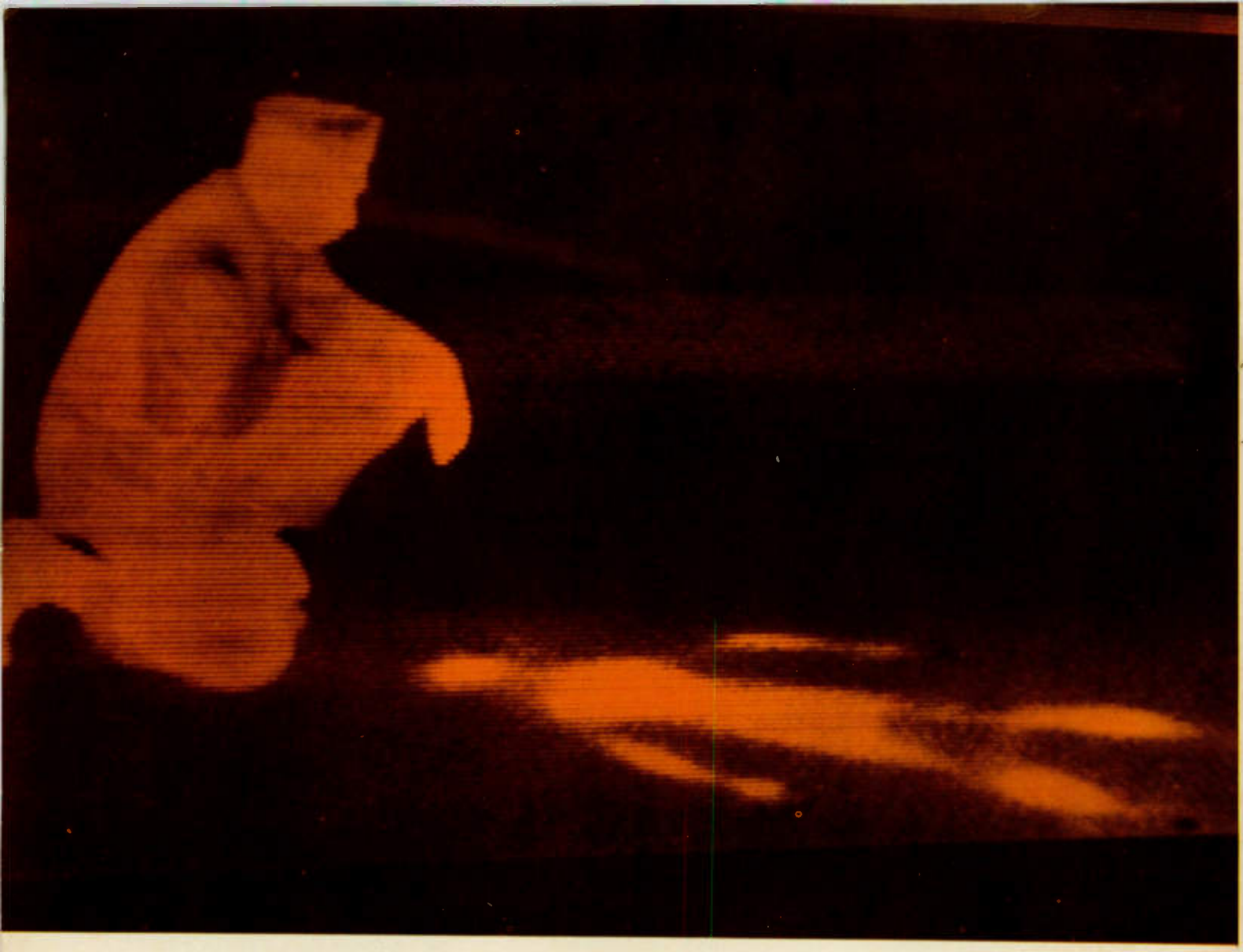
SON 2



ELECTRONICS IN CRIME

▲ *Hours after the murderer has moved his victim's body, a heat-sensing camera produces this thermogram showing exactly how and where his victim lay. The camera has reconstructed a scene – that the detective (left) can see only as a bare rug.*

In the battle against crime – *both* sides are using increasingly sophisticated techniques. Electronics Today reports –

HOURS after a murderer has moved his victim's body a thermographic (heat-sensing) scanner can clearly delineate the exact manner in which the victim first lay.

A person's movements can be plotted – hours after his presence – using holographic pictures to show up microscopic (elastic) deformation of the area where he has been.

It is electronics that has made this possible – together with other equally impressive instruments for a multiplicity of purposes – from infra-red image converters used for night vision to laser eavesdropping devices; from sophisticated devices for hidden weapon detection to units for finding long-since buried bodies.

IT'S A TWO-WAY GAME

Needless to say, since the devices used in surveillance and detection are of a 'passively aggressive' nature there have as a result evolved complementary devices used to neutralise or counteract the originals.

Many of the devices described in this series operate in conditions that are, at best, on the ragged edge of legality or sometimes in contradiction of it. One can readily foresee that the future battle against crime will be one in which *both* sides use electronic devices and counterdevices.

Already there are instances where this has happened. A major betting fraud was perpetrated in Queensland, Australia quite recently, in which quite sophisticated electronic equipment was used to intercept and delay telexed race results.

In another instance a UK-based radio operator tuning across the 27 MHz band overheard bank robbers using walkie talkies during an actual felony.

The London police unsuccessfully tried to locate the crime when notified. Unfortunately, it being a

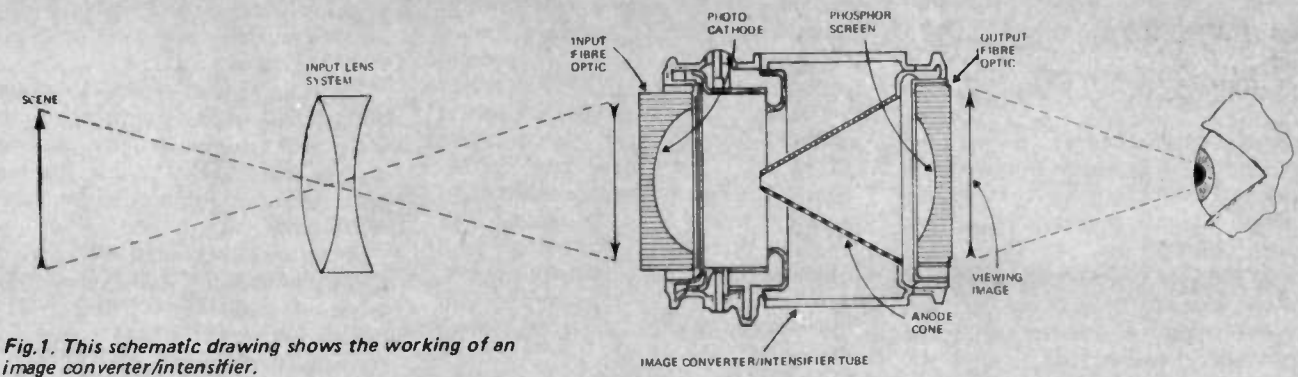


Fig.1. This schematic drawing shows the working of an image converter/intensifier.

A MODERN IMAGE CONVERTER-INTENSIFIER SYSTEM

Passive night viewing devices depend upon the light amplification of the image intensifier.

The scene is very faintly illuminated from sources such as starlight or proximity to man made lights.

Conversely in an active system a source of infra-red light, such as a tungsten filament globe kept just below incandescence, is directed onto the scene. By using an infra-red filter over the "searchlight", the subject is not aware that he is being illuminated since infra-red rays are invisible to the human eye. The image converter tube is capable of "seeing" both visible and infra-red radiation.

The optical system focuses the reflected light onto the face of the input fibre optic plate on the image converter. The optical image is then transferred by the fibres to the interior concave surface where a high sensitivity photocathode transforms the photon image into an electron image. Photoelectrons are released in direct proportion to the light intensity at each spatial point of the image. These electrons are now accelerated and focussed electrostatically onto the phosphor screen of the output fibres optic plate by the potential applied between the anode cone and the photocathode.

The electrons striking the phosphor produce an image similarly to that on a cathode ray tube and so a radiant image is built up. The intensification factor depends on the accelerating voltage of the tube. For a voltage of 15 kV, the intensified image is typically 25 to 60 times brighter than the optical image formed at the photocathode. Apart from the refinement of fibre optics and higher bias voltage this unit is little different to the "Tabby" system (described in the main text).

weekend, all banks were locked making a total search impossible.

Major payroll robberies have been committed by 'bent' computer operators who not only programmed their machines to divert funds in their direction, but wrote deletion instructions into the programme as well — thus effectively covering up their tracks.

SURVEILLANCE

During the second world war a device was developed by the allies known as "Tabby", "cats eye" or "owl eye". Supplied mainly for tanks it enabled the tank-driver to "see" in the dark. Later versions giving greater definition were used as snipers appendages for night work.

"Tabby" consisted of an orthodox optical system which brought the image to focus on the photocathode of an image converter tube. By applying a bias voltage an image was formed on a fluorescent screen at the rear of the converter. This image was intensified by the tube giving an improved brightness over the original picture. The bias was obtained from a then special type of battery called a "Zamboni pile." The image appeared on the fluorescent screen inside the converter. Image quality left something to be desired but the unit was adequate for the purpose of assisting night drivers.

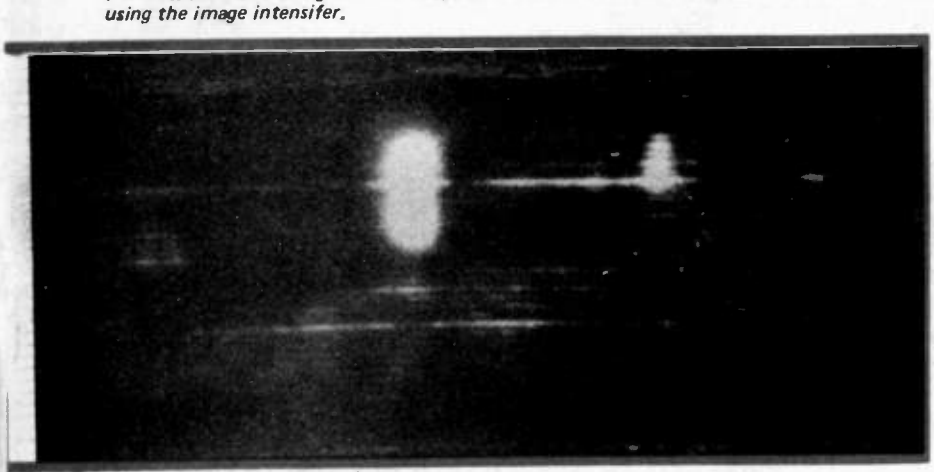
From these early instruments have evolved both active and passive image intensifiers and viewers as well as thermal imagers.

Thermal Imaging is an additional night vision technique which has certain advantages over intensifiers for the detection and observation of people and vehicles.

A human body (live) emits about 100 watts of heat energy in the form of long wave (far infra-red) light.

The average temperature of a man's head and his outer clothing is several

Fig.2. Thermal imaging (left) via image intensifier (right), both pictures are of a man walking along a path in open country on a dark night — (10-4 ft. candles). Using thermal imaging, the man could be clearly seen 1000 metres away, compared to the 100 metre or so maximum using the image intensifer.



ELECTRONICS IN CRIME

degrees above the background temperature so although other objects around him are also giving off infra-red radiation the man stands out thermally from his background.

Over the past few years a number of thermal cameras have come into use. However most of these are intended for industrial rather than forensic use and their need for liquid nitrogen cooling of their indium-antimony IR detectors has rendered them too cumbersome for police use.

More recently details of a de-classified unit developed for the US army have become available. This unit is hand-held, has a thermoelectrically cooled detector and a 2.5 cm CRT display viewed through an eyepiece. Developed by Hughes in the USA the unit is energised by a 3 kg power pack and takes approximately 15 seconds to reach operational temperature.

Hughes have more recently announced a new portable unit called "Probeye". The unit weighs 3.1 kg and contains six InSb detectors cooled to 87°K by an argon gas cooler. Sensistivity is high and a small battery supplies the 1.5 watts required to operate the unit. Both battery and argon bottle have a life of four hours.

Latest work in the field comes from the English Electric Valve Co. where thermally sensitive TV tubes (pyroelectric vidicons) are being developed. Their main advantage is that they do not require cooling.

The two photographs on page 27 illustrate the different images obtainable by a light intensifying system via IR image converter as compared to a thermal image system.

The image intensifier system relies on the subject being illuminated by the surrounding faint light or by an infra-red source, whilst the thermal image is a heat picture which builds up an image from radiation emanating from the subject itself.

Thermal viewers form a valuable addition to night viewing equipment. Men and vehicles in most situations can be detected at twice the range obtainable using intensifiers and active IR systems.

Under certain conditions where the scene illumination makes observation with an intensifier difficult, (as in woods where little light enters from outside to illuminate the subject, or where there is a presence of strong lights in the field of view) then thermal viewers make detection and observation simple.

Cadaver Sniffing – A "Grave Operation"

A more macabre aspect of personnel detection is the detection of cadavers (dead bodies).

Searching for cadavers concealed in vegetation, buried or underwater often

"FALSE COLOUR" INFRA-RED COLOUR PHOTOGRAPHY

Infra-red can be used to take pictures in colour but the colour is what is known as false colour. Colours are sensations produced in the brain by certain wavelengths of visible light, that have entered the eye. Infra-red radiation produces no sensation because the human retina is not sensitive to it. But since certain photographic emulsions are sensitive to infra-red, it can be considered a colour and used to take pictures that show it as a colour when they are developed.

This is generally done by making invisible infra-red reveal itself as a red in the final photograph.

Like standard film that can take pictures in true colours, infra-red film has three superimposed emulsions, each sensitive to a different set of wavelengths – in this case infra-red, green and red.

These wavelengths form images on their respective layers, but when the film is developed, positive images in other colours appear.

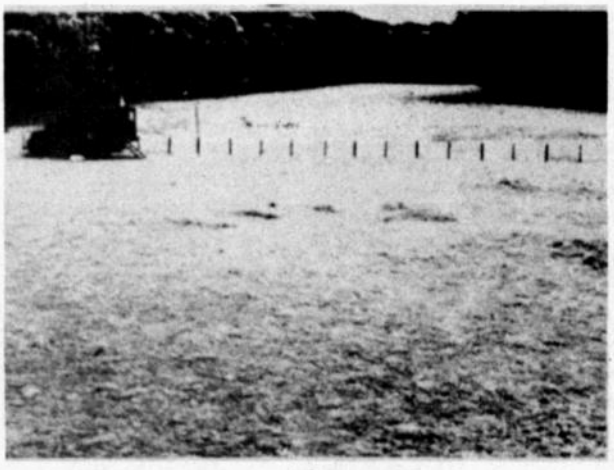
False colour pictures are useful militarily because they make it even more difficult for an enemy to hide behind camouflage.

False colour has its civilian uses too. When an orange grove is photographed in false colour the healthy plants appear as a uniform reddish brown whilst trees attacked by fungi or pests are purplish or blue. Similarly landscape has its individual components brought out in full gamut of false but meaningful colours.

Amateurs have no great difficulty with false colour film and sometimes get surprising results that even experts cannot explain.

False colour film is available from the better known film manufacturers in standard 35 mm rolls for the would-be experimenter, as is manufacturers literature containing tips on how to use the film. (Kodak Ektachrome infra-red film to be used with orange filter).

Four graves, seven weeks old, normal colour.



Four graves, seven weeks old, false infra-red colour.

**It should be noted here that the monochrome print does not show as marked contrast as the original colour print.*

occupies large numbers of people for long periods. Nevertheless cadaver location, even if foul play is not suspected, is treated by the police with a high order of priority.

But it is often a long and difficult task, for the places of concealment and other circumstances, which determine the most effective search technique, are as wide as the environment in which man lives.

The Plessey Radar Research Center (in the UK) have recently studied various aspects of cadaver detection on behalf of the Home Office Police Scientific Research Development Branch. Plessey studied various search methods suitable for three well defined types of area. Large areas in open country, small areas in well defined boundaries such as back gardens; and areas of water such as canals, gravel pits, quarries, ponds, rivers or docks.

The study of the effluents of a living human body, including breath and vaporisation of odours from the body surface, have revealed that a broad number of chemicals are given off. The total organic emission is as high as 0.5 gms/hour.

Similarly a cadaver whether on or beneath the surface not only undergoes chemical changes and emmits organic matter into the atmosphere but also affects the surrounding soil and vegetation.

With these factors in mind electronic detectors of organic matter have been developed.

Most successful among these has been the body ammonia detector first used by the US army in Vietnam; continuous sampling monitored the air for ammonia together with carbon dioxide produced when the urea of sweat is broken down by bacterial action. This "sniffer" could detect the presence of humans, under jungle conditions and in the dark, even when concealed.

However, when searching for a cadaver over a large area it is more difficult and a combination of techniques has to be applied.

Photographic methods, using special film sensitive in the infra-red region, will pick up spectral anomalies of a grave where a body has been buried. In brief it constitutes a sensitive detector of recently disturbed vegetation and soil.

This technique has been used for detecting camouflage by the military with great success.

Evidence will be visually apparent with a fresh grave, but as the grave becomes overgrown other methods of detection must be used. For the first six months or so, the drop in soil moisture content above the cadaver will restrict vegetation growth. As decomposition products due to the cadaver's putrefaction seep up, thus enriching the soil, a lusher vegetation will appear (Ugh! — Ed). Some changes in the type and nature of the vegetation are also evident. Both these effects produce changes in the visible and near infra-red reflection spectra which are detectable on infra-red film.

Thermal imaging methods can also be used to detect thermal anomalies over a grave site. These occur for similar reasons as those causing spectral anomalies. It is to be noted that whereas the previous method measures the reflectivity of the soil and vegetation, thermal imaging measures the emissivity of the area.

Live humans have been observed from aircraft fitted with thermal imaging equipment even when concealed in trees.

During the rapid decomposition of the cadaver either on the surface or lightly buried, the surface temperature of the skin, clothing or even the soil, may be raised by the exothermic reactions set up inside the putrefying body. This effect could lead to a marked temperature anomaly which could make this type of system attractive.

Multispectral sensing is an experimental technique developed to improve on "false colour" infra-red photography. By this method a target is viewed using spectral bands by which it appears with maximum contrast against its background.

A special instrument called a "Telespectro-reflectometer" has been constructed. This is designed to scan a selected area of ground from an evaluation platform. It provides a very narrow spectral resolution of 0.005 μm over a broad wavelength range. The data are extracted on punched tape for computer analysis. Vegetation reflection spectra over graves are being investigated to see if a characteristic "fingerprint" of a grave for all conditions of weather, solar angle, age of burial and soil type, can be established. (Fig. 3).

Acoustics may also be used for cadaver location — and a single operator instrument is already in use.

Sound travels at different velocities through compacted soil as compared with less compacted fill. The more compacted the soil the higher the velocity and vice versa. Thus if the instrument is located over a grave the slower time of arrival of the shock wave at the sensor will be indicated by a time anomaly as compared with the surrounding more homogeneous terrain.

In the instrument shown (Fig 4) a hand-held striker generates a mechanical impulse which is transmitted into the ground and about five to 20 cm away a sensor picks up the vibrations transmitted by the soil and feeds it to the measuring unit. Tests have shown anomalies to be evident when over shallow test graves with pig carcasses in them.

VHF techniques have also been applied as a search medium. A

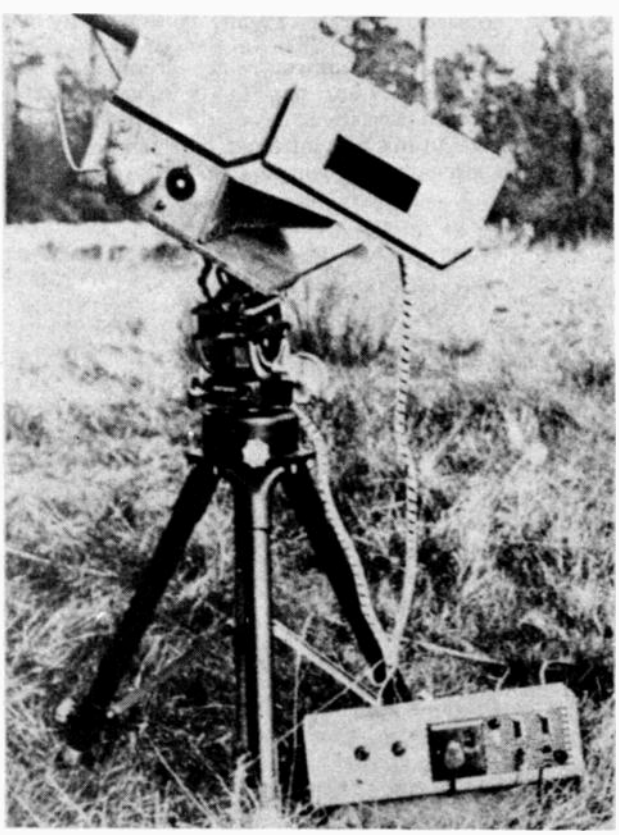


Fig.3. Telespectro-reflectometer.

ELECTRONICS IN CRIME

Fig.4. Experimental acoustic cadaver detector.

differential VHF cadaver detector has been developed. The search head for this unit consists of three equally spaced co-planar dipoles. The outer pair are used for transmission and the inner one for reception. The two transmitted signals are of equal amplitude and opposite phase so the received signal is zero when the search head is placed over a homogeneous medium such as undisturbed soil. If the head is swept towards an anomaly, the disturbance to the field of the nearer transmitting dipole will be greater than that to the field of the further dipole. The system thus becomes unbalanced and a signal appears at the receiving dipole.

The results obtained with this rig have been most encouraging. The detection of cadavers buried in soil to a depth of 15 cms has been achieved with soil moisture content of about 15% by weight.

Radar A more recent experimental method uses a short-pulse high resolution radar developed by Calspan Corp of Buffalo NY. Subsurface cadaver detection is accomplished by transmitting a very short pulse, receiving its (much weaker) reflection from the target and presenting the time delayed, changed pulse shape either for visual inspection by a human observer, or to suitable automatic recognition circuitry.

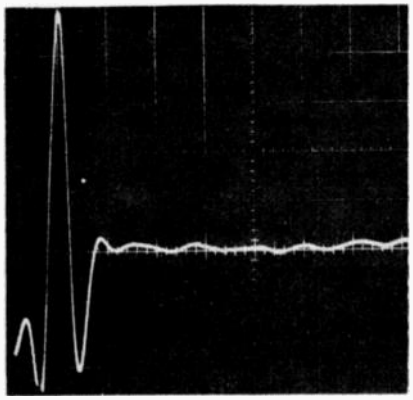


Fig.5. Soil surface radar return signal before burying dog.

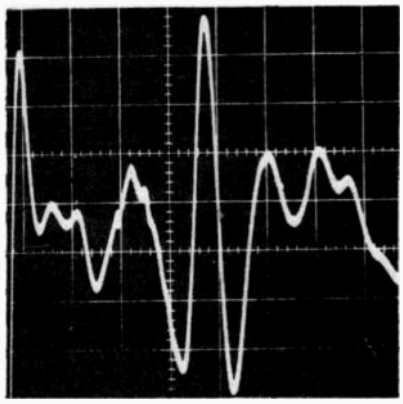


Fig.6. Signal obtained.

The transmitted signal must have a sufficiently large bandwidth to permit separation in time of the very strong soil surface return from the much weaker subsurface object return.

This experiment has demonstrated that a one-man-portable radar may be employed as a means of detecting buried objects. The holes made by disturbing the natural soil can also be detected, even though they have been filled and covered with an appreciable amount of soil fill. Animal bodies or cadavers may be easily detected.

By scanning the radar antenna laterally and longitudinally and noting corresponding signal response a fair estimate of the cavity size may be obtained.

Display of the signals obtained when a recently-dead dog was buried in a shallow grave are shown in Figs. 5 & 6.

Finally, the detection of bodies underwater. Turbid water can provide good transmission of ultrasonic energy up to 3 MHz. This is adequate for imaging objects of the size of cadavers, or even as small as hand weapons. There are nevertheless many engineering problems associated with generating a display which provides the operator with readily recognisable signals.

There are three main imaging systems.

1. Focused sonic image using refraction or reflection optics and an image converter.
2. Phased linear arrays of discrete pulse generating and receiving elements, which with suitable electronic processing can provide image displays.
3. Holographic techniques.

These are then a number of techniques which are available on an experimental basis. Further research and development is required before they can be put into general use.

Much research has been applied to techniques for detecting evidence of intrusion in some area or location. Recently a new technique of laser hologram interferometry has been applied with encouraging results.

The principle is that any surface which has had some force applied to it, such as the pressure of a human

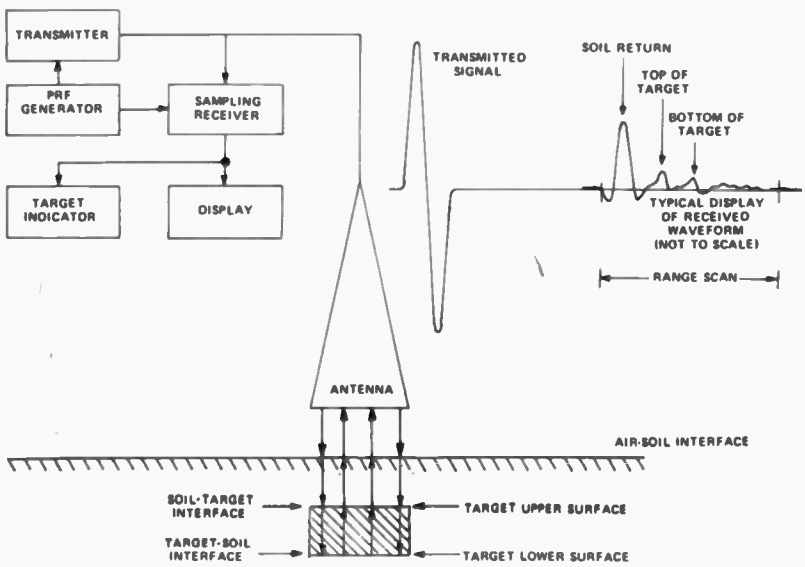


Fig.7. This is a block schematic of the Calspan radar system used for cadaver detection.

foot, elastically deforms around the pressure region. The elastically distorted area recovers rapidly at first — with about 90% return to original shape within seconds of removal of force, however further relaxation is progressively slower and detectable displacements persist for several hours.

This phenomenon is most marked with fibrous substances such as wood and textile materials.

If now, a method of comparing the surface shape of such a material at two instants during the slow recovery period is possible, it will provide the evidence of the earlier disturbance without the need for knowledge about the pre-disturbed state of the surface.

Through the use of holography this is possible. It must be noted here that such changes are of very low amplitude and the resolution of any measuring system used must be better than the minimum displacement of the material over the period of measurements taken. With a laser interferometer the resolution is at least half the wavelength of the light source (about 0.3 μm). This is of the order of magnitude required for detecting the minute changes of shape found by this technique.

Since interferograms are produced by taking photographs from the same location at successive intervals, absolute mechanical stability of the measuring system is essential. This requires a rather bulky set-up with a vibration-reducing platform if successful interferograms are to be obtained. Also motion of the object can mask localised variations.

Figure 8 shows that by locating a local reference mirror on the object surface, the motion of the object itself is compensated for. Any localised displacement due to elastic distortion by an external force will show up as interference fringes unmasked by the total motion of the object.

Figure 9 shows results from test set-ups using fixed-size samples of various materials which have been subjected to the force of a fixed weight for various intervals of time. The interferograms were taken at five minute intervals.

The illustration shows two identical hardboard samples. The weight on the upper one has been removed 15 minutes prior to making the hologram. The result indicates that the centre has moved 1.5 μm relative to the ends during the five minute sampling period. Each fringe corresponds to 0.34 μm. The lower "control" sample has shown no movement thus indicating the mechanical stability of the measuring system. After two hours the disturbed sample was still recovering at the rate of half a fringe per five minute interval. This dramatically demonstrates the order of magnitude of the measurements to be taken; measurements that were physically impossible prior to the development of the laser and holography.

Tests on rubber backed carpet underlay, where a footprint has been produced, yielded the fringe interferograms shown in Fig. 10. Photographs covering the time up to four hours after the event are shown.

These experiments have indicated the very high sensitivity of hologram interferometry in a stable environment. Where there are air currents, temperature changes and vibration, the technique can still be used with a pulsed laser and a local reference beam. The limits of sensitivity in an uncontrolled environment have not yet been established. The requirement of pulse to pulse frequency stability, coherence length and power requirement demand a somewhat bulky laser system at present. It is expected that future improvements in laser technology will overcome this disadvantage.

(These experiments were supported by the Police Scientific Development Branch of the Home Office in the UK and were implemented by EMI Electronics).

To be continued next month. ●

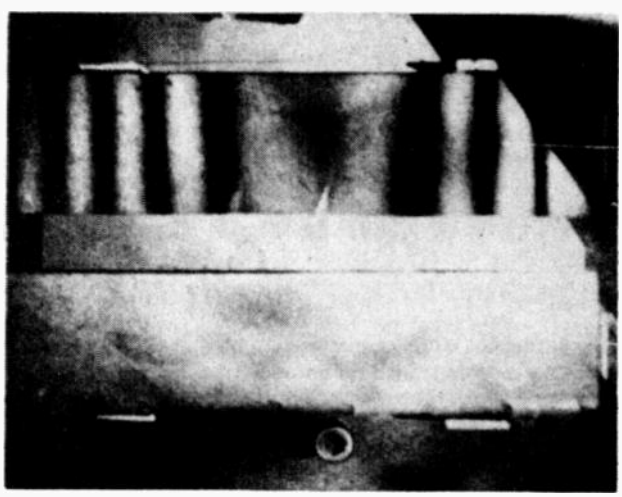


Fig.9. Interferogram showing movement in a hardboard sample. A second (control) sample is shown beneath the sample under test.

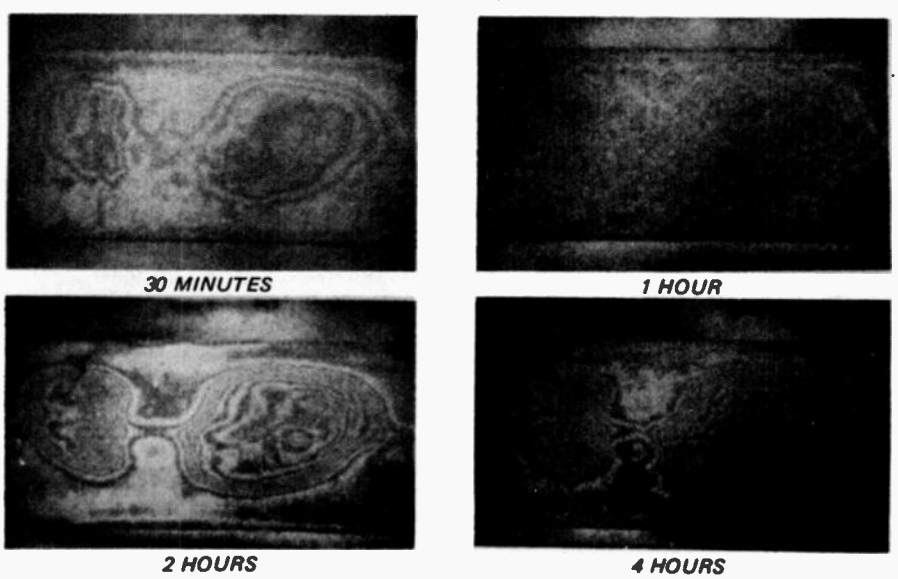


Fig.10. Sequence of 'live' fringe interferograms of footprint.

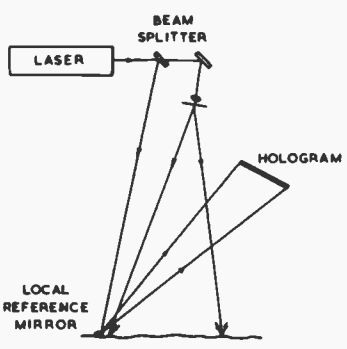
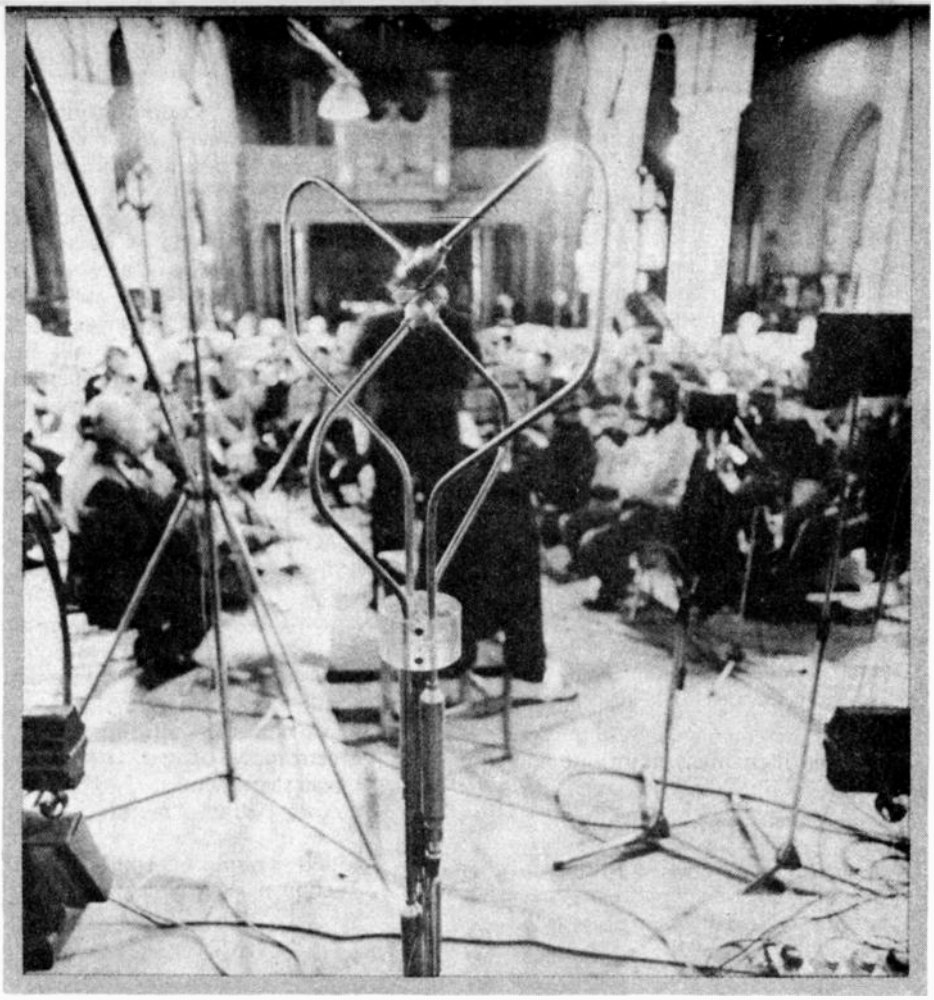


Fig.8. Local reference beam for object motion compensation. (See main text)



◀ *Here the tetrahedral microphone array used for ambisonic recording is used to capture the direct and reverberant sound field in St. Giles' Church, in the city of London.*

Worldwide, interest is growing in this effective new way to obtain true 'surround sound'. ETI's Assistant Editor, Andrew Pozniak describes the latest developments.

AMBISONICS

In recent issues, contributors such as Dr. Farrimond and Prof. Fellgett have generally questioned what four-channel is all about and what its actual goals are. With this interest from both academic as well as commercial institutions some exciting developments are coming to light with the promise of more to come.

In this article a broad look is taken at the "Kernel" approach to "Surround-sound". Since these innovations are yet in their embryonic stages, little in the way of information other than of an academic or peripheral nature is available. Also patents already applied for, preclude much practical technical data being published.

As more information comes to light further articles will be published. A broad list of references is listed at the end of this article. To indicate how current this topic is, the last reference is to a paper given by M.A. Gerzon "Psychoacoustic criteria relative to the conception of matrix and discrete systems in tetraphonics". This was read at the International Festival of Sound in Paris on March 16th this year.

It is not without some renewed eagerness and anticipation that further developments from various sources are to be looked forward to, after the somewhat meandering start that quadraphonics has had.

"QUADRAPHONICS" has been with us for some time now, but, unlike the introduction of stereo about two decades ago, its acceptance by the public is far from accomplished.

The major reason for this is that in spite of much work by manufacturers on developing a viable system for this new dimension, none of these systems comes up with a "convincing" argument or sound in keeping with what is the basic purpose of the whole exercise.

A polyglot of systems has evolved (SQ,QS,RM,CD4,UMX etc.) all have a sound technological approach, however arguments for and against each method have been raging since their inception, especially by their innovators, each wishing to see their system adopted as the standard.

Unfortunately out of this "Babel" little has resulted except confused consumers, slow sales of already manufactured four-channel equipment and suitable records, and perhaps most important, non-emergence of any sort of standard throughout the industry.

Most vivid proof of this state of affairs is the growing number of positions one sees on the "mode" switch of currently manufactured four-channel amplifiers with inbuilt multiple decoders to cover every possible contingency.

A slight polarisation of thought in favour of the CD4 discrete system is in evidence, especially in the USA. However before even the adoption of *that* system takes place severe re-thinking of the whole approach is definitely merited. This last statement is prompted in the light of recent technical papers on the subject as well as experimental work being done both at academic institutions and by certain companies in various countries.

In the UK, P.B. Fellgett, Professor of Cybernetics and Instrument Physics at

Reading University has teamed up with John Wright and, under the co-sponsorship of the National Research Development Council of Great Britain and the IMF company has been conducting research into a new concept for multi-channel sound recording and reproduction called "ambisonics".

As a result in 1971 a patent was taken out by NRDC arising from developments carried out at Reading University. At present experiments are mostly being carried out by IMF under Prof. Fellgett, John Wright and a more recent member of the team, Michael Gerzon, an Oxford University mathematician. Considerable help has been forthcoming from many parts of the audio industry from such companies as Dolby Laboratories and Calrec.

The first major public demonstration of Ambisonic sound was given at the recent Sonex '74 exhibition in London.

Unfortunately the demonstrators could hardly have picked a worse spot than the room they had allocated to them.

The acoustics of the room were completely unsuitable for the demonstration. In spite of the handicap one or two selections did give an idea of what an ambisonic system is capable. One particular piece of organ music produced a strong impression of the sound echoing inside a church. Some aspects of what "ambisonic" sound is, did come to light.

Professor Fellgett hopes to arrange a future demonstration in a more suitable location.

The new technique improves on present quadraphonic systems because of its ability to present natural sound images between front and rear pairs of speakers, and to reproduce sounds which seem to arise either between listener and loudspeaker or beyond.

So much so, that Mr. Gerzon believes that "Quadraphonics" as conceived widely at present, is a Dead End.

Unlike conventional quadraphonic approach, the new "ambisonic" system uses information from a multidirectional microphone array encoded onto just two channels. This means that the complexities of surround sound techniques are relegated to the recording studio and not the living room. It is envisaged that apart from two separate loudspeakers suitably in phase only a decoder will be necessary to convert an existing stereo system.

This new approach is not to be confused with the so-called matrix systems to date. In matrixing, information from conventional microphones is artificially blended to achieve synthetically the approximation of surround sound.

With ambisonics sound from every direction is picked up by a tetrahedral microphone array and is treated equally until the decoding operation.

In retrospect there have been two approaches to surround sound four-channel reproduction.

1. "Matrix" systems which aim to simulate discrete systems via less than four channels.
2. "Discrete" systems, which use four channels to create phantom inter-speaker images by feeding (panning) sounds only to the two adjacent speakers.

Now, with "Ambisonics" a new approach is emerging. This uses the "harmonic synthesis" or "Kernel" system. This new approach requires some explanation. The aim of a Kernel system is to convey through a finite number of channels an infinite number of directions (and thus an infinite number of channels). The mathematics used is not "Matrix" algebra but what is known as "Kernel" algebra (which is the corresponding mathematics used when one has an infinite continuum of variables).

"Kernel" systems start from the observation that the desirable effect is to produce a sound coming from an infinite number of directions around the listener. Such systems imagine a limited number of channels (two, three or four) being used to convey the sound to the listener, but are designed to create a continuous range of directions around the listener thus approximating the original. This re-creation may take place via (say) only four speakers. The signals fed to the speakers do not matter in themselves, only the directional effect of the sound field at the listener matters (This philosophy is close to that expressed in Blumlein's famous 1931 stereo patent.)

Commercial examples of Kernel systems are the UMX family of systems of Nippon-Columbia, Japanese RM systems excluding Sansui's QS system which is only an approximation to RM., and also the British NRDC "ambisonic" system.

Work along similar lines is being done in Germany by Sennheiser, see ETI, March 1974.

All in all, it would appear that at long last some more rationalised approach, as to what four channel surround sound should really be, is being taken. Interestingly enough the impetus for this has come from the academics rather than commercial incentives.

Pop-gimmickry and special-effect records may offer the recording-engineer scope for juggling the controls. However, it is high time that the record makers realise that in general the serious listener likes music "au naturel" – as close as possible to the original. If this goal can be achieved by quadraphonics then let it be so; but unadulterated by synthetic (stereo or four channel) "pseudophonics".

It is obvious that the whole question of quadraphonics is in a state of ferment and movements in the right direction are being made. This year should see many interesting developments and further articles dealing with the topic will follow as information comes to hand.

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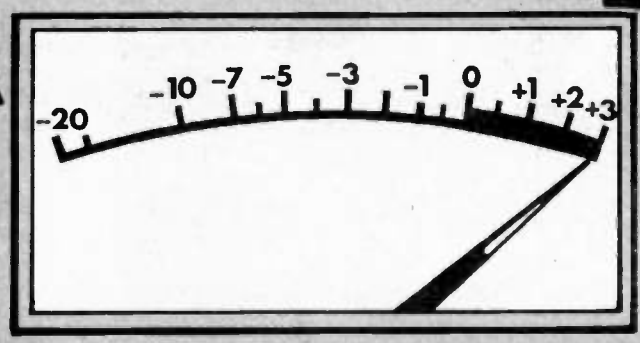

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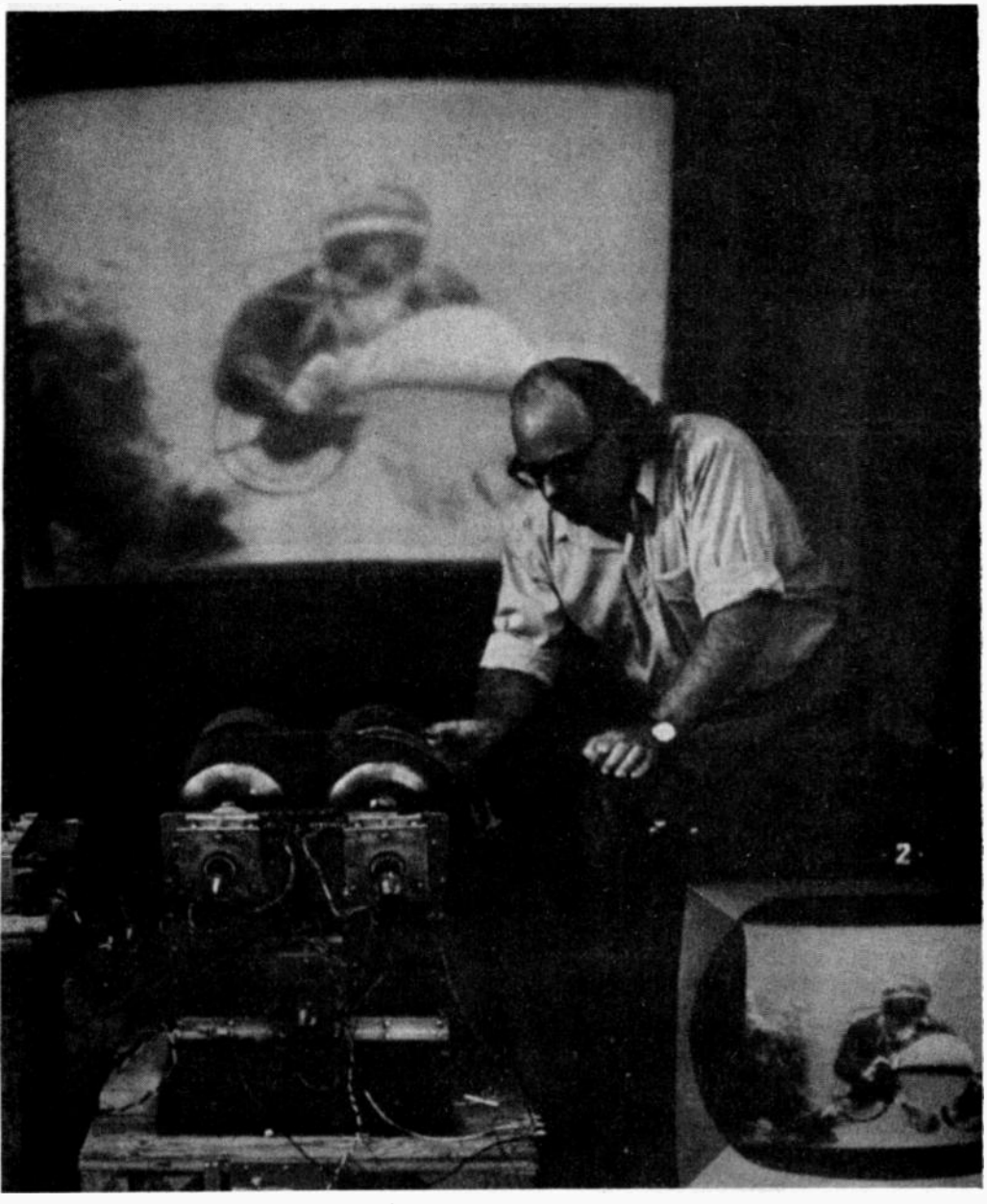


World-famous for his loudspeaker designs, Henry Kloss, President of Advent Corporation, is seen here adjusting an early prototype unit.

PROJECTION TV

Life-size colour in your living room is not only possible — it's here right now. — Larry Steckler reports . . .

COLOUR TV pictures four feet by six feet across can now be projected in your own living room.

Picture size is more than ten times the area of the largest conventional colour TV generally available. Usable area is more than 24 square feet (2.2 sq m.)

The picture is clear, well defined and bright enough to watch in a room with moderate background lighting.

It costs US$2495 — and it's available right now!

The system, called Video Beam Projection TV is produced in the USA by the Advent Corporation (better known in Australia as loudspeaker manufacturers).

Unlike other TV's, the Video Beam set comes in two major pieces — a receiver-projector and a separate rather-special screen. The receiver-projector plucks the TV signals out of the air, just like any other colour TV, but as the signal is received, the projector beams the resulting picture across the room to a separate screen.

All the electronic steps needed to produce a television picture are performed inside the projector-receiver. What travels from the projector to the screen is a beam of projected light, just like that from a motion-picture camera. The electron beam that produces the picture is not projected, and the set operates at voltage levels very close to those of conventional colour sets so there is no additional radiation hazard.

THE SCREEN

Obviously, the screen has no resemblance to a conventional TV screen. It has no phosphor coating, and no electronic circuitry. Essentially, it is an advanced kind of movie screen. Its surface is curved, and it is coated with a new, highly-reflective aluminium screen material. It stands on legs, with its lower edge 80 cm off the floor, and its total height is about 210 cm. Wall mounting is possible (brackets are available) but requires extra care and effort.

There is no wiring between the projector and the screen. Sound as well as the picture is beamed at the screen from the projector, and is effectively bounced back at the viewers.

THE VIDEOBEAM RECEIVER-PROJECTOR

The projector unit is in a moulded plastic console. All the usual controls are on the top of the 80 cm high unit. Three separate projection tubes at the front of the cabinet transmit the three primary colours. Once tube is red, one is blue and the third is green — the same three colours used in conventional colour TV tubes. The three beams are converged at the screen to produce a full-colour picture.

The screen must be placed 2½ metres in front of the projector. This is a fixed distance and cannot be varied more than 4 cm in either direction. Picture size is also fixed, along with the angle of projection and the height of the projector and screen.

The projector has the same basic picture controls as any colour TV set and, is operated in the same way. There are some additional controls to

make it simple to maintain optimum focus and convergence, and to re-establish best picture quality if the projector is moved.

The sound is produced by a single wide-range acoustic suspension speaker driven by a 5-watt low-distortion amplifier. It delivers surprisingly good sound.

LOOK AT THAT PICTURE

The curved highly-reflective screen is an important part of the picture system. If you took the screen away and projected the picture on a flat white wall, it would be barely visible.

The screen spreads light effectively over a gradually widening area and focusses it vertically over the range where the viewers are likely to be seated or standing. At a distance of four metres from the screen, the ideal viewing area is four to five metres wide (Fig. 2). Outside these boundaries, which continue to widen as you get further away from the screen, brightness and colour intensity lessen, but there is no optical distortion.

One key factor in the picture clarity is that the set maintains proper vertical interlace of the scanning lines that make up the TV picture. Interlace is improving in most modern sets but in some instances is still so badly maintained that the lines drift together, cutting picture resolution in half, and causing the scanning lines to become visible on the screen. (Things have been this way for so long that some people believe that the scanning lines are supposed to be visible — which just isn't true).

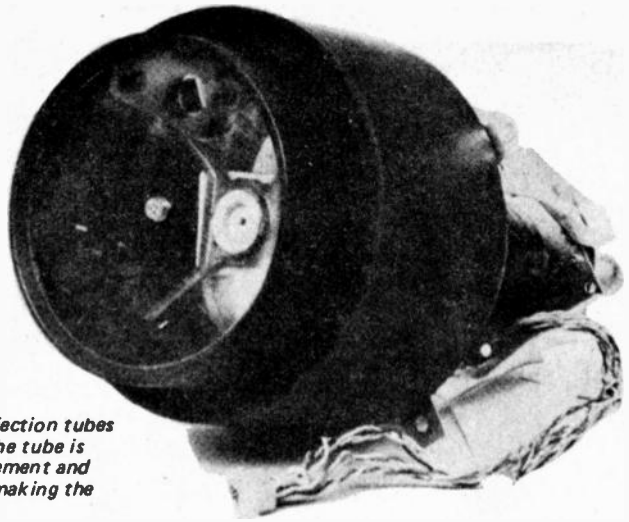
The Video Beam set also provides full dc restoration of the black level in a picture avoiding the loss of detail that can occur in the dark areas. This loss is particularly obvious when there is a sudden camera switch from a very light to a very dark subject. Full restoration provides this detail, keeps large dark picture areas blacker and improves contrast.

Since final picture quality depends to a great extent on reception conditions and the quality of the signal appearing at the antenna terminals of the set, a good antenna is a must. With the large screen, even minor signal deficiencies become obvious, while they might not bother you on a smaller conventional set.

HOW IT'S DONE

As we all know, colour television broadcasts are a mixture of three colour signals — one red, one blue and one green. When these signals are properly re-combined in a receiver, the full range of visible colour is produced.

In the Advent Video Beam projection design, there are three separate



This is one of the three projection tubes The single lens in front of the tube is the only external optical element and plays an important part in making the system possible.

Light Guide projection tubes, one for each colour. Inside each tube is a single electron gun for the colour that tube will project to the screen across the room. The gun is aimed to sweep back and forth over a 7½ cm phosphor-coated target screen inside the tube, which lights up the colour of the phosphor coating. Since the light emitting coating only has to produce one colour, it can be uniformly covered with a single phosphor for that colour. The colour dots or lattices of conventional sets are not needed, nor is a shadow mask — making tube efficiency much greater than is possible in a direct-view picture. This efficiency is the key to a bright projection picture.

Figure 2 shows how the picture from the light-emitting target is projected. The light given off is reflected by a spherical mirror that directs the light out of the tube via a corrective lens. The mirror focusses the light from each point of the internal target to the corresponding area of the big screen across the room. When the separate blue, red and green images from the three projection tubes converge on the screen, the full-colour picture is produced.

As roundabout as this may seem, it is much simpler than the usual colour television technique. The beam from the single electron gun inside each tube sweeps back and forth over a span of only 15° instead of the 90°

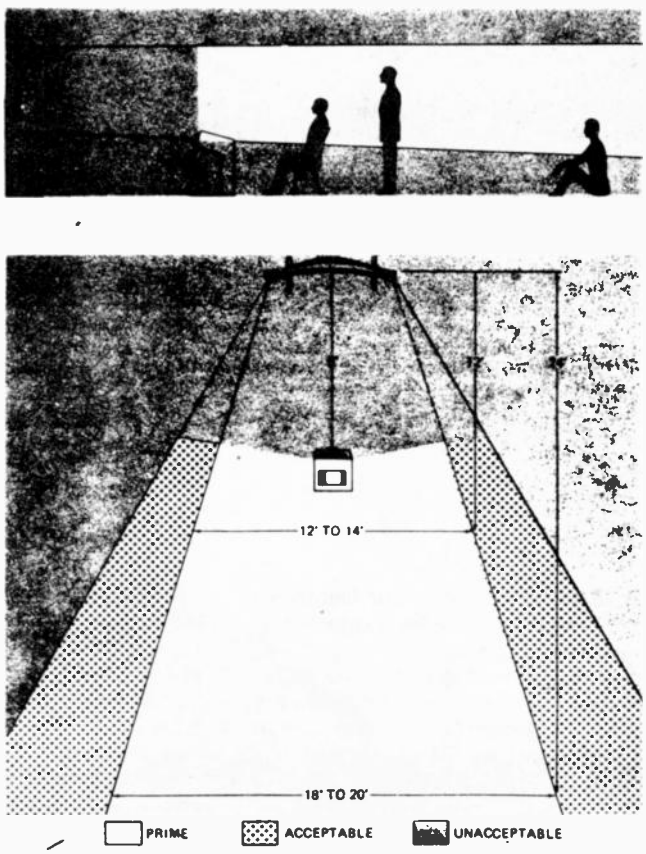
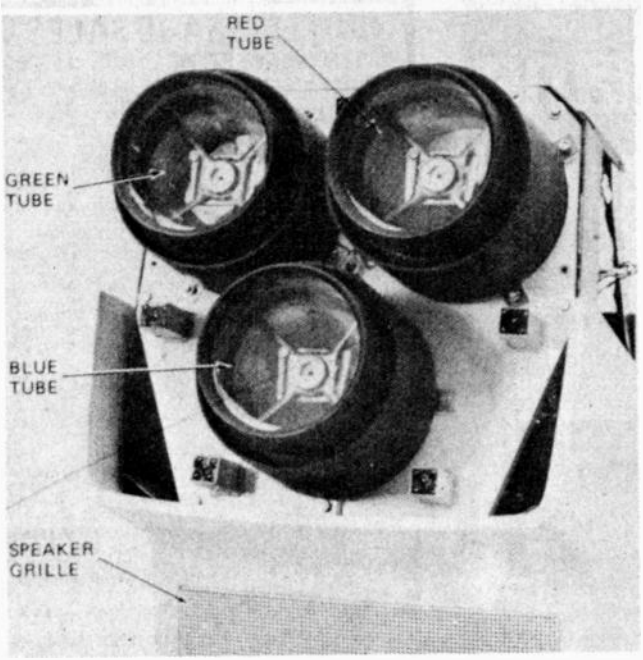
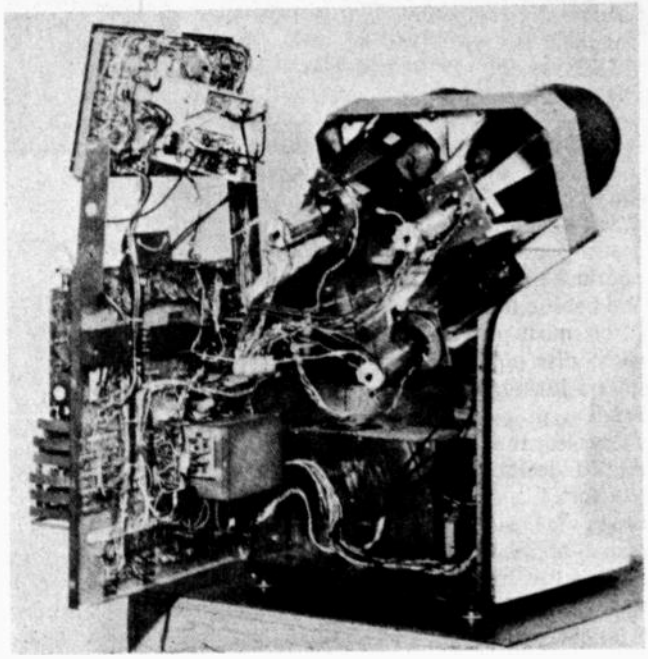


Fig. 1. Where you sit to watch TV is important. These two drawings show the proper viewing positions. All other positions are not acceptable.



Three projection tubes put the TV picture on the screen. Here, with part of the console case removed you can see how the projection tubes are positioned.



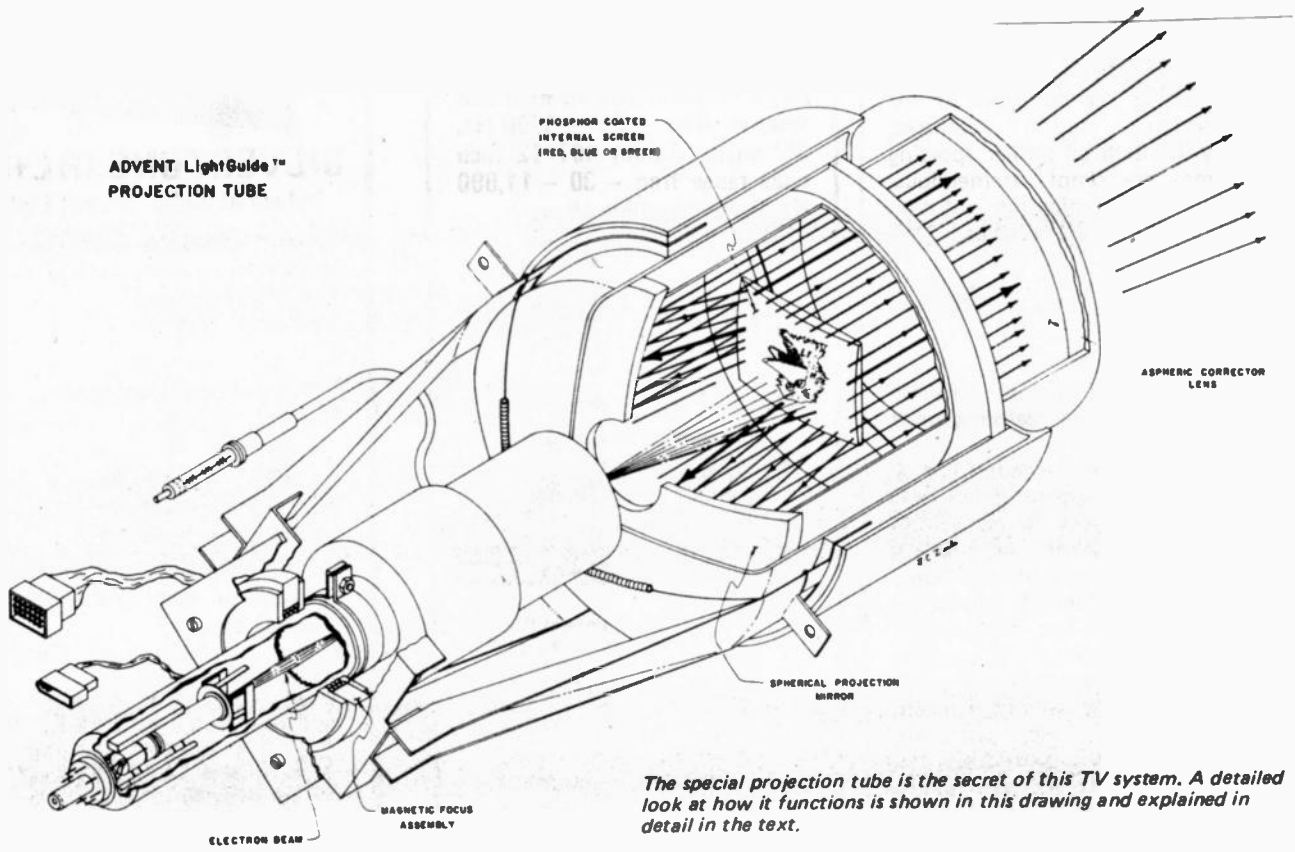
With the cabinet removed the innards of the projection set are revealed. Note the easy access to parts which speeds and eases servicing should it be required.

span in the ordinary colour tube. This makes it far easier to maintain picture linearity across the screen. Also, there is no need for clusters of colour dots or for the colour lattices used in newer picture tubes, and no concern that an electron beam might strike the wrong colour phosphor. The result is that the usual fussy convergence of three colours on the face of a picture tube becomes the simpler matter of overlapping the beams from the three projection tubes on the large external screen.

The projection tube also contains all the critical optical elements, sealed in a fixed relationship inside the tube. This allows all critical optical adjustments to be made only once – during manufacture of the tube. This also keeps these optical elements dust free. The only optical element exposed is the front of the corrector lens which requires occasional dusting.

WHERE DO YOU PUT IT?

The VideoBeam set is far from a personal portable, but it should fit into the average home. The basic



The special projection tube is the secret of this TV system. A detailed look at how it functions is shown in this drawing and explained in detail in the text.

Advent's projection colour TV is designed for use with the American NTSC system.

It is not yet known if it can be adapted for use with our forthcoming PAL system.

requirements are an unobstructed 2½ metre projection span and a comfortable viewing area alongside and behind the projector.

For most of us, videocassettes or video disc playback is still some time in the future. But when pre-recorded video programmes do become available, the VideoBeam projector will be ideal for playback.

In fact the set is designed with video recording and playback in mind. Inputs to the set are provided both by way of the antenna terminals and by a special direct input that bypasses the rf stage of the set. These two inputs will accommodate future as well as present playback devices.

A video output jack makes it easy to record TV programs with an external video recorder. A separate audio output jack permits playing the audio channel through a hi-fi system or provides for taping by an audio tape recorder.

WHAT'S IT LIKE?

I've only spent a few hours watching the VideoBeam projection TV and have not yet experienced it for an extended time in my home environment, but I do have some immediate comments.

The huge picture is a great advantage when watching certain types of TV programming. Action features, especially football or similar sporting programmes are simply tremendous. The near life-size pictures put you right in the middle of the action.

But even regular programmes become more exciting. You can see not just more close-up detail, but more of what is happening too. Instead of being locked into looking straight ahead, your eyes are free to move, to follow the action. The added realism cannot be described.

The bad, of course, becomes just as exaggerated as the good, and there is plenty of it. Technical flaws, in particular, from out-of-focus camera work to commercials shot in a hurry on mediocre equipment, show up unmistakeably at life size. Poor-quality broadcasting, especially when the colours aren't right, is much more visible and annoying on the big screen. And the variation in quality from station to station, programme to programme, or even moment to moment on a particular programme is striking. ●

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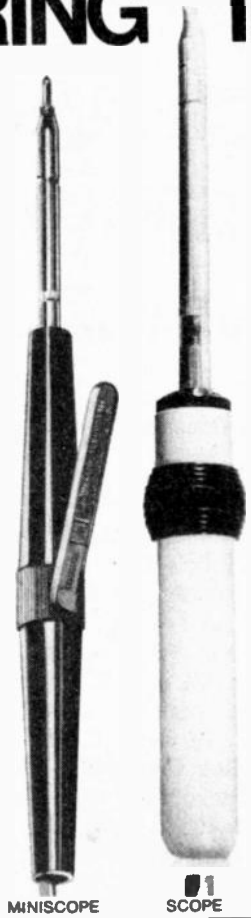

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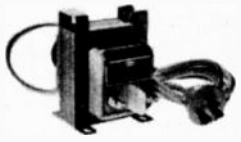

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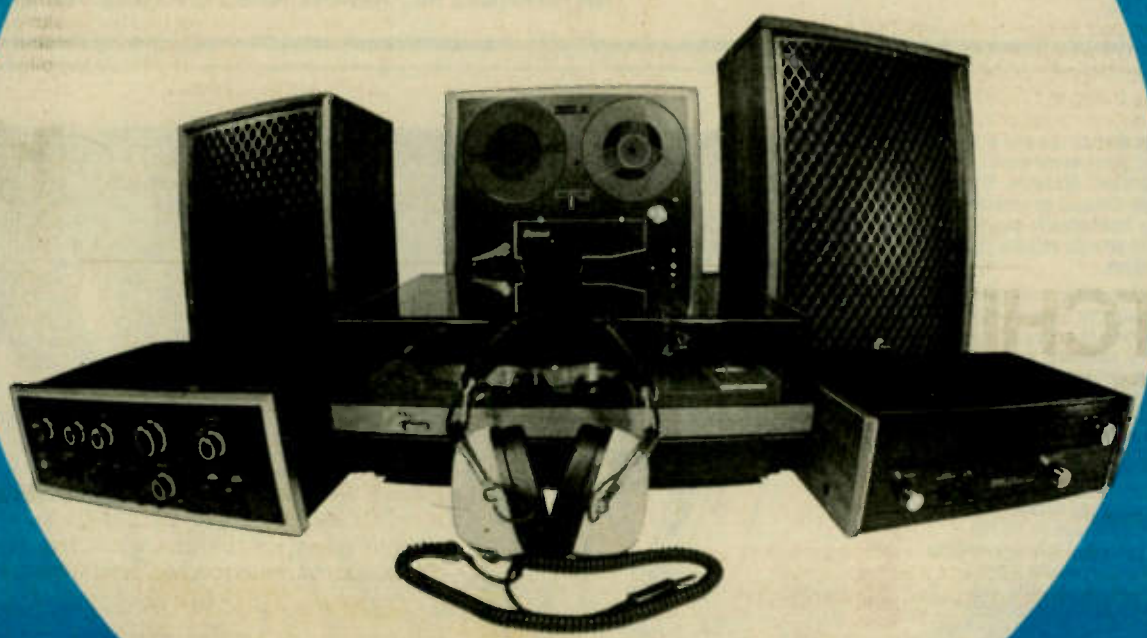

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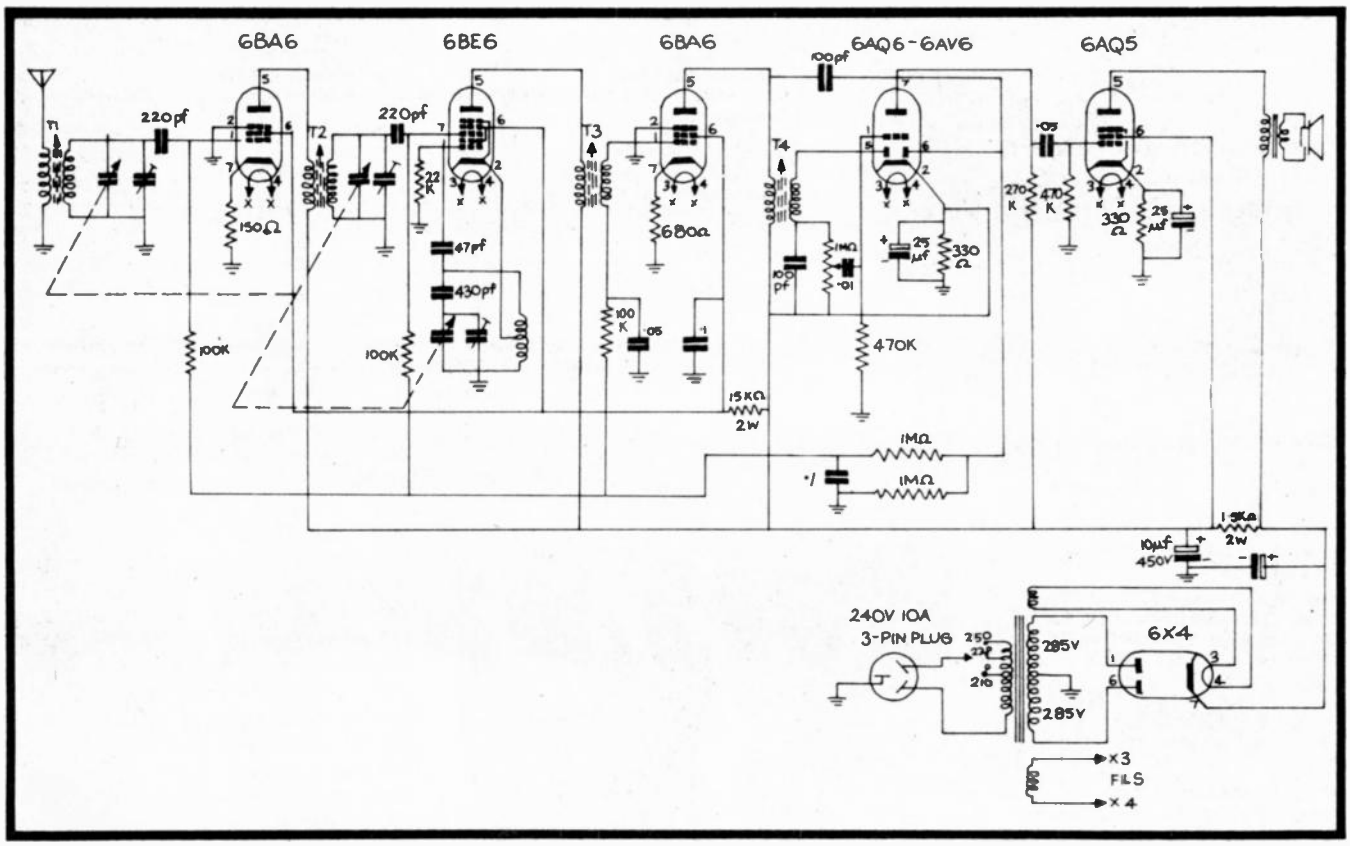

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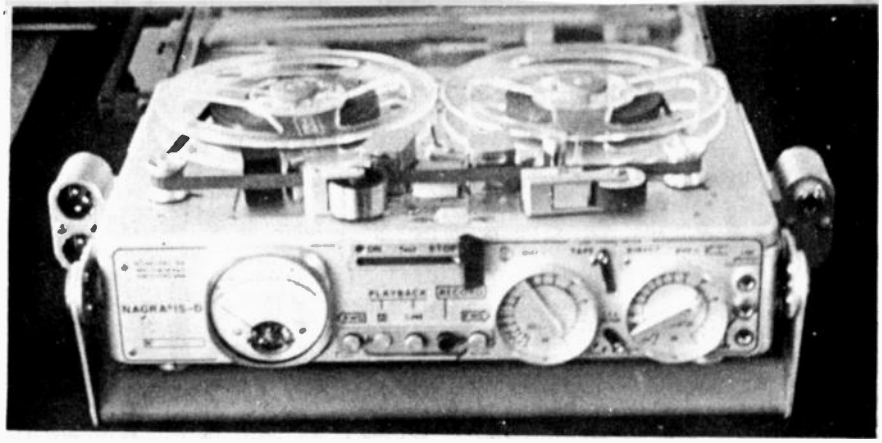

NEW NAGRA RECORDER

Kudelski to introduce three-motor recorder soon.

THE SWISS tape recorder manufacturer, Kudelski, has an outstanding reputation for producing high quality products.

Kudelski's Nagra recorder is in fact generally accepted as the best and most reliable machine of its type ever made.

Intended primarily for professional use, Nagra recorders range in price from $1500 to $3000 and have applications from producing synchronized sound tracks for film and TV productions and radio broadcast recording, to data aquisition, especially in sound and vibration engineering.

For many years the Nagra III tape recorder was the only true battery operated portable "high fidelity" tape recorder available, and it is worthwhile recounting that just after the mid-sixties an American corporation released pre-production information on their new tape recorder which had a specification performance equal to the Nagra III. Within weeks Kudelski unveiled the IV series Nagra – and the American Corporation shelved their production plans virtually overnight.

The Nagra deck is used as the basis for a large number of specialised recorders used for space, geophysical, military and scientific purposes, and Kudelski produces special stiffening frames to facilitate the fitting of multi-channel heads and wide tape reels.

The company have not yet entered the field of multi-channel tape recorders themselves (if one ignores the IV-SJ series recorder which is a true three-channel recorder) but it is obvious that they have set their eyes in that direction, for during a recent visit to the company's plant in Lausanne we came across the yet-unreleased Nagra 1S-D.

This new recorder is most probably the first three motor machine that Kudelski has produced. It is more than just an innovation or improvement on the basic portable Nagra, for the machine is obviously the first step that Kudelski is taking to develop a multi-track tape recorder system which will be the basis of a future incursion into the studio tape recorder market.

The Nagra 1S-D incorporates a push button operated mechanism which is a significant departure from the operational controls that have been a feature of all previous Kudelski tape recorders.

As can been seen from the illustration, the frontal appearance is typical of the BH-III series Kudelski Nagra with the exclusion of the operational controls in the top and bottom centre of the front panel.

The machine is significantly lighter than the Series IV machine and is claimed to have even better wow and flutter figures than those achieved by the series IV – which are most probably the best available in the industry at present.

Like the BH-III and early series IV machines, the input connectors are still designed for Cannon plugs, but the drive capstan system appears to be more rugged than that provided by the current series IV machines.

Kudelski is obviously delighted with this machine and although a release date was not available, it is clear that Kudelski will only release this machine because it offers distinct advantages in terms of improved performance from the series III and series IV Nagras.

It is now roughly six years since Kudelski released the series IV machines and excluding the improvements such as the two channel IV-S and IV-SJ released over the past two years, there have been no other new tape recorders released.

We expect that the 1S-D recorder will be even more in demand than the series IV and will become the obvious replacement for the series BH-III Nagras currently in use. ●

NAGRA PRODUCTION

The production facilities at the Lausanne factory are as modern as any in the world. From the production of their recording heads right through the machine and tool shops one gains a healthy respect for their excellence of production and quality control. The machine shops feature fully automatic numerically controlled lathes, and machines which produce the complex parts for the capstan supports on the one machine.

The technical staff are very proud of these facilities, and tell you so!

Each recorder is played with a continuous tape loop for twenty-four hours before final quality control testing is *even commenced,* and to see so many Nagra tape recorders undergoing this unusual pre-testing chore was really delightful. This run-in for each tape recorder provides not only a check of the quality of the head but also helps to provide a final honing of the head surface which is already mirror smooth from the automatic machining process.

Each machine undergoes a complete detailed acceptance test where all (not some) of the major system parameters are checked out to determine compliance of the machine with the published specification. This test, includes record-to-replay frequency responses, wow and flutter, signal noise, channel separation, distortion, azimuth alignment and head linearity. All are carefully checked out, as is the degree of frequency response deviation in the critical 20-200Hz region.

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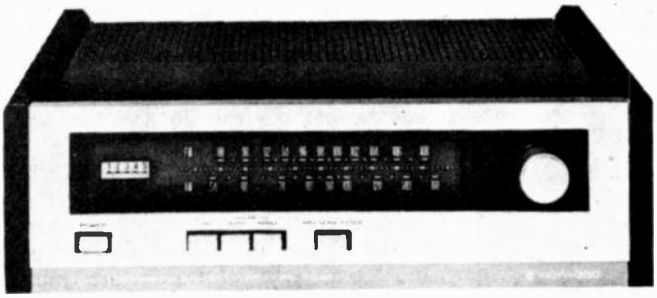

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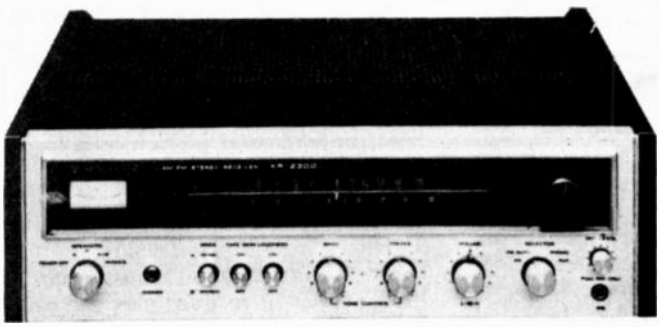

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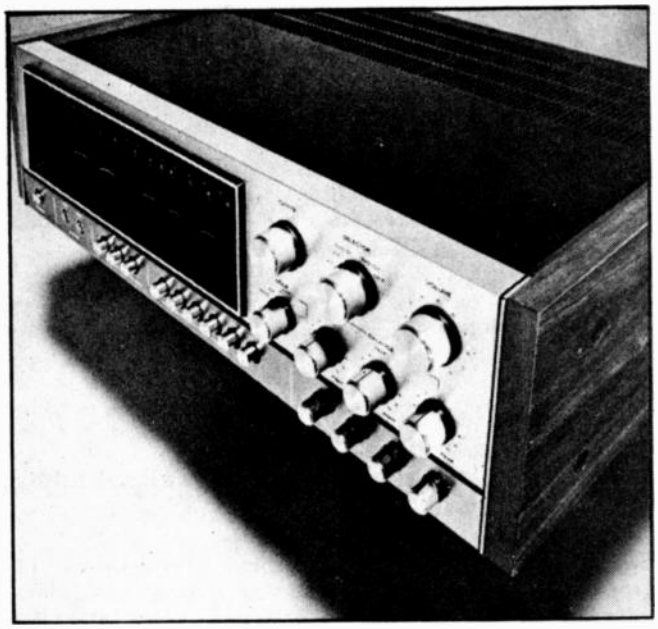

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Delegates to the IEC conference near the Kremlin.

LOUIS IN MOSCOW

Ten thousand loudspeakers in one hall alone! Louis Challis reports from the USSR.

ELECTRONICS TODAY'S acoustic expert, Louis Challis recently returned from Moscow where he was Australia's official representative at the International Electro-Technical Commission's Technical Committee 29.

The International Electro-Technical Commission is an organisation created by the technically advanced nations of the world to set standards in the electro-technical sphere. The Commission works through the operation of Technical Committees which each have a number of Sub-Committees dealing with various aspects of their work and generally having representation from the official sponsoring nations.

Regular meetings of the I.E.C. take place. For example I.E.C. Technical Committee 29 meets at least every eighteen months somewhere in Europe to ratify proposals made, implement changes, and plan the forthcoming working programme.

Louis attended a number of the working groups of TC29B and C, particularly those dealing with high fidelity and loud speakers, and reports on some of the more interesting aspects of the discussions.

Working Group 12 of Sub-Committee 29B Audio Engineering, has finally deleted the concept of music power from International Specifications. In their deliberations and research, they have found that there does not appear to be a satisfactory measurement technique presented by its protagonists. To some this may appear surprising, but the I.E.C. just do not reject a specification or a theory out of hand but give the protagonists of a system every opportunity of validating their ideas.

Working Group 2 of TC29B has been looking at the electrical and mechanical requirements of plugs and sockets, and it is of interest to note that they have found that the DIN type loud speaker plug is not suitable for voltages exceeding 34 volts. This corresponds to approximately 140 watts into an 8Ω load. This, you might say, is enough but there are many amplifiers coming on to the market in both Europe and America which typically exceed such ratings and it is not surprising even in the home high fidelity scene that I.E.C. are looking beyond the current requirements to provide for what will be with us soon.

Another group (7) has been examining headphones and head sets. They are closely examining the requirements for artifical heads as one of the measuring devices required for simulating the acoustical conditions for a set of headphones when mounted on a human head. Because of the interest of the work already carried out in Europe in this sphere they have instituted a research programme which is being carried out simultaneously in a

number of Europe's and America's foremost laboratories. (See front cover of E.T.I. March 1974). The Chairman of Sub-Committee 29B has now proposed that for the rated impedance loudspeakers should be the lowest measured value of the internal electrical impedance within the working frequency range of a loudspeaker. They have proposed a new term to be specified as *rated input impedance* to be used rather than the nominal impedance which has been the value quoted in the past. This we believe is well justified when one compares the variation of measured impedance that we have presented for loudspeakers over the last three years.

One of the most ineresting proposals to be put forward to the Sub-Committee 29B was that of Ulf Rosenberg of Sweden who presented a proposal for loudspeaker efficiency ratings to be presented on a decibel basis in order to facilitate the design of electro-acoustic systems. All that would be then necessary would be to add up the numerical values of the performance rating of microphone or transducer, amplifier, and speaker, to know the final acoustical performance of the system.

Ulf Rosenberg, who works for the Statens Provningsanstalt (State Testing Authority) points out that over the past two years they have found variations in nominal efficiency corresponding to a factor of 65 in speakers of the vented and non-vented type (not including horns)! For this reason he scoffs at manufacturers who advertise that their new amplifier has, say, 18 watts output instead of 15 watts compared with the old model. He denigrates such advertising for its stupidity because the perception of the acoustical performance of any system has to be equated to the almost logarithmic hearing response of the human ear.

This whole question of unscrupulous advertising could well be one of the first areas for the new Australian High Fidelity association to devote their attention to. (We will present more data on Ulf Rosenberg's paper in a subsequent article).

Above all we were impressed by what can be achieved by a conscientious and dedicated group of professionals working together in an area where national boundaries and political pressures are either of secondary or no importance.

THE CONGRESS HALL, MOSCOW

During the meeting the participants visited the famed Congress Hall in the Kremlin. This modern general-purpose auditorium has a volume of 50 000 cubic metres and seats 6000 people. By any standards it's large.

The stage facilities, in particular, are excellent. Compared with some of the world's halls it sets an example of what stage facilities can be provided when money is no object.

In keeping with the latest Russian trends, the hall has a fairly short reverberation time. This varies between 1.1 and 1.6 seconds, being typically 1.1 seconds at low frequencies, 1.4 seconds at medium frequencies, rising to 1.6 seconds at 6000 Hz.

The reverberation time is controlled primarily by using special low frequency absorbing panels on the walls, extensive use of carpets in the aisles, and a very unusual ceiling treatment.

Unlike most other general-purpose auditoria the Congress Hall makes extensive use of assisted resonance (or artifically controlled reverberation time) to achieve a controlled reverberation time which can be increased to as much as four or five seconds as desired.

Using tape delay loops and reverberation plates, electronic equipment provides three zones of delay for speech or music, and sound reinforcement between the front and the rear of the auditoria – which is some 70 metres from the stage.

To achieve the reverberation characteristics of this hall, 10 000 loud speakers are installed, one in the back of each seat (6000) and some 4000 in the walls over the podium!

Speakers mounted in the rear of each seat are mainly intended for Congress use, i.e. speech. The loud speakers over the podium are sound columns with separate drivers for high frequencies and low frequencies. These columns are connected into five pairs of stereophonic channels. The bank in the centre of the podium has an additional centre channel. Naturally, the loud speakers cannot be seen and are hidden behind decorative cloth over the proscenium. The loud speakers in the side and back walls are used mainly for sound effects and reverberation.

These speakers are driven by fourteen solid-state amplifiers, each capable of providing 400 watts rms continuously.

The sound reinforcement system for the stage uses individual microphones placed in front of the stage, together with additional microphones hidden both on the stage or hanging in close proximity to the actors' heads. The facilities provided make it possible to use up to 60 microphones.

The main sound mixing and control console at the rear of the balcony is operated by three technicians who work independent of the sound recording booth (which is enclosed behind the balcony). The amplification and main sound system is located in a large room behind the balcony.

In addition to the above, there are facilities on each individual seat for selecting direct translation of Congress proceedings. A seperate switch in the arm of each seat selects any of fourteen different languages, and it is possible to plug in headphones directly into the arm of the seat.

The technical equipment used in the Congress Hall is particularly interesting. The lighting effects and the control equipment used is of Austrian origin. The tape recorders are Studers and there are four of these located in the recording booth. The amplifiers are of German origin. Surprise of surprises, the cathode ray oscilloscope used for monitoring, and we presume maintenance purposes, was Tektronix (U.S.A.). The speakers, we were told, were from Hungary, but we could not confirm this. The dc power supplies were made in Russia, as were the patching panels.

The double glazed external curtain walls are particularly utilitarian as they provide not only thermal insulation but excellent acoustical isolation as well (not that there is much noise in the Kremlin anyway, which is set well back from the noisy Russian streets).

BROADCASTING IN THE USSR

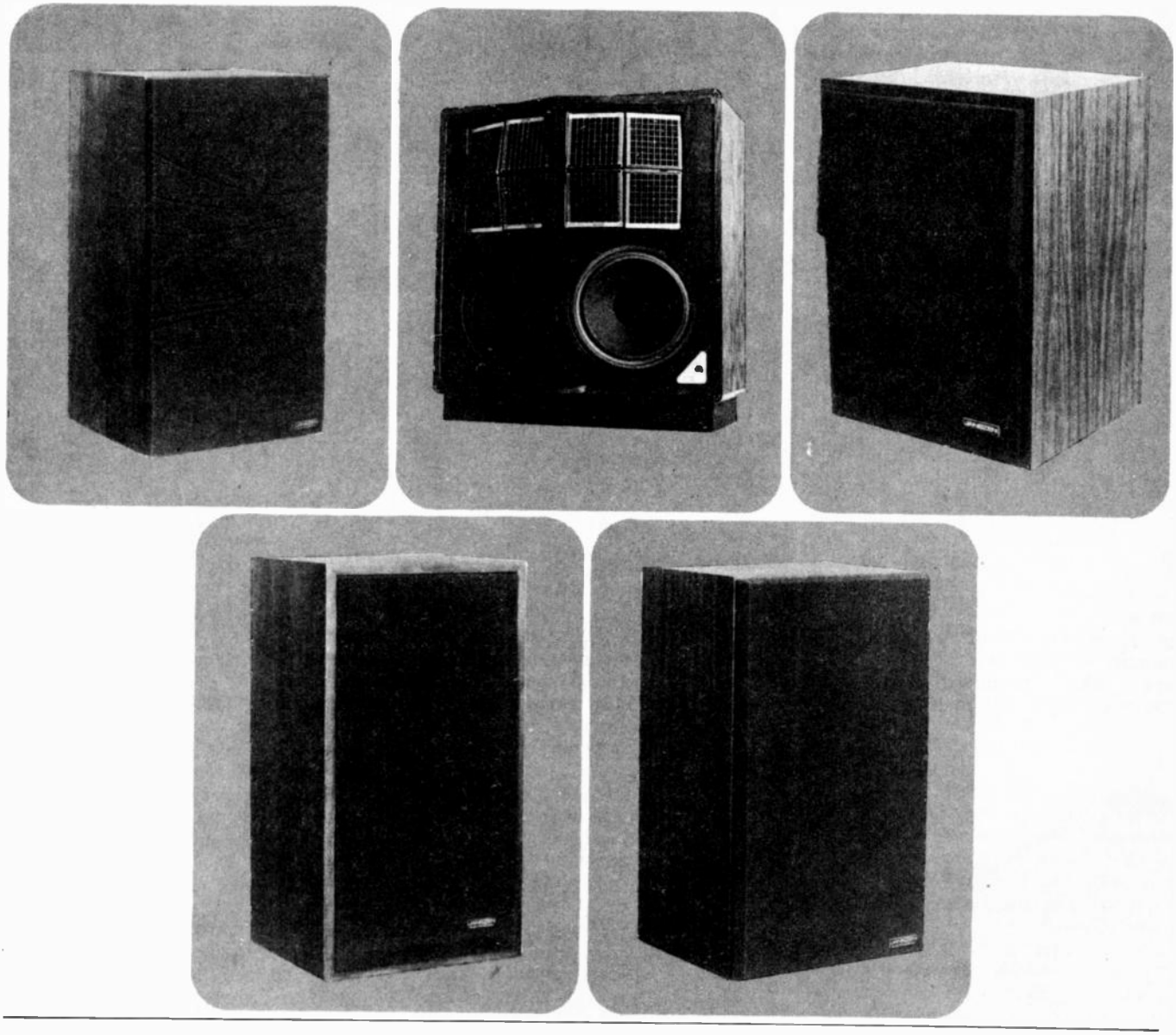
A most interesting visit was to Moscow's 'State House of Broadcasting and Sound Recording.'

In Russia the radio and television networks are one of the most important means of disseminating information to the very large population – who are spread out over a wider time zone than any other country in the world. When one considers that there is something like an eight hour difference from one side of Russia to the other one starts to appreciate the immensity not only of the nation but also problems of communication.

Most programmes are pre-recorded and in Russia, unlike the West, there is little direct transmission, the only exception being news and information programmes. All overseas transmissions are pre-recorded, the only exception being urgent newscasts. This is probably essential as Radio Moscow broadcasts in *seventy* languages each day.

The equipment used in the studios is particularly interesting. The pianos that we saw were Steinways; the microphones Telefunken M26's and Neuman M69's and U48's; with a few Russian MK13 and MK14 microphones; portable tape recorders

INCOMPARABLE JANSZEN



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LOUIS IN MOSCOW

were Nagra IV-S's although apparently they also use some Uher Report 5 and Report 6's and their Hungarian equivalent.

The major tape recorders which we saw in the control rooms were Studers, whilst magnetic tape appeared to be of German manufacture; the monitoring loud speakers (Beag Type 3H922011) were manufactured by the Budapest Electro-Acoustic Factory and designed by Dr. D. Huszty, one of the delegates in Moscow for the I.E.C. Meeting.

The State House of Broadcasting was constructed in 1938 – prior to the second World War. Architecturally it is uninspiring and although it features the typical Russian marble foyers it is now over thirty-five years old and showing its age. The construction is solid and typical of the pre-war edifices which fortunately don't have the grandiose features of some of the post-war Stalinist buildings, which are no longer being constructed.

The actual studios are divided into two groups, some in the main building and some in Patnitskaya Street – the new centre in the heart of the city. The main building studios are used to produce children's programmes, drama, and stereo music. News broadcasts, current affairs and foreign programmes for Radio Moscow are produced in the Patnitskaya studios. A number of major musical programmes are also produced at the Conservatorium, and the Great Hall in the House of Trade Unions in Pushkinskaya Street.

All material is produced with three original tape copies, one for transmission, and two further copies for mix downs and permanent records.

One basic programme is transmitted four times to the Far East, the Urals, Middle Asia, Kazakistan and the middle areas, during the eight hour time scale. A second programme, (the Mayak) consists mainly of music and current events, a third programme consists only of classical music, and a fourth programme which is transmitted for Moscow at UHF. All other programmes are transmitted using medium frequency and high frequency radio relay systems. Extensive use is now made of satellites for primary back up. These satellites are now starting to replace coaxial systems and microwave cable systems for transmitting to regional centres in Russia.

The acoustics of each studio are well documented and reverberation curves showing the overall acoustical characteristics are mounted on the wall. One-third octave band reverberation times between 125 Hz and 6 kHz are included.

Sixteen studios are available. These range from drama studios to vast music studios capable of mounting full size plays and full size orchestras.

The director who showed us around took great delight in reminding us that the 7th May is Radio Day – the commemoration day of Popov's discovery of radio. I started to ask if he had ever heard of Marconi but I changed the subject rather than start an International fracus. (It is now generally accepted that Popov pre-dated Marconi in the discovery of radio – Ed.). ●

STUDIO CHARACTERISTICS

Studio	Floor m^2	Height m	Volume m^3	Reverberation Time
N1	420	11.5	4,800	1.6 – 1.8
N2	230	9.9	2,360	1.0 – 1.3
N3	120	7.0	840	0.6 – 0.7
4	38	4.5	168	0.4
5	600	13.8	7,736	2.0 – 2.4
6	100+32	5.0	500	0.9 – 1.0
7	96+32	5.0	480	0.8 – 0.9
8	130	5.9	770	1.0 – 1.2
10	16	4.0	64	0.3 – 0.4
12	16	4.0	64	0.3 – 0.4
13	24	4.0	96	0.3 – 0.4
14	24	4.0	96	0.3 – 0.4
101	135	6.8	9.8	1.5 – 1.7
102	68	4.5	306	0.7 – 0.8
103	68	4.5	306	0.7 – 0.9
104	135	6.8	9.8	1.0 – 1.4

Dick Smith Ele

Bookworms Corner

Chew your way through some of these (most are in paperback form so are excellent value).

P & P 50 cents unless stated.

COLOUR TV BOOK SCOOP

With colour TV rapidly approaching we have checked through all the books on the subject and placed special orders for two outstanding ones.

THE MAZDA BOOK OF PAL RECEIVER SERVICING by D.J. Seal runs to 275 pages and is easily the best practical book for technicians keen to learn about servicing. Seal is a college lecturer in the UK and he assumes you have some knowledge. The book starts by comparing B&W with colour circuitry.

From there on it's into installation, test equipment, rf and luminance circuits, shadow masking, time bass etc. The section on fault finding is outstanding since it makes extensive use of full colour illustrations of actual faults. Colour is used extensively elsewhere also.

This book is an absolute must for the serviceman at only **$12.90** (P&P 75c).

COLOUR TV THEORY by G. H. Hutson is the course book for many Australian tech colleges. The 326 pages cover PAL and NTSC for the engineer and technician who has a good understanding of mono principles.

In all there are 17 chapters covering basic PAL, convergence, reshaping, chrominance, modulation, decoders etc. It is very well illustrated and avoids tedious mathematical analysis. Highly recommended for any one interested in the technicalities of colour at **$10.25** (P&P 75c).

HOW THINGS WORK (subtitled 'The Universal Encyclopaedia of Machines') is a veritable goldmine of information. Packed into 600 pages are the answers to questions that confuse the layman. Over 1000 two colour diagrams tell you why zippers zip, how soap works, what nylon is, why a ship floats and on to synchromesh and automatic transmissions ... rockets and explosives ... cameras, lenses, polaroid etc. Even a basic description of colour TV!

A truly fascinating book to browse through and now in a new updated English edition (the original German book has sold out of every printing). Will keep inquisitive kids quiet and saves you the embarrassment of not knowing 'Why?' At only **$3.90** it should be on every bookshelf.

HOW TO LISTEN TO THE WORLD is a handy introduction to the fascination of short wave listening, produced in association with the BBC World Service. Enables anyone to get the best enjoyment from his radio (and TV). Excellent chapters on antennas, operating DX, keeping logs, first 20 countries, listening to music and sport. Contributions from all over the world including Radio Australia's Bob Padula. 170 pages, recommended for POM's who long to hear Big Ben (that'll bring in a few irate letters!) at only **$4.95.**

BUILT THE ETI 422 SUPERKIT 100Wrms AMPLIFIER

Congratulations to Electronics Today on a really great amplifier. We are proud to announce that this project is to receive the Superkit treatment with exclusive fibreglass boards. Just check the spec alongside.

The kit will be available in 3 stages to suit your budget. Compare the finished amplifier with commercial units at twice the price. We have secured the most magnificent TEAK cabinet to house the project which gives the final professional touch. Your friends just won't believe it's home made.

Kit 422A PreAmp consists of the 420B PCB and all components for the low noise Pre-Amp including fibreglass board $24.50 (P&P $1.00)

Kit 422B Main Amp and Power Supply consists of the ETI 422 Power Board fibreglass) and all electronic components for it and the power supply including transformer. $62.00 P&P $1.50.

SPECIAL COMPLETE KIT FOR ONLY $118.00 includes all sections ABC above and full instructions (P&P $2.50). On a limited budget. Then get Kits A and B only and supply your own hardware. Special price only $82.50 saves you $4.00. Or fit it in your own cabinet by ordering full kit less cabinet for $113.00. Missed the article? Then send us a stamped self addressed envelope (fullscap) and we will send full details.

Separate components available

ETI420B PreAmp Board (fibreglass) $2.80 ETI422 Amp Board $3.60 2500/50V electros $1.80 each McMurdo 2900-4 switch $3.60 9504/3577 Transformer $11.75 (P&P 75c) McMurdo 2904/1 switch $1.40 Front Panel $3.50 Chassis $6.90 (P&P 75c) McMurdo phone jack 75c WBF003/3 heatsink $1.90 LED Indicator $1.45 TEAK cabinet $8.00 (P&P 75c) 4 input RCA strip 80c.

"BEAT THIS SUPERKIT VALUE" WITH OUR EXCLUSIVE FIBREGLASS BOARDS.

SPECIFICATIONS

Power output 50Wrms Frequency Response ±5dB from 20Hz to 20kHz. Channell separation 45dB. Hum & Noise – 78dB (aux) – 67dB (disc) Input sens. Aux 210mV Disc 2.1mV. Main amp 500mV. Distortion (10W) 0.16% Tone controls ±8dB. Damping factor >70. PCBs in fibreglass throughout. Handsome teak cabinet. Full instructions.

ONLY $118

HAVE YOUR OWN LIGHT SHOW

At last you can have a light show of your own — create those psychedelic light effects in your home, club or where ever. Dick has located the same gear that professionals use and just to see how they go, he has some special prices. Check the value of these projectors and wheels.

Aquarius 100 is a specially modified 100W slide projector with rotator mechanism for colour wheels and rim drive. Throws a 6' by 6' pattern at 12'. Supplied with FREE COLOUR WHEEL worth $14.00 for only $58 (P&P $4.00). **$58**

Aquarius 500 is more powerful and will produce images up to 30' diameter. Choose from 16 colour wheels at prices as low as $17.95. Exactly the same as professional equipment at twice the price. Only $99 (P&P $4.00). **$99**

SPECIAL LENSES to create more fantastic effects Kaleidoscope **$16.80**, Duo-image splitter **$12.80**, Triple splitter **$34.00** (All P&P $2.00 or free with projectors) Build your own colour show. We have some 6" oil wheels which can easily be fitted to non-cartridge type projectors. Simply devise a rim drive and your away for only **$13.60** (P&P $2.00).

BEGINNERS SPECIALS

Simple Electrical Kit Packs

These are very easy to build real working models. See how the basic principles work in practice. Three to choose from with full instructions and they are extra easy to build. No soldering needed and will give a lot of fun. Electromagnets pack 80c: Bell **$1.00**; Motor **$1.50** (All P&P 50c).

Morse Code Trainer

Produced specially for the forthcoming Novice Licence trainee. Only needs case and battery. All the electronics including a minispeaker and so easy to build **$3.75**. Key special at only **$1.50** extra.

Electronics Today Projects May '74

Monophonic Organ $13.50 (P&P 75c), Monophonic Organ **$13.50** (P&P 75c), Hee Haw **$12.00** Siren **$12.00** Temp. Alarm **$9.75** Amplifier **$.90** Temp. Meter **$9.75** Transistor tester **$10.25** Signal Injector **$2.50** Power Supply **$17.50** (P&P $1). Special parts available separately OM802 IC **$2.50** each. ETI218 PC Board (gold plated) **$3.50** 0-1mA meter **$7.24** Morganite alarm 6V **$3.50.**

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THOUSANDS OF TRANSMISSIONS AND STATIONS THE WORLD OVER!

WE COULDN'T EVEN MAKE THEM FOR THIS FANTASTIC PRICE!

$49.50

Although it is not a communications receiver, Model 250 covers the frequency range from 535kHz — 1605kHz AM, Marine band from 1.6 to 4.4MHz. Short wave from 4 to 12MHz FM from 88 to 108MHz, VHF bands from 108 to 135MHz and 147 to 174MHz including aircraft and weather bands. Dial is set out in 9 bands for easy identification, with flip-up lid giving, time zones on simple calculator. 455kHz and 10.7MHz ifs. Six volt battery operation and mains unit built-in. Also suitable for rechargeable cells, having built-in charging facility with indicator to show condition of batteries. Dual ferrite bar antenna and telescopic. Comes in handsome leather-effect case complete with instructions, earpiece and batteries. End controls make for easier setting on difficult stations. Highly recommended, we've been looking for this set for over a year. It's a knockout at **$49.50** (P&P Free)

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NEW 'BUILD-YOUR-OWN' SPEAKER CABINET SYSTEMS FROM $17.95

Yes, you can build a really professional cabinet with these kits because Dick has done all the complicated carpentry for you. Joints are premitred and all cabinets have a beaut veneer finish. No one will believe you built them, they're that good! 8ohm speakers. We supply everything including innerbond, ready for you to start glueing. You can build them in about an hour and just look what you'll save:

System 1 is intended for our popular Project 250 amplifier system. Features a 6" dual cone wide range speaker and FULLY BUILT Cabinet. Just bolt in the speaker and connect up. Handles 12W peak. Measures 15" x 10" x 7". It's a knock out at **$17.95** (P&P $2.50).

System 2 has a 6" Rola or MSP woofer coupled to a Plessey or Philips dome tweeter. Cabinet is a Bass reflex type measuring 17¼" x 10½" x 8½". Handles 20W peak with a response from 50-19000Hz. A great sound for **$42.50** (P&P Road Freight on).

ONLY $42.50

YOU CAN DO IT !!

System 3 features a great big 12" heavy duty Bass driver and dome tweeter combination. Fully sealed enclosure uses the acoustic suspension principle. Handles 30W rms with a response from 30 to 30,000Hz. Yes a full 2-way, 12" system is yours at a fraction of the normal price for just an hour's fun building it. Terrific value at **$49.90** (P&P Road Freight on).

System 4 as system 3 but has sealed midrange unit also **$57.90** (P&P freight on).

X30 dome tweeters cover 3kHz to 30kHz only **$8.90.**

JUST IN

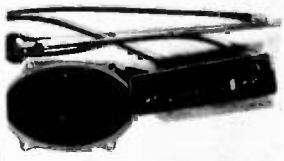
EXPO STEREO CASSETTE DECKS SCD77X. Twin VU meters. Slider volume controls Headphone socket. Supplied complete with patch leads, twin mics and blank cassette. 14 transistors and 12 diodes. Frequency response from 50 to 10,000Hz. Output 100mV into 220k. Limited quantity at only **$99** (Road freight on).

ALSO ALL JUST IN

NEW CAR RADIO/CASSETTE UNIT featuring F.M. multiplex stereo-radio as well as usual Broadcast Band. Powerful 4.5 W rms/channel. Fits most negative earth cars and has reversible black/teak trim. Cassette unit has fast forward for rapid programme selection. So you're getting a complete AM/FM/multiplex/cassette stereo combination complete with HD 5W speakers in dual mount cabinets for just **$127.95** (P&P $3). Aerial supplied for only $2 extra.

ENJOY YOUR DRIVING

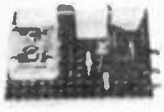
The 12 transistor Auritone radio costs just **$47.95** as a complete do-it-yourself installation. You get radio with 7 x 5 flush mount or box type speakers (please specify) and a chrome plated aerial. Full instructions and connecting leads are included. This is a very popular radio at only **$47.95** (P&P **$2.00**).



PREFER A TAPE PLAYER?

We have a similar package 8-track cartridge player using latest integrated circuit amplifier complete with speakers (again specify type) for the same low price only **$47.95** (P&P **$2.00**)

FERRANTI ZN414 MICRORADIO IC KIT



(as featured in Electronics Australia May '74). At last you can build a true miniature radio. IC features a 10 transistor circuit which requires only tuned circuit and 3 parts. 72dB gain. Operates on 1.5V and only 300μA. We've seen one in half a matchbox, can you beat it? No case supplied because you'll want to build it your way. Regular kit $9.75 or Minikit still available on special offer at only **$6.75** (see article).

HIGH SENSITIVITY MULTIMETER SPECIAL

20,000Ω/V ONLY $10.50

This must be Australia's cheapest 20,000ohm/V multitester having 5 DC voltage ranges, 4 on AC, 2 DC current ranges and 2 resistance ranges. 34μA high sensitivity movement. Big, mirror scale. Off position for safety 3% DC accuracy. Normal Retail Price is **$17.50**, a few discounters have them at $15.00. Please support our bulk purchase (it's in your interest) Only **$10.50** Yes ten dollars fifty!! (P&P $1.00).

YOU WON'T BEAT THESE MONARCH AMPLIFIERS FOR DOLLAR VALUE!

We have just added the terrific Monarch range, call in and hear the superb sound and then amaze yourself with the low, low prices. Just check these specs and get us to quote — Monarch 88 20-40,000Hz ± 1dB : 24 Watts rms/channel : THD below 0.4%.
Monarch 800 5-70,000Hz ±1dB: 40Watts rms/channel : THD below 0.4%.
Monarch 8000 10-60,000Hz ±1dB : 55Watts rms per channel : THD below 0.1%.
All feature tape facilities, Hi and Low pass filters etc.

$49.75 NE-310 DELUXE 1W 3 CHANNEL CB TRANSCEIVER

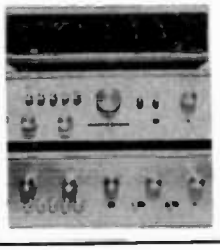
13 transistor 27MHz featuring call tone, squelch, battery check meter etc. Ultra-sensitive 0.7μV receiver with ceramic filter. Diecast case. Sockets for aerial, power speaker etc. Crystal supplied for 27.240MHz Operates on 8 penlight cells **$49.75** (P&P $1.00) only **$97.50** per pair.

SNEAKY SPECIAL $5.99

You remember the cheap radios we had a couple of months ago? They sold out in under a week. We've rushed some more over. They're worth buying just to break down for parts! Five transistor and 2 diodes, 9V battery operation with earpiece only **$5.99** (P&P 75c).

ARE YOU TIRED OF CRACKLE AND POP? Then get a record cleaner and keep your records like new. Less than the cost of a record and keeps them like NEW. Antistatic treated with combined brush and pad cleaning the grooves. Complete with spare rollers. Fully adjustable for all decks (not changers!!) Only $3.90 (P&P 50c).

EXPO AMPLIFIERS



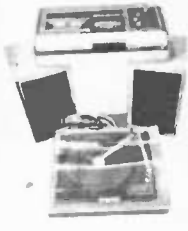
Expo Amplifiers are extremely good value as many satisfied customers keep on telling us. We still have them at last year's price too! (All P&P $2.00). KA205 12Wrms total only $65. TA3100 25Wrms total only $87 KA410 50Wrms total only $109 Call in and hear one.

JENSEN SPEAKERS

have been around since 1927 so you buy nearly 50 years experience in their speakers — and it sounds like it! The clarity is unbelievable. The latest Flexair suspension is responsible for that combined with Total Energy Response which gives a balanced sound. Beautiful walnut grained finish with beige fabric. 25W capacity smooth 40 — 18000Hz speakers. You must hear them to believe the sound at only **$49.50** (That's $99 a pair). Road freight extra.

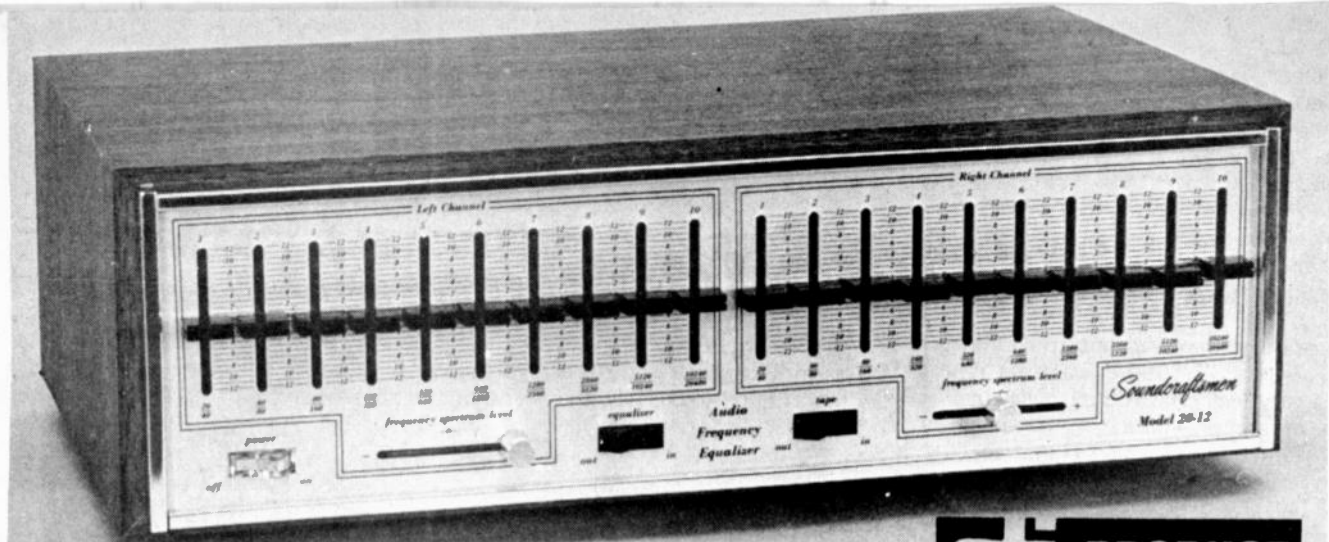
$99 pair

THE COMPLETE HI-FI DISC, TAPE, RADIO, AMP, SPEAKERS PRINSTAR MUSIC CENTRE



$259

Prinstar Music Centre is literally just that, a complete tape/record/radio unit with 27 transistors and 16 diodes. Radio covers AM and FM with multiplex for stereo. Amplifier has 20Watts output, Turntable is by Garrard, Cassette unit has microphone facilities or will record from other units. Supplied with separate speakers. This must be the most economical way to get quality in a complete system at $259 (P&P Road freight on).



Recommended retail price: $292

Selective filters compensate for room and equipment deficiencies.

HFI PRODUCT TEST

SOUNDCRAFTSMAN GRAPHIC EQUALIZER

LONG before man understood the principles of acoustics he was able to exploit natural phenomena to achieve equalization of sound. Archeologists have found indications that leaders of prehistoric communes projected their voices (using natural horns) to obtain equal intensity of sound in all areas of a cavern!

Today, graphic equalizers are used to improve room and concert hall acoustics – albeit using more refined techniques.

In principle, graphic equalizers are a series of filters, each filter covering a small segment of the frequency spectrum, and each capable of amplifying or attenuating that segment.

Thus the equalizer 'corrects' for inequalities in a room's acoustics by amplifying or attenuating those segments of the frequency range previously established as deficient.

Nearly three years ago (August 1971) we reviewed the Nivico PST 1000/E preamplifier. This unit has a sound effect amplifier which is in fact a twin-seven-channel graphic equalizer. It was, at that time, probably the first multi-channel graphic equalizer offering reasonable performance for a reasonable price.

Obviously, professional requirements call for more than a seven-band controller, rather users prefer octave band centre frequencies for each individual channel control, or ideally one-third octave band filter spacing.

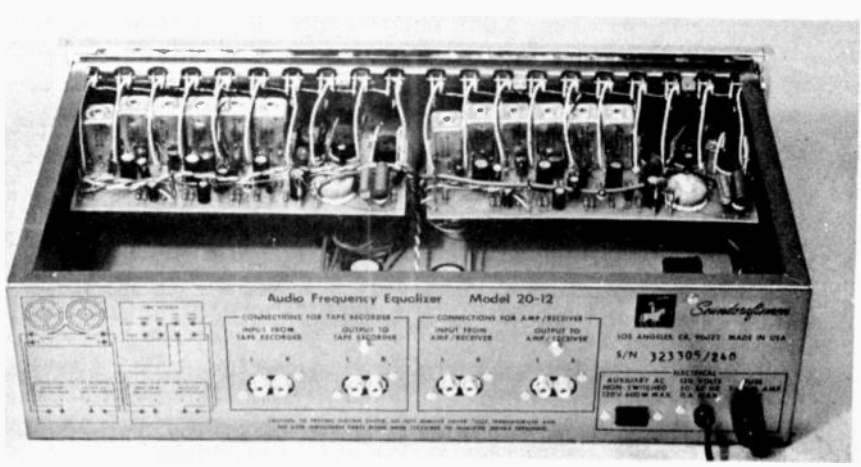
One-third octave band graphic equalizers are costly devices, and because of this most hi-fi enthusiasts (and not so well-heeled professionals) settle for octave band units.

The Soundcraftsmen Stereo 2012 is the first ten channel graphic equalizer that we have seen. It has been designed to provide good performance at a fairly low price. Its major use, as the sales literature states, is to correct for the deficiencies in the standard amplifier treble and bass control circuits – through the use of true spectral equalization.

Whilst some of the previous units offered tended to suffer from assymetry of equalizer control, particularly between boost and cut, the latest units of which the Soundcraftsmen 2012 is one, provide a well balanced symmetrical control with a minimum colouration or distortion in the pass band of each filter.

What then is the major purpose, and hopefully end result of using such a device?

Firstly, it allows the audiophile to correct deficiencies in the linearity of either his speaker system alone, or the combination of his speaker system plus his living room, for even though the speaker system may be good, it would be most certain that the living room is not. This is easier



said than done though, for it is necessary to use spectral analysis equipment, such as a gliding tone record together with a linear sound level meter, or sound level indicator with known characteristics. Alternatively recorded bands of pink noise and a sound level meter for indicating spectral response can be used.

One of our comments concerning the Nivico Type PST 1000/E was that it was "a very well constructed device in search of a use". We were not being nasty. Rather we were saying that the 'sound effect amplifier' in that unit would be in as much danger as being misused as being correctly used. For the average audiophile does not have access to the equipment (of the type that we have discussed above) to optimise the performance of his system.

Soundcraftsmen have foreseen this difficulty and have produced and supplied with the equalizer a special test record that overcomes these problems. The data on the back of the record cover gives clear instructions on the use of the record.

The record presents four distinct methods of use, a simplified equalization, a most accurate equalization, and a professional equalization. These enable the novice or the professional to adjust his sytem in a given environment to provide a better frequency equalization, and thus a subjective improvement in audible sound.

By using the record supplied in conjunction with whatever record player, amplifier, and speakers we were using, we found it readily possible to equalize the frequency response of a system at a *given position* to within ±3 dB for octave band filtered pink noise. We did not attempt to record the frequency response for pure tone under the same circumstances as this would have been an unfair test.

The Soundcraftsmen 2012 graphic equalizer is primarily designed for mounting in a 19" rack and as such the external walnut grained plastic coated particle board case is purely supplied for shipping convenience, and as the little slip tells, is not warranted against defects. After reading the slip we had to look twice at the case because as it was so well finished we were sure at first that it was true walnut veneer. Without a closer inspection we had been fooled into thinking that it was a true veneered wooden cabinet!

The internal circuitry is very well made and features high quality glass-epoxy printed circuit cards with medium quality consumer electronic components.

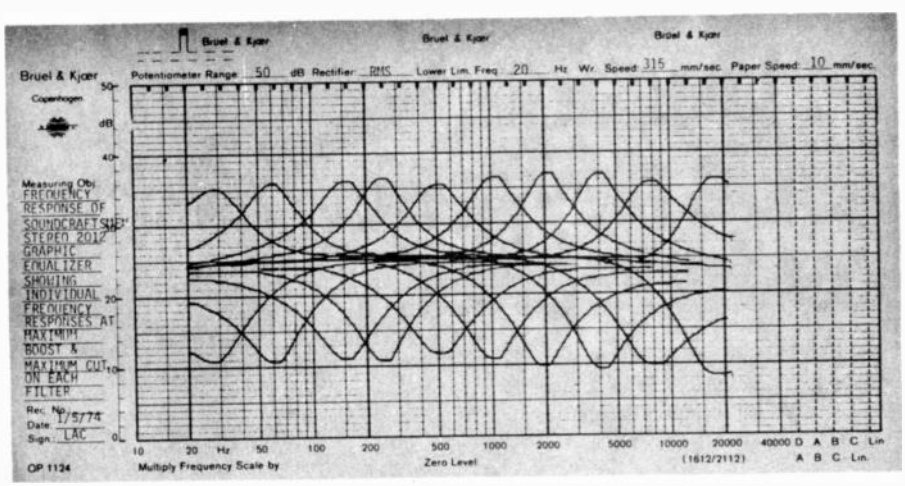
The electronics is remarkably simple using only six transistors per channel output and a regulated power supply which controls hum and ripple to a particularly low level.

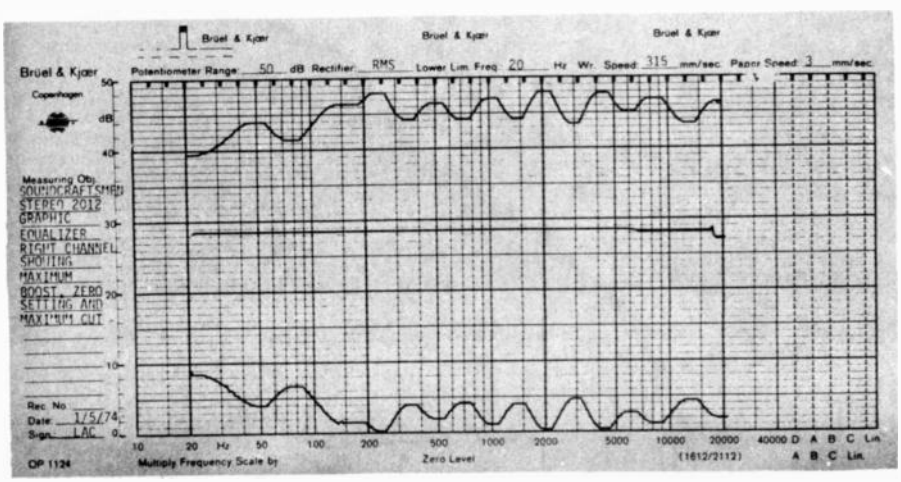
The front panel, is remarkably simple. Parallel slider controls featuring flat black knobs, adjust the nominal 12 dB boost or cut for each of the octave bands lying between 20 Hz and 20 kHz.

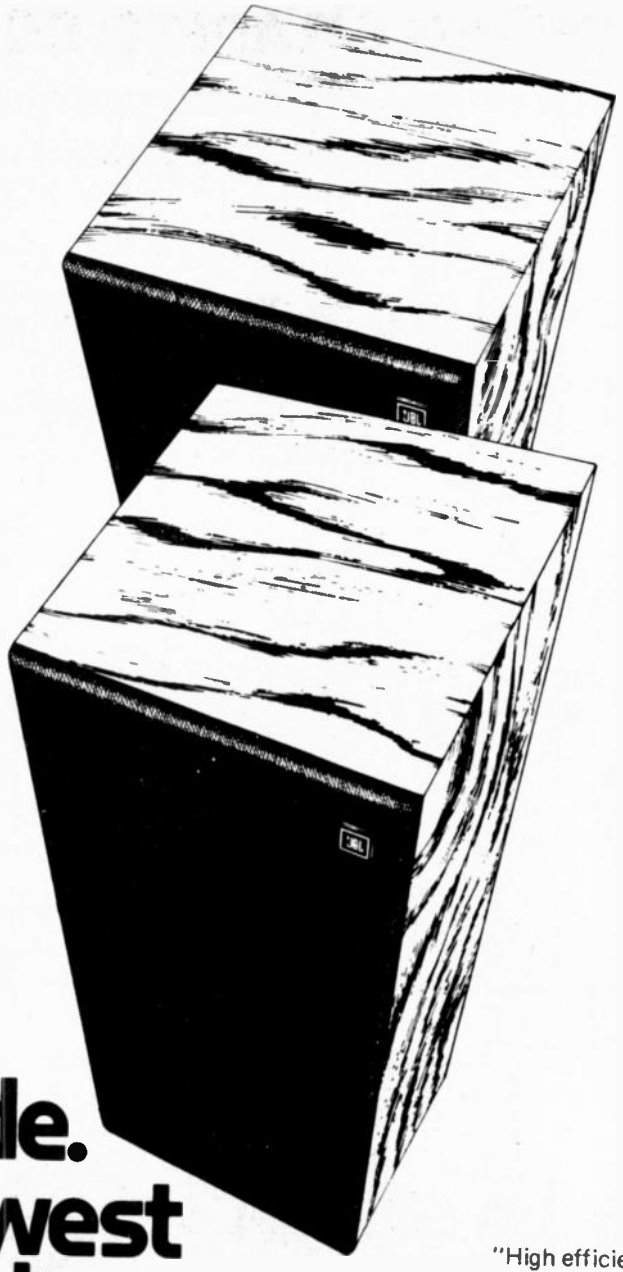
Centrally mounted below each bank

PERFORMANCE OF SOUNDCRAFTSMEN STEREO 2012 AUDIO FREQUENCY EQUALIZER SERIAL NO. 323305/240

Maximum Change in Output Level for Equalizer Switch from IN to OUT (with spectrum level at zero setting)		−4 dB on right channel
Frequency Response	− Equalizer out	±0.2 dB 20 Hz − 20 kHz +0 −1.5 dB with equalizer in and all filter settings at zero
Range Control		±12 dB on individual filters with overall maximum +19 −28 dB possible ±20 dB typical
Maximum Output Signal		8.8 volts before onset of clipping
Maximum Input Voltage		4.5 volts before onset of overload.
Harmonic Distortion Level (at 2 volts output)	100 Hz 0.15%	1 kHz 0.15% 6.3 kHz 0.1%
Intermodulation Distortion		Less than 0.2% at 2 volts
Signal to Noise Ratio		Greater than 70 dB (Lin) at 2 volts input Greater than 86 dB A-scale weighted.





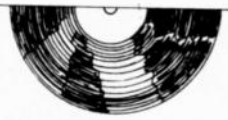


Decade. JBL's newest loudspeaker.

(The price has been strategically placed in a later paragraph of this advertisement. We can't have you running into your JBL dealer's because of "price." That's not even the right reason.)

Some of us think Decade is the best two-way sound system we've ever made. If you'll forgive a few buzz words, we'll tell you why:

"Definition." That's a loudspeaker's capacity for letting the listener hear each part, every part of a whole sound. JBL's Decade has almost perfect definition.



What makes JBL loudspeakers so different from the rest?

Well, we grew up on the other side of the sound tracks, in the music business, making loudspeakers for recording engineers, professional musicians — people who listen to music for a living.

Would it impress you to know that the top professional recording studios like Warner Brothers and Capitol and Elektra and MGM use JBL loudspeakers to record, play back, mix down and master their music? It's true.

"High efficiency". Very important. Most loudspeakers are low efficiency speakers they need a big amplifier to give you back a big sound. Not JBL. The big sound is built in, and a little amplifier goes a long way.

"$189". That means if you've been saving up for a JBL loudspeaker, stop.

Come hear JBL's new Decade. Except for the price it sounds expensive.

JBL

James B. Lansing Sound Inc. 3249 Casitas Avenue, Los Angeles 90039. High fidelity loudspeakers from $189 to $4,000.

Distributed in Australia by JERVIS AUSTRALIA PTY LTD. P.O. Box 6 Brookvale, NSW.

SOUNDCRAFTSMAN GRAPHIC EQUALIZER

of slider controls are the level control levers providing overall positive and negative amplification. These are flanked on either side by the equalizer out-in switch, and the tape recorder out-in switch. An illuminated power on-off switch is positioned at the lower left hand corner of the panel.

Eight RCA coaxial plugs are provided on the back of the unit. A diagram shows correct interconnections for tape recorder and power amplifier. Also on the back of the unit are an auxiliary unswitched power outlet, and the mains fuse.

The internal circuitry uses a bank of parallel connected circuits consisting of series connected capacitor, inductor, and resistor for each separate filter circuit. By connecting these across the main amplifier transistor it is possible to provide symmetrical boost or cut.

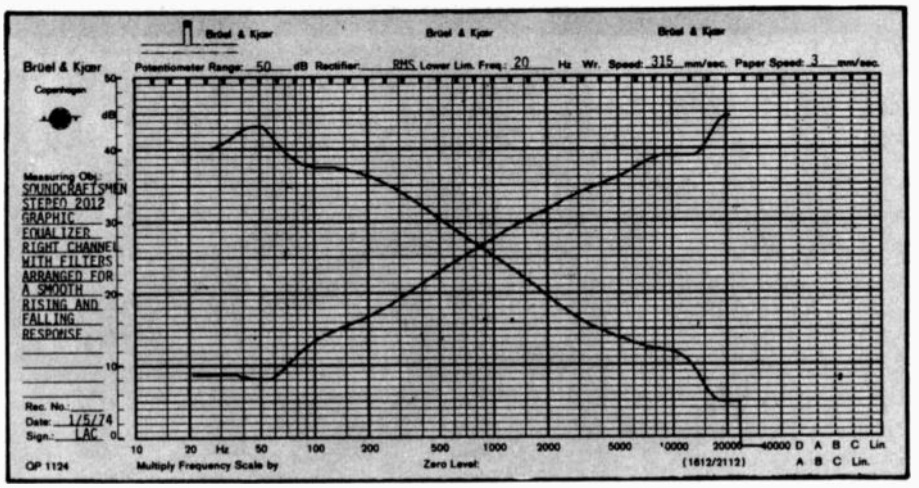
The circuitry chosen for this graphic equalizer results in significant interaction between the individual filters, so that whilst in theory each one has a significant measure of control over a given frequency, in practice adjacent filters also have a measure of control because of the broad band nature of the circuitry (See level recordings).

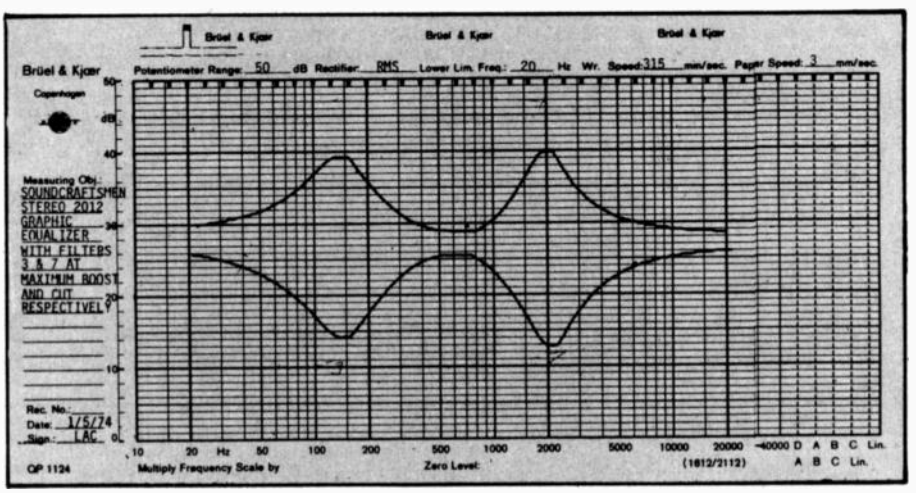
For this reason the graphic equalizer is best suited for overall frequency control rather than curing the nastiest types of frequency non-linearity problems which often occur in loudspeaker systems or in rooms.

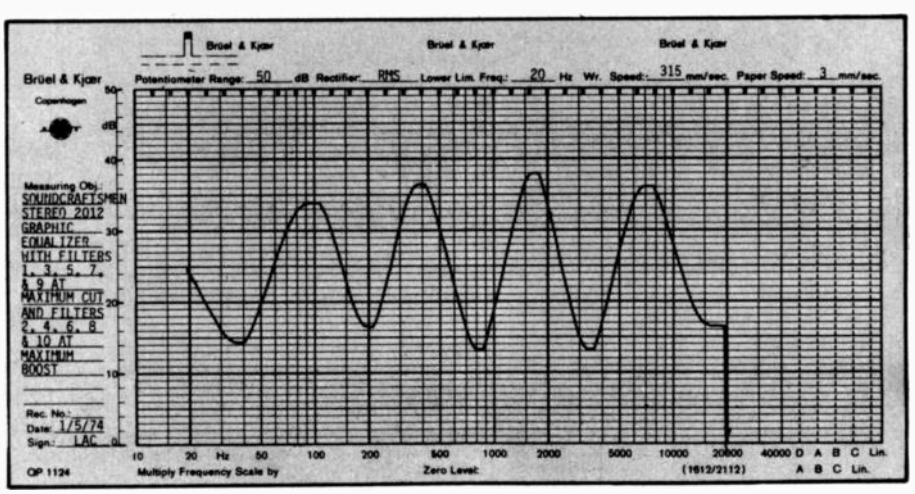
We tried the Soundcraftsmen out in a number of rooms, including a living room with excessive reverberation time; and our office which is fairly acceptable but far from perfect. We found that whilst it does improve and modify a subjective sound it offers little advantage in rooms with excessive reverberation time, except as the brochure points out, for improving the threshold of loop gain where feedback is a problem with a public address system.

We subjected the Soundcraftsmen to exhaustive performance tests and found that the left channel had a small electronic fault in filter number 7 (1280-2560 filter) but the right channel was apparently working well.

The filters offer symmetrical performance, but the overload characteristics of the individual circuits (with the slider controls at the mid-point position) results in assymetrical wave shape clipping. This is, however, not normally a problem except on overdrive conditions.







The maximum slope that can be achieved between filters is better than 35dB per octave.

In our opinion there are some excessive claims in the maker's literature, but ignoring the more extreme of these it is true to say that this audio frequency equalizer is a useable and practical piece of equipment.

It is not perfect in that there is interaction between adjacent filters, but the overall performance that it offers is practical, in many situations it is really called for.

At a selling price of $292 many serious amateurs and quite a few professionals could more than justify its purchase. ●

Dick Smith Electronics Centre

TAPE PRICES CHOPPED

Dick's done it again! Remember the cuts in semiconductors? Well now a huge bulk purchase of tape has bought prices on top brands right down among the cheapies. YES THESE ARE ALL GUARANTEED TOP QUALITY, BRAND NEW FROM LEADING MANUFACTURERS. Buy direct in quantity and save a fortune – get together with your friends and share the savings!!

Everyone knows that huge duty and price rises have affected most tape prices. By rationalising our buying and eliminating types that don't sell well in quantity we can pass the savings on to you.

ALL TOP BRANDS

BASF

$1.40 each*

BASF Nothing but the best. This is the extremely low noise (LH) type in the Special Mechanics (SM) snap pack. Guaranteed not to jam or damage your machine. Made in Germany by BASF. Do not confuse with their cheaper 'Rainbow Pack'. This is the genuine SM for as little as $1.40 C90's in CrO_2 Chromium dioxide too!!

TYPE	LIST PRICE	Price each for 5	10	20
C60SM	$2.99	$1.75	$1.55	$1.40
C90SM	$3.99	$2.25	$2.00	$1.80
C120SM	$4.99	$3.00	$2.60	$2.50
C90SM (Cr)	$5.60	$3.75	$3.60	$3.50

TDK

$2.40 each*

TDK 'Super Dynamic' as used by professionals because it incorporates Gamma ferric oxide which gives an extended frequency response from 30 to 20000Hz and has much lower high frequency drop off due to smaller particle size. Guaranteed made by TDK in Japan.

C60SD	$3.95	$2.60	$2.50	$2.40
C90SD	$5.85	$3.40	$3.20	$3.00

Certron

95¢ each*

Certron 'Pro' This is a top American tape. An ideal high output, low noise tape for the budget conscious. Louis Challis & Associates a leading audio authority reports that the C60 at –20VU is +0,–3db from 20 – 19000Hz which is fantastic for such a low price tape. Screwed cassette – try them you won't tell the difference. Certron cassette head cleaner only 90 cents Certron cartridge head cleaner only $1.20

C60PRO	$1.35	$1.15	$1.00	$0.95
C90PRO	$1.75	$1.50	$1.30	$1.20
C120PRO	$2.25	$2.00	$1.75	$1.50

Cartridges

$1.90

8 Track Tape Cartridges also from Certron exactly the same quality as cassettes above. Why pay more when you can get quality at a lower price?

40 MIN.	Special Price $1.90 ea
80 MIN.	Special Price $2.25 ea

*These prices apply if 20 of each respective C60 cassette are ordered.

USE THIS ORDER COUPON TO SPEED DELIVERY

HOW TO ORDER

Minimum quantity is 5 tapes. Please order in multiples of five to simplify handling. Allow P & P as follows – 5 tapes 50 cents, 10 tapes $1.00, 20 tapes or more $1.50. All tapes in stock at time of going to press. If out of stock we will credit or refund. No C.O.D. No Backorders (sorry we can't AFFORD TO AT THESE PRICES)

NAME .....

ADDRESS .....

..... P'CODE .....

MAKE	TYPE	QUANTITY	COST EACH	TOTAL
	TOTAL		Makes P & P	

I enclose cheque/PO/ Money Order for

DICK SMITH WHOLESALE PTY LTD

Head Office and Mail Orders to 160-162 Pacific Highway, Gore Hill NSW 2065
Telephone 439-5311 or 02-439-5344 (24hour Answerphone)
also at 361 Hume Highway Bankstown (100yds from Chapel Road) Tel 709-6600

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With Sansui

UTA FRENCH AIRLINES

2 UTA Holidays must be Won

To Noumea. The Paris of the Pacific

Here is the opportunity for you to enjoy free an exciting 7 day overseas holiday in charming French Noumea – there is duty free shopping – sparkling white beaches – deep blue lagoons and its French Restaurants are renowned. Yes – it could be YOUR tropical paradise holiday. Apply your skill to complete the Crossword Entry Form below, and you could be on your way as a guest of Sansui. There are two Noumea Holidays to be won including return economy air fare and Hotel Accommodation.

ENTER NOW

LOOK FOR THESE FABULOUS Sansui UNITS TO ASSIST YOU WITH YOUR CROSSWORD PUZZLE CLUES.

SANSUI SPEAKER SYSTEM SP 65

A 2-Way wide dispersion, acoustic suspension, 40 Watts. Convenient size, with rich and clear sound, smooth transient response, handsome open-pore walnut finish and air tight enclosure distinguish this advanced speaker system.

SANSUI SOLID STATE INTEGRATED AMPLIFIERS AU 101/505

Handsomely designed, practically priced control amplifiers within the means of everyone. AU 505 delivers 90 watts of music power output with below 0.5% distortion.

SANSUI AUTOMATIC RETURN TURNTABLE SR 212

Budget-minded and a winner this new automatic turntable is not only made of carefully-chosen precision components, but it has been designed with particular emphasis on ease of operation, reliability and tonal quality.

SANSUI "DOLBY SYSTEM" STEREO CASSETTE DECK SC 737

Reel-to-Reel quality with cassette convenience. Features include high-density magni-crystal ferrite record/Play Head, Record/Play back Preamplifier Tape selection switch and peak level indicator and professional VU Meters.

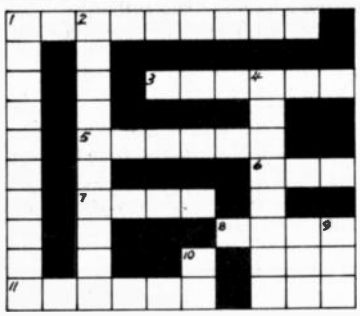
SIMPLY COMPLETE AND RETURN THIS CROSS-WORD ENTRY FORM WITH YOUR COMMENTS – IT COULD BE YOUR FREE PASS TO PARADISE.

CLUES ACROSS:

1. Opposite of Manual.
3. This Hi Fi Company could send you on a Noumea Holiday.
5. An Amplifier control that accentuates stringed instruments.
6. Abbreviation for an input socket.
7. The Deepest sound.
8. A basic part of tapes or fishing rods.
11. Sansui offer a complete Hi-Fi .....

CLUES DOWN:

1. These Sansui components are both solid state and integrated.
2. A place for your records to revolve (plural).
4. They produce the sound and enhance your room.
9. Sansui amplifiers have this Degree of noise level.
10. The new modulation code which is incorporated in Sansui Stereo Tuners.



Tell us in 25 words or less why you prefer Sansui HI-FI Units:

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Conditions of Entry

1. Closing date 29th September, 1974 – Winners notified by mail within 3 weeks after closing date.
2. Chance plays no part in determining prize winners.
3. Judges' decisions are final and no correspondence will be entered into. Entries will be judged on accuracy and neatness.
4. Employees and the immediate relatives of Sansui, their Advertising and Promotion Agencies, Associated Companies and Electrical Retailers are ineligible to enter.

NAME.....

ADDRESS.....

.....P/C.....

Mail to: SANSUI PROMOTION HEADQUARTERS, P.O. Box 73, Hawthorn, Vic., 3122.

SEE SANSUI HI-FI UNITS AT YOUR HI-FI RETAILER NOW ! ! !

RANK INDUSTRIES AUSTRALIA PTY. LIMITED.

Melbourne Office: 58 Queensbridge St., South Melbourne, Vic. Tel. 61 3281. Telex 31904.
Sydney Office: 177 Salisbury Rd., Camperdown, N.S.W., 2050.
Canberra Office: 25 Molonglo Mall, Fyshwick, A.C.T. Tel. 95 2144*.
Adelaide Office: 2 Bowen St., Kensington. Tel. 332 4288.
Brisbane Office: 14 Pros Street, Fortitude Valley, Qld. Tel. 52 7333.
Perth Office: 27 Oxford St., Leederville, W.A. Tel. 81 4988.

eti reader offer

6W AUDIO IC FOR $1·50

LIMITED TO THE FIRST 1000 APPLICANTS

A COUPLE of months ago, the UK edition of this magazine arranged for its readers to purchase 6-watt audio ICs for a fraction of their normal price.

Readers bought 3500 in the first few days!

We have now arranged for a quantity of these integrated circuits to be made available to our readers here at a similarly low price.

The offer is limited to the first 1000 orders received and orders will be processed in strict rotation-first come, first served.

If you think that 1000 is enough for all, bear in mind the response in the UK!

Please allow at least two weeks for delivery.

Readers may order as many ICs as they like, but a separate coupon must

(Continued on page 59)

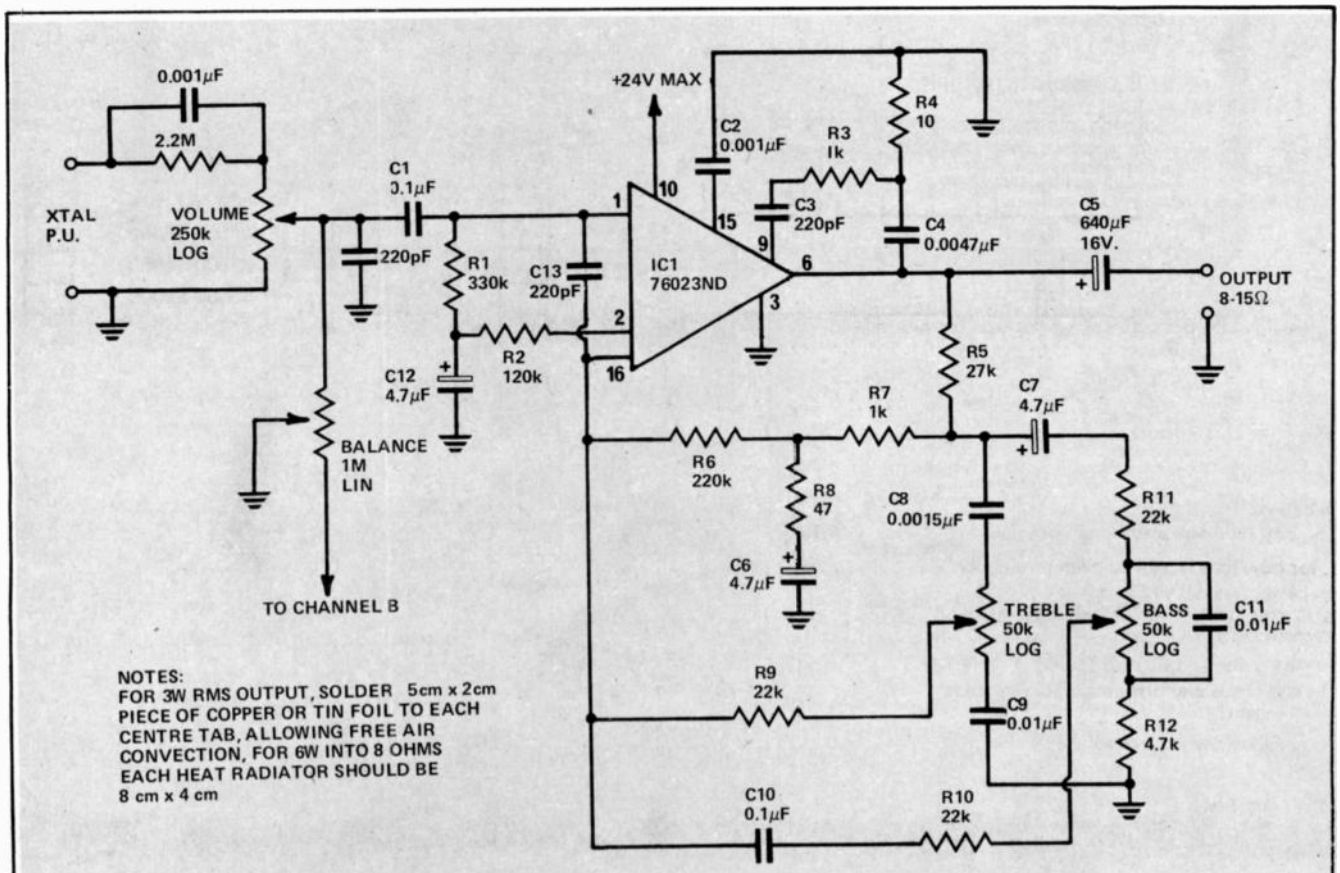

Fig. 1. Manufacturer's suggested circuit using the SN 76023 ND with active tone controls. A stereo version may be constructed simply by duplicating this circuit. (Note, the 1M balance potentiometer will not be required if the circuit is built in single-channel form).

Help us to help you.....

SINCE ETI was launched in April 1971, it has established an extraordinarily loyal, regular readership which is still continuing to grow. The magazine has also proved equally successful overseas. We have separate editions published in Britain and France.

Like most magazines, we have made several changes to our contents and presentation and we would very much like to know what readers now like and dislike about our present format.

This will enable us to establish more surely if there are any features that most readers would sooner see dropped — or others that could perhaps be increased.

To ensure as wide a cross-section as possible we would ask you to *please, please* complete and send us this questionnaire.

We would like to hear from readers who like things just as they are (if any!) as well as those who would like to see some changes.

As a small token of our appreciation for your help we will be giving away 25 annual subscriptions to ETI, these will be selected in a draw which will be held once all the forms are in.

— please tick appropriate box

FEATURES	Interest			Technical level			Would you like	
	High	Fair	Low	Too High	DK	Too Low	more	less
Electronics								
Technology								
Audio								
Hi-Fi Tests								
News Digest								
State of the Art								
Sensors On								
Tech Tips								
Electronics it's Easy								
Book Reviews								
Equipment News								
Component News								
Readers' Letters								
Pop Reviews								
Classical Reviews								
Constructional Projects								

GENERAL

Do you buy ETI regularly? YES/NO

If so, for how long have you been buying it? .....

If you have been taking ETI for more than two years do you think it is now better or worse. Or much the same? BETTER/WORSE SAME

How many other people read your copy of ETI? .....

Do you ever have any difficulty finding one in your newsagent? YES/NO

Do you keep issues for more than three months? YES/NO

Are there any features that you particularly dislike — or never read. What are they please? .....

If those features were to be upgraded in some way, would you read them then. YES/NO

Is there any section or feature that you would like to see expanded? .....

Which of the following magazines do you read?

	Reg.	Freq.	Never or Rarely
Wireless World			
Practical Wireless			
Practical Electronics			
Electronics Australia			
Australian Hi-Fi			
Australian Electronics Engineering			

EMPLOYMENT

Are you employed in the electronics or closely related fields? .....

If the answer is YES — in what capacity .....

If not we would appreciate knowing what your profession is .....

Do you read ETI as an extension of your job? .....

Age

- Under 14
- 14 – 16
- 16 – 18
- 18 –21
- 21 – 25
- 25 – 30
- 30 – 35
- 35 – 45
- 45 – 55
- 55 +

Educational qualification/s

SALARY LEVEL

- Student
- Under $3500
- $3500-$4500
- $4500-$5500
- $5500-$6500
- $6500-$8000
- $8000-$10 000
- $10 000-$15 000
- $15 000 +

Any General Comments

▼ First Fold

◄ Second Fold

Stamp please

Electronics Today International,
15-17 Boundary St.,
Rushcutters Bay,
NSW, 2011.

◄ Third Fold and Tuck In

25 ANNUAL SUBSCRIPTIONS TO BE WON

As a small token of our appreciation for your help, we will draw 25 of the replies once they are all in and each will receive an annual subscription to ETI. You do not have to complete the personal details section to qualify. If you wish to be considered please fill in your name and address clearly.

Name .....

Address .....

.....

.....

Information given on this form will be treated as confidential and will only be used for the purpose stated.

▲ First Fold

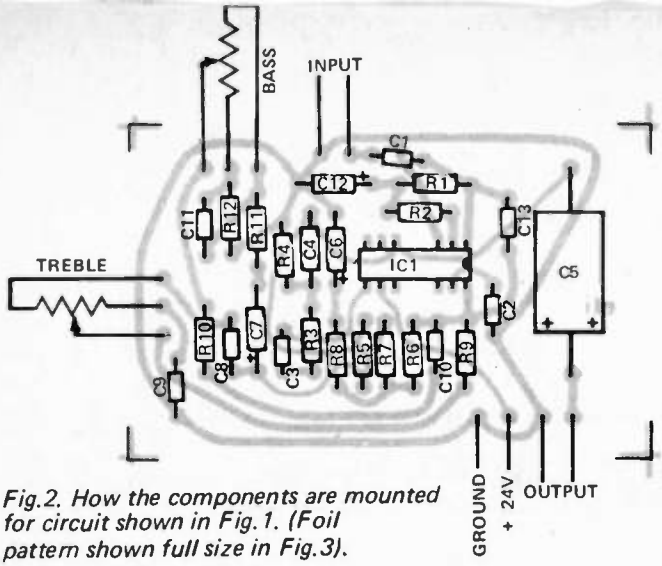

Fig.2. How the components are mounted for circuit shown in Fig.1. (Foil pattern shown full size in Fig.3).

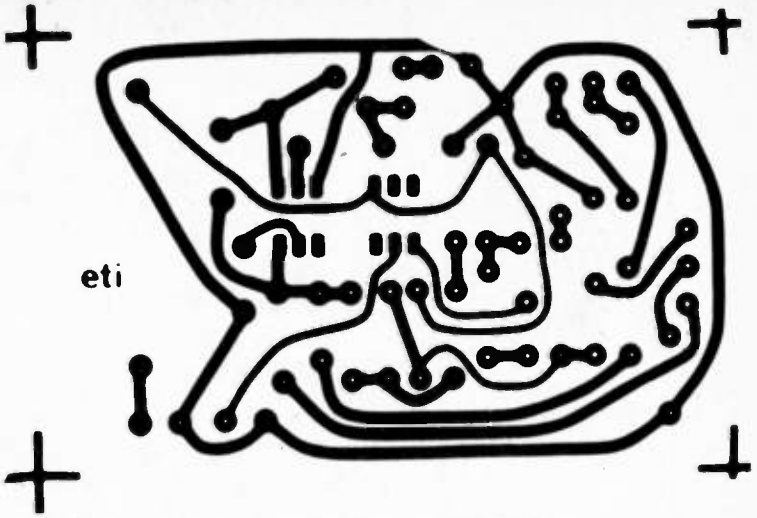

Fig.3. Printed circuit board foil pattern (full size) for circuit shown in Fig.1.

be enclosed for every two ICs ordered, (original coupons must be used – we cannot accept photostats).

This is not an ETI constructional project in the normal sense. The suggested circuit shown here is that used in the UK where it has proven totally satisfactory. However we cannot enter into any correspondence nor offer assistance in the event of constructors experiencing any difficulties.

Should the offer be over-subscribed, your cheque or postal order will be returned in your stamped addressed envelope. ●

To: SPECIAL IC OFFER
Electronics Today Int.
15-17 Boundary St.,
Rushcutter's Bay,
NSW. 2011

Please find enclosed my cheque/P.O. for $1.50/$3.00 for one/two audio ICs.
I also enclose a self-addressed stamped envelope for the return of my IC – or my money if the offer should be over-subscribed.
Number required (tick please) ☐ ☐

Name .....
Address .....
.....
.....

offer closes July 25.

This offer is limited to one or two ICs per coupon. Readers may order more than two ICs but a separate coupon must be enclosed for each pair.

Instant Component Service

ICS ICS ICS ICS ICS ICS

Introducing a unique form of Distribution – BROADLINE DISTRIBUTION providing you the Professional/Industrial buyer with FAST EFFICIENT DELIVERIES and IN DEPTH STOCKING. You can now buy the leading brands with one order from a single source, delivered in kits, individually or scheduled.

Acme	:-	RF. Coax. Connectors
Alco	:-	Toggle Switches
		Push Button Switches
		Rotary Switches
Augat	:-	IC Sockets
		LED Sockets
A. P. Besson	:-	Audible Alarms
A & R Soanar	:-	Electrolytic Capacitors
		Polyester Capacitors
		Ceramic Capacitors
		Carbon Track Pots
		Switch Pots
		Trim Pots
		Preset Pots
		Resistors
		Transformers
Beyschlag	:-	Resistors
Clarostat	:-	Precision Pots
General Electric - U.S.A.	:-	Triacs
		S.C.R's
		Diodes
		Bridges
		U.J.T's
Jean Renaud	:-	Push Button Switches
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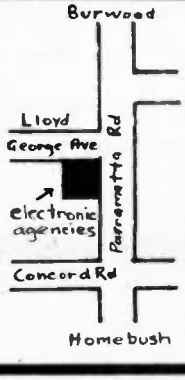

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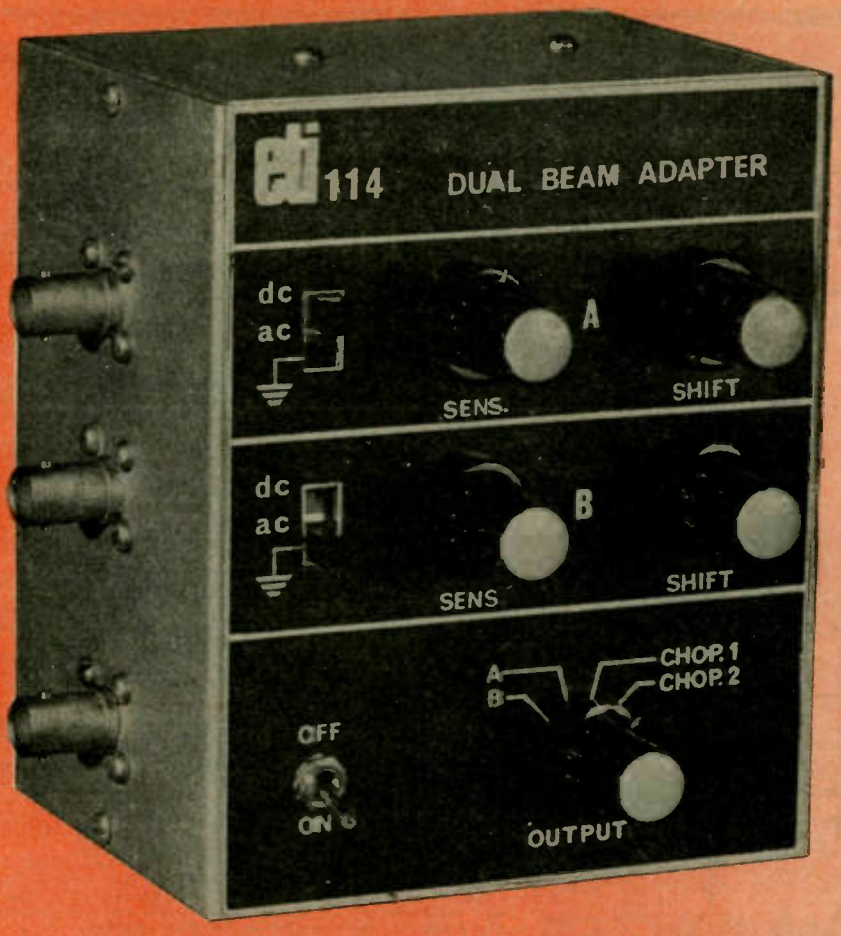
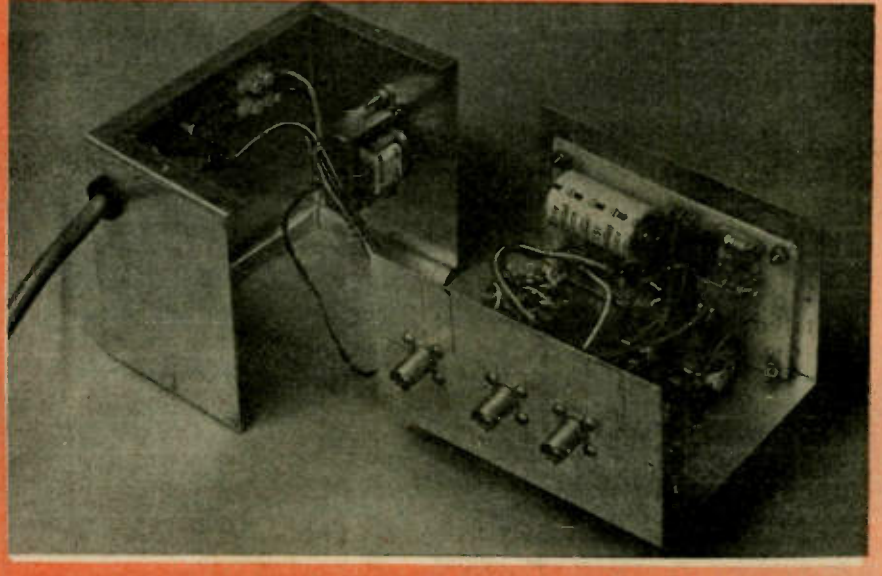


DUAL BEAM ADAPTOR

Simple unit converts single beam CRO to dual beam operation.



THE oscilloscope, next to the multimeter, is perhaps the most useful test instrument. Indeed, for any serious experimental work an oscilloscope is indispensable. Unfortunately they are expensive beasts, and whilst an experimenter may well afford a simple, low-frequency single-beam type, a dual-beam version (at $300 or more) is usually beyond his means.

Nevertheless a dual-beam facility is most convenient, for it allows comparison of two different signals, for wave-shape or timing, and makes obvious, differences which otherwise would not be discernable.

The simple dual-beam adaptor described here, whilst not providing *all* the capabilities of an expensive dual-beam CRO, will however, cover most experimenter's requirements.

It is a low cost unit which allows two inputs of similar amplitude to be displayed simultaneously on separate traces. Frequency response of the unit is sufficient to allow observation of signals up to about 1 MHz.

CONSTRUCTION

Most of the components are mounted on a printed circuit board. However, if desired matrix or veroboard may be used.

Be careful to orientate the polarised components correctly, as shown on the component overlay. Wiring to the sockets and switches should be as short as possible. Note that C3 and C4 are mounted on the input switches and C5 is mounted on the output socket.

Our prototype was mounted in a small aluminium minibox as illustrated. As individual requirements will vary, details of front panel layout and metalwork only are supplied.

USING THE ADAPTOR

Connect the output of the adaptor to the input of the CRO. The two adaptor inputs now become A and B trace inputs to the CRO. A triggering signal should be applied direct to the trigger input of the CRO as otherwise the CRO will tend to synchronize to the chop frequency and not to either input signal.

It is preferable that the two input signals have approximately the same amplitude as there is no input amplifier or range selection provided

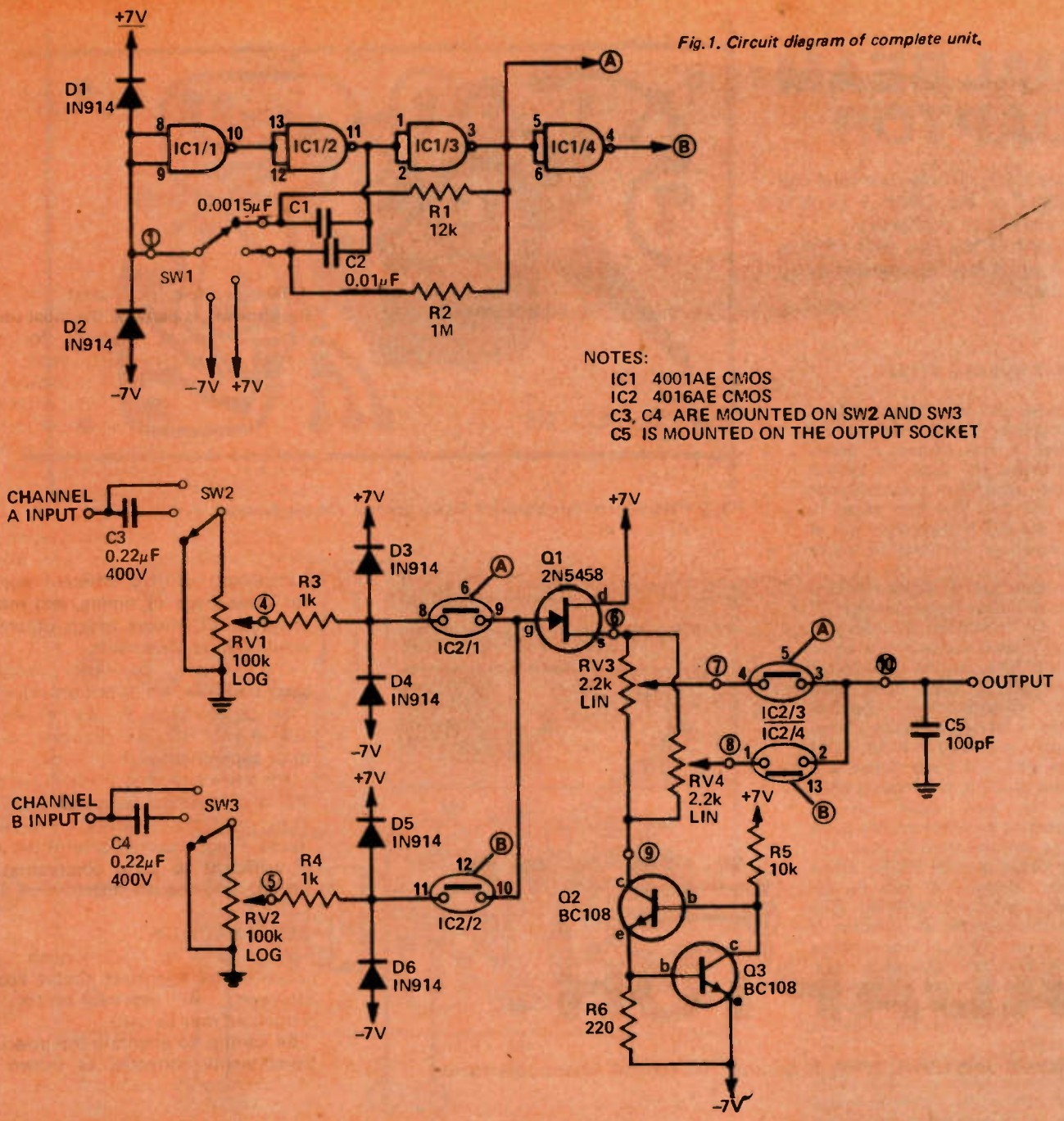


Fig. 1. Circuit diagram of complete unit.

NOTES:
IC1 4001AE CMOS
IC2 4016AE CMOS
C3, C4 ARE MOUNTED ON SW2 AND SW3
C5 IS MOUNTED ON THE OUTPUT SOCKET

on the adaptor. However there is an attenuator provided on each input so that some adjustment may be made.

If only one input is to be applied it is best to switch to that input only thus eliminating the second trace and any cross talk which may occur due to the high input impedances.

Two chopping frequencies are used, having widely different frequencies, so that if the input signal is a harmonic of the chopping frequency, (see Fig. 4) choosing the other chop mode will prevent the chop frequency being visible.

Normally CHOP 1 would be used for high frequency inputs, and CHOP 2 for low frequency inputs. An ALTERNATE mode has not been included (entails obtaining an output

SPECIFICATION

Input Level	
dc	± 4 volts max
ac	2 volts RMS max
dc insulation on ac	± 400 volts max
dc level shift	± 1.5 volts
Frequency Response	
– 3dB point	> 1 MHz
Chopping Frequencies	
A	60 Hz
B	35 kHz
Input Impedance	100 kHz

DUAL BEAM ADAPTOR

from the CRO of unknown level and availability) as the CHOP 1 mode is similar and almost as effective.

By means of the two shift controls traces A and B may be separated by up to ±1.5 volts.

HOW IT WORKS – ETI 114

Switches SW2 and SW3 select dc or ac coupling, or input shorted, for channel A and channel B inputs respectively. The signals are applied to the sensitivity potentiometers RV1 and RV2 and then passed to IC2/1 and IC2/2 which select one of the signals as an input to source follower Q1.

Transistor Q1 is supplied with a constant current (approximately 2.7 mA) by transistors Q2 and Q3. Hence, there is about 3 volts across RV3 and RV4, and this is unaffected by changes in input signal level. These potentiometers therefore provide a level-shift facility. When channel A is selected by IC2/1, IC2/3 selects RV3, and when channel B is selected by IC2/2, IC2/4 selects RV4. Thus as each signal has an independant level shift the two traces may be separated when chopped.

The CMOS gates of IC2 are driven by the outputs, A and B, the circuitry associated with IC1. The drive circuit mode of operation is selected by SW1, a four position switch, such that channel A only, channel B only, A and B chopped at 60 Hz or, A and B chopped at 35 kHz may be selected. The operation is as follows.

Integrated circuit IC1 forms a multivibrator which can run at 60 Hz or 35 kHz, or be locked in A-high B-low, or A-low B-high output states. For example, if SW1 selects –7 volts, IC1 pin 10 will be at +7, IC1 pin 11 will be at –7, IC1 pin 3 will be at +7 and IC1 pin 4 will be at –7 volts. The CMOS switches of IC2 will be "on" if the control voltage is at +7 volts and "off" if the control voltage is at –7 volts. Thus when –7 volts is selected by SW1, "A" will be at +7 volts, and IC2/1 and IC2/3 will select channel A. Similarly if +7 volts is selected by SW1, IC2/2 and IC2/4 will select channel B.

If C2 and R2 are selected by SW1 the multivibrator will be free to run at 60 Hz and channels A and B will be alternately selected at this frequency. Similarly if C1 and R1 are selected, channels A and B will be alternately selected at 35 kHz.

The power supply is a simple full-wave bridge type which uses two Zeners to provide the +7 and –7 volt supplies required.

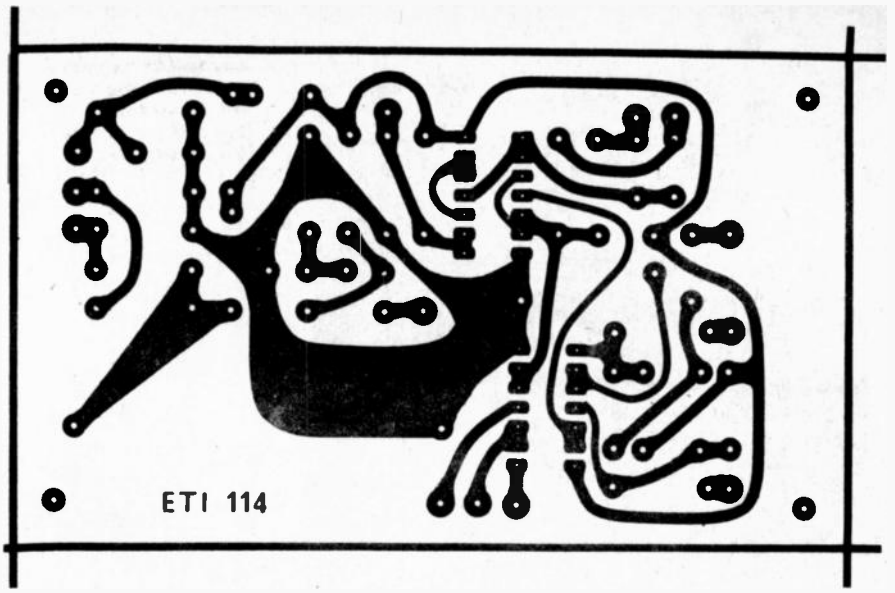


Fig.2. Printed circuit board pattern for the adaptor. (Shown fullsize).

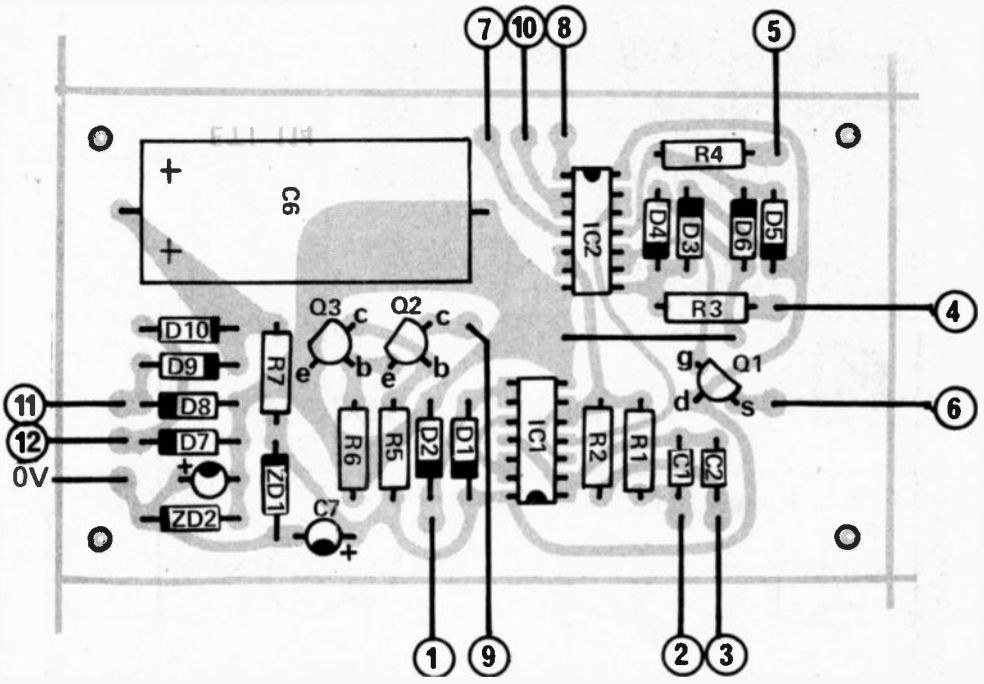
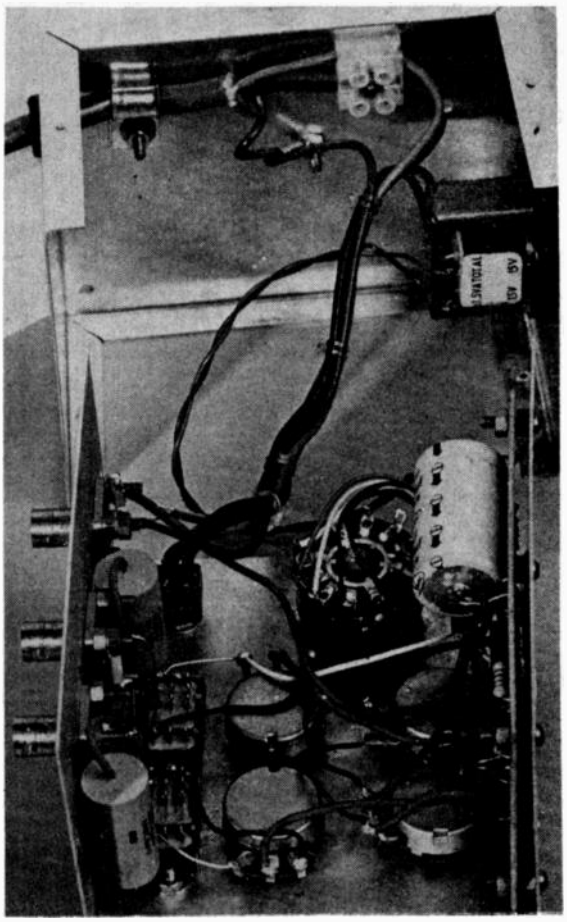


Fig.3. Component overlay.

Fig.4a. Two signals, correctly displayed using the dual beam adaptor.

Fig.4b. Use of incorrect chopping frequency for a particular input signal (chop frequency a harmonic of signal) results in above effect. To cure use other chop frequency.



Layouts of components within the unit can be see from this and accompanying photographs.

PARTS LIST — ETI 114

R6	Resistor	220	½W	5%
R7	"	470	½W	5%
R3,4	"	1k	½W	5%
R5	"	10k	½W	5%
R1	"	12k	½W	5%
R2	"	1M	½W	5%

RV1,2 Potentiometer 100k log rotary
RV3,4 Potentiometer 2.2k lin rotary

C5	Capacitor	100pF ceramic
C1	"	0.0015μF polyester
C2	"	0.01μF polyester
C3,4	"	0.22μF 400V poly.
C7,8	"	10μF 16V electrolytic
C6	"	1000μF 35V "

D1-D6 Diode IN914 or similar
D7-D10 " EM401 or similar
ZD1,ZD2 Zener Diode BZY88C6V8 or similar

Q1 Transistor 2N 5458
Q2,Q3 " BC108, BC548 or similar

IC1 Integrated circuit 4001AE CMOS
IC2 Integrated circuit 4016AE CMOS

T1 transformer 12.6V — 15V @ 300ma PF2851, PF3786, A&R7577 etc.
PC Board ETI 114
SW1 switch one pole 4 position rotary
SW2,3 switch 3-position slide switch
SW4 switch 2-pole on-off toggle 240V rated.
Metal Box 130mm x 105 mm x 80 mm
3 sockets to suit CRO leads
Knobs for front panel.

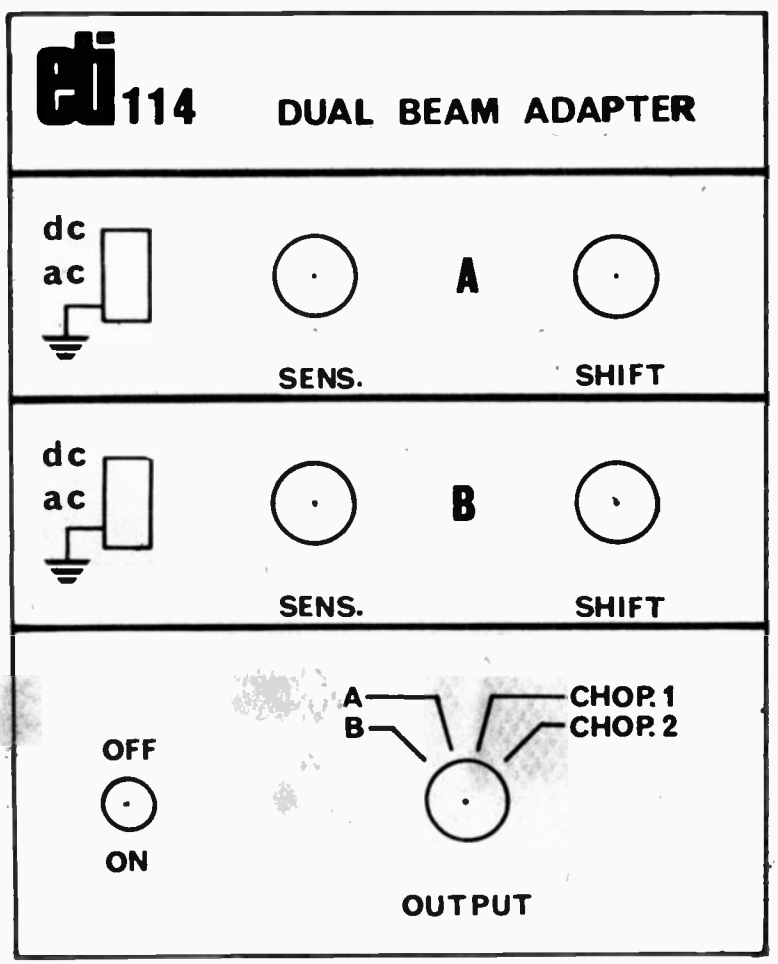


Fig.5. Artwork for front panel of the adaptor.

ERRATA

There is a printing error in the Lafayette Electronics advertisement on page 101 of this issue. In this advertisement the HA600A 5-band receiver is shown twice at two different prices.
The correct price is
$199.50
including sales tax

☆ SPECIALS FOR JULY ☆

ORION STEREO CASSETTE DECK
2 – BIG VU METERS.
Noise filter, chrome tape switch, auto stop on play, record, F. forward F. return separate record and playback level controls Din + RCA connections. Headphone skt, 2 mikes, all for $95.

HITACHI CASSETTES

	1 off	12 off	24 off
BASF C 90 SM	$2.23	2.00	1.80
Sony Low Noise	$2.88	2.50	2.23
UDC 60 Ultra Dynamic	$2.37	2.14	1.93
UDC 90 Ultra Dynamic	$3.15	2.84	2.56
UDC120 Ultra Dynamic	$4.35	3.92	3.53

SONY C90 CHROME CASSETTE $3.95

ORION STEREO CAR CASSETTE
Complete with 2 speakers in boxes $69.00

Philips 8" Woofers	$12.00 ea
Philips 1" Dome Tweeters	$ 8.00
3 TC Tweeters	$ 3.50

BASF DP 26 2400' 7" TAPE

1 off – $10.00 10 off – $ 9.00
3 off – $ 9.50 15 off – $ 8.50

Plessey	12U50	8Ω	15Ω	$36.00
	C12P	8Ω	15Ω	$19.79
	C12PX	8Ω	15Ω	$21.15
	C100	8Ω	15Ω	$13.26
	C100X	8Ω	15Ω	$14.68
	C8MX	8Ω	15Ω	$ 8.95
	C6MR	8Ω	15Ω	$ 7.90
	C60	8Ω	15Ω	$11.09

University meters

MUA5/73 (20K-/VOHOC) **$13.50 each**

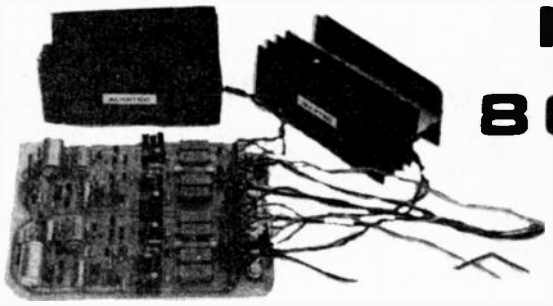
CTN500MP (20K-/VOHDC) **$16.00 each**

EDGE ELECTRIX
34A Burwood Rd., Burwood.
Phone: 747-2931

CATALOGUE 50c. We do not have elaborate Catalogues, just a simple one everyone can understand one sole Proprietor deals with all your problems personally.

COMPLETE MAIL ORDER SERVICE
All goods available at competitive prices. Please write or ring for a quote... allow a sufficient amount to cover Freight when ordering.

250 WATTS R.M.S. INTO 8 OHMS



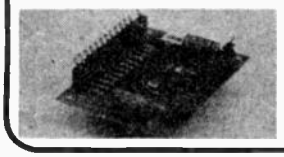
The new 027 module from Auditec

Recommended price $98.50 + 15% sales tax.

Designed for guitar, public address and entertainment systems where high quality with high reliability are essential. For full details and specifications, send the coupon below.

OTHER NEW RELEASES:

006 HEADPHONE AND V.U. METER AMPLIFIER
Input 1 volt, outputs master gain, headphones, V.U. meter (all types), with preset meter level control $10.75.



007 12 CHANNEL MIXER MODULE
Constant gain I.C. mixing, output 1 volt into high impedance, 0 dBm into 600 OHMS. $8.75.

OTHER AUDITEC MODULES INCLUDE:
001D Power amplifier 32 watts RMS @ 0.1% T.H.D. $19.95.
002 Comprehensive preamplifier $15.25.
005 I.C. Wide-band A.M. Tuner $29.95.
009 125 watt power amplifier $52.50.
013, 014 Siren modules $9.55.
015 Guitar/Public address/entertainment preamps $12.90.
016 6-channel mixer module $7.95.
018 60 watt power amplifier $31.95.
019 12 volt 20 watt amplifier $37.91.
020 Multi-channel mixer modules $6.70.
021 Multi-channel mixer modules $7.60.
022 Multi-channel mixer modules $7.95
023 Regulated power supply for all Auditec preamps $12.95.
024 Variable regulated laboratory power supply $22.00.
025 Stereo magnetic preamplifier to professional specs $15.90.
028 Stereo 20 watt power amplifier $32.25.
Prices of 001, 2, 5, 025, 028 + 27½% sales tax; all other plus 15%.

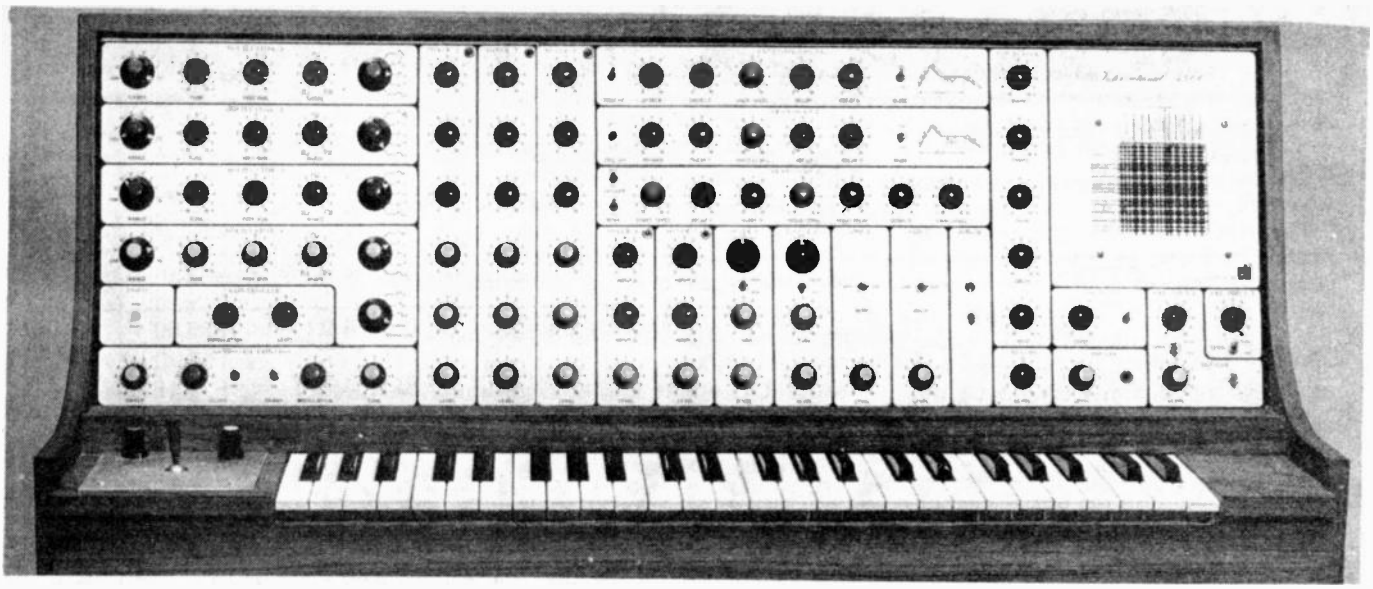
These modules are all designed for professional applications, use only top-quality components, and are guaranteed for 12 months. They re ready to wire into your system by means of connector plugs on the modules. All modules are fully Australian made, and are normally available ex stock, order by cash, cheque or C.O.D. Now available from all Kit-Sets Aust. Branches, or send for full details to:—

AUDITEC AUSTRALIA
P.O. Box 228, Hornsby, NSW, 2077.
Phone: 47-4166

Please send full details of:

001,2	005	006,7	009,18
013,4	015,6	020,1,2	023,4
019	025	027	028

To:
NAME .....
ADDRESS .....
.....Postcode .....
ETI 7/74



The completed International 4600 synthesizer.

INTERNATIONAL MUSIC SYNTHESIZERS

Completing the 4600 unit.

THIS month's article completes the description of the larger (model 4600) synthesizer.

Interconnections between modules and the patch board are given together with front panel drawings and details of the cabinet woodwork.

Finally, two small modifications are described. The first improves the reliability of the power supply, and the second eliminates a small inconsistency in the operation of the transient generators.

POWER SUPPLY

The power supply is protected against short-circuit to ground of any of the output voltages (except +13.4 volts) and this is normally entirely adequate. However during test procedures on our unit, the +14 volts was inadvertantly shorted to the +7 volts. This caused the +7 volts to be taken to +14 volts, and correspondingly, the tracking -7 volt rail to go to -14 volts, damaging some of the CMOS IC's.

Whilst the occurrence of such a fault is considered to be a remote possibility, we feel it is advisable to fit Zeners (8.2 volt 1.5 watt) from the plus and minus 7 volt supplies to ground, and also from the +5 volt supply (5.6 volt 1.5 watt) to ground, to protect against any such fault condition.

TRANSIENT GENERATOR 1

The Transient Generator I and Envelope Control modules work well and are very reliable. However, over a long period of use, it was found that occasional latch-ups of the Transient I type modules occurred. To understand the cause of this problem we must refer to the operation of the circuit diagram (Fig. 1) on page 50 of the January 1974 edition.

It will be recalled that, when a key is pressed, a 3-millisecond pulse is generated at point A, which resets IC2, discharges C8 and toggles the flip-flop IC6/3/4. This initiates the attack and causes the output to go to +5 volts. On reaching this level the output of IC4 (via IC6/2/1) toggles the flip-flop IC6/3/4 and initiates the first decay. However, if a new trigger occurs at that same instant, the flip-flop receives two commands and may be set either way, depending on which pulse ends first.

To prevent such latch-up ever occurring the following changes should be made with reference to the original circuit diagram and Fig. 1. of this article. Remove C9, D3, R24 and instal a wire link in place of C9. Next cut the copper PC board track between pins 1 and 2 of IC6 and connect pin 1 to pin 13.

The output of IC6/1 is now a level, not a pulse, and therefore cannot be lost. Thus the trigger pulse into IC6/1 will restart the sequence at any time.

To improve the stability of the circuit, when using fast decay times, it is recommended that R14 be reduced to 100 k and C6 to 10 pF.

TRANSIENT GENERATOR 2

The stability of Transient Generator 2 may be improved by reducing R21 to 100 k. No other changes are necessary on this module.

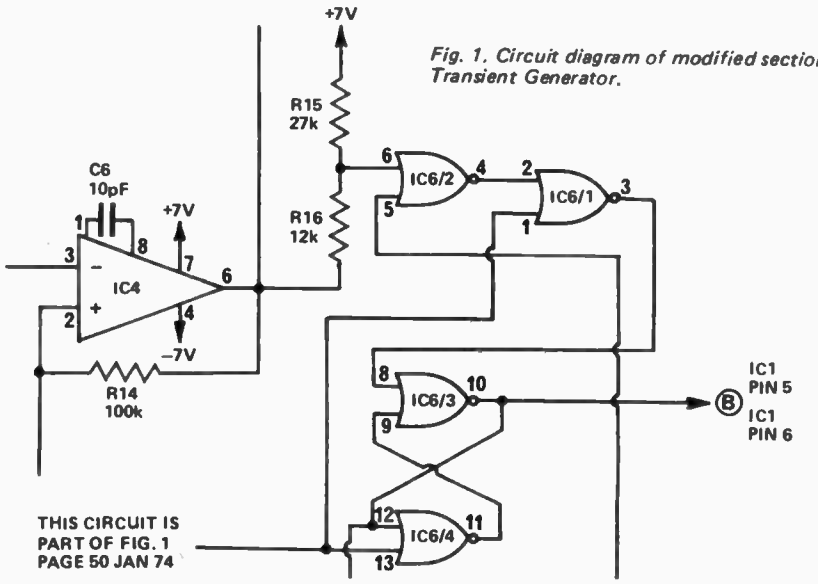


Fig. 1. Circuit diagram of modified section Transient Generator.

WOODWORK

The cabinet, detailed herein, is designed for the keyboards described last month. If different keyboards are used, such as those from Kimber Allen, some dimensions will need to be changed.

The stops (part K) and the hinge (part M) should be assembled to the case with the aid of the front panel. Stand the unit on end and place the front panel in its normally closed position with about 2 mm clearance at the top, and 1 mm clearance at the bottom, of the panel. Mark the pivot hole position and the rear edge of the front panel. Repeat the procedure for the other end. Drill the pivot holes 4.8 mm diameter and 10 mm deep. With the unit upright, fit the panel (using the parts M as pivots) and support it so that it is open and horizontal. Parts K can now be glued in position such that they rest of the edges of the front panel and are aligned with the pencil marks previously made. When the glue is dry parts M may be screwed into position.

The front panel may be secured in the closed position by a self-tapping screw countersunk into each side of the cabinet. The pivots and securing screws should be individually fitted on each unit to ensure proper alignment.

All material, unless otherwise specified, is 13 mm particle board.

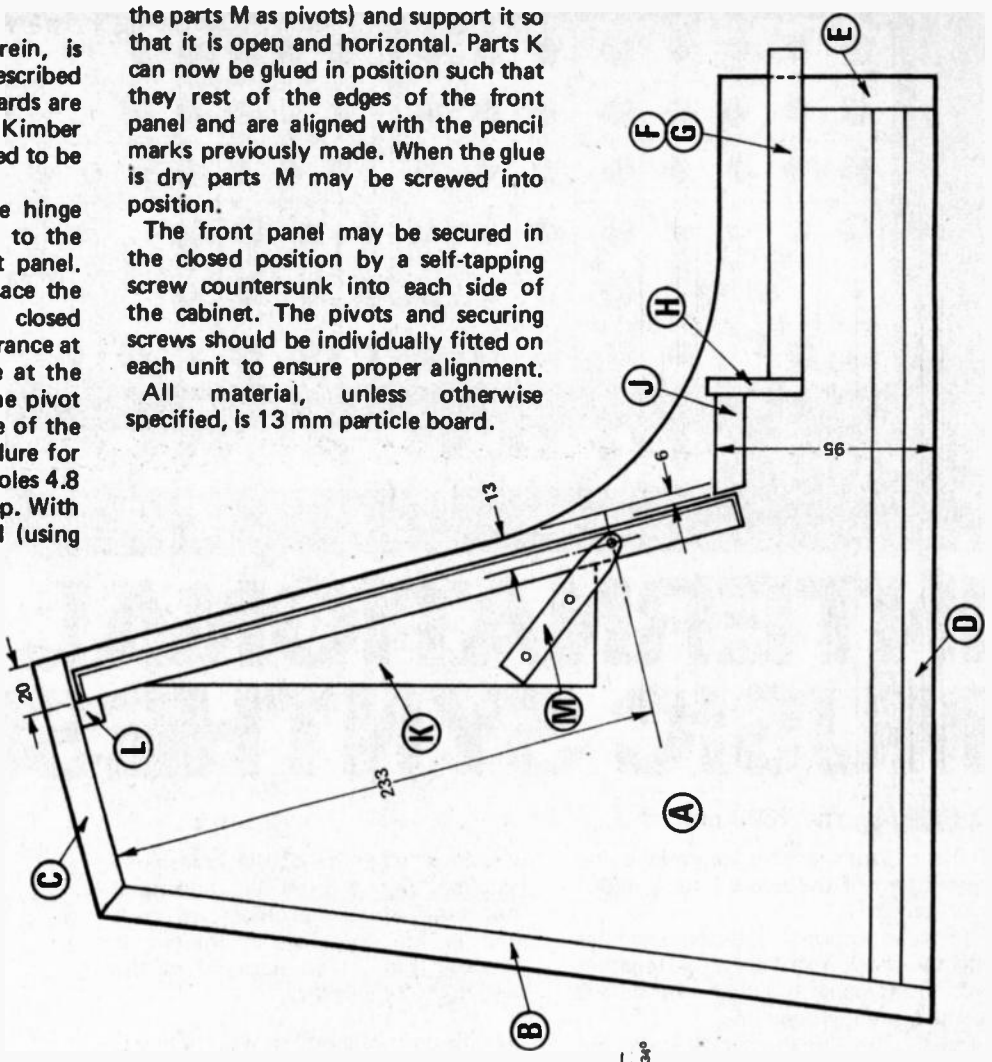
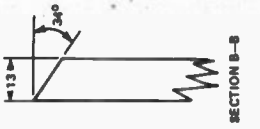
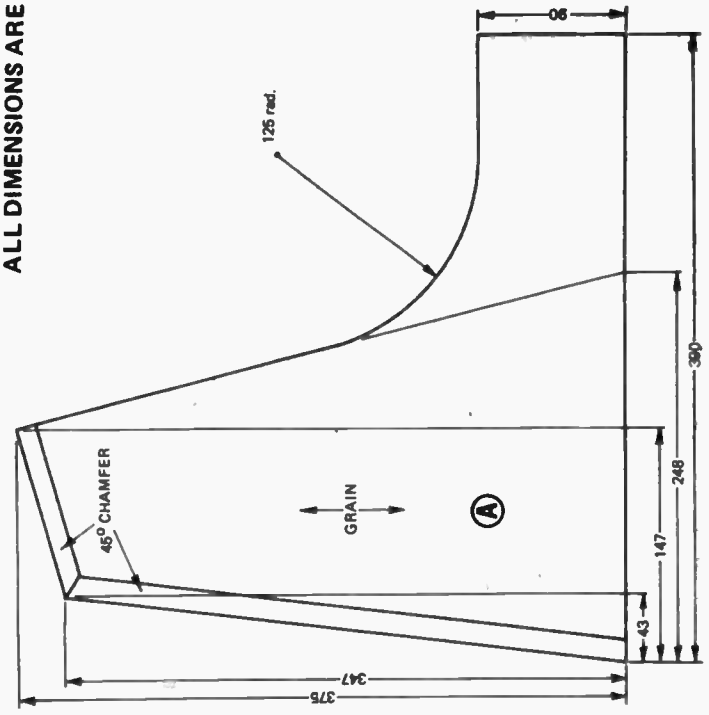
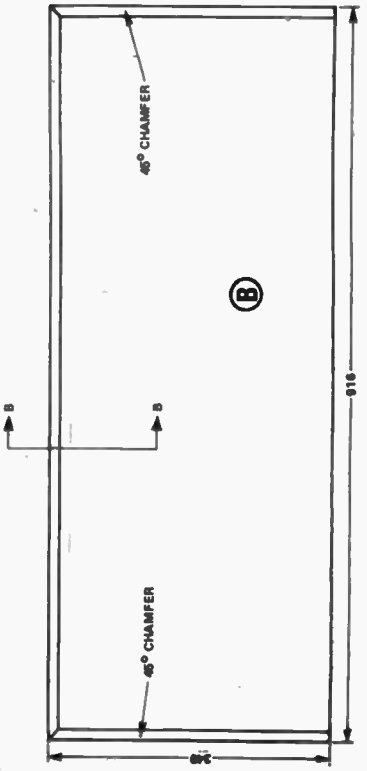


Fig.2. Cabinet assembly. Letters designate pieces described in separate drawings.







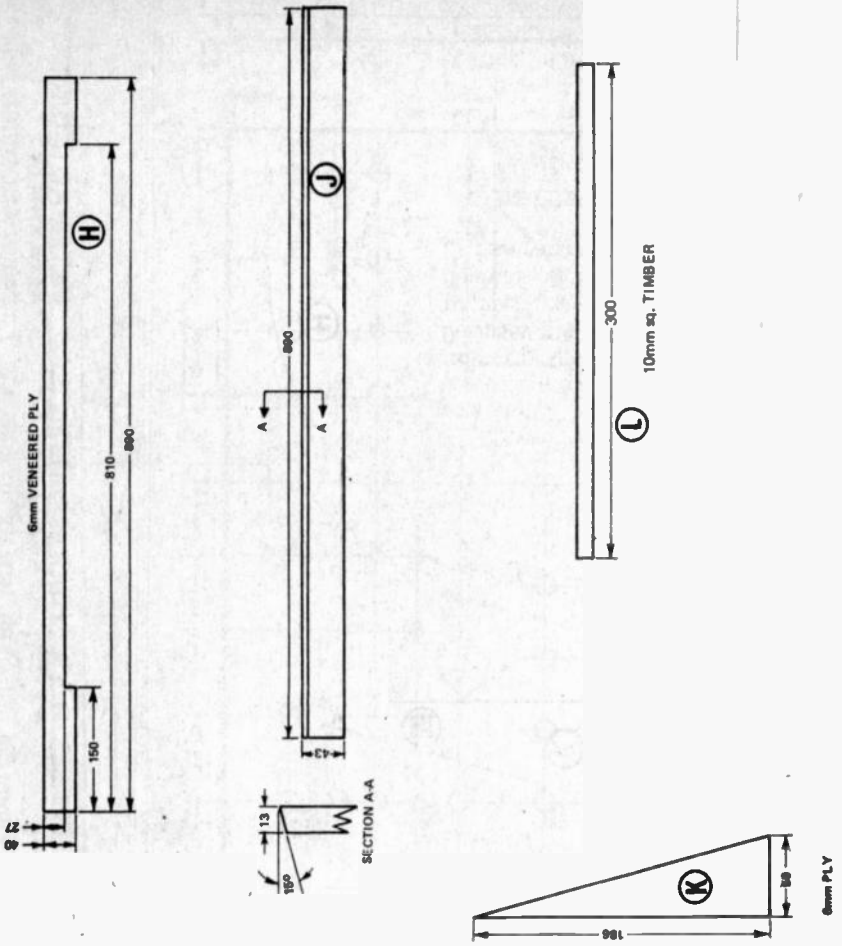
ALL DIMENSIONS ARE IN MILLIMETRES

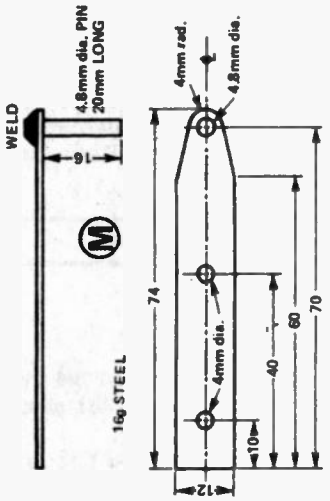
KEYBOARDS

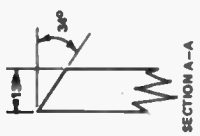
Kimber-Allen have now advised us that whilst they can supply keyboards for the ETI Synthesizer — they cannot fulfill individual orders.

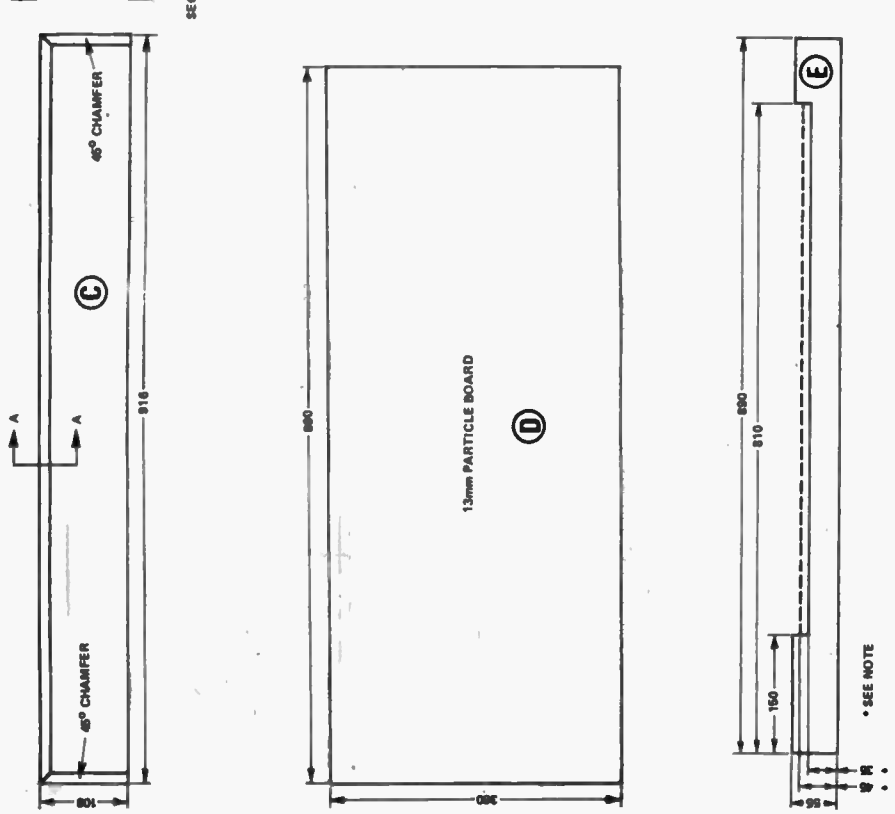
We are currently making arrangements for a bulk purchase of these keyboards.

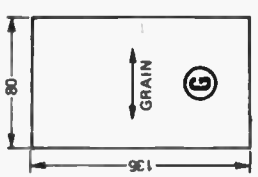
Readers seeking to purchase should contact ETI.

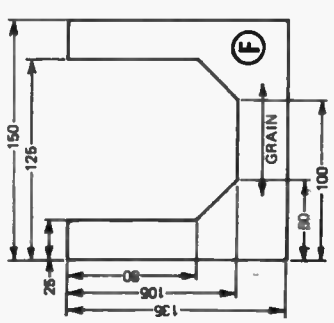












INTERNATIONAL MUSIC SYNTHESIZERS

To assist constructors, the following negatives are available from ETI.

Full set of printed circuit board negatives $25.

Front panel artwork, positive or negative (state which required) $12.50 set. Send cheque/postal order to Electronics Today International, 15-17 Boundary St., Rushcutters Bay, NSW 2011.

ERRATA

May 1974, page 78,
50 watt amplifier.
Lines six and seven in the third column of the parts list should read as follows.
ZD1 Zener diode BZY88C5V6
ZD2 Zener diode BZY88C5V6
ZD3 Zener diode BXZ70C18
(16V or 20V will do)

June 1974, page 86
Reactance Chart.
second paragraph of instructions should read "Note also that 0.7 uF has the same reactance, and an 0.7 uF capacitor and a 10 mH choke will resonate at 2000 Hz.

(Continued on page 109)

AEGIS PTY. Ltd. advises that their factory premises on Thornbury were entered by thieves on the night of Thursday, May 30, and the following items of equipment were stolen — Hewlett Packard HP.35 Calculator, Serial No. 1302S40308. Tektronix Model 422 Double Beam Oscilloscope, Serial No. 140. Sugden Distortion Measuring Unit Type SC453, Serial No. 2128. Sugden Audio Oscillator Type S1453, Serial No. 2059. Odhner Adding & Calculating Machine, Model MX11C/9, Serial No. 21489.

Would anyone knowing anything of the whereabouts of any of the above instruments kindly advise Aegis Pty. Ltd., 347 Darebin Rd., Thornbury, Vic. 3071. Tel: 49-1017 or the Northcote (Victoria) C.I.B.

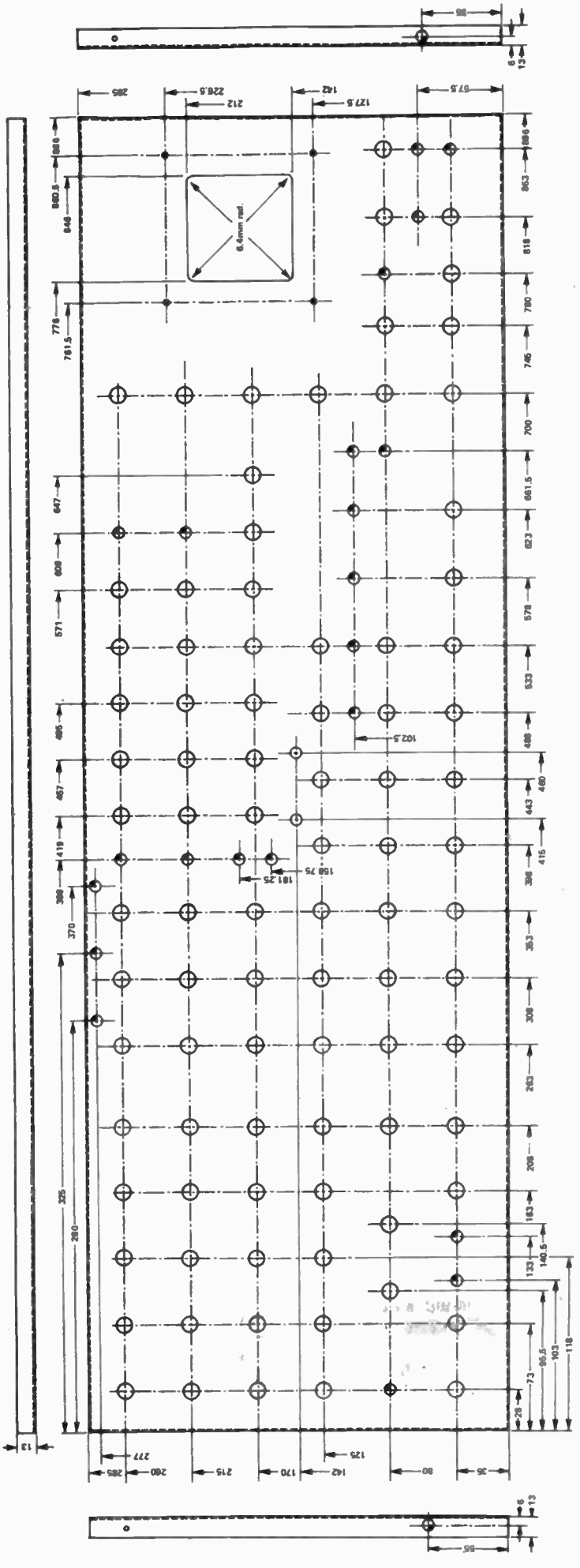


Fig. 3. Front panel metalwork

How many styles of resistors Have you been buying?

SIX?

Now you need stock only

ONE Style!

IRC TYPE RG¼ ±2% TOLERANCE METAL GLAZE RESISTOR ½ WATT (at 70°C Ambient)

Body Length 0.25"

Diameter .090"

Small enough to replace many ⅛ watt resistors but with a high stability ½ watt rating, the RG¼ is manufactured in tolerances of ±2% and ±5%.

A calculation of the cost of using ⅛W, ¼W and ½W resistors in both 5% and 2% tolerances will show you can make a dramatic saving by switching to RG¼ 2% tolerance.

That is why we have made the decision to stock the full range of E-24 values in 2% tolerance.

Apart from the question of economy, what other resistor gives you so many benefits?

***Rugged:**	Moulded jacket gives protection from roughest handling.
***Lower Temperature Coefficient:**	Less than 200 ppm/°C (.02% per °C).
***Superior Stability:**	At ¼ watt rating Mil. load life is better than 1%. At ½ watt, better than 1.5%.
***Lower Surface Temperature:**	Body temperature rise at ½ watt at 70°C amb. is only 40°C.
***Permanent Colour Bands:**	Acrylic colours remain bright and clear after years of service.
***Leads Solder Fast:**	Exclusive IRC tin-lead alloy plating process results in first class solderability even after years of storage.

Manufactured in Australia by

IRH COMPONENTS DIVISION
NATRONICS PTY. LIMITED
The Crescent, Kingsgrove, N.S.W. 2208

Please send me information on Metal Glaze Resistors.

NATRONICS PTY. LTD.
IRH COMPONENTS DIVISION
P.O. BOX 71, KINGSGROVE, N.S.W. 2208

Name.....

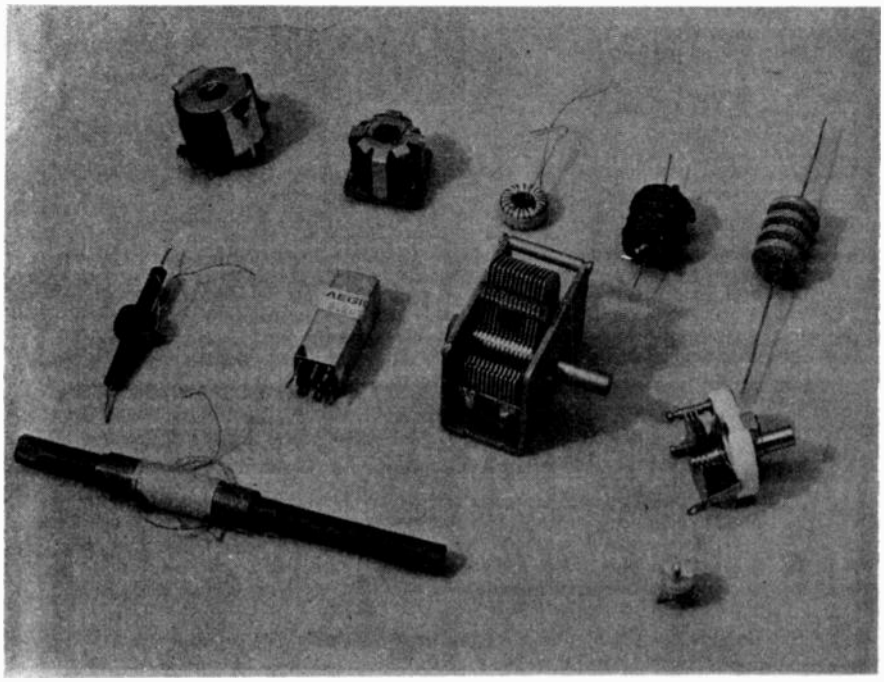
Company.....

Address.....Postcode.....

MG.4/74

ELECTRONICS -it's easy!

PART 8



The last of the heavy stuff! — the combinations of resistance, inductance and capacitance.

WE HAVE stressed throughout this course that a good solid understanding of basic electronics is essential if one hopes to understand complex devices.

It is not at all necessary to understand the extraordinarily complex physics going on inside our electronic black boxes. But we must know how these boxes behave in various circumstances and combination.

Hence the fairly solid material that we have presented so far.

Happily this part of the course is now virtually at an end and we are about to get into the more interesting stuff.

That, as they say, is the good news. Bad news is that this last theoretical section is fairly heavy. Do plough through it though — it really is important.

This part of the course deals with circuits that contain resistors in parallel with inductors or capacitors. It also covers the effect called resonance that occurs when inductors and capacitors are used together.

RESISTANCE AND INDUCTANCE IN PARALLEL

Vector diagrams may be used to study paralleled resistance and inductance. This is done much in the same way as series combinations.

In Fig. 1, the signal common to both components is the applied voltage (not current, as in series combinations). So the vector diagram uses a voltage vector as the horizontal reference. The current flowing in the resistor I_R is in phase with the voltage so it is drawn as shown, coincident with V. You will remember from previous theory that the current passing through an inductor lags the applied voltage by 90°. The current vector will therefore point downwards at 90° to the voltage vector.

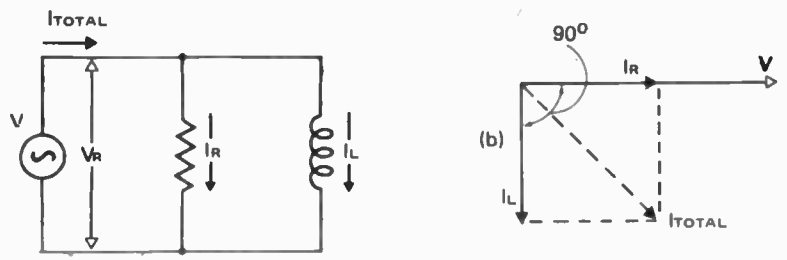


Fig.1. (a) The parallel resistor and inductor. (b). Vector diagram of circuit in Fig. 1a.

To find the magnitude of the current drawn from the generator the diagram is added vectorially to produce I_{total}. This procedure is exactly the same as we used previously.

The Pythagoras rule also holds allowing us to compute I_{total} from I_R and I_L giving:—

$$I_{total} = \sqrt{I_R^2 + I_L^2}$$

Similarly the phase angle is found from:—

$$\text{Tan } \theta = \frac{I_L}{I_R}$$

A worked example is worth a thousand words, so let us consider the circuit given in Fig. 2a. Here the problem is to work out the current in each component and the magnitude and phase of the current drawn from the 10 V generator. (Remember V is common to both components so we can directly apply Ohm's law to each if we know their reactance values).

$$\text{Hence } I_R = \frac{V}{R} = \frac{10}{25} = 0.4 \text{ A}$$

$$\text{and } I_L = \frac{V}{X_L} = \frac{10}{33.3} = 0.3 \text{ A}$$

By calculation we get

$$I_{total} = \sqrt{0.4^2 + 0.3^2} = 0.5 \text{ A}$$

Alternatively, this result could have been reached by using an accurately drawn vector diagram (see Fig. 2b) in which I_R and I_L are the knowns that lead to I_{total} on completion of the parallelogram.

The tangent of the phase angle is:—

$$\text{Tan } \theta = \frac{0.3}{0.4} = 0.75$$

$$\text{Hence } \theta = 36° 52'$$

and we know it is lagging as there are no capacitive elements present. The phase angle could also have been found by measuring the angle directly from the graphical vector diagram.

Calculation of current magnitudes and phase angle rarely needs better

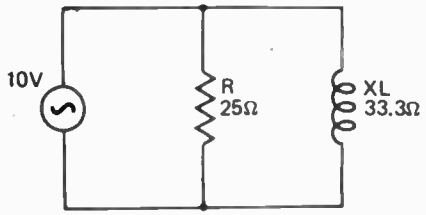
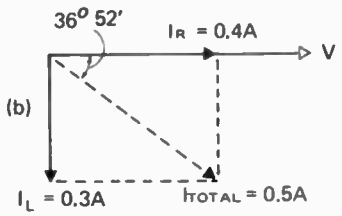


Fig. 2a. A practical exemple of parallel L and R.



(b) The vector solution.

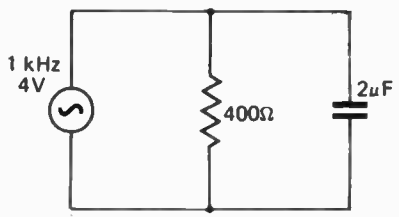
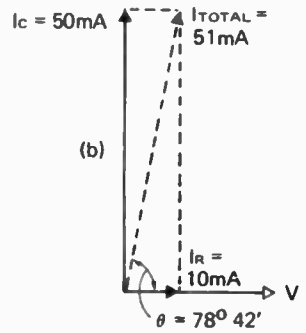


Fig.3a. Parallel combination of capacitance and resistance.



(3b) Vector solution of circuit.

than 1% accuracy; often 10% is quite adequate.

Indeed, the *majority* of electronic calculations require little precision. There is no point in making long and tedious tasks out of these, often arising, sums. What is more important is that the underlying principle is properly understood. Much of the electronic theory needed in practice is a case of mental arithmetic followed by final adjustment once the circuit is wired up.

RESISTANCE AND CAPACITANCE IN PARALLEL

Figure 3a is the circuit of paralleled resistance and capacitance. The magnitude and phase of the load current may be calculated in exactly the same way as for RL combinations. To check that you have understood the foregoing principles do the figures for yourself and draw the vector diagram as a second check. You should get the values shown in Fig. 3b. Remember, this time, that the current in the capacitor leads that in the resistor.

Now work out the total impedance represented by the two paralleled components — it should be 78.1 ohms. Remember Ohm's law applies to ac circuits provided the impedances are added vectorially to obtain the total — it is quite invalid to arithmetically add the values unless they are in phase (or if 180° out of phase, they can be directly subtracted).

To improve your understanding try it again using firstly, a resistor of 40 ohms with 2μF of capacitance and secondly, with 40 ohms and 0.1μF. Finally compare the three diagrams and results.

COMBINATIONS OF L AND C

Until now those circuits involving both a capacitor and an inductor have purposely been ignored, for these can (under certain conditions), exhibit characteristics that are strikingly different to those seen so far in our discussion of storage elements.

With the concepts of the vector diagram and the phase of signals behind us, it is now a reasonably straightforward task to gain an understanding of circuits that contain both inductance *and* capacitance.

SERIES COMBINATIONS

When two components are in series, the same current must flow through each, but, as we have previously seen, the voltage across an inductor must lead the current by 90° and the voltage across a capacitor always lags the current by 90°. Thus these voltages *always oppose eath other* (180° out of phase) and the difference between them — is the input voltage! That is, either or both of the voltages across the reactances, may be larger than the input voltage.

To provide a better understanding of what happens in such circuits, let us calculate the current drawn from the supply and the voltages across the reactances in the circuit of Fig. 4a.

Firstly we must find the reactance of each component at the supply frequency of 12 kHz.

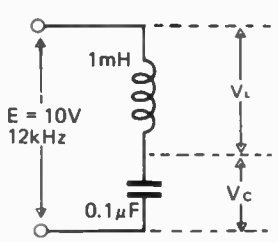


Fig.4a. A series inductor and capacitor combination. (4b) Vector solution.

$$X_L = 2\pi FL =$$
$$6.28 \times 12 \times 10^3 \times 1 \times 10^{-3} = 75.4 \text{ ohms}$$
$$X_C = \frac{1}{2\pi FC} = \frac{10^6}{6.28 \times 12 \times 10^3 \times 0.1}$$
$$= 132.7 \text{ ohms}$$

To determine what the current through the series combination is, we must find the effective combined reactance. As the reactances have the opposite effect, this is simply obtained by subtracting capacitive from inductive reactance (capacitive reactance is always assumed to be negative by convention).

$$\text{Thus } X_{comb} = X_L - X_C$$
$$= 75.4 - 132.7 = -57.3 \text{ ohms}$$

The negative sign indicates that the combined effect is that of a capacitive reactance of 57.3 ohms.

By Ohm's Law the current will thus be:—

$$I = \frac{E}{X_{comb}} = \frac{10}{57.3} = 174 \text{ mA}$$

Now that we know the current, we can go back and calculate the voltages across each component

$$V_L = X_L I =$$
$$75.4 \times 174 \times 10^{-3} = 13.1 \text{ volts}$$
$$V_C = X_C I =$$
$$132.7 \times 174 \times 10^{-3} = 23.1 \text{ volts}$$

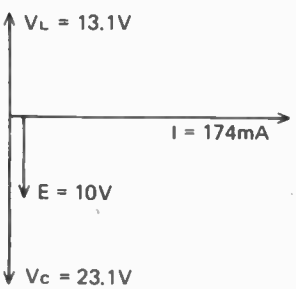
Note particularly the magnitude of these voltages in relation to the input of 10 volts. In fact, due to the subtraction process, the input voltage is always smaller than that across the larger of the two reactances.

The vector diagram for the circuit is as shown in Fig. 4b. We will leave for the moment, the special case where the reactances are equal and study the parallel system.

PARALLEL COMBINATIONS

The parallel combination of L and C is shown in Fig. 5a. In this case the voltage will be common across both components, the current will lag the voltage by 90° in the inductor, and lead the voltage by 90° in the capacitor.

Thus, in this case, it is the two currents which are 180° out of phase so the total current is the difference between them.



ELECTRONICS -it's easy!

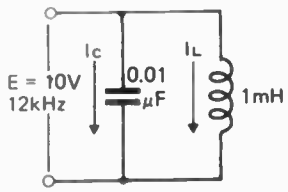


Fig.5a. A parallel combination of L and C. (5b) The vector solution.

Let us use the same values as for the series case

$X_L = 75.4$ ohms, $X_C = 132.7$ ohms

$$\text{Thus } I_L = \frac{10}{75.4} = 132.6 \text{ mA}$$

$$I_C = \frac{10}{132.7} = 75.4 \text{ mA}$$

$$\text{and } I_{comb} = I_L - I_C = 132.6 - 75.4\text{mA} = 57.2 \text{ mA}$$

Compare this current to the previous case. The combined reactance is now:—

$$X_{comb} = \frac{E}{1} = \frac{10}{57.2} = 174.8 \text{ ohms}$$

From this procedure we can deduce that, as the current from the supply is always smaller than the larger of the two reactive currents, the combined reactance, will *always be larger* than the larger of the two reactances. think about it for a while and you will see that this is so.

All practical LC circuits contain some resistance which modifies the behaviour of the circuit. The general circuit of a series LCR combination is given in Fig. 6 and a parallel combination in Fig. 7. These are the most common configurations but by no means the only ones.

In the series case the vector diagram shows how the difference between the reactive voltages is vectorially summed with the voltage across the resistor to obtain the magnitude and phase angle of the supply voltage. Alternatively we can use the Pythagoras rule again to find the input voltage:—

$$Vin = \sqrt{V_R^2 + (V_L - V_C)^2}$$

and the phase angle

$$\text{Tan } \theta = \frac{V_L - V_C}{V_R}$$

In the parallel case we look at currents instead of voltages. Remember the voltage must be the same across each component, and again a vector diagram of reactive and resistive currents will provide us with the magnitude and phase of the input current.

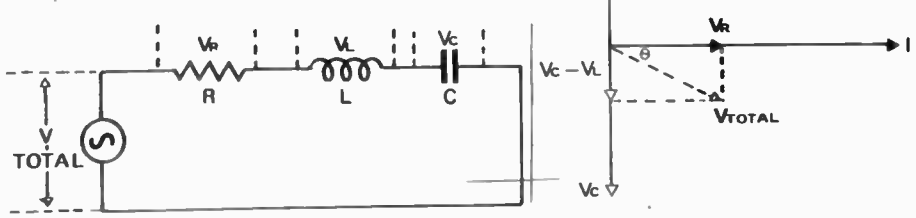
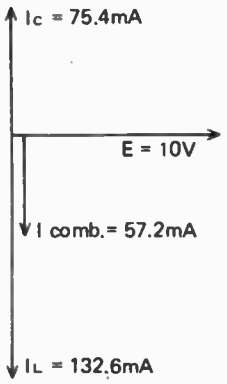


Fig.6a. Series combination of L, C and R. (6b) Vector diagram of the combination.



By Pythagoras:—

$$Iin = \sqrt{I_R^2 + (I_L - I_C)^2}$$

$$\text{Tan } \theta = \frac{I_L - I_C}{I_R}$$

APPARENT POWER & POWER FACTOR

In a circuit containing both reactance and resistance, only the energy supplied to the resistor is dissipated. The energy supplied to the reactance is alternately stored in a field and then returned to the supply. Thus no energy is dissipated by the reactance.

The energy supplied to the resistance is called 'REAL' power (because it does work) and is measured in watts. The energy shunted back and forth by the reactance is called APPARENT POWER and is simply equal to the input voltage times the current drawn. The apparent power is measured in terms of volt-amperes — often abbreviated to VA.

The ratio of the real power in watts to the volt-amperes is called the POWER FACTOR of a circuit.

Referring to Fig. 4b we can say that:—

real power in watts = $E_R I$

and apparent power VA = EI

$$\therefore \text{power factor} = \frac{E_R I}{EI} = \frac{E_R}{E} = \cos\theta$$

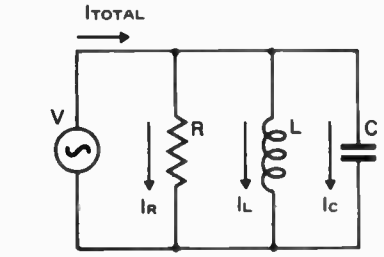
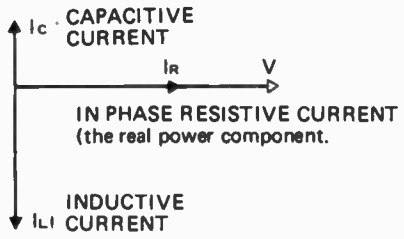
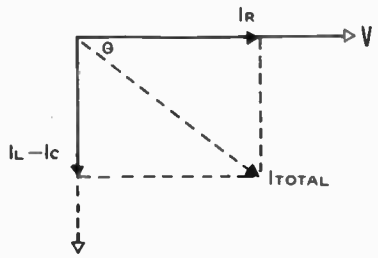


Fig.7a. A parallel combination of L, C and R.



(7b) The basic vector diagram.



(7c) The vector solution — the reactive components having been subtracted.

Thus the power factor in any circuit is equal to the cosine of the phase angle and the power actually dissipated in such a circuit is:—

$$P = EI \cos\theta$$

A PRACTICAL EXAMPLE

An excellent example of the use of reactances is found in fluorescent lights. A basic fluorescent light consists of a gas discharge lamp and a current limiting choke called a ballast as shown in Fig. 8.

Once lit, the complete light appears to the mains as an inductive load and, the current drawn from the mains will lag the voltage by a considerable amount.

The typical four-foot long lamp is rated at 40 watts but, when fed via the correct ballast-choke, draws 0.4 amps from the mains. Thus the VA will be 240 x 0.4 = 100VA approximately! As the consumer only pays for real power, this is of little concern to him, but the extra current drawn causes higher losses in the transmission line, which means the electricity supplier loses revenue. The suppliers therefore, in some areas, insist that large installations of fluorescent lights have suitable power-factor correction.

How is power-factor correction done? Quite easily — because all we need to do to cancel an inductive reactance, is add an equivalent

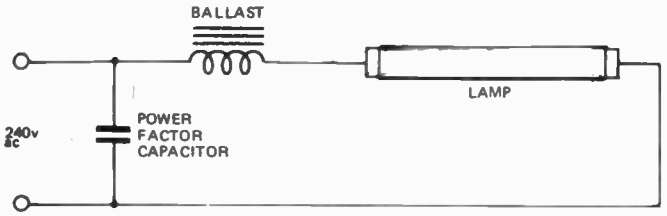


Fig.8. The circuit of a basic fluorescent light fitting (not including starting circuitry). This is an excellent industrial example of the uses of inductors and capacitors.

capacitive reactance in parallel (see section on parallel L and C). Thus a capacitor added across the input terminals will not affect the operation of the lamp but keeps the electricity supplier happy by reducing the input current from 400 mA to about 150 mA.

RESONANCE

As we vary the input frequency to an LC circuit the reactances of L and C change in different directions. That is, as frequency goes up, capacitive reactance goes down, (and inductive reactance goes up). At one particular frequency the reactances will be equal and, when this occurs, we find some very interesting effects — as we will see.

The frequency at which the reactances of L and C are equal is called the RESONANT FREQUENCY, and the circuit is said to be RESONANT at that frequency. Let us now look at the characteristics of series and parallel circuits at resonance.

PARALLEL RESONANCE

In a parallel reasonant circuit the individual currents flowing in the inductor and the capacitor depend upon the frequency at which the ciruit is operated and upon the size of the component (remember $X_L = 2\pi fL$ and $X_C = 1/2\pi fC$). These currents can be plotted as shown in Fig. 9b. The combined current is the direct difference of the two.

At low frequencies the circuit is predominately inductive. As the frequency is raised, more capacitive current flows: at the same time the inductive current reduces. A point is reached where the two are equal and, as they are of opposite sense, the circuit draws no current from the input. It behaves as though the generator is connected to nothing — as would occur if the load was an infinitely high resistance. This happens at the frequency known as the resonant frequency fr, for short. Above resonance the circuit becomes more and more capacitive as the effect of the capacitor becomes more dominant, and the input current gradually increases again.

It is often convenient to consider the impedance of such circuits instead of the currents. Variation of the impedance of a parallel resonant circuit is plotted in Fig. 10. Note the

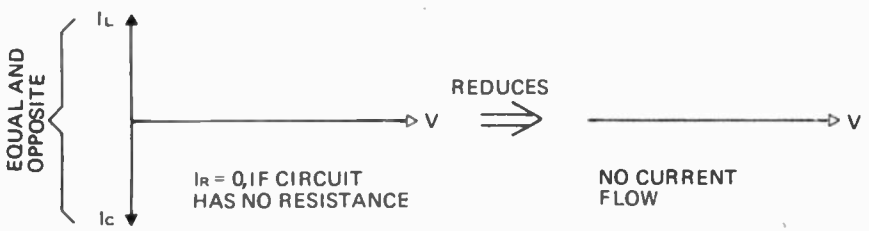


Fig.9a. Vector representation of the condition at resonance, when inductive and capacitive reactance are equal.

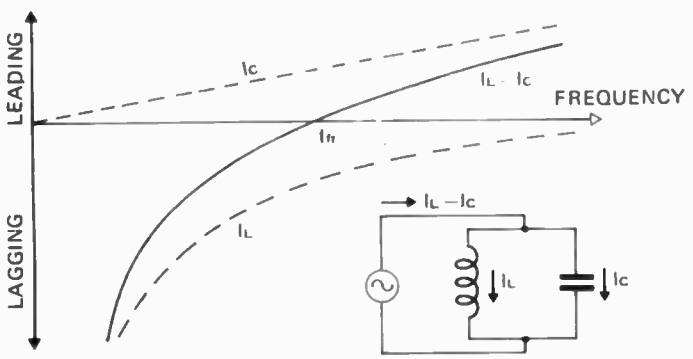


Fig 9b. Currents in the parallel tuned circuit as the frequency is varied.

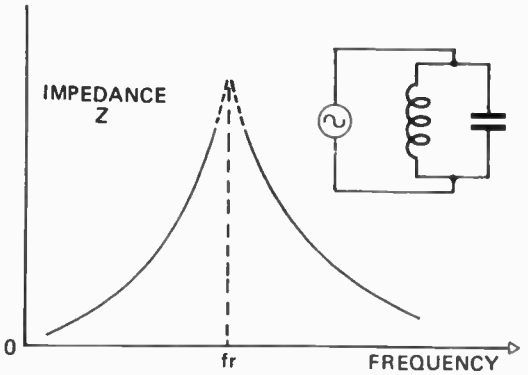


Fig.10. Variation of the impedance of a parallel tuned circuit as the frequency is varied.

theoretical impedance rises to an infinitely high value (zero current flow) at the resonant frequency. However, there is always some resistance in practical resonant circuits and this limits the rise and sharpness of the curve. This resistance is termed the DYNAMIC RESISTANCE.

Circuits capable of resonating in this manner are known as tuned circuits. Tuning is the procedure whereby any of the components is selected or carefully adjusted to achieve the resonant condition.

SERIES RESONANCE

A similar argument to the above can be used in the case where the two storage components are wired in series. The effective characteristics turn out

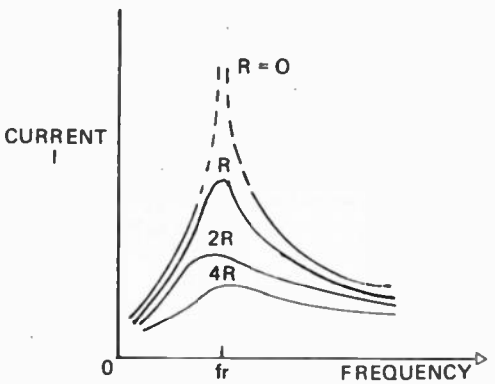


Fig.11a. The dynamic resistance of a series tuned circuit affects the sharpness of the resonant effect as shown.

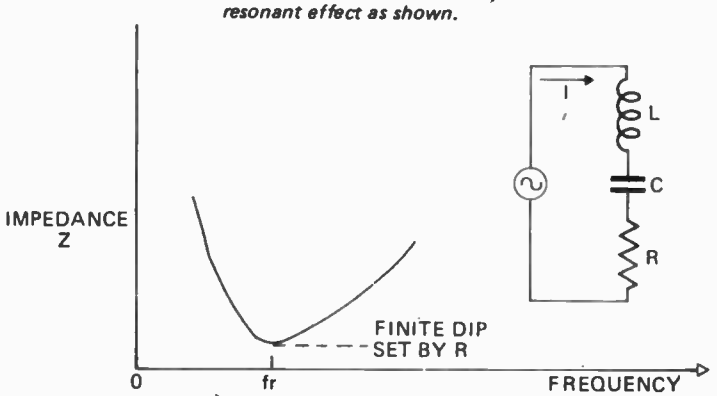


Fig.11b. Impedance of a series tuned circuit drops, at resonance, to a value determined by the dynamic resistance.

to be the reverse of those of the parallel resonance case.

Here the current is common to both components so the typical vector diagram looks like that shown in Fig. 6. The case illustrated has the capactive voltage larger than the voltage across the inductor so the combination appears to be a circuit that has a value of capacitance smaller than that of the component actually in circuit.

It is when the two reactances are equal, at a particular frequency, that interesting things happen for there, the effect of the capacitor cancels that of the inductor and, the source sees only the resistance of the circuit. Ohms law tells us that the current drawn from the source is limited only by the value of the resistance, which in a typical tuned circuit is very small. Consequently the current could well be very large indeed. Fig. 11a shows how the current is limited by various values of dynamic resistance. Impedance variations for a series tuned circuit are given in Fig. 11b. The minimum of the dip is limited by the dynamic resistance.

QUALITY FACTOR OF TUNED CIRCUITS – THE Q

In the series tuned circuit the voltage across the resistor can never be greater than the applied voltage. On the other hand the voltage across the reactive components can rise to values many times that of the supply. The V_L and V_C values in Fig. 6 demonstrate how this occurs.

Consequently the series resonant circuit can be used to produce voltages considerably larger than those supplied to it. The magnification that occurs in this process is expressed as the 'Q', or quality factor of the circuit and is given by

$$Q = \frac{V_L}{V} = \frac{V_C}{V} \text{ (at resonance } V_L = V_C)$$

As the windings of the inductor are responsible for the majority of the resistance a good approximation for the Q factor is found using the realtionship

$$Q = \frac{X_L}{R}$$

introduced earlier in the course.

In parallel tuned circuits it is the current in the reactive components that is magnified, and again the same definition of Q can be used to express the goodness of the tuned circuit. Hence

$$Q = \frac{I_C}{I_R} = \frac{I_L}{I_R}$$

As currents are related to reactances by Ohms law, the Q can also be found from the ratio of the reactance and resistance as for series resonance.

RESONANT FREQUENCY

As pointed out earlier, the resonant frequency is that frequency where the inductive and capacitive reactances, of a series (or parallel) tuned circuit, are equal. That is:–

$$X_L = X_C$$

and hence $2\pi FL = \frac{1}{2\pi FC}$

By transposition we obtain resonant frequency $F_r = \frac{1}{2\pi\sqrt{LC}}$

The following examples will assist. Given a 100 mH inductor and a 0.4μF capacitor, find the frequency at which the two resonate.

$$F_r = 2\pi \frac{1}{\sqrt{100 \times 4}} = 800 \text{ Hz}$$
$$\sqrt{10^3 \times 10^7}$$

This is the frequency for series or parallel resonance of the two.

Often the need is to produce a resonant condition at a given frequency with one component supplied. For example, we may need a circuit resonant at 4 kHz, using a 160 mH choke. The capacitance needed will be:

$$F_r = \frac{1}{2\pi\sqrt{LC}}$$

from which $LC = (\frac{1}{2\pi F_r})^2$

or $C = \frac{1}{L} \times (\frac{1}{2\pi F_r})^2$

and putting figures for this example

$$C = \frac{1}{160 \times 10^{-3}} \times (\frac{1}{2\pi \times 4 \times 10^3})^2$$
$$= 0.1\mu F$$

Tuned circuits with zero resistance have the greatest magnification and the sharpest resonance peak. In practice there will always be some resistance present, for the inductor element needs to be as small and light as possible, these factors dictate that the wire used in the coil must be relatively fine in gauge, and hence will have a resistance valve that may need to be taken into consideration. However, in systems-level discussions of electronic devices we can usually ignore the effect of the dynamic resistance, we only need to worry about that when actually designing circuits.

If careful measurements of the resonant frequency of a tuned circuit were made, it would be found that dynamic resistance does vary the resonance value by a small amount. In practice, most resonant combinations have an inbuilt variability that enables the capacitor of the inductor to be finely varied to peak up the response.

WHAT USE IS RESONANCE?

We have seen the series resonant circuit represents a large impedance when away from resonance but a very small resistance when tuned. The parallel configuration provides the reverse effect. These are summarised in Fig. 12. This way of looking at the resonant circuit is relevant to an understanding of how they are used to select certain frequencies out of a multiple frequency signal.

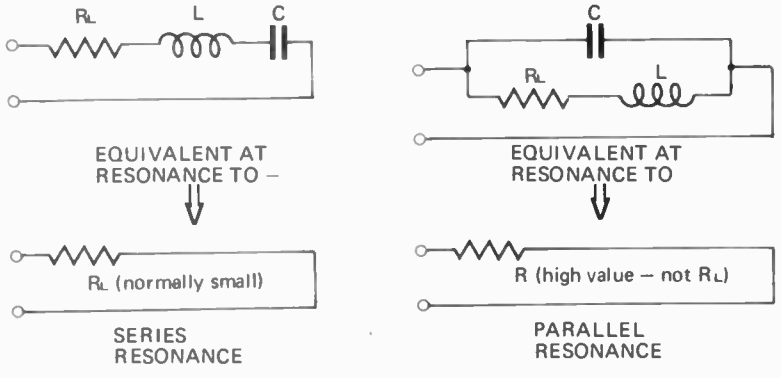


Fig.12. At resonance the two types of tuned circuit become purely resistive. The series circuit becomes a very small resistance and the parallel circuit becomes a very high resistance.

FREQUENCY SELECTION

Often the need arises to select a known frequency signal (or a narrow band of frequencies) from a wide spectrum. The most common example must be that found in radio transmission where many stations broadcast into the same medium, each at a slightly different frequency. The task of the radio receiver is to tune out the unwanted signals leaving only the required one.

The system to do this is depicted in Fig. 13. A series resonant circuit (Fig. 10a) will provide very little

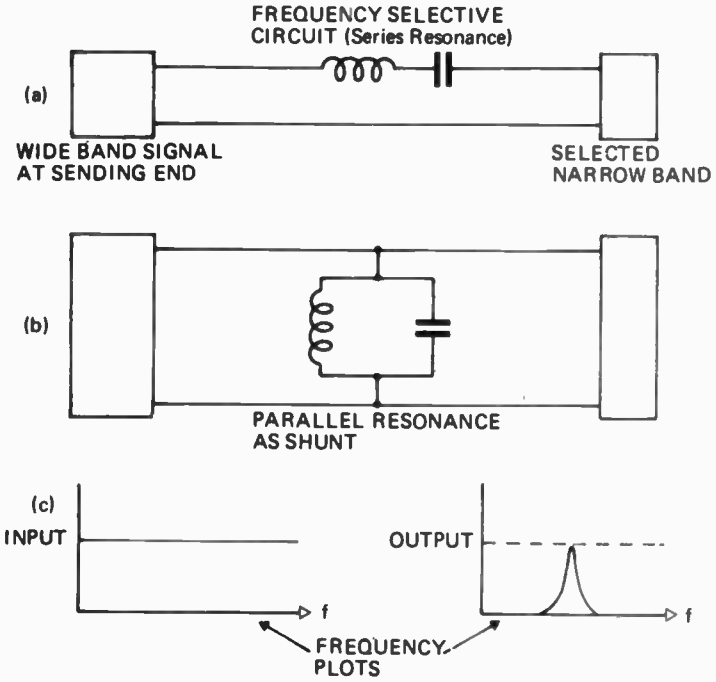


Fig.13. How coupling black boxes with tuned circuits provides frequency selection. (a) coupling by series tuned circuit. (b) coupling by parallel tuned circuit. (c) the input versus frequency compared to the output versus frequency.

attenuation to signals of the required frequency but will act as a larger resistor (actually as an inductive or capacitive reactance) away from the desired frequency. Thus, only those signals near to the resonant frequency of the combination are allowed through with any signal strength. Although series systems could be used, they seldom are in practice.

A similar effect can be produced by using the parallel resonant circuit as a shunt across the received output. All frequencies will be attenuated except those required. This form of selection is the one most used in radio work.

The sharpness of this tuning process is dependent upon the Q of the tuned circuit. A coil with a high Q will be more selective (better able to separate two close frequencies) but will of course produce a tuned circuit having a narrower bandwidth. If the signal to be selected is a single frequency all is fine, but most signals must cover a small bandwidth in order to convey information on a frequency as well as time basis. Fig. 14 sums up the various responses. To obtain a wider bandwidth the Q must be adequately low – sometimes resistance is added to spoil the Q to achieve the required compromise between selectivity and bandwidth.

Increased selectivity can be obtained by cascading tuned circuits. Filters used in telephony often consist of many pairs of components. The design of these is very specialised – it is more than merely adding stages one after the other.

When both high selectivity and wide bandwidth are needed, as is the case in radio programme reception, another arrangement is used. Effectively two tuned shunt circuits are used in cascade but with a difference. Each is tuned to a slightly different resonant frequency so that their characteristics

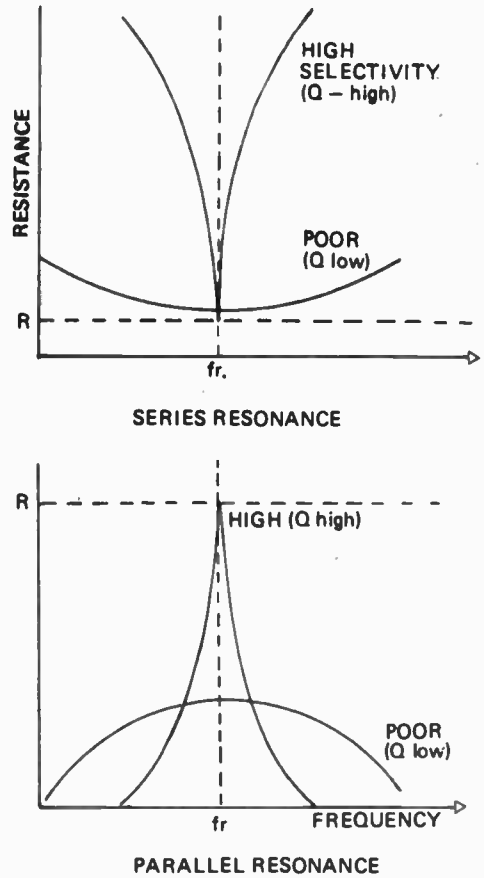


Fig.14. Summary of responses of the two types of tuned circuit with extremes of Q. (a) Series Resonance. (b) Parallel Resonance.

overlap as shown in Fig. 15a. The resultant overall frequency response curve is one that has higher gain and a wider bandwidth. The small dip in the middle is not a problem provided the two central frequencies are not taken too far apart.

Rather than use two separate inductors it is, in practice, better to combine them into one component as a doubly-tuned transformer. A transformer is an inductive-coil assembly that can transform ac currents of voltages to smaller or larger values. This is based on the principle of mutual inductance, that is, windings linked by a common magnetic field have voltages induced in them in proportion to the number of turns in each coil.

In the tuned transformer, used in radios, the two windings are wound on a common former; this may be non-magnetic (ferrite, an iron powder material, is now commonly employed) depending on the frequency of operation. Tuning is achieved by screwing-in slugs of ferrite thus slightly altering the inductance. When the capacitance, rather than inductance, of the tuned circuit is to be varied to peak the circuit performance,

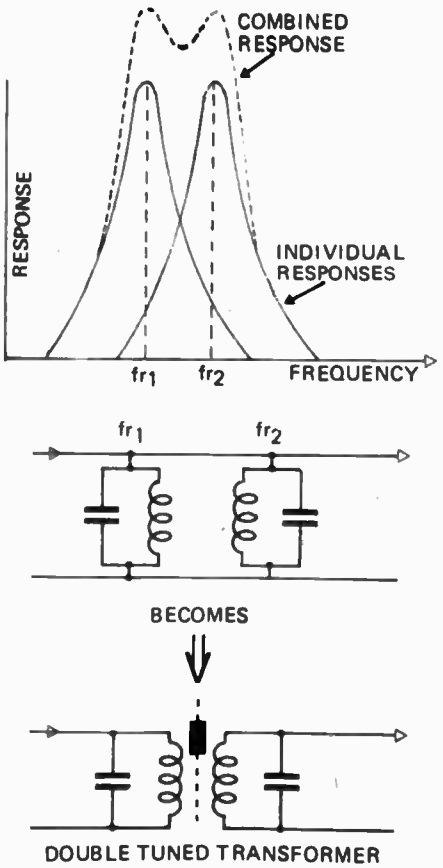


Fig.15. (a) Two tuned circuits may be used to obtain a better bandwidth/ selectivity compromise. (b) The two separate-tuned circuits may be combined into a single transformer. This construction is used extensively in radio receivers.

ELECTRONICS -it's easy!

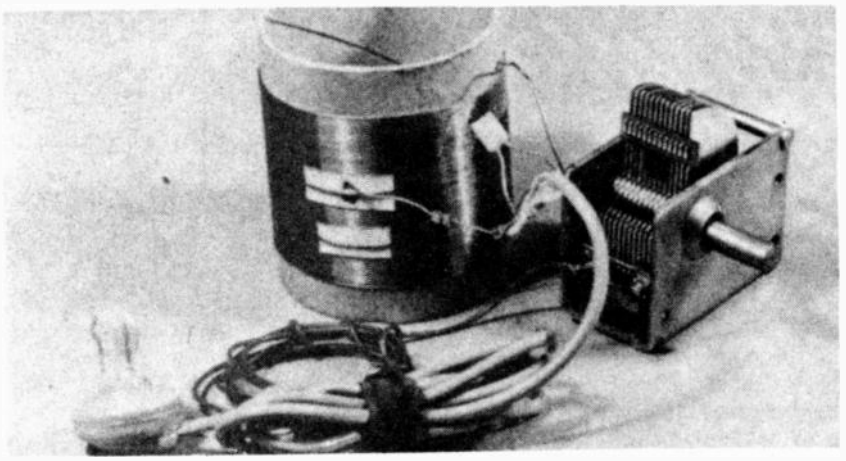
small-range variable capacitors are used. If the range needed is large – e.g. tuning across the AM radio band – the capacitor is invariably made of sets of blades that mesh into each other to vary the capacitance. A range of variable capacitors and transformers and chokes commonly encountered in electronics, is shown in the picture on page 74.

FREQUENCY GENERATION

If a resonant circuit arrangement is given a short impulse of energy – a short period of dc signal, for example – the energy put into the circuit oscillates back and forth between the magnetic field of the inductor and the electric field of the capacitor. This exchange of energy between reactances occurs at the resonant frequency. If the Q of the tuned circuit is high, this process will develop a reasonably pure sine-wave. If no more energy is added after the initial impulse the sine-wave will gradually die away as the energy is dissipated as heat in the coil resistance. If, however, an arrangement is made to add energy to the circuit every time the waveform rises to the same level and phase, the sine-wave will continue to run. High-power radio transmitters make use of this principle to obtain pure signals from highly distorted sources. It is, however, essential that the pulses are delivered to the system at the correct time. Pushing a child on a swing is a good example of pulsed excitation of a resonant system.

Electrically-operated clocks often use the energy pulse concept. The hair-spring and flywheel form the mechanical tuned circuit, and the flywheel rotates it makes a brief electrical contact with a small electromagnet that pulses the flywheel onward with an extra, small amount of energy. Pendulum clocks also often operate this way, gravity providing the restoring force for the mass of the pendulum. ●

ELECTRONICS - in practice



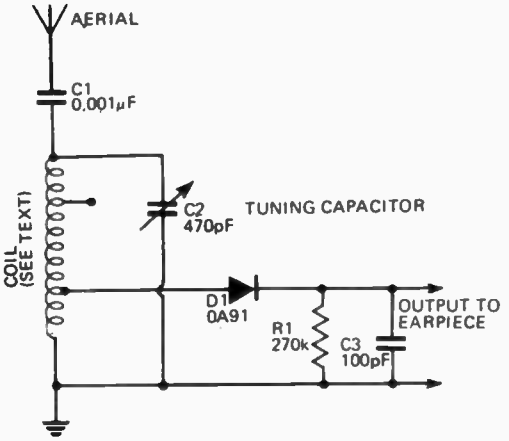


Fig.15. Circuit diagram of the crystal radio.

PARTS LIST — Crystal Radio ETI 227

R1 Resistor 270 k ½ watt 5%

C1 Capacitor 0.001μF
C2 " 100pF

D1 Diode OA91 or similar

L1 Coil see Table 1.

TC1 Tuning gang single section 470pF Roblan or similar

Coil former piece of cardboard tubing (see Table 1).

TABLE 1
Winding details of air-cored coil (close wound).

COIL DIA.	NUMBER OF TURNS VERSUS WIRE GAUGE			
	22 SWG	24 SWG	26 SWG	28 SWG
1¼"				108
1½"			96	87
1¾"		88	77	70
2"	82	72	67	62
2¼"	71	64	58	54
2½"	61	56	52	49
2¾"	54	52	—	—

Note 1. Tap the coil every ten turns.
Note 2. For former sizes between those stated use an intermediate number of turns. This is not critical.
Note 3. Select the tap for the diode by determining which one gives best volume, whilst still adequately separating the stations.

CRYSTAL SETS were the latest thing in the 20's.

The schematic of the modern version of grandfather's pride and joy is given in Fig. 15. The term crystal-set was coined at the start, for early sets used a small piece of galena crystal which was touched by a fine piece of wire – the cat's whisker – to produce a rectifying contact, if and when you found the right place!

Today, that annoying variable is eliminated by using a germanium diode.

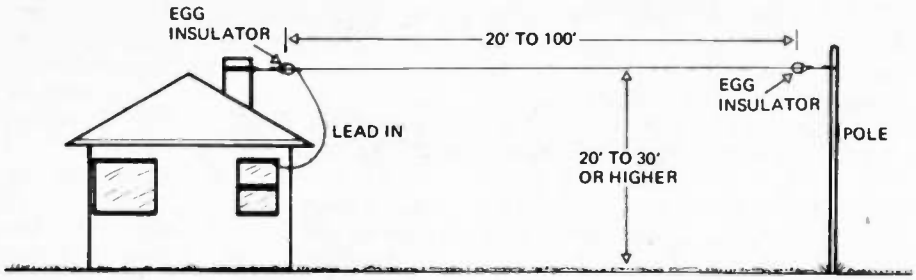
The aerial acts as a conductor in space and couples into the electromagnetic waves sent out by the broadcasting station; minute voltages are induced in it. These small signals, including those from unwanted stations as well, feed energy to the tuned coil and capacitor stage. Signals not at the resonant frequency of the tuned circuit do not excite it and, therefore, go undetected.

The detection and listening circuitry are connected to a tap on the coil, not across the entire inductor winding. This method is used to give the user the ability to make a compromise between signal strength and signal clarity, for the rest of the circuit acts as an unavoidable spoiling resistor that reduces the Q of the tuned circuit. Placed across the full winding the circuit reduces the Q, thus broadening the bandwidth, but reducing selectivity; placed across only a small part of the coil gives the highest Q (the best selectivity) but the smallest signal strength. In use, the taps are tried in turn to find that which gives the clearest signal with the best rejection of unwanted stations.

The diode (virtually any germanium diode can be used) rectifies the amplitude-modulated carrier.

The best headphones to use would be those with high impedance. Impedances of 165 k are in the correct region. Crystal earpieces can also be tried if you are in a high signal strength area – you might be lucky.

Although this set is not to be compared with modern radios any experimenter who has not built one has missed out on a basic training exercise. It is a must.



This simple antenna is suitable for the crystal radio and may be used for the one transistor radio if required.

A LITTLE BETTER – THE ONE TRANSISTOR RADIO

Since the crystal-set days there have been many changes in radio detection. Apart from more efficient front-end aerials and coils these improvements all involve amplification with active amplifiers. We are not quite to the stage in this course where the operation of transistor amplifiers can be explained, but this simple circuit should present no constructional difficulties.

Note that the input stage is based on a standard modern radio antenna unit. The aerial couples into the tuned circuit by mutual inductance via its own quite separate winding. The resonating signal is taken from the tuned circuit by a second winding, an arrangement that enables a more optimum loading of the circuit to be achieved. It is, in fact, an inductor and transformer combined.

The transistor is used to amplify the signal and the radio frequency choke (R.F. choke) filters out the carrier. We will say no more about the rest of the circuit until the course has proceeded further.

Components for this radio are available as kits ready for assembly from most kit suppliers. It was first published in an early issue of this magazine (Project ETI 406) and subsequently became extraordinarily popular.

If radio receivers are your "thing" a good introductory book covering the practical assembly and operation of the above and more complex models is "Radio" by D. Gibson, Brockhampton Press, 1968. (Illustrated Teach Yourself Series). This inexpensive book is well illustrated and provides the constructional details of sets ranging from a crystal set through to quite advanced receivers. ●

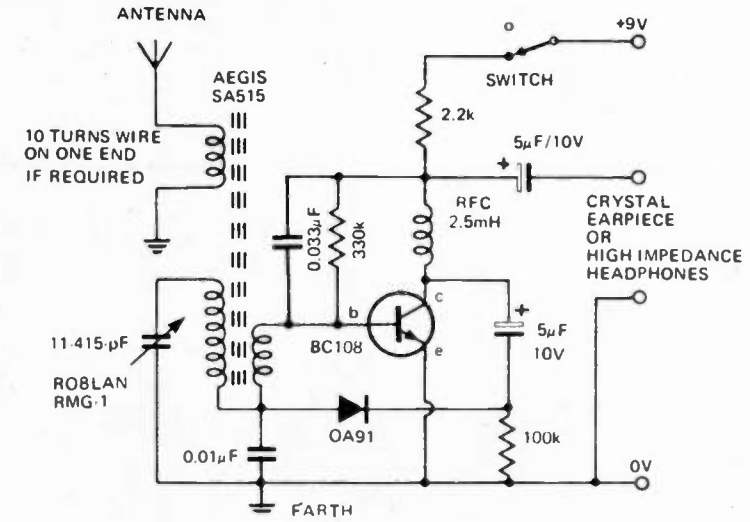


Fig.16. Circuit diagram.

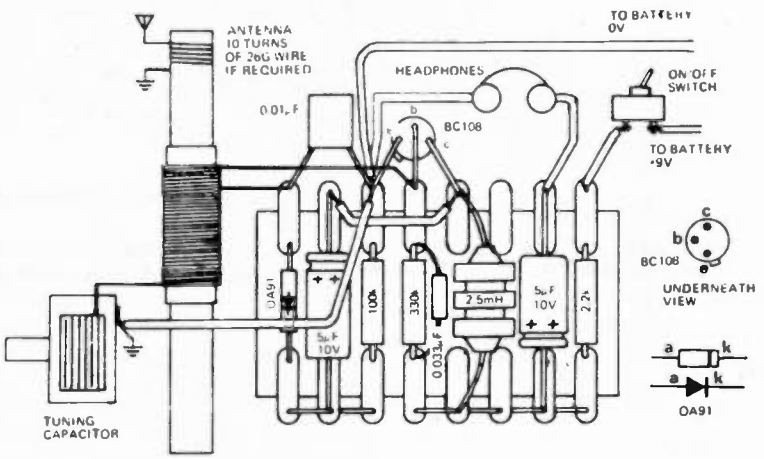
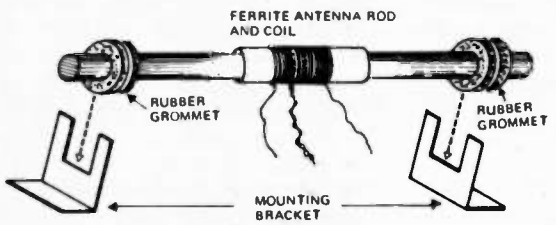


Fig.17. The receiver may be built on tag strips or a piece of circuit board.



The ferrite antenna rod and coil should be supported by two grommets and small metal bracekts.

PARTS LIST ETI 406 ONE TRANSISTOR RADIO

1 resistor 2.2k ½ Watt, 10%
1 resistor 330k ½ Watt, 10%
1 resistor 100k ½ Watt, 10%
2 capacitors 5μF 10 Volt electrolytic
1 capacitor .01μF
1 capacitor .033μF
1 transistor BC 108, BC 109, 2N3565 etc.
1 diode OA 91 etc.
1 ferrite rod and coil — AEGIS type SA 515 or similar
1 tuning capacitor 11 — 415 pF, Roblan type RMG — 1 or similar
1 nine volt battery and connectors
1 toggle switch — single pole single throw —
1 RF choke, 2.5 mH
1 crystal earpiece or high impedance headphones
1 pointer control knob
Rubber grommets, screws, plywood etc.

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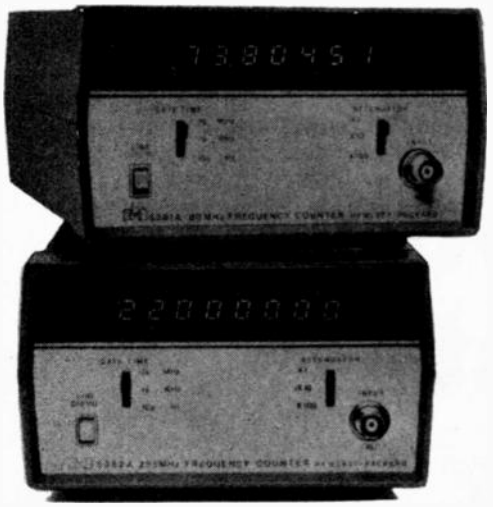

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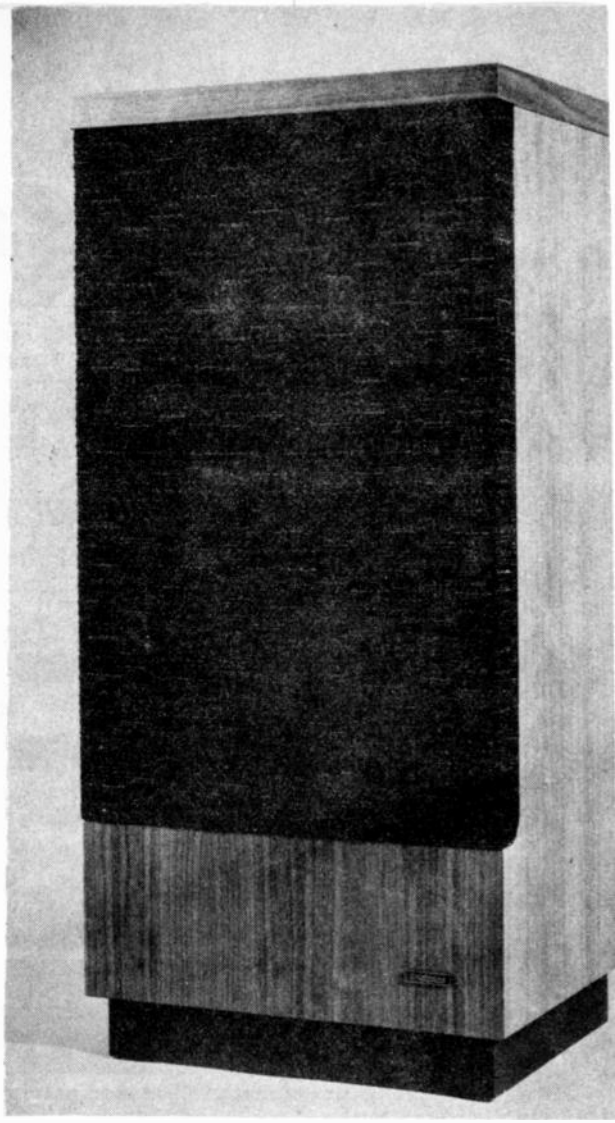
ET PRODUCT TEST

GOODMANS' Goodwood Domestic Monitor Loudspeaker



Although conservatively British in appearance, Goodmans' latest speaker has several unusual features.

GOODMANS' have, over many years, produced some of Britain's finest loudspeaker systems and the company pioneered many types of high-efficiency high-quality loudspeakers.

Fairly recently Goodmans were taken over by Thorn Industries and the Goodwood speaker system is the first new product, that we have had the pleasure of testing, which has been designed and produced by the new company.

The concept of this speaker has been based on the premise that listeners seek above average quality with minimum distortion and colouration but achieved with a price structure below that of true studio monitoring systems.

In appearance, the Goodwood system can best be described as of conservative British design. The enclosure is fabricated from veneered particle board approximately 1.5 cms thick, excepting the top and bottom panels which are made of a heavier board.

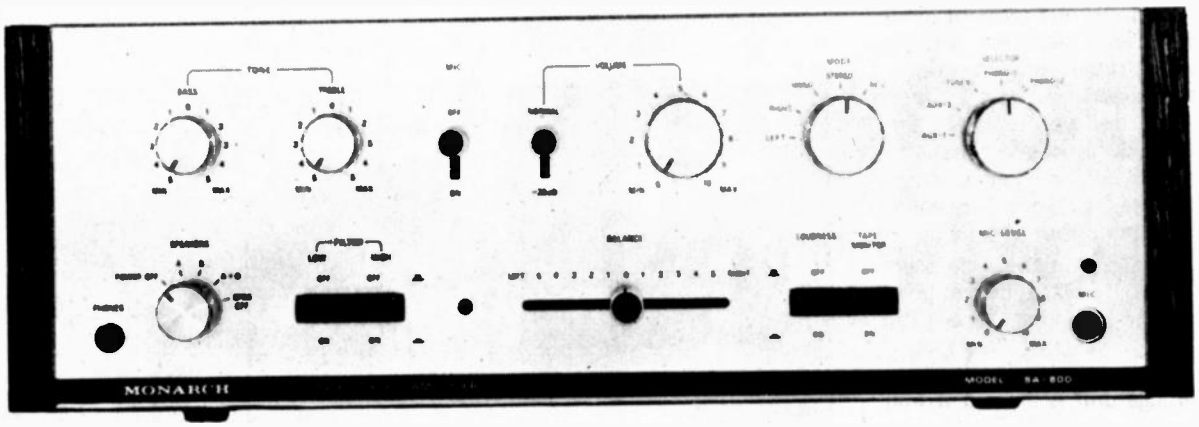
The method of fixing the front speaker grill is quite conventional, using four Velcro type fasteners. The grill cloth is a mixture of artificial fibres and wool. It has low flow resistance and an attractive appearance. The enclosure is approximately 46 litres (2.5 cf.) in volume and in theory should be able to provide a good frequency response over the major part of the audible spectrum.

Although conventional in appearance, the enclosures, do in fact have several unusual features. Firstly the woofer looks quite unlike any other Goodmans' woofer we have ever seen. It is 30 cms (12") high but only 26 cms (10") across. It should probably be best described as a 25 cm diameter loudspeaker.

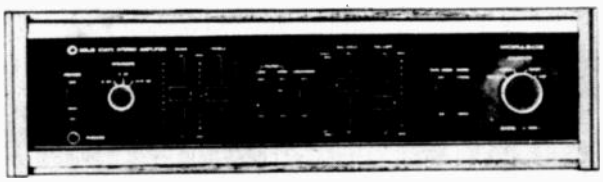
Goodmans claim that this driver has been specifically developed to provide high power handling capacity.

Their approach to reducing harmonic distortion, which is generally frequency doubling or cone break up at low frequencies, has been to optimise the geometry of the flux distribution in the magnetic circuit. The woofer has a 3.6 cm diameter voice coil, and has a ceramic magnet clamped between steel pole pieces which are themselves fitted to a heavy and rather unusual die-cast housing. By making use of a heavy fibrous cone (which provides internal damping and dissipation of energy) together with a

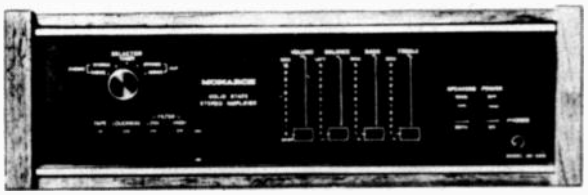
Three Kings



MONARCH SA 800 (80 watts RMS)
Recommended retail price $240



MONARCH SA 5001 (60 watts RMS)
Recommended retail price $189



MONARCH SA 600 (34 watts RMS)
Recommended retail price $139

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plastic coated diaphragm which is extended to provide an integral flexible surround, the manufacturers state that they significantly reduced unwanted resonances.

Goodmans have patented this design and, based on our measurements, have achieved what they claim.

The mid-range driver, which covers the range from 600 Hz to 4 kHz is a 10 cm cone type direct radiator. This speaker also uses a high-flux ceramic magnet and a rather unconventional rigid die-cast chassis. It bears a strong similarity to the woofer and also features a composite cone of plasticised polymer and conventional fibre cone to achieve excellent damping characteristics.

Goodmans claim that the wide angle of radiation of this speaker gives smooth power transfer over the operating range. Our measurements certainly confirm this.

The mid-range unit is located within its own separate enclosure. This has an internal volume of 3.7 litres and is lined with polyurethane foam.

The tweeter is a dome type radiator (2.5 cm diameter) which is moulded from synthetic fabric with a homogenous plastic coating. Again, it bears a very strong resemblance to the other two speakers. The dome tweeter is the only speaker of the three to bear a type number (DT3) and features a construction technique which is far less expensive than similar speakers Goodmans have produced in the past.

All three speakers are sealed into the enclosure with urethane foam strips, and internal damping is achieved by large blocks of 8 cm thick urethane foam. The speaker connections are unusual terminals at the bottom of the enclosure. These consist of a pair of screw terminals which flank a DIN type speaker socket, and the unit comes equipped with a seven metre long colour coded lead with a DIN plug at one end and a pair of spade lugs at the other.

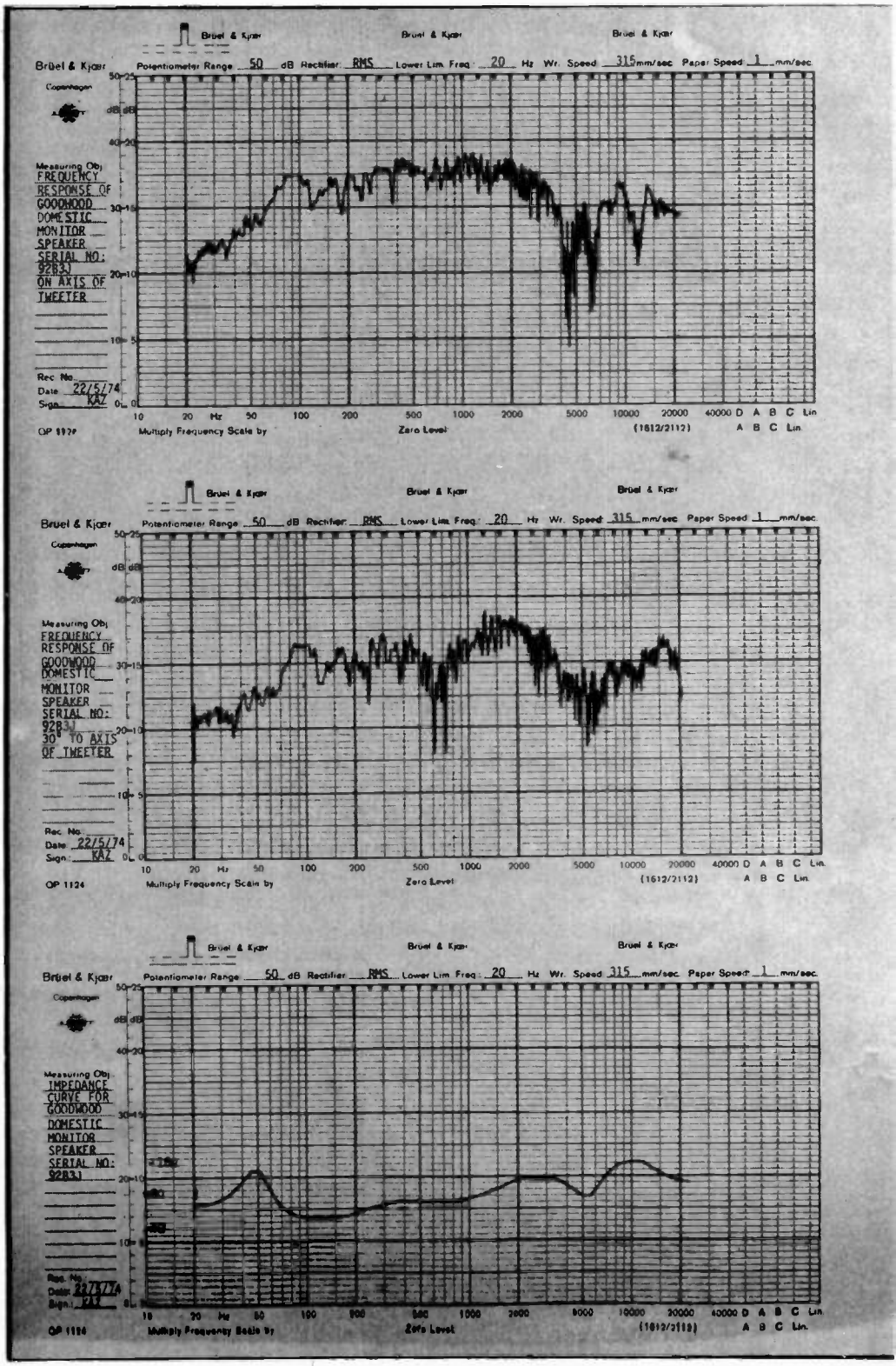
The cross-over network is screwed into the back of the cabinet. It consists of four inductors and five capacitors connected as a three-way pye filter which proved to work quite well.

MEASURED PERFORMANCE

Our first test was to measure the frequency response on axis, and at 30° to axis, under anechoic conditions. The frequency response by and large (if one is prepared to ignore the predominant dips in the region of 4.5 to 6 kHz), was smooth, being ± 8 dB from 35 Hz to 20 kHz. Surprisingly, the frequency response at 30° off the main axis had fewer dips in the response than directly on axis.

The impedance curve, likewise, was quite smooth with a minimum impedance of 5 Ω and a maximum impedance of 15 Ω.

The distortion characteristics at high signal levels were reasonably low. Far higher signal levels than we would have expected from this system were



Goodwood Domestic Monitor Loudspeaker

tolerated before the onset of frequency doubling.

Performance on music featuring deep bass such as EMI "Music of the Incas" SOXLP 7543, and CBS "Olatunji! Drums of Passion" was good, but not really up to the standards that we would have expected from a speaker system described as a monitor speaker system. In other respects though, the manufacturer's description is fair enough. The sound is definitely smooth and colouration is only very slight.

Our overall subjective impressions of the Goodwood speakers are that they offer a very smooth response and clear uncoloured sound, but the bass end is not as good as we would expect from what is most probably the premium quality speaker system marketed by Goodmans.

The Goodwood speaker system is for purists who will primarily be listening to classical music, but will not really suit the man who wants to play heavy rock or some of the more modern styles of music. ●

GOODMANS GOODWOOD DOMESTIC MONITOR SPEAKER
SERIAL NO: 92B3J

Frequency Response	±8 dB	35 Hz-20 kHz
Total Harmonic Distortion		
(for 90 dB at 2 metres on axis)	100 Hz	0.6%
	1 kHz	0.2%
	6.3 kHz	0.3%
Electro-Acoustic Efficiency		
(for 90 dB at 2 metres on axis)	9 watts	
Measured Impedance	100 Hz	5 Ω
	1 kHz	7 Ω
	6.3 kHz	8 Ω
Cross-over Frequency	600 Hz and 4000 Hz	
Dimensions	76 x 36 x 27 cm	
Weight	18.3 kg.	

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DIGITAL INTEGRATED CIRCUITS

7400	.25	7447	1.45	74141	1.25
7401	.25	7448	1.50	74145	1.25
7402	.25	7450	.29	74150	1.25
7403	.25	7451	.32	74151	1.05
7404	.29	7452	.32	74153	1.45
7405	.27	7453	.32	74154	1.75
7406	.55	7454	.45	74155	1.35
7407	.53	7460	.30	74156	1.50
7408	.29	7464	.45	74157	1.50
7409	.29	7465	.45	74161	1.65
7410	.25	7472	.45	74163	1.80
7411	.35	7473	.55	74164	2.95
7413	.95	7474	.55	74165	2.95
7415	.50	7475	.95	74166	1.95
7416	.50	7476	.55	74173	1.95
7417	.50	7483	1.25	74175	1.95
7420	.25	7486	.55	74176	.95
7422	.32	7489	3.25	74177	.95
7423	.37	7490	1.25	74180	1.15
7425	.39	7491	1.40	74181	4.25
7426	.35	7492	1.05	74182	1.10
7427	.39	7493	1.05	74185	2.50
7430	.25	7494	1.10	74190	1.65
7432	.30	7495	1.05	74191	1.65
7437	.50	7496	1.05	74192	1.65
7438	.55	74100	1.65	74193	1.65
7440	.25	74105	.55	74194	1.65
7441	1.25	74107	.55	74195	1.15
7442	1.15	74121	.65	74196	1.35
7443	1.25	74122	.55	74197	1.15
7444	1.30	74123	1.15	74198	2.50
7445	1.25	74125	.69	74199	2.50
7446	1.45	74126	.95		

LOW POWER TTL

74L00	.40	74L51	.40	74L90	1.75
74L02	.40	74L55	.60	74L91	1.50
74L03	.40	74L71	.60	74L93	1.75
74L04	.40	74L72	.60	74L95	1.75
74L06	.40	74L73	.60	74L164	2.95
74L10	.40	74L74	.80	74L165	2.95
74L20	.40	74L78	.80	74L98	2.95
74L30	.40	74L85	1.25		
74L42	1.75	74L86	.95		

HIGH SPEED TTL

74H00	.37	74H21	.37	74H55	.45
74H01	.37	74H22	.37	74H60	.45
74H04	.37	74H30	.37	74H61	.45
74H08	.37	74H40	.37	74H62	.45
74H10	.37	74H50	.37	74H72	.60
74H11	.37	74H52	.37	74H74	.70
74H20	.37	74H53	.45	74H76	.70

8000 SERIES TTL

8091	.69	8214	1.95	8810	.95
8092	.69	8220	1.95	8811	.75
8093	.69	8230	2.95	8812	1.25
8094	.69	8301	1.25	8822	2.95
8095	1.55	8309	1.05	8830	2.95
8121	1.05	8312	1.05	8831	2.95
8123	1.75	8520	1.45	8836	.69
8130	2.50	8551	1.95	8830	1.50
8200	2.95	8552	2.95		
8210	3.95	8554	2.95		

CMOS

74C00	.85	74C74	1.50	74C162	3.25
74C02	.85	74C76	1.70	74C163	3.25
74C04	.95	74C107	1.50	74C164	3.50
74C08	.95	74C151	2.90	74C173	2.90
74C10	.85	74C154	3.50	74C192	3.25
74C20	.85	74C157	2.25	74C195	3.00
74C42	2.15	74C160	3.30	80C97	1.50
74C73	1.70	74C161	3.25		

4000 SERIES RCA EQUIVALENT

CD4001	.65	CD4013	1.50	CD4025	.65
CD4002	.65	CD4016	1.50	CD4027	1.35
CD4009	1.00	CD4017	2.95	CD4030	.65
CD4010	.65	CD4019	1.35	CD4035	2.85
CD4011	.65	CD4022	2.75		
CD4012	.65	CD4023	.65		

MEMORIES

1101	256 bit RAM MOS	2.50
1103	1024 bit RAM MOS	7.95
5260	1024 bit RAM Low Power	7.95
7489	64 bit RAM TTL	3.25
8223	Programmable ROM	6.95

TTL

7402	Quad 2 input NOR gate	$ .22 ea
7403	Quad 2 Input NAND gate (op.col.)	.22 ea.
7405	Hex Inverter (open collector)	.22 ea.
7408	Quad 2 Input positive AND gate	.25 ea.
7437	Quad 2 input NAND buffer	.35 ea.
7442	BCD to decimal decoder	.95 ea.
7446	8CD to 7 segment dec./drlv. (30V)	1.00 ea.
7447	8CD to 7 segment dec./driv. (15V)	1.00 ea.
7472	J-K Master-Slave flip-flop	.30 ea.
7475	Quad Latch	.75 ea.
7476	Dual J-K flip-flop w/ preset & clear	.45 ea.
7490	Decade Counter	.80 ea.
7495	4 bit right shift, left shift register	.80 ea.
74121	One-Shot	.39 ea.
74164	Serial in Paral. out 8 bit shift reg.	2.00 ea.
74193	Binary up/down counter	1.40 ea.

LINEAR

LM301	Hi-perfor. AMP T05 or Mini Dip	.25 ea.
LM302	Voltage Follower T05	.75 ea.
LM304	Neg. Volt. Regulator TO5	1.00 ea.
LM307	OpAMP (super 741) Mini Dip	.40 ea.
LM324	Quad Op AMP DIP	1.95 ea.
LM339	Quad Comparaor DIP	2.00 ea.
LM550	Preclsion Volt. Reg. DIP	.75 ea.
LM741	Comp Op AMP Mini Dip	.35 ea.

MEMORIES

1101	256 bit RAM MOS	2.00 ea.
7489	bit read/wr. memory (RAM) TTL	2.95 ea.
5260	102 bit fully decod. dynamic RAM	6.95 ea.

DISPLAYS

MAN3A	type 7-seg. .127	1.25 ea. 6 for 5.00
DL707	type (Mana 1 Repl.)	2.75 ea. 6 for $15.00

CALCULATOR CHIPS

5001	LSI (40-Pin) Add, subtr., mult. & div., 12-dig. Data supplied with chip	$6.95 ea.
	Data only — Refundable with purchase	1.00
5002	LSI similar to 5001 exc. des. for battery operated - Data supplied with chip	8.95 ea.
	Data only — Refundable with purchase	1.00
5005	LSI (28 pin) Full 4 funct. mem. 12-dig. displ. & calc. 7 seg. mltplx. outp. Data suppl. w/chip	10.95 ea.
	Data only — Refundable with purchase	1.00
MM5736	18 Pin. 6-dig., add. subtr., mult., div.	4.95 ea

DIGITAL CLOCK CHIPS

MM 5311	28-pin any readout 6-dig. BCD with spec. sheet	11.95 ea.
MM 5312	24-pin any readout 4 digit lpps output BCD with spec. sheet	8.95 ea.
MM 5313	28-pin any readout 6 digit lpps BCD with spec. sheet	10.95 ea.
MM 5314	24-pin LED-Incandescent readout 6-digit with spec. sheet	10.95 ea.
MM 5316	40-pin norm. alarm set snooze alarm-timer 12 or 24-hr. operat. with spec. sheet	15.95 ea.

LED's

MV50B	Visible red TO 18	.25 ea
MV50	Axial leads micromini dome .25 ea	5/1.00
MV5020	Jumbo clear dome visible red .35 ea	3/1.00
MI4	Infra red (invisible) diff. dome	.60 ea

DISPLAYS

MAN1	Type red, 7 segment .270"	3.95 ea	
MAN3M	Type red 7 seg .127"	1.75 ea	4/4.85
MAN4	Type red, 7 seg .190"	2.35 ea	4/ 7.95
MAN5	Type grn 7 seg .270"	4.75 ea	4/15.75
MAN 7	Type (SLA1), red 7 seg.	2.50 ea	4/ 7.95
MAN8	Type yel. 7 seg. .270"	5.50 ea	4/18.95
DL707	Type (MAN 1Repl.)	3.50 ea	4/13.00

PHASE LOCKED LOOPS

S60	Phase locked Loop	DIP 2.95 ea
561	Phase Locked Loop	DIP 2.95 ea
562	Phase Locked Loop	DIP 2.95 ea
565	Phase Locked Loop	DIP 2.95 ea
566	Function Generator	MINI-DIP 2.95 ea
567	Tone Generator	MINI-DIP 2.95 ea

LINEAR INTEGRATED CIRCUITS

300	Pos V Reg (super 723)	TO-5	$ .95 ea
301	Hi performance AMP	MINI-DIP, TO-5	.45 ea
302	Voltage Follower	TO-5	.95 ea
304	Negative Voltage Regul.	TO-5	1.25 ea
305	Positive Voltage Regul.	TO-5	1.25 ea
307	Op AMP (super 741)	MINI-DIP, TO-5	.45 ea
308	Micro Power Op Amp	MINI-DIP	1.25 ea
309H	5 V Regulator	TO-5	1.25 ea
309K	5 V 1A Regulator	TO-3	1.95 ea
310	Voltage Follwer Op Amp	TO-5	1.45 ea
311	Hi perf. Volt. Comparir.	MINI-DIP, TO-5	1.25 ea
319	Hi-Speed Dual Comparir.	DIP	1.65 ea
320	-5.2 V Neg. Regulator	TO-3	1.95 ea
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340T	Pos. Volt. Reg. (6V-8V-12V-15V-18V-24V)	TO-220	2.25 ea
370	AGC/Squelch AMPL	TO-5 or DIP	1.65 ea
372	AF-IF Strip-detector	DIP	.85 ea
373	AM/FM/SSB Strip	DIP	3.60 ea
376	Pos. Volt. Regulator	MINI-DIP	.65 ea
377	2W Stereo amp	DIP	2.75 ea
380	2 Watt Audio	DIP	1.75 ea
380-8	.6W Audio amp	MINI-DIP	1.75 ea
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723	Voltage Regulator	DIP	75 ea
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741	Comp. Op AMP	MINI-DIP, TO-5	45 ea
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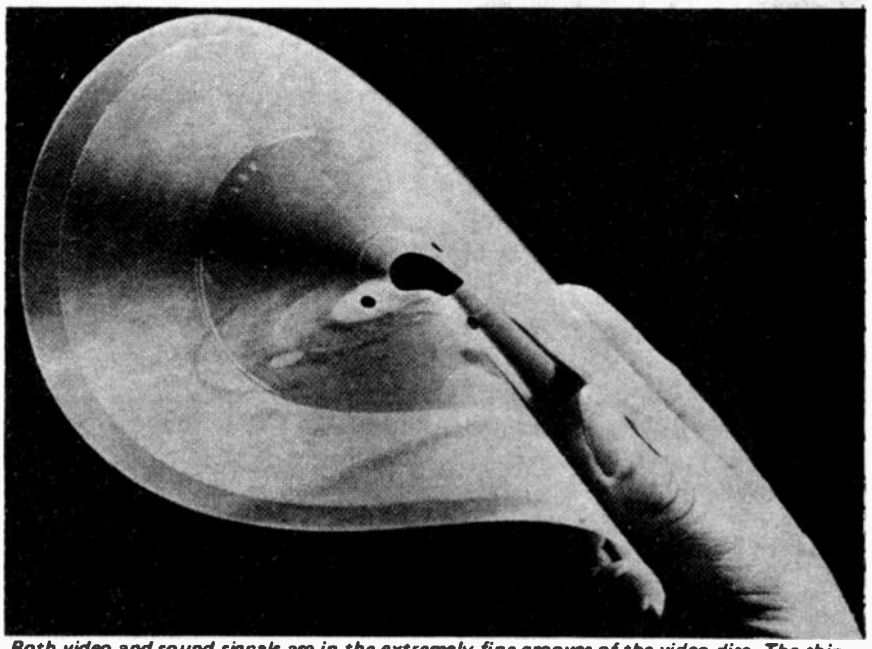
VIDEO-DISC COLOUR TV

Colour TV records this year — Decca-Telefunken's Teldec system now ready for production — here's how it works.



Both video and sound signals are in the extremely fine grooves of the video disc. The thin and flexible PVC foil used appears flimsy, but is actually quite tough and is said to be able to withstand 1000 playings without damage. Disc is driven by a high-speed keyed centre spindle; remainder floats on air cushion.

THE gramophone record is now a familiar enough object. So much so, that the technical achievement of translating complex musical sounds into mechanical variations in a groove and back again is taken for granted.

A measure of this achievement is the fact that on the inner grooves of an LP record the recorded wavelength of one cycle, near the upper (frequency) limit of hearing, is approximately 0.01 mm (about 0.005") in length.

Small wonder then that a stylus has difficulty in tracking a heavily modulated passage, or that pick-up designers are constantly seeking ways of reducing stylus mass and stiffness so that accurate tracking can be ensured with the minimum of wear.

In view of these problems, the thought of putting video signals of high definition on to disc, needing as they do frequencies of several megahertz has always seemed like a wild dream not worthy of serious consideration.

But, incredible though it may seem, it *is* possible, for a domestic video-disc player will be marketed this year that reproduces a full colour picture with 625-line definition plus sound.

The device, developed jointly by Decca and Telefunken, plugs into a conventional colour TV receiver and is no bigger than most record players.

The electronics involved are fairly complex, but, surprisingly, the mechanical arrangements for playing the discs are quite simple.

THE DISC

Unlike conventional long playing records, the video-disc is flexible. In this respect it is similar to the sampler discs that are sometimes freely distributed. The video-disc is 20 cm in diameter and carries about 5 cm radius of groove space. The grooves terminate some 5 cm from the centre.

Playing time is approximately 10 minutes. The video-disc is recorded on one side only, and is made from a specially toughened PVC material which is expected to have a life about the same as an ordinary LP.

The grooves are vertically modulated, in the manner of the old "hill-and-dale" sound recordings, instead of laterally. As there are no side-to-side excursions of the groove, more programme material can be accommodated in a given space.

A playing speed of 1500 rpm is required for the 625-line disc. This corresponds to 25 revolutions per second which is the same as TV frame frequency — there being two interlaced fields to each frame, thus one complete frame is contained in one revolution.

Video waveforms are not modulated directly on to the record grooves, but for reasons that will become clear later, are frequency modulated on a carrier having a deviation from 2.75 MHz to 3.75 MHz. A 1 MHz carrier is also frequency modulated with the sound channel, and a further sound channel could be accomodated if required to provide stereo, or sound in an alternative language.

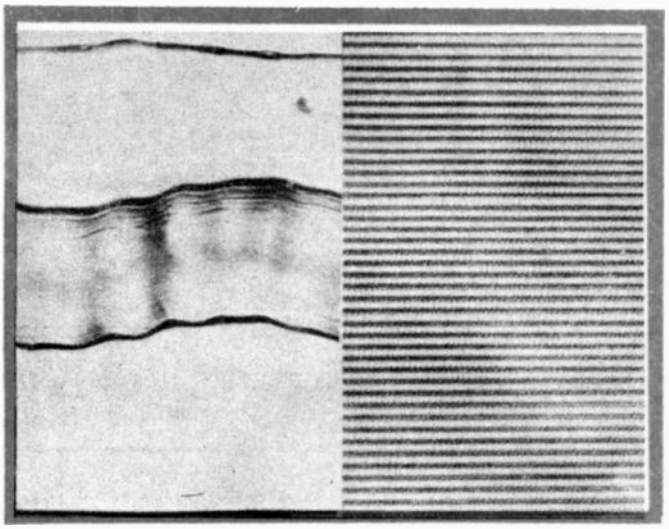


Fig. 1. Photomicrograph compares grooves of (left) standard long-play audio record, and, (right) Teldec video disc.

THE PLAYING DECK

At first glance something radical seems to be missing from the playing deck, it is the turntable! In its place is a small disc similar to the spool carriers used on open-reel tape-recorders, set into a hole in the deck-plate. The disc is smaller than the hole so that a gap exists around it. There is the normal spindle for the central record hole although it is larger than usual, and in addition there is an offset post on the disc which engages with one of the three holes near the centre of the record.

When stationary, the record just lies on the deck, but as it rotates at speed, air is drawn up through the gap around the centre disc, and is forced outward to escape at the rim of the record. It is thus supported on a cushion of air, the air-flow being maintained by the spinning action of the record.

The pickup arm differs from normal in that is is not pivoted at one end, instead, the cartridge is carried across the record by a transverse carriage.

As the groove spacing is constant the pickup can be driven at constant speed along the carriage, and still correctly track the groove on its inward journey.

The drive is simply effected by means of drive-wire passing over pulley wheels, in the same manner as the dial-drive used in radio receivers. The wire is wound around a drive-drum which is driven through a gear chain from the record-disc spindle. By this means the pickup drive speed is directly related to the record speed.

Because the record is vertically modulated, the cartridge responds to vertical movements rather than lateral ones. It can thus be designed to accomodate lateral stylus displacement without ill-effect. Hence any departure from the mean tracking rate due for example to any eccentricity of the record, will not cause mistracking.

This characteristic has another application: if it is desired to repeat a few frames and thus 'freeze' the action, the drive to the pickup can be disengaged.

The stylus will then follow the groove for one or two revolutions until its compliance is overcome when it will jump the groove. It will keep doing this until the drive is re-engaged, and so as each groove carries one complete frame, a complete number of frames will be displayed at each jump thereby maintaining the sync. pulse timing.

This groove jumping will not damage the record because of its flexibility providing it is only continued for a reasonable time. The normal rate of progress of the pickup along the carriage is a little over 5 mm per minute.

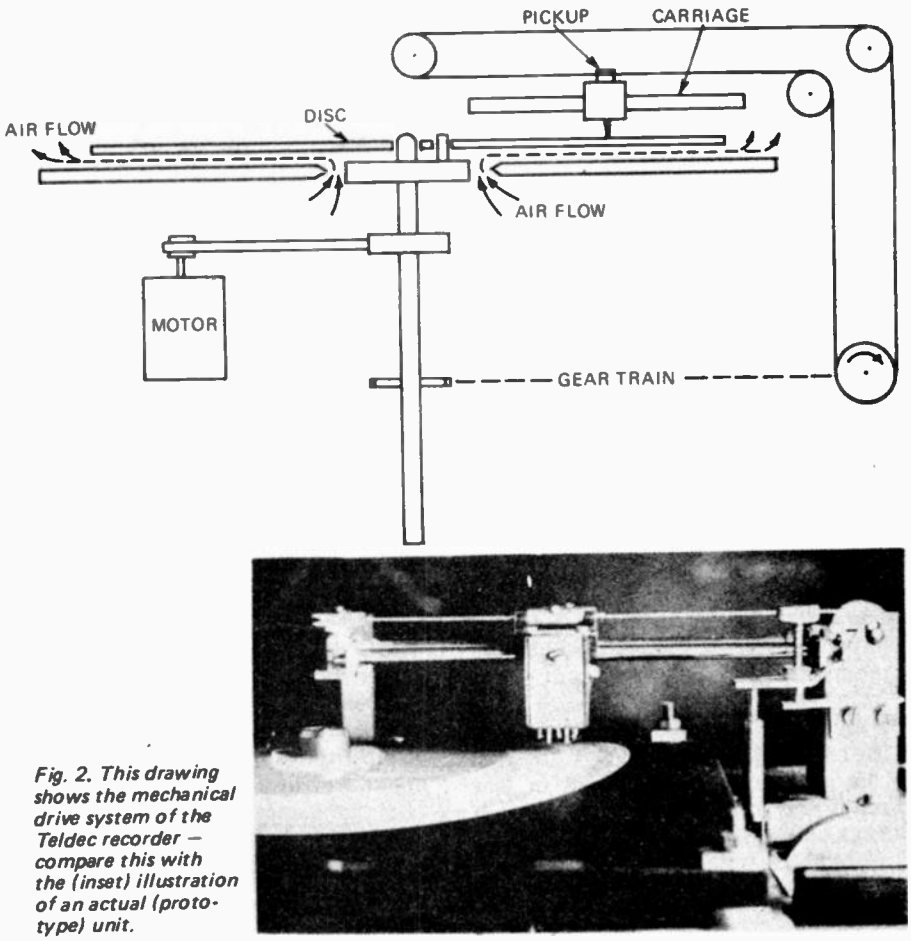


Fig. 2. This drawing shows the mechanical drive system of the Teldec recorder — compare this with the (inset) illustration of an actual (prototype) unit.

The basic player is thus quite straightforward, but in addition to the single-record player, it is planned to produce an autochanger, which is rather more complicated, A magazine, of up to 12 discs, can be inserted into the machine which feeds them automatically to the player with only a few seconds break between records. Each disc is returned to the magazine, or in the case of a single disc, to its sleeve after playing and the magazine is then ejected when all are finished. A programme of up to two hours can therefore be shown without handling the records, and the short breaks can be timed to coincide with scene-fades and natural breaks in the recorded material.

THE PICKUP AND STYLUS

It is this part of the equipment which usually arouses the greatest curiosity. Just how can a stylus faithfully follow modulations in the megahertz range? The short answer is that it doesn't! We remember that the modulations consist of a frequency modulated carrier. Now it doesn't really matter with an f.m. signal, whether the carrier is a pure sinewave, a square wave, saw-tooth or just pulses, as long as the frequency deviations are

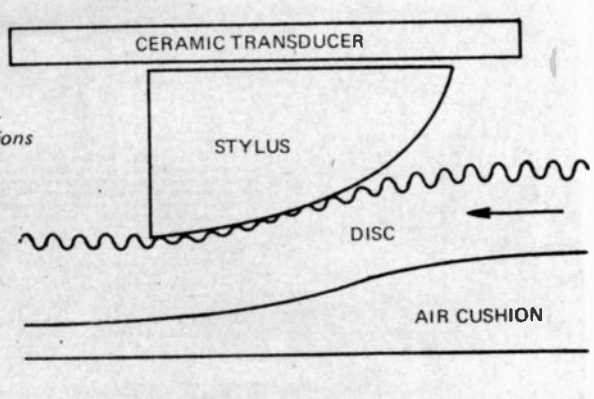


Fig.3. Stylus rests on a number of hill and dale modulations that are compressed under the stylus' curved leading edge. As each modulated 'hump' is released at the stylus' straight trailing edge it imparts a 'flip' to the stylus which thereby produces a pulse from the piezo-ceramic transducer to which it is attached.

distinguishable. So as long as each hill-and-dale in the groove produces an electrical wave-form at the right time it matters not how severe the *amplitude* distortion may be.

This greatly simplifies matters and in fact the diamond stylus, which is shaped rather like the bottom half of a capital D, actually lies across quite a number of modulations as it sits in the groove. Bearing in mind that the record is flexible as it rests on its cushion of air, the stylus causes a depression in the area of contact. The modulations pass under the curved portion of the stylus and are gradually compressed by the curvature. Upon reaching the straight trailing edge, each one is suddenly released whereupon it imparts a flip to the stylus. Thus the modulations produce a series of pulses from the transducer which are frequency modulated in accord with the recorded signal.

Hence the stylus does not, in fact could not, follow the contours of each modulation faithfully as is required of a lateral-cut audio disc.

As a series of pulses is all that is required, the carefully engineered cantilevers and stylus-mounting assemblies of the audio pickup are not needed. The stylus is cemented directly to a slice of ceramic material which has piezo-electric properties, (i.e. pressure applied to the material causes a voltage to be generated across it), and this generates the pulses.

Stylus pressure on the record is 0.2 grams, far lighter than even audio pickups, yet in spite of the minute size of the modulations, pulses of the order of 20 mV are obtained at the start of a record.

THE ELECTRONICS

The resolution of the video signal once it is demodulated is 250 horizontal lines, which corresponds to a bandwidth of about 3 MHz. This is less than the broadcast definition standard for 625 lines and is not wide enough to accept the normal PAL colour coding information. A further difficulty from the PAL viewpoint is speed stability which although good enough for monochrome video signals is not good enough for colour coding.

For these reasons, a modified colour-coding which is more tolerant of speed variations has been devised. This is known as "3-PAL". The colour components are sequentially modulated in a band up to 500 kHz. The luminance information, which requires higher definition – as the eye is more critical of luminance definition than colour, is modulated from 500 kHz to 3 MHz.

In order to achieve the sequential demodulation of the three colour components, two 64 μs line-period delay elements are used. These are connected in series so that a delay of one line for one colour appears at their junction, and a two-line delay for the third colour at their end. One colour is of course un-delayed.

The sound channel is modulated on a 1 MHz carrier, and the audio response extends up to 15 kHz. The sound carrier amplitude is –30 dB compared with that of the vision signal, yet a signal-to-noise ratio of –50 dB is maintained.

If we follow the signal as it leaves the pickup, it is applied first to two filters, one is a band-pass filter tuned to 1 MHz which separates out the sound carrier, and the other is a high-pass filter which allows only the higher-frequency vision carrier through. The two signals then pass through their own limiter, and demodulator stages to the audio and video amplifiers respectively.

The vision signal is then divided by a high and low-pass filter into the luminance and chrominance channels, the luminance signal passing directly to the output mixing and modulator stage. Chrominance information is processed through the delay lines and 3-PAL switch to the RGB matrix from where they are fed to the colour modulator along with a 4.43 MHz indent signal. Thus it emerges as a standard PAL signal and is passed to the UHF modulator along with the luminance and sound signals.

Output is the same as a received UHF colour transmission, so all that is necessary is to plug the unit into the aerial socket of a colour TV receiver, or of course it can be displayed on a monochrome set.

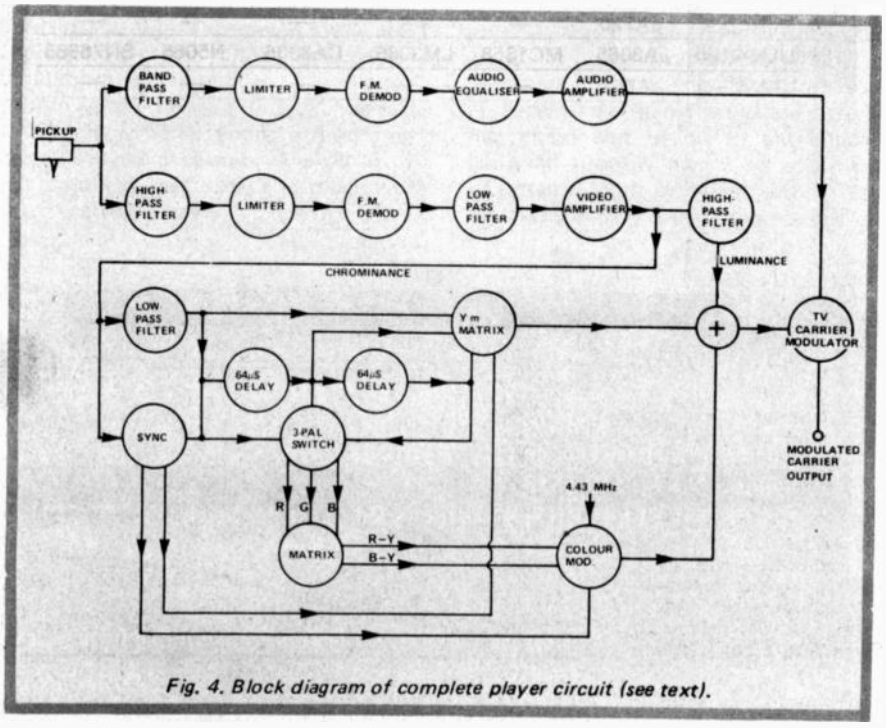


Fig. 4. Block diagram of complete player circuit (see text).

GENERAL FEATURES

Unlike tape video-recorders, the video-disc system cannot be used for home recording. It can only play back pre-recorded material. Some of the manufacturers of alternative recording systems regard this as a major drawback. However, in this respect it is no different from the gramophone disc, and no-one will claim that these are lacking in popularity! Obviously, those who wish to record their own video programmes will opt for video-tape just as those wishing to make their own audio recordings use a tape-recorder. There is room for both systems to suit individual requirements.

Cost of the discs compared with tape is well to the advantage of the discs. For a run of 5000 copies, the disc would cost about a fifth of the comparable length of tape. Smaller runs catering for minority interest programme material would cost more, but even then should show a decided advantage over tape. Actual cost should be little more than a top-priced LP record. The record-players should also show a price advantage over video-tape systems, owing to the simplicity of the mechanical section. They should be about twice the cost

of a good quality audio record-player.

It is of interest to speculate on the nature of the records that may be issued.

It is in the field of instruction that the discs could come into their own. Enrollment in various adult education centres and the variety of subjects that now appear on the syllabus show the tremendous interest that exists in educational subjects. Students of home-decorating, cookery, dress-making, carpentry, golf, and a wide range of other subjects would greatly benefit from being able to see and hear experts give instruction, repeated as often as required, in their own home.

Coming back to technical considerations, the application of the system for purely audio recordings is intriguing. A much slower speed would be ample to record a low-frequency pair of FM carriers for a stereo programme, or even four carriers for discrete quad. If the higher carrier had an upper deviation frequency of 200 kHz which is some 15 times less than the 3 MHz or more upper limit of the video disc, it follows that the speed could be reduced by a similar amount and the playing time extended correspondingly. Thus some 2½ hours could be accomodated on a single 20 cm disc. Other advantages would be better stereo separation, elimination of tracking and tracing error, turntable rumble and harmonic distortion. There may be problems of maintaining the air cushion at slow speeds, but this could no doubt be overcome by mounting fan blades on the drive spindle beneath the deck.

Without doubt the video-disc is a remarkable achievement, and fascinating, proof that one must be wary of dismissing 'impossible' concepts totally out of hand! ●

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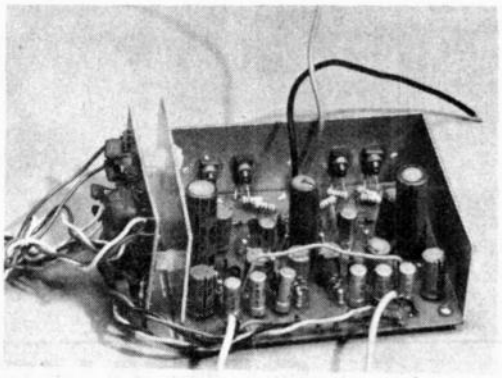

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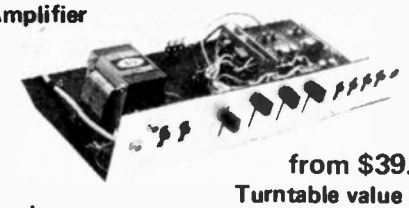

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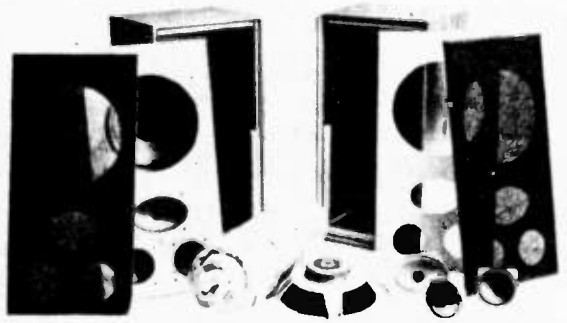

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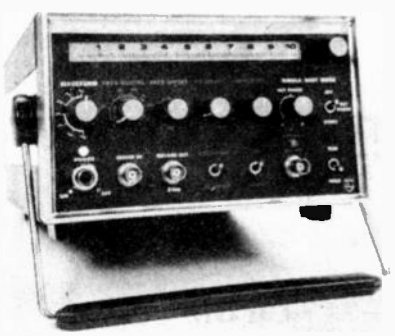
A distinct feature of the device is a 3-colour display unit using a Trinitron display tube.

Facilities are provided for the operation of an xy plotter without modification.

An operational frequency range of 1-10,000 Hz is possible, using filters of Q factors of between 1 and 100. As the filter centre frequency and bandwidth is established during manufacture these may be designed to meet customer's requirements.

Further details from: British Merchandising Pty Ltd, Box 3456, GPO Sydney.

COMPACT FUNCTION GENERATOR



The first unit in a new generation of Philips function generators designed to provide a broad frequency range and high output voltage has just been brought onto the market. Designated the PM5167, this compact function generator covers the frequency range 1 MHz to 10 MHz (10 decades) and gives a high output voltage of 40 V $_{p-p}$ open circuit or 20 V $_{p-p}$ into 50 Ω.

Intended for use in general electronics work and in process control, servo-system and simulator applications, this instrument generates sine, square, and triangular waveforms, as well as sawtooth waveforms and pulses with ratio of 1:9 and 9:1. It employs a linear frequency-indication scale giving a setting accuracy of 2% ±0.2% (0.1 Hz to 10 kHz) of maximum range value, and small variations (± 5%) can be made around the chosen frequency using a fine-tuning control.

Noteworthy is the unit's single-shot facility since the starting point of this can be adjusted by ± 90° over the given waveform being generated. It is also possible to trigger this shot either electronically or manually.

A further feature is that its sweep facility provides a sweep whose frequency output has a linear relationship with the amplitude of the input signal employed. Covering three frequency decades, this facility is particularly useful in many electro-mechanical type applications.

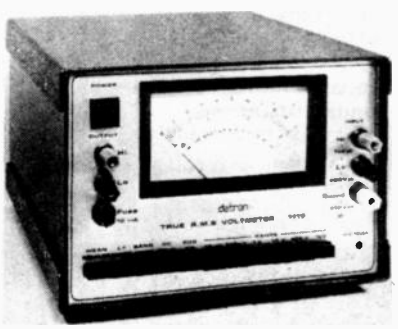
With a low distortion claimed to be better than 0.5% from 1 Hz to 10 kHz on sinewave signals, the OM5167 has a non-linearity on triangular and sawtooth waveforms of less than 1.0% and a rise/fall time on square waves of less than 30 μs. It also features a dc offset facility (± 10 V) and has an over-range indicator.

TRUE RMS VOLTMETER

Datron Electronics' Model 1010 measures the rms amplitude of waveforms in the frequency band 0.01 Hz to 1 MHz and displays the value on a 3½ digit gallium phosphide display.

By utilising a unique all-electronic circuit the manufacturers say that the inherent disadvantages and expense of thermal rms voltmeters have been overcome, and that this new instrument offers particular advantages to the user in the low frequency and low level (down to 10 μV) areas. Accuracy is maintained at a claimed 0.1% of reading ±0.1% of full scale even at the lowest frequencies and the 5:1 crest factor is maintained across the entire frequency band.

The instrument can measure either the rms value of the ac + dc signal or, by push-button selection, measure only ac in the presence of up to 1000 volts of dc – a useful feature when measuring the ripple content of dc



power supply lines. As well as measuring root mean square values, the instrument can also measure mean square, for use in statistical or control engineering applications.

Fully isolated BCD output is a standard feature and isolated remote programming of all ranges and functions is an optional feature. Other options include various low and high frequency bandwidth limits, which may be specified to suit customer requirements and which enable the fast settling time capability (50 milli secs.) to be fully utilised.

Further details from: Arlunya Pty. Ltd., P.O. Box 113, Balwyn, Vic. 3103.

"IN-CIRCUIT" TESTER

Schlumberger have recently released the Weston Model 670 "In-Circuit" Tester.

This instrument is based on the drop-proofed 660 multimeter series and incorporates an additional facility for measuring dc current on printed circuit boards without breaking the conductor. Two miniature coaxial probes are applied directly to the printed circuit track and an offset current generated to reduce the potential drop on the track section to zero. This then gives the dc current value directly.

Optional Kelvin clip probes are available to enable use with solid conductors.

Polarity is automatic and indicated by LED annunciators.

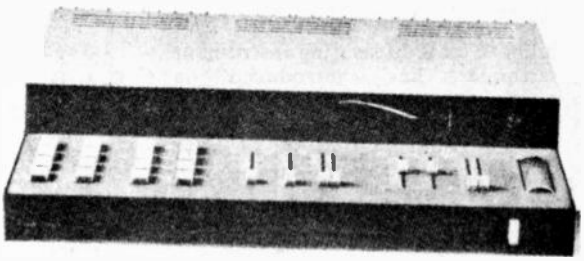
Apart from its use for in-circuit measurement, the 670 may also be used as a general purpose electronic multimeter with minimum AC/DC voltage ranges of 100 mV.

Further details from: Schlumberger Instrumentation Australia Pty Ltd., 112 High Street, Kew. Vic. 3101.

scan-dyna

Scan-Dyna 3000 tuner/amp

The ***Scan-Dyna*** 2000 and 2400 are typical of the very latest in Scandinavian design. The amplifier is dc-coupled, they are beautiful to look at, and have 22 wts rms and 30 wts rms per channel into an 8 ohm load. Into 4 ohms they deliver 25 wts and 40 wts rms respectively with an enormous music power rating. Distortion is, of course, very low. The 2400 has a mixer unit which controls three separate channels — two for disc and tape and a third for microphones.

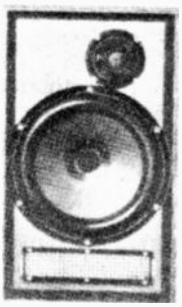


2400 tuner/amp

The recommended selling prices are:
Scan-Dyna 2000 ***$289.00***
2400 ***$399.00***

The ***Scan-Dyna*** 3000 and 4000 are powerful. Indeed they are worth the money for the amplifier alone.
3000 2 x 50 wts rms 4 ohms
(2 x 8 ohms music power) Price ***$369.00***
4000 2 x 60 wts rms 4 ohms
(2 x 90 wts music power) Price ***$399.00***

The aperiodic enclosure has become famous for its clean bass. At ***$210.00*** per pair for the A 25x and ***$278.00*** for the A 30x these loudspeakers represent unbeatable value. Don't forget our ***Scan-Dyna*** 4D quad adaptor. It costs only ***$39.00.***



A 25x

A 30x

Sole Australian importers and distributors

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Botany St., Phillip. ACT

Trade enquiries welcome

EQUIPMENT NEWS

REMOTELY PROGRAMMABLE COUNTER/TIMER

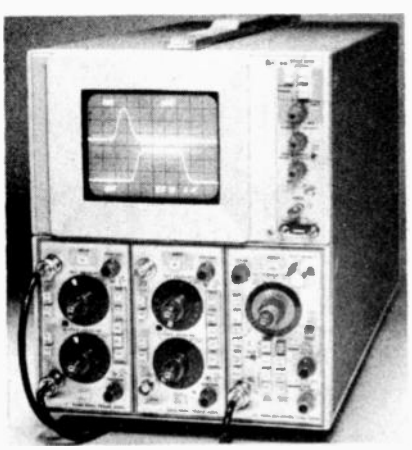
Philips' Test & Measuring Instrument department has introduced a completely remote programmable counter/timer which combines direct frequency counting up to 512 MHz with a resolution of 10 ps on time-interval average measurements. This instrument, designated the PM 6650, offers the operational capabilities of multifunction compact unit together with the flexibility of a modular system's counter.

Intended mainly for use in advanced R & D work, the instrument also has application in its programmable form in production testing of telecommunications equipment and the testing of semi-conductor devices, particularly digital units. Additions can be made to the basic unit's capability through the use of several sub-units.

NEW VARIABLE OSCILLOSCOPE

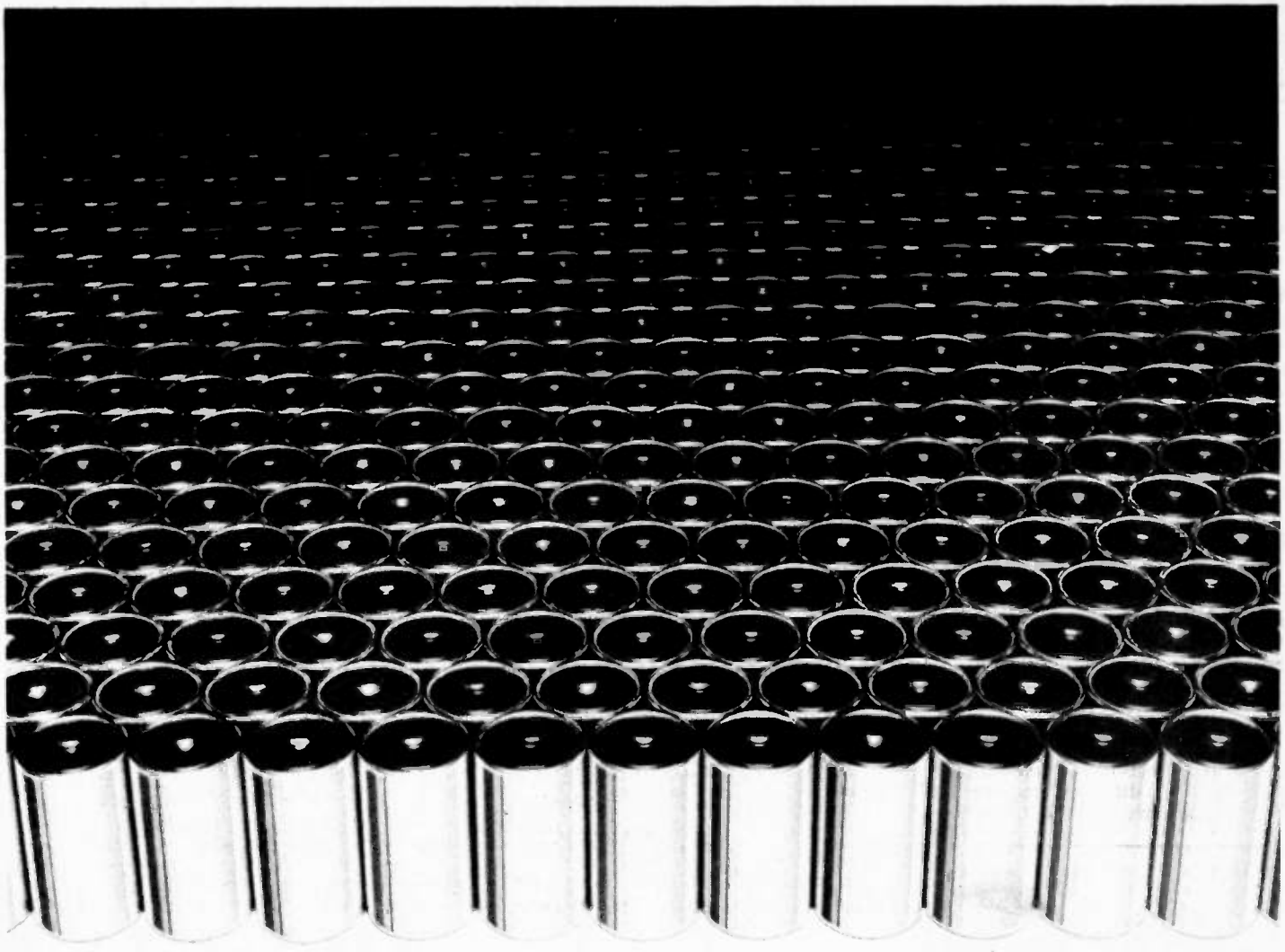
Tektronix, Inc. has introduced a new 60 MHz variable persistence storage model, the 5403/D41, to further enhance the versatility of its 500 Series of plug-in oscilloscopes. The variable persistence storage display allows the user to change the length of time a trace persists on the CRT by simply turning a dial.

For applications requiring the maximum writing speed, the 5403/D41 Variable Persistence Oscilloscope provides an integrating or half-tone mode of operation. In this mode, it is possible to achieve writing speeds ranging from 0.1 div/microsecond with 5 minutes viewing time up to 5 div/microsecond with 15 seconds viewing time. Furthermore, by pushing a button, the trace can be stored from 5 minutes to an hour at a reduced brightness level. Erase time for the 5403/D41 is 0.5 seconds. When variable persistence is not required, the 5403/D41 can be used as a conventional oscilloscope.



The variable persistence capability of the 5403/D41 allows the oscilloscope user to accomplish measurements that are difficult, if not impossible to achieve using conventional display or bistable storage. Viewing of all low frequency and low repetition rate signals is enhanced by variable persistence. In the case of displays viewed at low sweep speeds (a few ms/div or less) annoying flicker can be eliminated by adjusting for the proper degree of persistence. With extremely low repetition rate pulses or signal bursts, persistence can be set to store the signal on the screen until just before the occurrence of the next signal and then gradually fade so that the screen is not cluttered with multiple waveforms.

Further details: Tektronix Australia Pty Ltd., 80 Waterloo Rd., North Ryde, NSW 2113.



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They're completely sealed so they won't leak throughout the incredibly long life of the battery.

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If you have a power problem, chances are an 'Eveready' "Nicad" battery could be the answer.

Post the coupon to Union Carbide Aust.Ltd., P.O.Box 5322, Sydney, N.S.W. 2001, and we'll send you a brochure that will answer all your questions.

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'Eveready' & 'Union Carbide' are registered Trade Marks.

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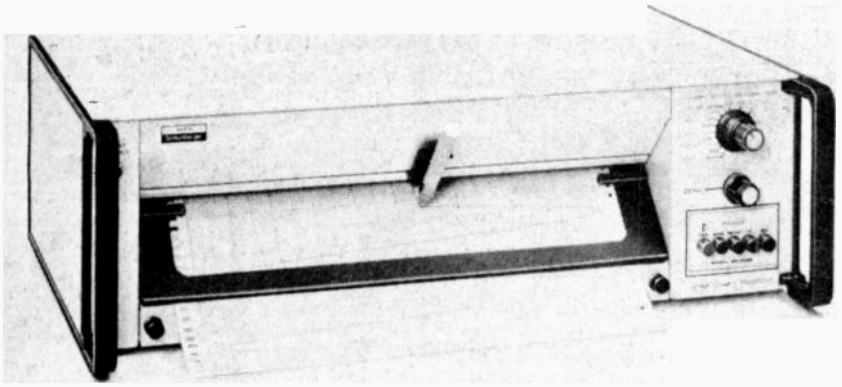
EQUIPMENT NEWS

HEATH CHART RECORDER

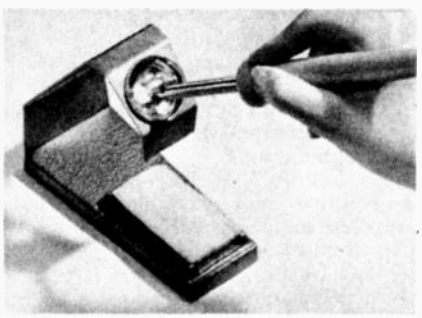


A new Heath model SR-255B chart recorder is a 10 inch potentiometric type designed as a flat bed bench recorder but also suitable for rack mounting.

Four calibrated voltage ranges are available with a maximum full scale of 10 mV and an input impedance of 10Ω. To reject mains interference a switchable 20 dB filter may be used. The chart drive is a digital stepping motor type ranging from 0.01 to 10 inches per minute. A metric transport is also available. A nylon tipped disposable pen is used.

To facilitate use in OEM applications all functions including pen lift are remote controllable using TTL logic.

Further details from: Schlumberger Instrumentation Aust (Pty) Ltd., 112 High St., Kew. Vic. 3101.



SOLDERING TOOL REST

Adcola has now developed a combined tool rest and protective shield compatible with the recently introduced Thermatic and Duotemp soldering tools.

Rubber strips make the solid cast base non-skid and non-scratch, while the chrómium plated brass shield – one for each tool size – protects and supports the barrel, ensuring free air circulation to prevent overheating while idling.

The tip-wiping sponge, which should always be kept wet, fits in a recess in the base of the unit, which is attractively finished in hammertone enamel and designed to combine speed, convenience and freedom from fatigue.

NEW DUAL-OUTPUT MODULAR POWER SUPPLIES

A series of dual-output power supplies is added to Hewlett Packard's line of modular power supplies. Designed to power linear IC's and similar devices requiring plus and minus voltages, this new HP 62200 Series includes four models covering two voltage ratings: ±12 V at 1.40 A and 3.30 A; and ±15 V at 1.25 A and 3.00 A. A single front-panel control provides ±5% adjustment of both outputs. These series-regulated supplies deliver full-rated output from 1 to 40°C with derated operation up to 71°C.

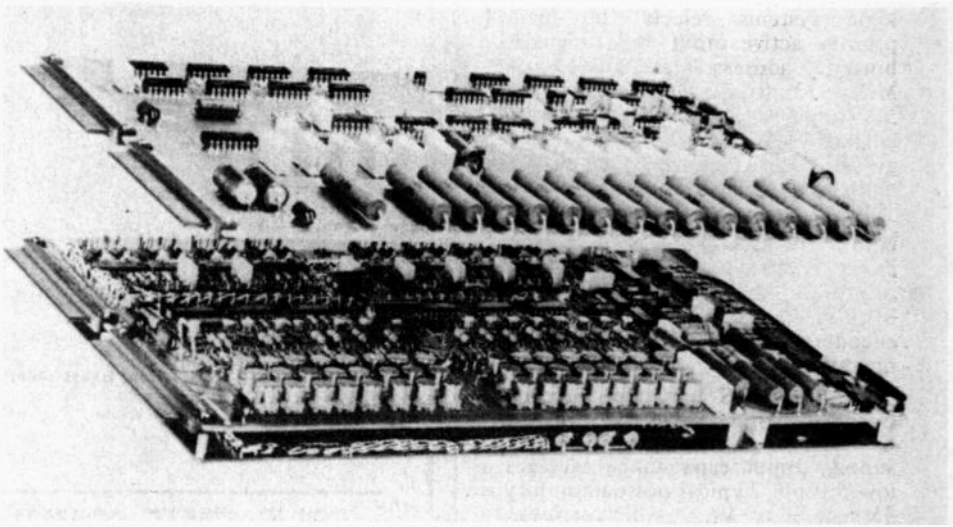
All four models are specified at 0.01% line or load regulation, 5 mV p-p ripple and noise, ±1% tracking accuracy, and 50 μs transient response following a load change from 100% to 50% and 50% to 100%. Cutback current limiting, overtemperature, reverse voltage protection, and remote sensing are standard features on all models.

Build-in crowbar protection (Option O11) is available. The crowbar circuit monitors all possible outputs of the dual supply and places a virtual short circuit across both outputs if the preset trip voltage is exceeded.

Further details: Hewlett-Packard Australia Pty Ltd. 31-51 Joseph St., Blackburn, Vic. 3130. ●

COMPONENTS

NEW FERRITE CORE MEMORY F1-75 FROM ELCOMA



ELCOMA (the electronic components and materials group of Philips) announce the release of a new random access memory system F1-75 which is ideally suited for minicomputer, process control, C.R.T. display, data transmission and monitoring systems applications.

Consisting of a memory control board and a memory module, it has 18 mil cores in a 3D three wire configuration with a basic capacity of 4 k words of 18 bits.

The memory control board carries timing circuitry, address register, data input/output register, inhibit resistors and is capable of driving eight memory modules in parallel. Thus the maximum available capacity is 32k words of 18 bits each. The memory module is built on printed circuit boards, linked mechanically by means of flexible combs and folded together. The basic memory consists of the two units, each approximately 21 x 32 x 2 cms and may be plugged into a main frame or chassis. Connection to each unit is by means of a pair of dual 31-way connectors.

The reduced cost, inherent non-volatility and extendability will make these memories very competitive with semiconductor and other memory forms in systems which require average storage capacity, says Philips.

Further details: ELCOMA, 67 Mars Road, Lane Cove, NSW 2066.

NEW McMOS CIRCUIT COUNTS TO 999, IN ANY UNITS YOU PICK – POUNDS, VOLTS, MILS, FURLONGS, ETC.

Anything that can be converted into a clock frequency can be counted with the new Motorola Complementary MOS, 3-digit decade counters designated the MC14553. It can count up to 999 and provides an overflow for cascading devices to obtain higher counts. Outputs are multiplexed BCD data to input a display driver, and are TTL compatible.

If a quantity being measured can be converted into the clock frequency up to 5 MHz, it can be counted by the MC14553!

The units being counted can be almost anything, rpm, dollars, meters, farads, picas, chains, etc. The basic circuit consists of 3-negative edge triggered BCD counters synchronously cascaded. A quad-latch output at each counter holds the data, which is time division multiplexed providing one BCD number or digit at a time. Digit select outputs provide display control.

A wide range of applications for the MC14553 include instrumentation counters, clock displays, digital meters and many more. It provides an accurate digital counting function in a single 16-pin-dual-in-line ceramic package. It offers the instrumentation designer a versatile low cost approach to counting.

Further details: Motorola Semiconductor Products, Suite 204, Regent House, 37-43 Alexander Street, Crows Nest, NSW 2065.

NEWS

NEW ENCODER PICKS TOP PRIORITIES

A new eight-bit encoder for positive logic systems selects the highest priority active input and assigns it a binary address. Designated the MC14532, this new priority encoder has eight data inputs and a data enable. There are five outputs: one is a group select; three are binary addresses; and one is an output enable.

In analogue to digital and D/A converters the priority encoder is extremely useful in assigning bit priorities. The MC14532 can also be used in code converters, and priority encoders depending on "1 of n" operation.

This McMOS encoder typically operates with a 25 nanowatt quiescent power dissipation from a 5-volt supply. Input capacitance averages a low 5.0 pF. Typical noise immunity is 45-percent of V_{DD}, which is ideal in A/D or D/A applications in high industrial noise environment.

Further details from: Motorola Semiconductor Products, Suite 204, Regent House 37-43 Alexander St, Crows Nest. 2065.

LOW POWER SCHOTTKY FAMILY OPERATES AT TWICE STANDARD TTL SPEED

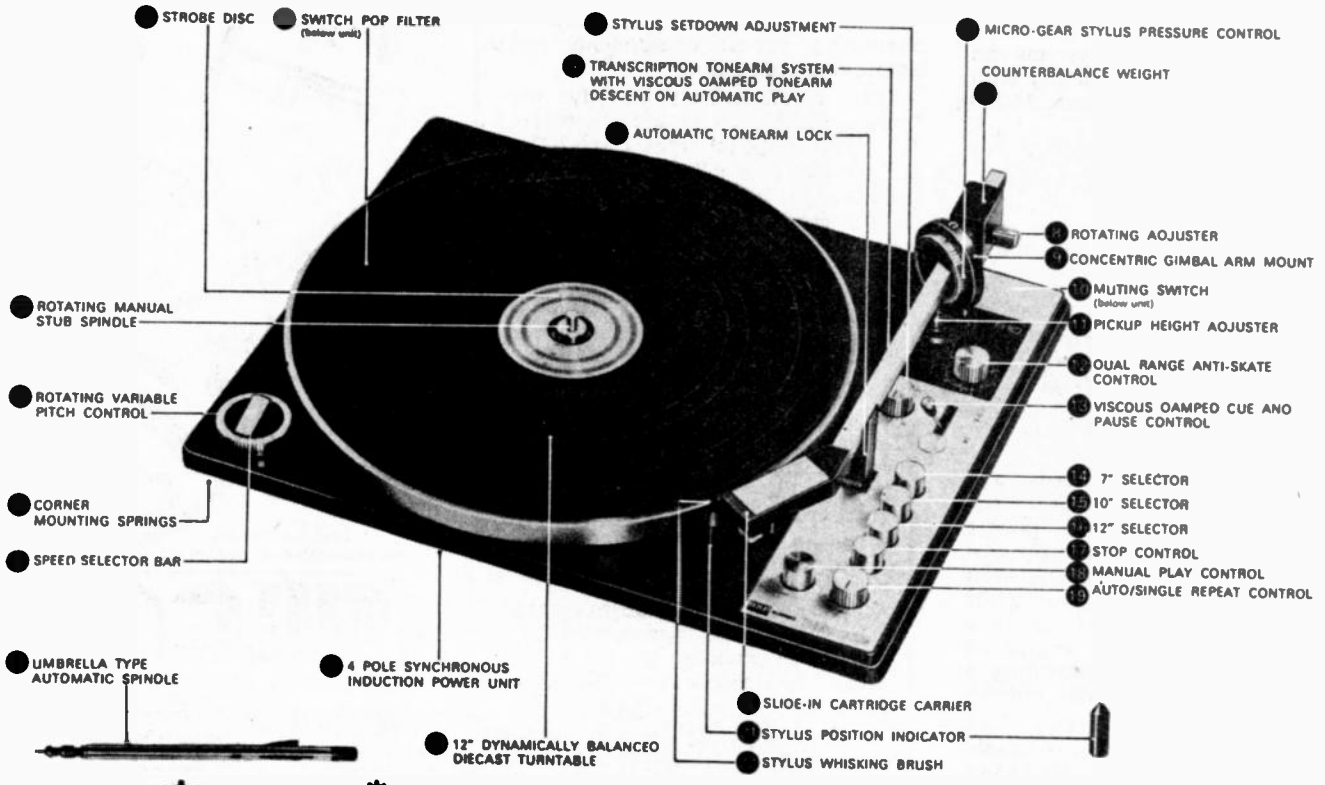
The Digital Products Division of Fairchild has introduced a proprietary line of low power Schottky TTL circuits that makes it possible for logic designers to produce 2 mW/gate digital systems that operate at twice the speed possible using standard TTL logic.

The new product line, designated the 9LS TTL family, operates at gate delays of only five nanoseconds typical, 10 nanoseconds worst case. This is twice the speed of standard 54/74 or 54LS/74LS low power Schottky TTL devices. An added benefit is that Fairchild's 9LS parts are direct plug-in replacements for 54LS/74LS low power Schottky devices.

First devices in the new Fairchild line include 11 gates and two flip-flops. The speed/power performance allows the 9LS devices to replace standard TTL, high speed TTL, low power Schottky and some standard Schottky TTL parts with a commensurate power savings of 500 to 1000%.

The 9LS parts also interfere directly with Fairchild's recently announced 34000 CMOS without external components.

"Taking it all together — performance, features, styling — the BSR 810 moves into ranking place among the best automatics we know of. And at its price, the others may well be in for a real contest." Hi-Fidelity Magazine, May 1972.



At $149* for the kit, the brilliant BSR/810 transcription turntable is hardly cheap. But your ears will tell you it's a bargain.

* At recommended retail price.

BSR, manufacturers of most of the world's turntables, have now turned the tables on expensive units.

And here are the features that make the 810 such an attractive proposition: the unit weighs 17 lbs — the diecast turntable alone is a solid, dynamically balanced 7½ lbs. A 4-pole beautifully balanced synchronous motor automatically compensates for any fluctuation in voltage input, or for any record load. A pitch control gives absolute accuracy of speed, utilising a stroboscopic centre plate.

The low mass pick-up arm gyroscopically pivots in a concentric gimbal mount producing virtually friction free movement in both horizontal and vertical planes. It also has a slide-in cartridge carrier, decoupled one piece counterbalance for a minimum tracking pressure of ¼ gramme with suitable cartridge. And the arm length is over 8½ inches to reduce tracking error to less than 0.5° per inch.

Viscous cueing is also standard on automatic as well as manual operation, and a unique anti-skate device is also featured for elliptical and standard styli. Speeds are 33⅓ rpm and 45 rpm. (Which are all you need today.)

Single to automatic play conversion is achieved with the interchangeable umbrella centre spindle.

Start-stop, record size control and auto repeat and manual conversion are actuated by push button controls set in a handsome brushed aluminium panel.

Of course there is much more you'll want to know about the BSR 810. Write to BSR and we'll send you a colour brochure.

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TELEGRAMS "BSR" St. Marys. 2760
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BSR McDONALD

810

BSR:117R2

COMPONENT NEWS

Low power Schottky TTL devices simplify system design because of low power requirements, reduced heating and low noise operation.

Low and medium speed systems can be implemented most efficiently with a combination of 9LS and 34000 CMOS devices.

Further details: Fairchild Aust Pty Ltd, 420 Mt. Dandenong Rd, Croydon, Vic.

MAGNITUDE COMPARATOR

Compare two, 4-bit words and determine whether they are "less than", and "equal to" or "greater than" is the chief function of the new Motorola complementary MOS, 4-bit magnitude comparator designated the MC14585. Separate outputs for each condition are activated depending on the comparator output providing a high level on the appropriate output.

In many applications, the 4-bit comparators can be cascaded to handle larger words lengths. The MC14585 can be used with both binary and 8-4-2-1 BCD codes, especially in instrumentation and control applications. Other possible uses for this McMOS comparator are controls, code converters, comparator testers, and correction/detection in instrumentation controls.

A fan out of 50 is provided. The high noise immunity of the McMOS device is particularly suited to high noise environment industrial applications. Quiescent power dissipation is an amazingly low 25-nanowatts typically. This can be extremely important in instrumentation applications. This low power McMOS device is pin compatible with the TTL 7485; however, it is not a direct electrical equivalent.

Further details: Motorola Semiconductor Products, Suite 204, Regent House, 37-43 Alexander Street, Crows Nest. 2065.

ICs FOR RADIO COMMUNICATIONS

Plessey announce the publication of the new enlarged second edition of the Plessey SL600 Series Applications Manual dealing with integrated circuits for radio communications.

The SL600 series is a unique range of integrated circuits which has been developed specifically for use in HF/VHF radio-communications equipment. Receivers, transmitters and transceivers for operation in SSB, AM and FM can be designed almost entirely with SL600 devices in place of conventional discrete components – minimising pre-set components and simplifying production.

Many manufacturers already use Plessey SL600 integrated circuits. Advanced radio amateurs are also recognising the potential of these circuits. This activity has stimulated a requirement for applications information of greater detail than that given in the data sheets. In the new second edition of this popular applications manual, the author has endeavoured to satisfy this need.

The second edition retains a similar layout to the first, and much new information has been added. The 92-page manual is in four parts. Section 1 deals individually with the devices in the range. The circuits are described, practical operating information is given and basic applications are investigated. Section 2 details more advanced applications.

Technical data on all the integrated circuits in the SL600 series is given in Section 3, providing a convenient reference for electrical characteristics and ratings.

The appendices, a new part of the manual, give additional information of interest to users of SL600 series integrated circuits. For instance, the details of a high performance morse keyer are described, as is the layout of a printed circuit board for an SSB transceiver.

The information contained in this manual will enable the user to understand and utilise the circuits in many useful configurations. It will also greatly assist him in the development of designs optimised for production efficiency.

Requests for copies of the SL600 Series Applications Manual should be made to Professional Components, Plessey Ducon Pty Ltd, Christina Road, (P.O. Box 2), Villawood, N.S.W. 2163.

DIGITAL ALARM CLOCKS

Two new digital alarm clock circuits intended for use with gas discharge displays are now available from National Semiconductor. Both devices are low threshold P-channel MOS circuits and contain all of the logic required to build several types of clocks and timers.

The new clocks, called the MM5370 (for 60 Hz. operation) and the MM5371 (for 50 Hz operation) interface with seven segment gas discharge displays to provide three display modes – time, alarm set, and sleep time. The display format may be either 12 hours with leading zero

COMPONENT NEWS

blanking and AM/PM indication, or 24 hours. Applications for the new circuits include alarm and desk clocks, clock radios, automobile clocks and appliance timers.

The MM5370 and MM5371 operate over a wide supply range – from 8 to 29 volts – and don't require a regulated power supply. Other features include power failure indicator to inform the user that the incorrect time is being displayed, (setting the time cancels this indication), a colon drive output which flashes at a one hertz rate to indicate clock operation, and a brightness control. Also included are a circuit to eliminate an illegal time display when the device is first turned on, and a nine-minute snooze timer.

The MM5370 and MM5371 are available in either a 28-pin Epoxy-B dual in-line package or a 28 pin ceramic dip.

Further details from: NS Electronics Pty Ltd, cnr Stud & Mountain Highway, Bayswater, Vic.3153.

DICK SMITH TO OPEN SECOND ELECTRONICS CENTRE

Dick Smith Electronics Pty Ltd will be opening a new store in Bankstown. The new store will be at 361 Hume Highway, approximately 100 metres from Chapel Road.

Opening during June, the Centre will be the only electronics store in the area catering for the needs of hobbyists and professionals.

Mail Order business will continue to be handled from the Gore Hill Centre.

HIGH GAIN ISOLATORS FOR LOW POWER APPLICATIONS

Two new Hewlett-Packard optically-coupled isolators require input currents of only 0.5 and 1.6 milliamperes, making them suitable for interfacing CMOS or LTTL to TTL and other low power circuits.

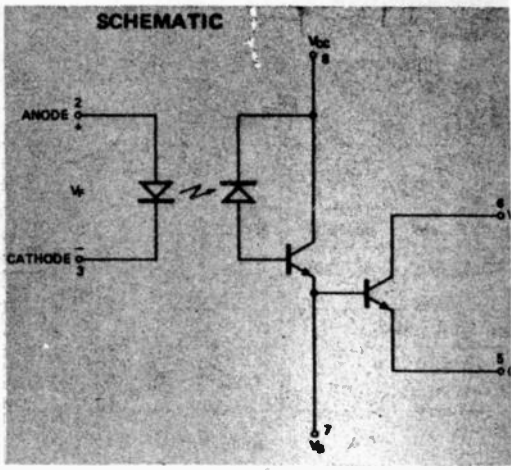
Model 5082-4370, with a current transfer ratio (CTR) of 300% minimum, is guaranteed over 0°C to 70°C for an LED current of 1.6 milliamperes.

Model 5082-4371 has a CTR of 400% minimum and is guaranteed over a 0°C to 70°C operating range for only 0.5 milliamperes of LED current. Typical CTR of the 5082-4370 is 600%; typical CTR of the 5082-4371 is 800%.

Both isolators use a light-emitting diode coupled to a unique high-gain photon detector to provide 2500 Vdc electrical insulation, 500 volts per microsecond common mode transient immunity and high current transfer ratio between input and output.

Logic low output voltage (V_{OL}) is 0.1 volt typical for TTL compatibility. The output transistor base is accessible so that gain bandwidth can be adjusted with a single resistor. Operating speed is from dc to 1 megabit per second.

Further details from: Hewlett-Packard Australia Pty Ltd 31-51 Joseph St., Blackburn, Vic. 3130.



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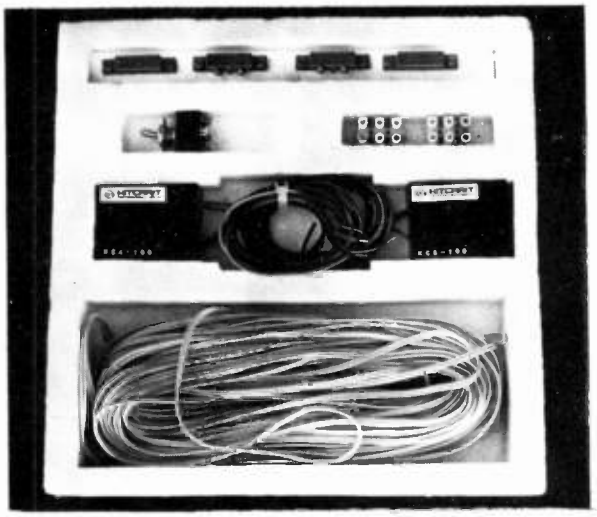
THAT EVERYONE CAN INSTALL AND AFFORD!

To be burgled is a traumatic experience — yet protection can now be provided for your home and family for less than $50.00.

The KITCRAFT home security system is the first professional system designed for easy "do it yourself" installations. It has been designed on the "EXPANDABILITY CONCEPT" that enables you to "add on" protection to meet your own special requirements. It incorporates an open and/or closed circuit sensor operation normally only found in systems costing hundreds of dollars!



THE SYSTEM INCLUDES

- encapsulated alarm module
- 4W siren module
- ear splitting HEE-HAW siren
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- 100 feet cable
- terminal block
- switches
- tacks

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COMPLETE

THE KIT CRAFT SECURITY PROTECTION SYSTEM OFFERS ALL THESE FEATURES . . .

- OPEN AND/OR CLOSED CIRCUIT SENSOR OPERATION
- LOW CURRENT DRAIN
- OPERATES OFF 2 6V LANTERN BATTERIES FOR APPROXIMATELY TWELVE MONTHS.
- READILY EXPANDABLE TO SUIT YOUR OWN NEEDS.
- NO TECHNICAL KNOWLEDGE NEEDED — NO SOLDERING.
- FULL RANGE OF ACCESSORIES AVAILABLE.
- FULLY AUTOMATIC OPERATION.
- EXIT/ENTRY DELAY
- COMPLETE EASY TO FOLLOW INSTRUCTIONS INCLUDED.
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FACTS ABOUT COLOUR TV

- **Can a mono receiver be converted to colour?**
- **What is a chroma-lock?**
- **Should I buy a set overseas?**

— Andrew Pozniak explains.

LIMITED colour broadcasting is now to commence in October — ahead of the full-scale transmissions which are still scheduled to begin in March 1975.

A number of fallacies and misconceptions are arising concerning this forthcoming service. This brief article should, hopefully, clear up some of these misunderstandings.

CHROMA-LOCK

Colour signals are similar to black and white signals except that added to the composite video/sync signal are chroma (colour) information, and a colour burst signal that is used for synchronizing the colours.

A great deal of programme material is now produced in colour.

When broadcast for reception by black and white sets, the colour information is also transmitted.

However to conform to a Broadcasting Control Board directive, the colour burst signal is removed before transmission. Because of this a standard colour TV set cannot display a colour picture satisfactorily

Some experimenters have overcome the lack of the colour burst signal by incorporating a so-called 'chroma-lock' circuit. This enables an existing colour TV to receive colour pictures by 'synthesizing' a colour burst signal within the receiver.

The chroma-lock circuit works fairly well, but the picture falls short of the best obtainable. Apart from this, a manual colour phase reversing switch is also needed and this has to be adjusted from time to time to keep the receiver synchronized with the transmitter.

Chroma-lock circuits cannot be bought commercially (not openly at least!) and, with C-day now so close it is not worth while attempting to so modify a standard colour set.

A number of retail stores are now displaying imported colour sets which are switched on during colour transmissions. Almost incredibly, some of these sets are operated without chroma-lock circuits installed.

The results are absolutely dreadful and give the uninitiated a totally wrong impression of what colour TV is all about.

RECEIVING THE SIGNAL

If black and white programmes are received satisfactorily using a conventional antenna, then it can be reasonably assumed that good colour reception can also be expected in that location.

In areas lying in propagation shadows, which are especially apparent in hilly terrain, or urban areas in close proximity to high rise buildings and other obstructions, severe ghosting is apparent. Whilst some cases can be overcome by more elaborate and costly antennae, installations exist, especially in high density urban areas where this is not a cure.

In Manhattan, New York, high rise buildings block reception almost entirely. Here virtually all TV installations have their programmes "piped" either from communal antenna systems or by cable TV.

No standard or provision for cable TV has as yet emerged in Australia — excepting a proposed test installation in Canberra.

With C-day very close it is surprising that little has been done either by government or industry to resolve this problem.

Since many high population density suburbs suffer from poor reception it is doubtful if retailers will find much market penetration in these areas. Few people are going to spend about $700 or more on a colour set and then find themselves up for a further several hundred dollars for a suitable antenna — or find that they cannot get a good picture at all.

Until a satisfactory solution is found, there are going to be some very frustrated consumers and perplexed retailers. One would have thought that some forethought could have been given and suitable measures taken to be truly prepared for C-day after so many years of waiting for colour TV.

CONVERTING MONO TO COLOUR

Technically, it is possible to convert *some* black and white sets to receive colour. In fact some conversions have already been made by experimenters.

But in practice, marrying-in the additional circuitry and fitting a colour tube — even apart from the labour costs involved in wiring and subsequent convergence and other adjustments is so high that it would be no cheaper than buying a new set.

It is possible to obtain colour using a field sequential technique of colour decoding.

In this technique the screen is sequentially modulated with three colour information and then viewed through synchronously rotating red-green-blue filters.

Domestic systems of this type have been tried — CBS proposed such a system for the USA, using 405 lines — but the drawbacks are such as to make it impractical.

The "flicker" produced by the filters changing at a rate of approximately 16 per-second (plus the necessity with a 23" TV of a four-foot filter wheel rotating at about 1000 rpm in the living room!) and poor colour saturation make this primarily an experimenter's excercise.

Nevertheless the technique works on cameras, in fact a rotating-filter sequential colour TV camera was used by an Apollo crew on one of the moon missions. The pictures thus obtained were processed on the ground and re-broadcast in the normal manner.

COLOUR COMPATIBILITY

A major fallacy has been fomented by commercial interests promoting sales of black and white sets.

There have appeared on the market so called "colour-compatible-sets". This nonsensical description has confused the public in two different ways.

Firstly, every black and white set, since the commencement of TV in Australia, is colour-compatible

anyway. (The PAL system enables black-and-white sets to receive colour transmisions in black and white). To describe recently made sets as colour-compatible is a sales gimmick bordering on deception.

Secondly some people are under the mis-apprehension that a so called "colour compatible" set is one that has been made for easy conversion to colour. (The writer recently had a long and useless argument with someone who was absolutely convinced that his "compatible" set was "Convertible". When finally asked how this could be achieved he promptly replied " ... with that chroma lock thing of course"!!)

PURCHASING OVERSEAS

There are several pitfalls to look out for if buying a colour set overseas. Unless you know how to identify a set suitable for Australia, we strongly recommend that you buy one here.

Firstly, the overseas set is more than likely an AC/DC type. This means that no isolation transformer is fitted. There is a direct connection between mains and chassis. This practice is forbidden in Australia for safety reasons.

Secondly places like Hong Kong and other duty free ports cater to tourists from everywhere; the unwary buyer is thus liable to finish up with a set for the (US) NTSC system. There is *no* and we repeat *no* "cheap" way of converting an NTSC set to PAL. If you bring back such a set it will be literally useless.

Most sets designed to receive the European PAL system can be made to work here (although some re-alignment of the tuner will almost certainly be required) but it may not be possible to tune in to all Australian TV stations. Our channels 3, 4, 5 and 5a for instance have no European counterparts frequency-wise. The IF bandwidth is also different, and retuning would be required for a good quality picture.

Locally made sets will be of the most up-to-date type in the world. It is certain that these sets will have as far as possible large scale integrated circuitry throughout and incorporate the latest innovations in colour circuits. It will also ensure that the customer will have a true PAL decoder which takes advantage of the PAL system. Some overseas manufacturers have developed a system of decoding PAL signals using other than the Telefunken patented methods and these do not offer the full advantages of the PAL system.

Thirdly consider the economics. Import duty, sales tax and cost of shipping will add substantially to the cost. Also to be taken into account is servicing. If the set is an odd-bod sold mainly for the European market, spare parts may not be readily available thus hiking the price of servicing. Finally the "parochial" attitude of most local importers precludes the chance of service under warranty or in some cases any service at all. ●

A FEW EXTRA KNOBS

The new owner of a colour set will find a few extra knobs on his set. A little practice will show how to adjust the set for optimum picture. Here are some of the controls to be expected – and how to use them:

"SATURATION" (SOMETIMES LABELLED "COLOUR")

This control adjusts the colour saturation of the picture. At one extreme no colour is evident on the screen (there is just a black and white picture). As the control is advanced, colours start appearing, washed out at first then more intense, until they are over-saturated and incorrect colour rendition becomes apparent.

"HUE" This control is found usually on older model sets, modern sets incorporate an automatic hue control circuit.

The control swings the overall colour balance of the picture between the blue and red ends of the visible spectrum. Careful adjustment of this together with the saturation control, will optimise colour.

"COLOUR-B&W SWITCH" This is available on only some sets. What it does in effect is to remove colour when a black and white only picture is being received. It prevents snow and other interference appearing as coloured flecks on the screen. Modern sets incorporate an automatic "colour killer" switch activated when no colour burst is present, thus obviating the necessity for this control.

ADJUSTING A COLOUR RECEIVER

The first essential is that the signal be tuned-in correctly. Any slight mis-tuning of the channel fine tuning will detract from the colour quality, usually indicated by a lack of saturation (washed out colours) or no colour at all with a loss of synchronization in the extreme case. Tune as with a black and white set, for the best picture obtainable before making further adjustments.

The next step is to set the contrast and brightness. These two controls adjust the "luminance" (black and white) signal only. To set these, the saturation control should be firstly backed-off so no colour is apparent.

Contrast and brightness should now be adjusted. A good black and white picture rendering correct gray-scale tones should now be visible. This adjustment is best done when a test pattern displaying a gray-scale "ladder" with squares of progressively darker tones from white to black is broadcast.

The "saturation" control is now advanced until correct colour rendition is obtained. This is best achieved by observing the flesh-tones and adjusting saturation for the most natural appearance. The rest of the colours should then "fall in" with the general picture.

Where a "hue" control is incorporated this should also be adjusted to somewhere near its centre point again using flesh-tones as a reference.

This adjustment has a subtler effect to the "saturation" control. Juggling between the two should result in an optimum setting. The effect is neverthless subjective and exact settings will vary from person to person.

It has been found that many people, especially children, advance the saturation control too far with resulting "vivider-than-life" pictures. With a correctly adjusted set, colours should be present, but the viewer should not be overaware of their presence, except where some unusual colour scheme comes to view. This is more or less similar to normal vision where we are surrounded by colour but only overaware of it when some vivid colours are present.

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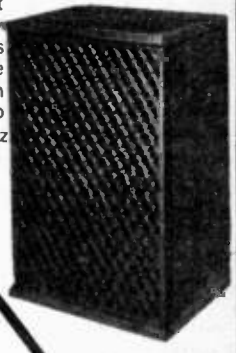
JVC SK12

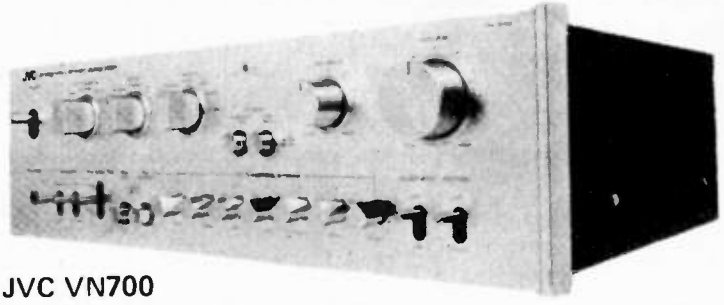
40W (RMS) 6 Speaker 4-Way system

This high class speaker system is the result of JVC own intensive research programme. The SK 12 has a 12" free edge woofer, two 5" mid range speakers, two 2½" tweeters and horn super tweeter. Together these speakers give a total coverage with a flat frequency response over the whole audio range. A continuous lever control for the high frequency sounds makes the SK 12 match any room acoustics. The front grilles are removable so that the cabinet has no side edges to reflect high frequency sound. This heightens the smooth response to 25-22,000Hz



JVC SK12

Here is the purists delight with 70 watts (RMS) of output and specifications that are very impressive. In figures this means a frequency response of 20-50,000 Hz and a THD factor of 0.25% plus the feature of JVC's SEA tone control system that gives you ultimate control over sound at 40, 250, 1000, 5000 and 15000 Hz. This unit will connect up to two pairs of speakers, two tape recorders, turntable and three auxiliary components.



JVC VN700

"4-channel ready"

A look at this precision component will tell you its different, but a closer look will prove it. Notice how the TH universal tonearm houses a 4/2-channel compatible cartridge. And how the turntable's 4-pole synchronous motor and belt-drive system combine to give it the precision required for reproducing discrete 4-channel stereo records: wow and flutter of less than 0.1% WRMS and an S/N ratio of better than 5-db. In addition, auto-stop-return mechanics with anti-skating device and cueing lever. In fact, all that's required to convert the SRP-87 to immediate discrete 4-channel status is JVC's 4DD-5 demodulator and stylus (4DT 10X).

JVC-SRP 87

Stereo Cassette Deck with ANRS

The professionalism of the open reel deck is combined with the convenience of the cassette in this high-performing compact, a 'must' for any serious stereo enthusiast. Built-in Automatic Noise Reduction System (ARNS) Tape Selector Switch, long life head and electrically-governed DC motor enable the unit to offer frequency response of 30 to 13,000 Hz (±3 dB), a signal-to-noise ratio of 50 dB and low wow and flutter characteristics of 0.15% RMS. For optimum recording, the unit features a pair of large VU meters, separate sliding volume controls and convenient pushbuttons for all recording and playback functions, including one for Pause and Eject. For professional monitoring with headphones, a headphone level switch is included.

JVC 1667 V

the price on this super system! See us at:—

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(Continued from page 72)

MODULE/PATCHBOARD—INTERWIRING

MODULE	INPUTS	OUTPUTS	OESTINATION
Oscillator 1	Input	Output	Patchboard 1H Mixer point 2
Oscillator 2	Input	Output	Patchboard 2H Mixer point 4
Oscillator 3	Input	Output	Patchboard 3H Mixer point 6
Oscillator 4	Input	Output A Output B	Patchboard 4H Mixer point 8 Mixer point 10
Keyboard Controller	Transient 2 Patchboard	Trig. Output Key Output Mod Input	Patchboard 14V Patchboard 11H Patchboard 12V Patchboard 16V Patchboard 17V
Noise and Controller	Controller Input	Noise Output Noise Output Cont. Output Cont. Output	Patchboard 10H Osc 4B selector Patchboard 11V Osc 4B selector Patchboard 20V
Mixers	2 4 6 8 10 RV61 RV62 RV81 RV82	Output 1 Output 2 Output 3 Output 4 Output 5	Osc 1 Output Osc 2 Output Osc 3 Output Osc 4 Output Osc 4B Output Patchboard 18H Patchboard 19H Patchboard 20H Patchboard 21H Patchboard 1V Patchboard 2V Patchboard 3V Patchboard 4V Patchboard 5V
Envelope	Keyboard Output Ext. Output Key Trigger Signal Control	Output	Not used Ext. Input mod-10 Patchboard 12V Patchboard 13H Not used ext. Patchboard 6V

MOODULE	INPUTS	OUTPUTS	OESTINATION
Transient 1	Key Output Ext. Trigger Key Trigger	Output	Patchboard 16V Ext. Input mod-10 Patchboard 12V Patchboard 13V
Transient 2	Ext Trigger Key Trigger	Output	Ext. Inp. mod-10 Patchboard 12V Patchboard 14V
VCF 1	Signal Inp. Control Inp.	Output	Patchboard 14H Patchboard 5H Patchboard 7V
VCF 2	Signal Inp. Control Inp.	Output	Patchboard 15H Patchboard 6H Patchboard 8V
Amp 1	Signal Inp. Control Inp.	Output	Patchboard 16H Patchboard 7H Patchboard 9V
Amp 2	Signal Inp. Control Inp.	Output	Patchboard 17H Patchboard 8H Patchboard 10V
Output Module	Input 1 17 19 21	Output 18 Output 20 Output SW1 Output 22 Phone Out.	Patchboard 22H Horiz. Joystick Vert. Joystick Patchboard 9H Patchboard 18V Patchboard 19V Rear phone jack Patchboard 15V Phone jack
External Inputs	Ext. Input 1 Ext. Input 2 Ext. Trigger from patch-board	Ext. 1 Out. Ext. 2 Out. Ext. Trigger (10) Out.	Rear phone jack Rear phone jack Patchboard 12H Patchboard 21V Patchboard 22V Envelope Transient 1 Transient 2

Notes: The patchboard is numbered 1H to 22H left to right and 1V to 22V top to bottom.

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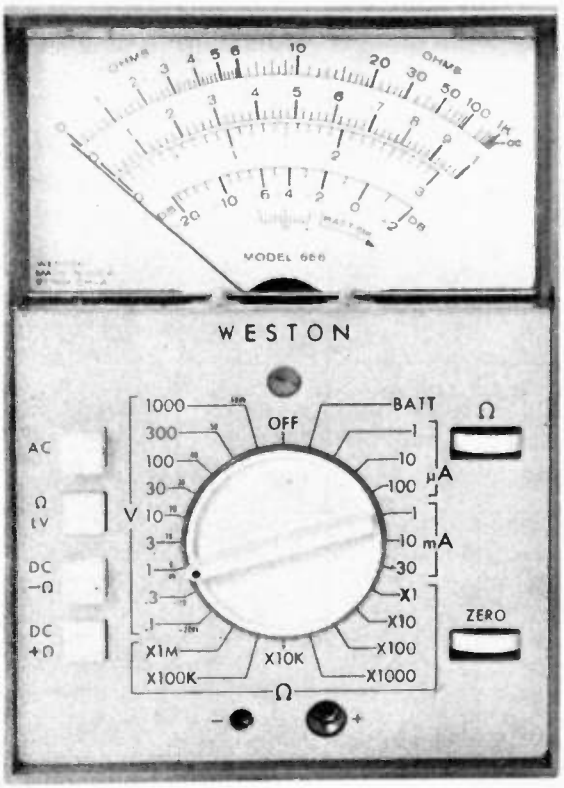

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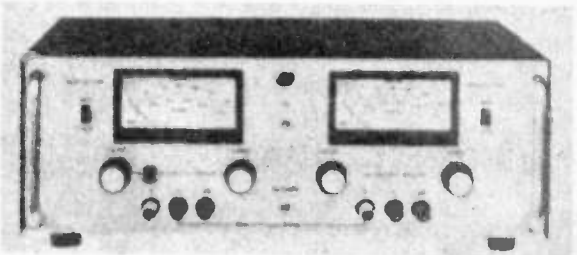

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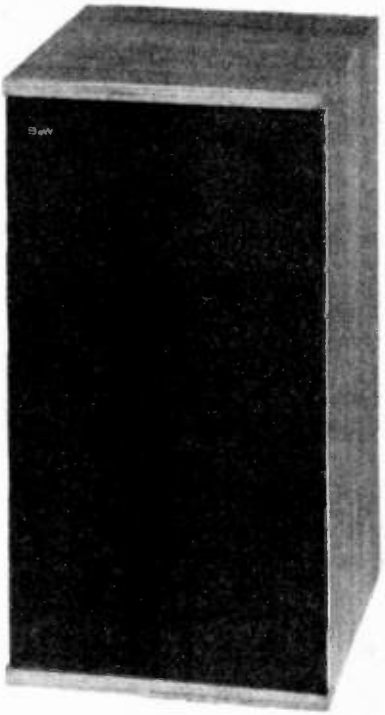

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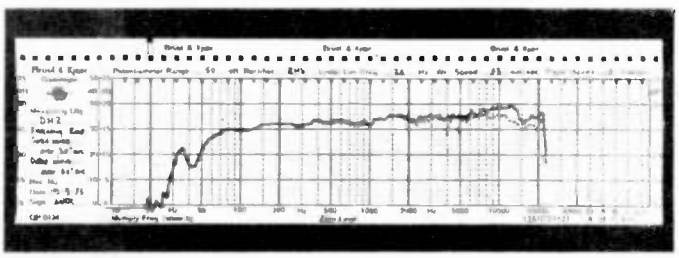

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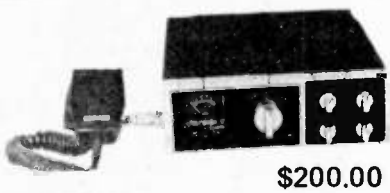

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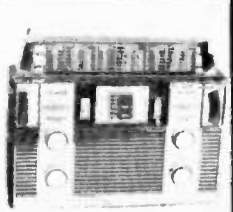

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SP520 — TS520 — VF0520

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Mode (Receive only) USB, LSB, CW.

Input Power: 160 watts on 80 to 15 meter band, 140 watts on 10 meter band.

Antenna Impedance: 50 to 75 ohms, unbalanced.

Carrier Suppression: 40 dB.

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Image Ratio: 50 dB.

IF Rejection: 50 dB.

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SPECIFICATIONS

Transistor: 12 Transistor, & 8 Diode; Frequency: FM 88-108 MHz, AM 540-1600 kHz, AIR-PB108-174 MHz; Power Output: Maximum 500 mW, Undistorted 280 mW; Speaker: 3" 8 ohms; Earphone: Magnetic 8 ohms; Power Source: DC 6V UM-2 x 4 pcs. or AC 230 Volt; Antenna: Ferrite bar for AM, Rod antenna for FM/AIR-PB-WB; Controls: Volume (w/on-off switch); Selector (AM/FM/AIR-PB-WB); Accessories: Earphone & batteries; Dimensions: 3 3/8" x 6¾" x 9¾"; Weight: Approx. 3 lb.

MODEL NC-310 DE LUXE
1 WATT 3 CHANNEL
C.B. TRANSCEIVER

- **WITH CALL SYSTEM**
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SPECIFICATIONS, NC-310

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RF Input Power: 1 Watt
Tone Call Frequency: 2000 Hz
Receiver type: Superheterodyne
Receiver Sensitivity: 0.7μV at 10 dB S/N
Selectivity: 45 dB at ±10 kHz
IF Frequency: 455 kHz
Audio Output: 500 mW to External Speaker Jack
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RECORDINGS classical

REVIEWER: Tanya Buchdahl

BEETHOVEN: Complete (32) Piano Sonatas. Claudio Arrau (piano). Philips 6747-009 (13-record set with notes) $32.50.

He who listens to these sonatas listens to the New Testament of keyboard music; he who listens to this set hears one of the monumental performances of the century.

At this point I was tempted to end the review; I haven't, but that contains the essence of what I shall say.

The 32 piano sonatas as a group show the entire musical development of Beethoven as no other type of his music does, not even the string quartets. Though he achieved in the last group of quartets an almost superhuman creative power, and visited realms of thought and emotion he had done nowhere else, the quartets as a collection do not show the wonderful range of character and expression that are in the sonatas. Nor do they show the youthfully virtuosic and sometimes inexperienced originality developing through an extraordinary range of ideas to the new world of the four or five last sonatas; the first quartets Op.18 were in a way already mature works. The piano was, after all, Beethoven's instrument – in his time he was known as a brilliant virtuoso pianist, not as a composer – it was reasonable that the works closest to Beethoven's character should be written for the piano. And yet, hard though it is to believe, after writing the 32nd sonata Op.111 in 1822 he decided the piano was an unsatisfactory instrument and returned to the string quartet as his means of most intimate expression, thereby producing the quartets Opp. 127, 130, 132, 133 and 135.

Though it is customary to divide Beethoven's works into three creative periods (Early, Middle and Late), the sonatas are more difficult to separate. The five sonatas Opp.101, 106, 109, 110 and 111 are regarded as late works, yet there are characteristics of the late style (widely separated hands; trills which are an expressive device in their own right, not merely ornament any more; slow movement themes of magnificent simplicity; and so on) in the rather ambivalent sonatas Opp.81a and 90. The 'Waldstein' and 'Appassionate' sonatas (Opp. 53 and 57) were produced shortly after the 'Eroica' Symphony and the Heilingenstadt Testament, written at the time Beethoven began to realize that his hearing was slowly but definitely fading – passionate works with magnificent melodic invention and development, characteristic of the Middle period; yet there are pre-echos in the 'Tempest' Sonata Op. 30/2, and even in the slow movement of Op. 10/3 (1796-8) which was Beethoven's first real excursion into tragic keyboard writing – a strange appearance amongst movements full of youthful bravura written for his own display purposes.

Thus it is a rare, perhaps a non-existent, pianist who not only can cope with the technical demands, which on occasion are colossal, but has sensibility and empathy sufficient to project the enormous emotional and intellectual experience covering almost the entirety of Beethoven's creative life. Inasmuch as anyone can aspire towards the ideal, I consider Arrau's cycle a truly monumental approach, and perhaps as a complete cycle as much as anyone could reasonably hope for. These recordings were produced around 1964 (though they don't sound so old) when Arrau was about 60, after a lifetime's study of Beethoven – beginning with his teacher Krause, who was taught by Liszt, who in turn was taught by Czerny, who was taught by Beethoven himself. Every last note Arrau plays is carefully thought out and deeply felt.

Even if you have various sonatas already on record, I suggest that this set is not only indispensible but a real joy – quite irrespective of the price, which is ridiculously low. A bargain at any price, but $32.50 is incredible. Perhaps you may want second versions of some sonatas – I selected alternative versions of nine sonatas for comparison, including the seven most likely to see wide variations in interpretation; Opp. 53, 57, 101, 106, 109, 110, 111 – not a large number of alternatives considering the vast number of recordings available, but the sanity of every reviewer is limited, and nearly 50 sides of Beethoven sonatas in under four days causes severe strain on it.

Obviously it is a matter of each person's own preferences, but I found that every time I returned to the Arrau version with one minor exception, Op. 78 in F#. Arrau's interpretation strikes me as being too cold and angular; Brendel's version (plus Op. 106; Philips 6500-139, $6.20) is as sprightly yet sweetly charming as one could wish for. But as for the rest, I found none better than Arrau's. Of the Op. 90 in E minor, I am inclined to think that no-one I have heard has produced a really outstanding version, of the last movement at any rate – not even Schnabel (plus Opp. 78, 79, 81a; HMV COLH60 (deleted), also WRC and Seraphim, $3.50), nor Solomon (plus Piano Concerto No. 1; Seraphim 60016, $3.50). As for the 'Waldstein' Sonata Op. 53, you may prefer Barenboim's version with its rather French style first movement (plus Op. 110; WRC S/5243) to that of Arrau, which suffers from a surfeit of rubato especially in the form of last-beat-retardation. This often irritating habit is scattered throughout most of the sonatas, though not so much the very last ones. The thought behind this, no doubt, is Arrau's opinion that rigid observance of the tempo and metronome markings leads to atrophy and death. I can't help feeling that the tension and continuity would have been improved, not lessened, had he not been so liberal with his tempi.

The other side of the Barenboim record, containing Op. 110 in A flat, is a fine performance, and it also contains fewer idiosyncrasies than Arrau's. Two of the latter's more peculiar (and unfortunate) ones occur in bar 130 of the last movement, where instead of allowing the syncopated arpeggio to melt into the return of the fugue (this time inverted) – this music surely comes of divine inspiration! – he hesitates for a liberal fraction of silence; and in bar 162 where it should become *meno mosso* (less speed) he treats it as *piu mosso* (more speed). Despite this, it is only after Arrau's performance that I feel I have returned from some kind of sublime journey.

Op. 57 is given another inspiring performance. Arrau's last movement is a sheer dazzling masterpiece. I followed it by Brendel's recent version (plus Op. 111; Philips 6500-138, $6.20) which I had always regarded as a very fine one, and the difference was surprising – at least in that final movement, Brendel's version just wasn't in the running. His Op. 111, however, is; and though I find Arrau's more satisfying, all I can say once again is that it is a matter of personal preference. My major criticism of Brendel's Op. 111 is that he treats the first movement with too light a touch, forming insufficient contrast with the second movement. The two movements of this sonata can be regarded as Thesis and Antithesis; where the first is powerful and dramatic, the second (a set of variations based very simply on C major and its relative A minor) travels by way of profound simplicity through realms almost unearthly, where sometimes even time seems to hang suspended (v. bars 106-120).

For comparisons of Opp. 101 and 109 I used an old Turnabout recording (plus Op. 49/1, 2; TVS34391, $3.50) by Brendel, in the current absence of these sonatas from the cycle he is recording for Philips. Op. 101 is a work recorded more rarely than the other four of the period because of its rather ambivalent, almost grab-bag

(not a criticism!) nature; performances of it seem to me very uniform, including Solomon's (plus Op. 106; HMV Concert Classics Mono XLP30116, $4.50). Op. 109, like Op. 111, has as its last movement a set of variations on a sublimely simple theme, which develops into ever remoter regions until the mighty *pp* trills cease and it returns without ceremony to the initial theme; and it is only then that one realizes the immense distance one has travelled in those few pages. Arrau's return to the theme (but not so much the beginning of the movement) is incomparable, and beyond description; Brendel's movement is a little too fast, and really isn't in the same class.

This brings me to the last but most, the 'Hammerklavier' Sonata Op. 106 in B flat. Fable has it that the violinist who was to give the first performance of the Beethoven Violin Concerto came to the composer and complained that it was too difficult for him. Beethoven fixed the unfortunate man with a squint and said, "You don't think I was thinking of your miserable violin when I wrote this, do you?". It seems very likely that he wasn't thinking of anyone's miserable piano when he wrote the Op. 106 either. It is the tremendous length, complexity and technical difficulty, and is the sonata which will make or break a set like the present one. In the case of this set, the Op. 106 makes it. It is usually the final massive fugue which proves the stumbling block – here it is played with discipline and reverence; and every note and every detail appears with its proper emphasis, almost in defiance of the performer's (or any performer's) physical capabilities. Of the three alternative versions I played (consecutively, all in one afternoon – an exercise I recommend only to born masochists), I found none which was of the quality of Arrau's, though each had its own merits. The old Backhaus version (Decca, now deleted) was dramatic, but lurking in the drama was the feeling that Backhaus was covering up for want of knowing quite what to make of the work. Brendel's (Philips, above) version contains a slow movement of extraordinary beauty and depth of feeling, a record almost worth having for that alone; but he founders on the last movement in non-technical respects. Solomon's (HMV, above) version is probably the best of these three, but because he insists on taking the last movement at a suicidal speed he can't avoid a certain amount of lack of clarity. No – Arrau has produced here one of the all-time great performances.

Perhaps I have spent too much space on comparisons; if nothing else I hope I have convinced anyone who feels there is no point in duplicating any records he may already have, that he will be missing out not only on a mature, deeply felt and thoroughly convincing performance, but also an enlightening, humbling and joyful experience.

T.R.B.

Arrau will be touring for the ABC in August; details of his tour are:
Perth (Concert Hall) – 3rd
Adelaide (Festival Theatre) – 6th
Sydney (Opera House) – 8th
Sydney (Opera House) Sub. Recital I – 10th
Sydney (Opera House) Sub. Recital II – 13th
Melbourne (Town Hall) – 15th
Melbourne (Town Hall) Sub. Recital – 17th
Melbourne (Town Hall) Special Recital – 20th
Canberra (Theatre) Special Recital – 22nd
Brisbane (City Hall) – 24th.

BACH: Cantatas BWV 212 'Peasant Cantata', BWV 211 'Coffee Cantata'. Rotraud Hansmann (soparano), Kurt Equiluz (tenor) in No. 211, Max van Egmond (bass). Concentus Musicus Wien/Nikolaus Harnoncourt. Telefunken Das Alte Werk SAW-9583-M ($6.20).

This is a re-release of SAWT-9515, issued as recently as 1969, and it is certainly a record which should always be kept in the catalogue. It seems a little odd, though, that it is a full-price record when the English price is £1.51, which usually translates out here to around $4.50.

Although not in the Telefunken Complete Cantatas (SKW) series, all the artists are the same but for Rotraud Hansmann, who appears in the Telefunken Mass in B minor. As anyone who knows other records of theirs would expect, this issue is delightful. Especially enchanting are the performances of the unnamed flautist, and of Rotraud Hansmann, whose light and delicate approach which is displayed in the Nonesuch (H-1008, coupled as above) recording, which is just not in the running with Harnoncourt's version. Incidentally, the last item in the Peasant Cantata is fortunately sung by just the three soloists, unlike the Nonesuch which introduces a chorus here – which not only breaks the continuity but detracts from that delightful pseudo-yodel on Dudelsack (bagpipes).

Both cantatas are mock opera buffa. The 'Peasant Cantata' was written using a libretto by Pikander who had just come by a new landowner-cum-overseer whom he wished to aufbuttern. It has scatterings of the Upper Saxonian dialect (suspiciously like Dutch), and the parody lies in the contrast of 'citified' and 'countrified' music. The 'Coffee Cantata' is a dig at the Leipzig vice of coffee-drinking; Schlendrian tells his daughter Lieschen that he forbids her to marry unless she gives up drinking coffee. She promises to do so, but when her father goes out to find her a husband she sends out a message on the quiet that she will consider no-one unless it be written into the marriage contract that she may still drink her coffee. All the singers are suitably straight-faced, which of course is essential in parodies such as these, probably most of the minute quantity of humorous music that Bach wrote.

The record comes in a folder-type of cover which when laid flat shows a beautiful reproduction of 'Die flaemische Kirmes' by the 17th-century David Teniers. Stapled inside is a booklet giving nine pages in all of promotions spiel mainly about the complete cantatas series (the same booklet comes with the cantatas themselves) and it tells us such things as that the cantatas come with texts, complete scores, and "synoptically bibliophilic" (sic) introductory notes. It is a pity that it seems Telefunken has not read its own PR, because the information given about this particular record is woefully inadequate and there is not a text or a translation to be seen anywhere – not even movement titles. However, this is the only drawback (and very unusual) to this otherwise delightful record, which I am sure cannot be bettered when it comes out in the complete edition (it should be at least eight years before we get that far, in any case), or anywhere else for that matter. – T.R.B.

HELP NEEDED

In August The Canberra Youth Orchestra will be taking part in the Sixth International Festival of Youth Orchestras in Aberdeen and London. The other orchestras taking part are from Britain, Tokyo, U.S.A., Switzerland, Bulgaria and Germany; among others associated with the Festival are Aaron Copland and Ruggiero Ricci.

This is an honour for both Canberra and Australia as a whole – but the C.Y.O. is desperately short of money to finance it. Donations of any amount are more than welcome, but $2.00 buys a "Friend of the Canberra Youth Orchestra" sticker, and $10.00 buys a raffle ticket for a $36,000 four-bedroom house in Rivett (Canberra), to be drawn in mid-July. Please help! All correspondence to The Secretary, Canberra Youth Orchestra, P.O. Box 33, Lyneham, A.C.T. 2602.

INPUT GATE

LETTERS FROM OUR READERS

TUPPERWARE PARTIES

May I say how much I appreciated your excellent coverage of the pirate radio affair.

It's good to see your magazine openly tackling a subject that others have been pussy-footing about with for years and years. I know that correspondence is officially closed on this one but there are a couple of points I would like to make.

Firstly, I must protest at the barefaced hypocrisy of many licenced radio amateurs in this debate. They carry on as if they alone were snow-white, and pirates — no matter what their purpose — totally black. How about the hams putting their own house even vaguely in order to start with. For example on one of the *WIA's own broadcasts*, there are repeated announcements of Tupperware parties. Surely the WIA don't have a commercial licence!

Secondly, you say that some allegations made by one or two of your correspondents are defamatory. Well, your magazine is generally outspoken so if you know the allegations are true then why don't you print them?

— D.P., University of NSW, 2033.

We cannot really comment on the first of our correspondents statements — certainly we have heard the broadcasts in question and, as our correspondent states, the WIA sub-group concerned (or their ladies auxiliary) are quite openly advertising Tupperware parties. Maybe this is covered under the terms of their licence — we don't really know. Perhaps one of the people concerned would care to comment.

Regarding the second point — the law of defamation legally prevents us publishing statements of the type in question.

The law of defamation is very complex, but broadly a statement is defamatory if by its publication a reasonable man will think less of the complainant. To successfully defend a defamation action it is necessary for us to prove that (a) the statement is true, (b) the statement is to the public interest, and (c) the statement is to the public benefit.

As publishers and editors know to their quite considerable cost, it is usually easy to prove (a), harder to prove (b) and virtually impossible to prove (c). And it is for us to prove that the complainant has not been defamed — not for the complainant to prove that he has.

The law is iniquitous and (thankfully) is due to be reviewed shortly.

ATOMIC EXPLOSIONS

I was very interested in your news item concerning massive pulses of electromagnetic energy following a nuclear explosion. (ETI June 1974, p. 17). What causes the effect and why are the US Airforce so interested?

— F.K, Parramatta, NSW.

We'll answer your questions in order.

Atomic explosions cause two main electromagnetic effects.

Firstly, the explosion causes an assymetry in the distribution of the electrical charge in the regions surrounding the explosion, there is also a rapid expansion of conductive plasma in the earth's magnetic field.

A second effect, whilst not generating electromagnetic energy, is the formation of ion pairs consisting of separated electrons and positive ions. The effect is to attenuate and refract radiowave propagation.

Presumably the US Airforce are involved in assessing the efficacy of high altitude nuclear explosions as a ICBM counter-measure or counter-counter-measure.

It is known that high altitude nuclear blasts disrupt radar stations for a period from several seconds to several hours.

(Anyone interested in this bizzare activity should refer to the currently definitive text which is — Monopulse Radar by Leonov and Fomichev of the USSR. It is obtainable from the NTIS, US Dept. of Commerce, 5285 Post Royal Road, Springfield, VA. 22151, USA — price is US$26.50 — NTIS book code number is AD-742-696).

RECORD QUALITY

Congratulations on your June editorial?

I have spent over $1,000 dollars on a Hi-Fi system in order that I may obtain greater enjoyment from recorded music.

However, although my system is only middle-of-the-road by today's standards, I am absolutely flattered to find that the quality of records seems to be the major limitation on performance.

Clicks, pops and background noise on top-priced recordings seem to be the rule rather than the exception. In fact the worst recordings seem to be those of classical performances! Why is this so? Surely the recording companies don't think that, because sales are relatively low in this category, anything will do.

It is certainly not that quiet recordings cannot be obtained. I bought a $1.95 Windmill (UK) recording for my young son and was surprised to find that it was free of noise and of a quality far superior to most of my $6.20 recordings. Absolutely infuriating!

Cannot the sound equipment industry bring some pressure to bear on these rip-off merchants. It is they who will ultimately suffer, for many of us will be reluctant to spend money on better equipment in order to reproduce clicks and pops ever more faithfully — as your editorial pointed out.

B.C.
Hillsdale, N.S.W.

POOR SERVICE

I would like to comment on your editorial in the May issue "Electronics Today" regarding complaints of poor service facilities for electronic equipment in this country.

I have been associated with the consumer side of electronic servicing for some fourteen years and at present am in charge of a service centre handling numerous brands of equipment.

Many of the problems of poor or inadequate service exist for Australian-made as well as imported equipment. Much of the blame for the poor situation can be attributed to the manufacturers and their agents or distributors. One of the biggest problems facing a service company today is total lack of interest and co-operation between manufacturer and service departments. The supply of spare parts is almost a joke at the present time in the industry — as any service technician will verify. Manufacturers who back their products efficiently are a mir
For example

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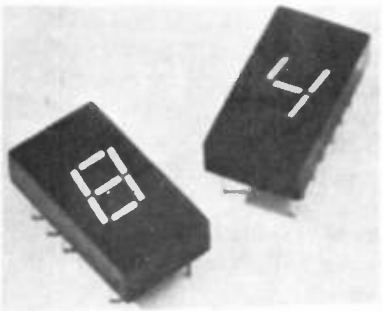

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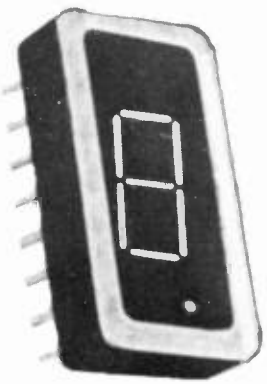

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INPUT GATE

(Continued from page 116)

increasingly difficult for service companies to obtain circuit diagrams and service manuals on much of the equipment offered for sale from Australian retailers.

I have had to refuse to service many brands of consumer equipment because of two main reasons, firstly, poor supply of replacement parts (or none at all) at reasonable prices and secondly, total lack of availability of service manuals and circuit diagrams.

My organisation services many Japanese and other imported equipment and all too often spare parts orders are returned, 'sorry parts no longer available – model obsolete', or delays sometimes approaching six to twelve months are advised. Obviously this situation does not help service companies or the unlucky consumer.

With colour television approaching I can see even more problems arising if manufacturers both locally and overseas continue in this way and show no interest in the service of their products. After all it is the consumer who buys the end product and he should be entitled to satisfactory service for the products he has purchased.

I hope this letter causes some reply or comment from both manufacturers and distributors of electronic consumer goods in this country.

Noel Stutterd
Burnie, Tas. 7320

VU METERS

Many cassette recorders are now fitted with peak indicator lights as well as VU meters. Do we really need both or are the manufacturers trying to push something that isn't really needed?

** Accurate VU meters are essential for professional recording. But those on domestic machines have only marginal value. Most are under-damped and indicate transients levels higher than they are because the needle overshoots. At best, VU meters indicate average levels – but it is peaks that cause distortion.*

A peak-indicating light is, for most purposes, of mugh greater value than any but a really well engineered VU meter – and that we have yet to see on any but a professional machine.

TRANSISTORS Pre-1948?

In all the literature I have ever read, the date for the invention of the transistor is given as 1948, it still only being a laboratory curiousity at this stage.

Yet in two books I have read recently I came across reference to the use of transistors as early as 1941. In the first book 'A Strange Kind of War' by Admiral M. Miles, the author says that in 1941 he received some 'transistors' from Bell Labs. for him to evaluate in his capacity in a sort of inspection and evaluation of new inventions. He goes on to say they were most useful in cruiser and battleship gun directors during the war.

The second reference occurs in 'Day of Trinity' by Lansing Lamont where among other things he mentions that some transistors arrived. This was 1945.

I would be very pleased to hear from you on any information you may have on this matter as it seems strange to hush up a seven year discrepancy this many years ago.

Russell Costin
Norman Park, Qld. 4170

** Any comments? – Ed..*

TESTING COLOUR TVs

Will you be doing product surveys on colour TVs? I would like to see these because many sets are not as advertised.

I recently bought a GE model (black and white) which indicated on the rear corner that it was transistorized. There was not a transistor in it.

– Rod Humphrey,
Belmore, NSW. 2192.

** We are currently investigating the possibility of reviewing colour TVs.*

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All listed prices are in Australian dollars, International Postal Money Orders (please send PO receipt with order for immediate shipment). Banque Chasiers check (preferably in US funds) and rated company cheques (with foreign exchange stamp approval affixed) will be accepted. Due to recent Australian government restrictions we are not able to clear personal checks . . . All goods are new unused surplus and are fully guaranteed. Orders will be shipped within two workdays of receipt of same. All customs forms will be attached. Minimum order amount is $5.00, do not add postage — we pay postage. Surface mail for orders under $10.00 and Air Mail for orders over this amount.

DATA SHEETS ARE PROVIDED FOR EACH ITEM PURCHASED

7400 SERIES TTL

		DIP
7400	Quad 2-input NAND gate	$ .20
7401	Quad 2-input NAND gate	.20
7402	Quad 2-input NOR gate	.22
7404	Hex inverter	.22
7405	Hex inverter*	.20
7406	Hex inverter buffer/driver*	.35
7408	Quad 2-input AND gate	.22
7410	Triple 3-input NAND gate	.20
7420	Dual 4-input NAND gate	.20
7430	8-Input NAND gate	.20
7440	Dual 4-input NAND buffer	.20
7441	BCD-to-decimal decoder/driver	.80
7442	BCD-to-decimal decoder	.80
7447	BCD-to-7 segment decoder/driver	1.00
7448	BCD-to-7 segment decoder/driver	.80
7450	Expandable dual 2-wide 2-input AND-OR-invert gate	.20
7451	Expandable dual 2-wide 2-input AND-OR-invert gate	.20
7472	J-K master-slave flip-flop	.30
7473	Dual J-K master-slave flip-flop	.40
7474	Dual D-type edge-triggered flip-flop	.40
7475	Quadruple bistable latch	.75
7476	Dual J-K master-slave flip-flop with preset and clear	.40
74L78	Dual J-K master-slave flip-flop	.40
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7489	64-Bit read-write memory (RAM)	3.00
7490	Decade counter	.90
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7493	4-Bit binary counter	1.15
7495	4-Bit right-shift left-shift register	.75
74121	Monostable multivibrator	.60
74123	Dual retriggerable monostable multivibrators with clear	1.50
74193	Synchronous 4-bit binary up/down counter with preset inputs	1.00

*With open collector output

LINEARS

NE540	70-Watt power driver amp	$1.00
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NE560	Phase lock loop DIP	2.00
NE561	Phase lock loop DIP	2.00
NE565	Phase lock loop TO-5	2.00
NE566	Function generator TO-5	2.00
NE567	Tone decoder	2.50
NE5558	Dual 741 op amp MINI DIP	.90
710	Voltage comparator DIP	.60
711	Dual comparator DIP	.25
723	Precision voltage regulator DIP	1.00
741	Op amp TO-5/MINI DIP	.55
747	Dual 741 op amp DIP	1.00
748	Op amp TO-5	1.00
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CA3045	5 NPN transistor array	.75
CA3026	Dual differential amp	.75
LM100	Positive DC regulator TO-5	.50
LM105	Voltage regulator	1.00
LM302	Op amp voltage follower TO-5	1.25
LM311	Comparator DIP	1.00
LM370	AGC amplifier	1.00
LM703	RF-IF amp epoxy TO-5	.25
LM3900	Quad op amp	2.00
LM1595	4-Quadrant multiplier	1.00

8093-8094	Tri-state quad buffer DIP	$1.00
8850-9601	One-shot multivibrator DIP	1.50
8811	Quad 2-input MOS interface gate 15V open collector DIP	.30

RTL EXPERIMENTER PACKAGE

We purchased a computer using RTL logic. All the ICs are Motorola plastic DIP 700 series. Each board contains 3 or 5 ICs and a gold-plated standard 42-pin finger connector. VCC and ground are connected to all ICs, and a .05 bypass is provided. Each active pin of all ICs on the board go to a pin on the connector.

BOARDS AVAILABLE:

#1	3 MC724P Quad 2-input gate	$1.25
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#4	3 MC792P Triple 3-input gate	1.25
#5	5 MC799P Dual buffer	1.25

SOCKETS FOR BOARDS:

Bank of 5 bussed together to take 5 boards - gold-plated wire $2.50

Ten bussed together $4.50

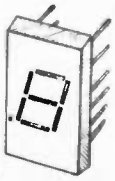
Set of 5 boards and sockets with data and applications $7.95

LSI CALCULATOR ON A CHIP

This 40-pin DIP device contains a complete 12-digit calculator. Adds, subtracts, multiplies, and divides. Outputs are multiplexed 7-segment MOS levels. Input is BCD MOS levels. External clock is required. Complete data is provided with chip (includes schematic for a complete calculator).

Complete with data $7.00
Data only $1.00

SLA-1 OPCOA



Pin compatible with MAN-1.

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Mounts on .4" centers.

Left-hand decimal point.

$2.00 Each; 10 For $16.00

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20 Ohm	2K	100K
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100 Ohm	10K	250K
200 Ohm	20K	500K
500 Ohm	25K	1 Meg

Each Only 89¢

Ten for $7.50

Please specify P or L (PCB or wire leads). Order NOW, these won't last!

COUNTER DISPLAY KIT—CD-2

This kit provides a highly sophisticated display section module for clocks, counter or other numerical display needs.

The RCA DR-2010 Numitron display tube supplied with this kit is an incandescent seven-segment display tube. The .6" high number can be read at a distance of thirty feet. RCA specs. provide a minimum life for this tube of 100,000 hours (about 11 years of normal use).

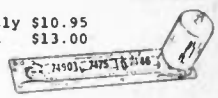
A 7490 decade counter IC is used to give typical count rates of up to thirty MHz. A 7475 is used to store the BCD information during the counting period to ensure a non-blinking display. Stored BCD data from the 7475 is decoded using a 7447 seven-segment decoder driver. The 7447 accomplishes blanking of leading edge zeroes, and has a lamp test input which causes all seven segments of the display tube to light.

Kit includes a two-sided (with plated through holes) fibreglass printed circuit board, three IC's, DR-2010 (with decimal point) display tube, and enough Molex socket pins for the IC's.

Circuit board is .8" wide and 4 3/8" long. A single 5-volt power source powers both the IC's and the display tube.

CD-2 Kit Complete Only $10.95
Assembled and Tested $13.00

Board Only $2.50



RCA DR2010 NUMITRON

RCA DR2010 Numitron digital display tube. This incandescent five-volt seven-segment device provides a .6" high numeral which can be seen at a distance of 30 feet. The tube has a standard nine-pin base (solderable) and a left-hand decimal point. Each $4.00
SPECIAL 5 for $17.50

COUNTER DISPLAY KIT—CD-3

This kit is similar to the CD-2 except for the following:

a. Does not include the 7475 quad latch storage feature.
b. Board is the same width but is 1" shorter.
c. Five additional passive components are provided, which permit the user to program the count to any number from two to ten. Two kits may be interconnected to count to any number 2-99, three kits 2-999, etc.
d. Complete instructions are provided to pre-set the modulus for your application.

CD-3 Board Only $2.25
IC's, 7490, 7447 $2.75
RCA DR2010 tube $5.00

Complete kit includes all of the above plus 5 programming parts, instructions, and Molex pins for IC's. Only $9.25

LM309K: 5-VOLT REGULATOR

This TO-3 device is a complete regulator on a chip. The 309 is virtually blowout proof. It is designed to shut itself off with overload of current drain or over temperature operation. Input voltage (DC) can range from 10 to 30 volts, and the output will be five volts (tolerance is worse case TTL requirement) at current of up to one ampere.

Each $1.50 5 for $7.00

Babylon Electronics Inc.

Post Office Box J, Carmichael, California. 95 608 U.S.A.

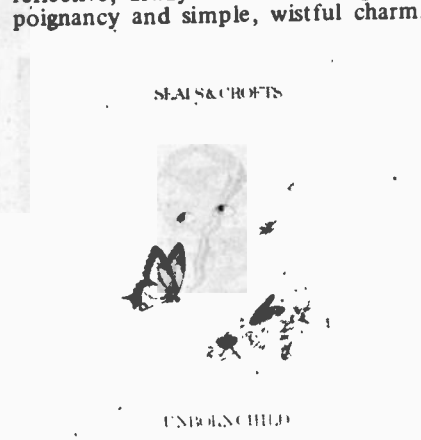
RECORDINGS POP

REVIEWER: Mike Delaney

"Wild Tales" – Graham Nash. W.E.A./Atlantic. Stereo.SD.7288.
"Abandoned Luncheonette" – Darryl Hall/John Oates. W.E.A./Atlantic. Stereo.SD.7269.
"Unborn Child" – Seals & Croft. W.E.A./Warner Bros. Stereo.W.2761.

Three warmly lyrical, vividly poetic albums lilting with melody, much love. A whole new batch of Sunshine musics:

"Wild Tales", the second Nash solo, eloquently follows his oft-brilliant "Songs For Beginners" (Atlantic/Stereo.S.D.7204) – a fine, memorable set of songs by the man who gave C.S.N. & Young such fortitude in heart. At times intensely reflective, always with such engaging poignancy and simple, wistful charm, Nash's optimistic, reassuring way with song poems is always a joy. And never more so than now. "Oh! Camil (The Winter Soldier)", a biting reaction to the atrocities of war, the tender "You'll Never Be The Same", "Hey You (Looking At The Moon)", the jubilant "And So It Goes" and delicate, moving "Another Sleep Song" are some of the best. Innocence, Sorrow, apprehension, Spiritual Affirmation by love – songs to make you feel less alone. A beautiful, sensitive album.



Darryl Hall and John Oates work through a more objective, musically complex approach, based on heavily augmented/orchestrated country ballads and a keenly inventive ear for melody and arrangements. "Abandoned Luncheonette", their third set (second in Australia) sizzles with all that's best in contemporary Roots Americana as seen by two veteran Nashville studio boys with that Southern up-town sensibility and laid-back nature. A refreshing, glowingly musical album with that special air culled from free, open spaces. Nice one, this.

"Unborn Child" continues in the vein of Seals & Crofts' last two albums, "Summer Breeze" (Warner Bros/Stereo.BS.2629) and "Diamond Girl" (Warner Bros/Stereo.BS.2699) with a collection of breezy, effervescent love songs, light jazz motifs and persuasive country/folk balladry – each track with that characteristic warmth, wide-eyed wonder and joyful, accepting grace in spirit. Seals & Crofts, as we have come to appreciate – Fair sky melodies bathed in sunlight, played with reverence, gentility, poetic tenderness. Another for the collection: the anti-abortion "Unborn Child", a host of gorgeous love ballads, "Windflowers", "Rachel" and the delightful "Dance By The Light Of The Moon" highlight.

"Back Street Crawler" – Paul Kossoff. Festival/Island. Stereo.L.35066.

As guitarist with the original Free through their first five albums, Kossoff's economy, brevity, cleanliness and insistent, hypnotic use of simple lick/chord suspensions heightened and intensified the band's penchant for moody, spatial rock/blues – sometimes sinister, mostly menacing, always with a depth, tastefulness and sense of dramatic hell fire that marked them aside as one of the truly great sixties' English outfits.

A somewhat limited, not overly imaginative nor inventive guitarist, Kossoff works best under strict back bone discipline (as the third instrument in Free sandwiched between Andy Frazer's superbly lyrical bass and the ever reliable Simon Kirke martial percussion). As a demi-god virtuoso, the reason behind his debut "Back Street Crawler" set, he lacks most every grace – like a dog chasing its tail for something constructive to play with.

Simply, nothing gels. There's no spirit of adventure, virtually no texture/tone variation, a paucity in range and technique, near inspirational bankruptcy. As an individual musician, Kossoff's ambitions far exceed his ability. What he needs is his former discipline, desperately, in this day and age the point of jamming deathlessly across one complete side i.e. "Tuesday Morning", is just ludicrous. Eric Clapton he ain't.

"These Foolish Things" – Bryan Ferry. Festival/Island. Stereo.L.35015.

Another burnt offering at the altar of ego – Bryan Ferry, Roxy Music's founder/leader/master of ceremonies, the Noel Coward of British rock and newly elected Prince of Art Deco Sleaze: "These Foolish Things", his first solo in the style of Bowie's "Pin Ups" grants him the opportunity to play Russian Roulette with a baker's dozen of *his* own favourite mouldie-oldies.

Dylan's "A Hard Rain's A-Gonna Fall", Jagger/Richard's "Sympathy For The Devil", the Beatles, "You Won't See Me" and a host of golden haemmorhoids from Lesley Gore, the Beach Boys, Smokey Robinson, Goffin/King amongst others – everything done with a blend of camp overstatement, foppish cynicism, parched dry humour, bulk haughtiness and pretention; everything done brylcreem slick and mostly vacuous. The ultimate in current British chic – a half-baked camp curio from Mr. Genuis-Is-Pain, Bowie's original "Cracked Actor" affectation in the flesh.

An album to prove how cool you are.

"Essence To Essence" – Donovan. C.B.S./ Epic. Stereo.ELPS.3684.

Donovan the minstrel eloquently restating the themes of his "Gift From a Flower To a Garden" ideology one-more-time. Since his artistic peak circa "Wear Your Love Like Heaven"/"H.M.S. Donovan", both melody and lyric have lost much in the way of poetic distinction – only one or two tracks i.e. "Dignity Of Man", the lilting "Life Is A Merry-Go-Round", come anywhere near evoking the intensity, intimacy and poignant beauty of his former work. Not a bad album but far from his inspired, insightful best – "Essence To Essence" verges, at times dangerously close, on truism and melodic cliche. Still, despite it all, there's "Dignity Of Man":

'Make a song song maker
Sing of love sweet love
Do not make it a shaker
Make it move from above
Sing it strong and gentle
Sing it sweet and low
Let the words be simple
So that all may know –
The Dignity of Man.'

After you don't believe the way the brand new decks sound, you won't believe the way they're priced.

The beauty of Pioneer's cassette decks is the way they reproduce high fidelity sound from unbelievably tiny cassettes. In fact, no others on the market with prices comparable to Pioneer's new CT-5151, CT-4141A, and CT-3131A give you so much sound for the money. Take, for instance, CT-5151, the top-notch among the three featured here. With a frequency response range from 30 to 16,000Hz, a built-in Dolby* noise reduction unit, and long life ferrite solid tape head, you're going to want to compare CT-5151 with most of the expensive reel-to-reel decks. CT-5151 is, indeed, loaded with a lot more features like normal/chromium dioxide tape selector (bias/equalizer independently switchable), full-automatic stop mechanism, tape running pilot light, peak level indicator, over-level limiter, electronically controlled DC motor, and even a memory rewind switch. If you've ever doubted the sound quality of cassette tape, now's the time to hear it all over again. On the CT-5151, CT-4141A, and CT-3131A, just a few of many quality high fidelity products made by Pioneer. To see and listen to them, please contact your nearest Pioneer Dealer.

Dimensions:	15⅝(W) × 9½(D) × 3¾(H) inches.	
Weight:	CT-5151	10 lb. 9 oz.
	CT-4141A	10 lb. 6 oz.
	CT-3131A	9 lb. 11 oz.

Pioneer Electronics Australia Pty. Ltd.
256-8 City Road, South Melbourne Victoria 3205,
Australia Phone: 69-6605
Branches are in all states.
*"Dolby" is a trademark of Dolby Laboratories Inc.

PIONEER®

"Viva La Trance" – Amon Duul II. Festival/U.A. Stereo.L.35028.

Another German miasma of old Zappa licks, psychedelic obscurities, cliched cosmic consciousness and the usual jazz/rock random-rootings-around inanity – everything super serioso, mock mystic mysterioso. Placed somewhere akin to the Hawkind Space Ritual, Amon Duul II noodle with much bravado about NOTHING. As they say, an apocalyptic bore. Forget it.

"Ass" – Badfinger. E.M.I./Apple. Stereo.SAPCOR.27.

Inexplicably held from release for over twelve months, Badfinger's last album under Apple contract just about scrapes the bottom of the opo/rock/schlock bowl in a frustrating search for anything remotely worthwhile, leastways novel, to say. A stale, lack-lustre set which fails to capture their former early Beatles-like charm in both distinctive, catchy melodies and perceptual lyrics. Badfinger have been superseded by more complex and articulate bands such as 10 C.C. – in their shadow, the "Come & Get It" crew sound decidedly undynamic, mostly dated. ●

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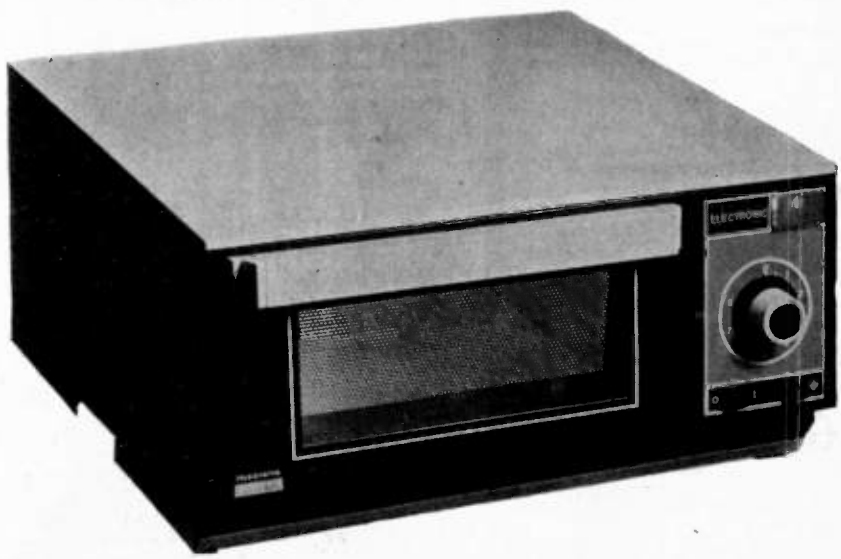

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AF116N	85c	MJE3055	2.00		
ASZ15	3.55	2N5459 (MPF105)	95c	2N3638	45c
ASZ16	3.60	2N5485 (MPF106)	95c	2N3638A	55c
ASZ17	3.55	OC44n	40c	2N3640	60c
AY9149	1.35	TT801	1.00	2N3641	45c
BC107	25c	2N706	80c	2N3642	45c
BC(208)108	24c	2N2646	1.20	2N3643	75c
BC109	25c	2N3053	80c	2N3644	45c
BC177	28c	2N3054	1.55	2N4249	50c
BC179	28c	2N3055	1.19	2N4250	50c
BD139	1.50	2N3564	55c	2N5294	1.10

INTEGRATED CIRCUITS . . . at ROCK BOTTOM PRICES.

By N.S., Fairchild, Motorola, Signetics, S.T.C. & Philips etc.

SN7400	59c	SN7476	1.18
SN7402	59c	SN7490	1.23
SN7403	59c	SN7492	1.48
SN7404	59c	SN7493	1.48
SN7406	59c	SN84121	1.18
SN7408	59c	SN84192	3.95
SN7410	59c	LM301A	1.25
SN7413	79c	LM307	2.20
SN7420	59c	LM308	3.95
SN7430	59c	LM370	4.35
SN7440	59c	LM372	3.65
SN7441	2.18	LM373	5.50
SN7442	1.98	LM380	2.85
SN7446	2.00	LM565	7.50
SN7447	3.00	LM709	95c
SN7472	99c	LM710	1.20
SN7473	1.18	LM723	1.50
SN7474	1.18	LM741	1.15
SN7475	1.48		

NE555 Timer	2.40
M5933 Dual 4 Input Expander	58c
M5935 Hex-Inverter w/o Input. Diode	58c
M5945 Single R-S/JK Flip-Flop	58c
M5946 Quad 2 Input Nand gate	58c
M5962 Triple 3 Input Nand gate	58c
DM946 DTL Quad 2 Input Nand gate	1.40
MC1810P MDTL . . . Nor gate	1.50
MM5311 MOS Digital clock	17.00
7806 Voltage Regulator, 6V	4.95

M.S.C.'s HOT SPECIALS

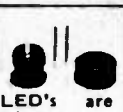
Hewlett-Packard LED's RED 1.6v 20-50mA 28c

240v Neon Bezel lamps, Red, Green, Orange, White 45c

2N3055	1.19
AY9149	1.35
10 BC177/178 Unmarked	95c
10 TT800/801 Unmarked	95c

MONSANTO

Mini RED LED's	30c
GREEN LED's	1.50
YELLOW LED's	1.50



Green & Yellow LED's are complete with mounting kit.

MINI-GREEN LED & MTG KIT. 75c

I.C. SOCKETS

8pin for T05 Pack.	50c
10pin for T05 Pack.	60c
8pin Dual-in-line	40c
14pin Dual-in-line	40c
16pin Dual-in-line	45c
16 pin Dual-in-Line (Wire wrap)	55c

MONSTER CAPACITOR PAC . . . BIG value at a LOW price. PAC includes 25 different branded Electrolytics' and 25 different branded Polyester, ceramic and Mica capacitors. We guarantee 50 different values and types. All NEW, UNUSED and PERFECT. Estimated value of this would be $15.00. Our very special offer only $5.00 P&P 35c.

TRIACS – S.C.R.'s – BRIDGES

Triacs	
SC 146D 400v 10amp	2.25
TC 1102 (With Diac) 400v 6amp	2.75
S.C.R.'s	
BT100A/300R 300v 2amp	2.10
C122D 400v 8amp	2.20
BT101/500R 400v 6amp	3.70
2N6240 (C106D1) 400v 4amp	1.85
Bridges	
MB4 400v 2amp	1.75
PA40 400v 8amp	5.10
PA60 600v 8amp	5.90
PB40 400v 25amp	6.70

'RODAN' DIGITAL INDICATOR TUBE

Type GR-211. Electronic gas-filled Cold Cathode display device. In-line 9-0 Side viewing. Anode supply voltage 200v Diameter of Glass Tube 30mm. Height of digits 35mm. Colour of display digits Neon Red. $2.50 each to clear Data sheet supplied.

SINCLAIR

The last few left in the country. Impossible to beat prices.

Stereo 60 Pre-amp	28.00
Active Filter Unit	17.50
PZ6 Power Supply Unit	24.00

Post and Packing $1 per unit.

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M5102AY 3watt Audio Amplifier in modified Jedec T03 Case. Will operate between 12 & 18v. Supplied complete with Data and construction sheet components and fully prepared PC board. TO CLEAR only $5.95 P&P 35c.

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Imported high quality. From 100ohms to 1megohm. Fantastic value at only 12c each. 10 for $1.00. P&P 20c.

GREATEST OFFER OF HYBRID POWER AMPLIFIERS EVER MADE.

Full descriptive Data supplied with each one.

ITT TA-20 20 watts	$5.95
ITT TA-20C 20 watts	$11.95
Sanyo STK015 (TA10B) 10watts	$7.00
Sanyo STK032 (TA25C) 25watts	$15.75

P&P 35c.

DIODES. Prices slashed to ribbons

BZY88 400mW Series up to 20V	33c each
BZX79 400mW Series up to 20V	30c each
BZX70 1.8W Series up to 22V	70c each
BZY93 10W Series, only 12V	1.35 each

POWER DIODES . I.T.T. — G.E. — I.R.

EM401	100v 1amp	20c
EM402	200v 1amp	20c
EM404	400v 1amp	20c
EM408	800v 1amp	30c
EM410	1000v 1amp	35c
A14A	100v 2.5amp	30c
A15A	100v 3amp	95c
A14P	1000v 2.5amp	95c
IS94	500v .36amp	25c
RS812	120v 80amp	2.45

P&P 40c

SMALL SIGNAL DIODES

AA119	10c
OA90	15c
OA95	15c
IN914	10c

PLESSEY 3 + 3 AMPLIFIER KIT

Beautifully packed easy to build kit. Complete with Volume, bass and treble controls, power supply and components (Transformer not included) and Plessey I.C.'s. Complete with comprehensive instructions. Price $28.50 plus 75c post. Transformer to suit A & R 5508 $7.50 plus 50c P&P.

MULTIMETER

Model SK 140

A truly remarkable instrument for a very modest price. Specifications: DC Volts: 2.5, 10, 50, 250, 1000 (20 Kohm/v) AC Volts: 10, 50, 250, 500, 1000 (10Kohm/v). DC Current: 50μA, 25mA, 250mA, Resistance: 40Kohms, 4 megohms. $14.00 P&P 50c.

MAKE YOUR OWN STROBOSCOPE . . .

The best value in Tubes & Transformers. 'ELEVAM' Strobe Flash Tube. Type MFT-1000. Voltage rating 200-400V. 100 flashes per second. $4.20 P&P 30c. 'ELEVAM' Trigger Transformers. Type TR4SK 4Kv $2.50 P&P 15c.

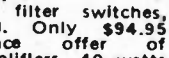
DEITRON AMPLIFIERS

Hi-Fidelity Stereo Amplifiers

TRUE VALUE FOR MONEY.

DSA-88. 16 watts RMS. Slide type controls. PB Selector switch. Our price only $74.95.

DSA-10-10. 20 watts RMS. Extra features include Main & Remote speaker switching.



High and low filter switches, loudness control. Only $94.95 Special clearance offer of 'DIAMOND' Amplifiers, 40 watts RMS. Normal price $135.00. To clear $89.95. All Guaranteed and New. P&P. $2.50 per Amp.

McMURDO Isostat Push-button switch assemblies. For ET-420 Amplifier. Type 2904-1 $1.05; Type 2900-4 $3.55; Type 2899-4 $3.90.

TOGGLE SWITCHES 240v 10a SPDT Black or White body 38c; SPDT Change-over Black or White body 48c; SPDT Rocker switch 45c.

C.O.D. Please add 95c to postage. NO orders under $2 accepted. S.A.E. For replies please P & P 30c where not included. Please print your name and address.

4-CHANNEL QUADRAPHONIC CONVERSION UNIT.

The 'QUADRONEC' QR-4 LED connects easily to most existing amplifiers, stereos and stereograms. 8 ohms. 10-50 watts. No additional amplifiers necessary — just connect speakers to the QR-4. Play your stereo collection with CONCERT HALL effect and all types of quadraphonic matrix records. Tested and approved by all leading sound equipment manufacturers. Last stocks at a very special price of $49.50, normally $75.00 P&P $1.00. Fully descriptive leaflet supplied. GUARANTEED.

'VORTEX'

Stereo Cassette Deck mechanism with tape eject facility and resettable counter. Easily operated by 5 push-button (piano key) controls, and includes high quality 'ALPS' recording, play-back and erase heads. Tape speed 4.7cm (1-7/8") sec. Plus or minus 1.5%. Wow and flutter less than 0.25%. Operates on 240VAC. Full data and specifications supplied with each purchase. Our price now only $27.50 P&P $1.00.

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The greatest value ever in these superior type record decks. Raved about far and wide, and at the moment in extremely short supply. Only limited quantities available, and at these prices are bound to rise again.

BMU-121 Fully manual $77.65
BRU-121 Semi-Automatic
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P & P all types $3.50

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All belt driven for 240 volt/50 Hz, complete with Stereo magnetic cartridges with diamond stylus — wired ready for audio and A.C. input.

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THORN-ATLAS 2 Track & 4 Track tape Decks suitable for 5" Reels. ALL NEW — GUARANTEED & CARTONED. Complete with moulded front Panel and Bezels. Push-button controls, 240VAC 50 Hz Motor with Fan, Mono or Stereo Record/Replay & Erase Heads. ONLY LAST FEW REMAINING. 2 Tracks $14.50 4 Track $19.50. Postage rates: N.S.W. 75c. Vic & Qld $1.15. S.A. & W.A. $1.50. N.T. & Tas. $1.65. N.Z. $4.25.

GREAT CLEARANCE OFFER OF 'DISCATRON' PORTABLE RECORD PLAYING DECK MECHANISM'S.

Suitable for 7" records at 45rpm. Includes superior 12VDC Motor, Sapphire stylus. Housed in handsome metal case and complete with carrying handle and full instructions. Personal Callers only. $1.95. AMAZING VALUE . . . Must be cleared to make room.

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Type AD-8065/W8 8" 20W RMS 8ohm $14.00 (WOOFER)
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Introducing the Bose 901 Series Two—it's everything that the original 901 was, and more: • Multiplicity of acoustically-coupled full-range drivers • Flat power radiation • Completely new Active Equalizer design, suited to program source variations never available before, and adapted to a much wider range of room environments (even drapes) • and SYNCOM™ II Speaker Computer quality control testing.

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We invite you to challenge us! Compare the Bose 901 Series Two to any other speaker, regardless of size or price; and compare the Bose 501 Series Two to any speaker up to the price of the 901 Series Two. You be the judge. If we have done our homework correctly, the comparison will be interesting and short!

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