ELECTRONICS
Australia

December 1970



Splash of colour from Veall's Audiotorium

AUDIO HI-FI FEATURES

How to Check on Pickup Tracking

Loudspeakers and Listening Rooms

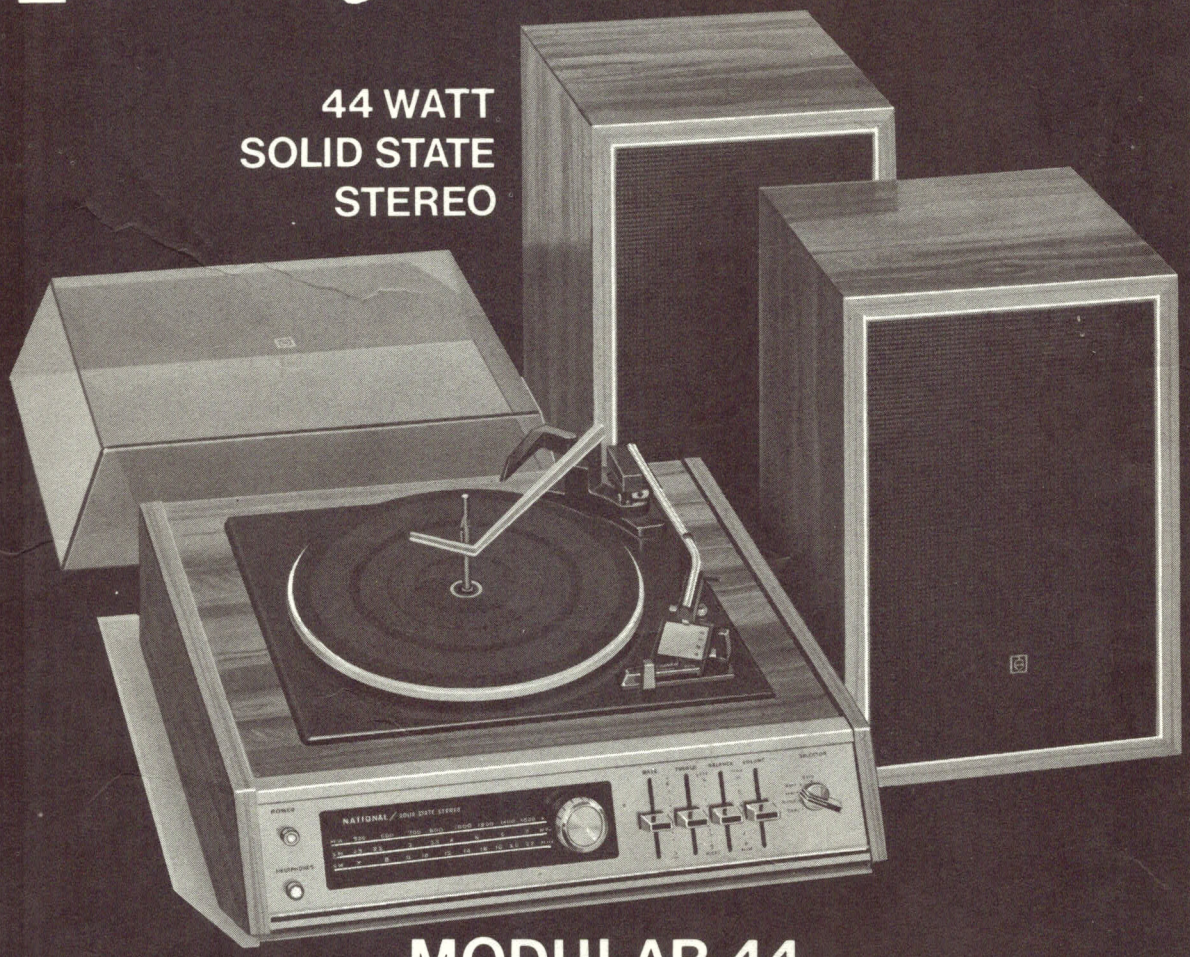
Record Reviews: Classical, Popular, Jazz

Review of Sony TA1010 Stereo Amplifier

Registered for posting as a periodical—Category B

the new National party machine

44 WATT
SOLID STATE
STEREO



MODULAR 44

You have to hear it to believe it. Pure sound. Peak music power 22 watts per channel. Clear as a bell at full blast. All solid state. Four-speed turntable to play *all* your records. Automatic/manual changer to handle them all with care. Four-speaker system with a woofer and a tweeter in each cabinet. The tuner/turntable unit incorporates a multi-band radio. Slide controls on a canted tuning panel let you adjust bass, treble, balance or volume precisely, with a flick of a finger-tip. Put on a stack of your favourite discs and throw a party for your ears. Talking discs. Singing discs. Gentle instrumentals. Booming orchestrals. The Modular 44 does full justice to them all. And when they're finished the system automatically switches off. All three handsome pieces built in solid wood. Teak or walnut. Send us the coupon and find out more.

National NATIONAL

TO HACO DISTRIBUTING AGENCIES PTY. LIMITED
57-69 Anzac Parade, Kensington, N.S.W. 2033

HACO

I must know more about the NATIONAL SS-3040 Modular 44 stereo system. Please send me free literature.

NAME.....

ADDRESS.....

.....POSTCODE.....

Printed and published by Sungravure Pty. Limited, of Jones Street, Broadway, at Morley Avenue, Rosebery.

ELECTRONICS Australia

Incorporating "RADIO, TELEVISION and HOBBIES"

ABC certified circulation in excess of 50,000

Volume 32, number 9

TV BY STARLIGHT. *Designers of TV camera tubes have succeeded in developing pickup tubes which are so sensitive that they can produce clear pictures of scenes illuminated only by the light of the stars. Page 12.*

LASER SURGERY. *British scientists have developed a practical system which will enable lasers to be used in the operating room as a "knife" capable of making incisions without causing bleeding. Story begins on page 22.*

THE EA160 RECEIVER. *Complete instructions and circuits for the construction of an AM/CW/SSB receiver are contained in the article beginning on page 72. It features modern circuit techniques, but is not unduly difficult to build.*

PICKUP TRACKING ERROR. *In response to the numerous letters received asking for advice on pickup tracking error, we publish this article explaining what causes the problem and how it can be overcome. Page 105.*

Editorial Office:
12th Floor, 235-243 Jones Street, Broadway, Sydney, Australia. Phone 2 0944.

Postal Address:
Box 2728, GPO, Sydney, 2001, Australia.

Advertising:
Manager, Howard Jenkins.
Sydney Representative, Bill Summons, Office: 8th Floor, 235-243 Jones Street, Broadway, Sydney. Phone 2 0944.
Melbourne Representative, Clarrie Levy, Office, 374 Little Collins Street, Melbourne, 3000. Phone 67 7021.

Circulation:
Alan Parker, Manager, Office: 9th Floor, 235-243 Jones Street, Broadway, Sydney. Phone 2 0944.

Subscription Rates: See back page.

Representation:
Melbourne — John Fairfax and Sons Ltd, 374 Little Collins Street, 3000. Phone 67 7021.
Brisbane — Sungravure Pty Ltd, 78 Elizabeth Street, 4000. Phone 2 6688.
Adelaide — John Fairfax and Sons Ltd, 104 Currie Street, 5000. Phone 51 3502.
Perth — Sungravure Pty Ltd, 454 Murray Street, 6000. Phone 21 8217.
Newcastle, NSW—Associated Newspapers Ltd, 22 Bolton Street, 2300. Phone 2 3696.
London — John Fairfax and Sons (Aust) Ltd, Reuter Building, 85 Fleet Street.
New York — "The Sydney Morning Herald" Ltd, 1501 Broadway, New York, NY 10036.

Distribution:
Distributed in NSW by Sungravure Pty Ltd, Jones Street, Broadway, Sydney; in Victoria by John Fairfax and Sons Ltd, 392 Little Collins Street, Melbourne; in South Australia by John Fairfax and Sons Ltd, 104 Currie Street, Adelaide; in Western Australia by John Fairfax and Sons Ltd, 454 Murray Street, Perth; in Queensland by Gordon and Gotch (A'sia) Ltd; in New Zealand by News Media Ownership Ltd; in Tasmania by Davies Bros Ltd, "Mercury," Hobart.

Copyright. All rights reserved.
Devices or arrangements shown or described therein may embody patents. Information is furnished without prejudice to patent rights and without responsibility for circumstances which might arise from its application.

CONTENTS — DECEMBER, 1970

features

3 Editorial — a matter of some import
12 TV by starlight
21 Silicon target TV tube
22 Laser surgery
24 Electronic tools for archeology
62 Electronics servicing and its problems

technical digest

29 Automatic micrograph scanner
21 Ultra pure germanium
33 CCTV surveillance in prison

technical articles

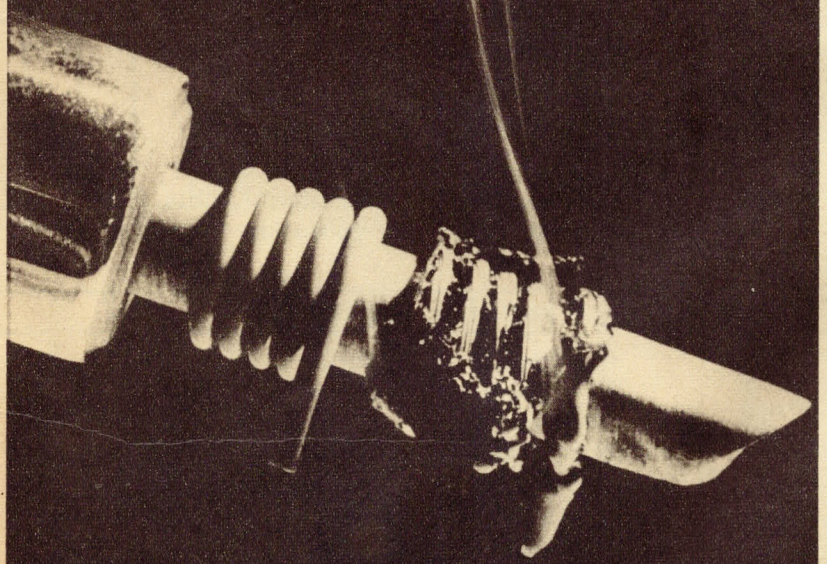
44 Versatile public address amplifier
55 Test chart for CCTV cameras
56 Automated testing
58 Checking surplus crystals
72 The EA160 short-wave receiver
88 Daylight controls interior lights
91 Microwaves go solid state

regular features

10 Electronics pictorial
35 Scientific and industrial news
52 Forum
99 Reader built it
105 Audio topics — pickup tracking error
112 Audio topics — room acoustics
117 Record reviews — classical
125 Record reviews — devotional, popular, jazz
141 Trade reviews and releases
153 Technical books and publications
160 Amateur band news and notes
172 Listening around the world
181 Answers to correspondents
187 Radio: unofficial history
191 Market place — classified advertisements
192 Index to advertisers
Notes and errata

PHILIPS

We proved Philips Teflon* Insulated Hook Up Wire withstands searing heat above 375°C.



*Du Pont Registered Trade Mark

This dramatic test shows normal commercially available PVC hook up wire disintegrating at a temperature of 375° C on the soldering bit. The Teflon Insulated Hook Up Wire remains unimpaired. Tested with Siemens Laboratory Thermocouple.

Teflon Insulated Hook Up Wire gives excellent, highly stable electrical properties.
Minimum dissipation factor, low dielectric constant, highest volume and surface resistivity of any solid insulation . . . all constant over a wide range of frequencies and temperatures. Plus high dielectric strength.

- Resistance to high temperatures and heat-aging
- Non-flammability
- Inertness to corrosives, fuels and lubricants
- Good mechanical properties
- Unexcelled performance in space environments
- Low coefficient of friction
- Complete resistance to outdoor weathering

Teflon wire is used in many diversified industries from . . .
oil derricks . . .
to space aeronautics.

Distributed by:

"Miniwatt"
electronics division of
Philips Industries Limited

Sydney • Melbourne •
Brisbane • Adelaide •
Perth • Canberra

PHILIPS

38.1120



EDITORIAL VIEWPOINT

by Neville Williams

A matter of some import...

EDITOR
Neville Williams
M.I.R.E.E. (Aust.)
(VK2XV)

ASSISTANT EDITOR
Philip Watson
A.M.I.R.E.E. (Aust.)
(VK2ZPW)

TECHNICAL EDITOR
Jamieson Rowe
B.A. (Sydney), B.Sc.
(Technology, N.S.W.)
M.I.R.E.E. (Aust.)
(VK2ZLO/T)

TECHNICAL STAFF
Ian Pogson (VK2AZN)

Harry Tyrer (VK2ZHH)

George Hughes

John Horsfield

Robert Flynn

Leo Simpson

Philip Pik

Ross Tester (VK2ZVO/T)

The question of whether equipment should be built or bought is always good for an argument, when radio amateurs get together for a "rag chew". As a rule, the discussion assumes an automatic supply of recruits to the amateur ranks, the number simply dividing into the builders and the buyers. More builders mean fewer buyers, and vice versa.

In fact, this sort of discussion can over-simplify the situation. It tends to ignore the fact that changing conditions in the HF and VHF spectra have ruled out much of the simpler equipment which amateurs once used to buy, adapt or contrive. Particularly on the HF bands, fairly ambitious equipment is now almost a pre-requisite to successful operation.

Nowadays, if a person wants to become active on the HF bands and plans to build his own equipment, he must have considerable resources of money, expertise and time. If he is short on expertise and time – particularly the latter – he has no alternative but to buy, and this will necessarily involve an outlay of many hundreds of dollars.

So the real speculation should not be: "builders or buyers"? It should be: "builders, buyers or non-starters"?

Which brings me to the real point of these remarks. A large share of the responsibility for the "non-starters" rests with the Government, which demands a whopping slice of every dollar which the would-be amateur might spend. It is true, of course, that the Government has recently conceded a reduction in sales tax on equipment specifically intended for use in an amateur transmitting station. But, in fact, the reduction is more significant as a principle than as a money saver.

The real slug which faces the buyer of amateur station equipment is the 45% duty, which must be paid when the equipment enters the country. Add to this 15% sales tax, plus all the implications of a higher "turnover" price and the discouragement to buy – or become an amateur at all – is painfully obvious.

If the effect of the duty was to protect Australian manufacturers, it could conceivably be justified on that score. But the simple fact is that, duty notwithstanding, virtually no equipment is manufactured in Australia specifically for amateur stations. The market is simply too small to cover developmental and manufacturing costs.

I've browsed through shops in Tokyo and Osaka, crammed with the kind of gear that could boost many potential recruits into the ranks of active amateurs. But very little of it will be seen here, because the Australian Government wants as much out of any deal as the original manufacturers!

Not to protect local industry, surely? Not for a morsel of revenue, surely?

Probably, I imagine, because amateurs and their equipment have been caught up in the draft. No one has accorded the matter the rather special consideration that it warrants. This is one area where the Government should "do" its duty.

ON SALE
THE
FIRST MONDAY
OF EACH MONTH

On the cover

A major factor in the success story of long playing records has been the opportunity for colourful display on the jackets. How colourful they can be is emphasised by this picture of a record bar at Veall's "Audiotorium", at 520 Bridge Road, Richmond, Victoria. To enhance the colour impact of the covers on display, Philips colour correction lamps are installed within the pelmets.

INSTROL HI-FI

the largest HI-FI showroom in Australia.

Just Released

Brand new range of:

PLAYER STANDS

and

PERSPEX COVERS

PLAYER STANDS

MODEL 35 STAND. Size 14½in x 15⅜in x 3½in. Complete with masonite base, rubber legs, fully veneered on all surfaces. Features attractive side panels raised by ⅛in from player panel.

Waltnut or Maple **$9.00**

Teak **$11.00**

MODEL 45 STAND. Size 17⅞in x 14⅞in x 3½in. Complete with special black surround on the base, plus a masonite safety base. Fully veneered on all surfaces. Sweeping new overseas styling.

Walnut **$10.00**

Teak **$12.00**

PERSPEX COVERS

MODEL 315. Size 14½in x 15½in x 3⅜in outside measurements. This sleek MOULDED cover in grey tinted perspex, is for use with the model 35 stand and any record player. Complete with attractive perspex knob.

MODEL 325. Size 14½in x 15½in x 4⅜in outside measurements. A fabricated grey-tinted cover, ideal for record changers in conjunction with model 35 stand. Complete with attractive perspex knob.

Model 315 . . . . . **$9.00**

Model 325 . . . . . **$10.50**

MODEL 415. Size 17⅞in x 14⅞in x 3⅜in outside measurements. This attractive MOULDED grey-tinted cover is for use with the model 45 stand and any record player. Complete with sleek perspex knob.

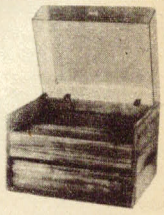
MODEL 425. Size 17⅞in x 14⅞in x 4⅜in outside measurements. A fabricated grey-tinted cover, ideal for changer models in conjunction with our No. 45 stand. Complete with attractive perspex knob.

Model 415 . . . . . **$10.50**

Model 425 . . . . . **$11.50**

(Extra for covers fitted with stay-up hinger, $1.50)

COMBINED AMP/PLAYER CABINET



This model 75 cabinet combines a player stand, attractive tinted perspex cover and amplifier cabinet (4½in x 17½in). Perspex cover comes complete with attractive perspex knob and a pair of stay-up type hinges. Cover measures 16⅜in x 14⅛in x 4⅜in inside dimensions. The cabinet comes as an easy-to-assemble kit of parts, both saving you money and facilitating transport.

Kit of parts in Maple **$25.50**

Kit of parts in Teak **$28.50**

PACKING AND REG'D POSTAGE

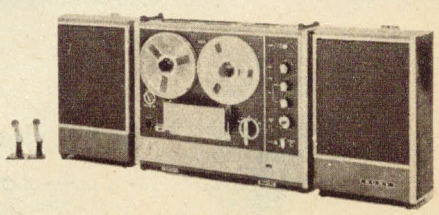
MODEL	NSW	VIC, QLD	TAS, NT, SA, NG	WA
Player stand	1.80	1.90	2.40	2.70
Perspex cover	1.80	1.90	2.40	2.70
Model 75 kit	2.70	2.95	3.95	4.50

SONY TAPE RECORDERS AND RADIOS

SPECIAL CHRISTMAS OFFER

Instrol are able to offer huge savings on the complete range of Sony Tape Recorders and Radios during the Christmas season. Write in for a fully illustrated catalogue of Sony Tape Recorders and Radios, together with our Special Christmas Price List.

BONUS OFFER. During the Christmas season Instrol will despatch any Sony Tape Recorder or Radio, FREIGHT FREE to anywhere in Australia. Not only can you purchase your Sony at the Special Christmas Price, but you can have it sent to you FREE of any freight charges.



WRITE NOW FOR OUR SPECIAL CATALOGUE AND PRICE LIST

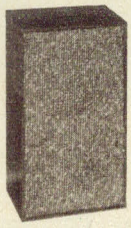
CENTRE

91a York St.(between King & Market St.)

Speaker Enclosures

Instrol Centre has the
LARGEST RANGE
of Speaker Enclosures
Available in both
KIT FORM & BUILT

MINI



Cabinet 14½" by 8 1/8" x 8½". Baffle is cut for Magnavox 6" plus 3" plus port.

Kit of Parts—maple	$9.00
Kit of Parts—teak	$10.00
Built—walnut, maple	$13.50
Built—teak	$15.50

POINT FOUR

Cabinet 14½" x 8 1/8" x 8½". Baffle is cut for Philips 6½" plus Magnavox 3" Playmaster design.

Kit of Parts—maple	$9.00
Kit of Parts—teak	$10.00
Built—walnut, maple	$14.50
Built—teak	$16.50

BOOKSHELF

Cabinet 19½" x 11½" x 6 1/8". Baffle is cut for Magnavox 6" plus 5". Playmaster design.

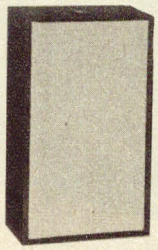
Kit of Parts—maple	$11.00
Kit of Parts—teak	$12.00
Built—walnut, maple	$20.50
Built—teak	$21.50

ONE POINT THREE

Completely sealed enclosure, of Playmaster design, 22" x 12" x 10¾". Baffle cut for 8" plus 3".

Kit of Parts—maple	$19.00
Kit of Parts—teak	$21.00
Built—walnut, maple	$30.50
Built—teak	$32.50

8" SLIMLINE



Cabinet 25¼" x 14" x 5 7/8". Distributed Port design. Baffle cut for one 8" speaker.

Kit of Parts—maple	$13.00
Kit of Parts—teak	$14.00
Built—walnut, maple	$23.50
Built—teak	$24.50

10/12 SLIMLINE

Cabinet 27¼" x 17¼" x 7". Distributed Port design. Cut for either 12", 10" or 8" speaker.

Kit of Parts—maple	$16.00
Kit of Parts—teak	$17.00
Built—walnut, maple	$27.00
Built—teak	$29.00

8" D.P.

Distributed Port, cabinet 23½" x 11" x 10¼". Cut for one 8" speaker.

Kit of Parts—maple	$18.00
Kit of Parts—teak	$19.00
Built—walnut, maple	$31.00
Built—teak	$33.00

10/12 D.P.

Cabinet 30" x 18" x 12" (3 cu ft). Distributed Port design. Cut for either a 10" or a 12" speaker.

Kit of Parts—maple	$30.00
Kit of Parts—teak	$32.00
Built—walnut, maple	$47.50
Built—teak	$49.50

All kits and enclosures are complete in every detail, and include all grille cloth and acoustic wadding (innerbond).

The baffle boards on the speaker enclosures outlined below are cut as outlined for each enclosure. However, baffle boards can be cut for your own requirements for an additional $1.00.

2 cu. ft Cabinet 27½" x 17 7/8" x 10". Cut for either one 8" or one 10" speaker.

Kit of Parts—maple	$23.00
Kit of Parts—teak	$25.00
Built—walnut, maple	$37.00
Built—teak	$39.00

MODERNE



Vented enclosure 25" x 18½" x 16". Baffle cut as requested.

Kit of Parts—maple	$28.00
Kit of Parts—teak	$29.00
Built—walnut, maple	$49.00
Built—teak	$50.00

OTHER ENCLOSURES

Instrol have a complete range of enclosures, the above-mentioned being a selection of the more popular ones. If one of the above does not suit your requirements, send in for our free speaker enclosure leaflet. (Models to suit Wharfedale and Peerless available.)

INSTROL
HI-FI CENTRE
91a York St.(between King & Market St.)
SYDNEY, 2000
(opposite Rank Xerox Building)
Phone 29-4258

for descriptive leaflet post coupon

Please include postage stamp.

Name _____

Address _____

Postcode _____

- ☐ Instrol Cabinets
- ☐ Sony Savings
- ☐ Player Stands and Covers
- ☐ Hi-Fi Equipment
- ☐ Speaker Enclosures



Model 500 with ceramic cartridge . . . $103
Model 500 with 800H Magnetic cartridge . . . $114
Model 600 with CI/ST4 cartridge . . . $114
Model 600 with 800H Magnetic cartridge . . . $125

The only triple tested total turntables. BSR McDonald.

Every BSR McDonald automatic turntable is precision made and tested in Great Britain to the most exacting specification. Upon arrival in Australia, every model is unpacked, tested and assembled in the total turntable concept, then re-tested again under actual playing conditions. That's why BSR service calls are the lowest in the industry – and perhaps that also explains why BSR sells more turntables than anyone else in the world.

The BSR McDonald 500 and 600 are complete modular units ready for use. Each unit has an ebony polystyrene base, smoke tinted dust cover, mains and audio leads – the only complete, packaged, factory tested units.

Features such as

- Dynamic anti-skate control applies continuously corrected compensation at all groove diameters.
- Cueing and pause control lever allows for exact positioning of stylus on record and permits you to interrupt listening and reposition to same groove.
- Micrometer stylus pressure adjustment permits 1/3 gram settings from 0 to 6 grams.
- Automatic lock on tone arm after last record is played.
- Dynamically balanced 4-pole induction motor has high torque, constant speed design – assuring minimum rumble and row.
- Tubular aluminium tone arm is perfectly counter-balanced both horizontally and vertically.
- Resiliently mounted, coarse and fine vernier adjustable counterweight.
- Tone arm is jam-proof even if it is held during the cycling operation.
- Clip-in cartridge holder, provides universal mounting and quick change. (Optional).



BSR A'Asia Pty Ltd
Southern Section Industrial Estate
St Marys New South Wales
Telephones 6230375 and 6230376

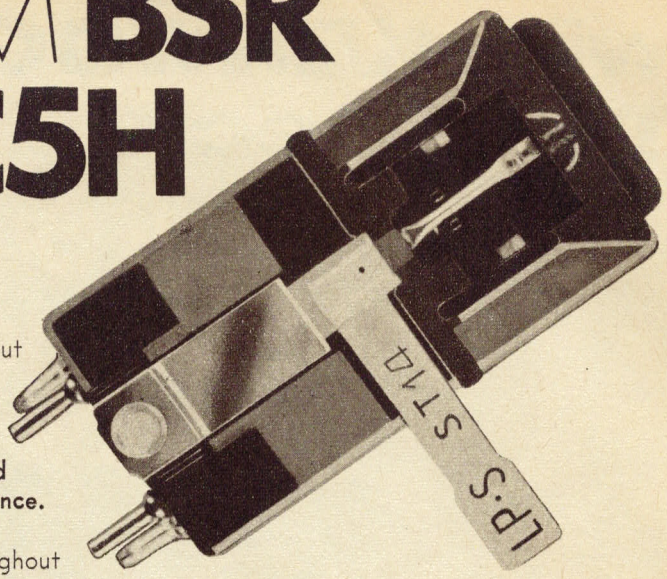
Wholesale Distributors Goldring Engineering (A'Asia) Pty Ltd **New South Wales** 443 Kent Street Sydney 2000 Telephone 29-5802/3/4 **Victoria** 162 Pelham Street Carlton 3053 Telephone 34-5105 **Queensland** 415 Adelaide Street Brisbane 4000 Telephone 2-3247 **Western Australia** 32 Northwood Street Leederville 6007 Telephone 84-988 **South Australia** 77 Wright Street Adelaide 5000 Telephone 51-5117

BSR:P 104

NEW FROM BSR

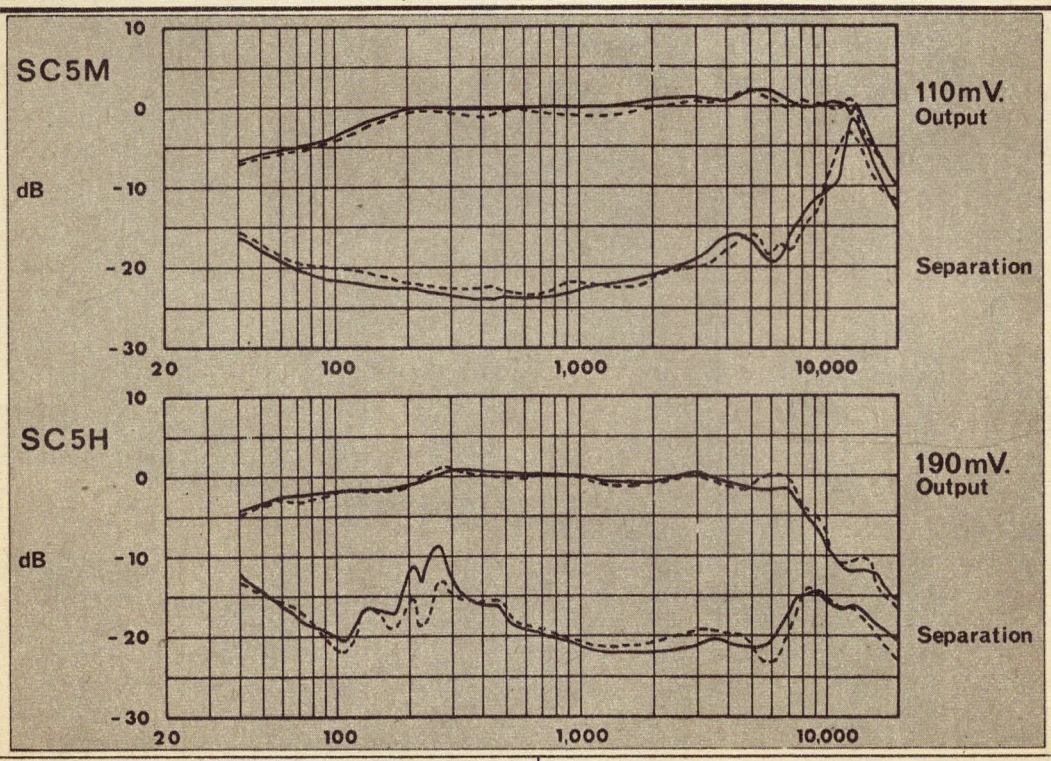
SC5M, SC5H

Stereo cartridges



The SC5M Stereo Ceramic medium output Cartridge is the first of the new BSR SC range, and the first BSR Cartridge to incorporate a de-coupled stylus arm which results in a smoother and **increased frequency response.** ☐ **Very high compliance.** ☐ Flip-over de-coupled stylus. ☐ Excellent separation and frequency response throughout the audible frequency range. ☐ Plays all stereo and mono LP and 78 r.p.m. records.

TECHNICAL DATA	SC5M	SC5H
Output at 1 Kc/s. 1.0 cm/sec (using Decca Record SXL 2057)	110 mV ± 2 dB	190 mV ± 2 dB
Horizontal Compliance	6.3 x 10^{-6} cm/dyne ± 20%	1.95 x 10^{-6} cm/dyne ± 20%
Vertical Compliance	3.0 x 10^{-6} cm/dyne ± 20%	1.25 x 10^{-6} cm/dyne ± 20%
Test Temperature	20° C—68° F	20° C—68° F
Recommended Loading	2 M Ω 100 pF	2 M Ω 100 pF
Equivalent Capacity per Channel	1.000 pF (Nominal)	1.000 pF
Channel Separation at 1 Kc/s	Greater than 15 dB	Greater than 15 dB
Channel Difference	Less than 3 dB	Less than 3 dB
Recommended Stylus Pressure	2-6 Grammes	5-7 Grammes
Colour	Graphite Blue	Graphite Blue

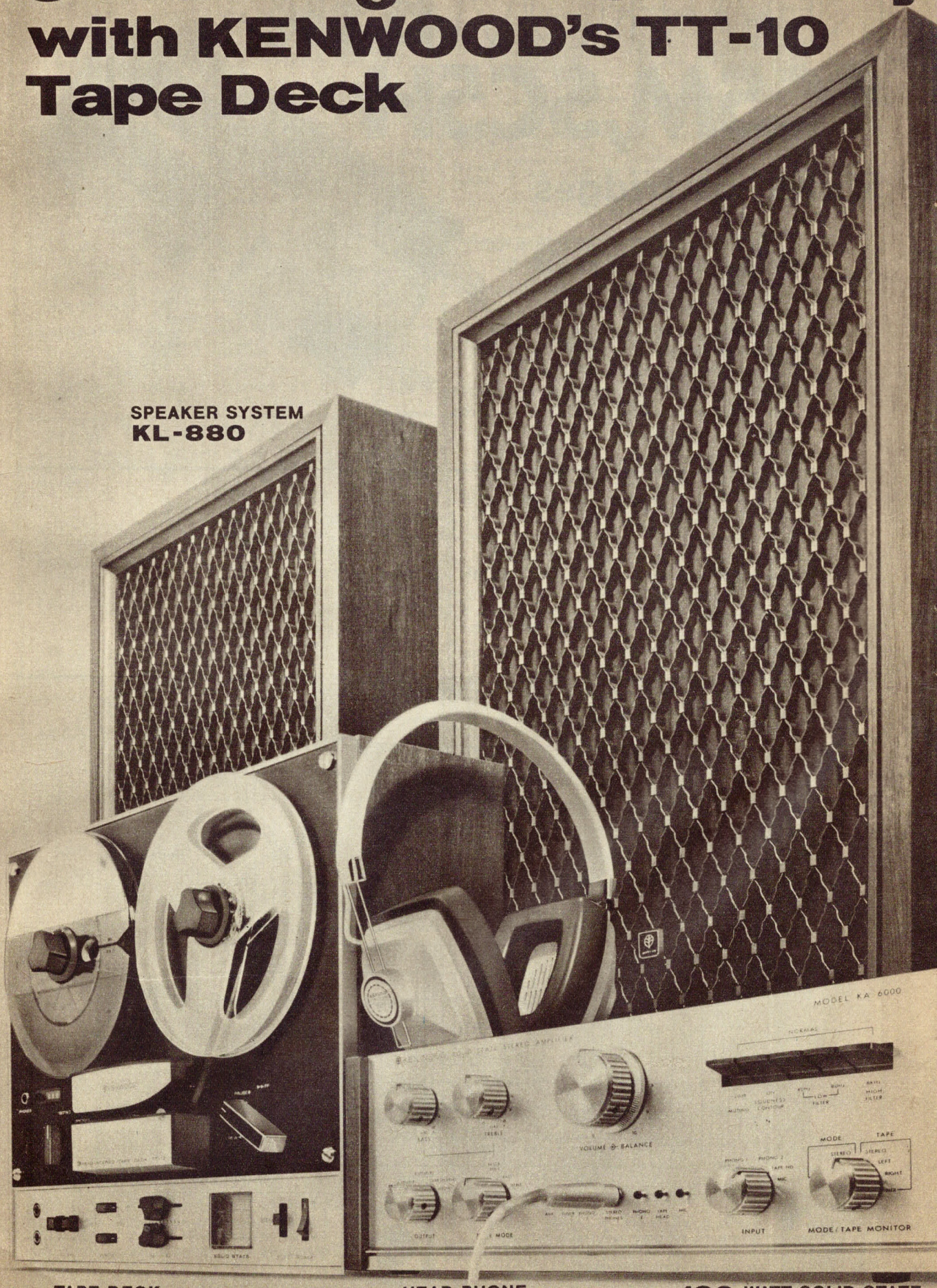


BSR (A'ASIA) PTY LTD
SOUTHERN SECTION INDUSTRIAL ESTATE
ST MARYS NSW
TELEPHONES 623-0375 623-0376

GOLDRING ENGINEERING (A'ASIA) PTY LTD
443 KENT STREET SYDNEY NSW
OFFICES IN ALL CAPITAL CITIES

BSR:P107

Streamling Your Stereo Sy with KENWOOD's TT-10 Tape Deck



TAPE DECK
TT-10

HEAD PHONE
HS-3

180-WATT SOLID STATE
KA-6000

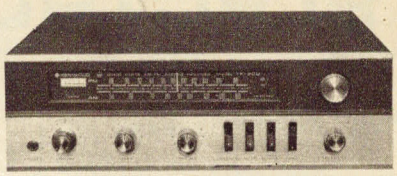
stem



STEREO AMPLIFIER

KENWOOD has the answer to the flaws that have bugged your stereo system. It's the "total circuit stereo system" – which means KENWOOD has exactly the right stereo instrument for that weak spot in your stereo system. The TT-10 tape deck is an ideal remedy. It fully minimizes recording and playback "Hiss" distortion while halting usual low frequency hum modulation. This 3-head deck has three tape speeds–7-1/2 ips and 3-3/4 ips for Hi-Fi recordings and 1-7/8 ips for speech recordings. The KL-880 4-way, 5-speaker system has a 15-inch free-edge woofer, a 5-inch cone type midrange, horn type high midrange squawkers with two tweeters. The HS-3 head phone also offers pure-tone clarity.

The KA-6000 amplifier is a dynamic 180-watt model able to drive even low efficiency speakers. Separately, as new members of your stereo system, or in a combined unit these KENWOOD instruments provide "total circuit stereo system" performance.



30-WATT
FET SOLID STATE AM/FM STEREO RECEIVER TK-20U

* F.E.T. (Field Effect Transistor) 3-Gang Tuning Condenser frontend for superior sensitivity, image rejection and cross modulation ratio.
* Dimensions:
  14-1/16"(W), 4-3/4"(H), 11-1/4"(D)



40-WATT
SOLID STATE STEREO AMPLIFIER TK-150U

* 5 pairs of input terminals for MAG, AUX 1, AUX 2, TAPE REC and TAPE PLAY,
* Damping factor: 40 (at 16 ohms), 20 (at 8 ohms)
* Dimensions:
  10-1/4"(W), 4-1/8"(H), 9-3/8"(D)



60-WATT
SOLID STATE STEREO AMPLIFIER TK-250U

* 2 sets of stereo speaker terminals and front panel speaker selector switch.
* Dimensions:
  13"(W), 4-1/8"(H), 9-15/16"(D)

Ask for a catalogue or demonstration by your nearest dealer.

the sound approach to quality

KENWOOD

TRIO ELECTRONICS, INC.

6-5, 1-CHOME, SHIBUYA, SHIBUYA-KU, TOKYO, JAPAN.

Sole Agent in Australia: **Jacoby, Mitchell & Co., Pty., Ltd.: Head Office;** 469-475 Kent Street, Sydney Tel: 26-2651 **Melbourne;** 15 Abbotsford Street Tel: 30-2491 **Brisbane;** 56 Edward Street Tel: 2-6467 **Adelaide;** 652 South Road, Glandore Tel: 53-6117 **Perth;** Jayem Electronics, 252 William Street Tel: 288102 **Tasmania:** K.W. McCulloch Pty., Ltd., 57 George Street, Launceston Tel: 25-322 **Newcastle;** Edmunds Moir & Co., Pty., Ltd., 18 Wood Street Tel: 61-4991
Distributor in New Zealand: JOHN GILBERT & CO., Tasman Buildings, Anzac Ave., Auckland, C.I.

To: Jacoby Mitchell & Co.,Pty.,Ltd. EA
469-475 Kent St., Sydney.

Send me information on KENWOOR RECEIVERS, AMPLIFIERS, SPEAKERS & name of nearest KENWOOD retailer.

NAME: AGE:

ADDRESS:

ELECTRONICS PICTORIAL

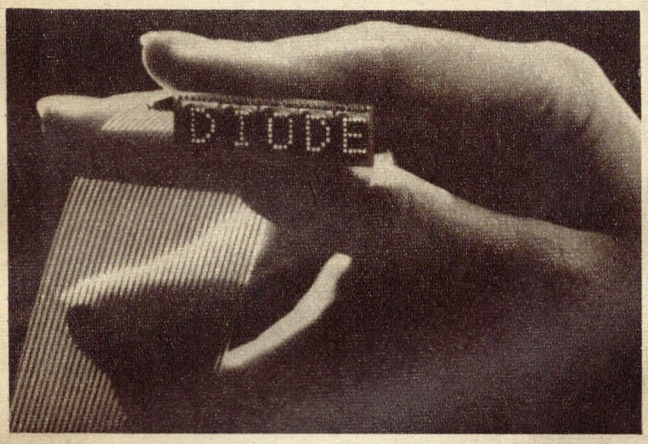
Colour scanner

A tremendous saving in production time, materials cost and operational stages is now available for the printing industry with the new single-step colour scanner shown at right.

Known as the Magnascan 450, the scanner can produce magazine size colour separation transparencies, screened and to size required, in 210 seconds. And it produces the separations to the exact size required.

The Magnascan also has an integral circuit computer which corrects for tone and colour. Separations of up to 20 by 24 inches can be made on this scanner. (Crosfield Electronics, 766 Holloway Rd, London, W19, England.)





New diode data display unit

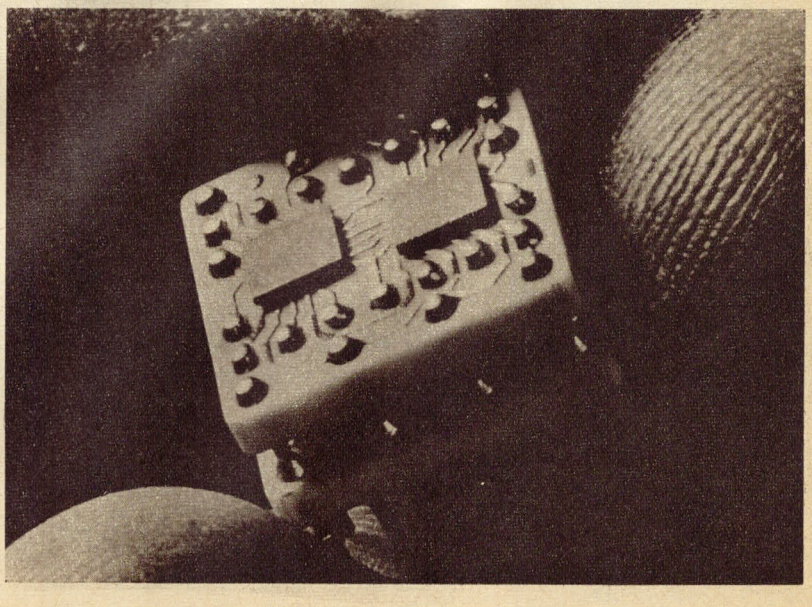
A new development in solid-state data displays is the unit pictured at the left, which has been produced in the UK by the Marconi Company's research labs. Using tiny slices of glass ceramic and a matrix of gallium arsenide phosphide light-emitting diodes, the display provides a pattern of bright red dots which make up letters, numbers or symbols.

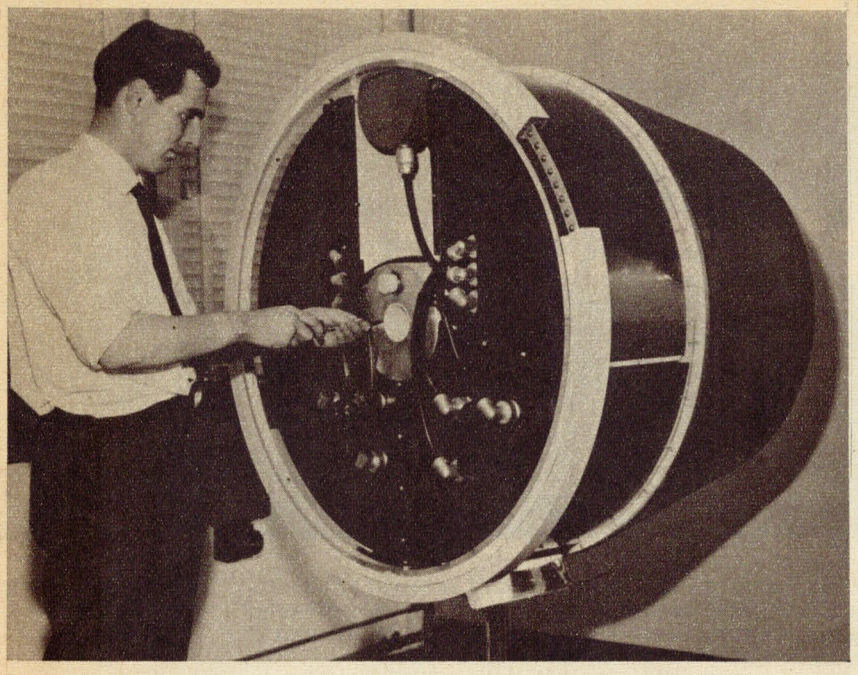
A feature of the new display is its small size, only 32.5mm long by 8.5mm high and 5mm thick. It also requires a simpler hookup to the generator which determines the character to be displayed. The new displays can be arranged in banks or rows to show numbers, words or even complete sentences.

New memory module

Monolithic circuits, as pictured at right, are now replacing the conventional magnetic core memory banks in new IBM computors. Using a silicon memory chip, each unit contains more than 1,400 circuit elements to make up 174 complete memory circuits on each chip.

The chips (see the two grey rectangles) are about an eighth of an inch in size. The monolithic circuits are used in the new IBM System/370 Model 145 units, which offer up to twice the capacity of their predecessors.





New military radar

This new multi-mode, dual frequency, nose-mounted radar (left) performs a number of separate radar functions simultaneously. It will combine terrain following; short-range high-definition mapping; long range ship detection and mapping; digital ranging on visual and radar targets.

Designed for aircraft such as the Buccaneer and the Phantom strike aircraft, it is produced in the United Kingdom by Elliott Automation Radar Systems.

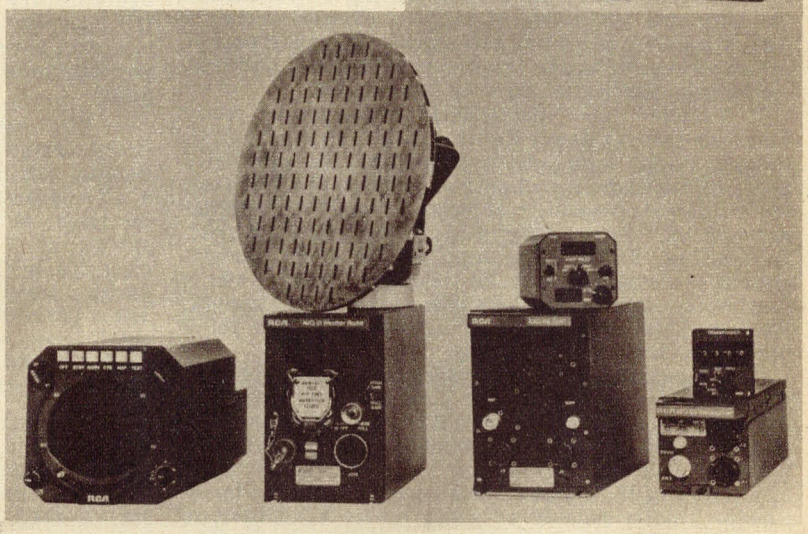


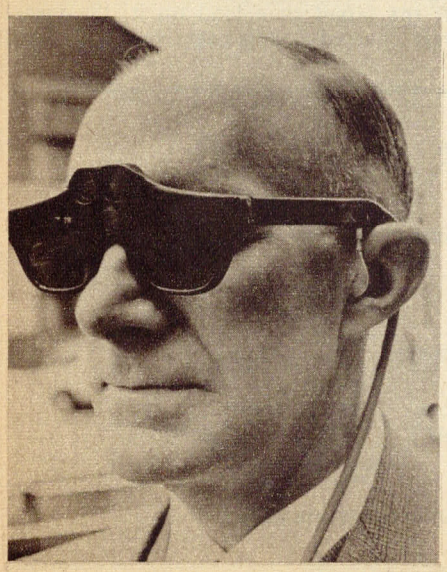
New small aircraft navigation aids

RCA have introduced a new line of navigational aids for use in business and light commercial aircraft. Light weight and exceptional performance for size are the units' major features.

The AVQ-47 (upper right) is a high altitude radar for light, twin-engined aircraft and has a range of 80 nautical miles (NM).

At right are: the AVQ-21, using a flat-plate antenna and transmitting only 8KW, achieves the performance of 30KW radar units, having a 200NM range; next the AVQ-85 DME presents present distance, ground speed and time-to-station on computer-style digital-light readouts with continuously updated information; and, the AVQ-94 ATC transponder, which produces a 400 watt signal over a 200NM identification range.





Stereo 'radar' gives space sense to blind

A new miniaturised version of the well known ultrasonic blind aid, worn in the same manner as a pair of spectacles, has been designed in New Zealand by Professor Leslie Kay, of the University of Canterbury. Professor Kay's system uses two receiving channels to provide an individual signal to each ear. The object is to provide a sense of space, as well as to indicate obstacles in the blind person's path.

The unit emits an undulating ultrasonic tone whose reflections are picked up by two disc transducers. The single transmitting disc and the two receiving discs are mounted in the spectacle frame. An electronic control box, carried on the user's belt converts the ultrasonic echoes into two audible tone signals. These signals are fed into each ear independently. The tone will vary according to distance and size of the object perceived. Range is up to 20ft.

TV by starlight

by I. H. Sinclair

If there was one feature which struck the visitor to a TV studio in the early days of television it must have been the intensity of the lighting. The Emitron camera tubes used in those days were extremely insensitive and lenses were of comparatively small aperture; consequently the lighting had to be brilliant enough to compensate for these failings.

Much of the work on TV-camera development has been devoted to improving the sensitivity of the camera without sacrificing the picture quality in terms of resolution, grey scale or signal-to-noise ratio. There is a limit to what can be done by improving lenses, though the improved sensitivity of modern cameras certainly owes a lot to modern lens techniques. The major part of the improvement in the sensitivity of cameras, however, comes from the development of camera tubes.

Camera tube development, from the early Emitrons through Super Emitrons and CPS Emitrons to today's image orthicons, has satisfied the sensitivity needs of television for all normal purposes. TV however, has military and security applications and, at the other extreme of use, nuclear and astronomical research applications. These other uses of TV often demand sensitivity levels capable of televising scenes whose illumination is no more than that provided by starlight, levels of illumination millions of times less than those used in studios for broadcasting.

For these special purposes three methods can be used to increase the sensitivity of camera tubes. One is to develop the ordinary image orthicon so as to increase its sensitivity without any drastic change in its method of working. Another method, now in production, is to use a variation of the image orthicon design called the image isocon. This is capable of giving better signal-to-noise ratios than the image orthicon at all light levels. The third method is to use a conventional camera tube along with an image amplifier mounted as part of the optical system to increase the illumination of the image applied to the camera tube.

THE IMAGE ORTHICON. As the first two techniques for the improvement of sensitivity are based on the image orthicon, we had better make sure that we understand the operation of the normal image orthicon tube. As shown in figure 1, an optical image on the faceplate of the image orthicon causes electrons to be released from the photocathode – the layer of light-sensitive material depositied on the rear surface of the faceplate. The quantity of electrons (number of electrons per second) released from each portion of the photocathode depends on the light intensity at that point.

The released electrons are accelerated along straight parallel paths to a glass target which they strike. Because the target is at a fairly high voltage (about 800V) positive to the photocathode, the electrons strike the target at a high velocity – about 20 million metres per second. The effect of this high velocity is that the electrons hitting the target – the *primary electrons* – knock some of the electrons from the glass. These latter electrons, called *secondary electrons*, have much lower velocities – in the region of a few hundred thousand metres per second – and are collected by the *target mesh* which is usually slightly positive to target.

Few primary electrons are collected on the target mesh because their speed makes it impossible for them to change course to strike the metal portions, so most of them pass through. Since in this process more electrons are knocked off the target than land on it, the target becomes positively charged (losing negative is equivalent

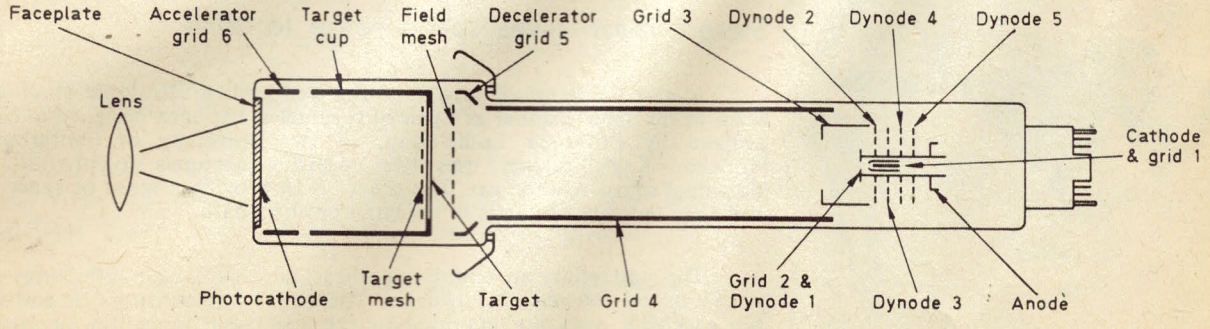
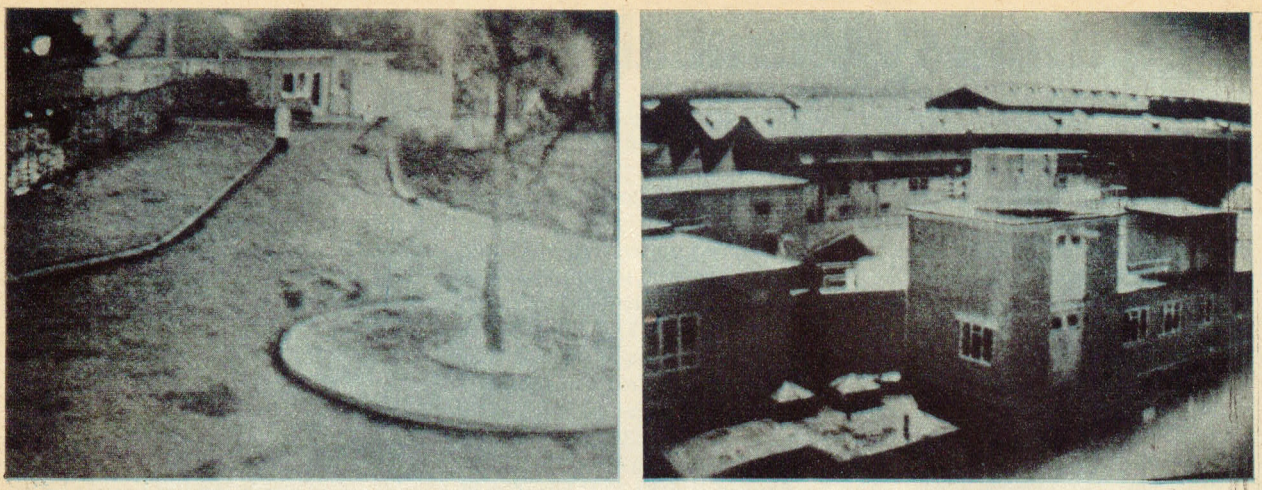


Figure 1. Internal structure of the image orthicon television camera tube.



Photographs of pictures taken by a TV camera using an image isocon tube. Scene at left was taken on a cloudless, moonless night; buildings on the right were illuminated by a full moon.

to gaining positive). The amount of the positive charge varies from place to place, being greatest where the greatest number of electrons have struck. This in turn depends on the light level at the part of the photocathode which emitted these electrons. In this way a "charge image" is built up at the target, controlled by the light image at the photocathode.

The distance between the target and its target mesh is important, for these two elements act as the plates of a capacitor. If the spacing between them is wide, around 0.1mm (0.004in) or more, then few electrons are needed to raise the voltage of the target by one volt because of the low capacitance, and the tube is sensitive to low light levels. If the spacing is close, 0.025mm (0.001in) or less, the capacitance is higher, more electrons are needed to charge the target and the sensitivity is lower. The latter case has the advantage however that the charge on the target is large compared to that on a wide-spaced target and is also large compared to the clumps of charge in the discharging beam, about which we shall talk later. This gives a superior signal-to-noise ratio and accounts for the fact that close-spaced target tubes are greatly preferred for broadcast use.

On the other side of the target an electron beam is directed so that it focuses on and is scanned across the target. Because the voltage between the cathode of the electron gun and the target is deliberately made very small the electrons of the beam move fairly slowly as electrons go, at about 500,000 metres per second. Though the target is made of glass or a glass-like material it is very thin (about 0.025mm) and thus conducts appreciably from front to back so that the rear side is at the same voltage as the front.

When the electrons from the scanning beam reach the target three things can happen to them. Some electrons land on the target, neutralising its positive charge and taking no further part in the action. Others, usually the slower electrons in the beam, are reflected back just as light is reflected by a mirror. This process, illustrated in figure 2a, is called *specular reflection*, so we call these electrons the *specular electrons*. The remainder of the electrons are scattered in all directions, as is light when it strikes a sheet of white paper; we refer to these as the *scattered electrons* (see figure 2b).

The fraction of the total electrons approaching the target that ends up in each of these three categories depends on the charge on the target. When an area of the target has a large charge, because it corresponds with a well-illuminated portion of the photocathode, most of the electrons land and neutralise the charge. Some are scattered and a few are specularly reflected to return in the direction of the gun. When the charge on a portion of the target is low, because of low illumination of the corresponding part of the photocathode, few electrons land, fewer are scattered than in the previous case, and many more are specularly reflected.

These differences in the behaviour of electrons at the target are important, because they are the root cause of the limitations of the image orthicon and of the advantages of the image isocon.

The electrons which return towards the gun, a mixture of specular and scattered electrons, land on the first dynode, which is the first of a number of amplifier

*Printed by special arrangement with "Practical Television." Illustrations by courtesy of the English Electric Valve Company, Ltd.

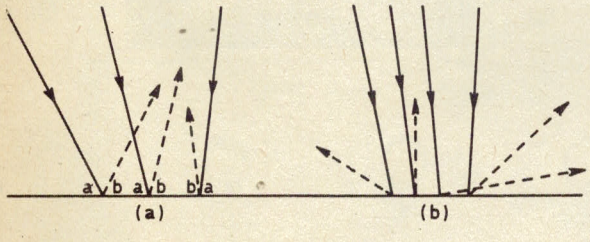


Figure 2. (a) Specular reflection: for each electron path, angle a equals angle b. (b) Scattering: the paths of electrons leaving the surface cannot be predicted. Both types return to the dynodes with picture information, but the scattered electrons carry less noise.

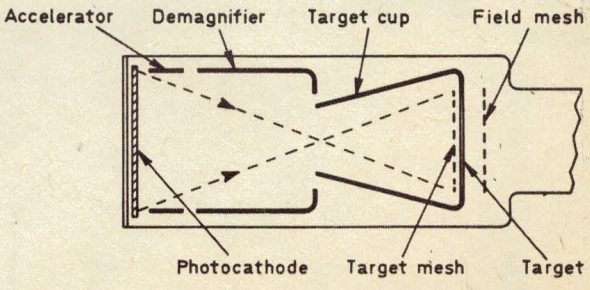


Figure 3. Extended image orthicon tube has a photocathode of about double the normal area.

Signal and system analysis at a glance.

Compare data streams and records. Characterize noisy, random signals. Detect periodic signals buried in noise. Identify vibration sources in structures and isolate different transmission paths and times. Completely characterize components in complex systems by impulse response measurements and frequency spectral analysis.

You can do all this and more with Hewlett-Packard's new all-digital 3721A Correlator — on-line, and at a price you can afford.

It's a powerful, portable signal analyzer. It offers cross-correlation for comparison of two signals in noise, without a sync pulse. Auto-correlation for comparison of a signal with itself. Signal recovery. And statistical probability measurement.

And it's as easy to use as an oscilloscope.

The time span across the CRT can be varied from 100 μS to 100 seconds (to infinity with external clock). Maximum resolution is 1 μS. An optional delay offset facility enables you to look at up to 1000 points of time scan. And a unique quick look feature gives you an almost immediate indication of the final value of the function being computed.

Remember, HP's 3721A is all digital. This gives you tremendous averaging versatility and power. The averaging time constant is changed at the flick of a switch — over a range of 36 milliseconds to over 100 days. And for maximum convenience, our new correlator can be interfaced directly to a computer for frequency spectrum analysis and other types of data manipulation.

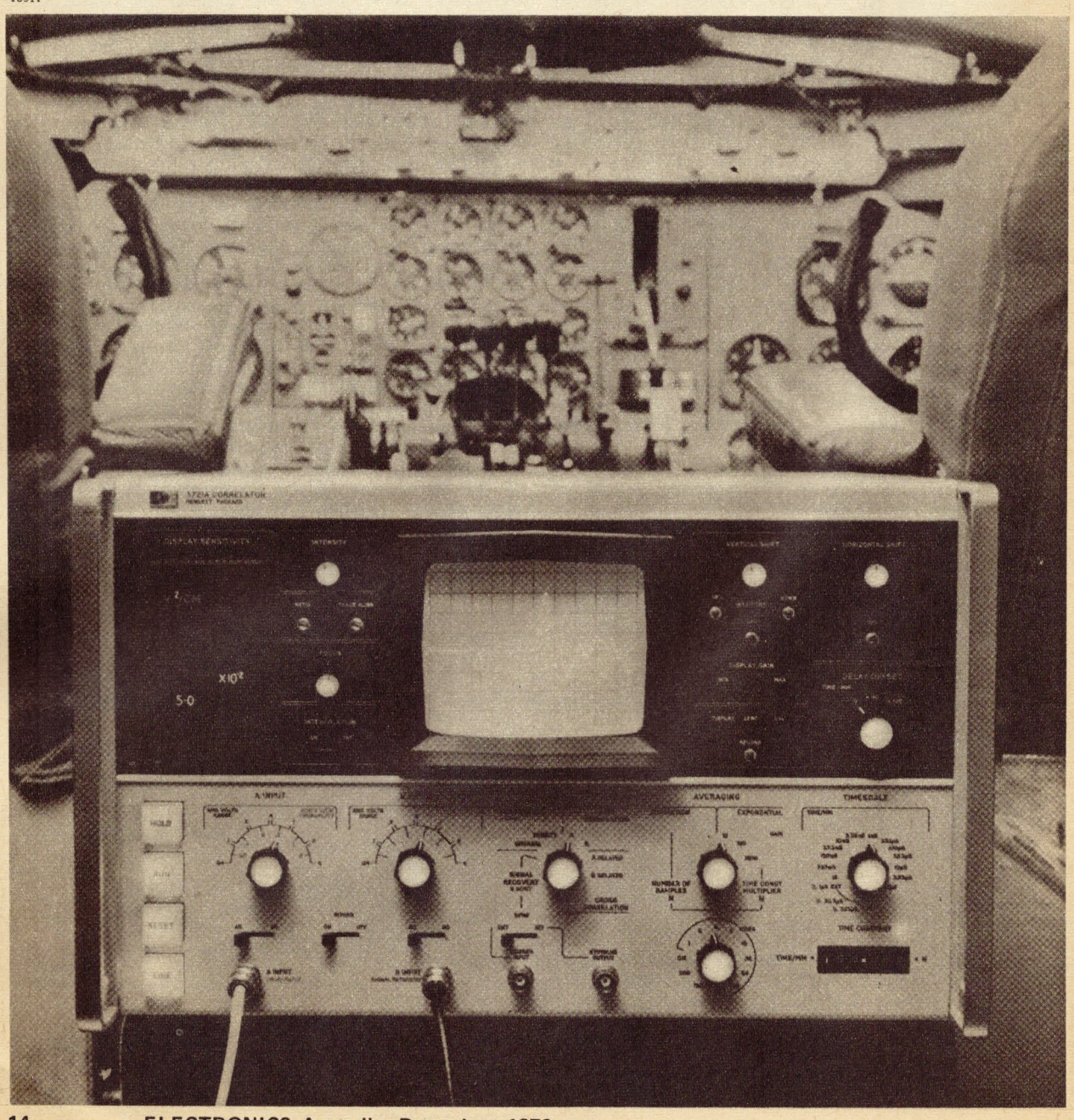
The price? Just $8325. For comprehensive signal and systems analysis at a glance, call your H.P. field representative.

Or call or write Hewlett-Packard Australia Pty. Ltd., 22-26 Weir Street, Glen Iris, Vic. 3147. Telephone: 20 1371

HEWLETT hp PACKARD

SIGNAL ANALYZERS

18911



stages built into the tube itself. Once again the high velocity of the returning electrons, because of the fairly high positive voltage on the dynode, causes more electrons to be knocked from the first dynode surface than land on it. The stream of secondary electrons from the first dynode is then accelerated to the second dynode where the the process is repeated. At each dynode the beam current is increased about sixfold, thereby amplifying the beam to an extent sufficient to be presented to an external amplifier.

The overall amplification in this process is about 500,000 and contributes no noise to the beam. Despite this however the signal-to-noise ratio of the image orthicon is limited by the noise in the beam from the cathode, as this noise is amplified along with the signal. This is made worse by the fact that the maximum return beam is in the regions where the target voltage is lowest, corresponding to poorly illuminated areas of the photocathode. This means that the maximum beam and the maximum noise exist in the black parts of the picture, just where noise is most noticeable.

LOW-LIGHT ORTHICONS. The standard version of the image orthicon is itself remarkably sensitive compared with earlier camera tubes but quite a lot can be done to improve sensitivity without any change in basic design. For broadcasting use the colour response of the photocathode is rather more important than the maximum sensitivity, because each colour must be rendered as a different shade of grey on the monitor. Where this is of less importance photocathodes can be made whose sensitivity is up to three times greater than normal, giving a useful overall gain with no loss of signal-to-noise ratio at the expense of greater processing difficulty and a higher rejection rate.

The most favoured high-sensitivity photocathode is the *trialkali*, made by evaporating films of sodium, potassium and caesium alternately with films of antimony on to the glass faceplate. The problems of controlling the process, each stage of which must be carried out with the faceplate at a different temperature, are enormous. So far it has been impossible to form the photocathode outside the tube, test it and transfer it, so that each photocathode is made in place after the rest of the tube processing is complete. Thus a slip up in the photocathode processing means the scrapping of a complete tube.

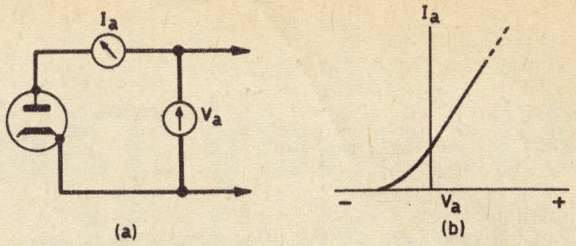


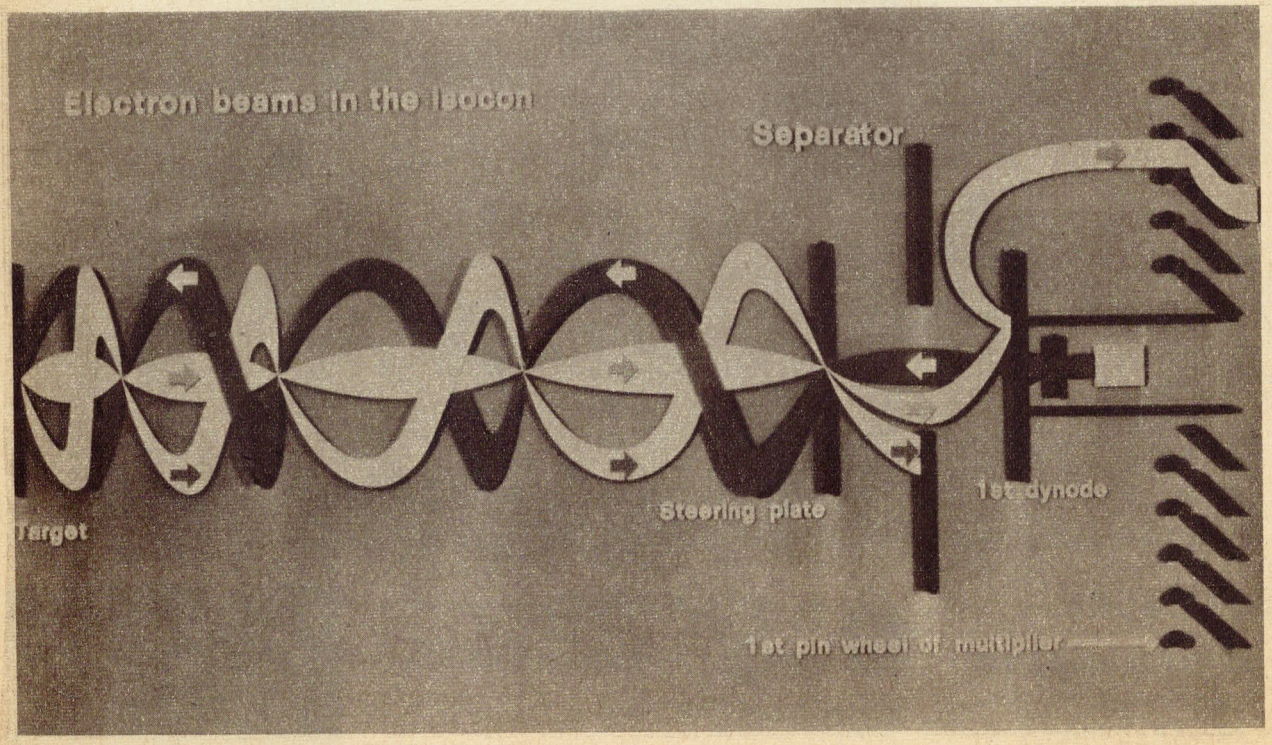
Figure 4. Noise characteristics of a thermionic diode show differences in the energy of electrons.

Another possibility is to use a wide target to target mesh spacing. As explained earlier this means that fewer electrons are required from the photocathode to charge the target to any given voltage, so that less light gives more signal. In broadcast use this has the disadvantage that the beam current from the gun must be enough to discharge the most positive areas of the target, and in this condition the noise of the beam is large compared to the charge on the target. At low light levels the beam current can be reduced, with some reduction in noise, and the wider spacing can give a sensitivity advantage up to ten times that of a close-spaced target tube.

To increase the sensitivity of the image orthicon much more than this requires some redesign. One method which has been extensively used is to retain the normal structure of gun, target and mesh but to substitute an extended image section of the type shown in figure 3. A photocathode of about double the normal area is used; in practice this is done by using the whole diameter of a 4½in tube rather than the smaller portion used on broadcast tubes whose photocathode size is equal to that of the target.

With a normal image section the extra area would not contribute to the sensitivity as the electrons from it would not strike the target anyway. However if the image section is modified so that the electrons converge towards the target, all the electrons from a large

Drawing shows how spiralling return beam gets shunted aside by steering plate but straight beam passes through separator to first dynode.



Plessey Tantalum Electrolytic Capacitors

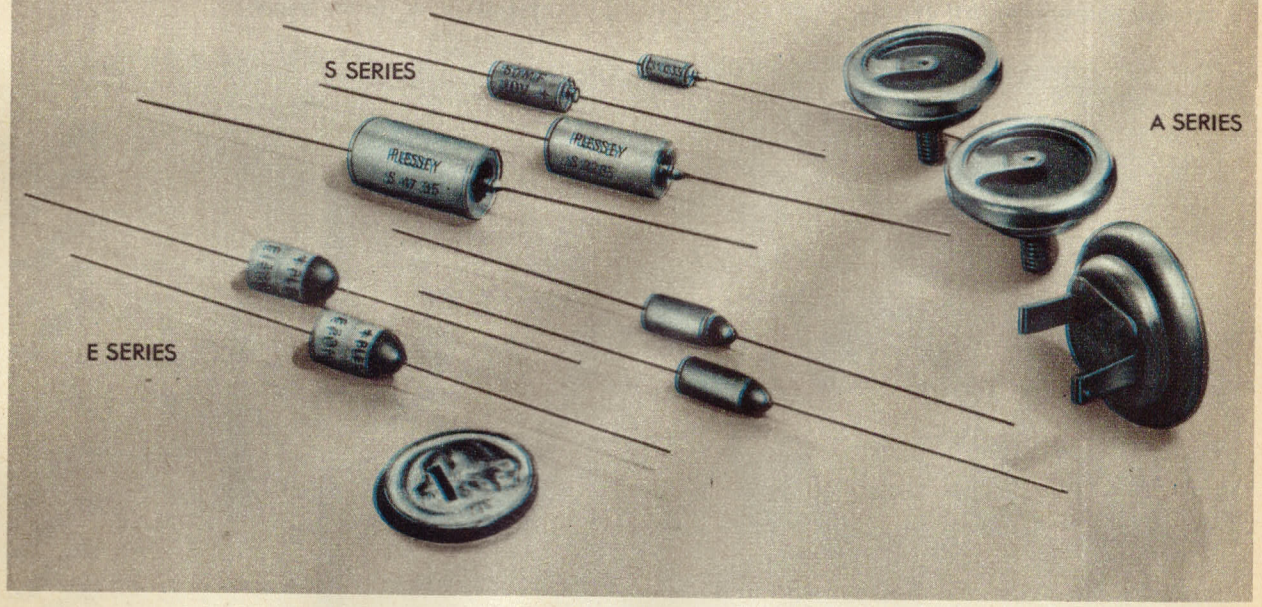
Plessey tantalum capacitors offer the highest operating temperature, capacitance range and reliability with the smallest size in liquid and solid electrolyte types.
Series A, E and K use liquid electrolyte whilst Series S are of solid electrolyte construction. In addition to high operating temperature, these capacitors also feature high stability, high capacitance/volume ratio, extremely long shelf life, low leakage current, low inductance and hermetically sealed containers. Also available is a range of T.C.C. tantalum foil capacitors and a wide selection manufactured by P. R. Mallory & Co. Inc., U.S.A.

Typical applications of tantalum capacitors are by-pass,-coupling and decoupling functions in low impedance circuits, R-C networks where low leakage ensures stable characteristics, also integrating and feed back capacitors in servo control systems.

Specifications

Series A and S are approved to DEF5134-A1. In addition Series S comply to MIL-C-26655-2D for power factor, leakage and physical size.

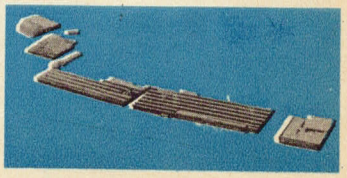
Series	A	E	K	S
capacitance μF	50-750	4-200	1-20	0.1-330
voltage (VWDC)	3-70	3-70	3-70	6-100
temperature °C	-55 to +150	-55 to +85	-55 to +85	-55 to +85
leakage μA	<5	$<.002\ \mu A/\mu F$	$<.005\ \mu A/\mu F$	$<.01\ \mu A/\mu F$



PLESSEY
Components

Plessey Ducon Pty Limited
Box 2 PO Villawood NSW 2163 Telephone 72 0133

Melbourne	42 3921
Brisbane	21 7444
Adelaide	76 3434
Perth	21 4821
Auckland (N.Z.)	78 509



photocathode can be focused on to a small target. This act of reducing the image size increases the sensitivity and can be combined with a wide target-to-mesh spacing and a trialkali photocathode to give image orthicons of very high sensitivity. An early application of such tubes was in televising the image on X-ray fluoroscope screens. In this way the dosage of X-rays could be cut down to less than could ever be used if the image were to be visible to the eye yet the monitor image could be comfortable viewed.

THE IMAGE ISOCON. The image isocon has great advantages over the image orthicon not through any increase in sensitivity (its sensitivity is rather less) but because of the great reduction in the beam noise which accompanies the signal at the final anode. In many ways the design is identical to that of the image orthicon but to understand fully how the reduction in noise level is achieved we must be clear about what we mean by beam noise.

In any beam of electrons there are differences in the energies of individual electrons. We can illustrate this by measuring the characteristics of a diode valve at low positive and negative values of anode voltage. As figure 4 shows, the current through the diode does not cut off abruptly as the voltage on the anode drops and is finally made negative. The reason is that the electrons have different values of energy; some, having low energies, are prevented from reaching the anode when the anode voltage is a fraction of a volt positive. Others, with more energy, continue to reach the anode until the voltage is slightly negative, while the most energetic electrons continue to reach the anode even when the anode voltage is more than one volt negative.

In a vacuum – as distinct from the different conditions of the solid state – the differences between electrons of different energy result in the electrons having different velocities, and this means that a number of electrons leaving the cathode at a given time do not arrive together at the anode since some are travelling faster than others. When electrons are leaving the cathode continually, these different velocities mean that the electrons arriving at the anode will arrive in groups as fast electrons catch up with slow electrons which started out earlier. The longer the electrons take to travel from cathode to anode, the more likely it is that they will bunch up in this way, and we must add to this the fact that no cathode emits electrons continually and evenly but only in bursts.

We measure this irregular arrival of electrons at the anode as small variations of current which we call noise for the simple reason that it sounds like noise of no definite frequency when amplified and fed to a loudspeaker. Incidentally, diode valves are still used in this way as noise generators so that signal-to-noise ratios can be measured.

The hotter a cathode is, the more noisy the beam of electrons, and even materials which are physically cold can generate noise because of some random interference with the flow of electrons through them. In some cases we talk of these materials as having a *noise temperature*, meaning that they produce the noise which we would expect a source of that temperature to produce. The lower the temperature, the lower the noise, down to a limit of -273 deg. C (absolute zero) where noise ceases. We cannot reach this temperature in any working electron beam but we can and do run high-gain maser and parametric amplifiers at very low temperatures to reduce their noise level..

BEAM NOISE IN THE ORTHICON. The beam of an image orthicon carries a noise signal which is normally inescapable. It arises due to the temperature of the cathode, which must be kept hot so as to emit electrons. Our only hope of reducing the noise is to make the beam forget somehow that it came from a hot cathode! This we cannot do, but we can select a part of the returning beam to form the signal current which appears to have "forgotten" that it came from a hot cathode.

The two types of returning electrons are those which are *specularly reflected* and those which are *scattered*, as we saw earlier. Now if we compare this with the case of light beams, we see that the beam of light reflected from a mirror carries information about where it came from – in everyday language, we see an image in a mirror. A scattered beam of light however does not carry this information, that is we do not see reflected images in a sheet of white paper. In the same way, the specularly reflected electrons from the target make up a beam which has the same noise as the beam from the cathode, but the scattered electrons behave as if they had come from a "cathode" at the temperature of the target.

In an image orthicon these two types of electrons are not distinguished. Both land on the first dynode and are multiplied to form the signal current. If however we could separate the scattered electrons from the specularly reflected ones we would have two advantages: first the noise of our return beam would be low because the "noise temperature" of the scattered electrons is the temperature of the target; and secondly as the number

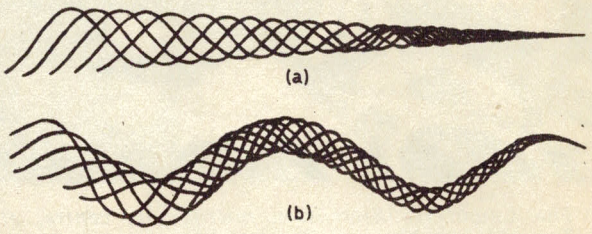


Figure 5. (a) In the image orthicon each electron follows a spiral path but the beam is straight and focused. (b) In the image isocon the entire beam follows a spiral path (the number of spirals is exaggerated).

of scattered electrons is greatest in the regions of large target charge (white on photocathode) and least in the low-charge (black) areas what noise there is occurs mainly in the white parts of the picture where it is least noticeable. This is the principle on which the image isocon tube is based.

There is one slight drawback: the number of scattered electrons which can end up back at the first dynode is small, because electrons are scattered in all directions and many end up on other positively charged surfaces. For this reason we might expect the sensitivity in terms of electrons collected per unit of light on the photocathode to be rather less than for an image orthicon, and this is indeed the case. However, the usefulness of a tube at low light levels depends more on its signal-to-noise ratio than its absolute sensitivity, since the image on the monitor must be visible through the noise, and in this respect the image isocon is greatly superior to the image orthicon.

The scattered beam is separated from the specular beam in the image isocon by an ingenious method. This involves "labelling" the beam from the cathode in such a way that the specularly reflected beam still carries the "label" but the scattered beam does not, having lost its "label" along with the noise of the cathode beam.

If the beam from the gun is passed between deflector plates with a voltage of about 50V between them this, combined with the magnetic field used for focusing the beam, will make the beam move in a spiral path. This type of path must be distinguished from the spiral paths which individual electrons in the image orthicon take. In the image orthicon the spirals are small and the beam as a whole is straight. In the image isocon however the whole beam of electrons spirals its way to the target (see figure 5). This spiralling is the "label" we need, because the specularly reflected beam keeps up this spiral motion as it returns towards the first dynode while the scattered electrons do not spiral but return in straight lines.

Moving Objects Observed by Microscope



The Cambridge Stereoscan microscope, centre, at the Ministry of Technology's National Physical Laboratory in south-east England, has been improved so that technicians can observe dynamic phenomena (moving objects) at high magnifications. The Stereoscan produces a bright, flicker-free image on a television monitor by scanning an electron beam over the surface of a specimen and synchronising this with the beam in a CRT. It is now possible, for example, to watch changes taking place in materials when subjected to stress. A conventional video tape recorder stores the results of experiments for later study.

PRACTICAL OPERATION. All we need now is a method of separating the spiralling from the straight beams. This is achieved by the deflector plates (usually called *steering plates)* again. When the spiralling beam of specular electrons passes back through the steering plates the radius of its spiral is increased to such an extent that the beam can be intercepted on a plate set at just the right diameter out from the first dynode. The beam of scattered electrons however is given only a slight spiral motion by the steering plates as it returns and the radius of the beam is not large enough to result in interception by the plate (the *separator)* which catches the specularly reflected electrons. Thus the scattered electrons end up on the first dynode to be multiplied in the usual way.

Isocons now in production feature three steering plates so that the steering field can be applied in any direction. The tube is first set up as an image orthicon with the steering plates and separator at the fourth grid voltage. When a good picture is obtained the tube is changed over to isocon operation by adjusting the separator voltage to about 80V and adjusting one or more of the steering electrodes until the picture turns negative. the video amplifier is then switched to reverse polarity and the picture adjusted for minimum noise, uniform shading and best resolution by alterations to the steering plates, separator and grid two voltages along with the usual image orthicon controls.

The isocon principle can be and is combined with the features of extended-image section and wide target spacing mentioned earlier to produce acceptable pictures at levels of illumination little greater than that of starlight. The limit of performance is set not by the noise level, as was always the case with earlier low-light level tubes, but by the loss in resolution as the available light level drops.

USING IMAGE AMPLIFIERS. The sensitivity of an image orthicon system can also be increased by increasing the light level reaching the photocathode. One method of doing this is to use electronic amplification of the image.

The simplest form of image intensifier is a vacuum tube with a photocathode on the input window and a fluorescent screen on the output window. A light image on the photocathode releases photo-electrons, which are accelerated to the fluorescent screen by the voltage applied across the tube. Because each photon falling on the photocathode gives rise to multiple photons at the fluorescent screen, a gain in image intensity is achieved.

This forms the basis for one type of image intensifier in which image diode cells, with a phosphor screen and a photocathode in each unit, are stacked together. A light gain of 50 in each cell gives a total gain (for a stack of three) of 125,000 if we disregard losses due to the coupling of the cells. In stacks of this type the coupling losses have been largely overcome by making the endplates for each cell from aligned glass fibres – the so-called "fibre-optic" technique. A diagram of this type of intensifier is shown in figure 6.

Another important type of image amplifier uses thin aluminium oxide films as electron multipliers, either in a straightforward way by secondary emission, or in the SEC (secondary electron conduction) method of use. In this type of tube the electron stream from the photocathode is multiplied by a series of dynodes. The stream is kept in focus by a strong magnetic field from either an electromagnet or a permanent magnet. The final electron beam at the phosphor is of higher current and also at a higher energy due to a high potential between the phosphor and the photocathode, so that very high gain can be achieved.

The most recent development in very low light level systems is the coupling of a fibre-optic image amplifier to an image isocon camera tube. The coupling is also done with fibre optics to ensure maximum gain with minimum coupling loss. There will undoubtedly be further progress in this field. ■

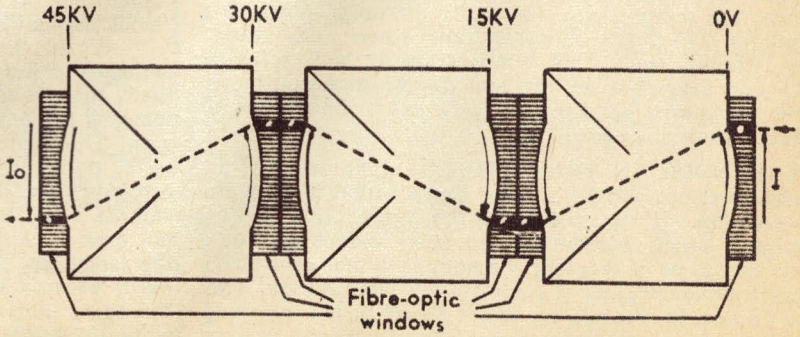
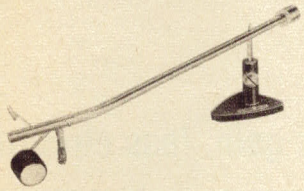


Figure 6. Light intensifier with stages coupled by fibre-optic windows.

ENCEL SOLVES YOUR GIFT PROBLEMS WITH FINE HI-FI ACCESSORIES AT BEDROCK PRICES...

Any of these accessories will delight the Hi-Fi fan! Only Encel, Australia's leading specialists in the field, could offer you such variety at such low prices!



MICRO MDP-3 DUST BUG—$4.50 (inc. sales tax).
A "must" for the stereo enthusiast. Dust records completely and automatically ahead of the stylus. Improves sound quality, reduces record and stylus wear.



MICRO MSB-1 SHOCK ABSORBERS—$12.50 (inc. sales tax) per set of 4. The ideal support for turntable base-plates. Prevents low frequency feedback (50-200 Hz) from reaching tonearm and cartridge. Suits all turntables, adjustable for precise levelling.

SONICS DEMAGNETISER—$4.90 (inc. sales tax).
Restores tape recorder heads to original characteristics quickly and effectively. Complete with power cord and plug.

BASF & PHILIPS LOW NOISE TAPE AND CASSETTES at special low prices! Write now for full details.

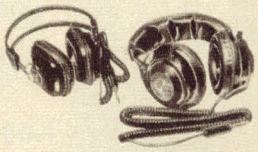
VELK A.C. ADAPTOR—$9.50 (inc. sales tax).
For 240 v AC input. Output 6v or 9v DC, 400 mA switchable. The perfect mains power source for most battery-operated reel-to-reel recorders, cassette recorders and transistor radios.

GRACE PM-1 STYLUS PRESSURE GAUGE—$6.50 (inc. sales tax).
Essential for accurate maintenance of correct stylus pressure for top hi-fi performance. Simple and quick to operate.



LUSTRE SA202 HYDRAULIC LIFT — $8.50 (inc. sales tax).
The perfect protection for sensitive hi-fi cartridges. Positive lift and lowering with convenient lever control. Permits track selection with non-skid safety. Suits most arms, fully adjustable.

PIEZO DX 132 DYNAMIC MICROPHONE—$6.50 (inc. sales tax).
Complete with remote control stop/start switch.



ROTEL HEADPHONES, STEREO MODEL RH-711—$17.50 (inc. sales tax).
MODEL RH-600—$9.50 (inc. sales tax).
The RH-711 head-set covers the spectrum from 15 to 25,000 Hz, model RH-600 has a response of 20 to 19,000 Hz. Both have max. input capacity of 0.5 watts and impedence of 8-16 ohms to suit any amplifier. Complete with 10ft of coiled cord and standard stereo plug.

HEADPHONE JUNCTION BOX (Model JB3)—$4.90 (inc. sales tax).
This switchable unit suits all amplifiers and recorders and accepts two pairs of stereo headphones.

NOW AVAILABLE:
P.M.L., Model EC71 CONDENSER MICROPHONES.
High-quality professional units. Send for details.
P.M.L., D422 stereo headphones. High impedence. High quality at only **$24.50** per set (inc. sales tax).

...AND TOP VALUE QUALITY STEREO COMBINATIONS

Choose your stereo from these Encel suggestions, all comprising fine-quality equipment at unbeatably low prices!

$229.00
gives you a Sound SAQ-203 amplifier, JH manual turntable, Lustre ST510 arm, Micro 2100/5 or Shure M44/7 cartridge and two Sonics AS61 speakers. Base for turntable included.

$388.00
buys a Sound SAQ-505 amplifier, Micro MR111 turntable with Micro 3100/5 cartridge and two Sonics AS303 speakers. Base, complete with dustproof plastic lid included.

$469.00
includes a famous Lux SQ 77TW amplifier, Connoisseur BD2 turntable, complete with base and lid, Micro 3100/e cartridge and two Interdyn 121 speaker systems.

$735.00
steps you up to a Cambridge P40 amplifier, Lesa PRF6 auto/manual turntable, the best Grace, Shure, A.D.C., or Ortofon cartridge and two Celestion "Ditton 15" speakers. Complete with base and lid.

$968.00
brings you a renowned Lux SQ 507 amplifier, JH "Encore" turntable, fitted with Grace G840 arms and Grace F8C cartridge, together with two Celestion "Ditton 25" speakers. Base and lid included.
Write now for full details.
Mail orders accepted.

SPECIAL OFFER
Shure Test Record TTR 101
List Price $6.50
OUR PRICE $4.50

ENCEL ELECTRONICS PTY. LTD.

HEAD OFFICE: 431 BRIDGE ROAD, RICHMOND, VIC. 3121
TEL. 42 3762
SYDNEY STORE: GROUND FLOOR, 2 SM BUILDING, 257 CLARENCE STREET, SYDNEY, N.S.W. 2000
TEL. 29 4563, 29 4564
■ **AUSTRALIA'S GREATEST HI-FI CENTRES**
■ **TRADE-INS ACCEPTED** ■ **TERMS**

EE70

varian EIMAC

new 3-500Z offers high power gain, less circuitry.

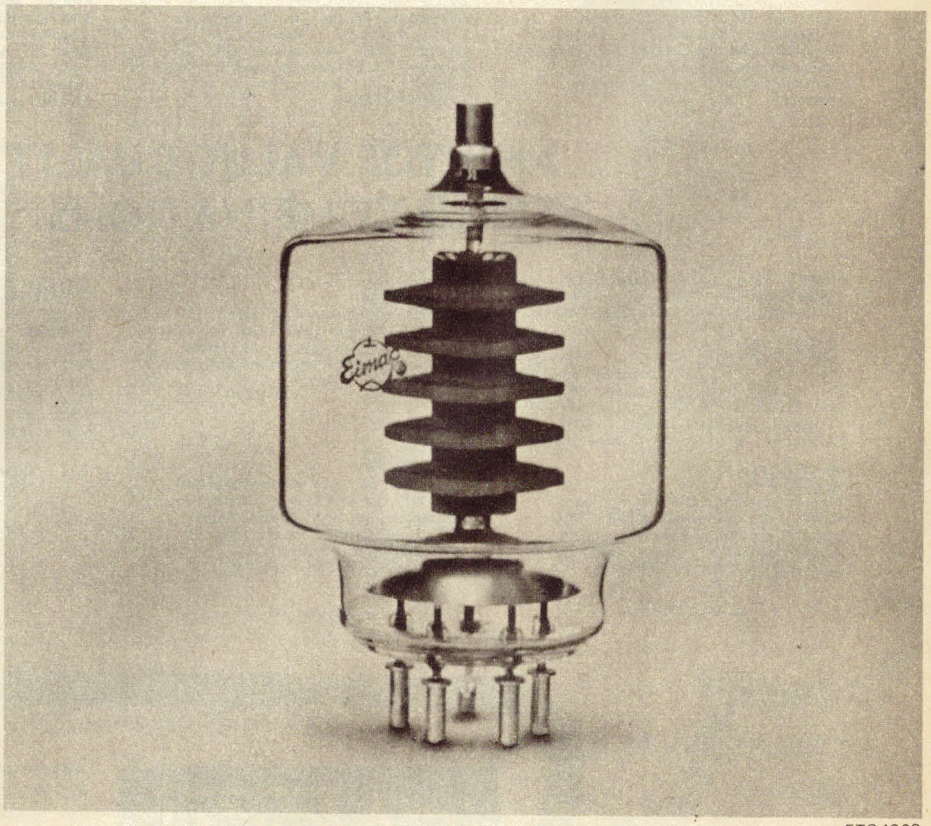
EIMAC's new 3-500Z is a compact, heavy-duty power triode with 500 W plate dissipation, designed for operation in zero-bias Class B r-f or audio amplifiers. The tube can be used as a cathode driven (grounded grid) linear amplifier where low distortion, high plate dissipation, and great thermal anode reserve are desired. The 3-500Z may be operated at plate potentials up to 3000 Vdc, and eliminates expensive, bulky screen and bias supplies. The 3-500Z will replace EIMAC's 3-400Z where additional plate dissipation or greater reserve is desired. Forced-air requirement is approximately equal to that of the 3-400Z, and a blower capacity of only 13 cfm at a back pressure of 0.2 inch is satisfactory for a single tube. The 3-500Z's zero-single plate current is somewhat higher than that of the 3-400Z. When used as a replacement for the latter tube, the 3-500Z's zero-signal plate current can be reduced by addition of a simple zener diode in the cathode return. This technique is particularly suggested if plate potentials over 3000 Vdc are contemplated, or if the tube is used in equipment that is power supply limited.

3-500Z TYPICAL OPERATION*
(Minimum Distortion Products at 1 kW PEP Input)

DC Plate Voltage	2500 V
Zero-Sig DC Plate Current**	130 mA
Single-Tone DC Plate Current	400 mA
Single-Tone DC Grid Current	120 mA
Two-Tone DC Plate Current	280 mA
Two-Tone DC Grid Current	70 mA
Peak Envelope Useful Output Power	500 W
Resonant Load Impedance	3450 ohms
Intermodulation Distortion Products	−33 dB

*Measured data from a single tube
**Approximate

varian PTY LTD
electron tube and device group
38 oxley street/crows nest/nsw 2065/43 0673
679 springvale rd/nth springvale/vic3170/560 6211



ETG 1069

UNIQUE SILICON-TARGET TV TUBE

A new type of television camera pick-up tube that offers high sensitivity and long life has been developed at the General Electric Research and Development Center, Schenectady, New York. One of the tube's earliest applications may be in "picture phones," where its sensitivity will permit it to operate in normal room lighting.

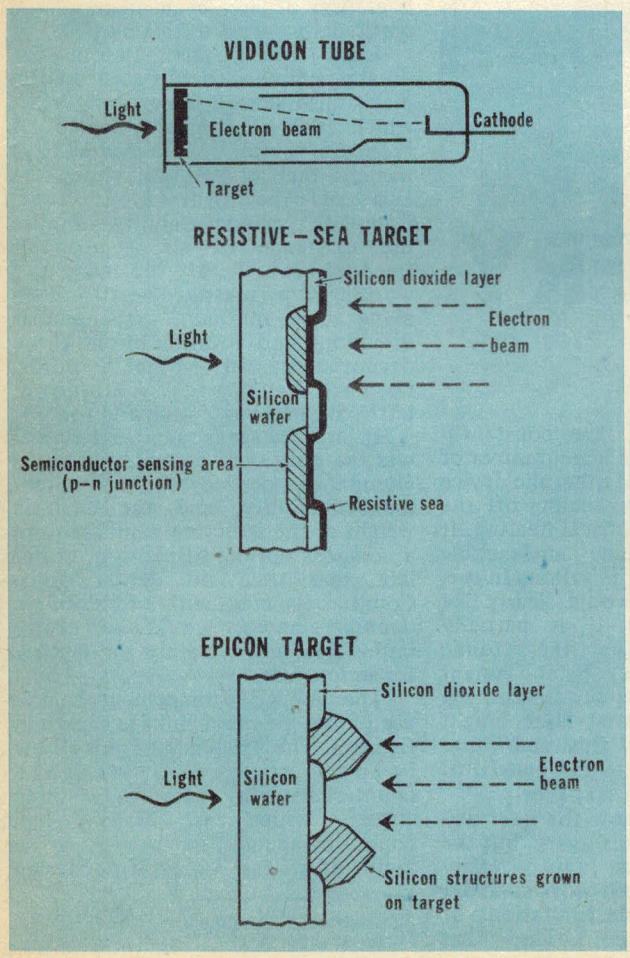
The "Epicon" camera tube, as it is called, is one of a family of silicon-target tubes that have been attracting wide attention in the electronics industry. According to its developers, the new tube offers solutions to critical technical problems that had faced its predecessors.

The key to the Epicon camera tube's simplified manufacture and improved performance lies in its structure. The body of the target, which converts an incoming light image into a corresponding electronic pattern, consists of silicon, upon which a layer of silicon dioxide is deposited. In earlier tubes of this sort, holes were etched through the silicon dioxide layer to form the semiconducting sensing devices, which were sunk below the surface of the target.

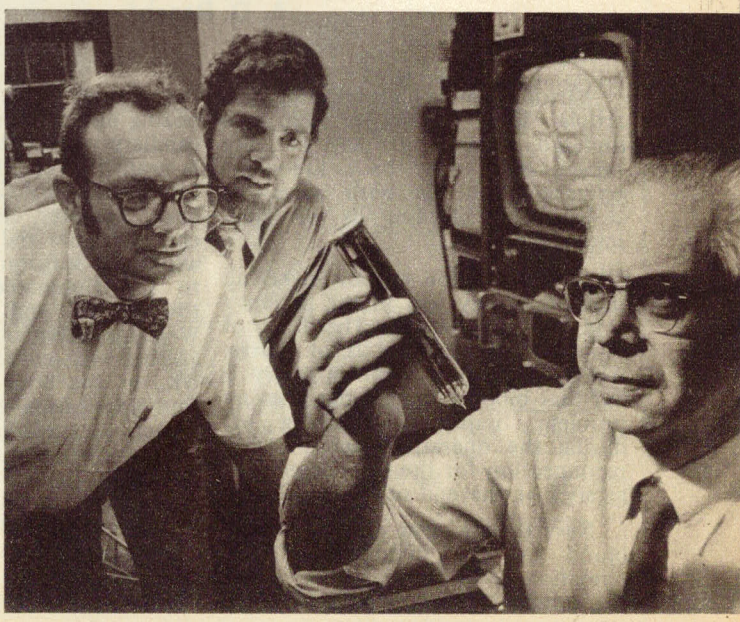
In those tubes, difficulties arose when electrons from the electron beam in the tube accumulated on the target. To avoid this problem, a thin layer of material called a "resistive sea" was added. This permitted the excess electrons to leak away, but the materials used do not permit high-temperature bake-out during manufacture.

The Epicon camera tube does away with the need for the resistive sea by "growing" an array of millions of silicon semiconductors in a few square inches – usually in the form of tiny pyramids – sticking up above the surface of the target (see photo above). These grow up through the layer of silicon dioxide, leaving only a small portion of the oxide layer exposed. The "geography" of the target, with many "mountains" overshadowing very narrow "valleys," protects the oxide layer from the influx of electrons. Because only silicon and silicon dioxide need be used in the Epicon array, high temperature tube bake-out is possible. This prolongs the life of the tube.

As a result of this structure, the Epicon camera tube is simpler to produce (making possible versions for consumer use, such as the picture phone), and will not be damaged by being pointed directly toward a bright light source (as happened on the moon during the flight of Apollo 12, when a camera was accidentally pointed at the sun). ■



Epicon TV camera tube is held by one of its developers, E. A. Taft. Looking on are the other developers of the small, high-sensitivity tube, Dr W. E. Engler and Dr S. M. Blumenfeld.



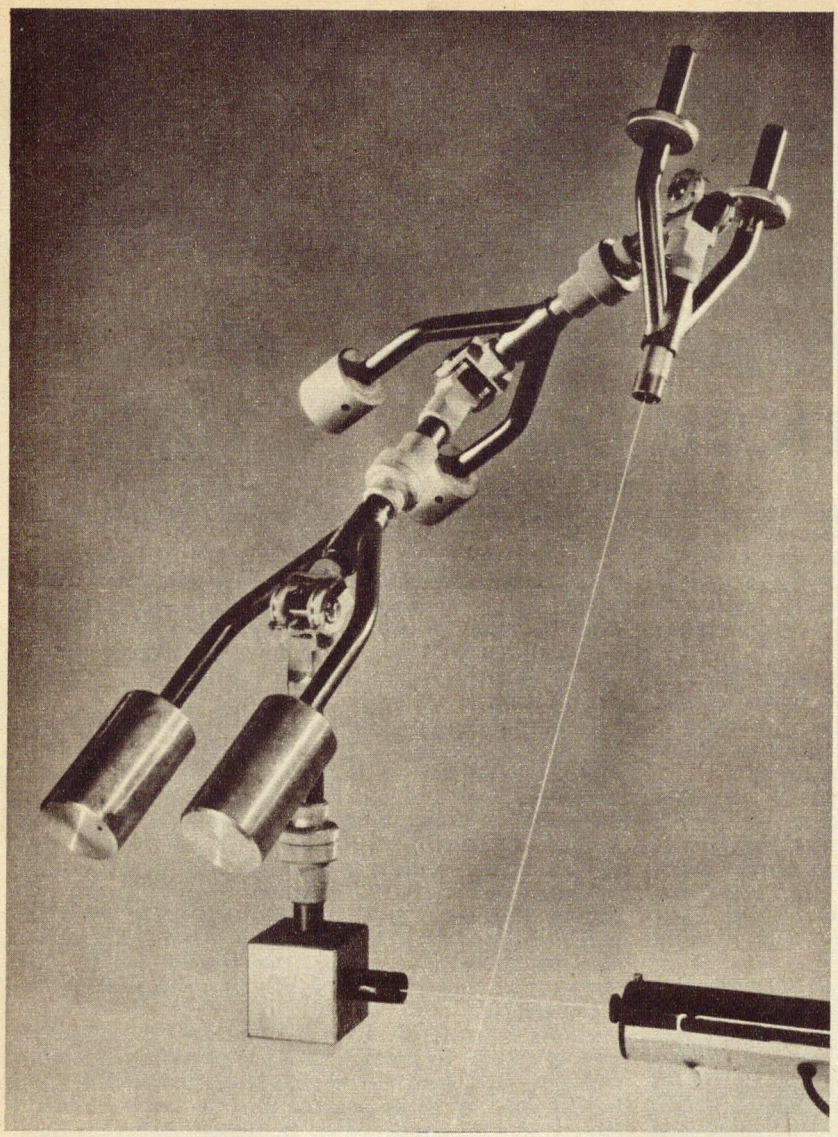


Figure 1. The prototype laser beam manipulator, shown with a small demonstration laser, and without the final focusing lens.

LASER SURGERY

A. D. Beach*

Virtually everybody reading this article has undergone, or will undergo, surgery. It may be only minor, or it may be a life-saving operation, but in both cases the control of bleeding is of great importance.

As soon as the surgeon makes an incision of any sort in the patient's skin, bleeding starts. The flow of blood from a skin cut is, of course, trivial. It is only when an artery is cut that blood loss becomes a severe problem, requiring clamping off during the operation, and possibly reconnection for the more important arteries at the end of the operation.

Nevertheless, even small flows of blood can be important if the operation is to last some time, and the surgeon may choose to cauterise the tissues which are constantly oozing blood from a large number of capillary vessels. A diathermic device is available for this, sealing off the small vessels by electrical heating. It has, however, some undesirable characteristics and limitations in use, which the surgeon would clearly like to see eliminated. It is partially toward this end that the Atomic Weapons Research Establishment (AWRE) has entered the field in the UK, in the hope that lasers might find application to this and other aspects of surgery, to the benefit of surgeon, patient and taxpayer.

No one knows how the laser will eventually be used in surgery, but the potential benefits are easily recognised, and much work is under way to discover the limitations of different techniques. The first problem one comes across is purely mechanical. Lasers are easy to make – to a certain scale of size. Try to reduce that size and the problems and costs become excessive.

The practical limitations, then, require that lasers are bulky, massive devices, so the problem becomes: how do you aim, easily and precisely, with great manoeuvrability, a 20lb laser, perhaps 6ft long, so that the surgeon can position the focused beam to within a small fraction of a millimetre of his target?

The answer is that you don't. You leave the laser, with its weight and bulk, parked somewhere where it will not get in the way, and aim and direct only its heat (or light) output. To use a phrase coined rather a long time ago and which has found ever increasing application – you do it with mirrors.

What the surgeon wants at the working end is something not too different from his scalpel, to be held between the first two fingers and thumb, and manoeuvred in the same way. Above all, he does not want to have to apply any force other than manoeuvring and controlling forces.

The device produced at Aldermaston is an interface between the laser and the surgeon's fingers which allows this manoeuvrability. It is a form of laser beam manipulator particularly suited to this purpose.

Light beam manipulators are usually simple devices based on the mechanical linkage shown in figure 2, which allows a single degree of freedom (or manoeuvrability) namely that of rotation about the axis of the light input tube. Complete manoeuvrability implies the existence of six degrees of freedom, which at the surgeon's working tip means linear motion along three mutually perpendicular directions and rotation about those directions – in other words, forward/backwards, up/down, left/right, and yaw, pitch and roll.

If the linkage shown in figure 2 was the only type possible, six joints would be needed for maximum manoeuvrability, and the intrinsic weight of the structure would require a complex sprung suspension, rather like that used on dental drills. Counterbalancing, with a series of six counterbalances, would be nearly impossible, and certainly too clumsy for serious use.

The AWRE arrangement makes use of the patented linkage shown in figure 3. The existence of this elbow joint makes possible counterbalancing with only three stages, which is easier than counterbalancing six stages by a factor of at least 10; or, if the design

*Reprinted by courtesy of "AWRE News" and "Atom".

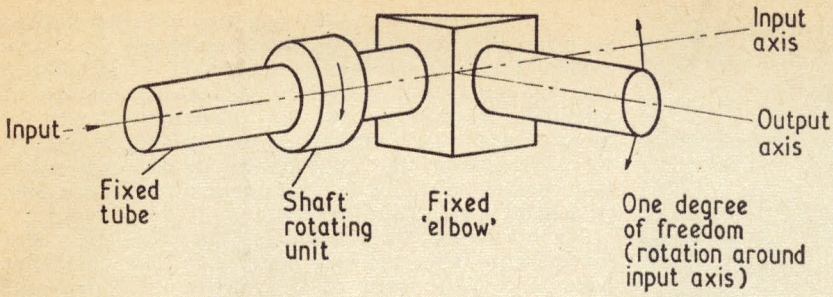
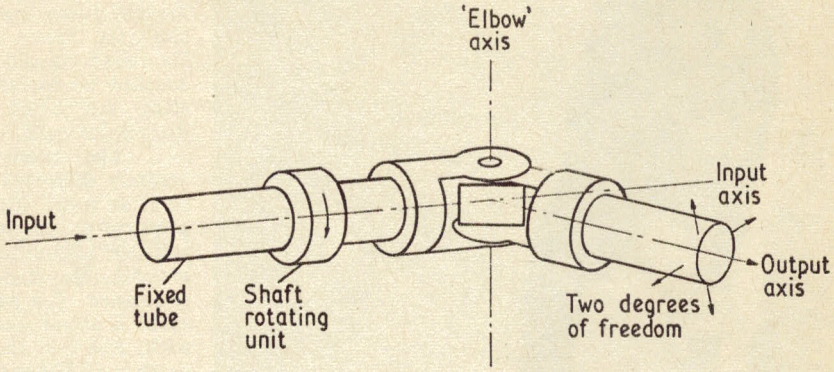


Figure 2. Six of the usual light manipulator joints would be needed to get the six degrees of freedom needed for surgery.

Figure 3. Improved linkage allows six degrees of freedom with only three joints; this makes counterbalancing much easier.



is made a compact one, easier by a factor of at least 30. This large improvement factor makes practical for the first time a fully counterbalanced manipulator, which, in the terminology of mechanics, is neutrally stable. In other words, it stays where you put it, and the only forces applied to it are positioning and steering forces, precisely as the surgeon requires.

The prototype system is shown in figure 1 (opposite page), with a small demonstration laser as a light source. The mirrors at the three "elbow" joints steer the beam along the tubes, and because each mirror is driven at half the differential angular rate of the joint on which it is mounted, the First Law of Reflection is obeyed and the light beam always passes exactly coaxially with the tubes.

It is quite interesting to look down the free end of the manipulator at a target placed where the light source would be. As the manipulator is steered around, swung, folded, straightened, the target stays always precisely where it first appeared, at the far end of an apparently straight tube, seemingly attached to the outermost arm of the manipulator.

This prototype manipulator is much too massive for the ultimate task – a surgical operation. It has too high an inertia, and is too large in the surgeon's hand. However, low cost of construction was necessary at this stage of the research, and the device has proved the feasibility of the "elbow" joint arrangement for the next design, which would be very much lighter and slimmer, with redistributed joints to provide increased mobility at the working tip.

This is not to say that the prototype has not been put to good use. Figure 4 shows the installation at the Royal College of Surgeons of England, in the Department of Surgical Sciences. On the left can be seen the end of a carbon dioxide laser, which continuously emits a 60 watt heat ray. This heat beam passes down the tube system of the manipulator until it reaches the working tip, held by the man in the picture, at which point it is focused down to a very small spot on the subject.

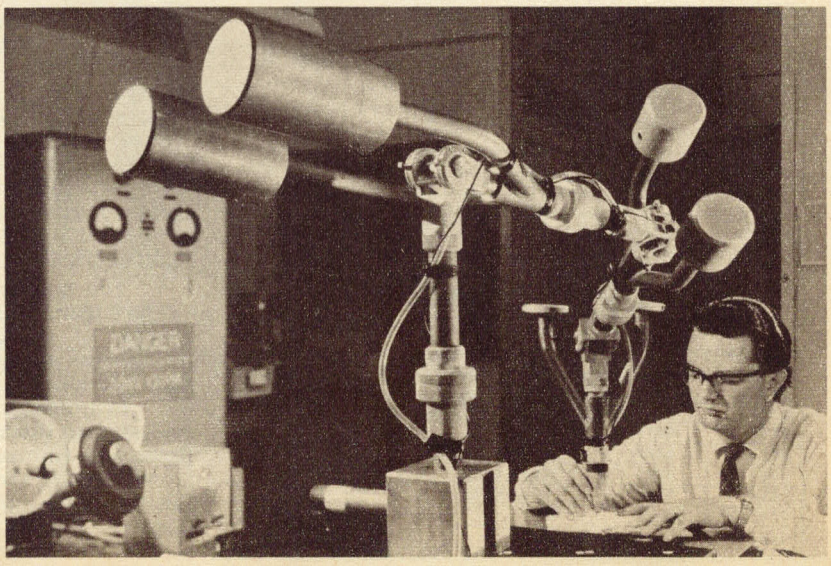
Sixty watts doesn't sound very powerful, but when focused on to a spot less than half a millimeter across, it is rather like beaming the heat output of 60 electric fires, each having three elements, on to a single square inch. The power density, in other words, is 180KW per square inch, over that very small half millimetre spot.

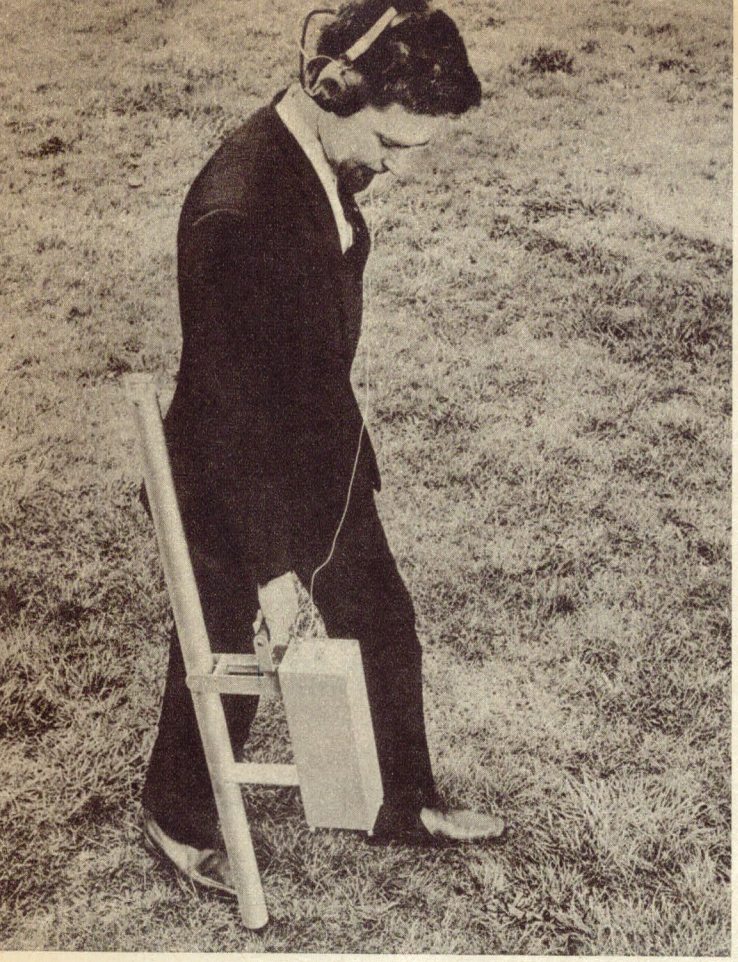
Needless to say, few materials can stand up to that. Only some metals, which reflect the heat away well, and some semi-conductors, which transmit it well, will survive. Refractory materials, like glass, asbestos, concrete, etc, are rendered instantly incandescent and then fuse, or vapourise. Tissue such as skin, muscle, liver, etc, with its high water content, vapourises into steam, without becoming incandescent – but only over the very small area of the focus. By traversing the focused spot along the surface of the tissue, a cut can be made which has cauterised edges, completely free from bleeding, provided that no large blood vessels are pierced.

Experiments are in progress at the Royal College of Surgeons to assess the abilities and limitations of the laser "light-knife". Now that freehand manipulation has been facilitated with the neutrally stable manipulator, work that was previously very difficult or impossible to carry out, can now be assessed to the full.

These techniques that are now being developed, are yet further examples of the application of the "hard" sciences to medicine. Perhaps, one day, the laser "light-knife" will take its place alongside the scalpel as one of the most useful tools at the surgeon's disposal. ■

Figure 4. The completed experimental surgery system makes possible complete freedom of movement at the working tip so that the surgeon need only apply gentle guiding pressure. Future models are to be lighter and slimmer.





The Plessey fluxgate magnetometer in use.

ELECTRONIC TOOLS FOR ARCHEOLOGY

by A. Aspinall

Dept. of Applied Physics
University of Bradford

In the past, archeology has been regarded more as an art than a science. That this is no longer the case is evident from the increasing involvement of scientists in the field practice of archeology, and the development of scientific instruments for the objective analysis of archeological data. Instruments and techniques evolved by physicists for the measurement of basic properties lend themselves readily to the examination of these same properties in archeological work.

In the past, the archoeologist operated largely on a hit and miss basis, and very often important discoveries were made as a result of luck. When no evidence of ancient ruins was visible on the surface of the ground, the only course of action open to him was excavation. He relied on old legends and local rumours, sometimes assisted by inspired deductions, to guide him to likely sites, but often months of arduous toil resulted in disappointment.

The modern day scientific archeologist uses entirely different techniques. He is aware that features such as walls, ditches, hearths, holes, etc, have certain physical properties which can be measured by the use of suitable instruments, while they are still buried in the ground. He knows, for example, that the electrical resistance of a particular volume of humus-filled, moist earth is about one millionth that of a similar volume of rock, and that the susceptibility to magnetisation of this earth is 10 times that of stone.

It is known that the firing of clays and iron-bearing earth alters the magnetic properties of the ferrous components, so that, when they cool later, their magnetism tends to be aligned along the direction of the magnetic field of the Earth at the time of firing.

The geophysicist also knows that differences in the field can be measured by using the techniques developed for geophysical investigations . To measure the electrical resistance properties of the earth it is necessary to introduce an electrical current into the ground by inserting two rods or probes; these must be separated by a distance somewhat greater than the expected depth of the feature under investigation. Two other intermediate probes are then used to measure a difference in electric potential thus created in the ground.

By this method it is possible to obtain an electrical resistance representative of the overall ground structure beneath the probes. Instruments are usually designed to give this value directly. A systematic traverse, made by using the probe system, over a suspected archeological feature shows up any variation in the resistance from which the nature of the substructure may be inferred. Two traverses at right angles to each other across the centre of a site, believed to be that of a pottery kiln, are shown as full lines in figure 2.

Large changes of resistance, consistent with a stone or brick structure occurring over a limited region can be seen. Localised reductions in resistance may be taken to imply that the internal regions of the kiln, now earth filled, are being crossed. The repeated movement and insertion of probes, which must be done in these surveys, is rather laborious, and ingenious switching devices and probe arrays have been devised in order to reduce the effort involved. Observed variations of resistance, however, do no more than imply variations of earth structure and these may be of a purely geological nature. Furthermore the sensitivity of the measurement is affected by local weather conditions; wet soil has a significantly lower resistance than dry ground.

The magnitude of the magnetic susceptibility of earth materials is, generally, very small and leads to changes of the order of 1/1000 part of the Earth's permanent magnetic field. For these measurements highly sensitive magnetometers are needed.

Instruments in use now for archeological surveying are based on three fundamental physical phenomena; the precession (movement round the axis of the field) of atomic nuclei about a steady magnetic field direction; the interaction of excited gaseous alkali atoms with a magnetic field; and the low magnetic field saturation properties of magnetic alloys.

In the first magnetometer, protons, the nuclei of hydrogen atoms readily available in water, are caused to precess about the Earth's magnetic field direction. The frequency of precession is very accurately related to the magnitude of the field and the protons, behaving as an enormous number of gyrating magnets, induce an alternating current of this frequency in a detector coil. After amplification, the frequency of this current, and hence of precession, can be measured with an accuracy approaching one part in a million. Small variations created by local differences in susceptibility caused by ditches, refuse pits and, in some cases, stone structures, may be detected. The local magnetism caused by kilns and hearths is much more prominent and may be as large as 1/100 of the Earth's magnetic field; these anomalies may therefore be located with a great deal of certainty.

Examples of traverses across the kiln of figure 2 are shown as dotted lines. The sharp high points are characteristic of "kiln-type" anomalies found by magnetometers.

The performance of the second type, the alkali vapour instrument is similar to that of the proton precession type. When either magnetometer is used it is necessary to "sample" the field; that is to take readings at stations spaced out over the area to be examined.

The third device, the fluxgate magnetometer, has the advantage of continouous recording. However, fluxgates used for archeological surveying do not have the sensitivity of the other two instruments.

All magnetometers have an important advantage over resistivity instruments; they do not require physical contact with the ground. Nor does a third class of instrument, based on the induction of electromagnetic effects in sub-soil conducting matter. A rapidly varying electric current in a coil system held above the ground induces currents in the conducting medium and these, in turn, modify the electrical conditions of the coil system. Measurements of these variations give the degree of electric and magnetic disturbance creating them. Originally designed for metal detection, these instruments are useful too for the location of soil-filled cavities in an otherwise thin soil cover. They have the basic disadvantage of a rapid fall off in sensitivity as the depth increases.

Where difficulties in exploring a site with a single method are met a combination of techniques is employed. Whichever method is used, it is common practice to take readings spaced out over the ground. In this way a contour map of "property variations" is created. Such a map can be expressed in various ways, perhaps as equal-value contours or by shading appropriate to intensity of response. Because of the very large number of readings involved, it may be necessary to employ a digital computer to process the data.

The speed with which large areas may be surveyed enables the archeologist to start excavation sooner, and with a greater certainty of success, than has been possible up to now. In an age when ancient remains are rapidly vanishing under the developer's bulldozer, this speed of action is essential.

When an archeologist finds specimens, he wants to know when and where they were produced and how they were made. The scientist, by appropriate analysis, may once again, be able to provide answers. The specimens can be made to reveal a great deal of information if examined properly. Organic matter, for instance, contains carbon, which is built up during the life of the animal or plant, and ceases on death and remains static from then on, except for a radio-active isotope of the element carbon, namely carbon-14. This decays at a characteristic rate; and it is present in dynamic equilibrium in the atmosphere.

The decay of carbon-14 is such that the number of active atoms present is halved every 5500 years. Thus, after death, the proportion of carbon-14 to stable carbon decreases at a slow but definite rate and a measurement of this ratio in ancient organic material gives the lapse of time since the death of the organism. From this it is possible to get an estimate of the greatest age of the environment in which the specimen was found. Techniques exist for the estimation of the age of samples other than those from living matter, particularly if, during their period of use, they have been raised to high temperatures.

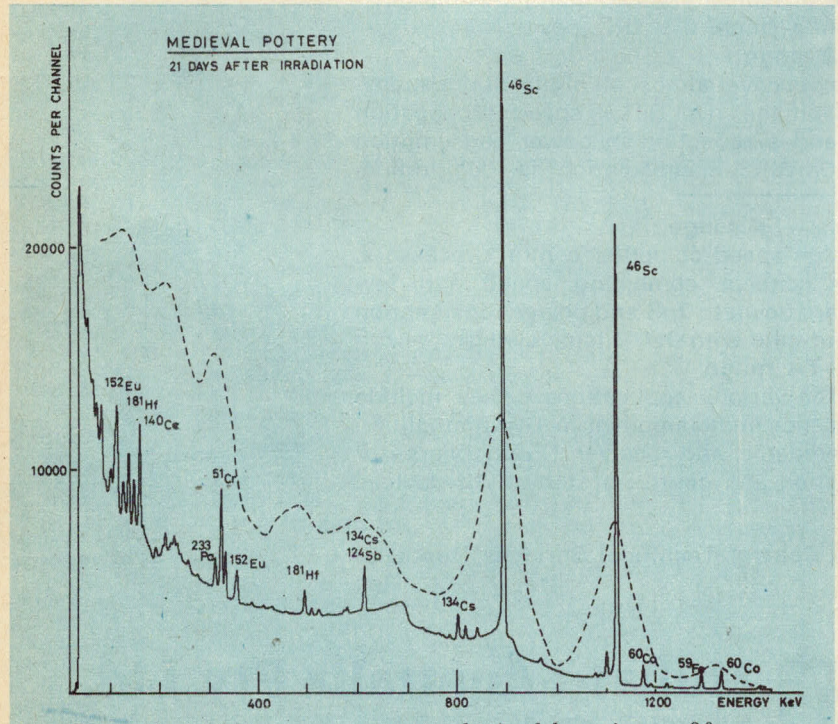


Figure 1. A gamma-ray spectrum, obtained by using an 80cu.cm Ge-Li detector, of irradiated medieval pottery. The general response curve of a sodium-iodide detector is given as a broken line, showing the greatly improved resolution achieved with the germanium crystal.

We have seen that residual magnetism in kiln clays is created by heating. The direction of this magnetism was determined at the time the kiln was last fired and then allowed to cool; the magnetic domains became aligned with the contemporary magnetic field of the Earth. A considerable library of data exists on the variation with time of the Earth's magnetic field. This enables the scientist to compare its direction, in a sample, with the field's present direction, and gives him a way of estimating the date of the last firing made in the kiln.

A laboratory magnetometer has been constructed at the Oxford Laboratory for Archeology and Art to enable these measurements to be made. Physicists there are also able to measure the date of fired material using the phenomenon of thermoluminescence.

Clays contain naturally occuring radio-active elements such as uranium and thorium in minute quantities. The energy of the nuclear radiations steadily emitted by these elements is, in part, absorbed by the material containing them and is stored in so-called energy traps. On heating, these traps are opened and energy is released in the form of light. The intensity of light is related directly to the period over which the radiation has been filling

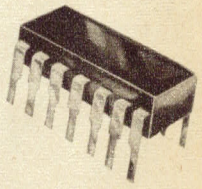
join the integrated circuit

(the people who use **Mullard** IC's)

Medium speed DTLs—FC range
These are monolithic circuits available in two temperature ranges for industrial and military applications. There is a wide choice of circuits, a high complexity of gates and modern encapsulations. Notable features include a propagation delay time of typically 20nS; high noise margins; high fan-outs; and operation from a single 6 V D.C. power supply.

Versatile high speed TTLs—FJ range
This is our general range and circuits cover almost all digital applications. These are monolithic and offer advantages over DTL in speed (propagation times are in the 13nS region) and a reduction in power consumption per gate (to approximately 10mW). Encapsulation is dual-in-line. Hermetic sealed types available.

Sophisticated, ultra-fast circuits—FK range
This is a specialised range for high speed computer central processors. It is a Mullard first—a new concept combining speed and low dissipation. Propagation delays are down to 2nS and power consumption is low (only 60mW for a standard gate with 0.7 V logic swing).



Compatible, versatile linears—TA range
These are specialised devices for various applications. They include low-level amplifiers, a high impedance audio amplifier, a 1-watt amplifier, operational amplifiers, a ring modulator, and receiver IF amplifiers, for telecommunications, instrumentation and control systems. All devices are of monolithic construction.

Send for full technical data to Central Technical Services Depts. at the addresses below—

Mullard

Mullard-Australia Pty. Ltd.

35-43 Clarence St., Sydney, N.S.W. 2000. Phone: 29 2006 ● 123-129 Victoria Pde., Collingwood, VIC. 3066. Phone: 41 6644 ● Cnr. Light St. and St. Paul's T'ce., Bowen Hills, QLD. 4006. Phone: 51 5151 ● 176 Wright St., Adelaide, 5000. Phone: 51 3123 ● 579 Murray St., Perth, W.A. 6000. Phone: 21 2561 ● Medhurst Wholesale Ltd., Hobart, Launceston, Burnie, TAS.

Associated with MULLARD LIMITED, LONDON

M 219

traps, that is from the last time of firing. An experiment in which a specimen is heated and the intensity of light it emits is measured thus gives the scientist an estimate of when it was produced. The technique shows considerable promise, provided the environment of the original sample has itself been examined for possible "contaminating" radiations.

Scientists would like to know something about the raw materials used by ancient man for his tools, weapons and ornaments and about the way he built them into completed articles. Spectroscopy over the range of the electromagnetic spectrum from microwaves (wavelength about 3 cm) through the visible range to X and γ radiation (wavelength about 10^{-12}m) is a powerful tool for such analysis.

Microwaves, infra-red radiation and X-rays are used to examine the structure of materials; concentration of elements that build up the structures can be studied with the aid of spectrometers designed for use in the visible, ultra-violet, X- and γ-ray ranges. In the visible region, a specimen is made luminous by heating and the distribution of intensity among the wavelengths of emitted light examined spectrographically. Radiation from a particular element is identifiable as specific groups of waves with intensities in a characteristic sequence, the overall intensity depending on the concentration of the element present.

A wide range of elements may be identified by careful examination of these spectra and their concentrations measured. An alternative approach is that of atomic absorption, when light from a laboratory source, containing a known element, is allowed to pass through a vapour containing atoms of the unknown sample at a temperature lower than that of the source. These atoms absorb, selectively, the radiation they would normally emit, so that the light emerging from the vapour is deficient in these wavelengths and the reduction in intensity is proportional to the concentration of the absorbing element. The sensitivities of emission and absorption spectrometers is such that trace elements present in proportions as low as one part in a million of the gross sample can, under favouralble conditions, be determined.

The sample sizes required for spectrometric measurements need be only one or two milligrams, but these are destroyed, a process that may not be permissible in some cases. Fortunately X- and γ-ray techniques are available that do not entail the destruction of specimens. In the method of X-ray fluorescence, atoms of the specimen are excited by electron or hard X-ray bombardment so as to emit their own characteristic

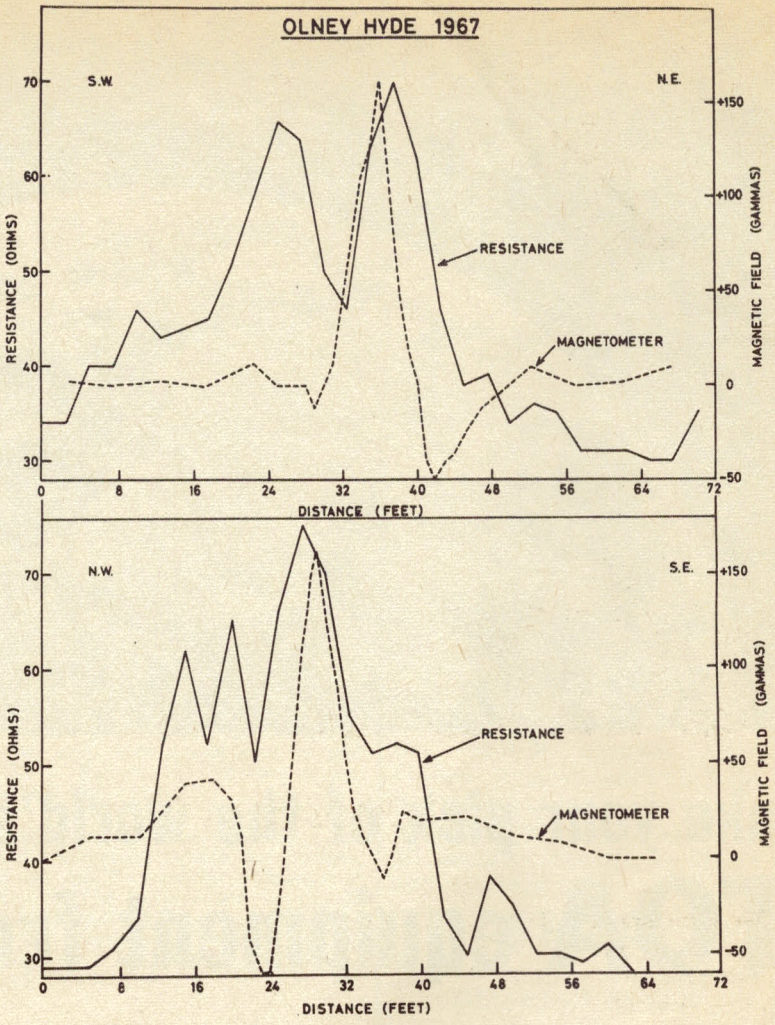


Figure 2. Earth resistance and proton magnetometer traverses across a suspected medieval pottery kiln, subsequently verified by excavation.

X-radiation; that is to "fluoresce" in the X-ray range. Measurements on these radiations, using X-ray spectrometers, allow the investigator to estimate the presence of elements in concentrations of 1/1000. The bombardment of the sample can be confined to a very small area of its surface layers, so that, by appropriate scanning, a picture of the surface distribution of elements can be made. The "milliprobe," designed on this principle by E. T. Hall and his colleagues at Oxford, has proved to be a valuable tool for the study of surface glazes and pigments. In all but extreme cases of surface bombardment, the method may be regarded as non-destructive.

When matter is exposed to intense irradiation by thermal neutrons, as in a nuclear reactor, isotopes of many elements absorb neutrons and became radio-active. A particular isotope may emit γ-radiation that identifies it uniquely in terms of γ-ray energy (or frequency) and the rate at which the total radio-activity dies away. For example the element scandium, of atomic mass 45, is present in minute quantities in most rocks and clays. It readily absorbs thermal neutrons to raise its mass by one unit, but is then unstable, becomes radio-active, and emits γ-rays of energy 889 and 1120 KeV (1 KeV – 1.6 x 10^{-16} joule) in a fixed intensity ratio. The activity decays by 50 per cent every 84 days.

A quantitative analysis of the γ-ray spectrum from an irradiated specimen enables the scientist to determine the presence of many elements with extreme accuracy, down to concentrations of 10^{-12} gm in certain cases. For many years the basic difficulty in the analysis of complex γ-ray spectra has been in the poor energy-resolving ability of γ-ray detectors. A great improvement has recently been made with the development of solid-state devices, notably lithium-drifted germanium diodes that are sensitive to γ-radiation. When used at liquid-nitrogen temperatures they have considerably better resolving power than traditional activated sodium-iodide detectors, but they are not as efficient.

A γ-ray spectrum of a sample of ancient pottery, obtained with a

(Continued on page 69)

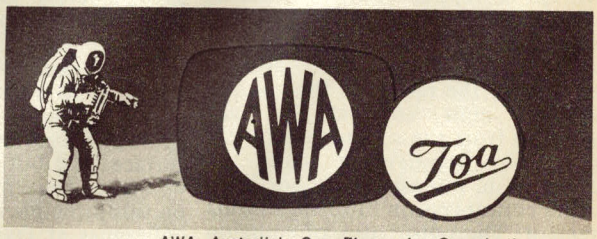


take your pick of the world's finest . . .

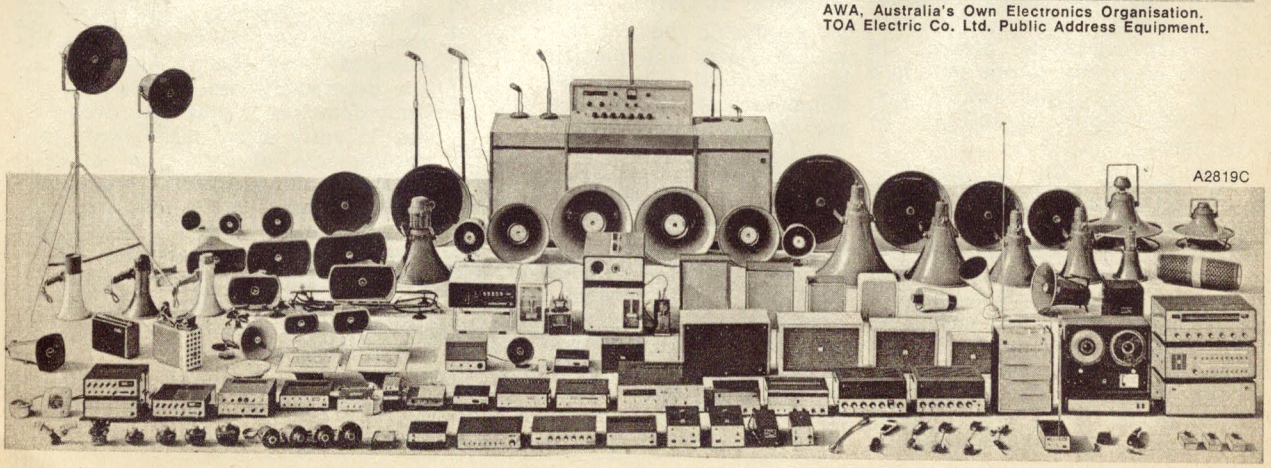
TOA equipment from AWA

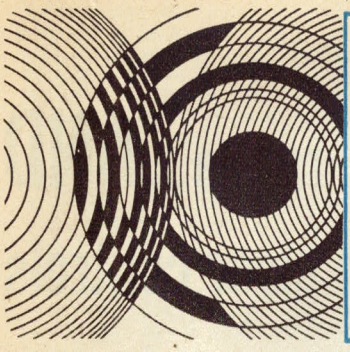
The world's finest public address systems and equipment . . . Australia's leading electronics organisation . . . AWA and TOA combine to bring a new high standard of equipment and service to Australia! TOA delivers high efficiency, long life and a sound that stretches carrying power and reliability to greater ranges in the most difficult conditions. TOA, Japan's top manufacturer of P.A. equipment, is now distributed in Australia and New Guinea by AWA, the Australian company deeply involved with satellite tracking, Project Apollo, satellite communication.

SYDNEY—Phone 797 5757
MELBOURNE—Phone 67 9161
ADELAIDE—Phone 72 2366
PERTH—Phone 28 6400
BRISBANE—Phone 41 1631



AWA, Australia's Own Electronics Organisation.
TOA Electric Co. Ltd. Public Address Equipment.





TECHNICAL DIGEST

Automatic micrograph scanner with high resolution

An advanced scanner now in use at the USA's National Bureau of Standards, Institute for Materials Research, is automatically scanning micrographs and producing data for metallographic analysis.

The device examines a photographic print or negative of 24 x 24cm at almost a million discrete points, assigns to each a density value from a 64-level grey scale, and presents an analysis of the data. Its speed of about two minutes for a complete scan and its resolution of a quarter of a millimeter make it extremely useful for metallurgical and biological analyses.

Reading graphical material directly into a computer for processing was a goal of computer pioneers. The Bureau early developed a drum-type scanner called SADIE (Scanning Analog-to-Digital Input Equipment) for use with the Bureau's SEAC (Standards Electronic Automatic Computer). SADIE scanned pictorial material 44mm square by means of a photomultiplier tube and produced a binary output – ones for dark squares and zeros for light areas.

Although slow by today's standards, SADIE was simple and reliable; it made possible a variety of research programs using first and second generation computers. Included were studies of character reading and pattern recognition, particle counting, and microstructure analysis. In the course of this work computer subroutines were developed to improve pictures degraded by "noise" and to distinguish individual objects in complex patterns. These subroutines were collected in STRIP (Standard Routines for Image Processing), a conversational computer program for digital image processing.

SADIE, SEAC, and STRIP were teamed in several projects. Graphite particles in cast iron were measured far more rapidly than by traditional "manual" methods, aiding in development of new ASTM (American Society for Testing Materials) charts for graphitic alloys. The amount of an alloy phase responsible for superconductivity was measured from colour separation prints of colour micrographs. Similar techniques were used to identify and count specific cells for biological studies.

Graphical readers grew with computers; an experimental SADIE-II was used with the Bureau's Pilot computer, while electronic scanning systems were used at the Bureau in such specialised devices as several models of FOSDIC and MAGIC (Film Optical Sensing Device for Input to Computers, and Machine for Automatic Graphics Interface to a Computer). The growth of computer speed and memory capabilities made obvious the usefulness of a scanner that would assign digital values to shades of grey in photographs.

This feature was provided by an NBS scientist, Dr George A. Moore, who, needing a larger device for precision metallographic analyses, designed a grey-reading machine called SADIE-III. It can be used to scan large copy (up to 24 x 24cm) at a resolution of ¼mm and at each point read the light value on a 64-level grey scale with a certainty of a fraction of a percent. Photographic prints, negatives, or transparencies can be scanned, as well as drawings.

Data from this SADIE, like its predecessor, can be recorded on magnetic tape for input to the computer. The new SADIE has an additional capability; it contains specialised computer circuitry that at the end of the scan displays a partial analysis of the data on two six-digit counters. This feature makes unnecessary the time and cost of a large computer for exploratory work or when only simple results are required.

SADIE-III was fabricated on a small metric metal-working lathe, an economical source of the dimensional precision and stability required. The micrograph is mounted on a drum turning between faceplate and tailstock. A photomultiplier tube is aimed through a microscope at a point on the drum that is illuminated by two small lens-end bulbs. This optical system is mounted on the lathe carriage and moved across the scan area by the lathe lead screw.

A similar optical system synchronises the gating circuitry that breaks up each rotational scan into up to 960 sensed positions. Its lights and sensing unit are aimed at a synchronising strip, attached to the left end of the drum, consisting of alternating black and white bars for most of its circumference and of a black strip for the remainder. The signal from the photomultiplier suppresses sensing when the blanking strip is seen and gates the scan as the black and white bars pass before it.

The scanning system also corrects for some defects in the photograph and of illumination. Recently added is circuitry providing a floating grey scale; it remembers successive brightest and darkest points to continuously adjust the proper range of the grey scale. Use of this feature, analagous to the "dodging" and "burning-in" of photographic art, corrects for small systematic differences of illumination in the microscope.

For accurate analysis of area and size, particle edges must be sensed accurately despite the fuzziness characteristic of



SADIE in use. On the drum is a 24cm x 19cm micrograph which will be examined at 750,000 points and the readings expressed on a 64-level grey scale.

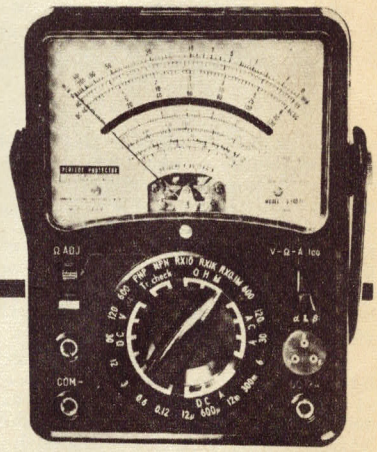
HIGH capacities ... a WIDE range ... AND HANDSOME cases with clear controls

THE WORLD FAMOUS RANGE OF Hansen MULTIMETERS BY

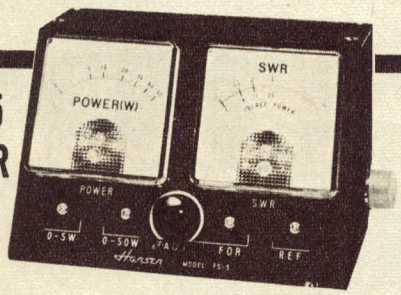
Model S-100 Tr — Measures AC/DCV, DC current, resistance, level & transistors

• DC 100,000 o.p.v. • 3" anti-parallax scale • Shock-proof suspension & full overload protection • DC voltage 0-600V • AC voltage 0-600V • DC current 0-12A • Resistance 0-1,600 mΩ • Transistor tester measures a, β, Ico • Size 2½" x 5 1/8" x 6⅞" • Weight 2 lbs. **$38** plus Sales Tax [1]

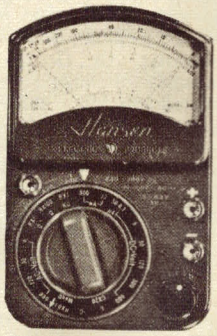
Also available: SWR-3 STANDING WAVE BRIDGE AND FIELD STRENGTH METER • Measures output power and standing wave ratio • Sensitive microammeter • Wide freq. band • Usable as field strength meter. **$12** plus Sales Tax. [2]



Model FS-5 Power-SWR METER

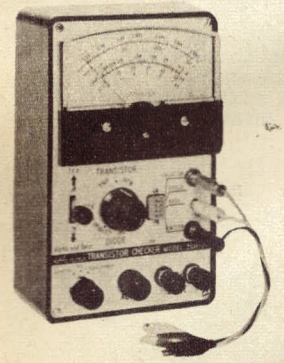


A power and standing wave ratio measuring instrument. Measurement ranges: RF power—0-5, 0-50 watts. SWR—1-3 VSWR • Frequency response—3 mHz-55 mHz • Meters—Power, 100μA DC F.S.D. SWR, 50μA DC F.S.D. • Dimensions—6⅜" (W) x 3⅞" (H) x 4⅛" (D). • Weight 2 lbs. **$28** plus Sales Tax [3]



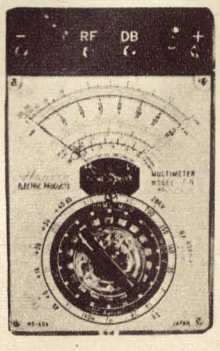
Model SC M/METER [5]

DC voltage, current, AC volts, resistance, capacity, inductance, LF level, valve emission • 6,000 o.p.v. • Resistance to 200 mΩ • Inductance to 1,000H • Level −15 to +58 • DC voltage—0-600 • AC voltage—0-600 • DC current—0-300 mA • Capacity to 2 MFDS • Size—5¾" x 3½" x 1". **$14** plus Sales Tax.



Model ZQM-2 Transistor Checker

Tests character of all receiving transistors in ranges of a, β and Ico by direct reading scale. Suitable for PNP, NPN, RF audio switching, general and power transistors, silicon and germanium diodes. **$20** plus Sales Tax [4]



Model FN MULTI-TESTER

• 20,000 o.p.v. • DC & AC to 700V • Probes to 28 kV • RF to 40V pk. DC voltage—0 to 700 • AC voltage—0 to 700 • DC current—0 to 140 mA • Resistance—OK to 0-50 mΩ. Size—6½" x 4" x 2¼". **$27** plus Sales Tax [6]

Distributed by:

JACOBY MITCHELL

SYDNEY	26 2651
MELBOURNE	30 2491
ADELAIDE	53 6117
BRISBANE	2 6467
PERTH	28 8102
LAUNCESTON	2 5322

MAIL THIS COUPON TODAY

Jacoby, Mitchell & Co. Pty. Ltd., 469 Kent St., Sydney, N.S.W. 2000.

Please send me details of the following instruments (place circle round applicable square).

[1] [2] [3] [4] [5] [6]

NAME.....

ADDRESS.....

.....POSTCODE.....

JM/5070EA1070

high-magnification micrographs. Dr Moore improved edge sensing by designing into SADIE a circuit that adds to the scan signal a time differential obtained from it. When in use this circuit counts doubtful points as the phase being entered. Thus questionable readings on crossing the boundaries of a particle are scored as the particle on entering and as the surrounding matrix on leaving.

The signal circuitry normally assigns to each point scanned a value on a 64-level scale of equally spaced greys. Also available to the user is a logarithmic density scale that simulates discrimination by the human eye and sometimes differentiates among several phases better than does the linear scale. Either scale can be adjusted to best discriminate among the tones present.

The scanner is used by attaching to its drum the pictorial material – usually a photograph – and setting the controls to match the tone scale and for the analysis desired. Then the lathe carriage is cranked to its leftmost position and engaged with the lead screw to slowly move the sensing system across the rotating drum. The following operations take place automatically: the sensing and analysing circuits are turned on when the first line to be scanned is reached and off at the last, an "end-of-file" notation is sent following the last datum, and the lathe turns itself off.

SADIE'S counter indications are used by the metallurgist to obtain several significant descriptors for the specimen. The area percent of a specific phase is found by dividing the number of counts of that phase's grey value by the total number of points scanned. When the area of several phases must be found the same material is scanned repeatedly by SADIE, with grey levels read by each counter changed on each scan to compile counts of additional phases on its two counters. Effective discrimination sometimes requires the scanning of colour transparencies through filters.

Further analysis is obtained from counts of the number of times that the scan enters particles of the phase being studied. The mean size of particles of this tone is obtained by dividing the area count by their intercept number. Division of the matrix area count by the intercept number, on the other hand, gives the mean free path between these particles. These relationships apply to distribution in volume as well as in sections. A size classification unit can be used to indicate the range of particle sizes.

Recent engineering improvements in SADIE'S capabilities raised the number of grey levels and added the floating grey scale circuitry, which is necessary to make the increased tone resolution meaningful. These features were particularly desired for metallographic analyses of austenite-ferrite mixtures and of spheroidised carbide structures. Accurately characterised samples of these materials have been needed for use as standards in X-ray phase analysis and in quantitative metallography. Present work with SADIE-III is expected to enable the Bureau to issue new Standard Reference Materials to fill this need.

SADIE'S scanning system has built-in correction for some errors inherent in an optical system. The aperture in the scanning system is slightly smaller than the individual scan units in order to compensate for edge diffraction. Because of the flare effect, some light still enters from outside the scan area, particularly when reading a single black spot surrounded by white. This error is compensated by inclusion as a negative signal of a fraction of the output of three photosensors observing the area around the aperture.

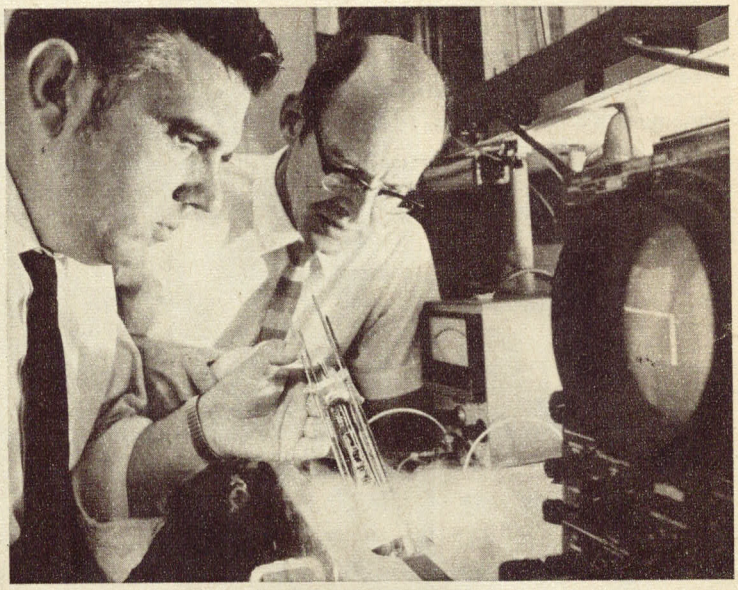
Although SADIE-III's scanning system was developed for precision metallographic analysis, its procedures are directly applicable to other work-to study of ceramic and biological materials, for example. When more computer capability than offered by SADIE is required, the machine is used as a scanner alone, feeding digital information to a 7-channel magnetic tape recording unit for later input to a computer. In this mode the scanner has been applied to aerial photographs, Post Office materials, and other subjects requiring analysis methods different from those now used for microstructures. (NBS "Technical News")

ULTRA PURE GERMANIUM

Scientists at the General Electric Research and Development Centre, Schenectady, New York, USA, have developed what they claim is the purest substance on earth.

Called ultra-pure germanium, the new metallic-looking material has less than one part of impurity in 10^{12}. The ratio is comparable to having only one grain of table salt in a freight car full of sugar. The new material was developed as part of a three-year program to make more effective devices for detecting X-rays, gamma rays, cosmic rays, and other high energy radiation. The research effort was funded in part by the Division of Biology and Medicine of the US Atomic Energy Commission.

A team of General Electric scientists headed by Dr Robert N. Hall and Theodore J. Soltys developed the technique for refining the germanium to such unprecedented levels of purity. The scientists start with an ingot of polycrystalline germanium which is already in a highly purified form, prepared by a process called zone refining. Their technique subjects it to still further purification and at the same time converts it into a single crystal.



GEC scientists check the germanium for purity.

The final ultra-pure germanium crystal has a silvery luster and is hard and brittle. A typical crystal is approximately six inches long and one to one-and-a-half inches in diameter. It weighs about a pound.

In preparing ultra-pure germanium, the zone-refined ingot is heated and melted, an oriented "seed crystal" is inserted into the melt, and a new crystal formed. Melting and crystallisation is repeated several times until the required degree of purity is attained.

The process is done in synthetic quartz or cleaned graphite crucibles, under a precisely controlled hydrogen atmosphere. The key to the new technique, says Dr Hall, is getting rid of all sources of impurity. "We had to learn where the impurities came from and then find out how to eliminate them", he explained.

The GE scientist described sources of impurity as "dust in the air, impurities in the furnace or in the source of heat, and even in the chemicals used to clean the original germanium ingot".

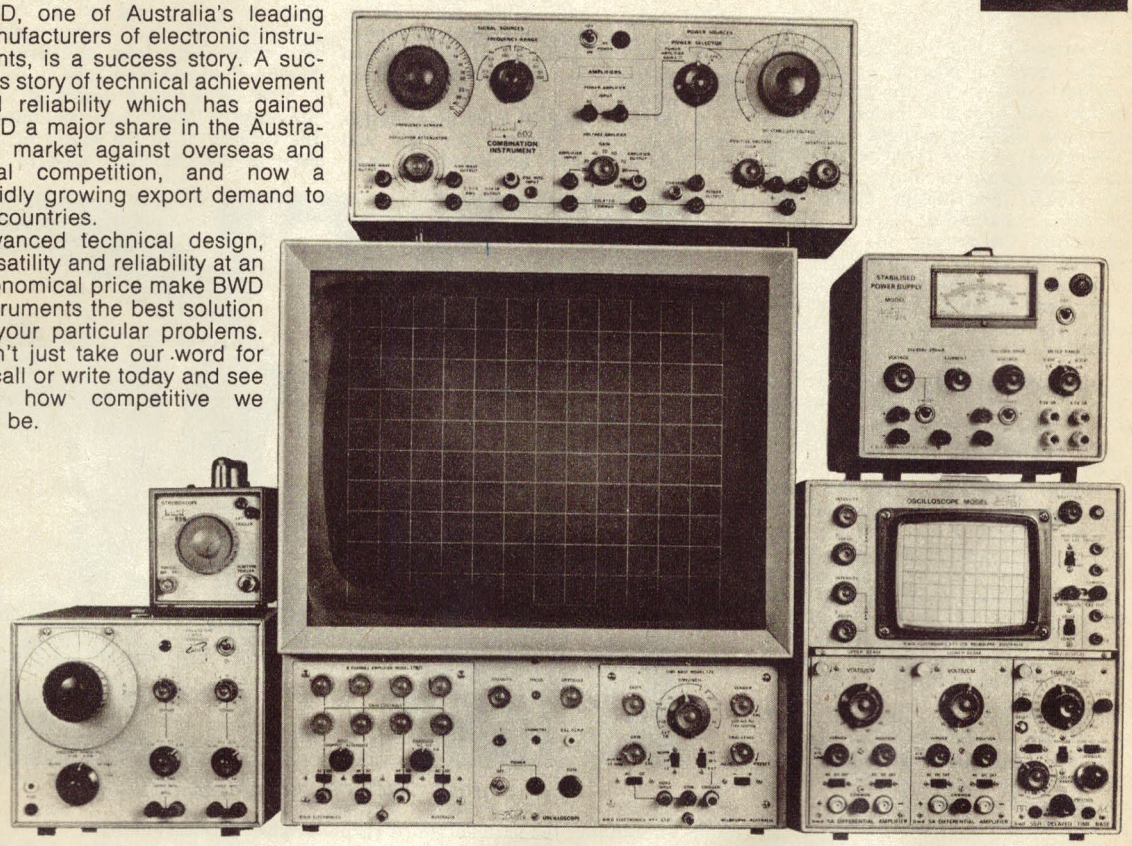
Sufficient quantities of the new material can be produced at General Electric's Research and Development Center to meet current market needs. The ultra-pure germanium is marketed and distributed by the company's Space Technology Products, Valley Forge, Pennsylvania.

Success of the GE breakthrough is expected to open new applications for the ultra-pure germanium, just as the zone-refining process of purifying germanium was instrumental in ushering in the era of solid-state electronics in the mid-1950s. "Meanwhile", says Dr Hall, "the success we've had leads us to believe we can do still better".

b.w.d This symbol of technical achievement in Australian electronic instrumentation has captured an export market in 25 countries.

BWD, one of Australia's leading manufacturers of electronic instruments, is a success story. A success story of technical achievement and reliability which has gained BWD a major share in the Australian market against overseas and local competition, and now a rapidly growing export demand to 25 countries.

Advanced technical design, versatility and reliability at an economical price make BWD instruments the best solution to your particular problems. Don't just take our word for it, call or write today and see just how competitive we can be.



NEW RELEASE TO THE b.w.d RANGE:

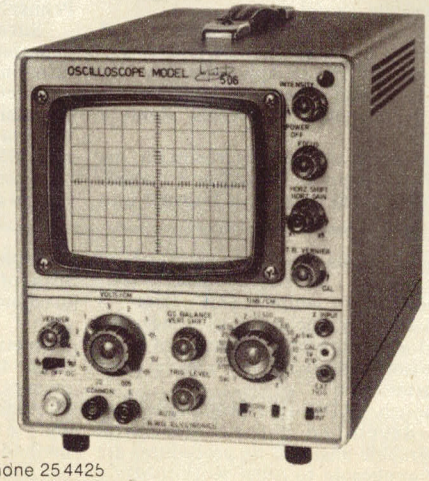
bwd 506 DC to 15MHz OSCILLOSCOPE

VERTICAL AMPLIFIER

DC to 15MHz — 3db ⎫ constant
5mV to 20V/cm ⎭ bandwidth
12 step attenuator and vernier
1MΩ and 30 pf input impedance

TIME BASE

200nSec to 2Sec/cm
22 steps and 5-1 Vernier
X5 Magnification
1 Hz to 15MHz Triggering
AUTO Trigger with bright base
Line or Level Select.
5" CRT 8 x 10cm display
3KV EHT P31 or P7 phosphor



To the 15 MHz 5mV performance add-
All solid state circuit,
protected F.E.T input,
Isolated ground to 400v,
Active TV line & Frame
Sync circuit
5% calibration including
10% line change.
D.C to 500 KHz Horz. Amp.
The low, low total
is only $298 + tax
if applic.

GL&C664BW

BWD ELECTRONICS P/L.
329-333 Burke Rd., Gardiner, 3146. Phone 25 4425
127 Blues Point Rd., Nth. Sydney. Phone 929 7452
Also phone S.A. 51 6895. W.A. 23 3871. Qld. 51 5121 and 63 581 in Wellington, N.Z.

DIGEST

CCTV SURVEILLANCE IN PRISON WITHOUT KEYS

New Zealand has recently completed a new maximum security prison at Paremoremo, near Auckland, which has a unique electronically controlled door system supervised by closed-circuit television.

The new Paremoremo Prison replaces the old Mount Eden Gaol, which had become a joke so far as its ability to keep prisoners inside was concerned. The best efforts of a devoted prison staff were unable to keep Mount Eden secure.

Paremoremo is a prison without keys, all doors being controlled from a central point which is itself supervised from yet another point. The whole system depends upon the use of closed-circuit television and electrically operated devices for the opening and shutting of doors and gates.

The extremely complex closed-circuit television and inter-communication system at the prison was designed, built and installed by the Electro-acoustics Division of Philips Electrical Industries (New Zealand) Ltd.

The classical method of prison escape is to overpower a prison officer, take his keys, and with these progress to the next officer, and so on, until the outer wall is cleared. A prison in which no officer carries a key, and the opening and closing of all doors and gates is controlled from a central strong point, makes this method of escape impossible.

The remote control system of opening and closing gates necessitated some system of communication, so that the controlling officer could satisfy himself on the identity of those requiring to pass. This is the function of the closed-circuit and inter-communication system.

On both sides of each gate there are inter-communication stations. Any person wishing to pass must first call the control room, as it is impossible for him to open the gate himself. When a call is received from any gate, the controlling officer answers the call. The switch which is used to make the interconnection of the sound system also automatically and simultaneously brings up the picture of the appropriate gate on one of the monitors. If, after scrutinising the picture, he is satisfied that everything is in order, he operates the control which opens the gate.

The caller can then pass into a space called a sally-port. The gate through which he has passed is then closed behind him by the control room officer, and only then is the second gate out of the sally-port opened. All gates are of open steel work so that any camera is able to see both sides of each sally-port.

The main surveillance system has 36 cameras and ten monitors. Each of the prison's 31 gates has its own camera and the inter-communication system, and there are five more cameras strategically mounted for special supervision. Eight of the 10 monitors are on the main control desk, one is set aside for test purposes, and one is a spare to be used if required. Two of the eight active monitors are reserved exclusively for the door control camera system; the other six can display the image from any camera which the control room operator wishes to close for supervision of any area.

Above the monitors is a ground plan of the prison on which individual lights come up to show which camera position is on view at any time. This is an aid to picture identification and a safeguard against confusion in the control room. Beneath each monitor is a pair of associated numerical indicator tubes on which the number of the camera providing the image is automatically displayed. This safeguards the control officer from becoming confused about which gate he is looking at.

A number of problems arose because of the complexity of the requirements. The most difficult of these was solved by using telephone-type crossbar switching. This uses three "twelve by ten" crossbar switches wired in such a way that any of the 36 cameras can be routed to any of the 10 monitors.

Video switching is through a Philips EL8220 video switching matrix. Although the number of video sources to be handled exceeds the recommended load for these units, no overload difficulties have been experienced. So far there has been no visible evidence of loss of frequency response in the display units, nor has there been any difficulties with cross-talk.

The use of crossbar switching with a "hunting" circuit enabled automatic selection of monitor positions to be provided. Thus the number of camera selections switches equals the number of cameras, and not the number of cameras multiplied by the number of monitors, as would have been the case if manual selection had been used.

The main camera-to-monitor selection system works in this way. When a camera is selected, the hunting circuit searches for a free monitor. As soon as it finds one, it switches the camera signal to that monitor and lights an indicator lamp on the diagram, to show the camera source position, as well as displaying on the numerical indicator tubes under the monitor the circuit number of the source camera.

There are only six monitors for general display, so it is possible for an operator to select a camera when there is no monitor available to receive its signal. In that case a lamp flashes a busy signal, indicating to the operator that he will have to make a monitor available by dropping the signal from one of the monitors already in use.

In certain positions in the prison there are double camera stations (that is, stations with two cameras each). If one of these is selected, the automatic selector circuit connects one camera to the first available monitor, and if an adjacent monitor is free, the second camera of the pair is connected to that monitor. If an adjacent monitor is not free, one is automatically freed by transferring its picture to the next adjacent monitor, and then the second camera signal is switched in to take its place. This ensures that double camera station signals always occupy adjacent monitors.

Video signals are sent from the main equipment to a master station overlooking the whole prison complex and the main entrance block. Included in this signal is a picture of the main control room itself. In the unlikely event of prisoners successfully seizing the control room, the staff at the main gate would know about this from their monitor and take the necessary isolating action immediately.

Apart from the system described above, there is a comprehensive system for distributing up to three radio programs and one tape music program to every cell and to the administrative blocks in the prison. The prisoners themselves each have specially constructed units with volume control and program selectors by means of which they can listen to the program of their choice. The selectors have remote controlled over-ride relays to enable the system to be used for paging purposes and announcements.

Separate subsidiary positions control the paging to each block, each with its own paging amplifier. The music distribution amplifiers are powerful enough to supply all loudspeakers in the system simultaneously.

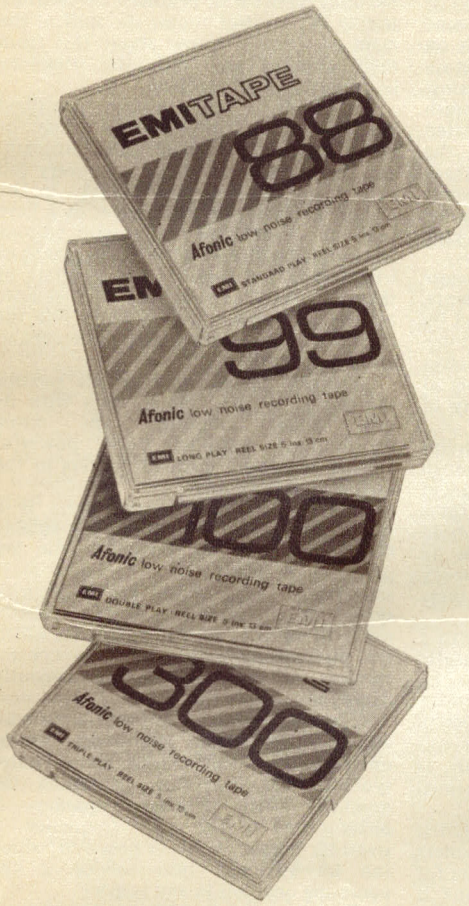
Within the prison itself there is a special block, described as the "intractable block," reserved for prisoners who are particularly dangerous or require close supervision. This block has a security system of its own with a separate control room fitted with four monitors on which the pictures from the four gate control cameras of the block are permanently displayed.

The system uses a fully inter-laced 625-line standard, and all timing operations are carried out by a Philips synchronising generator, in which the nominal 50Hz frame frequency is phase-locked to the mains frequency. A stand-by sync-generator is provided, which can be switched into service if the operating one fails in any respect.

Because of the nature of the system, many cameras will have long periods of "down time" during which they will not be called upon to supply a monitor, yet they must be able to supply a stable picture instantly. For applications of this kind, a system has been devised to lengthen tube life, by having a stand-by situation for cameras not in use, and yet ensuring that a camera can be selected and will come on-power without delay. In the "stand-by" situation, the vidicon tube heater is run at lower than normal voltage, the target voltage is taken off the tube, the beam current is suppressed, and a shutter is placed over the lens to block off light from the photo-conductive layer. The shutters are solenoid operated, for remote control. The stand-by relays and the shutter solenoids are switched on by an appropriate contact on the crossbar matrix. (Philips "Sound + Vision") ■

EMITAPE

Afonic-low noise recording tape in the NEW transparent library case



Type No.	88 STANDARD PLAY	Reel Diameter Ins	cm	Approximate Tape Length feet	m
	The best general purpose tape, giving maximum durability at all professional speeds. Prestretched polyester base film of super strength.				
88/12		7	18	1200	366
88/6		5	13	600	183
88/4		4	10	300	91

Type No.	99 LONG PLAY	Reel Diameter ins	cm	Approximate Tape Length feet	m
	50% longer recording time specially designed for multi-track recorders. Prestretched polyester base film of super strength.				
99/18		7	18	1800	549
99/12		5¾	15	1200	366
99/9		5	13	900	274
99/4		4	10	450	137
99/3		3	8	210	64

Type No.	100 DOUBLE PLAY	Reel Diameter ins	cm	Approximate Tape Length feet	m
	Twice the recording time for a given size of spool the perfect film for low speed multi-track recorders superflex polyester base film.				
100/24		7	18	2400	732
100/18		5¾	15	1800	549
100/12		5	13	1200	366
100/6		4	10	600	183
100/3		3	8	300	91

Type No.	300 TRIPLE PLAY	Reel Diameter ins	cm	Approximate Tape Length feet	m
	Maximum playing time on spools up to 5" dia. extended dynamic range specially suitable for battery operated recorders extra tensile polyester base.				
300/18		5	13	1800	549
300/9		4	10	900	274
300/3		3	8	450	137

The new and attractive Emitape transparent hinged library case ensures dust free storage. The pre-folded index card included, has been specially designed to provide maximum space for titling with easy visible reference without opening the case.

EMI

To **The Advertising Department EMI Australia Ltd.,**
P.O. Box 352, Haymarket, Sydney 2000.

Please send details of the EMI Tape Afonic Low Noise Recording Tape

NAME

ADDRESS

STATE POSTCODE

SCIENTIFIC AND INDUSTRIAL NEWS

CETIA 71.

The Minister of Supply, Senator Sir Kenneth Anderson, will officially open the 1971 Control, Electronics, Telecommunications, Instruments, and Automation (CETIA) Exhibition, to be held from February 15 to 19 at the RAS Showground, Sydney. The Minister will also address delegates attending the EAA national symposium, "The Seventies – The Electronic Decade", which forms part of the CETIA Congress. Keynote speaker at the symposium will be the chairman and managing director of Philips Industries Pty Ltd, Mr H. D. Huyer. The main topics to be discussed will be electronic data processing, communication, control systems, and instrumentation.

The Minister for National Development, Mr R. W. Swartz, has accepted the invitation of the Institute of Instrumentation and Control Australia to officially open its national symposium, "The Advance of Process Automation in Industry", Nuclear energy will be a key topic at the symposium. Speakers will deal with requirements for the installation of a nuclear power station. Other topics include computers, chemical processes, pollution control, and metrication.

The Fluid Power Society, one of the contributing organisations, will include an international speakers day in its national symposium, "Automation Through Fluid Power". The National Association of Testing Authorities, the other associated organisation, will conduct a symposium on the theme "Laboratory Management". Particulars of the exhibition, congress and and symposia can be obtained from the Executive Director, National CETIA Program, GPO Box 3629, Sydney, 2001.

Personal two-way radios

Australian telecommunications companies are collaborating with the Department of Supply in investigating the possibility of short-range radio for communication between individual soldiers of a squad or group. It would be smaller than the PRC-F1 lightweight man-pack transceiver used for communication between forward groups and command posts. A spokesman for the Australian Telecommunications Development Association said that individual two-way radios would necessitate applying the most advanced design knowledge, including the extensive use of integrated circuits of microscopic size.

Damage to films

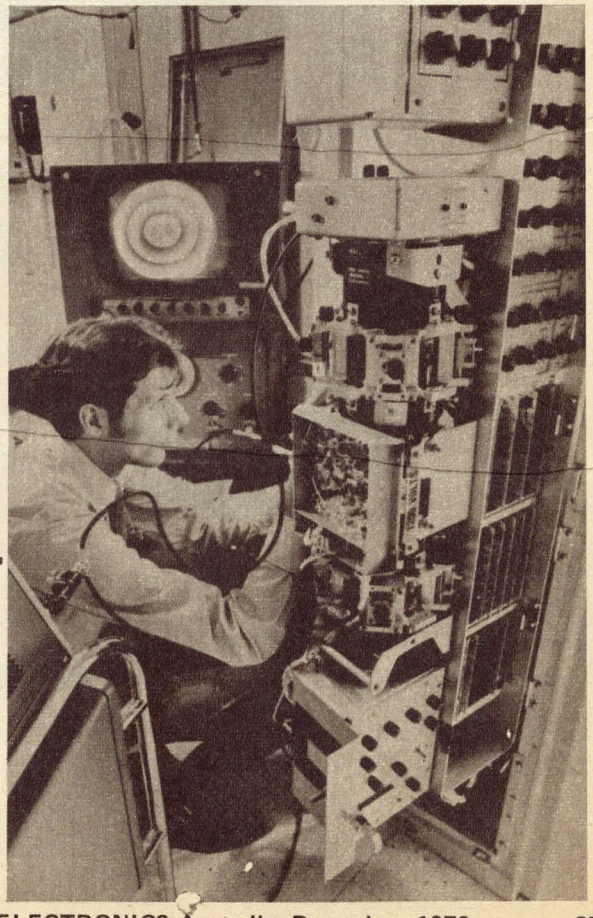
Kodak has advised air passengers of the possibility of damage to unprocessed films (both exposed and unexposed) from X-ray and fluoroscopic devices used to check luggage for security purposes. Many airlines and government agencies use magnetic detection equipment which has no effect on films. If films are X-rayed, the result is the same as if they had been totally fogged or light-struck; all exposures made before or after the X-ray treatment would be completely spoiled. Processed films are unaffected by X-rays.

The best protection at present against X-ray fogging is to carry all films in hand luggage. In locations where hand luggage might be screened, passengers are advised to offer their carry-on luggage for visual examination.

International symposium

The Polytechnic Institute of Brooklyn has announced the 21st in its series of annual international symposia. To be held in New York City on April 13, 14 and 15, 1971, the theme of the symposium will be "Computers and Automata – Towards a Common Theory". It is co-sponsored by US Defence Research Agencies and is organised with the participation of the Institute of Electrical and Electronics Engineers, and the Society for Industrial and Applied Mathematics.

The topics to be discussed will be grouped under the following broad headings: Basic limitations on speed and power; Real-time and other time-bounded computations; Artificial intelligence and computer creativity; Principles of languages, programming and compiling; Computer architectures; Synthesis of automata and logical circuit design; Machine diagnostics. Inquiries should be addressed to the Polytechnic Institute of Brooklyn, MRI Symposium Committee, 333 Jay Street, Brooklyn, NY 11201, USA.



Radar bright-display equipment

An engineering model of a radar bright display scan converter, on test in a Westinghouse laboratory. The company is to supply 161 of these units and two control rack assemblies to the US Federal Aviation Agency to expand the air route traffic radar control centres in the USA. Radar bright display equipment and a double ended storage tube are used to transform air traffic control radar and beacon information into a high resolution 945-line television display which can be seen in normal lighting. (Westinghouse News and Information Service, GPO Box 3270, Sydney, 2001.)

The rave reviews keep coming...

"The Bose 901 is, indeed, one of the finest speaker systems it has ever been my pleasure to hear. I have lived with it now for several months, so that I am quite sure of what I say . . . it is the sound itself that remains paramount. The 901 is characteristically smooth. Everything is simply **there** . . . I urge that you listen for yourself. I think you will have to agree that Bose has, in a single giant step, produced one of the finest speaker systems ever made."

Larry Zide—American Record Guide—December 1969.



1. Norman Eisenberg—High Fidelity
"you feel you've made some sort of stereo discovery . . . if your own response to it is like ours, you'll be reluctant to turn it off and go to bed."

2. Julian Hirsch—Stereo Review
"all the room-filling potency of the best acoustic-suspension systems, combined with the tautness and clarity of a full-range electrostatic speaker . . . I have never heard a speaker system in my own home which could surpass, or even equal the BOSE 901 for over-all 'realism' of sound."

3. Bert Whyte—Audio
"the illusion of an orchestra spread across the wall is uncanny . . . To hear a thunderous low 'C' organ pedal . . . or a clean weighty impact of a large bass drum is truly impressive . . . There is no doubt that the much-abused term, 'breakthrough', applies to the BOSE 901 and its bold new concepts."

4. Hi-Fi Buyers Guide
". . . its over-all sound quality so clean that the listener is almost unaware of the electronics between him and the instruments . . . The sound? The 901 is very possibly the only speaker to date to pour forth in true concert hall fashion."

5. Stereo & Hi-Fi Times
"but the proof of the pudding inevitably is sound. And it is here that the BOSE 901 stands clearly away from the crowd . . . What a lovely sound those speakers produce! . . . Listen to Columbia's 'Carmina Burana' on this speaker and hear what a chorus should sound like! . . . these speakers provide a quality that is not to be matched."

6. Elementary Electronics
"conclusion. The BOSE 901 speaker system delivers the most natural stereo sound, creating the illusion of being in a concert hall, with a uniformity of frequency response and freedom from distortion that is unbelievable, particularly if the listener takes into account the physical size. It is our opinion that this is the speaker system to own, regardless of price, if one wants the ultimate in listening pleasure."

Your inquiry will bring you complete reprints of these unprecedented reviews and a list of franchised BOSE dealers in your area. Ask your dealer for an A-B comparison of the BOSE 901 with the best conventional speakers—**regardless of their size or price.** Then, go back to your present speakers—if you can.

You can hear the difference now.

BOSE

Australian Distributors

W. C. Wedderspoon Pty. Ltd.

Showroom: 193 Clarence Street, Sydney. 29-6681

WD2/FP

W.A. Leslie Leonard
London Court,
Perth, 6000.

VIC. Douglas Trading
191 Bourke St.,
Melb., 3000.

A.C.T. Homecrafts
Petrie St.,
Canberra, 2600.

TAS. P & M Distributors
87 Brisbane St.,
Launceston, 7250.

QLD. S. G. Hughes
154-158 Arthur St.,
New Farm, 4005.

Sound Spectrum
33 Regents Arcade,
Adel., 5000.

Miners' television

Equipment for six television repeater stations has been supplied by Broadcast Engineering, a division of Associated Telecommunications Australia Ltd, under contract to the Australian Mining Industries Council. (A television repeater station is a station of low operating power designed to transmit only programs recorded on magnetic tape.)

The stations will serve the mining communities of Weipa, Groote Eylandt, Mount Tom Price, Dampier, Koolan Island, and Mount Newman. Karratha and Cockatoo Island will be served by translators from Dampier and Koolan Island respectively. In addition, five mission stations (with local populations of up to 1,000 Aborigines who have never seen television) and several fishing villages will receive the programs.

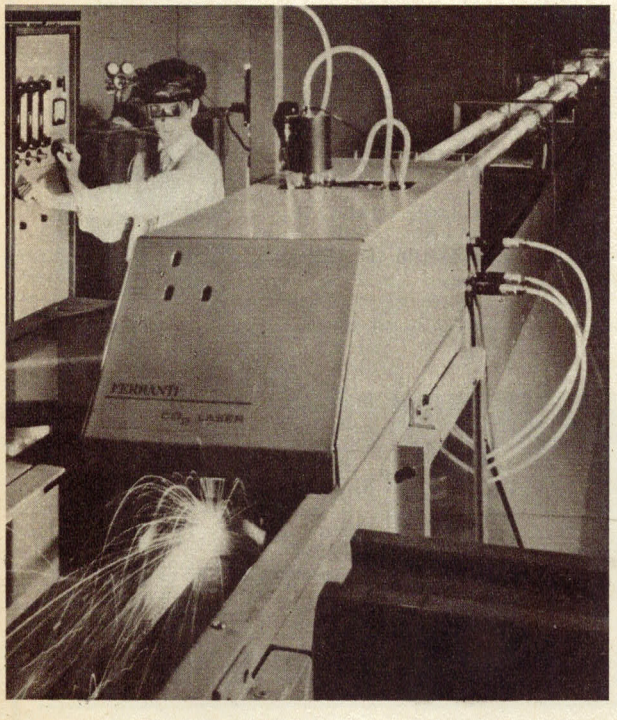
Each station includes two video tape recorders, a vision and sound control desk, with comprehensive switching and test facilities, and a rack containing video processing, pulse generating and transmitting equipment. The transmitter uses low level IF modulation. Each station is capable of transmitting PAL colour signals. The programs, of a quality comparable with those in the metropolitan areas, will be video taped by the Australian Broadcasting Commission and flown regularly to the stations.

The station at Weipa opened on November 3 with a video recording of the Melbourne Cup run that day. The other stations were planned to open by the end of this year.

Canadian ground stations

Telesat Canada is seeking preliminary proposals from 30 firms in connection with the construction of 34 ground stations for Canada's first domestic communication satellite, due to be launched in late 1972 or early 1973. After examining the proposals, Telesat will ask five or six of the firms to submit formal bids. Surveys have been conducted on the proposed sites, and construction of the ground stations (to cost nearly $C40-million) is due to begin next year. The plans include two heavy-route stations to be built near Toronto and near Victoria, British Columbia, to house telemetry, tracking and command facilities.

High power laser



A very high power laser, developed by Ferranti Ltd, has been installed at a Rolls-Royce factory in Scotland. The laser is a continuous output carbon dioxide (CO_2) blowing-gas folded type with a rated output of 600W, but said to be capable of delivering 1150W of continuous power. The laser will be used for cutting and welding studies, mainly on the specialised metals of the aerospace industry. The laser, with an overall length of 8 metres, is rigidly mounted in a frame structure which encloses the necessary vacuum manifold and cooling water circuits. The power supply is housed in a compact operating console. (Ferranti Ltd, Ferry Road, Edinburgh EH5 2XS, Scotland.)

Cartridge video recorder



A miniature colour video tape recorder, which can record on cartridges or open-face reels, has been developed jointly by Toshiba of Japan and Ampex of the USA. The recorder, called "Instavision", weighs only 15lb and operates from either batteries or mains. The unit has two independent audio channels. Slow-motion playback and electronic editing are possible. Using standard video tape, 20 minutes of recording are possible. The unit will be marketed in Japan in mid-1971 for about $A600. (Tokyo Shibaura Electric Co Ltd, Gold Fields House, 1 Alfred Street, Sydney, 2000.)

Apollo program

Apollo 14, the sixth US manned flight to the moon, is scheduled to lift off from Cape Kennedy on February 1, 1971 (Australian time). The Apollo 14 astronauts will explore the hilly uplands region 15 miles north of the Fra Mauro crater. They will set up a series of experiments to study the surface and internal structure of the moon, the lunar ionosphere and atmosphere, solar wind at the lunar surface, and the lunar magnetic field. They will also bring back lunar materials which scientists believe were originally deep inside the moon.

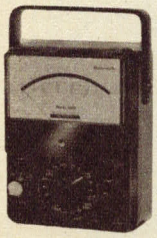
Astronauts Shepard and Mitchell will spend one-and-a-half days on the moon, including two four-to-five-hour ventures outside the lunar module. While Shepard deploys other scientific instruments and gathers rocks, Mitchell will lay out 310ft of cable and stick three vibration detectors (called geophones) into the soil at 150ft intervals. As he walks back to a central recording and relay station, he will fire cartridges every 15ft with a device called the "thumper", which creates seismic waves for detection by the geophones.

After firing the last of the cartridges, Mitchell will set up and arm a four-barrel mortar containing four high-explosive grenades that will be launched by radio command from earth after the astronauts have returned from the moon. The grenades will detonate at ranges of 500ft, 1,000ft, 3,000ft and 5,000ft. The vibrations caused will also be picked up by the geophones. Their strength and speed through the moon will provide additional information on its structure. Data will be obtained from as deep as 1,500ft.

A northern lunar plain cut by a large gorge that runs along the base of some of the moon's highest mountains has been chosen as the landing site for Apollo 15, scheduled for launch July 25, 1971. The site is about 3 east of the centre of the moon as viewed from earth, and 25 (about 465 miles) north of the lunar equator on the edge of the massive Mare Imbrium. In contrast, the sites where Apollos 11 and 12 landed last year, and the site for Apollo 14, are all within 70 miles of the equator.

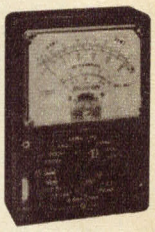
University TEST EQUIPMENT

U.G.I. wish you a Merry Xmas and a Happy New Year, and suggest one of the following instruments as an ideal Xmas Gift for students, hobbyists, etc.

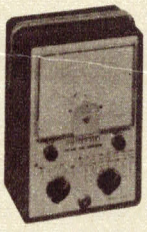


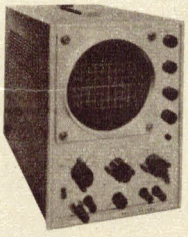
MODEL MVA—100 Multimeter
D.C.V.: 0.5-2.5-10-50-250-500-1000 (100 KΩ/V). A.C.V.: 2.5-10-50-250-1000. D.C.A.: 10 uA-250 uA-2.5 mA-25mA-250mA-10A. A.C.A.: 0-10A. Ohms: 20K-200K-2M-200M. db —20/0/+62.
Price each: $35.00 + 15% S.T.

MODEL MVA—4 Multimeter
D.C.V.: 2.5-10-50-250-1000 (20 KΩ/V). A.C.V.: 2.5-10-250-1000 (8 KΩ/V). D.C.A.: 50uA-2.5 mA-25 mA-250 mA.
Ohms: 10K-100K-1M-10M.
db. —20/0/+22. +22/+36.
Price each: $16.00 + 15% S.T.



Model MVA—6 vacuum tube Voltmeter. AC-DC Volts. 7 ranges to 1.5KV; P.P. volts, 7 ranges to 4KV, db (1mW-600) 10db to + 65 db ohms .2 to 1000M.
Price each: $45.00 + 15% S.T.
Also available in Kit Form.



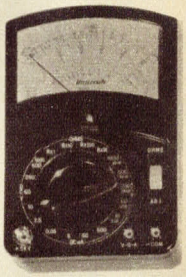


Model UC5 5" Oscilloscope.
Vertical: 10mV P.P./cm.
Freq. Range: D.C. to 10 MHz.
Horizontal: 300mV P.P./cm.
Wide Sweep 1Hz to 200 KHz.
Continuously variable.
Price each $250.00 + 15% S.T.

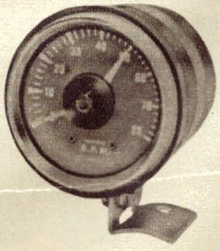


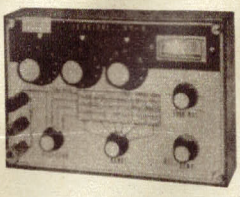
Model MVA—5 Multimeter.
D.C.V.: 5-25-50-250-500-2.5K (20KΩ/V). A.C.V.: 10-50-100-500-1000 (10 KΩ/V). D.C.A.: 50 uA-2.5 mA-250 mA. Ohms: 0.6K-6M. db: —20/01+22.
Price each: $10.00 + 15% S.T.

Model CT-500 Multimeter
D.C.V.: 2.5-10-50-250-500-5K
A.C.V.: 10-50-250-500-1K
D.C.A.: 50uA-5mA-50mA-500mA
Ohms: 12K-120K-1.2M-12M.
db: —20/0/+62
Price each: $14.00 + 15% S.T.



Automotive Tachometers
★ Universal Mounting.
★ Illuminated Dial.
★ Maximum Rev. Pointer.
★ Chromed Bezel.
When ordering please specify: 6,000 or 8,000 RPM—4, 6 or 8 cylinder—6V or 12V system.
3" Diameter.
Price each $19.50 + 15% S.T.





Model BR8 AC Bridge
Inductance (L) 1μH-111H. 6 Ranges.
Capacitance (C) 10pF-1110μF. 6 Ranges
Resistance (R) 0.1 Ω-11 1 MΩ. 6 Ranges
Turns Ratio (T) 1/10000-1; 11100.
Price each: $50.00 + 15% S.T.

ALL BACKED BY "UNIVERSITY" SALES, SPARE PARTS AND SERVICE

All test equipment can be inspected at

University Graham Instruments Pty. Ltd.

106 Belmore Road, Riverwood, N.S.W., 2210.
Telephones: 53 0644 (5 lines).
Telegrams and Cables: Raquip, Sydney.
Victorian Office.
Contact Mr Graeme Wright on 397 7253 or at 5 Langridge Street, Werribee.

REPRESENTATIVES:

WA: Atkins (WA) Ltd. 894 Hay Street. PERTH: WA. 6000.
TAS: W. P. Martin and Co. 202 Argyle Street. HOBART: Tas. 7000. And 32 Canning St. LAUNCESTON: Tas. 7250. 22 844.
SA: Compar Distributors Pty Ltd. 33 Market Street. ADELAIDE: SA. 5000. 51 6263.
NEWCASTLE DISTRICT: Hunter Engineering Sales Pty Ltd, 64 Broadmeadow Road, Broadmeadow. NEWCASTLE, NSW. 2303. Phone 61 4321.
PORT KEMBLA DISTRICT: Hundell Engineering Sales Pty Ltd. 1 Fitzwilliam Street. PORT KEMBLA. 2505. 43 397.
QUEENSLAND: And from our newly appointed agents in Qld. Gee & Co., 35 Railway Terrace, Milton.

Also available from all leading wholesalers.

Opera House electronics

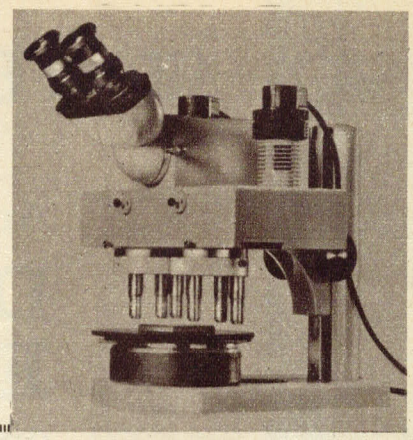
The NSW State Government has awarded contracts worth nearly $1 million to Amalgamated Wireless (A'sia) Ltd for the installation of a comprehensive system of electronic services in the Sydney Opera House. There will be eight electroacoustic systems, which can be interconnected to provide comprehensive sound amplification and distribution in the various theatres and public areas. A simultaneous interpretation system will allow multi-lingual conferences to be held at the Opera House. Another contract is for a closed-circuit television system, including video tape-recording and playback.

A contract has also been let to Standard Telephones and Cables Pty Ltd for the supply and installation of a modern telephone system, including two Pentacosta private automatic branch exchanges, for the Sydney Opera House. These will provide 350 lines for the Opera House management and 25 lines for caterers. Tie-lines between the two systems will give complete internal communications. The installation will provide for 31 exchange lines to the external PMG network, and direct tie-lines to the Australian Broadcasting Commission.

Food research program

The CSIRO Division of Food Preservation at North Ryde, NSW, recently took delivery of a Digital Equipment PDP-15/30 computer. The division is investigating the flavour components of foods and their behaviour during preservation processes. This involves very demanding chemical analysis using a mass spectrometer and up to 18 gas chromatographs operating simultaneously. The division plans to use the computer for processing data from all the instruments, thereby considerably reducing the time before final results are available, and increasing the overall output of the instruments.

Circuit alignment microscope



This mask alignment microscope, manufactured by Carl Zeiss of West Germany, is used for the alignment of transistor and integrated circuit masks with the circuit support during production. The instrument works on the principle of comparing two objects viewed simultaneously as two clearly separated images which can, by sliding diaphragms, be superimposed either partly or completely over each other. (Degenhardt & Co Ltd, Carl Zeiss House, 31-36 Foley Street, London W1P 8AP, England.)

Computer technicians graduate

Eight student technicians have graduated from the first computer technology course conducted by the Institute Division of Control Data Australia Pty Ltd. They completed a full-time 28-week course designed to produce computer technicians for such jobs as systems manufacturing, installation testing, operation, maintenance, and repair.

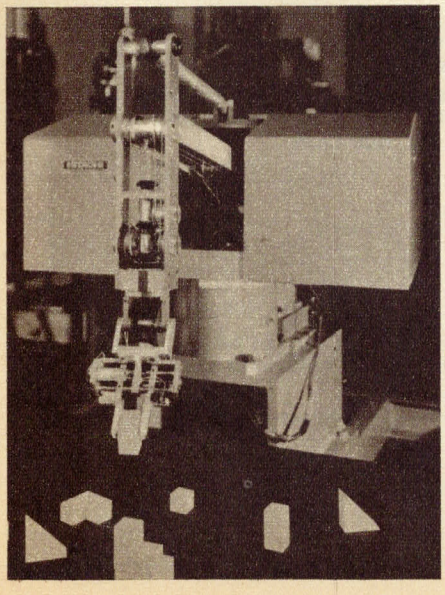
The Institute Division expects to double its total intake of students in 1971 to about 270. Established early this year, the institute will increase the number of full-time programming technology courses from three to seven, and evening programming courses from one to three. It will again run two full-time computer technology courses. The institute will run several 7-week evening courses on an introduction to digital computers. It has also decided to provide specially designed courses for groups from individual user organisations or potential users. See also "Electronics Australia", November 1970, page 18. (Institute Division, Control Data Australia Pty Ltd, 283 Alfred Street, North Sydney, NSW 2060.)

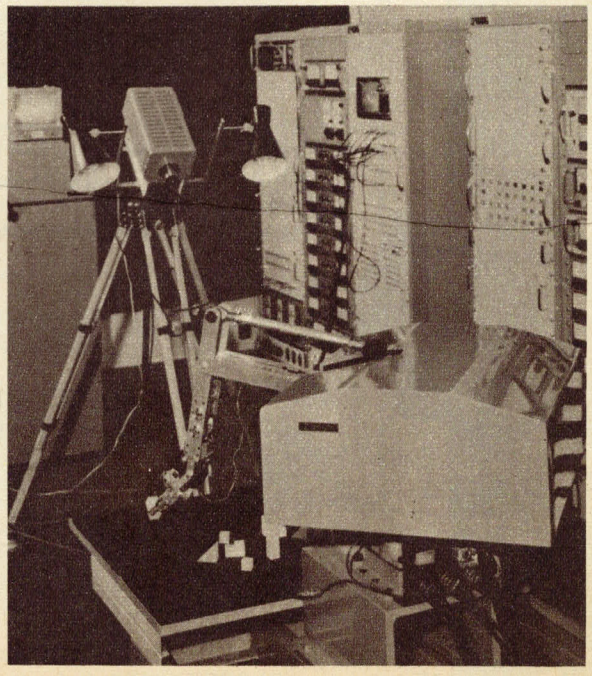
Computer-assisted industrial robot

A prototype computer-assisted robot, developed in Japan by Hitachi Ltd, requires no human assistance in assembling various parts of an integrated product once it is shown an orthographic projection of the product. Known as the Hitachi HIVIP Mk 1, it is a combination of a computer system, two television cameras and a manipulating hand.

With the aid of one of its TV camera "eyes", the robot surveys the orthographic diagram of the required product and reconstructs within its memory a stereographic image of the object and analyses its dimensional structure. When it has completed its analysis and comprehends the three-dimensional structure of the object on the diagram, the robot compares the diagram-orientated image with the actual image of the various component parts placed on the table. The parts are viewed with the robot's other TV camera "eye".

The two images are compared and recognised by the robot which then decides how to assemble the parts into the required form. Its "brain" is pre-stocked with the data of simple thinking processes required to perform such basic tasks as deciding the most economic movements for the hand to travel to and assemble the various parts on the table. When the final assembly procedure is decided, the computer activates the manipulating hand. This moves in seven different modes, sufficient to simulate the basic functions of a human hand. (Hitachi Ltd, Nippon Bldg, No 8, 2-chome, Ohte-machi, Chiyoda-ku, Tokyo 100, Japan.)





LEFT: Hitachi's industrial robot picks up a block to show its ability to assemble a complex product without human assistance. The robot is a combination of a computer system, two TV cameras and a manipulating hand.

RIGHT: A general view of the robot with, at the rear, one of its television camera "eyes".

SECOND EDITION NOW AVAILABLE!

An Introduction to

DIGITAL ELECTRONICS

Theory, Instruments and Computers

A 104-page basic textbook written by Jamieson Rowe, B.A. (Sydney), B.Sc. (Technology, N.S.W.), M.I.R.E.E. (Aust.) Technical Editor of "Electronics Australia."

The many technical colleges, students, technicians and amateurs who have vainly sought copies of this popular handbook, following the exhaustion of stocks of the first edition, should be happy to learn that a second edition has now been published. The new edition contains basically the same information as the first, but has been updated and revised.

An Introduction to Digital Electronics was written to bridge the gap between a conventional electronics training and the background required to understand the operation of digital electronic equipment. Step by step it introduces the various concepts which digital electronics has borrowed from other fields, and shows why and how they are combined with familiar electronics techniques. In short, it is an easy-to-read introductory textbook on digital electronics, written especially for those who already possess a fair background in conventional electronics.

An Introduction to Digital Electronics was conceived out of the need for more satisfactory books covering this important new field. Originally published as a series of articles in "Electronics Australia", it was published as a book in response to the very favourable reader reaction to the original articles. In producing the book, the material was considerably revised, expanded and updated.

Since it was first published in late 1967, **An Introduction to Digital Electronics** has found wide appeal not only among students and hobbyists, but also among engineers and technicians. It has been adopted by many technical colleges as a text for digital techniques courses, and also by many utilities and private electronics firms as a staff training manual. It can therefore be recommended as a valuable source of information concerning the techniques which have brought about a revolution in the electronics and information processing industries.

You can buy copies of **An Introduction to Digital Electronics** by calling personally at any of the offices of Sungravure Pty Ltd, as shown below, or by completing the form at the bottom of the page and posting it together with the appropriate remittance.

SYDNEY	Herald-Sun Bldg, 12th floor, 235-243 Jones St, Broadway or 26 Hunter Street, Sydney.
MELBOURNE	374 Little Collins Street.
ADELAIDE	104 Currie Street.
NEWCASTLE	22 Bolton Street.
PERTH	454 Murray Street.
BRISBANE	78 Elizabeth Street.

USE THIS COUPON TO ORDER YOUR COPY BY MAIL

TO: ELECTRONICS Australia, Box 2728, G.P.O., Sydney. 2001.

Please send me..... copies of "An Introduction to Digital Electronics" at $2.20 each posted within the Commonwealth. ($2.00 plus postage to overseas buyers. Please estimate for 10 oz. posted weight.)

Please enclose only cheque, money order, Australian postal order, etc., NOT CASH.

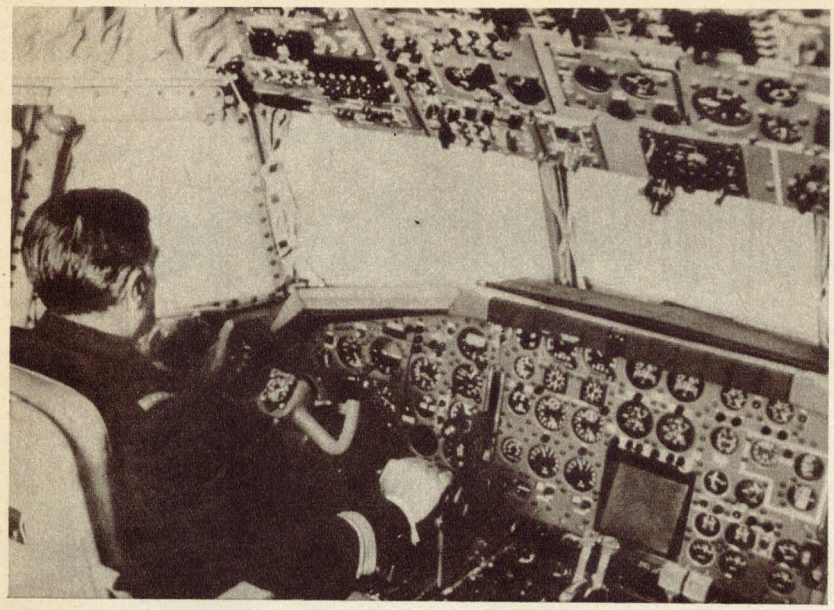
NAME .....
(BLOCK LETTERS)

ADDRESS .....

STATE ..... POST CODE .....

A special 10% discount is available on the single copy rate for bulk orders of not less than 25 copies to Radio Clubs, Youth Groups, etc. Please enclose remittance with order including estimated parcel postage or freight.

Concorde simulator



The LMT company in France has manufactured a simulator for the Concorde airliner which will allow aircrew to train in preparation for the entry into service of the Concorde. The heart of the simulator is a computer which processes all calculations necessary to simulate the behaviour of the aircraft when in flight. This simulation covers all aircraft manoeuvres from take off to landing. During taxiing, take off and landing, colour vision of the Toulouse-Blagnac airfield is presented on the windscreen and varies according to the position of the aircraft. The pivoting of the plane's nose is also completely reproduced. The simulator cockpit (illustrated above) is identical in appearance and operation with that of the true aircraft.

The instructor's station includes: a simulated fault display panel enabling the display of 150 faults; an initial condition control and display desk; a radio control desk enabling the simulation of radio links with other aircraft or navigation control centres; a panel repeating the aircraft instruments and indicating the postions of controls by lights; two course tracing units to display the aircraft trajectory, one for long distance and one for approach control; an indicator to control the approach trajectory in space.

(LMT—Le Material Telephonique SA, 46-47 quai Alphonse La Gollo, 92-Bologne-Billancourt, France.)

Engineering 71

A complex of exhibitions, Engineering 71, will be held in London from April 21 to 29, 1971. The constituent exhibitions are the London International Engineering and Marine Exhibition (at Earls Court) and the International Welding and Metal Fabrication Exhibition (at Olympia).

A conference, called "Technology for Profit", will be held during the period of Engineering 71 to examine and review many of the present engineering trends and problems. Topics to be discussed include: several aspects of materials technology; modern machine shop practice; mechanical handling methods; latest developments in welding technology. Engineering 71 is sponsored by the London Chamber of Commerce with the full support of the British Electrical and Allied Manufacturers Association. It is organised by Industrial and Trade Fairs Ltd, Commonwealth House, New Oxford Street, London WC1A 1PB, England.

National TV stations

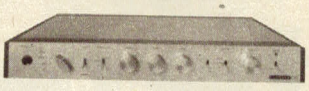
The National television station to serve Mount Isa will open this month. The station at Cloncurry is expected to be operating a month after work on the Mount Isa station is completed. The stations at Julia Creek, Richmond and Hughenden should then be brought on the air, in that order, at monthly intervals. The Mount Isa station has a power output of 500W. Those at Cloncurry, Julia Creek, Richmond and Hughenden will have 50W. A station to serve Mary Kathleen has been programmed for installation in the present financial year, in conjunction with the completion of the Post Office broadband communication link. A station at King Island will be completed towards the end of 1971.

Grand Tour invitations

An "Invitation for participation in mission definition for Grand Tour missions to the outer solar system" has been issued by NASA to experimental and theoretical scientists in the USA and overseas. The proposed missions are made possible in the late 1970s by a rare alignment of all five outer planets (Jupiter, Saturn, Uranus, Neptune and Pluto), so that a spacecraft could use the gravitational force and orbital velocity of one planet as an aid in getting to the next. This outer planet alignment will not be repeated for 179 years.

Missions to be considered include three-planet swing-bys which collectively would result in fly-bys of all five outer planets. It is anticipated that trajectories can be arranged so that the spacecraft will also closely encounter various moons of the planets. Flight times to the outermost planets would be from 7½ to 9½ years. (Grand Tour Studies Manager, Code SL, NASA, Washington, DC 20546, USA.) ■

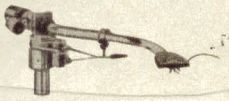
LOOK TO ENCEL FOR TOP HI-FI VALUE...



Cambridge P40 Amplifier — Encel price, **$298.00** (inc. sales tax). The latest outstanding product from Cambridge Audio Laboratories Ltd, England. It inspired Reg. Williamson in his technical review in Hi-Fi News earlier this year to report — "I have been completely won over by this amplifier. The P40 is sheer pleasure to use and, most unusual for this reviewer, I shall be sorry when the time comes to return it. Bravo, Cambridge Audio, you have restored some of my faith in the British audio industry." Write now for full technical details and a copy of this review.



Stax SR-3 Stereo Headphones and SRD-5 Adaptor — Encel price, **$76.50** (inc. sales tax). World's finest electrostatic headset, with a frequency range of 30 — 25,000 Hz and maximum sound level of 115 dB. Adaptor suits any amplifier of more than 5 W outputs at 4 — 16 ohms. Some experts say they are better than the best speakers! Write for full review and technical data now.



Lustre ST 510D Tonearm — Encel price, **$24.50** (inc. sales tax). A high precision, universal arm, which will accept all standard ½" mounting cartridges. Lightweight, removable headshell. Tracking is effortless and stable. Stylus pressure is adjusted by calibrated counterweight. Oil damped cueing lift is inbuilt. Encel will send you reviews on request. Lustre ST510 Tonearm, **$19.50.**

Lustre ST 510 Tonearm: Encel price $19.50 (inc sales tax).

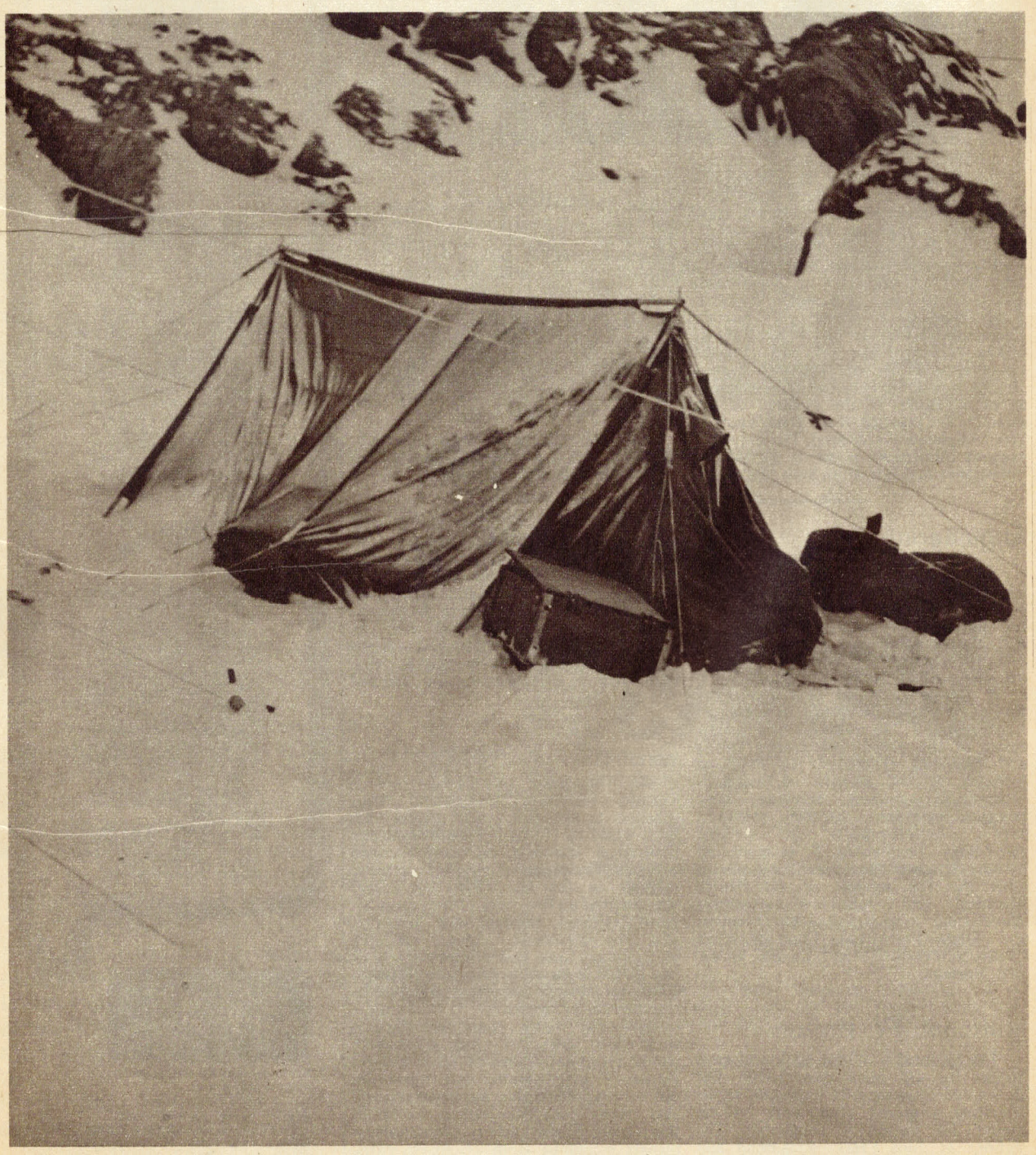
Similar high quality to the ST 510 D, but without the in-built hydraulic lift/lower control. A first-class general purpose arm.

EE70B

ENCEL ELECTRONICS PTY LTD

HEAD OFFICE: 431 BRIDGE ROAD, RICHMOND, VIC. 3121
TEL. 42 3762
SYDNEY STORE: GROUND FLOOR, 2 SM BUILDING, 257 CLARENCE STREET, SYDNEY, N.S.W. 2000
TEL. 29 4563, 29 4564
■ **AUSTRALIA'S GREATEST HI-FI CENTRES**
■ **TRADE-INS ACCEPTED** ■ **TERMS**

Pye announces the remarkable new Koldseal Crystal.



In Antarctica a man could be lost without it.

Antarctica is a great place for seals. A deadly one for man. To survive he needs every weapon science can provide. And nothing is more important than radio. The better we make radio, the slimmer the chances of a life being lost.

The Koldseal crystal will improve radio because it's the most reliable crystal ever made. It's the first metal encased crystal that's contamination free. Which means it will hold frequency more precisely, for a much longer time.

The secret is in the way it's sealed. Not hand soldered like other crystals. But cold welded. So dust and dirt just don't get a chance. It's a new era in crystal purity.



Koldseal. A new era in crystal purity.

PYE **Crystal Division**

Head office and factory, Clarinda Road, Clayton, Victoria, 3168.
Phone 544 0366.
Sales offices all states.
In Western Australia — W. J. Moncrieff Pty. Ltd.

SPASM1600MCM

A Versatile Public Address Amplifier



By George Hughes

Here is a design for a 30W solid state PA amplifier of modest size and weight, suitable for use with a 12V accumulator or the 240V AC mains. It features a number of facilities, such as audio AGC, mixing, short circuit protection etc, which may be included or omitted as desired. In short, a versatile design which should have a wide appeal.

Two years ago, in the May 1968 issue, we published details of a 30W solid state PA amplifier designed to operate from a 12V accumulator. This was an excellent design for outdoor PA work, and still is, but lacks the facility of being able to operate from the mains. While it would be possible to provide a 12V DC mains operated supply, such a circuit is quite involved, and the resultant unit might well cost nearly as much as the amplifier.

In the days of valve type battery/mains amplifiers, it was a simple matter to arrange power supply connections so that the amplifier could be used from a 12 or 6 volt car battery, or from the 240 volt AC mains.

This type of amplifier incorporated a dual purpose transformer with two primaries; one for 240 volt operation, and one to be used in conjunction with a non-synchronous vibrator for battery operation.

The application of transistor circuitry to audio amplifiers is relatively simple at the present state of the art. High power levels are easily accomplished, and locally made transistors suitable for such needs are readily obtainable.

Higher power levels than can be conveniently provided by single-ended Class A amplifiers usually employ one of two basic types of Class B power amplifiers for the "business end" of an amplifier.

The first is the ever-popular Class B push-pull transformer coupled arrangement so familiar with valve circuits. The second development is the "single-ended" Class B amplifier operating at a higher supply voltage. This latter type of power stage requires only a capacitor to couple it to the load, or not even this if the balanced or symmetrical type of power supply is used.

In either system, a coupling transformer driven from a class A driver stage is almost always used to provide the necessary drive and correct phase relationships at each output transistor base. Low voltage, high current power stages have relatively low current gain and the driver stage is required to deliver relatively large amounts of drive power. To handle this power the transformer core has to be of sufficient size to prevent non-linearity due to magnetic saturation, particularly if there is already a standing DC flowing through it.

The heavier the drive and standing currents, the bigger the transformer has to be to avoid core saturation. At the same time, sufficient turns of wire are needed to maintain the inductance at a minimum level as dictated by the lowest frequency response required.

To operate directly from 12 volts, a high power amplifier requires a large driver and output transformer, plus suitable power transistors to handle the peak currents required at these low voltages.

Another disadvantage is that operation without a load (speaker) could damage the output transistors by creating large spikes across the output transformer primary inductance. Some protection can be provided by incorporating supply voltage links within the speaker connecting plugs, but this does not guard against the eventuality that the speakers may be disconnected by some other means.

If the output transistors are connected in the single-ended Class B configuration at a higher DC supply voltage, the need for an output transformer is automatically eliminated and the driver transformer size is reduced. Lower current transistors can now be used to advantage in both the driver and output stages. This approach also makes for a reduction in the overall price of components and transistors for the output and driver stages.

With no output transformer, the risk of power transistor failure is eliminated if the load is disconnected whilst the amplifier is operating.

Short circuited speaker leads will, in both cases, cause power transistor failure, but the problem can be solved by using a protected power supply.

Against this approach is the fact that the single ended configuration requires a higher voltage supply rail than does the transformer coupled Class B system. Whereas the latter can be designed around, say, a 12V supply, the former assumes a much higher figure, probably four times as high.

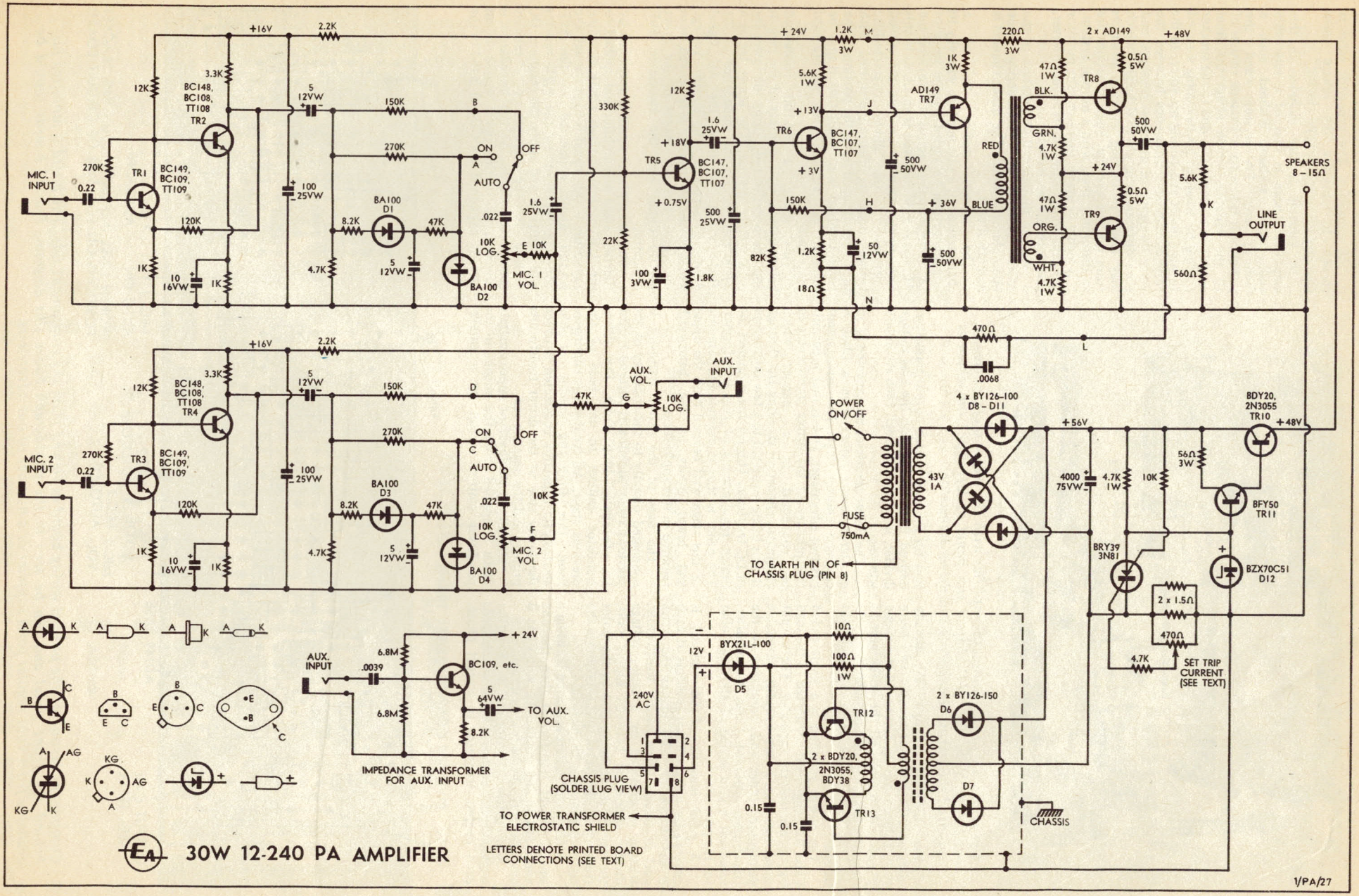
This is of little consequence as far as a mains operated amplifier is concerned, since it is simply a matter of specifying a suitable transformer for the power supply. When we came to consider battery operation, however, it is another matter. The delightful simplicity of being able to work directly from a 12V accumulator is immediately lost, and we are forced to think in terms of a converter which will provide the required level from a 12V supply.

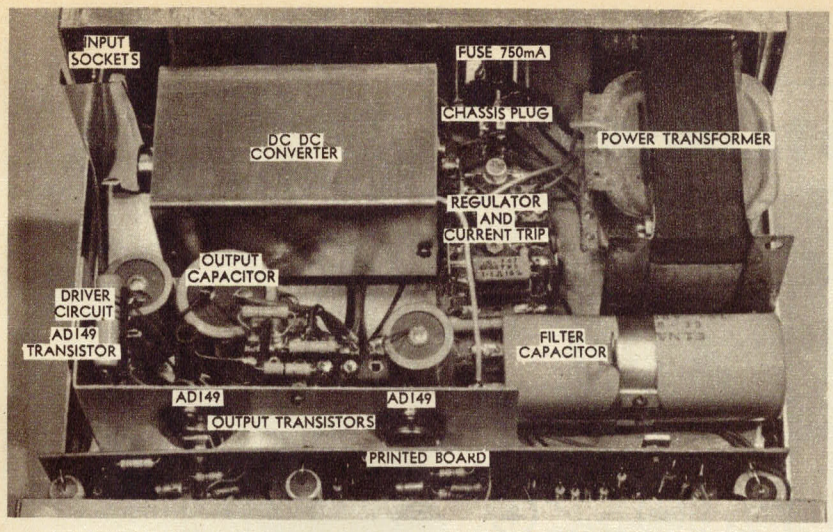
While this means greater complexity and expense, this is largely offset by the

The complete circuit diagram is shown on the opposite page. It includes all the facilities but a number of these are optional and may be omitted if not needed or to reduce cost.

SPECIFICATIONS

OUTPUT POWER: 30 watts continuous on battery or mains into an 8 ohm load impedance, 15 watts continuous into 16 ohms.
HUM AND NOISE: 60dB or better, below 30 watts.
FREQUENCY RESPONSE: (-3dB) Mic channels: 100Hz-22KHz.
Aux (high or medium Z): 30Hz-22KHz.
BATTERY DRAIN: approx 700mA at zero signal, approx 4 amps for 30 watts output.
MAINS POWER INPUT: approx 43 watts at full power.
SENSITIVITIES: (AGC): 7mV
(Norm): 4mV
(Aux medium Z): 55mV
(Aux high Z): 60mV
AGC THRESHOLD: At any volume control setting: 8mV at either Mic input.
TOTAL HARMONIC DISTORTION: 3% at 30 watts with no AGC, 3% below AGC threshold at 30 watts.
INPUT IMPEDANCES: Microphone channels: approx 80K
Aux channel: approx 10K and 1.5M.


30W 12-240 PA AMPLIFIER
MIC. 1 INPUT
MIC. 2 INPUT
AUX. INPUT
LINE OUTPUT
SPEAKERS 8–15Ω
POWER ON/OFF
FUSE 750mA
TO EARTH PIN OF CHASSIS PLUG (PIN 8)
TO POWER TRANSFORMER ELECTROSTATIC SHIELD
CHASSIS PLUG (SOLDER LUG VIEW)
IMPEDANCE TRANSFORMER FOR AUX. INPUT
TO AUX. VOL.
SET TRIP CURRENT (SEE TEXT)
CHASSIS
LETTERS DENOTE PRINTED BOARD CONNECTIONS (SEE TEXT)
1/PA/27



A general view of the complete amplifier with the major sections clearly indicated. Note the "L" shaped sub panel at left front on which is mounted the output transistors and driver transistor.

simpler amplifier design as already discussed. In our opinion, the two more than balance out in favour of the single ended system when all the advantages of the latter are taken into consideration.

This, then, is the basis of our current design.

The power amplifier is a single ended Class B arrangement connected to the load by an electrolytic capacitor. The output transistors used are readily available germanium types and, compared to the transformer coupled Class B amplifier, represent a cost saving of about a dollar for the pair.

A good measure of DC stability is ensured by using emitter resistors at each power transistor. This makes the extra cost of silicon types hardly worthwhile. Biasing is provided by a series voltage divider connected between supply rails, the centre point being tied to the point from which the AC output is taken via the coupling capacitor to the load.

A few more dollars are saved by using a smaller driver transformer than the one employed in the original 12 volt Class B amplifier published a few years ago.

The driver transformer is a bifilar wound, split secondary type, which feeds each output transistor in correct phase. Bias for the base of each output transistor, derived from the taps on the bias voltage divider, is applied through each secondary winding.

The driver transistor is connected as an emitter follower rather than a Class A common emitter stage. This arrangement has two advantages. One is that it permits the primary of the driver transformer to be connected in a manner which eliminates almost all standing DC through it, this being restricted to a few microamps of DC feedback. This further simplifies the design requirements of this transformer. The other is that it extends the response of this stage well beyond both the upper and lower limits of the bandwidth required in this application.

The base of the driver transistor is connected directly to the collector of the previous stage. Stability is ensured by the DC feedback loop from the driver transistor emitter to the base of the previous stage. AC feedback is eliminated from this loop by means of the electrolytic capacitor connected between the lower side of the driver transformer primary and the negative rail.

Overall AC feedback of approximately 26dB is applied from the output to the pre-driver emitter circuit by a parallel combination of a 470 ohm resistor and 0.0068 capacitor. The capacitor value is chosen to optimise the square wave response for overshoot and ringing.

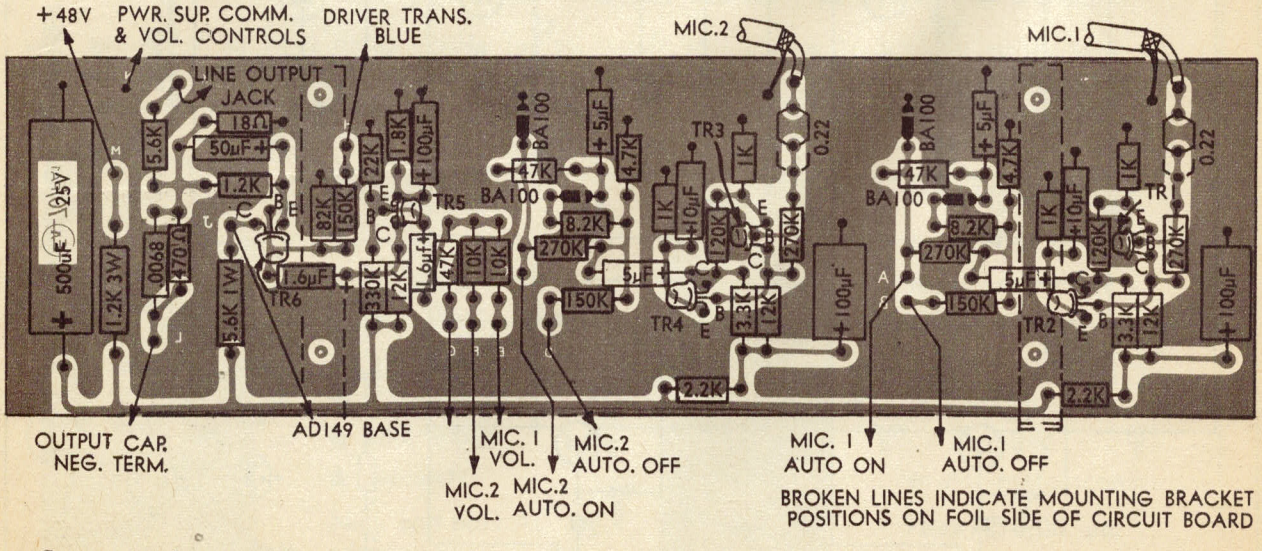
A valuable facility included in this amplifier design is that of a selectable audio AGC system. Without such a facility, any PA system – and the audience it is serving – become victims of all the variables which effect the final output level; variations due to the speaker turning his head, to his becoming warmed to his subject and raising his voice, to the very considerable difference between the voice "weight" of different speakers, and even differences in physical height, which may result in varying working distances from the microphone. Such variations are so disturbing that, with a normal system, it is highly desirable that someone monitor the gain continually. In practice, however, this is usually neglected.

We can illustrate the operation of the AGC system by considering one microphone channel. The other channel is indentical to it.

The system makes use of a characteristic of a silicon diode whereby its impedance can be varied by the value of DC voltage applied across it. Provided the AC signal level involved is small, as in this case, it may operate on even the curved portions of the diode characteristic without being significantly distorted. With such a small signal level, the portion of the curve involved is so small that it may be regarded as "straight" for all practical purposes.

This diode, a BA100 connected between the "ON" contact of the switch and the negative rail, forms the lower leg of a voltage divider. The upper leg is a 270K resistor. As the impedance of the diode varies, so does the AC signal developed across it. The control voltage which varies its impedance is derived from the signal itself, by means of the other BA100 diode and the associated 5uF capacitor.

The microphone signal is amplified by the two stage preamplifier and applied to the AGC system through a 5uF coupling capacitor. If this signal is high enough the BA100 diode connected to the 5uF coupling capacitor via the 8.2K resistor will rectify it and apply the resultant DC voltage to the second, or "variable impedance" diode. As the impedance is lowered, so is the signal across it, as already explained. This signal is fed to the



Component layout of the printed wiring board as viewed from the component side. The board is mounted just behind the front panel and can be seen in the photograph above this diagram. Printed boards should be available from your regular parts supplier or a number of our advertisers.

latter stages of the amplifier.

AGC is selected by a rocker switch marked "Auto". Its two positions, "OFF-ON", select either the AGC output or a series 150K resistor. The resistor value is chosen to give approximately the same attenuation as the threshold level of the AGC system, and allows switching from one condition to the other without a major adjustment to the volume control.

To obtain maximum benefit from the AGC facility, the gain of the PA system should be adjusted to a level just below that of acoustic feedback, and left at this setting. If the speaker raises his voice, the AGC will reduce the level accordingly, or raise it when he turns to one side or the other. The gain can be set lower than this if it is still too loud for the particular situation, and the AGC will still operate at the same threshold level, but the overall amplifier output will be lower.

If the AGC system is not required, the selector switch and AGC circuitry can be omitted and the 150K resistor connected directly to the input of the volume control.

Between the AGC system and the input to the next stage is the mixing section. It not only allows the mixing of the two microphone channels, but a third, "auxiliary", input facility if required. The mixed signal is then applied to the base circuit of a voltage amplifier stage in the main amplifier.

A protected supply is recommended if the amplifier is intended for hire or "on location" PA work, as the risk of short circuited speaker leads or very low load impedances is likely, particularly with inexperienced or careless personnel.

A permanent installation may not warrant a protected power supply, as the risk of shorted speaker leads is less.

The sensing circuit for excessive current consists of a series 0.75 ohm resistor (2 x 1.5 ohm) between the negative end of the rectifier filter capacitor and the common negative rail. Across this resistor is placed a small preset potentiometer with the moving contact connected to the gate of a silicon controlled switch (SCS) via a series current limiting resistor.

If excessive current is drawn from the power supply, and depending on the setting of the parallel preset potentiometer, sufficient voltage will be developed to trigger the SCS. This reduces the reference voltage to to a very low value, about 1.4V. This, in turn, cuts off the two transistors in the regulator circuit, although the input DC from the rectifier section is still at a potential of approximately 54 volts.

The DC supply rail can be furnished by two sources, a conventional mains transformer/rectifier combination, or a DC-DC converter/rectifier combination. A "battery only" or a "mains only" amplifier can be made if desired by simply omitting the unwanted supply.

Our version was equipped with both power supplies, as shown in the photographs and circuit diagram. The DC or AC power input is selected by the appropriate pin connections within a battery or mains female cable plug which fits the male plug on the amplifier rear panel.

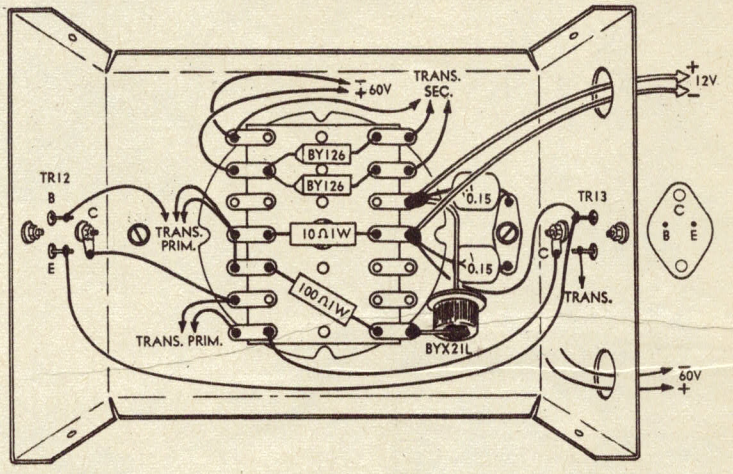
The mains power supply used a conventional copper strapped transformer with a bridge rectifier composed of four BY126-100 diodes (or similar) feeding a 4000uF 75V electrolytic capacitor. With this combination, approximately 54 volts is available to feed the regulator and protection circuits. An encapsulated bridge can be substituted for the four diodes if desired.

The 12 volt input from an accumulator is applied to a DC-DC converter and feeds approximately 60 volts to the input of the regulator. This output voltage was deliberately designed slightly higher than the mains derived one to allow for varying charge condition of the battery.

A wrong battery connection reverse biases a series automotive type silicon diode and prevents converter transistor damage. To eliminate switching radiation, the entire converter unit is built in a small aluminium box and mounted by two short spacers (one of brass and the other of insulating material) within the metal amplifier case.

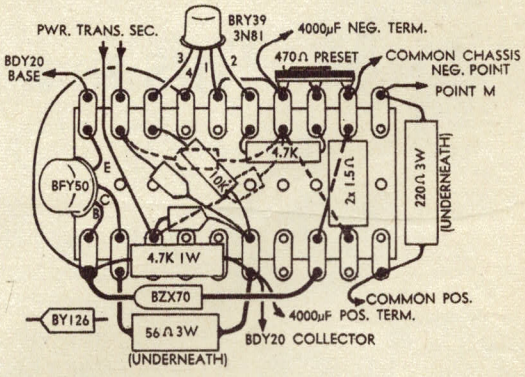
To eliminate the possibility of accidental shorts between the speaker leads, or other items at chassis potential, and the bodywork of a car from which the system may be operating, the input side of the DC-DC converter is isolated (as far as DC is concerned) from the chassis of the amplifier. Thus it is immaterial whether the car electrical system uses a negative or positive chassis. Each input lead is bypassed to chassis by a .15uF capacitor.

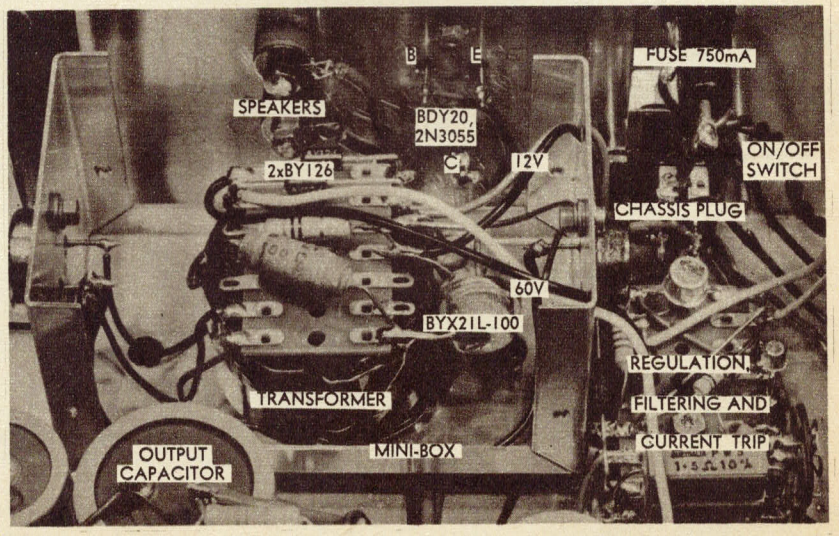
The auxiliary input is of medium impedance, about 10K, and is suitable for connection to most tape recorder outputs. However, there will be those cases where it is desired to play music from a record player equipped with a crystal or ceramic pickup. These types of pickup require a



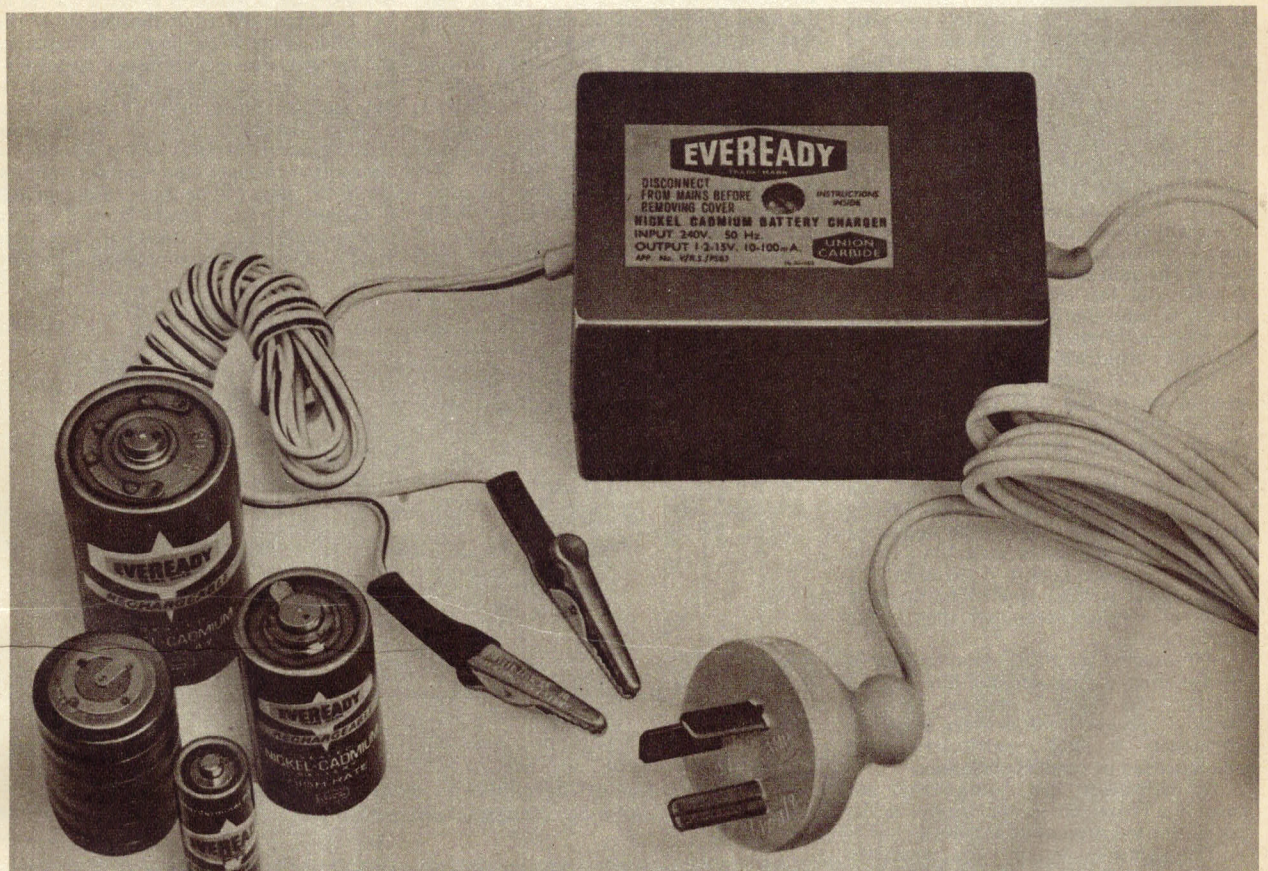
Wiring and layout of the DC-DC converter. The terminal board is mounted on top of the converter transformer. The metal box must be connected to the main chassis at one point only.

Wiring and layout of the regulation and protection circuit. Note the common chassis negative point mentioned in the text.





Close up of the DC-DC converter and the regulation and overload protection network mounted to the right of it. Compare this picture with the two diagrams above.



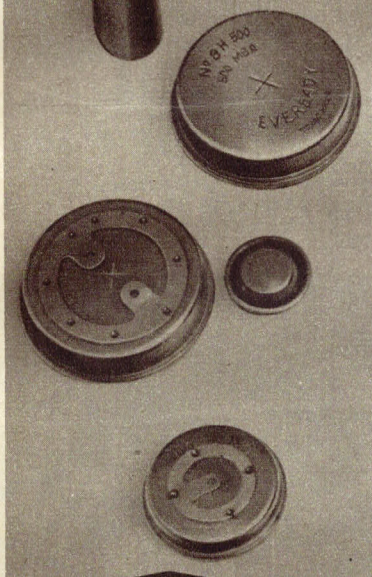
This is a plug for our batteries...

Eveready Nickel Cadmium Batteries.

Completely sealed. No maintenance. And they come in a variety of shapes and sizes to suit a variety of applications.

For a brochure about our Eveready rechargeable batteries; what they do and how well they do it, drop us a line. If you have a problem with your power source, we'd like to help you solve it.

No charge.



EVEREADY BATTERIES Products of UNION CARBIDE 'Eveready' & 'Union Carbide' are registered Trade Marks.

UNION CARBIDE AUSTRALIA LIMITED
Consumer Products Division, 167-187 Kent Street, Sydney. Tel: 20 559
SALES OFFICES:
Brisbane: 243-253 Edward Street. Tel: 31 1391 **Melbourne**: 505 St. Kilda Road. Tel: 26 1241, 26 2332
Adelaide: 41-49 Currie Street. Tel: 51 6099 **Perth**: 901 Hay Street. Tel: 21 2926

085.P.133

sensitivity of about 60-100mV and a 1-2 meg load.

To achieve the desired high impedance, an "outboard" emitter follower stage can be placed on a miniature tagstrip, interposed between the "AUX" input jack and the volume control. The details of this unit are shown on the main circuit diagram and on a layout drawing. Its position in the amplifier is between the printed board and the front panel, immediately under the "AUX VOLUME" control. Two extra countersunk screws through the base anchor this assembly in position.

A low impedance, unbalanced line output is also provided as a front panel facility. This is derived from the output stage by a resistive divider connected to the speaker terminals. At full output from the amplifier, the level here is about 1 volt into an impedance of approximately 600 ohms.

The output level and impedance at the line output jack is of sufficient magnitude to comfortably drive most tape recorders or similar equipment at their auxiliary inputs.

Similarly, additional power amplifiers may also be connected to the line output jack and used as "slaves" if more sound coverage and/or power is required. The first amplifier with its facilities is then used as the master unit.

The two microphone preamplifiers, the two AGC systems, the voltage amplifier and pre-driver stages are all located on the one printed board. The letters on the circuit diagram correspond to those on the printed board, and will assist in making the various connections to the controls and other sections of the amplifier.

The power amplifier section, the power supplies and regulator are all wired on tagstrips and tag panels. Layout of the amplifier is straightforward, with the power supplies towards the rear of the case and the power amplifier on an "L" shaped aluminium sub panel, mounting vertically towards the left front of the case. The two output transistors are mounted on the long leg of the "L" and the driver transistor on the short leg. The driver transformer is mounted between the two output transistors. See photograph of general layout.

The upper mounting screws of the driver transformer and driver transistor carry the necessary tagstrips for all bias and emitter resistors not on the printed board. The mounting lug of the tagstrip mounted with the driver transformer is the connecting point for the common negative rail to all points on the preamplifier board, the mains "earth" wire (green), the negative rail of the DC power supply and protection circuit, and the speaker cold terminal.

Two other components need to have their "chassis" connections returned to this point. These are the negative pigtails of the two 500uF electrolytic capacitors associated with the driver transformer and driver transistor respectively. Each negative pigtail is terminated on an insulated lug of a two lug tag strip, both secured by mounting bolts used to mount the "L" shaped sub panel. One is close to the end of the long leg, and the other the end of the short leg. A lead runs from each of these terminals to the common terminal.

Heatsinking for the regulator power transistor is provided by mounting this on the rear panel of the case. The transistor should be sprayed with clear lacquer to prevent accidental shorts, but this is only likely to occur in a case of extreme carelessness. If a short circuit does occur, the mains fuse will blow, or the DC-DC converter will cease to function, depending on which supply source is being used at the time.

The main filter electrolytic capacitor is mounted in a horizontal position using the clip supplied with it. In order to mount it in this way, the mounting clip has to be modified, one mounting lug being bent parallel with, but clear of, the body of the capacitor. This clearance should be sufficient to allow a nut and lock washer to be fitted between the lug and the capacitor body. The capacitor clears the bottom of the case by about 3/16in when mounted.

A 3/8 inch brass spacer is used under the protection and regulator tag panel to mount it clear of the bottom of the case, as some of the wiring is on the underside of this panel.

The microphone input jacks should be isolated from the metal case either by using insulated barrel types, or mounting

PARTS LIST

2 BC149, BC109, TT109 or similar.
2 BC148, BC108, TT108 or similar.
2 BC147, BC107, TT107 or similar.
1 BFY50 or similar.
1 BDY20 or 2N3055 and mt'g accessories.
1 AD149.
1 2AD149 (matched pair) and accessories.
1 BRY39 or 3N81.
4 BY126-100, or similar, or 1 bridge rectifier of suitable rating.
1 BZX70-C51 zener diode.
1 Power transformer, 43V, 1 amp, 240V primary, with electrostatic shield and copper strap. (Ferguson PF3226, Special Transformers ST5467, A&R PT7156.)
1 Driver transformer. (Ferguson TRD223, Special Transformers ST4953, A&R TD19.)
1 Printed board 70/pal
1 Metal case with inner panel and cover.
1 Mains ON/OFF switch (Sato or similar.)
2 Insulated phone jacks.
3 Knobs.
2 Terminals – 1 red, 1 black.
1 6-pin chassis mt'g male connector.
1 6-pin cable socket to suit above, with cover.
1 10-lug twin row tag board.
1 7-lug tagstrip.
1 9-lug tagstrip.
2 2-lug tagstrips.
1 Cartridge fuse holder.
1 750mA fuse.

RESISTORS: ½ watt, 10% unless specified.
1 470 ohm preset potentiometer.
3 10K log potentiometers.
2 1.5 ohm 3 watt wirewound.
2 0.5 ohm 5 watt wirewound.
1 18 ohm.
2 47 ohm 1 watt.
1 56 ohm 3 watt wirewound.
1 220 ohm 3 watt wirewound.
1 470 ohm.
4 1K.
1 1.2K.
1 1.2K 3 watt.
1 1.8K.
2 2.2K.
2 3.3K.
3 4.7K 1 watt.
1 4.7K.
1 5.6K.
1 5.6K 1 watt.
3 10K.
3 12K.
1 22K.
1 47K.
1 82K.
2 120K
3 150K
2 270K
1 330K

CAPACITORS:
1 4000uF 75V Elna type RG3E with clip.
1 0.0068uF 160V.
2 0.22uF 160V.
2 1.6uF 25V.
2 5uF 12V.
2 10uF 16V.
1 50uF 12V.
1 100uF 3V.
2 100uF 25V.
1 500uF 25V.
2 500uF 50V.
1 500uF 50V Ducon type EMG or Elna type RG with clip, insulated Suitable length of 3-core power flex and 3-pin plug.
1 ¼in fibre or insulated spacer.
2 3/8in brass spacers.
Fibre washers for printed board mounting.
Chrome plated panel screws. Self tapping screws (No 6 x ¼in).
1/8in whit c'sunk screws. Brass nuts. Lockwashers. Solder lugs.
Hookup wire.
2 Small phone jacks (3/16in).
The above parts list refers to the basic amplifier for 240 volt operation only, with two microphone inputs and one auxiliary channel. It does not include the audio AGC section, emitter follower, or the 12 volt power supply. The three sub-listings below refer to the additional components required to include the extra facilities.

Audio AGC section:
4 BA100 diodes.
2 4.7K ½ watt 10% resistors.
2 8.2K ½ watt 10% resistors.
2 47K watt 10% resistors.
2 270K ½ watt 10% resistors.
2 5uF 12V capacitors.
2 0.022uF capacitors.
2 ON/OFF rocker switches (NKK No 6).

12 volt power supply section:
1 DC-DC converter transformer, Ferguson TSW147, A&R PT7157, or one to specifications in table.
1 BYX21L-100 or similar diode.
1 Aluminium Mini-Box 3½in x 2¼in x 2¼in.
1 10 ohm 1 watt resistor.
1 100 ohm 1 watt resistor.
2 0.15uF 160V.
1 6-lug twin row tag board.
1 6-pin cable socket with cover (to suit chassis connector).
1 2BDY20, 2BDY38 (matched pairs) or 2 2N3055 with accessories.
2 BY126-150 diodes, or similar.
2 ¼in mounting bushes, one brass, one bakelite.
Suitable length of battery lead with two clips and/or cigar lighter plug.

Emitter Follower Section:
1 BC109, TT109 or similar.
1 8-lug miniature tagstrip.
2 6.8M ½ watt 5% resistors.
1 8.2K ½ watt 5% resistors.
1 0.0039uF 160V capacitor.

1 5uF 64V capacitor.



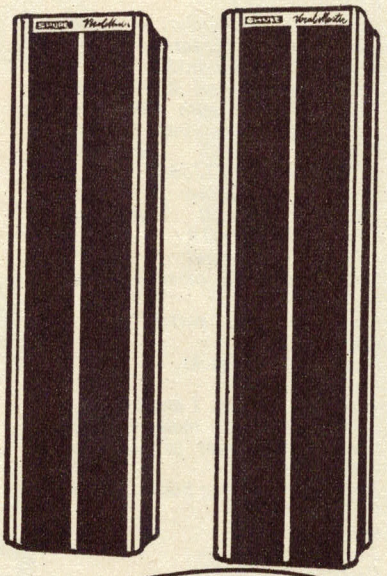
SHURE

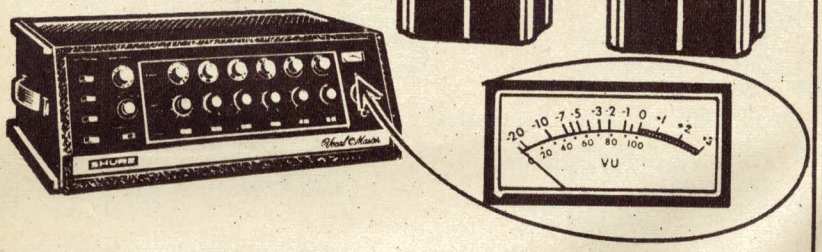
VOCAL MASTER

Newest Vocal Arrangement & Projection System from the U.S.A.

Vocal Master is used by the 'world's' leading artists, vocalists and pop groups — built for professionals, with professional features. Specially designed to overcome a multitude of challenging conditions found in auditoriums, concert halls and stadiums. Consists of a VA302C Amplifier Console and two VA300S speaker columns

- PENETRATING POWER
- HIGHLY DIRECTIONAL
- VERSATILE! FLEXIBLE!
- DISTORTION FREE





VA302C VOCAL MASTER CONSOLE

- True V.U. Meter that follows the programme material and gives a positive reference to actual sound output. With 2-position meter sensitivity switch.
- Specially designed for low impedance microphones and longer cable runs.
- Female Cannon type Connector Mike inputs.
- Mike Level Output with 3 pin connector and impedance selector.
- Greatest penetrating power ever. Up to 300W of vocal power conservatively rated at 100 watts RMS continuous.
- Most versatile ever. Not just five, but six input channels.
- Up to 6 low impedance microphones.
- Projects your voice — be heard over the instruments.

VOCAL MASTER VA300S SPEAKER COLUMNS

Specially designed for penetrating power over the entire vocal range. Highly directional by virtue of tuned rear ports. Each column utilises two 10" speakers and four 8" speakers.

Sole Distributors in Australia

AUDIO ENGINEERS PTY. LTD.

342 KENT STREET, SYDNEY, 2000. TELEPHONE 29 6731

them on a small piece of laminated fibre board. We mounted ours on a scrap piece of fibre board, positioning the jacks on this panel so that two large holes in the rear of the amplifier case cleared them sufficiently when mounted. The screened lead from each input point on the printed board carries the common return for each jack, which eliminates a possible hum loop. It is important that the screen lead have an outer insulating covering.

If desired, input connectors can take other forms than standard phone jacks. Whatever is used, it will be essential to shield the jacks with a small metal plate if the DC-DC converter supply is used, as a small amount of capacitive coupling can take place between the microphone inputs and the case of one of the converter transistors.

As mentioned earlier, the mains power supply uses a full wave bridge rectifier feeding a 4000uF electrolytic capacitor. At least three manufacturers have suitable transformers available (see parts list) and there may be others with similar types. There is little to choose between these types, although the Ferguson unit is slightly smaller physically then the Special Transformers model. For this reason it may run marginally hotter, but the difference is purely academic.

The DC-DC converter transformer may be wound by the home constructor or purchased ready made. At least two transformer manufacturers have indicated their intention of marketing ready made versions. For those who wish to wind their own all the winding details are given in the accompanying table.

The transformer is wound on a Mullard DT2206 Delrin bobbin and assembled in two FX2243 cup cores. All three windings are centre tapped and all three are bifilar wound.

Because it uses reasonably heavy wire for all windings, side by side layer winding can be easily accomplished if the bobbin is clamped between two large washers by a long bolt and then held in a vyce by this bolt. With the gauge of wire involved, it is easier to wind around a fixed bobbin than to rotate the bobbin in a drill chuck.

Commence winding by placing two 26B&S DTE (double tough enamel) wires side by side at the bottom of the bobbin and anchor them with suitable electrical tape. Wind on 38 turns of this pair keeping them in line so that they do not cross or kink. At the last turn, bend them at right angles and pass them out of the bobbin, at the same time anchoring securely with a single wrap of electrical tape. Code one of the start wires by knotting it.

Over this winding, place a single wrap of thin cardboard cut so that it neatly fits between the bobbin cheeks. Anchor this securely with electrical tape.

WINDING DATA

Order of windings: Secondary, Primary, Feedback.
Secondary: 38 turns/38 turns bifilar, 26B&S DTE wire.
Interleaving: 1 wrap of thin cardboard. Between secondary and other windings.
Primary: 8 turns/8 turns bifilar, 22B&S DTE wire.
Feedback: 2 turns/2 turns bifilar, any light gauge or thin hookup wire.
Coding: Knot on one start of each bifilar winding (see text).
Finishing: One outer wrap, and impregnate with suitable varnish or epoxy resin. Core halves clamped together with long 2BA or 5/32 whit bolt.

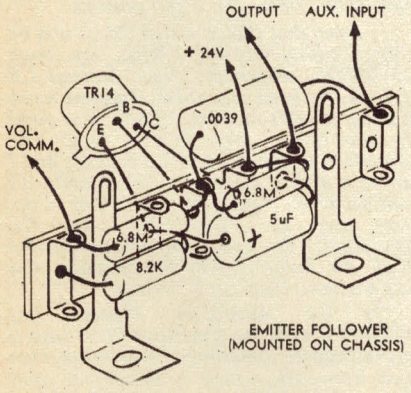
Anchor the ends of two 22B&S DTE wires on this cardboard support with electrical tape and wind on eight turns of this pair in the same direction as the secondary winding. Anchor the winding with electrical tape as before. Code the start of one half of the winding with a knot.

The feedback winding can be of the same gauge wire as the primary or secondary, if desired, or thin flexible hookup wire. This is a bifilar winding similar to the other two, and is of two turns. Identify the start as before.

Place an outer wrap of cardboard around the finished winding, and place it in the two cup-core halves, taking care that there is no foreign matter on the faces. Line up the four grooves in the cores and clamp the assembly together with a long 2BA or 5/32 whit bolt, nut and flat washers. Impregnate the assembly with varnish or an epoxy resin such as Epirez 8859 or similar.

With an ohmeter identify the finish of the knotted half of the bifilar secondary winding and temporarily twist this with the unknotted start. Repeat the procedure for the other two windings. This junction becomes the centre tap in all cases.

The whole DC-DC converter power supply is mounted within a small aluminium mini-box. The power transistors are mounted centrally at each end and wired to the appropriate points on the tag panel which carries the biasing components, rectifier diodes, and reverse connection silicon diode. Input and output leads are passed through two holes in one end and connected directly to the power plug and the main filter electrolytic capacitor. No trouble should be experienced with switching waveform transients produced by the converter if



Wiring and layout diagram for emitter follower stage needed for crystal pickups.

these leads take the shortest possible routes to their connecting points within the amplifier.

Setting the correct trip point of the protected power supply is best done using a heavy duty resistor across the power supply to simulate an overload condition. A value of 7.5 ohms is required, with a wattage rating of not less than 10. Even so, it should be connected only intermittently.

Adjust the preset pot to its minimum position, i.e., away from the common rail end of the sensing resistor. Switch the amplifier on, but do not apply any signal to it. Touch the resistor briefly across the power supply output, from the series regulator (emitter) to the common rail. The protection circuit should not trip.

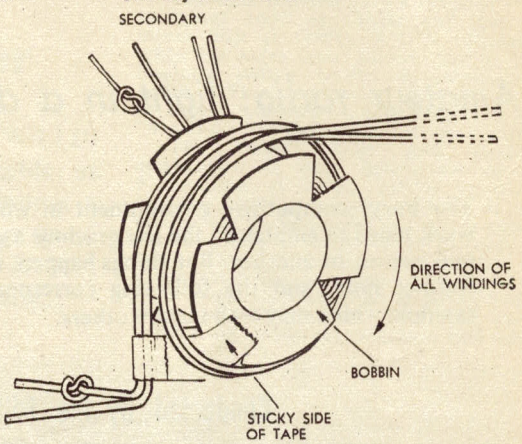
Advance the pot slightly and touch the resistor across the output again. Repeat this procedure until the circuit trips, as indicated by the positive rail voltage dropping to zero.

To reset the protection circuit, switch the amplifier off until the main electrolytic capacitor discharges. If the amplifier is switched on again too soon, the charge in the capacitor will keep the SCS in the fully conducting state.

The resistor value specified will simulate the amplifier being driven to full output or a little above it, at which point clipping of the output waveform is commencing, producing noticeable distortion.

The point of overload trip should not be encountered in the majority of PA installations or "on location" set-ups. If repeated dropouts do occur it is a definite indication that the system is being consistently overloaded, or that a wrong load has been connected. Either way, the remedy is obvious. ■

This diagram should assist readers who are inexperienced in winding techniques. Note the relative direction of all windings, the coding of each winding, and the method of anchoring the start turns. A similar method should be used to anchor the finish.



fed up with your job?

...and too little money?

Start to think positively about improving yourself now; getting a better job; earning more money. You too should own your own home; your own car; have everything you want. The key to all this training and education is within your capabilities.

THE ANSWER: International Correspondence Schools can help you get this training. I.C.S. can train you at home, in your own time, for a career in the job of your choice.

WHAT KIND OF JOB DO YOU WANT? Perhaps you'd like to be a writer, journalist or become an advertising executive. If you like meeting people, then perhaps you would make a good salesman, sales manager or marketing executive. Perhaps you like to build? You could become a foreman, builder or engineer electronics expert, or TV-radio repair specialist. These are highly paid jobs. Jobs that are within your reach through I.C.S. training.

OVER 236 I.C.S. COURSES. There are over 236 I.C.S. Home Study Courses — one of them will undoubtedly cover the business you are now in or can help you break into an entirely new field. An I.C.S. Home Study Course can train you for the qualifying examinations in many professions.

ACT NOW! Opportunities are everywhere — but you must be trained. Over 8 million people have enrolled with I.C.S. throughout the world. Take the first step now — fill in the coupon below and we will send you a FREE book about the I.C.S. course that suits your needs.

YOUR FUTURE CAREER COULD BE LISTED HERE

Accountancy
Secretarial
Cost Accountancy
All Public Exams.
Bookkeeping
Small Business Owners
Office Management
Club Administration
Shorthand-typing
Modern Supervision
Hotel-Motel Management
Retail Merchandising
ISME Marketing Exams.
Sales Management
Salesmanship
Window Display
Advertising Exams.
Copywriting
Commercial Art
Painting in Oils
Water-Colour Painting
Caricature—Cartoons
Showcards—Tickets
Signwriting
Professional Writers
Short Story Writing
Freelance Journalism
Script Writing
Photography
Interior Decorating
Home Dressmaking
Pattern Drafting
Hostess—Entertaining
Etiquette
Foreign Languages
English—Maths.
General Education
Nurses Entrance
Police Entrance
Building Trades
Draughtsmanship (Mech., Arch., Elect., etc.)
Carpentry & Joinery
Heating—Ventilation
Air Conditioning
Plumbing
Estimating & Quantities
Concrete & Struct. Eng.
Surveying & Mapping
Highway Engineering
Clerk of Works
Business Letters
Civil Engineering
I.A.M.E. Exams.
Refrigeration
Motor Mechanics
Farm Machinery
Diesels
Driver's Maintenance
Electronics
TV & Radio Servicing or Engineering
Welding—Gas & Elect.
Jig & Tool Design
Eng. Drivers Exams.
Industrial Chemistry
Plastics
Soft Drink Mnfg.
Psychology
Industrial Management
Business Management
Computer Programming
Maths for Engineers
Production Engineering
Small-Boat Sailing
Boiler Attendant
Decimal Currency
Mercantile Agents

ICS INTERNATIONAL CORRESPONDENCE SCHOOLS

International Correspondence Schools.
Dept. 526—400 Pacific H'way., Crow's Nest, N.S.W.
Tel. 43 2121. Branches all States and New Zealand.

Send me FREE book on.....

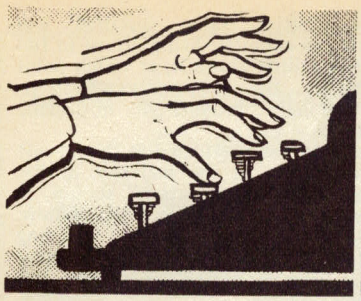
Name (Mr., Mrs., Miss) ..... Age.....
ALL CAPITAL LETTERS PLEASE

Address .....

..... State..... Postcode ..... Dept. 526

Occupation..... Phone.....

Examination Coaching Special Tuition Available for ALL Exams., including: MATRICULATION, SCHOOL CERTIFICATE, LEAVING, UNI-ENTRANCE INST. OF SALES ADVERTISING INST. OF AUST. SOC. OF ACCOUNTANTS, INST. BUSINESS ADMINISTRATION INST. OF SECRETARIES.



FORUM

Amateur radio: light in a dark world

The busy, competitive environment in which most of us live and work tends to emphasise the less gracious aspects of our relationship, one person to another. But things happen, at times, to bring a much warmer note, and the following correspondence is quoted as an example which may well inspire others.

Conducted by the Editor

During March of this year, we received a letter from the Lions Club of Mitcham, South Australia, which read as follows:

Dear Sir:

I am writing to you in my capacity as Second Vice-President of the Lions Club of Mitcham, South Australia, in charge of club projects and activities.

In our community, we have a blind person who is keen on Amateur Radio, and who wishes to take the examination for an Amateur Radio Licence. He is being assisted in this by a radio "ham", but of course his instruction is verbal and he has no opportunity of recall of information.

It has been suggested that the Course of Instruction on Radio, featured in "Electronics Australia" in chapters over the past two or three years, and published as a separate volume by you, would form a good basis for this particular person. In fact, he has purchased a copy of that volume, but, of course, cannot read it.

It is hoped that our Lions Club can help him. Realising that copyright is involved in the reproduction of such work, I write to seek your permission to reproduce the content of the Radio Course in a tape recording for the express and individual use of this particular blind person, to assist him in gaining his licence and widening his restricted horizons.

Yours Faithfully, J. E.

In due course, we replied to the Club, granting the necessary release of copyright to assist the particular nominee. Such arrangements do, of course, have to be expressed in specific terms, if the copyright of a publication is not to be eroded. We heard nothing more of the matter until we received another letter, recently, from a correspondent who has specifically requested that his name not be published. He says:

Dear Sir,

I was interested to read the information shown under the heading "Course For The Blind" on page 98 of the October issue of "Electronics Australia". I thought that you, in turn, would be interested in the following:

Early this year, the Mitcham Lions Club approached your office for approval to record your "Basic Radio Course" for an elderly blind person in this district. Approval was given for the specific project and the service Club provided me with the recording tape.

My friend and I, both radio amateurs, read your entire publication, describing the various diagrams, where feasible and desirable, as we proceeded. On the tape that was left, I recorded some basic notes of my own, plus a number of past AOCP examinations papers, with model answers.

The gentleman concerned listened to these tapes intently for some weeks and began to ring me occasionally with queries. This led to a week per night personal coaching for perhaps some eight weeks, culminating for him sitting for the August 1970 LAOCP examination held in Adelaide.

I am happy to say that the said very proud gentleman was successful and now holds the call VK5ZJJ becoming, to the best of my knowledge, the first blind amateur in South Australia. His next goal – the Morse exam and a full licence.

As we said, situations like this bring a flush of warmth into our rather materialistic environment and we would commend the initiatives of those who have brought a new dimension to another person's literally dark world.

Still on the subject of amateur radio, we reproduce a letter to hand from a correspondent from Bellevue Hill, NSW.

Dear Sir,

I have a number of comments regarding frequency allocations. Firstly, if Australian amateurs have been given 26.96-27.230MHz on a secondary basis why is there no amateur activity on these frequencies?

I am a firm believer in the policy of you either use a band or you lose it. An incentive for the use of 27MHz is that both Canadian and New Zealand as well as Australian amateurs have this frequency for their use on a secondary basis. Canadian amateurs can operate from 26.96-27.00MHz, New Zealand amateurs have from 26.96-27.230MHz and therefore 27MHz DX is still possible.

I think that this so called CB system be moved completely off 27MHz, say down to 26MHz where the New Zealand CB system has been organised. Old-time hams will agree with me that 27MHz is as good if not better than 28MHz skip. The American Citizen's Band is a disgrace and I am at a loss to know why the American's can dominate frequency allocations in the way they do. They have many HF frequencies devoted to MARS traffic, the Civil Air Patrol (CAP) on 26.2MHz and the Citizen's Band on 27MHz.

Is the Australian amateur less important than the American CB'er who is a bootlegger, sometimes using more than two kilowatts, which is more fact than fiction. As laid out in the Australian Amateur Regulation Book on page 15, amateurs can use 26.96-27.23MHz, provided that they accept any harmful interference from industrial, scientific and medical equipment. I think that the Australian PMG should give priority to the amateur over the CB'er and as 27MHz gear is easy to make or procure, then operation in this band is quite possible. Diathermy and similar interference is prominent all over 27MHz but the clearest frequency is 27.185MHz and I propose that this should become an Amateur Net Frequency. If the PMG forbids 27MHz operation for licensed Australian amateurs then I realise that the FCC must also govern the PMG which is typical of some Australian policies with the USA.

(I would be very pleased if you would publish this letter in the December issue, and give your opinion on the subject.)

J. G. (Bellevue Hill, NSW.)

4CD VERIFICATION

Dear Sir,

I advise that we will forward a verification card to persons, who may write to us for same, reporting reception of our station and indicating accurately the date and time and the program material being broadcast. We are transmitting on 930KHz with a directional aerial and an aerial power of 2000 watts.

F. Bellet (Manager),
Gladstone District
Broadcasting Pty Ltd,
PO Box 420,
Gladstone, Qld 4680.

Well, our first reaction to the letter was: "J.G. has to be joking"! Either that, or he is having us on, or is trying to stir up something with the "population" of the 27MHz region.

Actual frequencies aside, the message that comes through in J.G's letter is that amateurs should move in on the 27MHz allocation and further, that the authorities should grant the amateurs a solus allocation.

As I understand it, the situation is that, by international agreement, frequencies in the 27MHz region were allocated for industrial RF processing, radio control, CB type activities, etc, all having a low priority in the radio frequency sense. Amateurs were given the right to operate in the same region, and under the conditions prevailing, as much as anything because there seemed to be no reason to deny them the facility.

The suggestion that amateurs should make greater use of the right makes sense, particularly if in so doing they can take advantage of imported CB type equipment, fitted with appropriate crystals.

That is one thing but to agitate for an exclusive allocation, to attack other users and to attribute questionable motives to our local administration is quite another.

To be sure, the CB situation in America is chaotic but that is a problem with which the FCC must cope. It can hardly be advanced as a reason why certain spectrum territory should be ceded to amateurs.

Far more to the point is that amateurs have allocations on either side, in the 28 and 21MHz regions, as well as others at 52 and 144MHz. These are the ones they should be worrying about and trying to populate, in order to justify what they have.

Reading J.G's letter, one cannot help but wonder whether he is still living in the era where he imagines that amateurs have some sacred right to their present allocations – or even to new ones. If so – and we may be doing him an injustice – some up-dating of ideas is indicated.

However, putting these matters aside, J.G. certainly raises one very legitimate question: Should amateurs make their presence felt in the 27MHz region?

Just to round off amateur matters for the month and in the context of populating the bands, here is a letter from Queensland:

Dear Sir,

I refer to your editorial "Use Them Or Lose Them", in your volume 32, number 4. I would like to advise that 52MHz is an active band in North Queensland. The Cairns Amateur Radio Club and Townsville Radio Club are extremely active on this frequency and both have nightly schedules between their own Club members. No doubt, 6 metres would be a problem in the south with TVI and this could be more so in Brisbane, with Channel 0.

I hope that other clubs active on 6 metres take the opportunity of speaking up and letting the rest of Australia realise that radio amateurs do exist in the north. Not only do they operate locally on 6 metres but they also, at times, work DX on the band.

Publicity Officer,
Cairns Amateur Radio Club.

THE FM SCENE: Turning now from amateur radio, a letter from a reader in New Zealand is very pertinent to the FM Inquiry by the Australian Broadcasting Control Board. It lends point to our recent editorials on the subject:

Dear Sir,

Your article in "Forum" in your September issue, about FM, was of great interest to us. (You may recall through earlier articles that this Society has taken a leading part in seeking to have FM introduced to New Zealand.)

Having experienced an inquiry here in New Zealand, which has decided there is no need for it yet, may we offer some advice based on our hard-bought experience?

Forget about "FM" as such. Go before any inquiry asking for better broadcasting. The present system reached the limit of its development years ago; the better broadcasting you want (as listed in "Forum") is technically possible, so you expose the sterility and limitations of the old and out-moded system. The old

NEW UNIVERSITY DEPARTMENT

Dear Sir,

Appended hereto are some observations about the new Department of Applied Physics, which has recently been set up at the University of New South Wales. It is my belief that your readers will be interested in the creation of this new Department and its aims.

C. J. Milner
(Professor of Applied Physics).

APPLIED PHYSICS, 1971

Various authorities have recently expressed concern that few jobs for physics graduates seem to exist in Australia. There is undoubtedly a changed employment situation in the 1970s as compared with the 1960s. The first analysis of a national survey conducted in 1968 (by the Commonwealth Department of Labour and National Service, with the collaboration of the Australian Institute of Physics) has clearly shown this. The "public sector", comprising universities and Government service, will no longer stand wide open for recruitment, except into secondary teaching.

But the demand for the services of physicists in the "private sector" can be expected to increase rapidly. A basic reason is that the increasing size and sophistication of the Australian market makes it vital that Australia's industrial research-and-development should expand, and become more comparable with that of major overseas countries. In these days, production technologists and design engineers are not enough: research for, and development of, new products and new processes are necessary to retain a grip on the market.

It may be that the authorities mentioned have not appreciated the strength of the demand that already exists. In the "public sector", one is accustomed to see demand evidenced by lists of advertised vacancies for persons with specified qualifications. But industry often does not advertise at all; someone who comes and asks for a position shows a keenness which makes them additionally welcome. And when an industrial position is advertised, the firm is seeking the right man, ready to tackle whatever problems the firm encounters. They are not likely to advertise specifically for a "physics graduate", let alone one "with experience of research in" this or that.

In the changed employment situation, it is necessary for physicists to change also, especially in their atttitude to industrial employment. Those who have an aptitude for applying their knowledge of physics to practical ends need to be encouraged rather than dissuaded. This is just as much necessary as it is necessary for employers to recognise more fully the special character of the service that applied physicists can give.

Any industrial research team, while it will necessarily comprise mainly specialists in the company's particular field, needs a proportion of physicists on its staff if it is to do best. Professor C. J. Milner and the staff of the new Department of Applied Physics at the University of New South Wales all have considerable experience of work as industrial scientists. They have found that a physicist is of special value in industry because of his broad and deep understanding of general principles. This sometimes enables him to solve those exceptional problems which baffle the specialists. Through serving in this kind of way, physicists in industry encounter great variety in their work. This diversity, and the fact that success, when attained, is so immediately evident, are among the greatest satisfactions of work in industrial physics.

The whole purpose of the new Department is to educate final-year physics students, and physics graduates, in the ways and means of applying their subject to practical matters, and to give them some insight into the character of industrial scientific work. In these activities the staff of the Department will enjoy the collaboration of a number of visiting lecturers from industry, both in the teaching and in the selection of problems for study and for research. The course-work will commence in March 1971.

The Department of Applied Physics is now engaged in occupying and fitting-out extensive new laboratories on the Kensington campus of the University, adjacent to the School of Physics. In these laboratories, the work of undergraduate students will be to a significant extent integrated with the research work of the staff and graduate students; this may be expected to contribute much to the process of education. While one section of the laboratories will be engaged in the work of applying road-safety problems, in which Professor Milner has been specially interested for some time already, the Department has decided to make the physics of technical materials its chief concern. In particular, the mechanical properties of materials are clearly of so much importance in almost every branch of industry that the Department plans to set up equipment for studying these mechanical properties over a wide range of conditions.

system will have its faults, made worse with the new private stations on 540-1604KHz in New Zealand; the better system will not be concerned about trans-Tasman interference.

One of the proponents of FM at the New Zealand Inquiry put it in a nutshell when he said: "The public is not interested in whether the Main Trunk Express is hauled by steam or diesel; they have trusted that those in authority have chosen the best system for them".

Therefore, as technical experts, go to the inquiry to give the public the service which technology can supply, and to which the public is entitled. Is bureaucracy the impediment to better service?

It does not matter that only a minority want stereo and distortion-free reception, with a wide frequency range. The world's first high-definition television system was the BBC 405 line system in 1936. There were no receivers capable of receiving the bandwidth to that definition in 1936. However, the BBC took the line that transmission should not be restricted to receiver capability, as receivers would catch up. As we all know, in 10 years they had caught up – to 625 line standard.

Our New Zealand inquiry had three questions to find answers to: What is FM, what are its advantages and disadvantages, and in what respect is the extension of broadcasting to include a frequency modulated type of service necessary or desirable in the public or national interest?

Having answered the first two questions in predictable fashion, our Broadcasting Authority concluded that there is no need of FM for the present, a view in which the Minister of Broadcasting hastened to concur. The point here is that the terms of reference of the Inquiry enabled the Authority to pronounce against FM on the basis of lack of public demand for FM. Naturally, the public is not demanding some weird thing called "FM" which engineers and technicians are talking about along with the rest of their jargon. But as our problems in reception mount, as yours are doing (note letter in the "Forum" article we are writing about), there is a continuing demand for better broadcasting.

Even the NZ Broadcasting Corporation, which opposed FM at our Inquiry (its immediate introduction, that is) agreed that it would eventually come. There is, therefore, the consolation that officialdom can only delay FM – it cannot stop it.

Best of luck with your Inquiry.

Yours faithfully,
Newlands Broadcasting Society Incorporated,
L. C. Brocklesby (Secretary)

SERVICEMAN

On page 62 we have a special article by our Technical Editor entitled "ELECTRONIC SERVICING: The Other Side Of The Story". Because of the inclusion of this article, our regular "Serviceman" feature has been held over for this month only.

FROM FM TO AUDIO: Any visitor to Japan is likely to form the impressions that I did: Of crowded living conditions but a rapidly rising standard of living; of a strong tendency for the Japanese to spend their money on things that can be owned and enjoyed inside the four walls of their homes – not on patios, not in gardens, not on the open road.

Commensurate with this is the enormous popularity of electrical and electronic consumer goods, ranging from fans and refrigerators, through FM, Colour TV and audio equipment, to highly developed amateur radio equipment.

With this as a background, it was interesting to read a release from Convoy International on behalf of the manufacturers of TEAC tape equipment. The item is far too lengthy to reproduce in full but one excerpt speaks very eloquently of the Japanese outlook and the way it is reflected in the design of their equipment. It comes, by the way, from a Japanese author, Hideo Kumon:

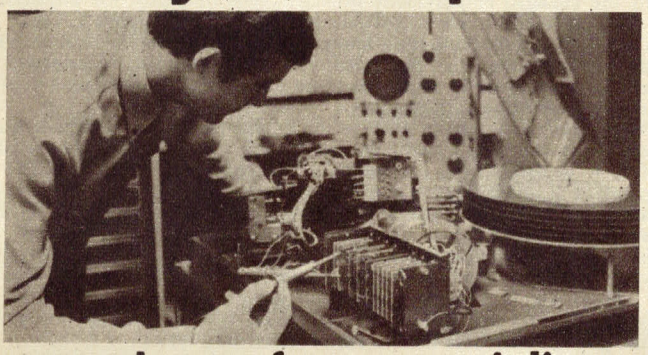
"In Japan, there is a pinball machine game known as 'pachinko' which has an enormous popular appeal. One can always find one or two pachinko parlours even in a suburban community if it has a center where a handfull of shops are grouped together.

"But if one crosses the narrow Japan Sea to South Korea, one will not find pachinko parlours. This is because the Korean people are not like the Japanese who would stand alone in front of a pachinko machine and become immersed in the solitary game.

"In the United States, there are game machines similar to the pachinko. However, the American game machines are

(Continued on page 189)

With your interest in electro-mechanics you're worth more money in computers



apply now for our specialist course in computer technology

The Computer Industry needs men trained in the technical side of computers. The Industry is showing how great is its need by the kind of money it is paying. Now is the time to get on with your training and get into this fast-growing industry on the ground floor.

If you are between 18-35 years and genuinely interested in entering the computer industry, you should apply now. You will be trained in the skills needed to install and maintain electronic computers and associated electro-mechanical equipment including practical training on the largest computer to be installed in Australia in a private vocational school.

Control Data's Institute Division is an international specialist school in computer education. Our Sydney school is one of 21 world-wide and the first opened in the Southern Hemisphere.

Control Data itself is one of the world's leading manufacturers of computers. We will teach you as only a computer manufacturer can.

CONTROL DATA AUSTRALIA PTY LIMITED

INSTITUTE DIVISION

283 Alfred Street North, North Sydney. 2060

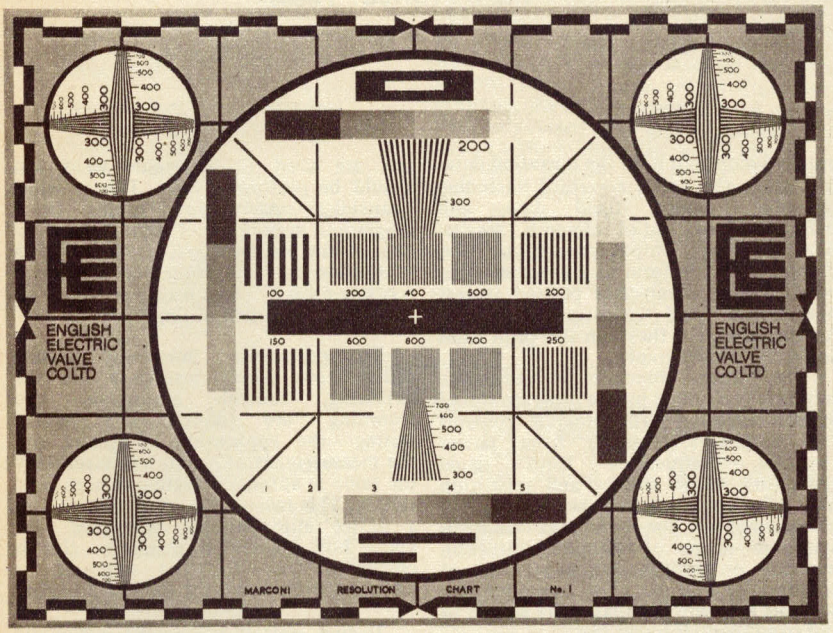
CONTROL DATA AUSTRALIA PTY. LIMITED. INSTITUTE DIVISION
283 Alfred Street North, North Sydney. 2060 CDI/141 EAL70

YOUR CAREER WITH COMPUTERS

Please send immediately, without obligation, a copy of your book, "Your Career with Computers."

Name Mr. Mrs. Miss .....Phone .....
Address .....
..... Postcode .....
Occupation ..... Age .....

EEV Test Chart for CCTV Cameras



The English Electric Valve Company has recently produced a camera tube and system test chart specially for use with closed-circuit television (CCTV) systems.

Photographic copies of the chart (measuring 10½in x 8in) and a leaflet describing its use are freely available to anyone using closed-circuit television, in return for information about the types of cameras they are using, etc. The test chart is also available mounted on hardboard: this more durable version will be available to customers who place orders for EEV vidicons.

The EEV test chart is based upon the Marconi Resolution Chart No 1, and Marconi's assistance in its preparation and permission for its use is gratefully acknowledged. Every care has been taken in the preparation and production of the EEV chart. It forms a most convenient, low cost, effective aid in making qualitative assessments of CCTV cameras and systems. In general it is intended for CCTV systems using vidicon cameras.

The test chart has the following important features, which may be noted with reference to the small reproduction shown above. The general background of the chart is a neutral grey, equivalent to the average brightness level of a typical scene. The centre line of the castellated surround defines the active picture area. The coarse grating pattern of horizontal and vertical lines allows a qualitative visual assessment of electronic scanning linearities.

There is a large central circle, and four corner circles, for checking picture geometry. Also vertical and horizontal blocks of lines of various frequencies placed in strategic positions, and five-step grey scales, disposed both vertically and horizontally.

The chart is designed for use with front illumination, preferably by a tungsten lamp. This must be placed to avoid or minimise specular reflections entering the camera lens. The recommended intensity of illumination on the chart is between 100 and 200ft candles. The chart is placed normal to the axis of the camera tube, at a distance such that the chequered edge of the chart produces an image on the target equal to the normal scanned area.

The fine detail resolving power of the camera or CCTV system can be noted from the resolution blocks and wedges in the test chart. The vertical bars within the circle are arranged in blocks to give the horizontal resolution of the system in number of lines per picture height. The vertical resolution wedges enable limiting picture centre resolution to be observed. The corner resolution wedges enable both the vertical and horizontal resolutions to be assessed. Adjustment may be made to achieve optimum overall picture focus by observing wedges in both the centre and the corners.

The grey scale is included for the setting up of the camera tonal range and enables final adjustments to be made in the brightness and contrast levels. The purpose of the blocks of black and white and white on black is to permit observation of low and middle-frequency response.

Applications for the EEV Test Chart should be directed to the Publicity Department, English Electric Valve Company Ltd, Chelmsford, Essex, England, enclosing the requested information about the cameras and other CCTV equipment being used. Information on other precision test charts in the Marconi range, if required, may be obtained from the Sales manager, GEC-Marconi Electronics Ltd, Central Division, Lane Works. Waterhouse Lane. Chelmsford, Essex. ■

ENCEL SPECIAL XMAS BARGAINS!

Save money now on these special offers, while stocks last. (All items brand new unless marked.)

Don't miss out!

Call to Encel stores now, or write immediately.

JUST ARRIVED

- Trimline L54/150, with legs retail $161.50 ea. **Special Encel Price** (below dealer cost price) **$138.00 ea.**
- Lancer 77 retail $268.00 ea. **Special Encel Price** (below dealer cost price) **$198.00 ea.**
- JBL 99 retail **$370.00 ea. Special Encel Price** (below dealer cost price) **$275.00 ea.**
- Lancer 88 retail $298.00 ea. **Special Encel Price** (below dealer cost price) **$219.00 ea.**
- Akai X330D Tapedeck. **Special $485.00.**
- Akai X360D Tapedeck. **Special $518.00.**
- Leak Stereo 70 Amplifier (used) **$198.00.**
- Leak Stereo 30 Amplifier (used) **$90.00.**
- Teac A560 Tuner/Amplifier (used) **$130.00.**
- Brenell Recorder/Model ST400 retail $495.00 **Special Encel Price** (below dealer cost price) **$340.00.**

JBL SPEAKER SYSTEMS

Limited shipment of Rotel 310 and 610 amplifiers.
Best performance. Best value anywhere in Australia.

Write for full technical details or hear them for yourself at one of the fully equipped Encel Sound Lounges.

Call in today. Encel has many other stereo items to delight the hearts of your Hi-Fi friends this Christmas!

ENCEL
ELECTRONICS PTY. LTD.

Head Office: 431 Bridge Road, Richmond Victoria, 3121. Tel.. 42 3762 . Sydney Store: Ground Floor, 2SM Building, 257 Clarence Street, Sydney, N.S.W. 2000. Tel. 29 4563, 29 4564.
● Australia's Greatest Hi-Fi Centres.
● Trade-ins accepted ● Terms available.
● Mail Orders throughout Australia.

EE70

Automated Testing

What is automated testing? What are its advantages? How has it evolved? These and similar questions are answered below.

by ROBERT A. GRIMM

Automatic testing of electronic devices is one of the fastest growing areas of electronic instrumentation. It is the way an increasing amount of our testing is done every day, and it is the way most of our testing will be done in the future. At present, however, most of the testing of electronic components, sub-assemblies, modules, and systems is still done manually. Many companies are just now installing or considering installing their first automatic test systems. While most people involved in electronic testing have read about or seen examples of automatic test systems, many may not be aware of the fundamentals involved in all automatic testing. This article has been written to explain the fundamentals of automatic testing, its advantages, and the type of equipment used.

Automatic testing of electronic and electrical devices requires the same functional elements as manual testing. These are:

- Stimulation of the unit under test
- Measurement of the unit's responses
- Switching
- Control
- Evaluation of data
- Recording of results

In automatic testing as in manual testing, the stimulus and measurement functions are performed with instruments. Stimuli sources include oscillators, signal generators, power supplies, and so on. Measurement devices include voltmeters, counters, power meters, and similar instruments.

Switching, control, evaluation, and recording in manual testing are usually performed by the operator. The switching of connections between the test equipment and the unit under test is done by reconnecting cables, by using test probes, or by means of a manually operated, pre-wired switch box. Control of the test equipment is exercised by the operator, by setting knobs on the panels of the test equipment. Control of the test sequence is also by the operator, usually following a written test sequence.

Evaluation of test results is again done by the operator, who compares the results to pre-established limits or uses his judgment. He may make some calculations or use graphs or charts. Recording of manual testing results is ordinarily by the operator's filling in a test card.

In automatic test systems, like the typical examples shown, human intervention is minimized, although it is sometimes not completely eliminated. Most of the test functions are done automatically under control of a computer or other device following a stored program sequence. Switching is done automatically by electrically controllable switches, such as relays, crossbar switches, and switch matrices.

The recording of test results is accomplished in an automatic system using a teleprinter, a digital printer, or punched or magnetic tape. These devices usually record not only the measured data, but often the entire test card, including parameter names, fixed data, and indications of out-of-tolerance results. Some types of output reports are best presented in the form of graphs, showing two or more parameters plotted against one another. X-Y recorders can be used for these reports; they can also print titles and scales on the graphs.

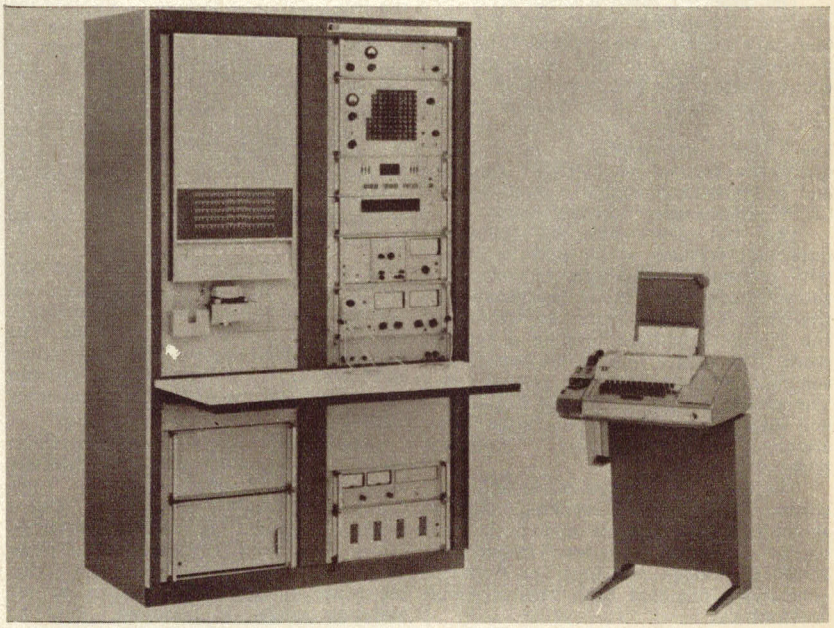
The control function in automatic testing is performed by the program stored in the computer. The program controls test sequences, voltages from power supplies, frequencies from signal generators, pulse widths and repetition rates of pulse generators, and so on. For measurements, the program controls amplitude ranges of voltmeters, function selection on multimeters, gate times of counters, and so on. The computer also controls the switches that route signals to and from the unit under test.

Evaluating results in testing is primarily a matter of comparing test results against established limits. However, some calculation or manipulation of data may be required before this comparison can be made. For example, if the linearity specification of a dc amplifier is stated as 'within ± 0.01% of the best straight line through all data points', this line must first be calculated and the errors determined, and then a comparison made against the limits. Although this is labourious if done manually, it is straightforward for a computer.

Frequently in testing, the results of a test are used to determine what test should be performed next. This is called 'branching'. At branch points in a program, a system might print out special test results or messages, or jump to a subroutine for fault locating. This is a powerful capability of computer-controlled testing.

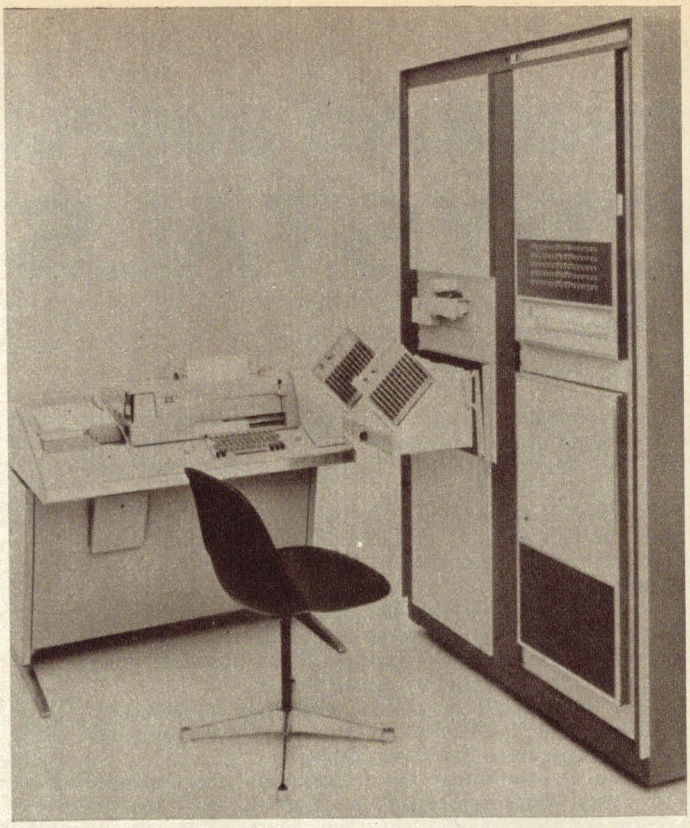
To summarize, automatic testing differs from manual testing in how the switching, control, evaluation, and recording are done. The actual testing – the application of stimuli and the measurement of results – is essentially the same in automatic testing as in manual testing. This means that to be able to test a device automatically one must first know how to test it manually; this is especially true for the engineer or technician who is writing the test program.

Testing started to become automatic when the devices to be tested became too complex, and the required tests too numerous, to be done economically by older testing methods. The testing of these devices called for fast, automatic equipment which could stimulate these devices and measure their output according to their complex specifications. Manual methods of testing, while satisfactorily meeting the requirements for sophisticated testing in most cases, tended to be too time-consuming when the quantities of devices to be tested or the number of tests to be performed made it difficult to meet schedules.



The Hewlett-Packard Model 9500A is a typical computer-controlled, modular, multi-purpose test system. It stimulates the unit under test, measures its responses, then processes and records the data.

This article is reprinted from Hewlett-Packard Journal, by courtesy of the Hewlett-Packard Company. The author is marketing manager of the HP Systems Division.



The Hewlett-Packard model 2060A digital logic module test system, which can perform up to 10,000 individual tests per second.

The advantages of automatic testing include the following:

- Speed
- Repeatability
- More comprehensive testing
- Self-test and error correction
- Operators can be less skilled

Computers operate at very high speeds, with individual program steps taking typically less than two microseconds. Even though it may take a large number of these steps to perform a control or conversion operation, such operations can often be completed in a few microseconds, or at most a few milliseconds. Electrically controlled, many kinds of test equipment can provide signals and take measurements much faster than an operator can set the controls or record the readings. A computer can take advantage of this speed. Also, the manual reconnecting of cables between tests is a slow process compared to the speeds at which relays operate. All of this means that testing is much faster under computer control. Digital testing, that is, testing of binary logic patterns, is one of the fastest kinds; thousands of tests per second can be done easily.

Case histories of organisations who use automated testing show that non-digital testing can be anywhere from five to 60 times faster than manual testing, and digital testing can be faster yet. It's reasonable to expect that most automatic testing will run at least 10 times faster than manual testing.

There are some steps in testing that may be difficult or impractical to automate or to speed up. These include steps that the operator must do, such as connection of a device to the system, a change of control settings on the device being tested, or screwdriver adjustments on the device. An engineer designing a new device might thus do well to anticipate how it is to be tested, and consider providing for automated adjustment of its controls.

Repeatability is much better when tests are automated. Tests run automatically are done the same way each time, faithfully following the same test sequence. Steps are not skipped. Stimulation of the device under test and the transfer of data from the measuring devices into the computer are done the same way each time, without parallax errors in meter readings, transposition of digits in digital readings, or other human errors.

With automated testing, more comprehensive testing is practical. In manual testing, spot checking of parameters is often necessary to speed up the tests. For example, the gain linearity of an amplifier may be measured and calculated at as few as three or five amplitudes. Or the standing wave ratio of a connector may be checked only at a few selected frequencies. Or the truth table of a digital integrated circuit may be checked with only one voltage input level. Automatic testing can be much more thorough because it is so much faster. It is even easy to do *additional* testing to detect marginal devices which may fail only under certain conditions. The programming to do this usually requires very few, if any, additional statements; for example, it is easy to repeat a test with a changed condition. By knowing completely what his product will do under very many conditions, a manufacturer can give more complete specifications, and can specify the product's performance closer to the tested values, with less allowance for unknown factors.

Self-test and error correction together make up one of the most significant advantages of automatic testing over manual testing. In any test setup, certain errors are introduced into the measurements by cables, connectors, or equipment. Some of these are random errors which vary from test to test; these errors may be caused by noise or other non-repeating parameters, and they are difficult to eliminate, although averaging techniques are sometimes helpful. However, many causes of error are repeatable. These include such things as voltage drops in cables, reflections in connectors, zero offset or full-scale error on a voltmeter, frequency calibration error of an oscillator, and so on. In an automatic test system it is both possible and practical to have the system make measurements based on internal standards to determine these systematic errors, then store the correction data and correct all subsequent measurements before using or displaying them. The result is accuracy approaching that of a standards laboratory, but obtained at a much higher speed.

Automated testing demands less skill on the part of the test station operator, one reason being that the test procedure is read into or stored in the computer's memory, so the operator does not have to know or follow a complex test procedure. Simple instructions can be typed out automatically to tell the operator what action he should take and what the results of the test are. In testing simple devices, such as electronic components or simple modules, only a go or no-go indication may be required, and this can be in the form of lights. With an automatic handler, good and bad devices can be ejected into appropriate bins. In testing integrated circuits while they are still on the substrate slices, bad units can be marked automatically, perhaps with a dot of ink. In all of these cases, the operator needs to be competent to conduct the test, but doesn't necessarily have to understand it.

There are many other advantages of automated testing besides those discussed here. For example, a computer can do statistical analysis of test results as the data are gathered, and can call attention to recurring problems very quickly. With a computer in a test station, there is no waiting for results to be resolved and tabulated off-line at some later time.

Much of the early work in automatic testing was done for and by various branches of the armed services, who recognised the long-term potential of the technique. These latter-day pioneers contributed much to helping automatic testing achieve its present practical status.

Automatic test systems have not always been so practical as they are today. For example, in the early days there was a shortage of equipment suitable for systems use. Most of the test equipment available was designed for manual control and visual readout of results. Therefore, automatic systems had to be assembled using custom-built, and consequently expensive, equipment.

Now, however, many standard

(Continued on page 189)

ARTHUR DOW

CHECKING SURPLUS CRYSTALS



Printed by arrangement with "Practical Wireless".

Although surplus crystals are readily available, cheaply and in large quantities, many of them are not marked with their frequencies or at best are marked with a code or "channel" number.

While it is possible to get information to decode these numbers it is far simpler in the long run to make a direct check on the crystal to determine its fundamental frequency.

In some cases the frequency indicated on the crystal holder is an operating harmonic frequency and not the fundamental. So once again the necessity arises to find the fundamental by direct means.

It is possible to build a simple transistorised oscillator using the Pierce circuit so that just about any crystal plugged into it will oscillate.

But to determine the fundamental frequency of this crystal with a receiver can lead to false answers because of the several spurious signals that can be generated due to the beating together of oscillators in the receiver and the fundamental and harmonics of the crystal under test.

Fortunately there is a simple way by which the fundamental frequency of any crystal can be found quite accurately before a final precise measurement is made.

All that is required is a Grid-dip Oscillator (GDO). This will normally have plug-in coils and a roughly calibrated scale for each range. It should be stressed that this calibration is really quite rough since the coil is subject to outside influences that can seriously affect the frequency at which the GDO will oscillate.

In normal use the GDO is loosely coupled to the tuned circuit being investigated and then tuned until grid current shown on its meter suddenly dips. Figure 1.

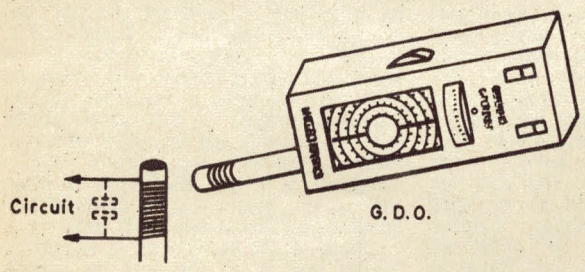


Figure 1. Conventional use of a GDO to investigate the resonant frequency of a tuned circuit.

The GDO is then moved away from the tuned circuit to reduce the coupling until a good clean sharp dip is obtained on the meter. The GDO should if possible, be placed with respect to the tuned circuit so that it does not have to be held in your hand.

It is at this point that the signal from the GDO can be picked up by a nearby receiver and its frequency determined. This is only an approximate answer since the frequency of the GDO is being measured and not that of the tuned circuit itself.

It is no use getting a dip on a hand-held GDO and then taking the GDO across the room to a receiver and expecting the frequency to remain constant.

When the GDO is used to check the fundamental frequency of a crystal a slightly different technique is used. A few turns of wire are wound on a former which is slightly larger in internal diameter than the GDO coils. The ends of the coil are connected to a suitable holder for the crystal, figure 2, but if it is expected that a large number of crystals having different size pins and spacings are to be checked it is suggested that a permanent board be made up with a number of different holders, all connected in parallel.

The lowest frequency range of the GDO is chosen to begin with and its coil inserted into the crystal coil. As you tune from the low end to the high end of the range very slowly a dip will occur as soon as the GDO

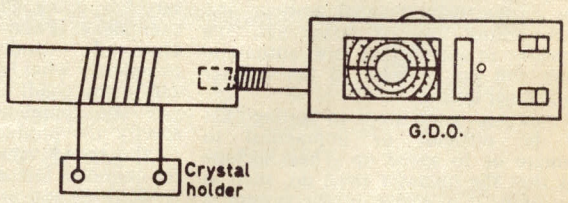


Figure 2. Using a GDO to "excite" a crystal at its fundamental frequency.

passes the frequency of the crystal. At this point the crystal is absorbing power from the GDO and it should begin to oscillate at its own natural frequency provided that the coupling between the coils is sufficient.

When the GDO is used to check a conventional tuned circuit the dip in grid current takes the form shown in figure 3 (a) but when it is used to check a crystal the form changes to that of figure 3 (b). This is because the GDO frequency becomes locked to that of the crystal once the crystal is oscillating and the tuning of the GDO is ineffective over a small range and its frequency is precisely that of the crystal.

The GDO frequency and hence that of the crystal can now be measured on a receiver in the conventional manner. Depending on the degree of accuracy of measurement required, the calibration of the receiver should be cross checked against a standard crystal calibrator with 1MHz, 100KHz, 10KHz and possibly 1KHz check points. It should be remembered that, in practice, the precise operating frequency of the crystal will depend upon the type of circuit in which it is used. If it is necessary to order a crystal for a specific frequency from a manufacturer the type of circuit to be employed should be stated.

The "locking" effect, mentioned above, between the GDO and the crystal is very marked but if it is not obtained during the initial tests the coupling between the coils should be increased by sliding the GDO coil further into the crystal coil.

It is important to begin with the GDO on its lowest frequency range, probably about 1.5-4MHz, so that the crystal will oscillate initially on its fundamental frequency rather than on an overtone mode. If it should work on such a mode further confusion will arise because overtone frequencies are not integral multiples of the fundamental frequency. On, say, the fifth overtone the measured frequency may be several kilohertz different from the fundamental frequency multiplied five times.

If a GDO is not available, a signal generator or a frequency meter may be used using a set-up shown in figure 4. The voltmeter should have a high resistance of about 10,000 ohms/volt or a general purpose meter may be used on a low voltage range. A valve voltmeter will be more sensitive and should be used in preference to a conventional test meter.

The procedure is to tune the signal generator from its lowest frequency, about 1MHz, upwards until a deflection is noted on the meter. In this case the peak indication is the point at which the crystal is resonant with the applied signal.

If the calibration of the signal generator is not to be relied upon, an external receiver can be used to measure the frequency as before. The author has found in practice that much too much faith is placed on the calibration of signal generators which do not have their own internal calibration facilities.

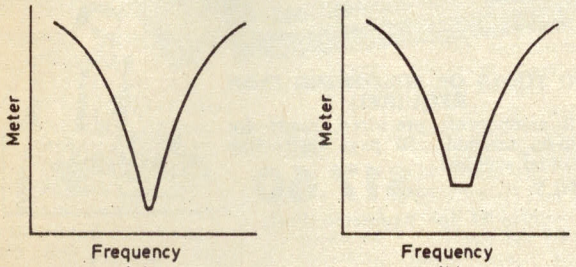


Figure 3. (a) Grid current of a GDO when used conventionally as in figure 1. (b) Grid current when used to "excite" a crystal.

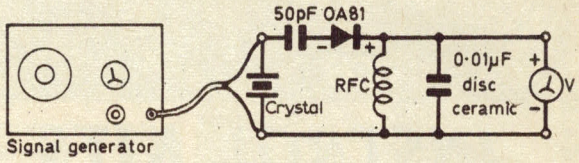


Figure 4. Use of a signal generator instead of a GDO to determine the frequency of a crystal.

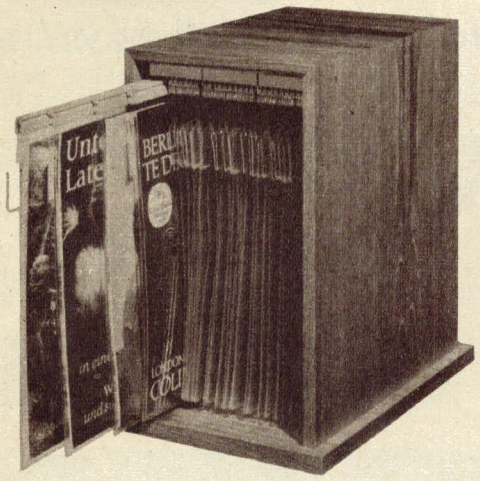
If the output of the signal generator has a calibrated attenuator the "goodness" of the various crystals can be estimated by keeping the input voltage to the crystals constant and noting the relative deflection on the meter when the signal generator is tuned to the frequency of the crystal under test.

Once the fundamental frequency of a crystal has been found, its performance in the overtone mode can be judged by applying signal voltages from the GDO or the signal generator at the third, fifth or higher harmonics. The dip shown on the GDO will be less than that obtained on the fundamental of the crystal and in the same way the output indication using a signal generator will be less, as the order of the harmonic is increased.

Crystals designed especially for operation on the overtone mode will naturally perform better in this test than those that are not, but after testing a number of crystals the good and the bad will be obvious. ■

VEALLS AUDIOTORIUM

RECORD-A-WAY



The most advanced Record care in the world.
Sold in kits of 10, complete with plastic containers and fixing screws.

$8.50 per kit of 10. Plus Freight

Franchise available all States.

THE NEW SYMPHONIC
'77' SOLID STATE STEREO COMBINATION



FULL PRICE
$198.00
plus $5.00 freight.

Small in size, yet delivers 14 WATTS RMS of faithful sound reproduction. This superior sound quality is due to advanced semi-conductor technology, and the use of solid state circuitry throughout. The price is unbelievably low, without any sacrifice in the quality of materials and workmanship, which is completely designed and manufactured in Australia.

SPECIFICATIONS:
- Total Music power — 18 WATTS into 4 OHMS RMS — 7 WATTS per channel at 8 OHMS.
- Frequency Response — 30 Hz to 30,000 Hz 3 dB.
- Input Sensitivity — Auxiliary 100 MV. Tape Deck 100 MV.
- Speaker Impedance — 4 or 8 OHMS.
- Dimensions — Amplifier and Player: 16½" x 13½" x 6½". Each Speaker: 11½" x 18½" x 6½".
- Turntable — 4 speed with CERAMIC cartridge.
- OUTPUT JACK for Stereo Headphones.

Please forward me 'Symphonic Unit'
Enclosed Cheque/M.O./P.N. for $203.00.

MAIL ORDER NOW

TO: VEALLS AUDIOTORIUM 512 BRIDGE ROAD, RICHMOND, VIC.

315

Name.....

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

Electronic Parts introduces the self-service

INSTROL

INSTROL KITS

Ideal Christmas gifts

INSTROL EDUCATIONAL ELECTRONIC KIT

In this Electronic Age, every person should have some knowledge, however elementary, of "how it works." The new Instrol 20 in 1 electronic kit will enable you to understand in an absorbing, simple manner the basic principles underlying computers, satellite communications, industrial electronic devices, etc., etc. You make 20 different experimental circuits, including 10 working radio transistor operated radio circuits. Audio Amplifier circuits, home intercom, testing circuits including Audio Frequency Oscillator and Signal Tracer, Morse Code practice set and telegraph transmitter, etc. You use and learn about the amazing SOLAR CELL.

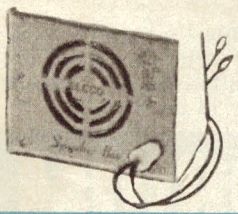


NO TOOLS OR SOLDERING IRON REQUIRED

All components pre-wired, ready for clip-on assembly. 50 page Instruction Manual supplied.

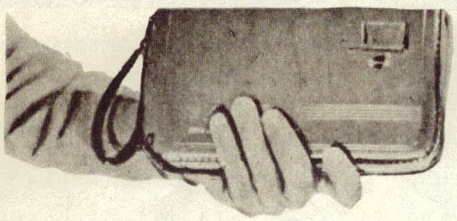
ONLY . . . **$17.60**

(plus $1 for Registered Post)



To allow others to hear the results you achieve, why not obtain the Instrol SP1 Speaker box. Completely assembled, includes transistorised audio frequency amplifier, dynamic speaker and leads, housed in an attractive plastic box, and ready to plug-in at any appropriate stage of your experiments with the Instrol 20 in 1 Electronic Kit.

INSTROL SPEAKER BOX. PRICE $6.40 plus 20 cents postage



ELECTRONIC TOOL KIT

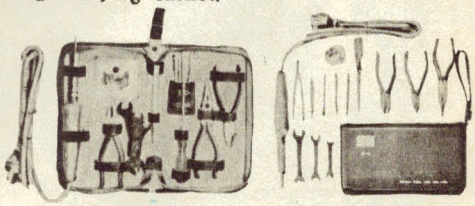
For Hobbyists Students and Servicemen

An inexpensive, yet most comprehensive, pocket-sized tool kit. Ideal for the Student, Hobbyist and Practising Service Technician. The Soldering Iron is an Australian made high efficiency 30 Watt 240 Volt type. All the other hand tools are imported, high grade steel. The complete kit fits snugly into a strong attractive zip-fastening carrying sachet.

COMPONENTS

1—Soldering Iron with 3-pin plug 30 Watts 240V
1—Set 3 Spanners.
1—Coil Resin Cored Solder
1—Pair Pliers standard
1—Pair Long Nose Pliers
1—Pair Side Cutters
1—Pair Tweezers
1—Screwdriver Set complete with handle and chuck, comprising
2—Screwdriver bits
1—Philips driver bit
1—Pointed awl
1—Spintite for tin nuts

PRICE $14.95 plus Regd. Postage $1



E.A. COMPLETE KITS

(Extra $2.00 postage and packing)

	$
Playmaster No. 101 amp	65.00
Playmaster No. 106 amp	108.00
Playmaster No. 113 amp	65.00
Playmaster No. 115 amp	99.00
115 Magnetic preamp	11.50
Playmaster No. 118 amp	89.00
118 Magnetic preamp	16.50
E.A. "3 plus 3" amp	47.00
E.A. "10 plus 10" amp	65.00
Playmaster 124 Stereogram	73.00
Playmaster 128 amp	105.00
112 Control Unit	45.00
Extra preamp 'A"	9.00
Extra preamp "B" or "D"	6.00
Extra preamp 'C"	9.50
120 Control Unit	46.00
127 Control Unit	49.00
111 Tuner (inc. magic eye)	40.00
Extra for power supply (111)	10.00
Extra for Whistle filter (111)	8.00
114 Tuner (inc. magic eye)	47.00
Playmaster No. 123	99.00
Keyless Organ	35.00
Electronic Bongo	13.00
Autodrum (without footswitch)	14.00
116 Guitar amp	78.00
117 Guitar amp	85.00
125 Guitar amp	105.00
Musicolour	47.50
27 MHz Radio Control Receiver	25.00
I.C. Volume Compressor	19.50
All Wave Two Receiver	37.50
Solid State Fremodyne	49.50
R.F. Preamp-cascade type	18.00
R.F. preamp-variable condenser type	13.50
Capacitor Discharge Ignition	22.00
Aug. 70 Short-wave Receiver	74.00
Playmaster 129 amp	54.50

ELECTRONICS CENTRE

Everything for hobbyist and technician

E. A. PROJECTS

METALWORK

(extra $1.00 for postage and packing)



Playmaster No. 3	$7.82
Playmaster No. 4	$8.23
Playmaster 101 amp	$4.01
Playmaster 102/103 guitar	$5.52
Playmaster 105 amp	$8.36
Playmaster 106 amp/tuner	$9.11
Playmaster 108 amp/tuner	$9.11
Jan. 65 Transist. Millivoltmeter	$5.46
Sept. 65 Transist. Audio Oscillator	$5.29
Playmaster 111 tuner	$9.11
Playmaster 112 control unit	$7.00
Feb. 66, V.T.V.M.	$9.20
Feb. 66, 4 channel mixer	$5.46
Playmaster 113 amp	$3.20
May 66, 3" CRO	$21.16
May 66, R.C. Bridge	$5.75
Playmaster 114 tuner	$9.11
Feb 67 Square wave Generator	$8.63
Playmaster 115 amp.	$13.33
May 67 Electronic Metronome	$8.63
Playmaster 116/117 guitar	$4.31
Playmaster 118 amp.	$10.20
Aug. 67 Fuzz Box	$3.49
Playmaster 119 tape adaptor	$5.44
Oct. 67 Reverb. Unit	$3.37
Dec 67 Audio Signal Gen.	$7.19
Playmaster 120 Control Unit	$7.00
Feb. 68 Train Control	$9.08
Mar. 68, Transist. R.F. Oscillator	$7.19
Apr. 68 Tone Burst Generator	$8.34
May 68 Audio Millivoltmeter	$8.34
June 68 Volume Compressor	$9.08
Aug. 68 Transistor Tester	$9.20
Playmaster 122 tuner	$6.05
3 plus 3	$3.73
Sept. 68 A.F. Signal Generator	$12.71
Sept. 68 Regulated Power Supply	$9.43
Playmaster 123 tuner	$8.29
10 plus 10	$6.80
Dec 68, Voltohm meter	$8.63
Keyless Organ	$5.03
Jan. 69, Transistor Power Supply	$9.20
Dummy Load (punched case)	$8.05
Playmaster 124	$5.31
Playmaster 125 guitar	$7.17
Musicolour	$3.73
Playmaster 127 control unit	$7.00
Playmaster 128 amp	$6.80
240 Communications Receiver	$21.41
I.C. Volume Compressor	$5.57
Electronic Bongos	$6.13
All Wave Two Receiver	$6.39
Autodrum	$4.72
70 MHz Digital Freq. Meter	$7.67
Playmaster 129 amp	$5.67

PRINTED CIRCUITS

(extra 20c postage and packing)

Playmaster 113, 63/A4	$3.31
July 64 Multimeter, 64/M7	$2.30
Playmaster 110, 65/T3	$3.31
Magnetic Preamp, 65/P10	$2.04
Playmaster 112, 65/P12A	$2.55
Playmaster 112, 65/P12B	$2.55
May 66 Converter, 66/R4	$2.30
4 Channel mixer, 67/P2	$2.30
Playmaster 115, 67/A3	$2.04
115 Preamp, 67/P3 or 67/P5	$2.04
Playmaster 120, 68P1	$3.06
Simple Transistor Tuner, 68/5T	$2.04
3 plus 3, or 10 plus 10, 68/A8	$2.72
A.F. Signal Generator, 68/09	$2.99
Playmaster 123, 68/8T	$3.23
Powered Loudspeaker, 68/a8	$2.04
Solid State V.O.M., 68/M12	$2.45
Keyless Organ, 69/01 gold plated	$4.60
Keyless Organ, 69/01 nickel plated	$3.68
Playmaster 124 tuner, 69/5T	$2.04
Playmaster 125, 69/P5	$2.91
Musicolour, 69/C10	$2.89
Playmaster 127, 69/P9	$3.05
Playmaster 127, 69/P9 (fibreglass)	$4.08
Playmaster 128, 70/A1	$2.37
Playmaster 128, 70/A1 (fibreglass)	$3.40
70 MHz Dig. Freq. Meter (fibreglass) 69/C9	$3.37
69/d10	$4.60
69C11	$2.45
70/C4	.92
Radio Control Rec. (Feb.), 70/R1	$1.36
Volume Compressor (Feb.), 70/P1	$1.53
1 Watt Handset 70/Tx1	$5.44
Capacitor Discharge Ignition, 70/cd1	$1.36
Stroboscope, 70/SL1	$1.23
Alignment Oscillator, 70/G7	$1.23
TAA 300 I.C. Board	$1.36
Playmaster 129, 70/a2	$3.40
Blank 4 x 2, 3 x 3, or 4 x 3	.20
Blank 6 x 3	.25
Blank 6 x 4	.31
Blank 6 x 6	.46
Blank 12 x 3	.51
Blank 9 x 6	.61
Etching Kit	$1.17



ETCHED LABELS

(extra 25c postage and packing)

Control Unit No. 10	$1.63
Playmaster No. 3	$1.63
Playmaster No. 4	$1.63
Playmaster 102/103 guitar	$1.72
Playmaster 106 or 108	$2.72
Playmaster 111	$2.72
112 Control Unit	$2.04
Playmaster 114 tuner	$2.72
Playmaster 115	$2.04
Playmaster 116/117 guitar	$2.45
Playmaster 118	$2.72
Fuzz Box (set of 2)	$1.23
Playmaster 119 tape adaptor	$3.53
120 Control Unit	$2.04
Playmaster 123	$3.60
3 plus 3	$2.04
10 plus 10	$2.04
Playmaster 124	$2.04
Playmaster 125 guitar	$4.17
Musicolour	$2.04
127 Control Unit	$2.04
Playmaster 129	$2.37
E.A. Eest Equipment	p.o.a.

GIVE A HOWARD SAMS BOOK FOR CHRISTMAS

(add 20c packing and postage)

A.B.C's of Transistors	$3.40
A.B.C's of Capacitors	$2.90
A.B.C's of Transformers and Coils	$2.90
101 ways to use your Hi-Fi Test Equipment	$3.40
101 ways to use your Sweep Generator	$3.40
101 ways to use your Signal Generator	$4.05
101 ways to use your Oscilloscope	$3.85
101 more ways to use your Scope in T.V.	$4.05
101 ways to use your VOM and VTVM	$4.05
Bench Servicing Made Easy	$3.40
T.V. Servicing Made Easy	$3.45
Electronics for the Beginner	$6.05
T.V. Diagnosis and Repair	$2.25
T.V. Servicing Training Manual	$5.75
Solving T.V. Tough-Dogs	$3.75
T.V. Servicing Guide	$3.75
AM-FM-TV Alignment	$4.60
Transistor TV Training Course	$4.60
Transistor Radio Servicing Made Easy	$4.05
How to Read Schematic Diagrams	$4.05
Troubleshooting with the Oscilloscope	$3.40
Radio Receiver Servicing	$5.20
Practical Transistor Servicing	$4.60
Auto Radio Servicing Made Easy	$4.60
Electronic Math Simplified	$5.70
Using Scopes in Transistor Circuits	$5.45
H-Fi Stereo Handbook	$6.50
Miniwatt Technical Data Valves picture tubes and semiconductors	$3.05
Audio Amplifier Design	$4.25
Transistors—How to Build all Transistor Equipment	$2.45

NEW TITLES

Understanding the Electronic Organ	$6.15
104 Easy Transistor Projects	$4.95
64 Hobby Projects	$4.95
Installing and Servicing Home and Audio Systems	$6.15
Transistor Ignition Systems Handbook	$3.85
49 Easy Entertainment and Science Projects	$4.05
F.E.T. Principles, Experiments and Projects	$6.80
Radio Handbook — Comprehensive Manual	$17.85
Computer Dictionary	$8.50
Workshop in Solid State	$11.05
Electronic Design Techniques—Comprehensive Manual	$17.45

INSTROL ELECTRONICS CENTRE

91a York St. (between King & Market St.)

PHONE 29-4258 SYDNEY N.S.W. 2000

for descriptive leaflet post coupon

Please include postage stamp.

- ☐ Playmaster
- ☐ Guitar amps and speakers
- ☐ Metalwork
- ☐ Test equip't
- ☐ Technical books

Name_ _ _ _ _ _ _ _ _ _ _ _ _ _

Address_ _ _ _ _ _ _ _ _ _ _ _ _

Postcode _ _ _

ELECTRONICS SERVICING: the other side of the story

There are many tough problems faced by those who work in this industry, and these are usually overlooked by their frequent critics.

by JAMIESON ROWE

Almost regularly the newspapers and popular magazines carry articles exposing alleged malpractice and profiteering in the servicing industry. Because of the large amount of complex electronic equipment in our modern technological society, it is virtually inevitable that many of the published cases involve this type of equipment, and therefore that the electronics servicing area of the industry receives a significant share of any criticism.

It cannot be denied, of course, that within the electronics servicing industry there are cheats and incompetents. After all, such people are found in just about every sphere of human activity. Fortunately, they represent a very small minority in most spheres, and this is certainly the case in electronics servicing. The vast majority of servicemen and servicing companies are highly competent, hard working, and honest. As such they are often acutely embarrassed by the activities of the minority, whether publicised or not.

No doubt these facts are of little comfort to the owner of a TV set, tape recorder or radio, if he has been grossly overcharged for a minor service job. Similarly they will possess a grim irony for the owner of an expensive stereo system who finds that his equipment has been badly damaged by the makeshift "dummying" of an incompetent technician. In such situations it is understandable that the unfortunate victim tends to regard the entire servicing industry as one populated by sharks and double-dealers, and that subsequently he approaches service companies and personnel only if and when this is unavoidable.

If they are unable to obtain satisfactory compensation by appeal to conscience or the law, it is only natural that the victims should seek to gain publicity. They stand to gain public sympathy, at least, and there's always the chance that the individual or company concerned may belatedly find a conscience when their activities are displayed for public censure.

The popular press has every right to publish stories exposing malpractices, of course, for clearly this is in the public interest. Besides which, it makes a good story . . .

Unfortunately, the activities of the honest and competent majority of servicing personnel, like those of the vast majority of decent citizens, do not make particularly "good" stories. Rightly or wrongly, the activities of this majority are usually not thought relevant in articles exposing malpractice, nor are they deemed important enough or sufficiently interesting to justify articles in their own right.

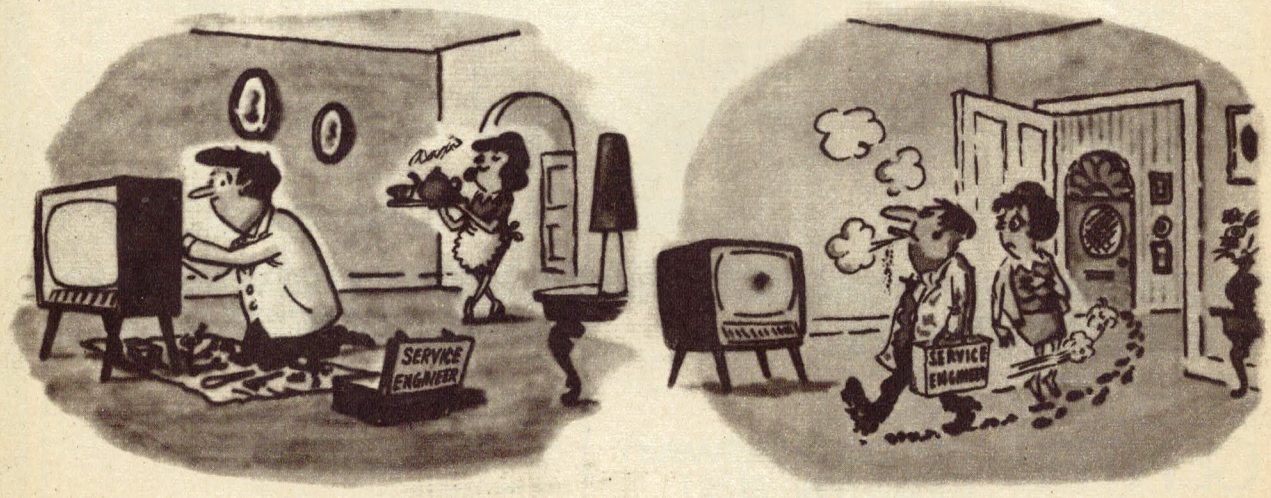
As a result, the image of the electronics servicing industry which one gains from the popular press tends to be a rather unbalanced one, just as the same source of information might well lead a visitor from another planet to deduce that most human beings were either criminals, wealthy eccentrics or scantily-clad photographic models.

It is unfortunate that the public thus tends to gain a distorted picture of electronics servicing, for the distortion is unfair both to the majority of people within the industry, and to the industry itself. For those within the honest, competent majority of the people in the industry, the image is particularly unjust, because electronics servicing is an occupation which requires a great deal of specialised technical knowledge and experience. Without a doubt, the competent electronics service technician is a highly skilled member of society.

As the name itself suggests, the electronics servicing industry does in fact render the community an essential service. This service is already very important, and it is likely that it will grow increasingly in importance as our society assimilates more and more technology. With the exception of simple low cost equipment such as the "personal portable" radio receiver, it is unlikely that even domestic electronic equipment will attain in the foreseeable future – if ever – the reliability/cost ratio which would be necessary for the wholesale adoption of a "throw it away when it fails" philosophy. So that electronics servicing is likely to be an important and essential community service for a long time to come.

For the industry to have a distorted image in the public eye is not only unfair and unrealistic, but ultimately against the public interest. Inevitably, it must result in a weakening of the ability of the industry to attract and retain competent and self-respecting personnel. And when this happens, the community must surely suffer in terms of inadequate and ineffective servicing.

It is with the idea of counter-acting the unbalanced image of electronics servicing that this article is written. In the remainder of the space available, the author will attempt to explain some of the problems which concern the electronics service company and technician, in the hope that this may provide much needed insight into



In a very real sense the field technician is an ambassador for his company. Happily few can be said to conform to the picture on the right, but finding good personnel can be quite a problem. (Cartoons reproduced by courtesy Mullard-Australia Pty Ltd.)

the "facts of life" in this important industry.

The problems which confront the electronics service company and the individual technician are many and varied. Some may be seen to stem directly from the nature of electronics servicing itself, and as such may have no complete solution. Other problems are more incidental in nature, although often no less important, arising from such matters as equipment design limitations or the difficulty of obtaining suitable personnel. Still other problems are those which arise in any commercial enterprise which involves direct dealing with the public.

One of the problems inherent in electronics servicing as a business and livelihood – admittedly not peculiar to it alone, but serious nonetheless – is that it involves both a relatively high initial outlay, and a high working overhead. To set up even a small service company generally involves many thousands of dollars, for purchase of vehicles, acquisition of even a modest stock of replacement parts, purchase of tools and test equipment, purchase or leasing of workshop premises, and vehicle and workshop fitting out.

Once in operation, the overhead costs become apparent. The vehicles used for field service must be maintained and insured, and either garaged on company premises or driven home at night and weekends by the field technicians – with the inevitable increase in vehicle operating costs due to private use.

Field servicing itself involves considerable overhead, because the technician man-hours, fuel and vehicle wear and tear spent in travelling from job to job, although unavoidable, do not directly contribute to income. And this can be a very serious problem in a sprawling metropolitan area such as that of Sydney, where sheer distance between jobs and traffic congestion make it quite common for a technician to spend up to *twice* as much time in travelling as he spends on the jobs themselves.

One way to reduce the proportion of time spent in travelling is to instal two-way radio facilities. This allows the remote co-ordination of technicians from the base workshop, and permits job-swapping and similar techniques to increase overall efficiency. But unfortunately the advantages of two-way radio are at least partially nullified by the further and quite significant capital outlay involved. Further contributions to overhead are also introduced, in the form of licence fees and maintenance costs.

Another problem inherent in electronics servicing is one which it shares with other servicing and repair industries: that of reconciling disproportionate job time requirements with fair and realistic customer charging.

Consider an example. Customer A, who requests service for his faulty stereo system, lives on the other side of town some 15 miles from the workshop. After more than an hour spent driving out, the technician easily finds and repairs a minor fault in 10 minutes. He then spends another hour travelling to the next job. Contrast this with the situation involving customer B, who lives only a block away. Tracking down an obscure fault in customer B's 3-in-1 TV set may take more than an hour, although travelling to the job involves only a few minutes each way. Costing the parts used for each job is simple and straightforward, but how does one charge each customer equitably for time and labour?

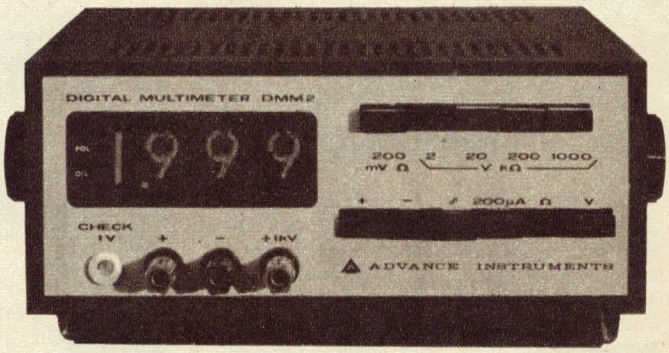
This type of problem can become particularly difficult when equipment is taken back to the workshop for intensive

Another

ADVANCE

in Instrumentation

DMM 2 digital m/meter



- LOW PRICE
- 17 ranges for measurement of AC & DC voltage, current & resistance
- Maximum stability
- LSI reliability

DC ranges

Range	Accuracy (at 25±1°C) ± % rdg.	± % FS	Input Impedance
200.0mV	0.1	0.15	10MΩ
2.000V	0.1	0.1	10MΩ
20.00V	0.2	0.1	10MΩ
200.0V	0.2	0.1	10MΩ
1000V*	0.2	0.1	10MΩ
200μA	0.3	0.2	1kΩ

*Using 1kV terminal. Normal input terminal may be used up to 500V.

AC ranges

Range	Accuracy (at 25±1°C) ± % rdg.	± % FS	Freq. Range	Input Impedance (typical)
200.0mV	0.3	0.15	40Hz-20kHz	1MΩ/150pF
2.000V	0.4	0.2	40Hz-20kHz	1MΩ/110pF
20.00V	0.4	0.2	40Hz-20kHz	1MΩ/110pF
200.0V	0.4	0.2	40Hz-10kHz	1MΩ/110pF
1000V*	0.4	0.2	40Hz-2kHz	10MΩ/40pF
200.0μA	0.5	0.5	40Hz-10kHz	1kΩ

*Using 1kV terminal.

Resistance ranges

Range	Accuracy (at 25±1°C) ± % rdg.	± % FS
200.0Ω	0.4	0.15
2.000kΩ	0.3	0.15
20.00kΩ	0.3	0.15
200.0kΩ	0.3	0.15
2000kΩ	0.3	0.15

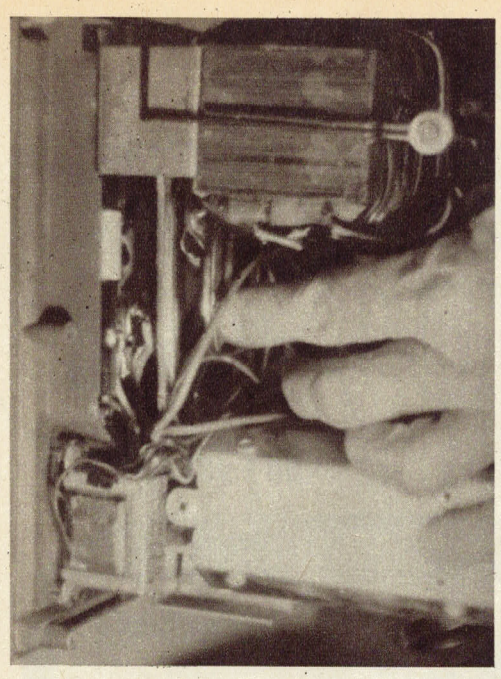
Open circuit voltage on resistance ranges 11 volts.

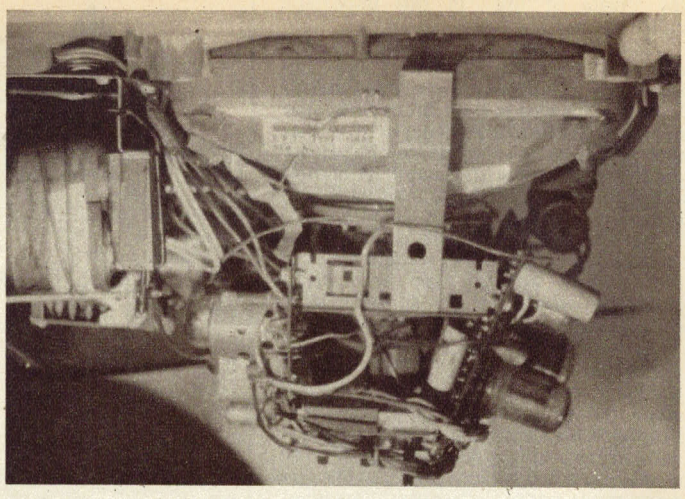
Distributed by:

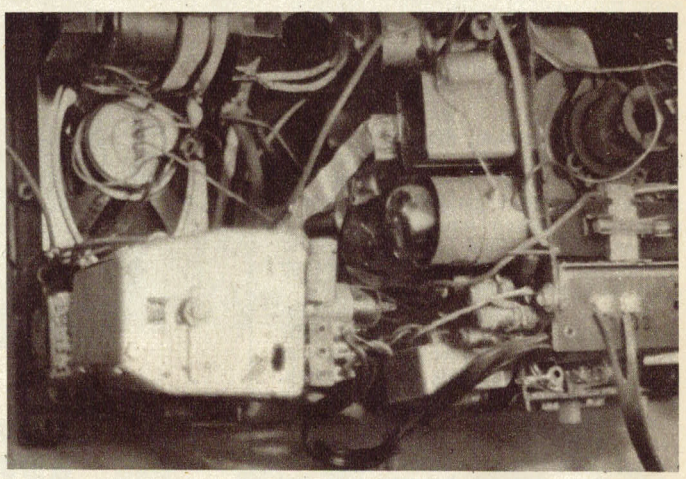
JACOBY MITCHELL

SYDNEY	26 2651	BRISBANE	2 6467
MELBOURNE	30 2491	PERTH	28 8102
ADELAIDE	53 6117	LAUNCESTON	2 5322

JM/41-70







Some manufacturers apparently direct little attention towards making their products either reliable or serviceable, as this example shows. Note the mounting of major controls beneath the speaker, which is itself partly beneath the power transformer. Also the flimsy support provided for the wiring boards.

servicing. A second example should show why.

Two TV sets are brought in. One has a fairly serious fault: a shorted yoke, burnt-out flyback transformer, damaged width coil and a few valves and minor components. But although a number of rather expensive replacement parts are involved, the repairs take less than an hour because of the ease of diagnosis and the good mechanical layout of the set. On the other hand, the second set turns out to have an obscure fault in the AGC circuitry. To make matters worse, the design of the set is such that servicing is difficult, and not only this but the model concerned has only been recently released and neither servicing information nor a circuit diagram is available. As a result this receiver requires some five and a half hours to find the fault, although only one faulty capacitor is involved – worth 30 cents at most.

Strictly, perhaps, one should charge the second customer for the full five and a half hours involved in servicing his set, while the owner of the first set should pay for only an hour. But is this really fair? Should the second customer be effectively penalised because of the poor serviceability of his set, and for the lack of servicing information, while the first customer gains an advantage purely because his fault happened to be easier to find? The answer is not entirely clear.

The temptation is for the service company or technician to adopt a "Robin Hood" attitude, subtracting from the time charged for "tough" jobs and adding to that charged for "easy" jobs, in an effort to equalise the situation. Unfortunately while this may be workable in theory, it is not entirely satisfactory in practice.

In an effort to maintain customer goodwill, and often out of sheer compassion (for example, where elderly pensioners are involved), the tendency in practice is to err in the customer's favour, either consciously or unconsciously. The time added to "easy" jobs tends to be significantly less, in the long run, than that deducted from "tough" jobs. The nett effect is thus one of consistent under-charging for time and labour. The Robin Hood Service Company tends to find eventually that it acquires a lot of happy customers, but a very unhappy bank manager.

Inevitably, the job time/customer charging problem tends to add to overhead, and by a rather unpredictable amount. About all that can be done to alleviate the problem is to make sure that overall efficiency is made as high as possible, so that travelling time and the time spent on "tough" jobs is minimised. This involves careful planning and co-ordination of field technicians, and the provision in the workshop of such things as a full complement of test equipment and servicing aids, and a really comprehensive collection of up-to-date servicing information. It is also clearly desirable that the workshop technicians, in particular, be at the highest level of competence.

Some of the problems of electronics servicing are more or less inherent in the work involved, then, and as such can only be borne stoically after all efforts have been made to maximise efficiency. But other problems seem more incidental in nature, and in theory at least should be capable of solution.

Lack of adequate and appropriate co-operation from the equipment manufacturer is one such problem. This is not often a problem with specialised and professional equipment, but is frequently encountered with radio and TV receivers, stereograms, tape recorders and other consumer appliances. All too often the designers and manufacturers of these products seem to relegate servicing considerations to the lowest possible priority level.

There are two aspects to the problem. One concerns the design of the equipment itself, with respect to serviceability.

It is undeniable, surely, that serviceability is an essential part of all good engineering design. This applies just as much to the design of electronic equipment as to any other. A well-engineered piece of equipment provides not only the highest attainable performance to cost ratio and reliability, but also permits internal faults and malfunctions to be diagnosed and remedied with a minimum of time and inconvenience.

The only conceivable situation in which this would not be so is the purely hypothetical one, wherein all components used to make the equipment were perfect, and subject neither to failure nor ageing.

A design which does not permit rapid and convenient servicing is thus nothing other than a bad design. And unfortunately, it is a fact that a significant number of domestic electronic equipment designs fall into this category.

In some cases mechanical layout is such that even a cursory inspection of the equipment for initial fault diagnosis is not possible without removal of major components or sub-assemblies. It is not uncommon for TV receivers to be designed in such a way that the complete chassis must be removed from the cabinet – in some cases, this operation itself takes more than half an hour – before anything other than the most rudimentary checks can be performed. In some designs even important fuses are buried deep in the bowels of the equipment, and require a major operation even for their location.

The writer himself has seen many such

examples of poor design, particularly among domestic TV receivers. In one noteworthy example the three most important user controls apart from the channel selector are all mounted within the loudspeaker cone, while the speaker itself is mounted almost underneath the power transformer. Two of the controls are carbon potentiometers, while the third is the power switch, thus all three require relatively frequent attention. Yet access to the controls can only be gained by removing the loudspeaker, which itself can only be removed by first removing the power transformer!

In the same receiver it is very difficult, if not impossible, to remove or replace the tuner valves without removal of the complete tuner. The design is also quite remarkable for the method of mounting the main circuit boards to the plastic escutcheon-cum-"chassis." This involves only a single self-tapping screw at the bottom, and two small plastic spigots at the top. As the set is a portable, the almost inevitable result is that the complete board assembly becomes adrift inside the case. Pictures of a sample of this design are shown.

From time to time it has been argued that where domestic electronic equipment is concerned, it is not possible to achieve really good serviceability at a competitive price. Yet this argument is soundly disproved by the really outstanding designs which have been produced. Pictured is a recent solid state portable TV by AWA Ltd, which is a particularly good example of what can in fact be achieved.

Unfortunately only a minority of manufacturers appear to strive consistently towards making their equipment serviceable. The result is that the job of the service company and technician is often made very much harder than it need be.

This problem is accentuated by the second aspect of the overall manufacturer co-operation problem, which concerns the supply of adequate servicing information, specialised servicing aids and replacement parts. Unfortunately this situation also leaves a lot to be desired.

It is true that probably a majority of major manufacturers supply adequate servicing information for their products. Nevertheless there are a significant number of manufacturers, again particularly in the domestic equipment field, who either do not supply adequate information, or who supply it only belatedly and after repeated requests. In some cases only a circuit diagram is given, often badly drawn and significantly out-dated as a result of last minute design changes. Frequently there is little if any guide to the important waveforms and supply voltages to be expected in normal operation, or to the correct adjustment procedure for pre-set controls.

Surprisingly, some manufacturers even charge the service company for the circuit diagrams and service information relevant to their products, thereby making a profit out of discharging their own responsibilities. The fee charged can be as high as 60 cents, and it is not uncommon for this information to be available only at the manufacturer's service department, for over-counter sale.

Quite recently, some major TV receiver manufacturers have adopted a practice of supplying only the circuit diagram. To further save costs, these are not sent to established service companies and technicians as formerly, but instead one copy is slipped into each receiver. Understandably, this almost forces the prudent technician to remove the circuit diagram from the first set he encounters, to ensure that he will have a diagram to assist

Snap in!







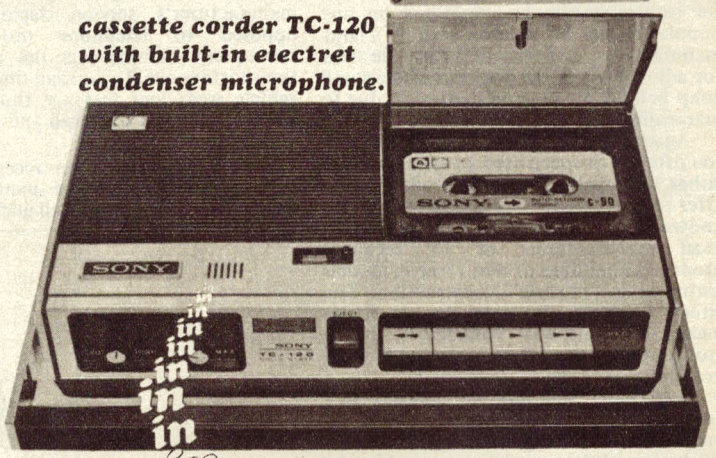
SONY Tape Cassettes offer high fidelity recording combined with handy portability — in a variety of precision made standard sizes for every application. Whatever make, you'll get magnificent performance in recording and reproduction from your cassette tape recorder or deck with the outstanding features of SONY tapes: Auto-Sensor foil at the end of the tape for tape-end alarm, stable smooth tape transport, trouble-free performance, durability that stands up under repeated use.

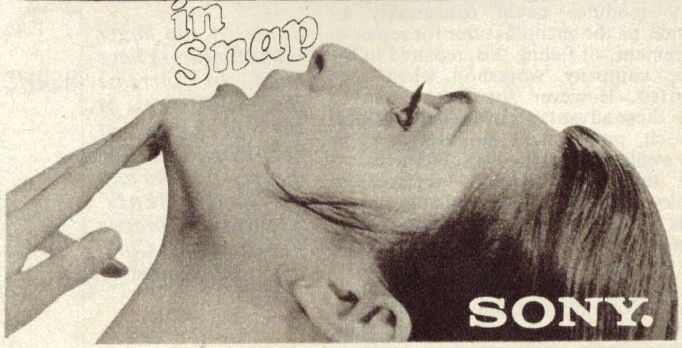
C-120. Plays 2 full hours on both sides. Extremely thin reinforced polyester base is free from deformity and high in tensile strength.

C-90, C-60. Standard tape cassette with strong polyester base. Reliable trouble-free performance. C-60 holds 1 full hour of recording and C-90 1½ hours.



cassette corder TC-120 with built-in electret condenser microphone.





Distributed by:

JACOBY MITCHELL

Sydney	26 2651
Melbourne	30 2491
Adelaide	53 6117
Brisbane	2 6467
Perth	28 8102
Launceston	2 5322

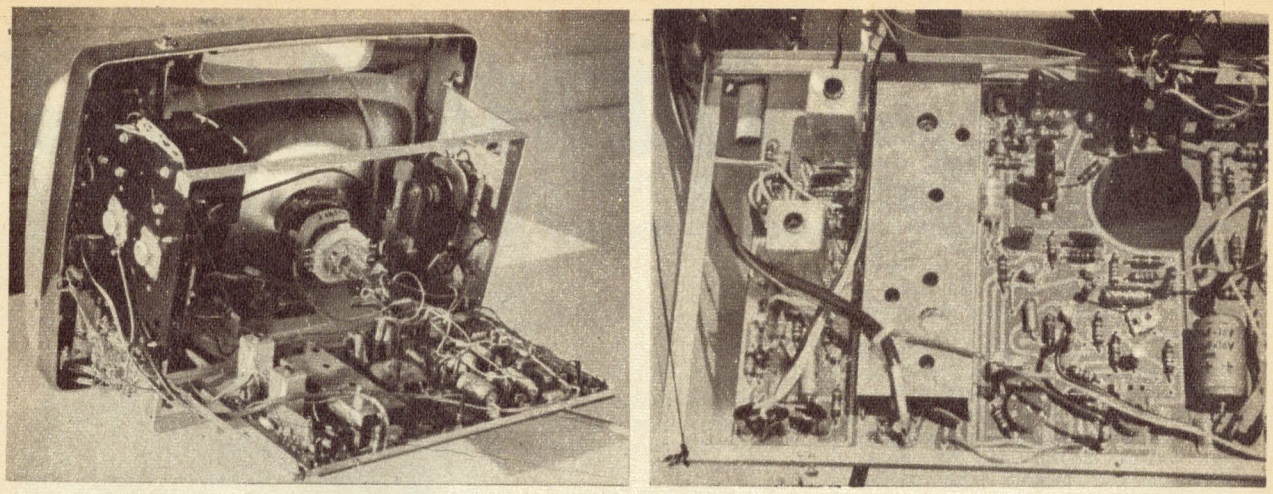
Jacoby, Mitchell Ltd., 469 Kent St., Sydney. N.S.W. 2000.

Please send details of SONY Tape Cassettes

NAME .....

ADDRESS .....

POSTCODE .....



A competitive product can still be fully serviceable, as shown by this solid state portable TV recently released by AWA. Note the straightforward construction, excellent access to all components and clear marking of printed wiring boards. (Courtesy Amalgamated Wireless (Aust) Ltd.)

with further calls on similar sets. The result is that the diagram has often disappeared when such a receiver is encountered, making service particularly difficult if the technician concerned is either scrupulously honest or simply unlucky enough to have never found a circuit previously.

Specialised servicing aids are often required for efficient servicing, and in some cases are virtually essential for such operations as TV receiver IF alignment. In some cases, special aids are required even for ostensibly simple operations: in one popular model TV receiver sold by a large manufacturer, a special tool must be used for adjustment of the position of the small lamp behind the channel indicator, due to inaccessibility.

Again, the unfortunate fact is that all too often such specialised servicing aids are either unavailable, or made available only after repeated requests. In one recent case known to the author, one of the largest local manufacturers of TV receivers produced a number of new receiver models featuring a "module" construction. The circuit modules plug into the chassis by means of multi-way connectors, and a group of modules are so mounted in close proximity.

Potentially the module concept is a good one, allowing rapid field servicing by means of an "exchange module" technique. Faulty modules could conceivably be returned to the manufacturer for repair or replacement, or failing this, repaired in the service company workshop when time permitted. However for the system to realise these advantages over a conventional approach, replacement modules must be freely available from the manufacturer.

In this case, however, replacement modules were not in fact available even as late as eight months after the models were released. Inquiries at that time brought forth the reply that no prediction could be made as to when modules would be made available. Not only this, but it also appeared that the manufacturer had made no plans for the supply of "extender" leads to facilitate testing of the modules whilst in operation. It was only after repeated requests that one of the established service companies was able to obtain the special "dummy" modules necessary to perform IF alignment.

Even with equipment using conventional construction, there are often problems in obtaining replacement parts. It is not uncommon for some manufacturers to stop supplying many of the replacement parts for a particular model, some seven to eight years after release. With a TV receiver some 12 years old, it is not uncommon to find that exact replacements for many essential components are no longer available except by salvage from junked receivers.

A further problem is that due to the frequent difficulty of adequately identifying replacement parts, it is often necessary to obtain parts by direct over-counter purchase at the manufacturer's service department, as opposed to telephone ordering and subsequent delivery via the mails or a transport service. Technician time, fuel, and vehicle wear and tear are thus involved, adding further to overhead and to servicing delays.

This problem is often accentuated by desultory service at the manufacturer's service depot. It is not at all uncommon, so the writer has learned, for a technician to spend at least 30 minutes at a service depot waiting to obtain a single replacement part. In the case of some depots, waiting times of 45 minutes are not unknown. One depot is even fitted with comfortable armchairs and a TV receiver, apparently to make the technician comfortable while time ticks slowly by.

Service information and replacement parts pose special problems with a lot of imported equipment, of course, and this is a related problem. Some years ago it was a relatively minor problem, but more recently it has become quite significant due to the large influx of equipment from Japan, Hong Kong and other countries.

Some have argued that the customer who purchases little-known imported equipment from unknown sources, and the traveller who brings back from overseas tape recorders, TV receivers and radios



HERE'S YOUR ANSWER, MR. AND MRS. SETOWNER!

999 times out of a thousand, when this happens . . . *don't blame your service technician!*

The repair to your television receiver made several days ago or even several months ago probably had no relation to the new trouble that developed today.

Actually, there are more than 300 electrical parts in even a small table model television receiver. Trouble in any one of them might cause the picture or sound to disappear or to be received poorly.

Take your automobile for instance. Tuning up the motor today is no guarantee against a tire blowout tomorrow!

Such a thing is easier to understand because most of us are more familiar with automobiles than with today's highly complicated TV and radio sets. But such unconnected troubles occur in TV and radio nevertheless—and because they are so hard to explain in non-technical terms, it is always embarrassing to your service technician when they do.

His continued business existence is based on gaining the full confidence of you and other set owners like you. He isn't in business to "gyp" you or to overcharge you. His success is based on doing each and every job to the level best of his ability, at a fair price for his skilled labor. It's only when you patronize the shops that feature "bargains" at ridiculously low prices that you need worry. Good radio and TV service can't be bought on the bargain counter! Set owners who recognize this aren't likely to get "gypped."

THIS MESSAGE WAS PREPARED BY SPRAGUE PRODUCTS COMPANY,
DISTRIBUTORS' SUPPLY SUBSIDIARY OF SPRAGUE ELECTRIC COMPANY, NORTH ADAMS, MASSACHUSETTS, FOR . . .

YOUR INDEPENDENT TV-RADIO SERVICE DEALER

Some of the larger manufacturers have tried to increase public awareness of the problems of servicing, using display posters and advertisements. (Courtesy Sprague Products Company, PF Reporter.)

should expect service problems, and have only themselves to blame when faced with high repair bills and long delays due to problems of part replacement. This may be so in theory, but in practice it is the service company who are faced with the difficult job of repairing strange and at times very shoddy equipment, and usually without even the benefit of a circuit diagram. And invariably it is the service company who is blamed when the repair bill is unavoidably large.

A number of the "incidental" problems facing the electronics servicing industry may thus be seen to stem broadly from a lack of co-operation, whether intended or not, from the equipment manufacturer. But these are by no means the only such problems. Another major problem area for the service company is that concerning the procurement of suitable technical staff.

As in many other technical fields, the electronics servicing industry has been suffering for some years from a severe shortage of trained technicians. No doubt this is due in part to the extremely rapid growth in technology; however it also seems due in no small degree to inadequate provision of suitable training institutions. There are simply not enough people receiving the appropriate technical training.

The problem seems to be particularly acute in the electronics servicing industry, where few companies are large enough to be in a position to run their own training programs. In general, most electronics service technicians must come from technical colleges, of which there are in Australia only a modest number. And few of these colleges actually run courses which are specifically orientated towards electronics servicing; most are concerned almost solely with producing what might be called "design technicians."

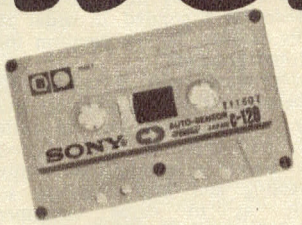
The nett result is that well-trained and capable service technicians are in painfully short supply, a fact which is made all the more unfortunate by the many changes taking place in the nature and scope of electronics. Developments such as television, stereo hi-fi, transistors, cassette recorders, videotape, printed wiring boards and integrated circuits have all taken place in recent years, and new developments such as colour TV and FM broadcasting are likely to appear in the near future. In a field changing and expanding so rapidly, the shortage of trained technicians is surely a very serious matter.

The electronics service company thus has a problem in finding suitable technicians. And in the "seller's market" created by the shortage, even mediocre technicians are able to demand a relatively high salary. Not surprisingly, poaching from other companies is common, so that if a company is to retain its technicians once having found them, it must pay at higher than average rates, and must generally also supply additional benefits such as superannuation and participation in some sort of profit-sharing scheme.

As in any situation where trained people are in demand, there is the inevitable swarm of "would-be" technicians, or people with a smattering of technical knowledge who hopefully present themselves whenever jobs are advertised. And this raises a further question: how do you know the really capable technician when you have found him? An interview and a few days at the workshop bench are capable of wheedling out the complete impostors, to be sure, but in many cases the only way to find out whether or not a man is really capable is to send him out into the field.

Unfortunately in the period required to determine a technician's true value, a lot of damage can be done if the man is really only a "valve jockey" or incompetent tinkerer.

Flick on



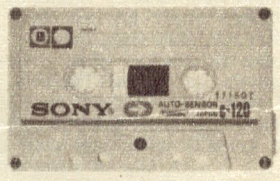
SONY Tape Cassettes offer high fidelity recording combined with handy portability—in a variety of precision made standard sizes for every application. Whatever make, you'll get magnificent performance in recording and reproduction from your cassette tape recorder or deck with the outstanding features of SONY tapes: Auto-Sensor foil at the end of the tape for tape-end alarm, stable smooth tape transport, trouble-free performance, durability that stands up under repeated use.

C-120. Plays 2 full hours on both sides. Extremely thin reinforced polyester base is free from deformity and high in tensile strength.

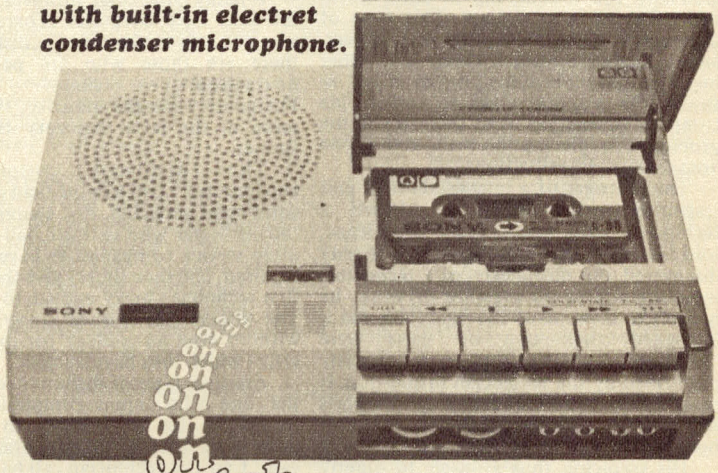
C-90, C-60. Standard tape cassette with strong polyester base. Reliable trouble-free performance. C-60 holds 1 full hour of recording and C-90 1½ hours.







cassette corder TC-80 with built-in electret condenser microphone.





Distributed by:

JACOBY MITCHELL

Sydney	26 2651
Melbourne	30 2491
Adelaide	53 6117
Brisbane	2 6467
Perth	28 8102
Launceston	2 5322

Jacoby, Mitchell Ltd., 469 Kent St., Sydney. N.S.W. 2000.

Please send details of SONY Tape Cassettes

NAME .....

ADDRESS .....

POSTCODE .....

Most companies feel bound to keep a man on trial for two weeks, out of fairness, but even in that time a bad technician can leave a large number of unhappy customers, together with an equal amount of improperly-repaired equipment. A considerable amount of time and labour may need to be expended in order to remedy this damage, not to mention the loss in customer goodwill.

Further problems with technical staff concern neatness, cleanliness, courtesy and personality. A technician may be quite competent, but after an initial "good impression" period he may become sloppy in his dressing and begin washing so infrequently as to cause customer complaints. He may perhaps begin smoking an extremely smelly pipe, or develop habits of tracking mud over customers' carpets. He may even burn holes in the carpet with his soldering iron, or perhaps kick the customer's prize Bassett hound out of sheer malice. Or he may begin abusing every customer at the least opportunity.

Happily, not many technicians behave in this way; the great majority are very conscious of the important job they perform, and strive to maintain a high standard of behaviour. However the few who do choose to take advantage of the situation can cause a company considerable embarrassment. In many cases companies are forced to retain such an employee for many months, simply because they are unable to find a suitable replacement.

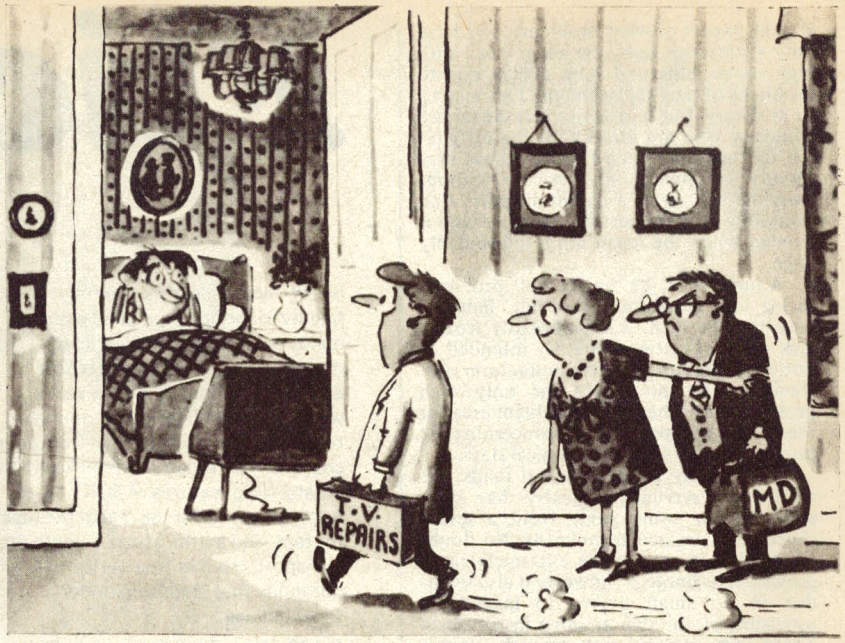
Employee dishonesty, when it occurs presents similar problems. There is the occasional technician who will frequently claim to have used more parts for repairs than were actually used, and may thus gradually rob a company of parts worth many hundreds of dollars. This type of dishonesty can be very difficult to detect, and although customer-check and other methods have been used in an effort to thwart the practice, these do not provide complete protection. And there is still the problem of replacing the man, even if one does discover this situation.

The manager of a long-established and respected service company, himself a technician with many years experience, told the writer that on one occasion he only discovered the dishonesty of a technician by chance. Due to pressure of work, he himself took some of the field jobs, and it happened that two of these were "call-backs" arising from work recently performed by the technician in question. It soon struck him that many of the parts listed on the job record cards had not in fact been fitted.

His suspicion thus aroused, he quietly checked on other jobs, and it became obvious that the technician was methodically acquiring for himself an appreciable number of parts. In effect, he was systematically robbing both the company and its customers, because maintenance contract jobs were involved as well as normal service work.

Unfortunately it took months before a suitably competent replacement technician could be found. During that time the company was forced to retain the dishonest man, for the simple reason that without a competent replacement, they would suffer an even greater loss than was due to his dishonesty.

But the electronics servicing industry has yet another source of "incidental" problems: the customer. Or more accurately, that group of customers who, for one reason or another, cannot be approached by the service company or technician in the normal manner appropriate for any honest commercial enterprise. Happily, these are again very much in the minority; but nevertheless they provide a source of problems which often far outweighs their modest numbers.



A slightly over-exaggerated view of the importance of electronics servicing, no doubt. Yet servicing is a highly skilled occupation and merits the appropriate level of importance. The cartoon, like those reproduced earlier, is from a Mullard poster intended to assist servicing personnel in presenting the most favourable public image. (Courtesy Mullard-Australia Pty Ltd.)

Broadly speaking, problem customers fall into two categories. There are those who can only be described as dishonest, and there are those who are perhaps best described as simply "difficult." Fortunately for the industry, there are far more in the latter category than in the former.

The dishonest customers are encountered mainly in the field of domestic equipment servicing. For example there is the customer who will call half-a-dozen or more service companies to have his TV set repaired, and then simply give the job to the first technician lucky enough to arrive first. The others are turned away, generally without even an apology for the time and effort which they have wasted.

Another type of dishonest customer is the one who, upon completion of the repairs to his set, claims to have just discovered that he is temporarily out of cash. Can the technician call back in a day or two? The catch is that when the technician does call back, he receives only a categorical denial that the service was ever performed.

Again, there is the customer who carefully watches while the technician finds the trouble in his equipment, and finding that the cause is relatively simple – perhaps a valve – then claims he cannot pay for the repair. The technician thus has no alternative but to restore the job to the condition in which he found it, and depart. The customer then pays a visit to another radio store, buys the required valve or other part, and fixes the trouble himself; thereby avoiding any payment for the technician's time and skill.

Despite the financial loss which is caused by dishonest customers, the small number of these people probably make them less of an overall problem than those in the "difficult" category. This is because the latter are relatively more numerous.

Who are the "difficult" customers? In general, they are the people who are either unwilling or unable to understand and appreciate the true realities of electronic servicing. They include the people who cannot accept that the electronics service technician is a skilled worker, and who, because he depends upon servicing for his livelihood, is entitled to expect a fair payment.

They also include the people who, after specifically requesting that the service technician repair only a certain fault in an elderly TV receiver, then complain that he has not restored the entire set to "as new" condition. Also the people who expect the service company to guarantee not only the parts used and the responsibility involved in making the actual repair, but in fact the complete equipment. And the people who have one fault repaired successfully, but then complain bitterly if the equipment develops an unrelated fault shortly after.

It is probably true that many of the problems associated with "difficult" customers are due to a lack of communication. There is perhaps too little done to acquaint the general public with the broad facts about the nature of electronic equipment, and about the practical limitations of servicing.

But is the problem solely one of faulty communication? Surely not. No one expects a complete guarantee against all illness when they visit the doctor to be treated for a sprained foot, nor does one hold the doctor responsible if one suffers a coronary a few weeks after being cured of pneumonia. Similarly no one tries to blame the motor mechanic if the differential of one's car breaks down a month after he has repaired the generator.

Yet the situation in electronics servicing is exactly parallel. A TV receiver or other piece of electronic equipment, like the human body and the automobile, is an extremely complex mechanism. It too contains a great many different parts, each of which tends to be subject to malfunction and to a deterioration with use and the passage of time.

Like the automobile, a piece of electronic equipment could only be restored to new condition by complete

replacement of every part. And clearly this would be a most uneconomical procedure, so that the only practical way to obtain a piece of equipment in truly "as new" condition is obvious: buy a new one. All that servicing can ever do is seek to extend the functional life of the equipment as long as possible, in the most economical fashion.

To extend the comparison with medicine and automotive repair a little further, the electronics service technician is no more capable of clairvoyance than the doctor or motor mechanic. Like them, he cannot predict what faults may develop in the equipment after he has effected a repair. The situation is simply too complex to permit even a vague speculation based on experience. All that the technician can do, when he is appropriately authorised, is repair whatever faults he can find in evidence, to the best of his ability and in good faith. The rest is simply a matter of chance, providence or whatever one may care to call it.

By this stage, the reader should surely need little persuasion that the electronics service company and technician do indeed have more than their fair share of problems. But although this article has unavoidably painted a rather bleak and negative picture of the situation, perhaps the insight given into the problems of the industry may itself contribute towards their alleviation. If nothing else, the reader himself may in future view his local service technician in a more understanding and sympathetic light! ■

TOOLS FOR ARCHEOLOGY

(Continued from page 27)

Ge-Li detector, is shown in figure 1, together with the same spectrum measured using a sodium-iodide crystal. The improved resolution of this more recent device is very evident, although its count rate is several times smaller than that of the older detector. Thus the method now possesses the advantages of sensitivity, selectivity and the possibility of non-destructive analysis. The last advantage is somewhat dubious, because many archeological samples are too large for existing irradiation facilities and, in any case, some of the induced radio-activity may persist for years so that the specimen may present an intolerable radiation hazard!

Extensive programs to investigate ancient ceramics, metals and other artifacts are going on. For instance, examination of artifacts excavated from the site of manufacture is likely to lead to a particular element distribution peculiar to that site. Hence similar objects found on sites may be traced back to their place of origin and much valuable evidence on site dates and trade routes inferred. Studies of this type have already been undertaken, with some success, by scientists using conventional spectroscopy; the new techniques should extend the work.

It may be concluded that modern archeological measurements have become highly specialised; almost any progress made in techniques of physical survey and analysis is followed by progress in archeology. ■

Pop up!

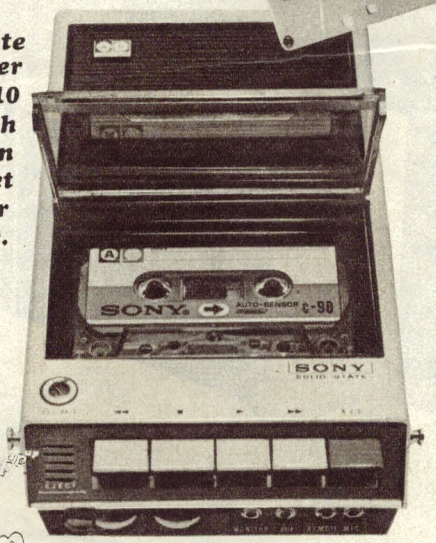


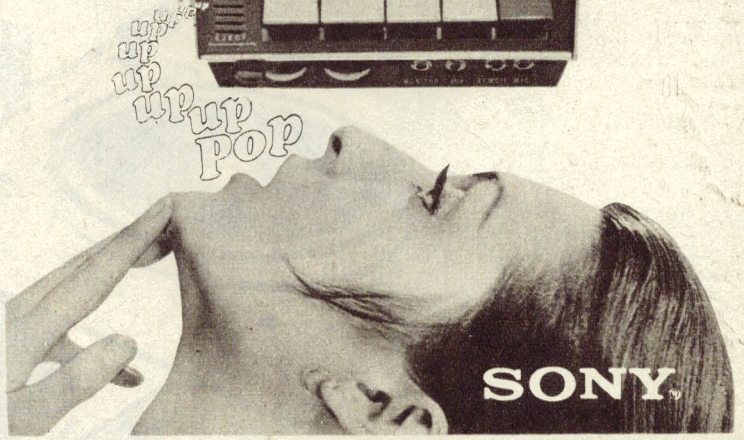
SONY Tape Cassettes offer high fidelity recording combined with handy portability—in a variety of precision made standard sizes for every application. Whatever make, you'll get magnificent performance in recording and reproduction from your cassette tape recorder or deck with the outstanding features of SONY tapes: Auto-Sensor foil at the end of the tape for tape-end alarm, stable smooth tape transport, trouble-free performance, durability that stands up under repeated use.

C-120. Plays 2 full hours on both sides. Extremely thin reinforced polyester base is free from deformity and high in tensile strength.

C-90, C-60. Standard tape cassette with strong polyester base. Reliable trouble-free performance. C-60 holds 1 full hour of recording and C-90 1½ hours.

cassette corder TC-110 with built-in electret condenser microphone.





Distributed by:

JACOBY MITCHELL

Sydney	26 2651
Melbourne	30 2491
Adelaide	53 6117
Brisbane	2 6467
Perth	28 8102
Launceston	2 5322

Jacoby, Mitchell Ltd., 469 Kent St., Sydney. N.S.W. 2000.

Please send details of SONY Tape Cassettes

NAME

ADDRESS

POSTCODE

Now in Australia:



PHILIPS

Philips Hi-Fi.

Philips introduce their Hi-Fi to Australia. Bringing together the finest total range of compatible stereo audio equipment which will enthuse the most eager hi-fi amateur or satisfy the most dedicated professional.

Each individual unit has been quality matched to integrate easily, perform faultlessly. Nothing has been spared to achieve the ultimate in sound reproduction and tasteful outward design. Designed and guaranteed by the world-wide organisation of Philips.

Where can you see and hear Philips Hi-Fi? Send the coupon below for our 40-page presentation booklet in full colour. Absolutely free. It includes complete specifications, plus price list and distributors.



To: Philips Industries Limited
69 Clarence St., Sydney 2000.

PHILIPS

Please rush me your Philips Hi-Fi full colour booklet immediately–without obligation.

Name.....

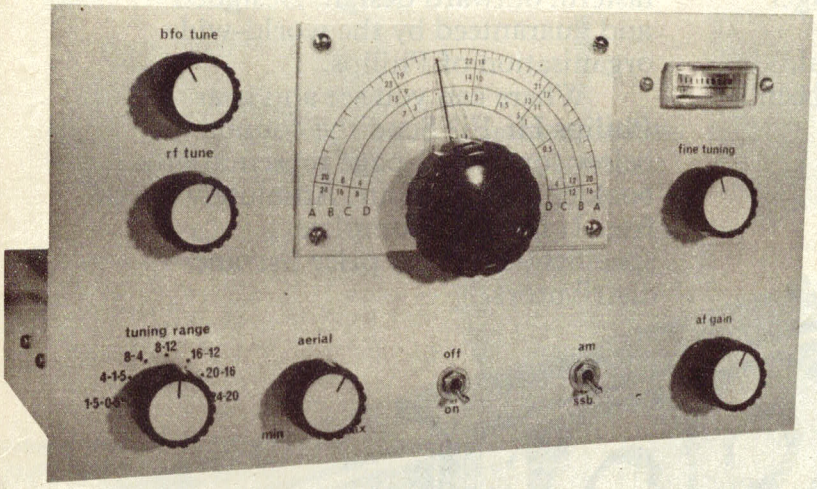
Address.....

City/Town.....State.....Postcode.....

38.1064

This new, not-too-complicated design provides for AM, SSB, CW reception

THE EA160 RECEIVER



By IAN POGSON

This receiver is a sequel to the EA110 Receiver, which we described last August. It features a ceramic BFO, amplified AGC with variable time-constants, S-meter, fine tuning and an RF stage. In all, we see this unit as appealing to the more serious short-wave listener, with an interest in SSB reception.

When we described the EA110 Receiver in August, 1970, we indicated that we intended to extend the facilities to make possible the reception of SSB and Morse Code. The addition of a BFO was a minimum requirement but, when reception of SSB is contemplated, other desirable features come to mind, including provision for fast and slow AGC decay, fine tuning, an S-meter and, possibly, an RF stage.

As we mentioned in the beginning of the article on the EA110 Receiver, the project was an outgrowth of the earlier and more ambitious EA240 Communications Receiver, which we described in January, February and March of this year. The idea behind the EA110 was to produce a modest receiver along similar lines but whereas the 110 version did not include facilities for SSB reception, this new one does. In other words, it is the result of scaling down the EA240 Communications Receiver and scaling up the much simpler EA110.

The EA240 incorporated an IF channel giving two orders of selectivity, suitably switched, and something less complicated was called for in this new receiver. By suitably sharpening what was the original "broad" response we found it possible to produce single, fixed characteristic which would meet the needs, quite well, of both AM and SSB reception. The simplification reduces the number of resonators required, eliminates the switching and simplifies alignment.

The original audio amplifier has been replaced with a much simpler unit, using a TAA300 IC on its own printed board. Although the available power output is less than from the previous arrangement, it is still adequate for the present purpose.

Closely associated with the audio amplifier is the detector. In this new receiver we have used a class B detector, which is easy to get going and which has the advantage of providing an appreciable amount of gain. This makes up for losses brought about by reduction in the number of stages in the front end, about which more will be said later.

No noise silencer has been provided, since it is considered too complex to be incorporated into a simple design. The mixer following the tunable IF is a junction FET, replacing the balanced mixer and amplifier which were used previously. A balanced mixer is not required here, as it was on the more elaborate receiver.

Perhaps the most radical changes have been made in the front end, and to a lesser extent, the tunable IF. We extended the range of the tunable IF in the interest of economy so that, instead of the previous 3 to 6MHz, we are now using 4 to 8MHz. By so doing, we are able to cover from the broadcast band to 24MHz in six ranges of equal width. Again, for reasons of economy, we have dropped the tunable IF amplifier stage but, as mentioned earlier, we have been able to make up substantially for the loss of gain in other parts of the circuit.

As you may recall, the front end of the EA240 Communications Receiver was crystal locked and, by a suitable selection of crystal frequencies, together with the tunable IF, we were able to get a wide frequency coverage with a minimum number of crystals. This worked out very well, but we felt that even the cost of a few crystals could not really be justified for an economy design. Accordingly, we decided to use a self-excited oscillator instead, switched to the various frequencies required. Inevitably, this must degrade the overall frequency stability but past experience suggested that the degradation would be well within tolerable limits and, happily, this proved to be the case.

Contrary to the usual practices, the higher frequency bands are covered with the oscillator set on the low side of the incoming signal. Thus, and by way of example, for the highest or 20 to 24MHz range, the first oscillator is at only 16MHz, instead of about 25MHz. The lower frequency tends to result in less oscillator drift, other things being equal.

For the first mixer, we have again substituted a junction FET for the balanced mixer of the earlier design, picking up a useful amount of gain in the process.

Additional gain has also been realised by the use of bipolar transistors in the IF amplifiers, in place of the junction FETs used previously.

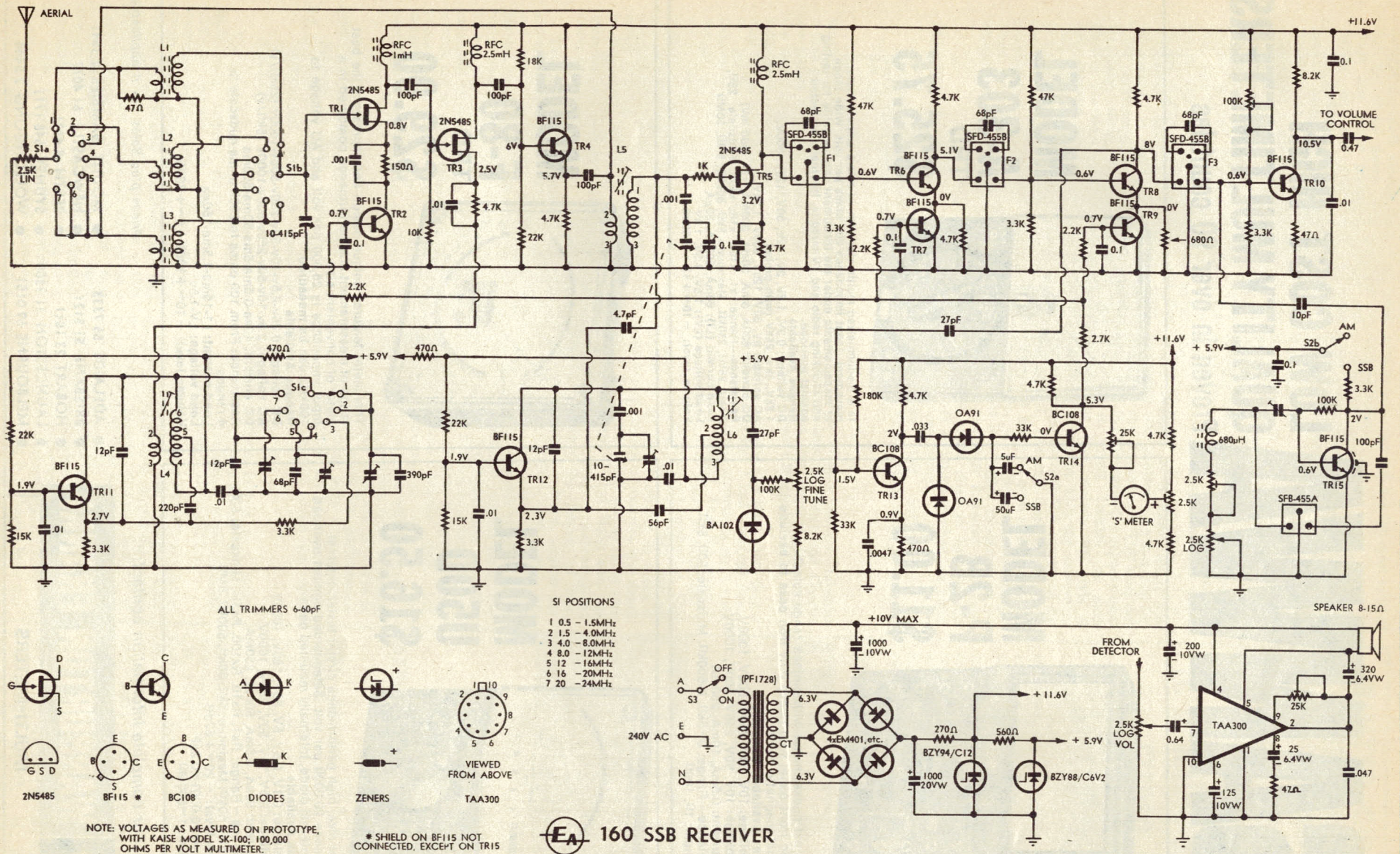
The method adopted for controlling the gain of amplifiers for AGC is similar to that used with success in our Playmaster 122 and 123 Program Sources. This involves introducing a transistor in the emitter circuit of each stage to be controlled, to give variable degeneration. As a method, it gives one of the best AGC characteristics obtainable. Admittedly, it involves the use of extra transistors, but they are modestly priced and we consider the addition well worth while.

The block diagram shows the basic format of the new receiver. The reader would be wise to study this before now turning ti the main circuit.

At the aerial input, we have an attenuator in the form of a potentiometer. Where necessary, a series capacitor may be included to further attenuate the lower frequencies, particularly the broadcast band, to reduce breakthrough interference.

Three aerial coils are used to cover the ranges 0.5-1.5MHz, 1.5-4MHz and 8-24MHz. This leaves a gap of 4-8MHz,

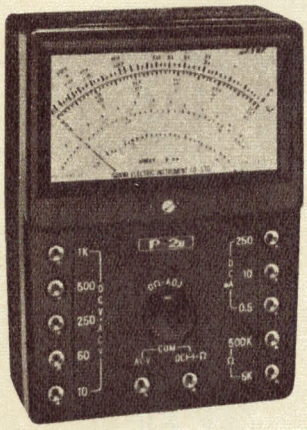
On the opposite page is the circuit diagram. Interesting features are the use of an audio amplifier IC and the use of ceramic resonators in the role of IF filters and a BFO.


AERIAL
L1
L2
L3
S1a
S1b
2.5K LIN
47Ω
10-415pF
RFC 1mH
RFC 2.5mH
2N5485
TR1
TR2
TR3
BF115
TR4
TR5
TR6
TR7
TR8
TR9
TR10
100pF
0.8V
150Ω
0.7V
10K
2.2K
18K
22K
4.7K
6V
5.7V
2.5V
3.2V
1K
68pF
SFD-455B
F1
F2
F3
47K
3.3K
5.1V
0.6V
0V
8V
680Ω
8.2K
100K
10.5V
TO VOLUME CONTROL
0.47
+11.6V
470Ω
+ 5.9V
S1c
L4
L5
L6
TR11
TR12
TR13
TR14
TR15
12pF
68pF
390pF
220pF
3.3K
15K
1.9V
2.7V
2.3V
10-415pF
56pF
27pF
4.7pF
10pF
2.7K
BA102
2.5K LOG FINE TUNE
OA91
BC108
180K
33K
5uF
50uF
AM
SSB
S2a
S2b
5.3V
2V
1.5V
0.9V
.0047
470Ω
25K
'S' METER
680μH
100pF
SFB-455A
2.5K LOG
2.5K LOG VOL
ALL TRIMMERS 6-60pF
S1 POSITIONS
1 0.5 – 1.5MHz
2 1.5 – 4.0MHz
3 4.0 – 8.0MHz
4 8.0 – 12MHz
5 12 – 16MHz
6 16 – 20MHz
7 20 – 24MHz
+10V MAX
1000 10VW
OFF
ON
S3
240V AC
(PF1728)
6.3V
CT
4xEM401,etc.
270Ω
560Ω
BZY94/C12
BZY88/C6V2
1000 20VW
FROM DETECTOR
200 10VW
TAA300
320 6.4VW
25 6.4VW
47Ω
.047
125 10VW
0.64
SPEAKER 8-15Ω
G S D
2N5485
BF115 *
BC108
DIODES
ZENERS
VIEWED FROM ABOVE
TAA300
NOTE: VOLTAGES AS MEASURED ON PROTOTYPE, WITH KAISE MODEL SK-100; 100,000 OHMS PER VOLT MULTIMETER. NOT DESIGN CENTRE VALUES.
* SHIELD ON BF115 NOT CONNECTED, EXCEPT ON TR15
160 SSB RECEIVER
2/SW/55

SANWA

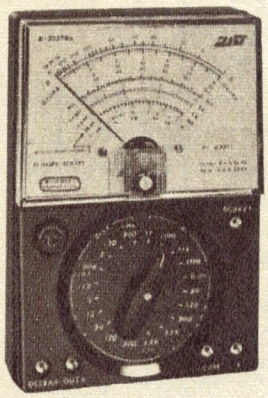
LOW COST HIGH QUALITY MULTIMETERS

Proven in over 90 countries



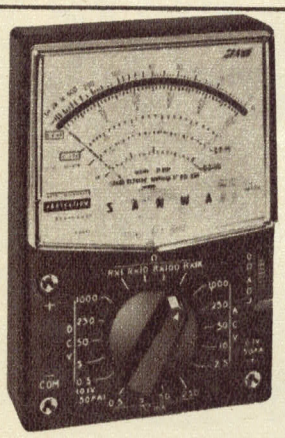
MODEL P-2B $11.00

Low-cost pocket meter with pinjack range selection. Plastic front panel with heavy duty iron case to exclude internal magnetic fields.
Ranges Available
DC voltage: 10V, 50V, 250V, 500V, 1000V
AC voltage: 10V, 50V, 250V, 500V, 1000V
DC current: 0.5mA, 10mA, 250mA
Resistance—Range: 0~5kΩ, 0-500kΩ. Midscale: 50Ω, 5kΩ. Minimum: 1Ω, 100Ω



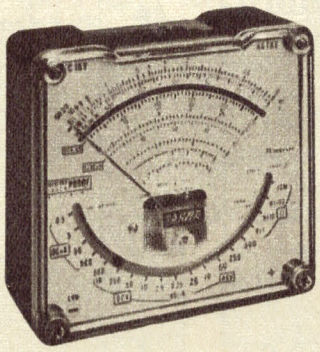
MODEL A-303 TRD $25.75

Is a medium-sized multimeter with 44 micro ampere meter movement. Input impedance 20k ohms per volt. Wide range of measurements under the instrument very versatile for testing and checking radio and TV circuits. Internally protected against overload.
Ranges Available
DC voltage: 0.3V, 1.2V, 3V, 12V, 30V, 120V, 300V, 1.2kV, 6kV, 25kV (with probe)
AC voltage: 6V, 30V, 120V, 300V, 1.2kV
DC current: 60ΩA, 3mA, 30mA, 300mA, 12A (300 mV)
Resistance—Range: x1, x100, x1K, x10K. Midscale: 25Ω, 2.5kΩ, 25kΩ, 250kΩ. Maximum: 5kΩ, 500kΩ, 5MΩ, 50MΩ
Load current (LI): 60mA, 600μA, 60μA
Load voltage (LV): 1.5V, 1.5V, 1.5V
Volume level: −10~+17 ~+63dB



MODEL U50D $16.50

Pocket size, high performance circuit tester. Internal resistance 20,000Ω per volt. Safeguarded against overload with internal diode. Internally mounted battery.
Ranges Available
DC voltage: 0.1V, 0.5V, 5V, 50V, 250V, 1000V
AC voltage: 2.5V, 10V, 50V, 250V, 1000V
DC current: 50μA, 0.5mA, 50mA, 250mA
Resistance— Range: Rx1, Rx10, Rx100, Rx1K. Midscale: 50Ω, 500Ω, 5kΩ, 50kΩ. Maximum: 5kΩ, 50kΩ, 500kΩ, 5MΩ
Volume level: −20~+62dB
Capacity: 0.0001~0.2μF
Megohm: 1~500MΩ



MODEL F-80 TRD $29.00

This meter features unique design and represents the best range of measurement and performance combined in a meter of convenient size.
Input impedance is 25,000 per volt and AC voltage to 100kHz can be measured.
Ranges Available
DC voltage: 0.25v-2.5v-10v-50v-250v-500v-1000v (25kΩ/v)
AC voltage: 2.5v-10v-50v-250v-500v-1000v (5kΩ/v)
DC current: 40μa-0.5ma-5ma-50ma-500ma
Resistance: From 100 ohms to 250k ohms midscale in 4 ranges
Load current: L1-15ma-1.5ma-150μa
Load voltage: LV-1.5v
Volume level: −10~+10db+5~+36db

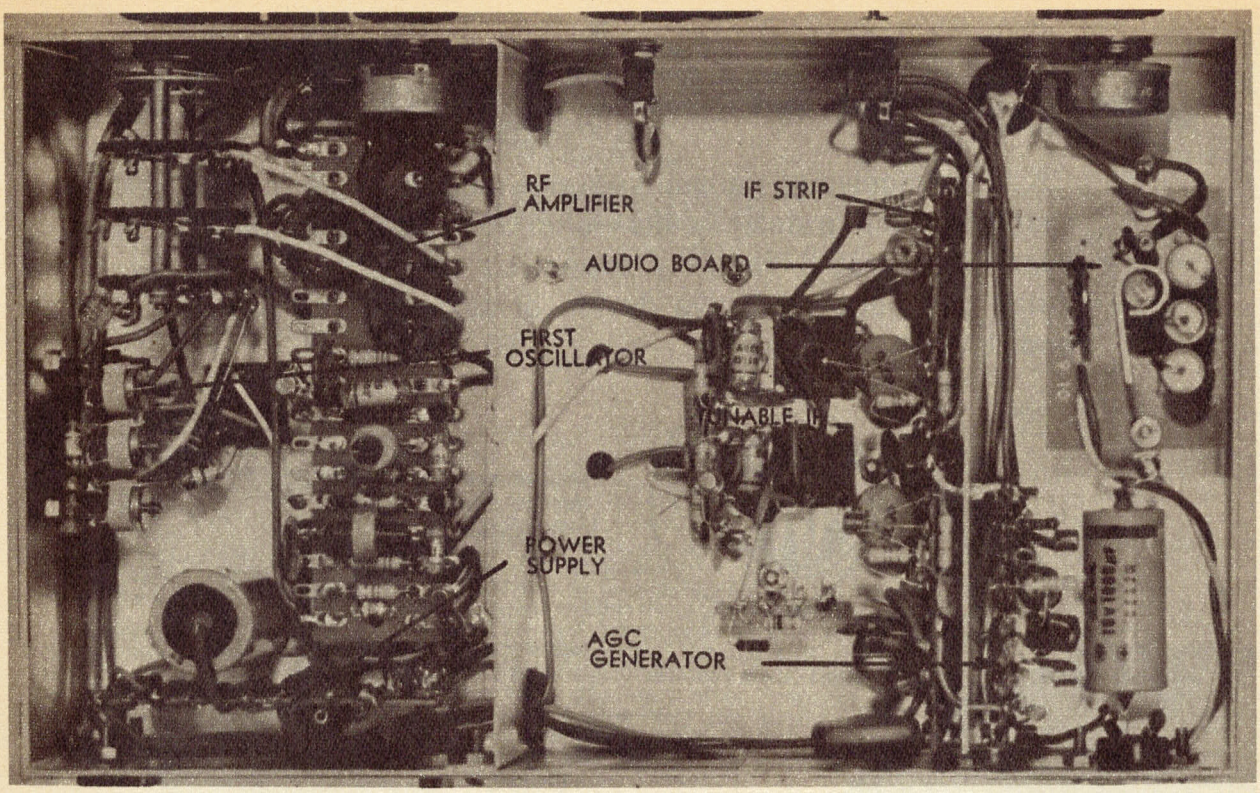
For complete information contact:

Prices plus Sales Tax if applicable

WARBURTON FRANKI

MULTI-METERS

- ADELAIDE 56 7333
- BRISBANE 51 5121
- HOBART 23 1841
- LAUNCESTON 31 3300
- MELBOURNE 69 0151
- MOUNT GAMBIER 2 3841
- NEWCASTLE 61 4077
- PERTH 8 4131
- SYDNEY 648 1711
- WOLLONGONG 2 5444



This underneath view shows the disposition of the various stages. All of the front end, prior to the tunable IF, is at the left of the partition, with the rest of the stages to the right. Note the 1000uF electrolytic near the bottom right corner.

which is the range of the tunable IF. For simplicity, the front end is not used for this range, the aerial input being switched directly into the first tuned circuit of the tunable IF. The three aerial coils are wound on ferrite toroid formers, giving compact coils with a high Q and thus permitting the use of a single tuned circuit.

The aerial tuned circuit selected by the range selector switch is connected to the gate of the 2N5485 junction FET RF amplifier. The drain of this amplifier is broadbanded by using 1mH RF choke for its load. This stage is coupled via a 100pF capacitor, to the gate of the 2N5485 mixer, with a 10K resistor between gate and earth. The drain of the mixer is also broadbanded by using a 2.5mH RF choke for its load. As a high to low impedance transformation is desirable to couple from the mixer drain to the following stage, an emitter-follower is used at the output of this stage.

Inspection of component values thus far will show that they favour the higher frequencies. The interstage coupling capacitors are small values and, in addition, the 1mH and 2.5mH RF chokes in the drain circuits have reduced reactance at the lower frequencies and so contribute to the overall effect.

There are two reasons for this. Firstly, there is a natural tendency for the RF gain to fall as the frequency is increased, so that the suggested approach has a levelling effect. The second is perhaps peculiar to this design. As mentioned earlier, we have used only one tuned circuit in the input to the first stage. Although the circuits are of quite high Q, there is not sufficient discrimination to prevent strong local broadcast stations from breaking through in some circumstances. By reducing the gain at these frequencies this problem is minimised.

The self-excited oscillator associated with the first mixer uses an adaption of the oscillator circuit which we employed in a recent wide-range dip oscillator. The tuned circuit of this oscillator, which determines the first injection frequency, is switched in a similar manner to the amplifier-multiplier circuit used in the EA240 Communications Receiver. As the oscillator is run at the final injection frequency and not multiplied, as in some instances with the previous crystal oscillator, spurious responses are thereby reduced. Switching of the oscillator is carried out by ganging it with the switching for the aerial tuned circuits at the input of the RF amplifier.

An extra winding of low impedance has been added to the oscillator coil to provide source injection to the mixer. Bias for the mixer is provided by means of a bypassed 4.7K resistor in series with the injection winding.

This arrangement of the first oscillator tuned circuit and injection permits the use of a single oscillator coil. It is only necessary to switch appropriate capacitors for band changing and this makes for the simplest and most conveniently aligned front end circuit we could devise.

Injection frequencies for the first mixer are 4MHz, 8MHz, 12MHz and 16MHz. The 4MHz injection is used for both the 0.5-1.5MHz and 1.5-4MHz ranges, 8MHz is used for the 12-16MHz range, 12MHz for the 16-20MHz range and 16MHz is used for both 8-12MHz and 20-24MHz. These figures may be clearly seen from the table.

Signal Freq. MHz	Injection Freq. MHz	Tunable IF MHz
0.5-1.5	4	4.5-5.5
1.5-4	4	5.5-8
8-12	16	8-4
12-16	8	4-8
16-20	12	4-8
20-24	16	4-8

It may be noted from the table that all ranges but that from 8-12MHz tune "forward", i.e., from 4-8MHz on the tunable IF dial. While the "odd band out" could conceivably have been made to tune in the same direction, it would have meant using an injection frequency of 4MHz, with a likely problem of spurious responses from

CHAN NEL LOCK ®
Little Champ PRECISION PLIERS
DIAGONAL CUTTER 41G
PLASTIC GRIPS
Finest quality precision pliers for delicate bench work. Handy gripping tools for work in electronics, model making and watch repair. Polished steel finish with blue plastic grips.
Complete range 41G to 49G inclusive.
Write for Illustrated Brochure.
Available From Wholesalers All States!
S.C. 11/12/70.
Sole Australian Distributor.
Selectronic Components
17 BARRY STREET
BAYSWATER, VIC. 3153
Phone 729-2992

yes,we are know men

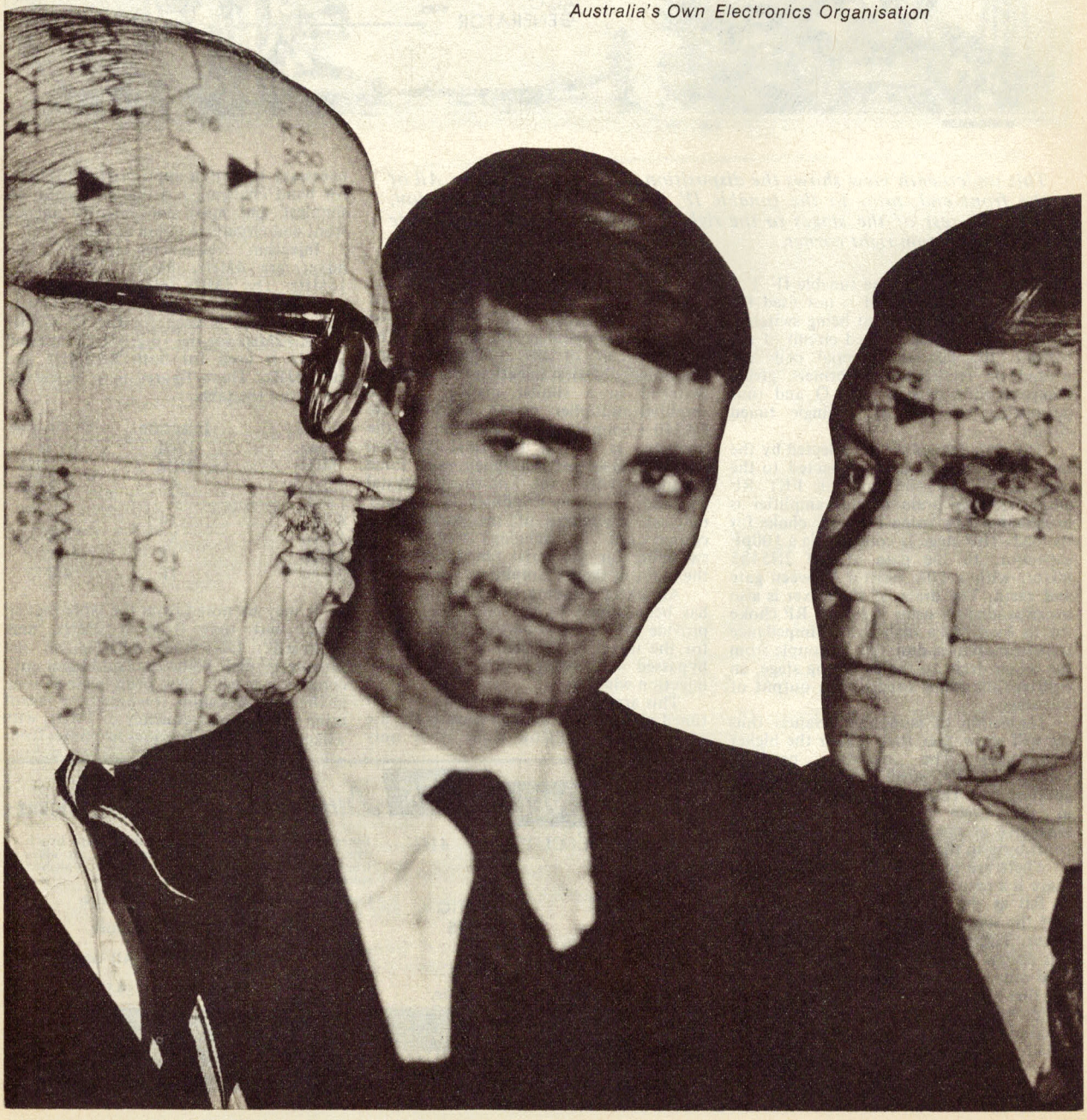
. . . from receiving, transmitting and picture tubes to transistors and integrated circuits—after 30 years' accumulated experience, you'd naturally expect us to be 'know-men.' When you need an active device or assistance in design and development, call us.

AWV

Amalgamated Wireless Valve Co. Pty. Ltd.
Rydalmere, N.S.W. 2116
Telephone 638 0411

V1300FP

Australia's Own Electronics Organisation

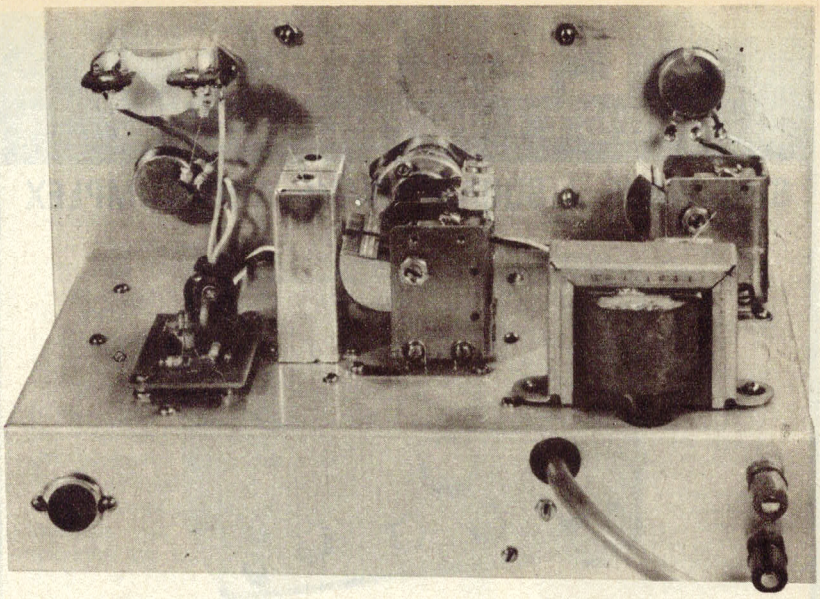


the broadcast band. A reverse tuning mode is considered a small price to pay for improved performance.

The "front end" which we have just described, in addition to being suitable as part of a complete receiver, could conceivably form the basis of a converter which could be used in a number of applications. Variations could be made in the oscillator frequencies, the RF tuned circuits and the tunable IF, to suit the particular need. Such a design could be readily adapted for spot frequencies, "amateur bands only", etc.

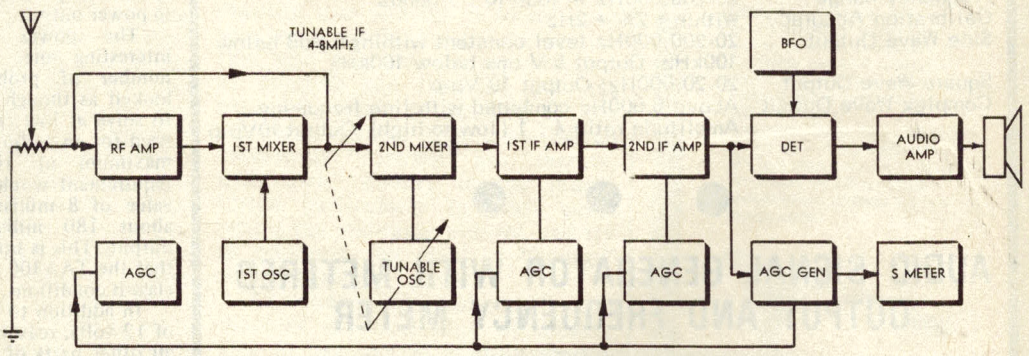
We now come to the tunable IF section. From here on the system is really a single conversion receiver in its own right, albeit one which tunes only the 4-8MHz range. The tunable IF does not have an amplifier in the strict sense, in that there is no transistor or other active device at this frequency range. However, the coil used has a tuned secondary, with a low impedance primary input, the step up giving a useful amount of gain.

Immediately following the tunable IF circuit is the second mixer, which is another 2N5485 FET. The tunable oscillator associated with this mixer uses the same basic configuration as the first oscillator, the main difference being the changed circuit values to make it tunable over the range 4.455MHz to 8.455MHz.



This view from above the chassis, shows clearly the location of all the major components on the chassis and the back of the front panel. Note the BFO unit at the bottom left.

The block diagram shows each function of the receiver and this should make the circuit diagram easier to understand.



Also, a BA102 varicap has been added, with a suitable bias adjusting circuit to provide a fine tuning facility. Injection from this oscillator is via a small capacitor to the gate of the second mixer.

The drain load of the FET second mixer is again a 2.5mH RF choke. The load requirement here is such that it must present a low DC resistance to the +12 volts DC supply and at the same time present a source impedance of 3K ohms at 455KHz, to the SFD-455B ceramic resonator which follows. The readily available 2.5mH RF choke meets this requirement quite satisfactorily.

The next two stages are the 455KHz IF amplifiers, and here silicon bipolar transistors of type BF115, BF184, BF185, or similar, may be used. Collector load in each case is a 4.7K resistor and these are followed by two more SFD-455B ceramic resonators, similar to the first one. Each of the resonators is top coupled with a 68pF capacitor. This value largely determines the bandwidth of the IF system and, unless you have good reason for making a change, we suggest that you adhere to this value.

After the third 455KHz ceramic resonator is another transistor which can be a similar type to the two previous amplifiers. This device is biased in class B consistent with its role as the detector. The circuit shows a 100K potentiometer in series with a 3.3K resistor, as the divider for the detector base bias; when the bias is adjusted on completion, the potentiometer may be replaced with a fixed resistor, if desired.

The detector collector load is an 8.2K resistor, with a .01uF shunt capacitor which functions as an IF filter, audio being recovered from this point. It will be noted that there is an unbypassed 47 ohm resistor in the emitter of the detector. The main purpose of this resistor is to give some degeneration to reduce the audio output, as only a fairly low level is required for the IC audio section.

For AGC purposes, part of the IF signal is taken from the collector of the second IF amplifier. This is fed via a 27pF capacitor to an amplifier, the output of which is rectified by the two OA91 diodes, connected as a half-wave voltage doubler. The output of the rectifier charges either a 5uF capacitor for AM reception, or a 50uF capacitor for SSB reception, the capacitors being switched according to the mode of reception.

As the source impedance for the rectifiers is relatively low, the capacitor in circuit will be charged rapidly, in proportion to the strength of the signal being received. The only path for discharge of the capacitor when the signal level is reduced or disappears, is via the 33K resistor and the emitter junction of the following transistor. The time constants are so arranged that discharge will be fast for AM reception but slow for SSB reception.

When no signal is being received, there will be no charge on either the 5uF or 50uF capacitor and consequently no forward bias on the following transistor. This means that the transistor will not be conducting, producing no voltage drop across the 4.7K collector load resistor. The collector of this transistor, is the source point of forward bias through a 2.7K resistor, to the bases of the three AGC transistors. Under these conditions, these transistors will be saturated, so there will be very little collector-emitter resistance. Consequently, the AGC transistors will have negligible effect on their associated amplifiers.

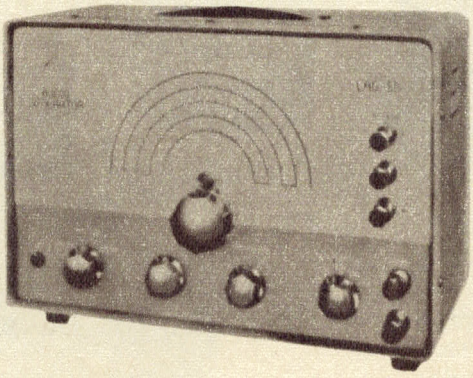
When a signal is received, one of the AGC capacitors will be charged, the following transistor will conduct according to the signal strength and there will be a resultant voltage drop across the 4.7K collector load. This means, in turn, that there will be less current fed to the bases of the AGC transistors, causing the collector-emitter resistance to increase and producing the same effect as placing a resistor of equal value in each amplifier emitter (or source) circuit. The resulting degeneration produces a reduction in amplifier gain.

It may be noted that each IF amplifier control transistor is shunted by a fixed resistor. The choice of these resistors determines the shape of the AGC characteristic and the values given should be adhered to, unless you have good reason for making any changes.

Since the collector voltage on the AGC DC amplifier falls with an increase in signal strength, this can be used as the reference for an S-meter. So that the meter will be forward reading, it is included in a bridge circuit, with a 2.5K preset potentiometer to set the zero reading of the meter under no-signal

LEADER
TEST INSTRUMENTS

SINE-WAVE / SQUARE WAVE AND COMPLEX



LAG - 55

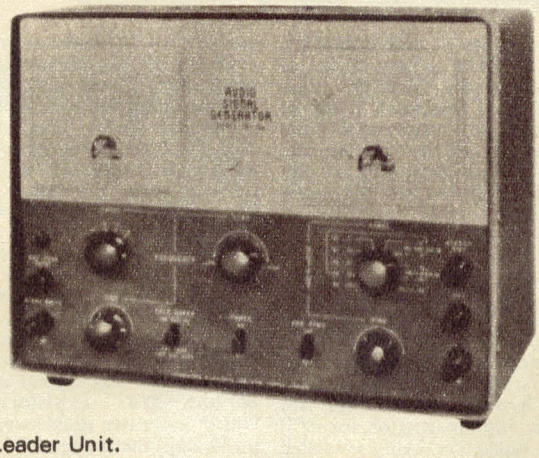
Budget priced unit indispensable for any serious audio measurements.

Specifications:

Frequency Range	20-200,000Hz in four 10 : 1 bands
Calibration Accuracy	Within ± 2% + 2Hz
Sine Wave Output	20-200,000Hz: level constant within ± 0.5dB below 100kHz: Output 5 V rms below 100kHz
Square Wave Output	20-20,000Hz; Output 10 Vp-p
Complex Wave Output	Above 5,000Hz combined with line frequency Amplitude ratio 4 : 1 (low to high) ; Output 10Vp-p

● ● ●

AUDIO SIGNAL GENERATOR WITH METERED OUTPUT AND FREQUENCY METER



LAG - 66

Top quality Leader Unit.

Specifications:

Generator		Frequency Meter	
Frequency Range	11 to 110,000Hz in 4 bands	Range	10 to 110,000Hz in 4 ranges
Output Voltage	600 Ohms: 0— 1V in 6 ranges	Input Impedance	200,000 Ohms, approx.
	10k Ohms: 0—10V in 2 ranges	Accuracy	± 1.5%, full scale: 10 to 11,000Hz
Distortion	Less than 0.3%, 20 to 20,000Hz		

FROM ALL GOOD TRADE HOUSES

WHOLESALE ENQUIRIES ONLY TO
SOLE AUSTRALIAN REPRESENTATIVES:
ASTRONICS AUSTRALASIA PTY. LTD.,
ALL STATES.

conditions. In series with the meter coil is a 25K preset potentiometer which is provided to set the limit of travel of the meter to just full scale, under the very strongest signal conditions. This potentiometer will suffice for any meter with a sensitivity ranging from about 200uA to 1mA.

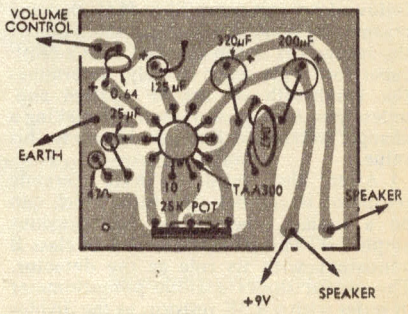
The BFO is the one which we described in detail in September last. It is a new design and this is the first application of it in a complete receiver. The unit is built on a printed board and, in spite of the low cost of the parts required, is virtually as stable as a crystal. It presents no trouble to get going. The frequency is variable over sufficient range to be able to resolve either upper or lower sideband SSB transmissions. The BFO is switched on and off with the same toggle switch assembly which determines the AGC time constants for AM and SSB reception. The output of the BFO is fed to the base of the detector via a 10pF capacitor.

Output from the detector is fed via a 2.5K volume control to the main audio amplifier. The Philips TAA300 IC used in this amplifier is mounted on a small printed board with its associated components. The power output is about 1 watt into an 8 ohm speaker, which is the lowest value which can be used. A 15 ohm speaker may be used, but with a reduction in power output.

The power supply is quite an interesting one. We were faced with a number of problems which, at first, looked as though they might be difficult to solve at low cost. Firstly, we had the need for an audio supply of 9 volts with a maximum of 10 volts. The current requirement would vary from a quiescent value of 8 milliamps to a maximum of about 180 milliamps with full audio output. This is brought about by the fact that the TAA300 amplifier operates under class-B conditions.

In addition to this, we needed a supply of 12 volts, reasonably well regulated, for all other parts of the receiver except the oscillators. The latter needed a supply of 6 volts, well regulated. All this adds up to quite an exacting need, considering the modest receiver which we aimed to produce. However, we were able to come up with a relatively neat solution by adapting an old idea used for multiple voltage power supplies.

This involves using a bridge rectifier across the total transformer secondary supply, for the highest voltage need. A lower voltage may be had by taking the output from the centre-tap of the transformer secondary. This is effectively fed from a full-wave rectifier system, using only two of the four diodes of the bridge rectifier system, but with the diodes in the negative, rather than the positive side of the supply With a secondary supply of



The audio board is shown from the component side. Note the polarity of electrolytics and orientation of the IC.

about 6.3 volts AC, each side of the centre tap, we thus obtain between 9 and 10 volts DC for the audio amplifier while at the output of the bridge we obtain something close to 20 volts. This is fed through a dropping resistor of 270 ohms to a BZY94/C12 zener diode, which gives a regulated supply of 12 volts, nominal.

The well regulated supply of 6 volts (nominal) required for the oscillators is obtained by a further dropping resistor of 560 ohms and a BZY88/C6V2 zener diode. Thus the supply voltage requirements of the receiver have been met in a very satisfactory way. In fact, although the supply current to the audio amplifier is constantly fluctuating, the other two supply voltages remain virtually unaffected.

To reduce the hum to an acceptable level, we found it necessary to use a minimum of 1000uF for each of the two main power supply electrolytics. Readers who wish to reduce the hum to an even lower level, could increase these two electrolytics to 2000uF each.

So much for the design. In the description which follows we hope to supply sufficient details to ensure that readers will have no difficulty in duplicating the prototype.

A good place to start construction is the power supply for, by starting here and working backwards, one can finish off each section and test it immediately. The power supply, less transformer, is built in a piece of miniature tag board, with 12 pairs of tags. It is a simple item to wire, particularly when reference is made to the wiring diagram. Note that, as there is not a great deal of room around the wiring board, the relatively large 1000uF capacitor on the 9-10 volt supply is located between the loudspeaker socket and the audio amplifier.

There are a number of small power transformers available which should do the job. The prime need is for one having a secondary of 12.6 volts, centre tapped, and rated at between 500mA and 1A. We used a type PF1728, which has two 6.3 volt windings rated at 1A. These windings must be connected in series aiding, thus giving an effective centre tap.

The printed board for the audio system has only nine items to be soldered into place and the job is done. The appropriate diagram should be followed carefully and a few important points should be observed to ensure success. Make sure that all the electrolytic capacitors are in their correct positions and that correct polarity is observed. When fixing the IC, make sure that it is done with due respect for the correct orientation of the connections. The tag on the IC is between connections 1 and 10 and these should be soldered to the appropriate band of copper on the board. The other connections will then automatically be correct.

Although this completes the wiring of the board, it is still necessary to provide a heat sink clip for the IC. We made one up from a piece of aluminium sheet, measuring 2in x ½in. One end was wound around a 5/16in diameter drill and the resulting loop was adjusted by hand so that it was a neat fit over the case of the IC. Although aluminium is excellent for this job, other metals such as brass, copper or steel, would be satisfactory.

Having completed the audio board, the other board for the BFO may be attended to next. It is very simple to make up and reference to the special picture should be sufficient guide. Every care should be taken to make sure that the transistor is correctly orientated. And, while care should be taken at all times not to overheat components, the requirement applies particularly to the ceramic resonator, transistor and trimmer.

The next assembly is the largest of the whole project. It consists of two boards and includes the second mixer, two IF amplifiers, detector and AGC system. Wiring is again based on tag strips, one with 19 pairs of tags and a smaller one which accommodates the AGC system, with 9 pairs of tags. The small board is secured with two screws, one of these screws being common with one of the three screws used to secure the large board – all to an aluminium panel, 4¾in long, 1-7/8in high and with a 5/16in foot. This panel serves as a mounting bracket for the complete assembly. There is a screw at the extreme end of each board, with one at an intermediate point on the large board.

The boards are spaced from the panel by about ¼in. Instead of spacers, we used extra nuts to perform the same job. At each screw, we fixed a solder lug and soldered to the nearest earth point.

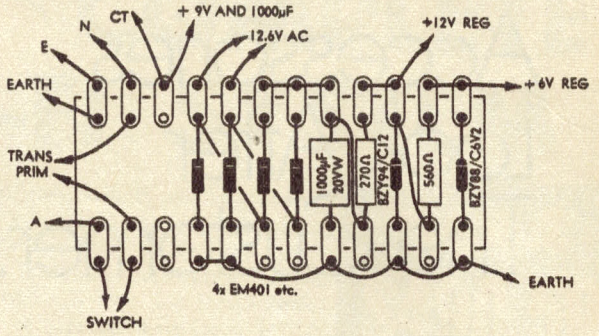
The three ceramic resonators are mounted directly on the tag board. Care must be used in mounting, as it is necessary to drill five small holes fairly accurately. Only holes large enough to pass the leads should be drilled. The resonator leads are passed through the holes and the other leads and components are then soldered to the opposite side. This is sufficient to hold the resonators in place. Make sure that the "dots" on the resonators are orientated correctly.

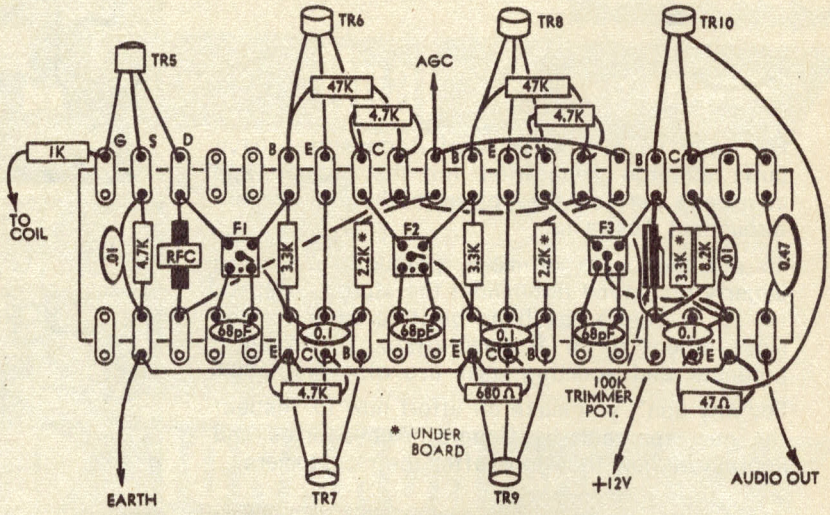
Most of the remaining assemblies involve the use of one or more coils, so this would be a good time to wind all the coils.

The aerial tuning coils L1-L3 are wound on Ducon toroids, which are about ¾in outside diameter, and of Q2 material. These coils have a high Q, can be wound readily and have the added advantage of being compact. The coil winding details are given in the table. The number of turns on each winding and the disposition of the windings should be closely adhered to but the gauge of wire specified is simply a guide. If you do not have the exact gauge, something close to it should suffice. At the same time, particularly at the higher frequencies, the gauge of wire should be as heavy as practicable. This will reduce the resistance of the coil and give a higher Q.

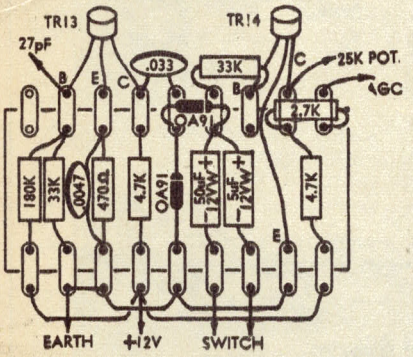
The switched oscillator coil L4 is wound on a Neosid former with a diameter of 7.6mm. The secondary should be wound first, with the primary wound over the earthy end of the secondary. Do not forget to make the centre tap on the secondary winding. When this point is reached, we suggest that you carefully remove the enamel for about 3/16in, tin

At right is the board for the power supply. Note that the 1000uF electrolytic for the audio supply is mounted at the speaker socket.





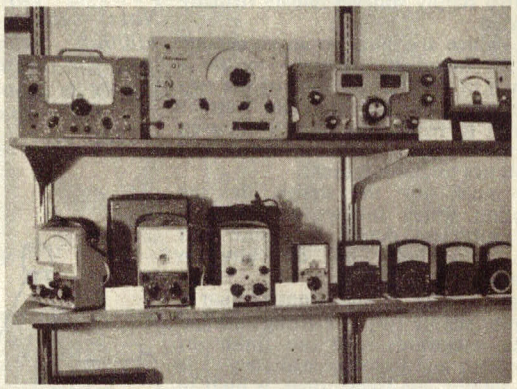
The IF amplifier strip is relatively easy to wire, when the above drawing is followed, in conjunction with the circuit.



Wiring details for the AGC generator board. This board is fixed on the same panel as the IF strip.

General Accessories Look After The Customer.

GENERAL ACCESSORIES





For many years now General Accessories have built a large reputation for the prompt and courteous service they offer to their customers throughout Australia.

To aid the customer more, products are being eagerly displayed throughout the store. A special Hi Fi Studio has been built to cater for the most ardent of hi fi specialists. Domestic products and sporting gear are also displayed.

So, why don't you make an effort now to inspect the new approach by General Accessories and appreciate how they look after their customers.



GENERAL ACCESSORIES

AVAILABLE AT FOLLOWING BRANCHES:

46 Milligan Street, Perth.
116 Clarence Street, Sydney.
81-97 Flinders Street, Adelaide.
50-54 Lt. Edward Street, Brisbane.
443 Concord Rd., Rhodes, N.S.W.
153 Sturt Street, South Melbourne.
Cnr. Ingham Rd. & Echlin St., Townsville.
Homecrafts, Tas P/Ltd. 199 Collins St., Hobart.

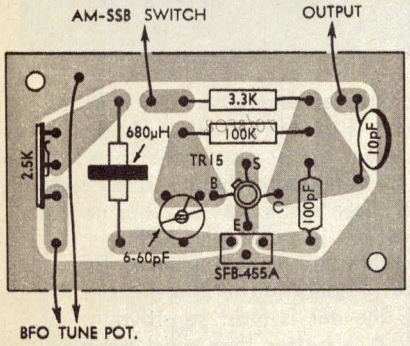
the bared copper and place a small piece of insulation tape under the wire at this point and continue winding. Later on, a small piece of the same wire can be soldered to the centre point and this can serve as the extra lead.

The means of anchoring each end of the windings is largely up to the reader. We have used a couple of different methods of anchorage. In one, a loop of linen thread is placed lengthwise on the former, with the loop near the start of the winding. The end of the wire is passed through the loop, a few turns made, and then the linen ends are drawn tight, causing the loop to anchor the wire at the start. A similar method is used at the finish. The loose ends are cut off and the anchorages reinforced with a small blob of cellulose glue.

An alternative, though not quite as neat a method, is to use a small strip of plastic adhesive tape, in a manner similar to that for the linen thread. In any case, when the secondary is wound, it is a good idea to place a layer of plastic adhesive tape over the secondary, where the primary will be wound, to minimise the possibility of a short-circuit between windings.

Coils L5 and L6 are wound on longer formers of the same type as used for L4, and in a similar manner to L4. Although care should be taken to make all windings in a firm and workmanlike manner, this applies more particularly to L4 and L6, which are oscillator coils. These must be wound tightly and precautions taken so that there will be no movement of the turns. If this is not done then the stability of the whole receiver could be prejudiced.

When coils L4, L5 and L6 are wound and terminated, each winding should be placed in a can, ready for use in the final assemblies. The Neosid cans are provided with a pair of lugs and the intention is that



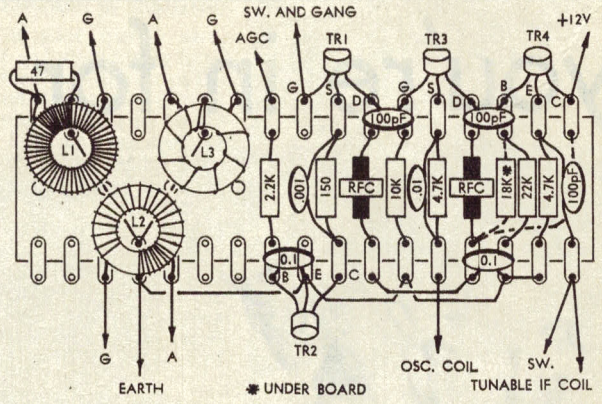
This shows the BFO layout from the component side of the board.

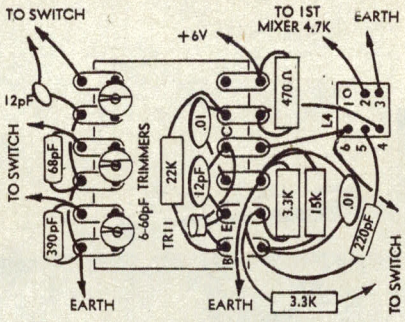
these lugs be bent over to hold the coil former in position. Two screws through the holes anchor the coil and the can to the chassis. This system is excellent but it requires a very special set of punched holes in the chassis. An alternative method which we used, is to bend the lugs outwards, rather than inwards. The former is firmly held in the can by crimping the aluminium over with a screwdriver, at a couple of spots which do not interfere with the terminating pins. The assembly is then held to the chassis with a couple of screws and nuts.

The next board to be wired is that containing the three toroidal coils, with the RF amplifier, first mixer and the emitter-follower. This is wired up in the usual way, according to the wiring diagram. When the coils are wired in place, it will be noted that they are more or less loose, according to the gauge of wire used for winding. To keep the coils held firmly in place, it is a good idea to tie each one to the board, with a piece of nylon or linen thread.

The last board to be wired is that for the first oscillator. It cannot be over-stressed that this board must be wired with the greatest care, making sure that all components are held firmly in place. Failure to do so will result in an unstable receiver, or one which is more susceptible to shocks than it should be. Details are

When wiring the RF amplifier board, special care should be given to the switching details.





The first oscillator should be firmly wired, again with care given to switching accuracy.

shown in the wiring diagram, which also includes the coil which is mounted separately. The new Philips dielectric film trimmers fit quite nicely between adjacent tags on the board, as may be seen from the photograph.

Having completed all the sub-assemblies, we are now in a position to undertake the final assembly and wiring. The unit is built on a chassis, 10in x 6in x 2in, with a front panel, 11in x 6in. As the order of assembly and wiring can affect the ease of the job, here are some suggestions as to how it may be done.

Fit the chassis partition first, making sure that a rubber grommet is fitted at least to the hole which must pass the 240V AC lead to the switch. Next, fix the speaker socket and aerial and earth terminals to the back skirt of the chassis. A solder lug is fitted under each of the terminals, making contact with the chassis for the earth and insulated for the aerial.

Solder trimmers to the top of the 2-gang capacitor and, to the bottom lugs, solder two pieces of hookup wire about 4in long. Fix a similar piece of wire to the single gang and mount both units to the chassis. Mount coils L4, L5 and L6, making sure that the pins are so orientated as to give the shortest wiring leads. Under one mounting screw of L6, fix a 5-tag strip and under the corresponding screw of L5 fix a 2-tag strip.

Mount the power transformer with the low voltage leads nearest the back of the chassis. Make sure that the two holes in the chassis are fitted with rubber grommets, to protect the transformer leads. Fit another grommet to the hole in the back skirt of the chassis, for the power flex.

Mount the power supply board assembly. We used a couple of 1/8in Whitworth screws, one at each end hole of the board. Three nuts are used on each screw, so that a spacing of about ½in is effected between the board and the chassis skirt. The board is orientated so that the vacant terminals for the 240 volt wiring is nearest the dividing partition. It is a good idea at this stage, to wire up the leads of the transformer, power supply and switch. This gets rid of flying leads, which can be a nuisance when doing the rest of the assembly.

Now the audio amplifier board can be next. It is also held off the chassis, by about 5/8in, with a couple of 1/8in Whitworth screws, using the three-nut technique as before. Before finally fitting the board, make sure that all leads from it are fitted, with sufficient length so that each will comfortably reach its intended destination. Under each fixing screw and next to the board, provide a solder lug for earthing purposes. At this point, you may fit the 1000uF electrolytic capacitor, between the speaker socket and the nearest earth lug of those just referred to. The 9-volt lead may also be run from the power supply.

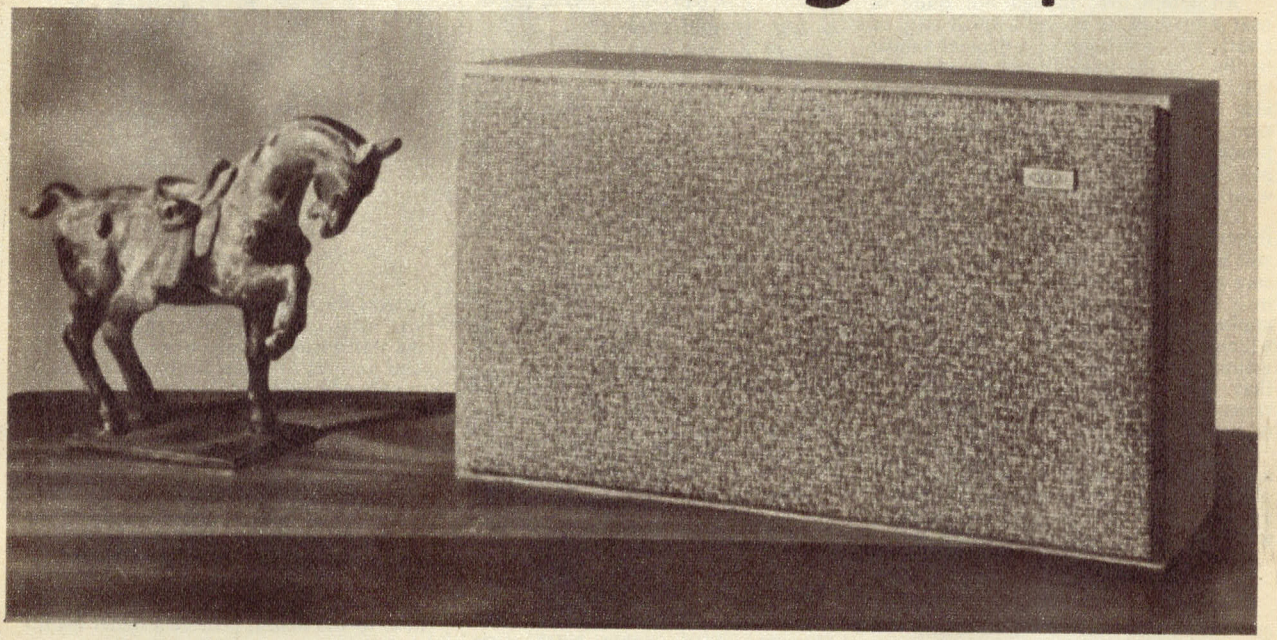
The IF strip assembly is the next logical step but this must be considered with the BFO assembly. The BFO is mounted above the chassis as shown in the photograph and in such a position that the output lead to the detector is kept short and direct. At the same time, its mounting screws must not foul any part of the IF strip assembly. In mounting the BFO, we placed the screw heads under the chassis and, by using three nuts on each screw, the BFO is held clear of the top of the chassis by about ¼in. The 6-volt supply and injection leads are passed through a hole in the chassis just near the 10pF capacitor. The leads to the 2.5K potentiometer are run along the top of the chassis.

The IF strip assembly is mounted with a gap of only about ¼in between the end of the panel and back skirt of the chassis. The detector must be at this end. Before fixing, provide leads for the 12-volt supply and the audio output to the volume control. The 12-volt lead may be run to the power supply but the audio lead must wait until the front panel is in place.

Now the tunable IF can be wired up. This involves coils L5 and L6, with associated components to the two tag strips previously fixed. The wiring here is largely a matter of common sense. Best use should be made of the tags available, together with vacant pins on the two coil

If you judge the CRESTA only by size...

you're in for a big surprise



CRESTA	
Size	12½x7½x8⅝ in 32x19x22 cm
Input	15 Watts
Impedance	8 ohms
Freq. Range	45-30,000 Hz
Dividing Freq.	3,500 Hz
Price	$76.00

KEF engineers have pioneered big advances in little speaker design. CRESTA is proof. No other speaker, of this size, has such an open, full and spacious sound. How is it done? Not by vainly stretching a small system to its limits and letting those limits play on your nerves. But by technical innovation. For example: KEF's acoustically neutral diaphragms of Acoustilene. This unique material reduces colouration in the mid-frequency band where the ear is most sensitive. Surprisingly, the CRESTA is better than most people's ears and room acoustics. Extra power and small bonuses at extreme frequencies can be extravagant luxuries. But judge for yourself. Hear this little giant. Its performance is truly remarkable for its size.

MADE AS ONLY **KEF** KNOWS HOW

1970 BNEC Export award for smaller firms 1970

J. H. REPRODUCERS CO.

293 HUNTINGDALE ROAD, CHADSTONE, VICTORIA. 3148

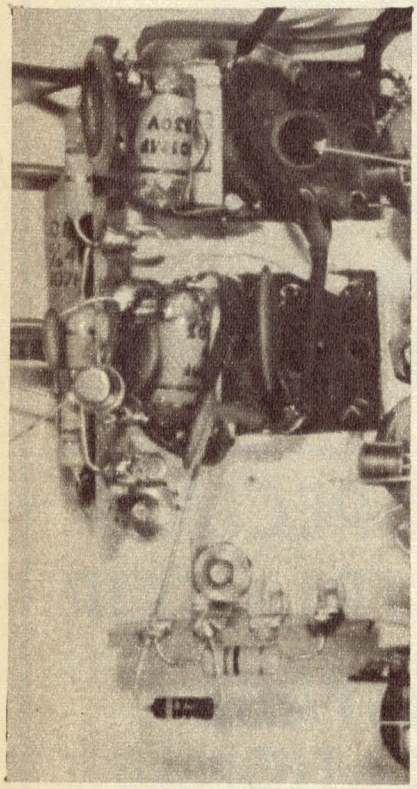
TELEPHONE: 277-3066

Exclusive Australian Agents for — ADC Cartridges and Amplifiers, Kef speakers, J. H./G. H. Unipoise Pickup Arms, Pritchard Arms, TRANSCRIPTOR TURNTABLES and the popular J.H. Synchronous Turntable.

formers. Once again, the oscillator components must be firmly fixed. In some cases, it is difficult to avoid some components having leads a little longer than we would like. However, this is of no serious consequence. The 1K "stopper" resistor, from L5 to the gate of the second mixer, must be so mounted that the resistor is hard up against the gate tag on the board. The other lead should run direct to the coil.

Having completed the tunable IF, it is interesting to note that we have completed 4-8MHz tuning range, and the unit at this point is a receiver in its own right. We now move on to the "front end".

Perhaps the next most convenient board to fit would be that of the first oscillator. This is fixed to the end skirt of the chassis and stood off the chassis by about 3/8in, once again using the same



This picture snows the wiring around the two coils for the tunable IF. The varicap for fine tuning is at the bottom.

technique with screws and nuts. As with other units, it is well to consider any leads from it, which may be difficult to fit later. Make sure that you run the 6-volt supply to this oscillator, as we hope you have already done with the second oscillator for the tunable IF.

Some readers may be wondering about the purpose of the 3.3K resistor which runs from the band switch to the emitter of the first oscillator transistor. It is simply there to stop this oscillator when the receiver is set to the 4-8MHz position, avoiding the possibility of any unnecessary "birdies."

Before attempting to fit the board with the toroidal coils, drop the 2.5K aerial attenuator pot through the hole in the chassis. The nut could be just run up finger tight at this stage. Stand the board off the chassis, by about 5/8in. The mounting screws are run through the extreme end hole nearest the aerial attenuator, with the other one through the fifth hole from the other end.

We are now in a position to attach the dial to the front panel and to fix the panel to the chassis. The panel is held in place with the nuts of the band change switch, aerial attenuator, toggle switches and volume control. The drive from the dial to the tuning capacitor is via a flexible coupling. To connect the coupling to the dial movement, it is necessary to provide a short length of ¼in diameter steel or brass rod. This needs to be about ½in long and can be obtained from an offcut of one of the controls, such as the switch or a potentiometer.

When fixing the band switch, it should be orientated such that the rotor lugs are nearest the top of the chassis. This done, the switch may be completely wired. A piece of light coaxial cable is run from the aerial and earth terminals, to the aerial attenuator. A convenient earth point for this end is a lug under the nearest fixing screw for the single gang capacitor.

A careful check should be made at this stage, to make sure that all leads have been properly terminated, and that there are no wiring errors or omissions. Assuming that all is well, we are ready to carry out final adjustments and alignment.

The first check which should be made is to see that the three supply voltages are correct. With the volume control turned right down the voltage to the audio amplifier should read between nine and ten volts. The 12-volt supply to other parts of the receiver, should read 12 volts within, of course, the tolerance of the zener diode. The supply to both oscillators should read 6.2 volts, with a similar tolerance.

Unsolder the 9V lead between the power supply and the audio amplifier. Connect a multimeter in series with this lead and set the multimeter to the 100mA range, or a higher one, and switch on. Adjust the 25K potentiometer on the audio board, for a quiescent current of 8mA. If a meter is not available, we suggest that you set the potentiometer to mid range. With the volume control partly advanced, a finger on the active lug of the potentiometer should now give a healthy noise from the speaker.

Set the 100K potentiometer in the base of the detector so that the full resistance is in circuit. Check the voltage at the collector, then reduce the 100K potentiometer resistance until the voltage drops by about half a volt on the previous reading. Later on, the final setting can be determined, to give best detection.

With no signals being fed into the receiver, set the S-meter to zero with the 2.5K tab pot. The 25K tab pot. determines the full scale limit of the pointer. This can be set arbitrarily such that the strongest signal just reads full scale.

COIL WINDING DATA

L1 Secondary, 120 turns 30 B&S enamel on Q2 toroidal former. About 90 turns occupy full former length. Overwind remainder back. Primary, 10 turns, interwound at earth end of secondary.

L2 Secondary, 43 turns 24 B&S enamel on Q2 toroidal former, wound to occupy about 90 per cent of former. Primary, 5 turns interwound at earth end of secondary.

L3 Secondary, 7 turns, 18 B&S enamel on Q2 toroidal former, wound to occupy about 90 per cent of former. Primary, 1 turn 24 B&S enamel, interwound at earth end of secondary.

L4 Secondary, 30 turns centre tapped 26 B&S enamel close wound on 7.6mm (0.300in) x 1¼in Neosid former. Primary, 5 turns over earthy end of secondary. Grade 900 slug.

L5 Secondary, 35 turns, 26 B&S enamel close wound on 7.6mm (0.300in) x 2½in Neosid former. Primary, 7 turns over earth end of secondary. Grade 900 slug.

L6 One winding, 32 turns centre tapped, 26 B&S enamel close wound on 7.6mm (0.300in) x 2½in Neosid former. Grade 900 slug.

The IF strip should need no adjustment at all. This is a good thing, as it simplifies the procedure considerably. With the three Murata type SFD-455B ceramic filters, top coupled with 68pF, we obtained very good results. The top of the band pass shape is almost flat, with only a slight dip in the middle. The bandwidth has been measured at 4.4KHz, at the 6dB points. The skirt selectivity is very good and is borne out by the receiver's ability to separate cleanly, adjacent signals about 5KHz away.

Fit a slug each to L4, L5 and L6. To ensure that the slug remains in its final position, it is necessary to use some sort of locking arrangement. This can take the form of a locking compound, which looks rather like a heavy grease, but the method which we prefer is the use of a short length of elastic. The elastic which we used is available from drapery stores in reels, and it is just under 1/32in in diameter. It is generally double cotton covered, like some of the copper winding wires, but the cotton should be removed. A length of about 1in is introduced into the former tube before screwing in the slug, providing a reliable locking action.

HI-FI XMAS OFFER



STEREO HEADPHONES
Type 650.30-15.00 Hz
$5.75

HI FI STEREO PHONES
Mark II 25-18,000Hz
$14.90

Full tone, perfect set
Type 205 10-22,000 Hz
$18.90

Postage 0.30 mail orders:

RONEC-BALGOWLAH. 2093.
372 Sydney Rd., Ph 94-1766

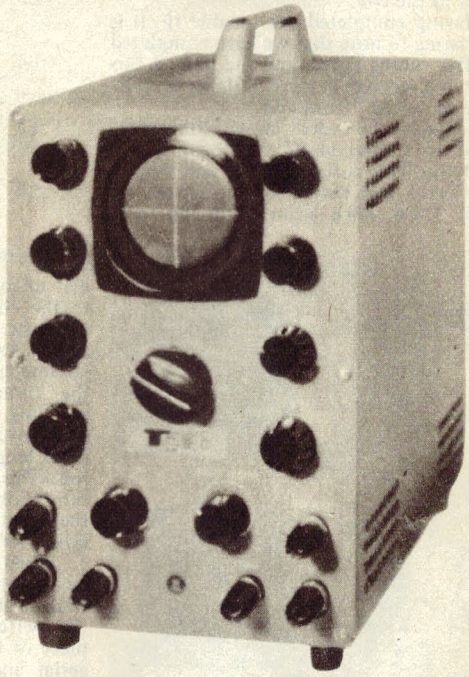
Ask price list for parts and kit-sets.

MAGRATHS

MELBOURNE'S ELECTRONIC HOBBIES CENTRE

CHRISTMAS SPECIALS

SPECIAL CHRISTMAS OFFER
T.T.1 OSCILLOSCOPE



Here's your opportunity to acquire a practical oscilloscope at a truly unrepeatable price. Indented from a leading Japanese manufacturer, the TT1 CO-50 is an amazing versatile and compact oscilloscope. It is an indispensable instrument to have in the Lab. or on the workbench. A compact portable 240V unit at this fantastic price.

$66

COMPLETE WITH HANDSOME VINYL CARRYING CASE

Price includes Sales Tax and freight within Aust. and Territories.

APPLICATIONS INCLUDE —

- ORDINARY APPLICATION —most widely used for waveform observation and measurement of voltages.
- CHECKING I.F. SELECTIVITY CURVES—this is done together with a Sweep Generator and the two instruments are important tools for efficient I.F. alignment.
- UTILISATION OF LISSAJOUS FIGURES—this method is used for frequency measurements.
- MEASURING PERCENTAGE OF MODULATION—the Test signal is routed DIRECT to the deflection plates. This is used for adjusting transmitters.

TWO MORE GREAT SPECIALS FOR THE HOME CONSTRUCTOR

"GELOSO" R.F. TUNING KIT

Comprises:
5 band tuner — model N2676
2 gang variable condenser — model N80570
2 serial 670 I.F. transformers
Dial and dial pointer mechanism

Build yourself a 5-band value radio tuner around this specially priced "GELOSO" kit.

This kit, No. 7676, is a 5-band unit covering from 520 KHZ-18.5 MHZ.

The tuning block features high selectivity, stability and sensitivity.

Band coverage is:	29- 65 metres
185-580 metres	25- 32 "
65-185 "	16- 25 "

Kit features a special 2-gang condenser with built-in trimmers designed to match into the "GELOSO" tuning block. Fully calibrated 4in square dial with first and second I.F. transformers.

Detailed instructions with suggested valve combinations are included with each kit.

$13.00

POST FREE

"INSTROL" EDUCATIONAL ELECTRONIC KIT

In this Electronic Age, every person should have some knowledge, however elementary, of "how it works." The new instrol 20 in 1 electronic kit will enable you to understand in an absorbing, simple manner the basic principles underlying computers, satellite communications, industrial electronic devices, etc., etc. You make 20 different experimental circuits, including 10 working radio transistor operated radio circuits.

Audio Amplifier circuits, home intercom, testing circuits including Audio Frequency Oscillator and Signal Tracer, Morse Code practice set and telegraph transmitter, etc. You use and learn about the amazing SOLAR CELL.

NO TOOLS OR SOLDERING IRON REQUIRED

All components pre-wired, ready for clip-on assembly, 50-page Instruction Manual supplied.

ONLY **$17.60**

(Plus 85c Post)

INSTROL SPEAKER BOX — OPTIONAL EXTRA

This amplified speaker box when replacing the earphone supplied with the kit above allows others to hear the results you achieve.

$6.40, plus postage.

J. H. MAGRATH & CO. PTY. LTD.
208 Lt. Lonsdale St., Melbourne, Vic. 3000. Tel. 663 3731

The scale provided with the dial assembly has a separate logging scale, and four blank scales which may be filled in as part of the calibration and alignment. Alternately, you may obtain a photographic reproduction of our original scale through the Information Service, for 50c each.

Set the dial pointer to 100 on the logging scale, or to the ends of the scale arcs. With the gang fully meshed, tighten all grub screws. The Fine Tuning knob should tentatively be set to its mid travel and left in this position while the tunable IF is aligned.

Set the dial pointer to 4MHz, or 95 on the scale. Set the band switch to the 8-4MHz range. Feed in a signal from a signal generator, set precisely to 4MHz and adjust the slug in L6, followed by the slug in L5, for maximum response. Set the dial pointer to 8MHz, or 6 on the scale. Adjust the trimmer for L6, followed by the trimmer for L5, for maximum response. Return to 4MHz and make any readjustment necessary. Then return to 8MHz and make a further adjustment. This procedure must be repeated until both points are correct.

Luckily, even if a signal generator is not available, the foregoing alignment may still be done accurately by using the 4.5MHz and 7.5MHz signals of station VNG, the new standard frequency station in Victoria. Details of this station were given in the magazine for May, 1970. As the 4.5MHz frequency is only in operation during the night time, alignment will be subject to this restriction.

The front end is aligned as follows: Set the dial pointer to 4MHz, corresponding also to 12MHz on the scale, then set the band switch to the 8-12MHz range. Feed in a signal from the signal generator, set precisely to 12MHz and adjust the slug in L4 for maximum response, making sure also to peak up the tuning of L3. If a generator is not available, then the VNG time signal on 12MHz may be used instead, between the hours of 7.45 am and 7.30 pm, Australian Eastern Standard Time. Once set, the slug in L4 MUST NOT BE TOUCHED AGAIN.

With the dial pointer still in the same position, corresponding to 16MHz, set the band switch to 20-16MHz. Feed in a signal from the generator, set precisely to 16MHz and adjust the appropriate trimmer across L4 for maximum response, followed by peaking of the tuning of L3. If a generator is not available, we suggest that you tune in a station within this range and on a known frequency, and adjust the trimmer across L4 to bring the station to the correct position on the dial.

With the dial pointer against set to 4MHz, corresponding also to 12MHz on the scale, set the band switch to 16-12MHz. Feed in a signal from the signal generator, set precisely to 12MHz and adjust the appropriate trimmer across L4 for maximum response, also peaking the tuning of L3. If a generator is not available, use can again be made of VNG on 12MHz as before.

Set the band switch to 1.5-0.5MHz and tune in a broadcast station of known frequency. Adjust the appropriate trimmer across L4 to bring this station to the correct position on the dial.

So far, we have not set the Fine Tuning control. Ideally, the point of travel of the rotor should be found, such that, turning the control either way gives equal frequency change from the reference. Having done this, it may be necessary to adjust the trimmer across the tunable IF oscillator section of the gang, so that the 8MHz point on the dial is correct.

To adjust the BFO. tune in a steady signal between 4 and 8MHz. Tune slightly to the low frequency side of the signal and switch to SSB. Set the 2.5K tap pot. and the BFO Tune pot. With all resistance in circuit. Now adjust the Philips trimmer on the BFO for zero beat. Re-tune by an equal amount, to the other side of the signal and set the BFO Tune pot. to the other end of its travel. Adjust the 2.5K tab pot. for zero beat. It will now be necessary to repeat the procedure for the low frequency side, and so on, until both sides are set correctly.

It is not easy to lay down the exact positions where the BFO should be set. This can best be determined experimentally, such that the best SSB reception is obtained. When tuning from one extreme to the other, the "hiss" should sound much the same. This indicates that the BFO is tuned equally about the IF pass band.

This completes the adjustment and alignment and your new receiver snould now be ready for full operation. Although it is of modest size and design, it is capable of quite a surprising performance. The selectivity is adequate for all normal listening and the overall frequency stability is better than we originally hoped for. It must be emphasised, of course, that the stability is not as good as an equivalent crystal-locked front end.

As the design is very simple, it is reasonable to expect that there would be a number of spurious responses. This is so in practice but they usually fall in such a position as not to cause much if any, inconvenience. Also, because of the simplicity of the front end design, it is vital that the RF Tune control be set to the wanted frequency and not otherwise, which can result in an unwanted signal overriding the wanted one. However, a little practice is all that is required to get used to this situation.

YOU WILL NEED THESE PARTS

1 Chassis 10in x 6in x 2in (with partition).
1 Front panel 11in x 6in.
1 Dual ratio dial assembly (Jabel).
1 Rotary switch, 3 wafers, 1-pole, 11-position.
1 Toggle switch, miniature SPST.
1 Toggle switch, miniature DPDT.
6 Knobs.
1 Power transformer, 2 x 6.3V, 1A.
1 2-pin miniature speaker socket.
1 Aerial terminal.
1 Earth terminal.
1 ¼in flexible coupling (Jabel).
1 ¼in extension shaft.
1 Miniature tag board, 6 pairs.
1 Miniature tag board, 9 pairs.
1 Miniature tag board, 12 pairs.
1 Miniature tag board, 17 pairs.
1 Miniature tag board, 19 pairs.
1 Printed wiring board (R.C.S. 745 or similar).
1 Printed wiring board (70/BF08).
1 2-tag strip.
1 5-tag strip.
5 Rubber grommets.
2 2.5mH RF chokes.
1 1mH RF choke.
1 680uH RF choke.
1 S-meter (University HK35 or similar).
3 Ferrite toroidal formers, Q2 material, Ducon type F4040/2.
2 Neosid coil formers, 7.6mm x 2½in, with grade 900 slug and can.
1 Neosid coil former, 7.6mm x 1¼in, with grade 900 slug and can.
3 Murata ceramic resonators, type SFD-455B.
1 Murata ceramic resonator, type SFB-455A.
Mounting panel for IF strip. Hookup wire, solder, screws, nuts, power flex and plug, solder, lugs, etc.

TRANSISTORS

3 2N5485 (motorola).
10 BF115, BF184, BF185, etc.
2 BC108.
1 TAA300 IC.

DIODES

4 EM401, BY126/100,etc.
1 BZY94/C12 zener.
1 BZY88/C6V2 zener.
1 BA102.
2 OA91.

RESISTORS (½ watt)

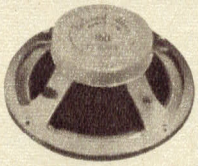
3 47 ohms
1 150 ohms
1 270 ohms
3 470 ohms
1 560 ohms
1 680 ohms
1 1K
3 2.2K
1 2.7K
7 3.3K
10 4.7K
2 8.2K
1 10K
2 15K
1 18K
3 22K
2 33K
2 47K
2 100K
1 180K
1 2.5K linear pot.
3 2.5K log pots.
2 2.5K tab pots.
2 25K tab pots.
1 100K tab pot.

CAPACITORS

1 4.7pF NPO ceramic
1 10pF NPO ceramic
3 12pF NPO ceramic
2 27pF NPO ceramic
1 56pF NPO ceramic
4 68pF polystyrene
4 100pF polystyrene
1 220pF polystyrene
1 390pF polystyrene
3 .001uF polystyrene
1 .0047uF 100V polyester
3 .01uF 25V ceramic
4 .01uF 160V polyester
1 .033uF 100V polyester
1 .047uF 25V ceramic
5 0.1uF 25V ceramic
1 0.47uF 25V ceramic
1 0.64uF 64VW electrolytic
1 5uF 12VW electrolytic
1 25uF 6.4VW electrolytic
1 50uF 12VW electrolytic
1 125uF 10VW electrolytic
1 200uF 10VW electrolytic
1 320uF 6.4VW electrolytic
1 1000uF 10VW electrolytic
1 1000uF 20VW electrolytic
6 6-60pF trimmers, Philips 222 808 01001
1 10-415pF variable, single
1 10-415pF variable, 2-gang

SOUTH AUSTRALIANS!

Adelaide's most progressive merchandiser of Hi-Fidelity Stereo Equipment continues to introduce world famous brands at attractive low prices!

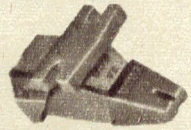


RICHARD ALLAN

A full range of these famous English loudspeakers is now available from our new store in the heart of Adelaide. CONSERVATIVELY RATED, in the best British tradition, Richard Allan loudspeakers incorporate massive ceramic magnets, long voice coil assemblies and a corrugated cambric suspension that ensures linear performance at high power. Magnetic flux is unusually high, being 105,000 maxwells for the 10in units, 186,000 maxwells for the 12in Super models and 220,000 maxwells for the 15in bass speaker. Call and hear these excellent speakers in action . . . you'll be agreeably impressed with their outstanding performance and pleasantly surprised at our low Challenge prices.

EMPIRE

The world's best magnetic cartridges from the U.S.A.



Reviewers all over the world have acclaimed the new generation Empire pick-ups. The 888VE and 999VE have firmly established themselves among the top cartridges available . . . and now the new 1000ZE Calibration Standard Cartridge completely eclipses all other pick-ups and sets new performance standards for Hi-Fidelity reproduction.

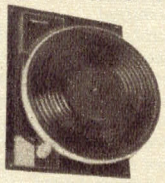
EMPIRE 888VE. Compliance 30 x 10 -6 cm/dyne, tracking force 1½grm, frequency response 6-32,000Hz, separation 30db, output 5 millivolts per channel, hand-polished 0.2 x 0.7 mil elliptical diamond, $68.

EMPIRE 999VE. Compliance 30 x 10 -6 cm/dyne, tracking force 1 gram, frequency response 6-35,000Hz, separation more than 30db, output 5mv per channel. hand-polished 0.2 x 0.7 mil elliptical diamond. $75.

EMPIRE 1000ZE. Compliance 35 x 10 -6 cm/dyne, tracking force ¾ gram, frequency response 4-40,000Hz, separation 35db, output 4mv per channel, hand-polished 0.2 x 0.7 mil elliptical diamond. $100.

CONNOISSEUR

ENGLISH QUALITY AT UNBEATABLE PRICES!



BD-1 KIT

THE CONNOISSEUR BD-1 BELT-DRIVE TURNTABLE KIT features a cast. non-ferrous platter 14-pole syncronous motor and heavy-duty drive belt. The unit is unusually robust, employing a ¼in diameter precision ground spindle running in a phosphor bronze bearing. Performance is exceptional . . . rumble is down 60db (RIAA), wow and flutter are well below 0.1% and hum radiation from the motor is extremely low.

BD-1 TURNTABLE . . $34.50
BD-1 ASSEMBLED . . $39.50

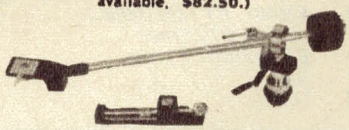


BD-2 RECORD PLAYER

CONNOISSEUR BD-2 RECORD PLAYER is a complete turntable/pick-up arm combination of highest quality and performance. The belt-drive turntable is the BD-1 described above and the tone arm is the famous Connoisseur SAU-2. The low-friction gimbal-pivot arm allows effective tracking below 1 gram and a unique anti-skating device is incorporated. The turntable is isolated from the attractive Afromosia wood base by springs to elliminate acoustic feedback. An oil-damped hydraulic lift is included and is conveniently controlled at the front end of the turntable base. A stylus alignment template and accurate stylus pressure scales are provided. The BD-2 Player, complete with Afromosia wood base and moulded perspex cover represents excellent value for money.

BD-2 PLAYER $99.50

(BD-2 Chassis without base and cover also available, $82.50.)



SAU-2 TONE ARM

Another top-value product from Connoisseur, the SAU-2 tone arm offers features not normally associated with tone arms in its price range. A unique off-set Gimbal-type pivot distributes the arm mass evenly between two bearings, thus permitting a gravity operated side-thrust compensating action to be incorporated without extra components. This consists of a small arm on the inner ring of the gimbal that gives an outward bias variable by the setting of a sliding weight. Other features include oil-damped hydraulic lift, precision stylus pressure balance, fully adjustable headshell (½in standard mounting) and a protractor enabling adjustment for optimum tracking.

$29.50

STAX

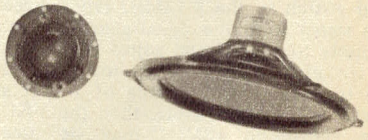
ELECTROSTATIC HEADPHONES



The new STAX SR-3 Electrostatic Headphones are causing a sensation at Challenge! English reviewers have likened their performance to the best available loudspeaker systems! Low-distortion electrostatic radiators provide unequalled quality of reproduction characterised by razor-sharp definition and lack of colouration. Frequency response of the SR-3 headphones is 30-25,000 Hz. Weight of the headset is extremely light, allowing hours of comfortable, fatique-free listening. Best news of all is the low Challenge price which includes the SR-3 headset and SRD-5 power supply.

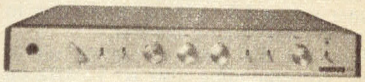
$76.50

SEAS



Quality speakers from Scandinavia, the new S.E.A.S. speakers exceed Hi-Fidelity specifications laid down by German standard Din 45 500. Two low-resonance bass speakers are available, the 21 TV-EW (8", 25Hz) and the 25 TV-EW (10", 20Hz). Both are designed so that the upper cut-off frequency is lower than the break-up frequency of the diaphragm, thus eliminating the relatively expensive low-pass filter section of the crossover network. The new 87H "soft dome" tweeter is characterised by extremely low distortion, wide polar dispersion and extended frequency response (1500-20KHz). It is rapidly becoming recognised as one of the finest tweeters available. Check out our low prices for these excellent loudspeakers at our new store in the heart of Adelaide.

CAMBRIDGE P40



Space-age styling heralds a fresh new approach to solid-state circuitry. English research and engineering have produced an amplifier of unique design with fantastic specifications . . . e.g. 0.05% harmonic distortion AT ALL FREQUENCIES at 20 watts r.m.s. Overload characteristic at the input stage is a remarkable 60 db. Read the rave review in HI-FI News, APRIL, 1970, and then call and hear the P-40 in action!

SUGDEN CLASS A

It had to come! Famous English Sugden Class A transistor amplifiers have been described as sounding "different" by reviewers. Call in and make your own evaluation!

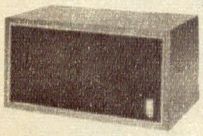
Challenge RECORDING CO.

HI-FI STEREO CENTRE

6 GAYS ARCADE, ADELAIDE, S.A.
Phone 23-2203.

ADELAIDE'S BEST VALUE HI-FI STEREO!

CELESTION
WORLD LEADERS IN BOOKSHELF SPEAKERS!

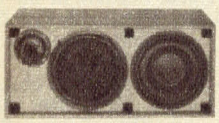


DITTON 10

Measuring only 12¾in x 6¾in x 8¼in, the Ditton 10 offers performance that rivals much larger speaker systems. The secret of its remarkable bass response is a specially developed 5in long throw woofer with a free-air resonance of 35 Hz. Treble range is covered by the famous HF 1300 pressure type high-frequency unit, which varies only plus/minus 2 db from 3.5 KHz to 15 KHz. The Ditton 10 is the ideal answer for the critical listener with only limited space available! Pop into our new store in the heart of Adelaide and hear this amazing unit . . . we'll be only too pleased to demonstrate it!

$66.50 ea.

DITTON 15



This truly superlative bookshelf speaker system has embarrassed more than one doubting audio-phile! Genuine low bass response, down to 30Hz, is achieved by an ingenious combination of an 8in passive radiator working in sympathy with a low-resonance (25Hz) 8in bass driver. This system results in lower harmonic and Doppler distortion, and also gives higher power handling capacity (15 watts r.m.s.). Above 5KHz the excellent HF 1300 Mk 2 tweeter provides wide-range, low distortion treble performance with effective polar dispersion. Measuring only 12in x 9¼in x 9¼in, the Ditton 15 is a magnificent speaker system . . . Hear it soon!

$99.50 ea.

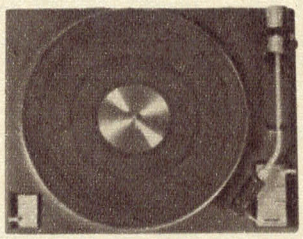
DITTON 25
PERFORMANCE PLUS

This revolutionary new speaker system represents the culmination of years of research and development by Celestion engineers. All drive units employed are completely new . . . the two HF 1400 mid-range/treble units were developed from the highly successful HF 1300 Mk 2 tweeter, an ultra high-frequency unit covers the range from 9KHz upward (on reference at 20KHz!) and a 20Hz low-resonance, long throw, 12in bass speaker, aided by a 12in passive radiator, provides magnificent bass performance. Overall frequency response is 20-40,000Hz, and specifically plus/minus 2db from 50 to 20KHz (—4db at 45Hz). Power handling is 45 watt r.m.s. This remarkable specification from a cabinet measuring only 32in x 14in x 11in! The Ditton 25 is one of the most advanced speaker systems available today, yet it costs far less than comparable units from other brands.

CELESTION
"Power Range" Loudspeakers for ORGAN, GUITAR and PUBLIC ADDRESS

Celestion "Power Range" speakers are incorporated in many top-quality imported musical instrument amplifiers. This series has been specifically designed to handle large power outputs with high efficiency. An 18in, 15in and two 12in models are available. You'll be surprised at our low prices for these robust, heavy-duty imported speakers!

MICRO
MR-111 TURNTABLE



At last! A belt-drive turntable arm combination that offers the performance and facilities you've always wanted! The MR-111 incorporates a micro-switch cut-off circuit, which stops the turntable automatically after the record has been played. The static balance tone arm tracks down to 1 gram and includes an adjustable anti-skate device and hydraulic lift. The 12in cast aluminium-alloy platter is driven by a large, well shielded 4-pole synchronous motor via a special polyurethane belt. Rumble is specified at better than 45 db and wow and flutter at less than 0.1 per cent. At the low Challenge price the Micro MR-111 is top value!

$72.50

PD82F IS SUPER VALUE!



Featuring a large ceramic magnet assembly and curvilinear cone, this 8in full-range speaker gives performance that completely belies its low price. Its long-throw suspension provides excellent bass and power handling is 15 watts in suitable cabinets. Because of its extended frequency response and natural tonal balance, the PD82F outperforms much more expensive units in subjective listening tests. Call in and listen for yourself!

$12.50

FANTASTIC DISCOUNT!

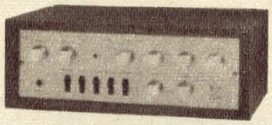


HANIMEX CORAL TA7700

This fine stereo tuner/amplifier features silicon transistors throughout, quasi-complementary circuitry and a big power output of 50 watts r.m.s. per channel at 8 ohms (Harmonic distortion 0.1 per cent at 45 watts). Frequency response is 20-40,000 (plus minus 1db). Almost $100 below our normal discount price of $395! Limited quantity only . . . . . **$299.00 ea.**

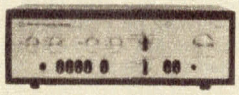
LUX
JAPAN'S FINEST AMPLIFIERS

Now firmly established in Australia, Lux amplifiers enjoy a reputation for quality and performance second to none. Sophisticated solid-state circuitry and unequalled workmanship combine with low Challenge prices to offer outstanding value for money.



LUX SQ-77TW

30 watts r.m.s. per channel at 0.5 per cent total harmonic distortion into 8 ohms. Frequency response is 10-50,000Hz (plus 0db, —3db). Features separate Negative Feedback bass and treble tone controls for each channel. Teak cabinet . . . . . **$179.00.**



LUX SQ-503

Latest of the Lux range, this magnificent amplifier features exclusive LUX NF tone controls with turnover frequencies at 200Hz, 400Hz, 2KHz plus 4KHz. Comprehensive facilities include bass boost circuit (80Hz, 6db per octave), A/B speaker systems selector and variable input impedance for magnetic pick-up. Pre-amplifiers and power amplifiers are individually adjusted at the factory to ensure optimum performance. 30 watts r.m.s. at 0.5 per cent THD at 8 ohms . . . . . **$269.00.**

LUXMAN 507

Boasting an r.m.s. power of 60 watts per channel at 8 ohms, the new Luxman SQ-507 demands the attention of enthusiasts seeking "state of the art" equipment. Harmonic distortion measures less than 0.08 per cent at 50 watts. Features include exclusive LUX NF tone controls with variable turnover frequencies, front panel switching for 2 sets of stereo speaker system, protection circuit, etc. . . . . **$350.00.**

New Release!

ROTEL
AMPLIFIERS

Model RA310
15 watts r.m.s. per channel at 8ohms. Harmonic Distortion: Below 0.2 per cent (15 watts). Intermod Distortion: 0.5 per cent (15 watts). Response: 20-30,000 Hz (—1½ db at 15 watts). Wooden cabinet, full facilities.

Model RA610
32watts r.m.s. per channel at 8ohms. Harmonic Distortion: Below 0.1 per cent (32 watts). Intermod Distortion: 0.1 per cent (32 watts). Response: 5-50,000 Hz (—1½ db at 30 watts). Wooden cabinet, full facilities, slide type tone controls.

Challenge RECORDING CO.

HI-FI STEREO CENTRE

6 GAYS ARCADE, ADELAIDE.

Phone 23-2203.

Daylight Controls Interior Lighting

Worried about burglars raiding your home while you are on holidays? The "Autolight" will switch your house lights on at sunset, thus discouraging such unwanted visitors. Want a gimmick to impress your visitors? The "Autolite" is an excellent example of the "marvels" of the electronic age.

by Leo Simpson

Many people going on holidays worry about the possibility of burglars raiding their home while they are away. While a burglar alarm may be fitted, this does not discourage the potential burglar from making an attempt. The Autolight provides an additional safeguard and peace of mind by switching on your house lights at sunset, thereby giving the passerby the impression that someone is "home".

The Autolight will also serve a useful purpose by turning on your patio lights at dusk so that one has a pleasant transition from the fading daylight to artificaial lighting. It could also control a nightlight in a constantly used passageway.

The Autolight takes the form of a compact diecast box with a light dependant resistor (LDR) protruding from one end. The box can be fastened to, or buried in a wall so that daylight has access to the LDR. A switch is fitted to the box so that any lights controlled by the device can be switched off if not needed.

The circuit of the Autolight is based on a phase-controlled Triac. The phase-control section of the circuit is rendered inoperative by the LDR whenever light falls upon it. As the ambient light becomes dimmer, the resistance of the LDR increases so that the phase control circuit comes into action to switch on the Triac.

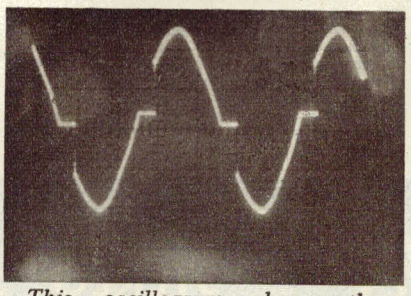
For readers who may not be familiar with the operating principles of Triacs and phase-control circuits, the following explanation should be helpful. The Triac is closely related to the Thyristor (silicon controlled-rectifier) in that it is normally non-conducting until triggered into conduction by a gate signal, in the same way as a Thyristor. In fact, the easiest way to think of a Triac is as a pair of Thyristors connected in inverse parallel with a common gate electrode and a common case.

In essence, the Triac is a bidirectional switch which after being triggered into conduction, stays "on" until the supply voltage decreases to zero or reverses in polarity, when it turns off and can be switched on again. Used with AC, a Triac can be triggered into conduction at any point on either half cycle by a low voltage signal of either polarity applied between the gate electrode and terminal 1 (anode 1). Note that, since the Triac is a bidirectional device it has no anode or cathode as such. The two end terminals are normally referred to as "anode 1" and "anode 2" or "terminal 1" and "terminal 2".

As the Triac is a switching device which is either fully conducting or "off" the only means by which it can provide variable power control is to use it as very rapid switch which closes for varying portions of each half-cycle of the AC voltage waveform – by adjusting the instant during each half-cycle when it triggers into conduction. If the Triac is triggered late in each half-cycle, low power is applied to the load and vice versa.

While there are many methods of varying the triggering point of a Triac, the most satisfactory one is known as "phase control". This involves applying to the gate electrode a sharp pulse of current whose phase, relative to the AC waveform, can be varied. This is done by means of a capacitor which is charged while the Triac is in the non-conducting state. The time the capacitor takes to charge will depend on its size, the resistance in series with it and the voltage supplied to it.

Referring to the circuit in figure 1 and ignoring, for the moment, the function of the LDR, we have a basic power control circuit. In this circuit the 0.1uF capacitor is charged from 240VAC via the 22K resistor. The capacitor's charge is delivered to the gate of the Triac via a voltage sensitive device which conducts only when the voltage across it reaches a certain value. The voltage sensitive device used here is a Diac, a three-layer symmetrical breakover diode which is an open-circuit until the applied voltage rises to the breakdown rating, whereupon it breaks down to a negative resistance. The breakdown voltage is generally around 25 to 40 volts, in either direction.



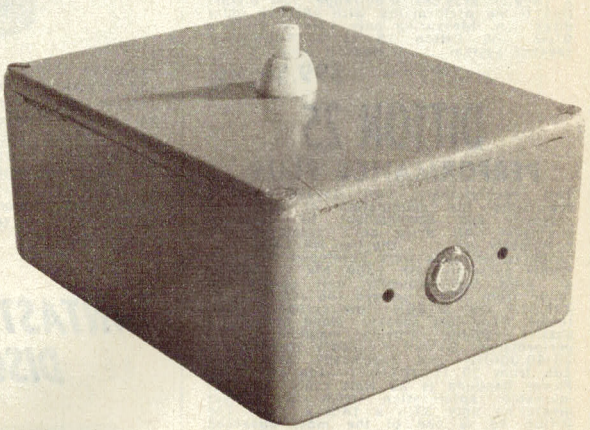
This oscillogram shows the voltage waveform across the load with the LDR out of circuit, i.e., not illuminated.

The oscillogram shows the power applied to the load when the light dependant resistor is effectively out of circuit, i.e., when there is no light on it and, it is a high resistance. When light falls on the LDR, its resistance is in the region of 500 to 1000 ohms so that the voltage applied to it, and the capacitor, is less than the breakover voltage of the Diac and consequently the Triac is not triggered.

When the ambient light level falls, the resistance of the LDR rises to the point where the capacitor is able to charge to the breakover voltage of the Diac and the Triac is trigged, but late in the half cycle. At this point, a phenomenon familiar to designers of light dimmers becomes evident – that of "Snap-on".

"Snap-on" refers to the abrupt change in firing angle just after the initial triggering of the Triac. While the mechanism of this snap-on effect need not be explained here, it will suffice to say that it causes the lamp to initially light at somewhere between minimum and half-brilliance.

Asymmetry in the Diac/Triac combination will also cause another problem in that, initially, the Triac fires on every second half-cycle so that it acts like a Thyristor. As the LDR rises to a sufficiently high value, the Triac reverts to normal bidirectional operation.



The complete unit is housed in a diecast aluminium box. The LDR is mounted on the front face of the box and the manual control switch on the top.

The combination of these two effects, snap-on and asymmetry, conspire to effectively turn the lamp or lamps on in two steps instead of a gradual increase in brilliance. We did not feel that this was a drawback, however, since this device is intended essentially for applications where a light-operated on/off control is required.

The Autolight may be used to control just one light or a number of lights throughout the house. All that is required is that the unit be placed so that ambient light has access to the LDR. Note that the unit should be mounted so that the lights it is intended to control do not illuminate the LDR and cause the unit to "hunt".

Power consumption of the unit during the day when the lights are off, is small – approximately 3 watts, so that

the cost of operating is governed almost solely by the number of lamps being controlled.

Figure 2 shows a similar circuit in which the Triac/phase-control circuit is actuated by an LDR. The major difference is that the lights or any other load are turned on when light falls on the LDR. This is included for those readers who may wish to experiment with such a circuit.

All but two of the Triacs specified may be used with incandescent lamp loads up to 1000 watts. The SC141D and AC06DR should not be used with loads in excess of 500 watts. This means that lights in several rooms of the house can be controlled with the one unit. While we have included a 2 amp switch to turn off the lights when not required at night, a higher rated switch must be used if loads in excess of 500 watts are to be controlled. The normal fascia-mounting light switches which have a rating of 5 amps or more suggest themselves as the most likely alternative.

While all the Triacs specified have adequate surge ratings to cope with their maximum specified loads, the individual incandescent lamps should not have ratings in excess of 100 watts. This is because the surge, which can occur when a high wattage lamp burns out and arcs over to the filament supports, can exceed 100 amps. While admittedly these circumstances are rare, a surge of this magnitude would mean destruction of the Triac.

As with other Triac circuits employing phase control, the two circuits presented here tend to radiate electrical interference when power is being applied to the load. This is due to the extremely rapid switch-on times of the Triac. The suppressor inductor L1 and the two .01uF capacitors bypassing the mains help keep the interference to a minimum. It is important that the Autolight should be housed in an earthed metal case, as the inductor is an efficient radiator of the electrical interference it is intended to suppress and it should be shielded.

Incidently, neither of the two circuits as presented are directly suitable for controlling fluorescent lights.

The details of construction are very similar to the 240V Flasher unit featured in the November 1970 issue. While the approach we have used is not mandatory, we do recommend that the unit be housed in a sturdy container, preferably a diecast aluminium box. The box we used measures 4-5/8 x 3¾ x 2in and is available from most parts suppliers.

The Triac is mounted on a small heatsink measuring 2½ x 1½ inches, made from 18-gauge aluminium. Since the case of the Triac is at mains potential, the plate must be isolated from the case by two insulating pillars. The AC06DR and AC10DR are mounted using the clamps which are supplied at purchase while the other Triacs specified are plastic pack units and mounted with a single screw and nut. If the power to be controlled is less than 300 watts the plastic pack units may be soldered directly into the circuit, with no additional heatsink required.

The interference suppression inductor L1 is not available commercially but is quite easily made. Start by winding a layer or two of thin insulation tape on a 2in length of 3/8in diameter ferrite rod. If a full length ferrite rod has been purchased it can be cut by filing a nick right around the circumference of the rod and then snapping it as if it were of glass – do not try to saw the rod. Close wind 50 turns of 18 B&S enamelled wire over the insulation tape. Then wind insulation tape tightly over the rod in a couple of layers. This last step is important – if it is not wound tightly the inductor will make a buzzing noise due to currents being switched by the Triac.

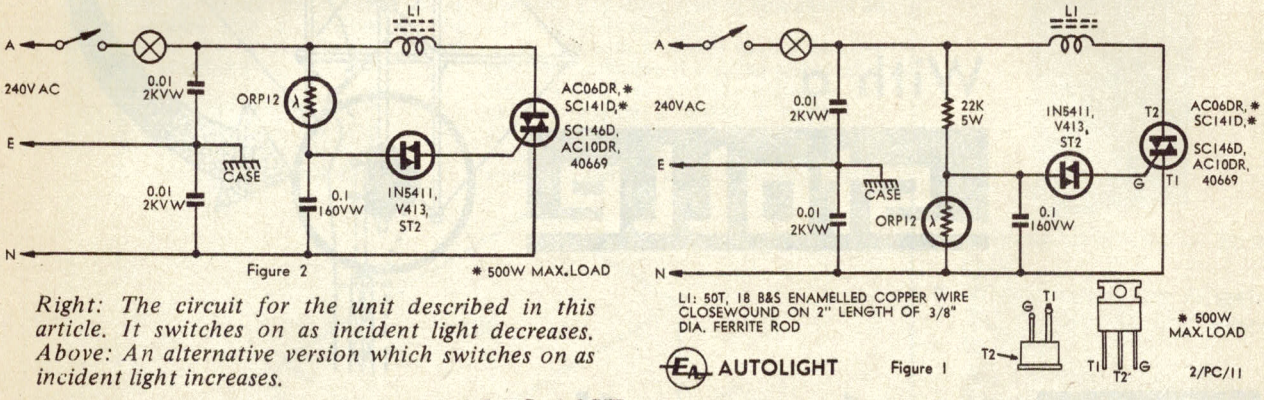
A point about wiring is appropriate here. Note that the lamp is shown on the circuit diagram as a lamp symbol. Not shown directly on the circuit is the two core flex which carries power to the load. This can be in the form of ordinary mains lighting flex which will be sufficient for up to the maximum load specified.

The mains input and output cords should be passed through a grommetted hole in the case and securely anchored with a mains cord clamp. The earth wire should be connected to the case. Most of the circuitry is mounted on a suitable length of miniature tagboard. Layout is not critical but good wiring practice should be followed.

The LDR is mounted by drilling a suitable clearance hole in the case and securing the LDR in position with Araldite. We mounted the LDR so that it was slightly proud of the case surface.

Remember that this is a mains-operated device. In no circumstances should any work be carried out on it while power is applied. All the

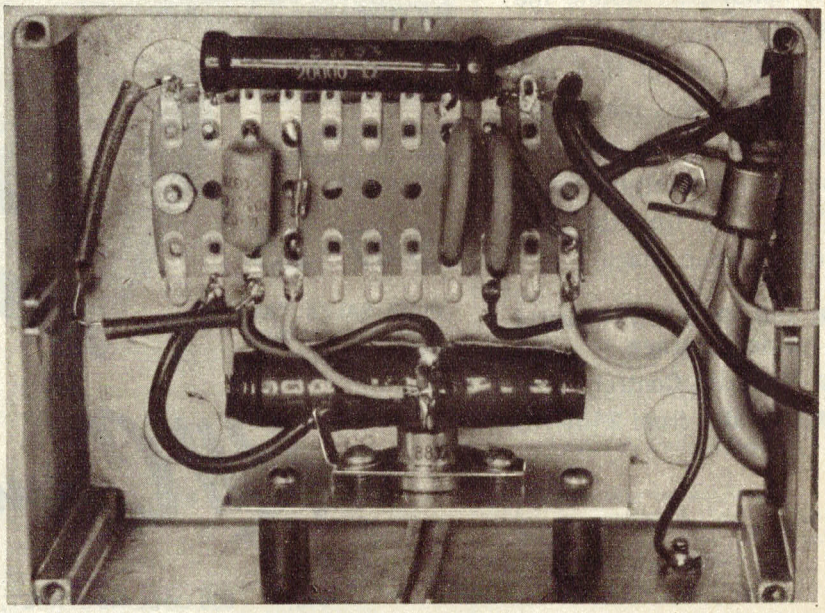
(Continued on page 190)



Right: The circuit for the unit described in this article. It switches on as incident light decreases. Above: An alternative version which switches on as incident light increases.

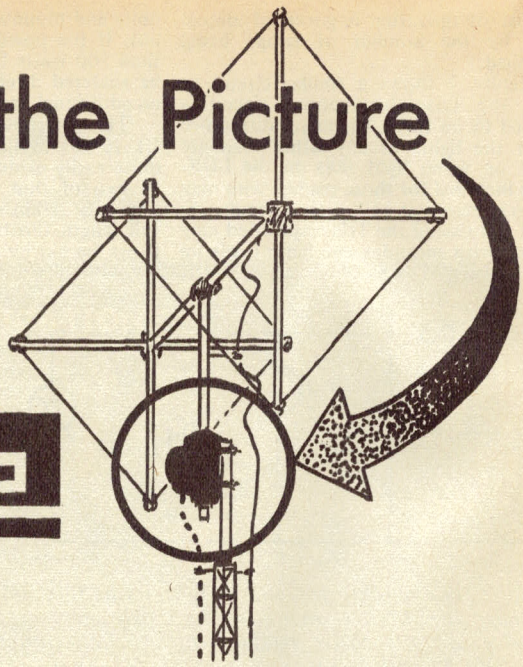
PARTS LIST

- *1 diecast box, 4-5/8 x 3-5/8 x2-1/8 inches.*
- *1 2-amp mains switch.*
- *1 AC06DR or equivalent Triac.*
- *1 1N5411 or equivalent Diac.*
- *1 ORP12 light-dependant resistor.*
- *1 ferrite rod inductor (see text).*
- *1 22K/5W resistor.*
- *1 0.1uF/160VW polyester capacitor.*
- *2 0.01uF/2KV ceramic disc capacitors.*
- *1 11-lug length of miniature tagboard.*
- *1 Heatsink for Triac.*
- *Insulating spacers, mains cord, mains cord clamp, solder lug, Araldite, screws, nuts, hook-up wire, solder, etc.*



Interior view of the complete unit. The Triac, with its heatsink, is shown at the bottom of the picture, supported on two insulating pillars. Note the cable clamp (right) securing the mains cable and the two leads to the lighting circuit.

Put Yourself in the Picture



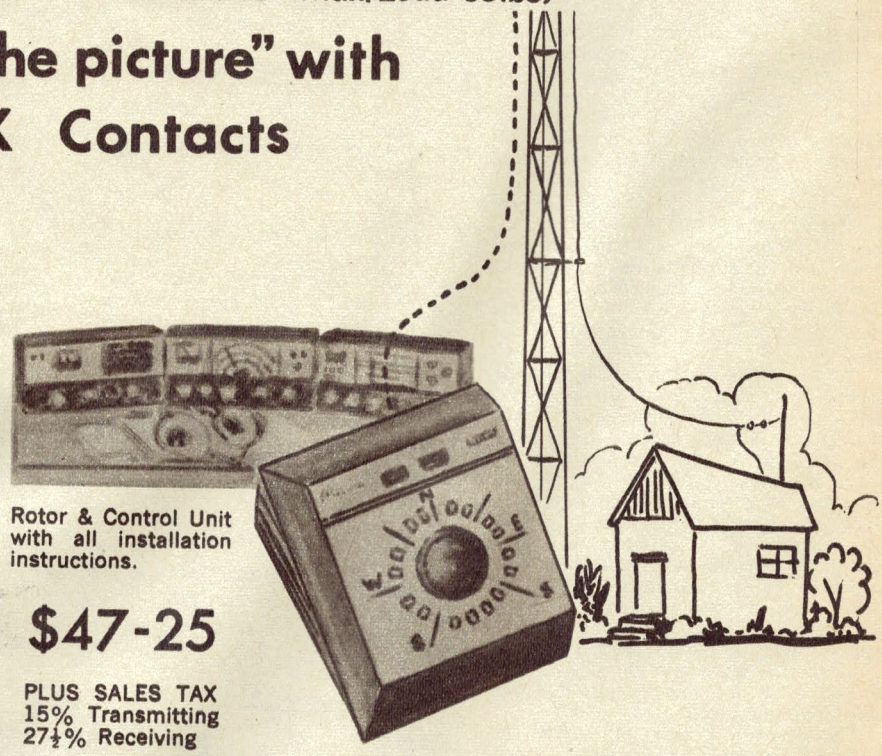
With a

stolle

stolle automatic Aerial Rotor

for *LIGHTWEIGHT BEAMS* (Max. Load 55lbs)

Puts YOU "in the picture" with Increased DX Contacts



Still rotating your antenna by hand? . . . Rotate the **STOLLE** way. Select direction on Control Unit and Rotor operates then stops automatically at the preset compass setting. Beam "SPOT ON" from the comfort of your shack.

- **360 Rotation — world wide coverage.**
- **Fingertip Control.**
- **Operates from 240V AC mains.**

Rotor & Control Unit with all installation instructions.

$47-25

PLUS SALES TAX
15% Transmitting
27½% Receiving

R.H. Cunningham PTY. LTD.

VIC.	608 COLLINS STREET, MELBOURNE, 3000. PHONE: 61 2464.
N.S.W.	64 ALFRED ST., MILSONS POINT, 2061. PHONE: 929 8066.
QLD.	L.E. BOUGHEN & CO., 30 GRIMES STREET, AUCHENFLOWER, 4066. PHONE: 70 8097.
W.A.	34 WOLYA WAY, BALGA, 6061. PHONE: 49 4919.

RHC 2

REVOLUTIONARY GUNNS HELP MICROWAVES GO SOLID STATE

The technology of radar and microwave communications systems is rapidly changing because of the increasing use of semiconductor devices. Just as the development of transistors and microcircuits has achieved the "solid state" electronics revolution at the lower end of the frequency spectrum, so Gunn devices and related elements seem likely to change completely the scope of microwave electronics.

by J. C. BASS, Allen Clark Research Centre, The Plessey Company Ltd.

Solid state techniques are likely to extend microwave communications to much more localised systems. A dense country-wide network of telephone, television and computer data transmission systems will probably supersede the few main trunk communication routes which exist at present. There will be far more communications capacity between communities for entertainment, education, industry and business. These local systems will almost certainly make use of higher microwave frequencies which have not been exploited to date. Their signal repeaters will be spaced perhaps as little as two miles apart and they will probably look like tall lamp standards with the solid state repeater in a plastic housing at the top. Such a design will be more aesthetically appealing than the present day pylons with their dish aerials.

The network of local routes will feed into main trunk routes as well as one or two super trunk waveguide communication routes of vast capacity up and down the length of the country. The waveguide systems will most likely use millimetre wave propagation in a waveguide of circular cross-section, which will only be economically feasible through the complete use of microwave solid state devices in them.

Radars are also going solid state. The forerunners of all-solid state radars have been developed in the past few years by a number of British electronics manufacturers and Government research establishments. Miniature radars weighing only a few pounds that can be powered by torch batteries have been made. Their range may be anything up to two miles. The important feature of these new developments is that, just as they extend microwave communications, solid state devices will lead to many more uses for radar.

Some of the applications of the present generation of mini-radars are intruder detection, vehicle sensing and speed measurement for traffic control, docking assistance for large ships, radar beacons and measurements of the velocity of industrial machinery. Long range radar systems require very large transmitted pulse power outputs, perhaps up to 100MW and at present there is no way of producing such powers by semiconductor devices. But the transmitter requirements of short range radars can be met now either by single solid state devices or assemblies of them.

What makes mini-radars possible is the Gunn effect oscillator, a solid state device that provides the microwave power output. It is the forerunner of transmitting devices of increased output and sophistication which will play a major role in the microwave solid state revolution.

The Gunn effect was discovered by Ian Gunn, a British scientist employed by IBM laboratories in the USA in 1963. He was studying the effects of high electric fields on semiconductors; a study which he began at the Royal Radar Establishment (RRE) in Malvern, England. Gunn found that by fixing a metal contact to each side of a slice of gallium arsenide about 0.1mm thick and then applying a voltage greater than about 30V, strong current oscillations at microwave frequencies greater than 1000MHz were produced in the connecting leads.

This was obviously the result of fluctuations in the electron current passing through the gallium arsenide, but the cause was unknown and the effect became known as the Gunn effect. Many possible ways were suggested in which the electron flow in gallium arsenide could become unstable and there were also suggestions that it might not be an inherent effect in gallium arsenide, but caused by the notoriously uncertain behaviour of the metal contacts.

The importance of the effect as a possible basis for solid state microwave sources was realised and a great deal of interest was aroused in the year after its discovery, though it was embarrassing not to know what caused it. However, in 1964 Herbert Kroemer, then of Varian at Palo Alto, realised that the effect was the same as had been predicted in theoretical papers by Brian Ridley and the late Tom Watkins of Mullards, in England, and Cyril Hilsum of RRE. They had calculated that the current-carrying electrons in gallium arsenide, as well as a few other compound semiconductors, could be in two possible sets of states because of the particular conduction band structure in gallium arsenide.

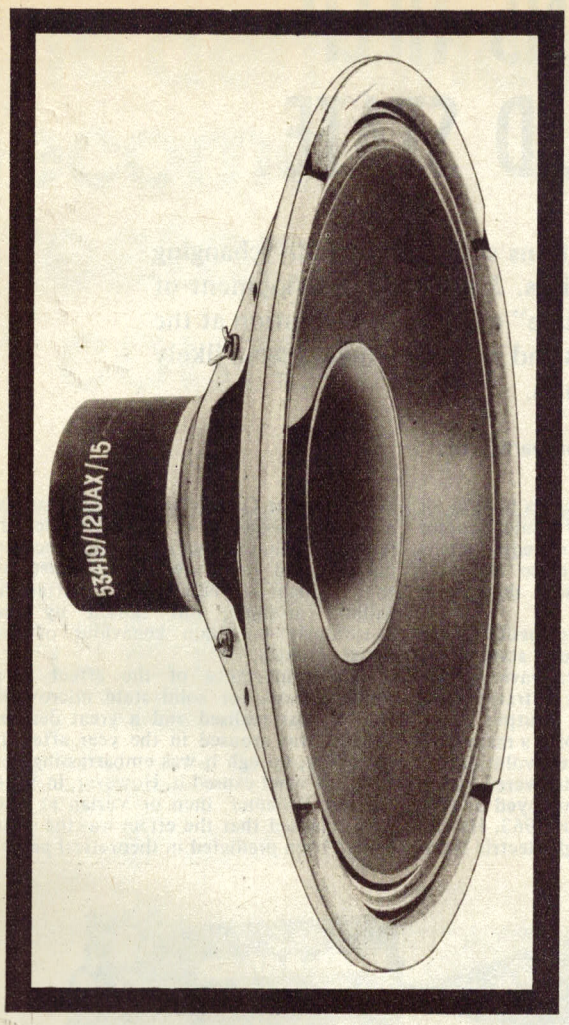


A mini-radar which operates in the 8–12.4GHz "X" band. (By courtesy James Scott (Electronics) Ltd.)

Figure 1(a) shows a representation of the energy of conduction electrons against their momentum. At room temperature virtually all of the electrons are in the lowest energy state (the central valley). When an electric field is applied the resulting stream of electrons gains momentum and their energy increases. If the field is sufficiently strong the moving electrons gain energy quicker than they can dissipate it by collisions with the crystal lattice and so they become "hot" and rise up off the floor of the valley.

Those electrons which acquire energy greater than about 0.36eV will "boil over"

EDITOR'S FOOTNOTE: The theoretical concepts involved in understanding Gunn device operation are quite abstract, and in fact virtually defy an explanation in simple terms. In consequence, readers may find part of this article heavy going. Despite this the article is strongly commended, for the insight it gives into recent developments in microwave technology.



one out of the box

This new speaker combines rugged bass diaphragm with a coaxially radiating high-frequency flare to give excellent wide-range performance. This basic unit has been extensively tested in both high-fidelity and guitar applications and has now been matched with its own specially designed high-frequency flare resulting in an extended range of 45 to 12000 Hz while maintaining a power rating of 20 watts (15 watts for guitar applications). The Hi-Flux magnetic system and matched voice coil give this unit full rich bass and extended treble performance for hi-fi, stereo or guitar applications.

a new 12" duo-cone speaker that handles up to 20watts on extended range

The four versions of this 12" speaker are two extended range types 53419/12UAX/15, 53416/12UAX/8 with a frequency coverage of 45-12000 Hz and two general purpose speakers type 53348/12UA/15 and 53422/12UA/8.

SPECIFICATION	53416/12UAX/8	53419/12UAX/15	53348/12UA/15	53422/12UA/8
TYPE NUMBER	20W (15W for Guitar)	20W (15W for Guitar)	20W (15W for Guitar)	20W (15W for Guitar)
Maximum Power Handling	45-12000 Hz	45-12000 Hz	45-6000 Hz	45-6000 Hz
Frequency Range	50 Hz	50 Hz	50 Hz	50 Hz
Resonance	Alnico V	Alnico V	Alnico V	Alnico V
Magnet Material	13,000 gauss	13,000 gauss	13,000 gauss	13,000 gauss
Flux Density	100,000 lines	100,000 lines	1000,000 lines	100,000 lines
Total Flux	1¾"	1¾"	1¾"	1¾"
V.C. Diameter	8 ohms	15 ohms	15 ohms	8 ohms
Impedance	11¾" P.C.D.	11¾" P.C.D.	11¾" P.C.D.	11¾" P.C.D.
Mounting Hole Centres	4¼"	4¼"	4¼"	4¼"
Maximum Depth				

Special enclosure designs for Hi-Fidelity and guitar applications are available on request.

For further information please contact:
47 YORK STREET SYDNEY 20233

MANUFACTURERS SPECIAL PRODUCTS PTY LTD

ADELAIDE 72 2366 BRISBANE 31 0341 HOBART 34 3836 LAUNCESTON 2 1804 MELBOURNE 67 9161 PERTH 28 6400 SYDNEY 533 1277 & 29 7031

AD6

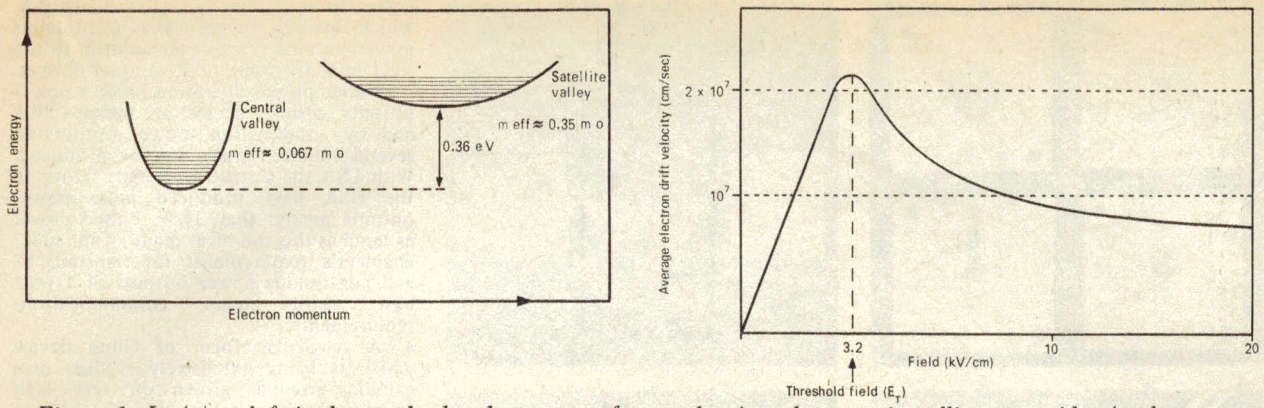


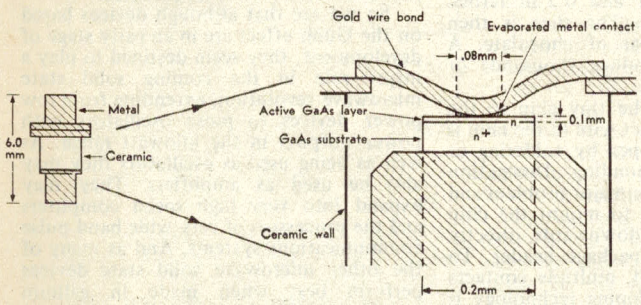
Figure 1: In (a) at left is shown the band structure for conduction electrons in gallium arsenide. As electron energy increases above 0.36eV, electrons transfer from the low-mass "central valley" to the high-mass "satellite valley". The graph in (b), right, plots the average conduction electron drift velocity against field in gallium arsenide. The drop in electron velocity above 3.2KV/cm represents a negative resistance effect, where the growth of electric field "domains" can occur.

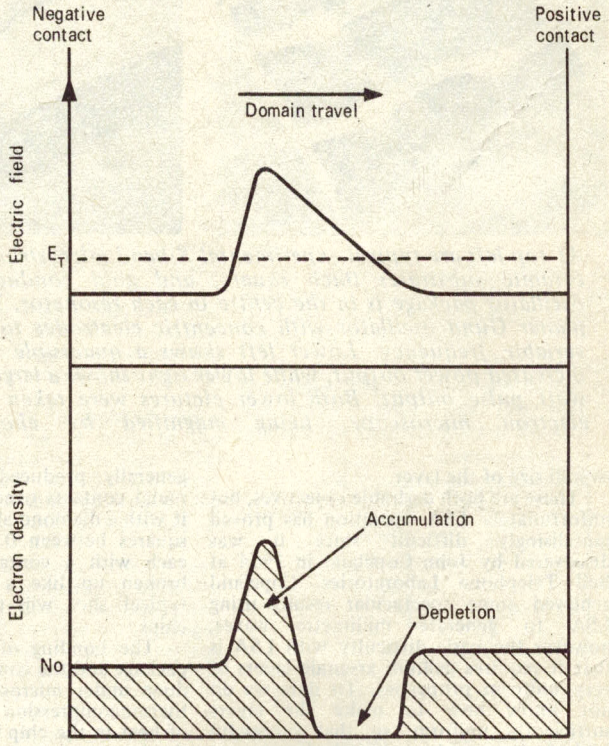
into the higher energy satellite valley where, although they have the same kinetic energy, their average velocity is much smaller or, correspondingly, their effective mass is much greater. The effects of this on the average electron drift velocity appear in figure 1(b), which shows that when a low field is applied to gallium arsenide, electrons move at a velocity proportional to it. When the field reaches 3.2KV/cm sufficient electrons move into the heavy-mass and slowly moving state to produce a drop in the average velocity of the drifting electron stream. If the field increases above the threshold the increasing transfer rate causes a progressive drop in drift velocity until virtually all the electrons are in the upper energy state and the velocity curve flattens. Eventually at very high fields it should start to rise again, although other phenomena such as impact ionisation will set in before this.

Since the drift velocity is a measure of the current flow we can see that the region above the threshold field represents a negative differential resistance, that is, an *increase in voltage* across the gallium arsenide layer produces a *decrease in current*. Negative resistance effects are the key to producing oscillations because they represent energy flow into a resonant circuit. When the energy flow is sufficient, resistive losses are overcome, the circuit breaks into spontaneous oscillation and power can be coupled out of it, as Gunn first saw.

Unfortunately, the situation is not as simple as this because the electrons, in general, cannot move as a steady stream across the gallium arsenide in one mass state or the other. Above the threshold value, the electric field redistributes itself through the layer into moving regions of high and low field intensity. At the pe of the high field region there is an accumulated travelling "domain" of slowly moving, high mass electrons. Electrons immediately in front of this drift away to give a depleted region of current flow. The general situation, with an instantaneous picture of the moving domain is shown in figure 2.

Figure 2 (right): Field and electron density distributions during passage of a fully formed domain. Figure 3 (below): A Gunn oscillator package with expanded view of interior.

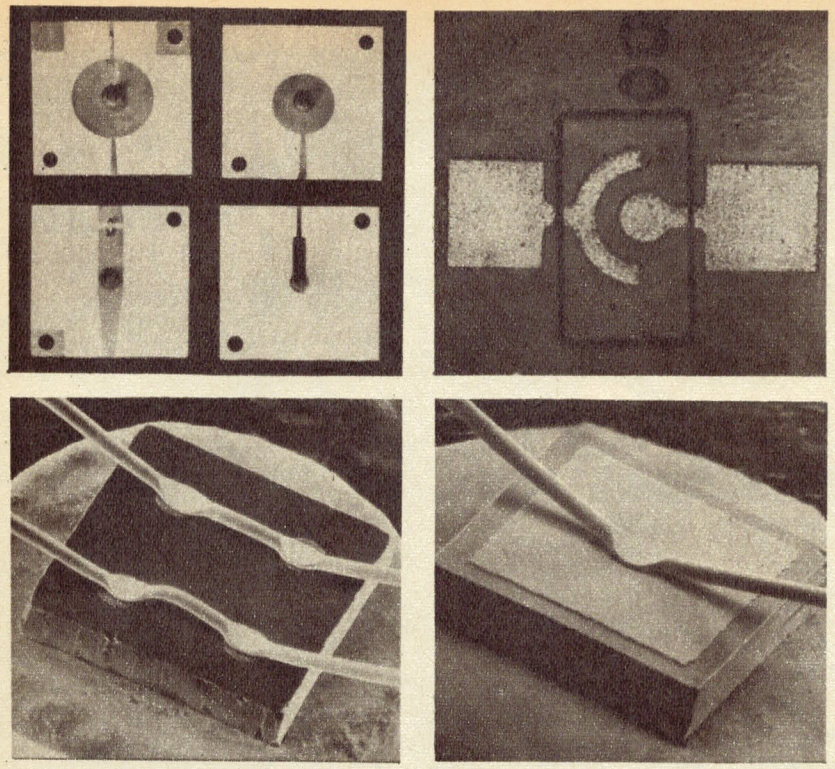




In the past few years a whole subject of domain dynamics has grown up, to produce computer-generated movies which follow the life and death of domains under various conditions. However, there are two general features which are always present; the domains always move at about 10^7 cm/sec, and they are born at local fluctuations in material properties near the negative contact, growing in size as they travel. When a domain reaches the positive electrode the field distribution collapses and a new cycle starts, so that only one domain at a time is travelling through the layer.

If the gallium arsenide layer is, for example, .01 mm thick then the domains will cross it in 10^{-10} sec and the associated current fluctuations will be at the microwave frequency of 10GHz (10,000MHz). When the layer is placed in a microwave cavity and has a bias voltage applied to it, oscillations are produced at the resonant frequency of the cavity rather than the transit frequency. The domains are then periodically triggered off by the oscillatory field of the cavity, which is superimposed on the bias. They may reach the positive electrode and die before the end of each oscillatory period, or they may be quenched out in transit before they can reach the positive electrode, because the total field drops below the threshold value. So frequencies lower or higher than the transit frequency can be produced by putting devices in the appropriate microwave cavity. A given device may, in fact, operate over a frequency range as great as 3:1.

It is also possible to operate without the formation of domains. This is termed LSA (limited space charge accumulation) operation. Its essential feature is that the generated microwave field is at such a high frequency that domains do not have time to nucleate, and the device then acts simply as a negative resistance. Also, since there is no characteristic domain transit frequency exercising overall control on the microwave frequency, LSA could be used to produce either microwaves in the millimetre region or to produce large power outputs just by increasing the



At top left are typical experimental X-band microstrip resonators, using ceramic substrates linch square, and gold conductors. The Gunn oscillator package is in the centre in each resonator. Top right shows a planar Gunn oscillator with concentric electrodes to give domains of variable frequency. Lower left shows a quadruple contact chip for increased power output, while lower right shows a large area chip for 10 watt pulse output. Both lower pictures were taken using a scanning electron microscope, being magnified by about 100 times.

overall size of the layer.

These are both desirable objectives, but unfortunately LSA operation has proved tantalisingly difficult since it was discovered by John Copeland in 1964 at Bell Telephone Laboratories. Copeland achieved some spectacular results using LSA to generate millimetre waves; however the basic difficulty with LSA is that it requires gallium arsenide layers of very uniform properties. To date we do not know how to make the layers sufficiently uniform, so that successful LSA devices are best described as happy accidents.

The gallium arsenide used in most Gunn effect devices is grown as a thin layer on a substrate slice, about 0.1mm thick, of single crystal gallium arsenide produced by zone refining. The substrate simply acts as one of the contacts, as well as being a support for the thin active layer. The growth process, known as epitaxy, can be carried out by chemical deposition of gallium arsenide through a reaction at high temperature in a gas stream. This technique was originated by John Knight and Dennis Effer of Plessey, England. Another technique is liquid epitaxy in which a layer of gallium arsenide is crystallised on the substrate by cooling a melt of molten gallium with gallium arsenide dissolved in it. The control of epitaxial layers of gallium arsenide to the correct thickness, resistivity (which is controlled by doping materials such as sulphur or tin), and uniformity, and making perfect crystals are the dominant problems in the device field today. The laboratories that are best at the art will make the most progress on devices.

The basic construction of a typical Gunn effect oscillator is shown in figure 3. The small "chips" of gallium arsenide are generally produced by first evaporating metal contacts over the slice and scribing it with a diamond along crystal planes into squares between 0.01 and 0.2 in across, each with a contact. The slice is then broken up like a bar of chocolate. A typical slice will produce thousands of chips.

The bonding of the tiny chip to the package and the contact wire to the chip is done under microscopes by soldering or thermocompression bonding. Dissipation of heat in the chip is a major problem and the best technique is to mount the chip with the active layer downwards, directly in contact with the package header. To increase power output, multiple contacts can be used. A developing technology is the use of type IIa diamond as a heat sink for the chip, since this can have a thermal conductivity up to seven times that of copper. This came as a surprising fact to semiconductor engineers two years ago, but since then there have been intensive efforts to exploit it.

Gunn oscillators are now operated in microstrip resonators as well as waveguide or coaxial resonators. Microstrip technology will be extensively used in solid state microwave systems. It is the microwave analog of printed circuit techniques and has considerable advantages in smallness and cheapness of assembly.

Gunn effect devices using domains can be made to produce continuous power outputs of about 0.1 watt over most of the microwave region, down to about 10mW at the start of the millimetre wave region (i.e. about 30GHz). This is because the properties of the very thin gallium arsenide layers (0.002mm) required become less controllable. To generate waves in this region it may be better to use other ideas, such as LSA, which involves thicker layers. Continuous power outputs can be increased up to the watt level by using multi-contact devices.

Under pulsed operation present power outputs of single devices are perhaps 20W and by combination, power outputs of several hundred watts can be produced. With LSA the Cornell University Group in the USA have produced pulse power outputs greater than 1KW. Pulsed power as large as this can meet many of the radar engineer's requirements for transmitters, and continuous power outputs of 1 watt can fulfil many communications requirements.

A particular form of Gunn device which is being extensively studied uses gallium arsenide grown on very high resistivity substrates. In this, the current flows across the active layer between metal electrodes deposited on the surface. This is a "planar" technology which has many potential advantages. The surface electrodes can be shaped in various ways. Between curved electrodes, for example, the domains propagate radially outwards. By control of the bias voltage large variations in the output frequency may be produced.

It is also possible to incorporate a domain triggering electrode between the two main electrodes. Combinations of such devices in which the triggering electrodes are interconnected may be used to make systems carrying out logic at rates which are a hundred times faster than can be reached with transistors or microcircuits. This may open the way to processors of greatly increased operating speed in computers. The development of planar technology Gunn effect devices and other microwave devices such as field effect transistors, detectors and mixers in this form is likely to lead the way to gallium arsenide microwave microcircuits in which transmitters, receivers and signal repeaters will be built on a single slice of gallium arsenide, just as silicon is used for microcircuits at lower frequencies.

So we see that although devices based on the Gunn effect are in an early stage of development, they seem destined to play a major role in the coming solid state microwave revolution, extending from low power devices to pulse oscillators with power outputs in the kilowatt range. As well as being used as oscillators they may also be used as amplifiers. They may expand into very high speed computers and the processors of very wide band pulse communications systems. And as many of the other microwave solid state devices perform best when made in gallium arsenide, a unified microwave microcircuit technology is likely to be based on this material. ■

EDITOR'S NOTE: Those readers who found this article heavy going could refer to our series of articles "Fundamentals of Solid State," which dealt with many of the concepts involved.

PRINTED CIRCUIT BOARDS

SUMMIT ELECTRONIC SYSTEMS

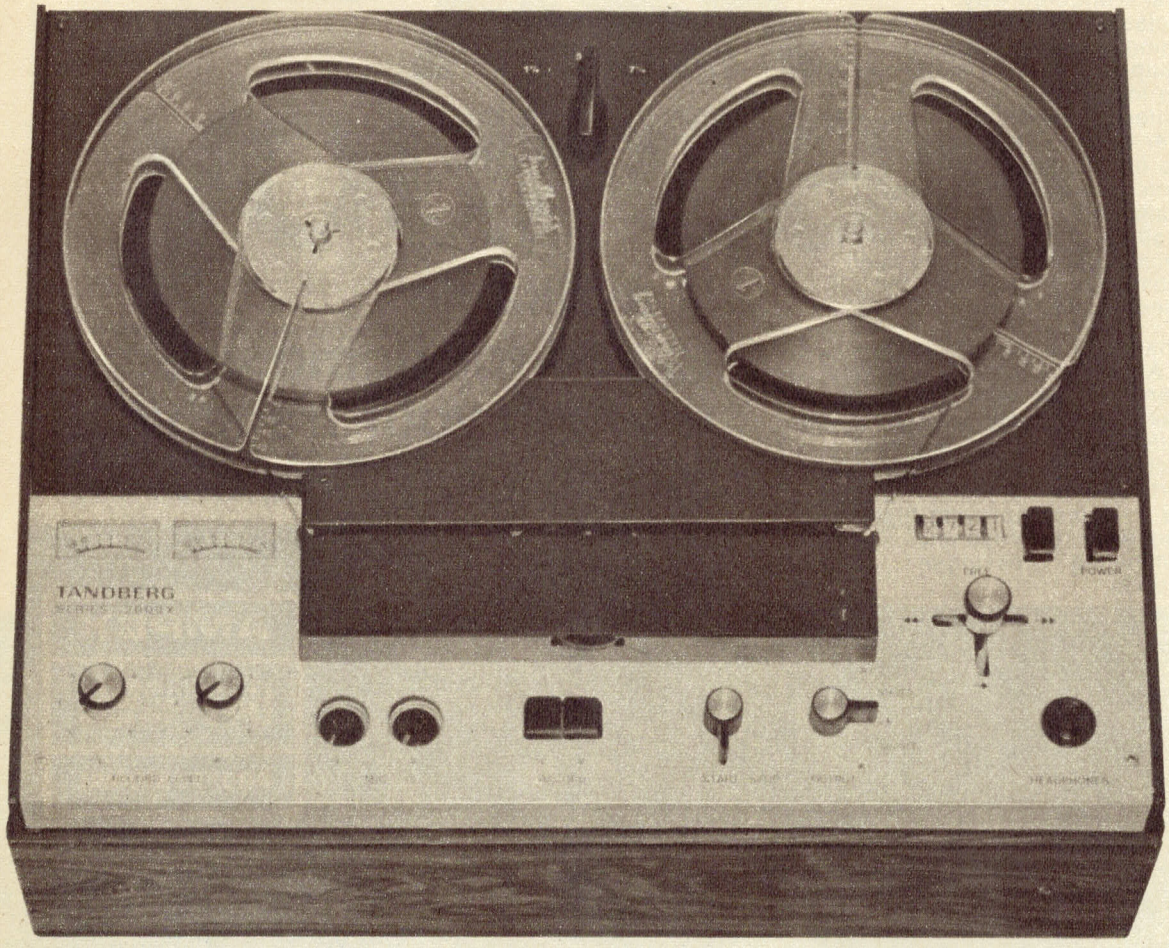
SUMMIT can now offer the industry a complete printed circuit board service.

- Original design and layout of board from circuit diagrams.
- High quality drawings from original sketches.
- Rapid manufacturing of both prototype and production boards.
- Same day service for special jobs.

Enquiries:

52 Excelsior Street
Granville, N.S.W. 2142
Telephone 637 1840

Now you can buy Tandberg quality without buying a whole lot of frills.



The new Tandberg 3000X

Everyone wants a tape recorder that gives them superb reproduction. But not everyone wants to pay for a whole lot of extra features as well. So we've designed the 3000X.

A brand new model that carries on the Tandberg tradition of impeccable engineering and craftsmanship but leaves off some of the frills. Its transport mechanism operates at three speeds and will provide a level of hi-fidelity sound at 3¾ and 1⅞ that many others cannot approach at 7½ ips.

Outstanding features include:

- four heads (record, playback, erase and cross-field) are all precision gapped and mumetal screened for absolutely trouble-free performance.
- unique cross-field head design produces excellent record/playback frequency response and signal-to-noise ratio.
- a flutter roller in the tape path guarantees low wow and flutter.
- no pressure pads on active heads ensures minimum of headwear.
- two tape guides at each of the four heads ensures professional tracking.

Getting technical:
Tape: Max. reel diam. 7". Low Noise tape may be used for recording.
Tape speeds: 7½, 3¾, and 1⅞ ips.
Speed tolerance: Absolute ±1.5%.
Frequency Response:
7½ ips: 40-20,000Hz ± 2dB.
3¾ ips: 50-16,000Hz ± 2dB.
1⅞ ips: 50-9,000Hz ± 2dB.

Distortion: A 400 Hz signal recorded at 0 dB level will at playback give 3–5% tape distortion.

Winding Times:
1,200 ft. of tape: 1¾ min.
1,800 ft. of tape: 2½ min.
Dimensions:
Length: 15½" Height: 6½"
Depth: 12⅜" Weight: 20 lbs

Simon Gray Pty. Ltd.

Head Office: 28 Elizabeth Street, Melbourne, Vic., 3000. Tel.: 638101.

Please send me detailed information on the Tandberg 3000X.

Name.....

Address.....

.....

Sydney Office: 22 Ridge St, North Sydney. 929 6816. Canberra Office: 21-33 London Circuit, Canberra City. 49 6050. Interstate Representatives: N.T.: Pfitzner's Music House, Smith Street, Darwin. Phone: Darwin 3801. Q'land: Sydney G. Hughes, 154-158 Arthur Street, New Farm, Brisbane. Phone: 58 1422. S.A.: Elico Sales Pty. Ltd., 7-9 Osmond Terrace, Norwood. Phone: 63 4844. Tas.: K. W. McCulloch Pty. Ltd., 57 George Street, Launceston, Tas. 7250. Phone: 2 5322. W.A.: Athol M. Hill, 613-615 Wellington Street, Perth. Phone: 21 7861. Available from leading retailers.

SPASM1699SGM

Now AMPEX "600 Series" professional tape, previously available only to TV, broadcasting and recording studios,

Ever wondered why professionally recorded tapes sounded better? While equipment plays a major role, the importance of tape in professional use cannot be over emphasized. Now, for the first time, AMPEX professional audio tape is available to the consumer. That's not all the good news. Because production has been substantially *increased*, the price has been *reduced*.

What are the big advantages of AMPEX professional tape? Precise oxide formulation, maximum dynamic range, uniform tape output and the exclusive "Ferro-Sheen" tape surface which extends head life . . . also improving high frequency response and eliminating "breaking-in" periods.

is available to you for home use through your franchised Simon Gray Dealer.

Make your selection from three basic types . . . 0.5 Mil. double play on tensilized polyester, 1.0 Mil. polyester for long play and 1.5 Mil. standard tape for maximum durability and superior strength. You can buy AMPEX professional tape on 3", 5", 7" and 10½" NAB reels . . . at your nearest franchised Simon Gray dealer.

If you own a high quality tape recorder or tape deck, you will appreciate the difference AMPEX professional tape can make. You'll agree with discriminating audio engineers in leading studios all over the world — the top professionals who demand the highest possible standards. *Settle for nothing less — use AMPEX professional tape!*



SPASM 1748/SGM

Australian National Distributors:
Simon Gray Pty. Ltd.
Head Office: 28 Elizabeth St., Melbourne, Vic. Tel. 63 8101*
Sydney Office: 22 Ridge St., North Sydney, N.S.W. 929 6816
Canberra Office: 31-33 London Circuit, Canberra City, A.C.T. Tel. 49 6050

INTERSTATE REPRESENTATIVES:
N.T.: Pfitzner's Music House, Smith Street, Darwin. Tel. 3801
Q'land: Sydney G. Hughes, 154-158 Arthur St., New Farm, Brisbane. 58 1422
S.A.: Eilco Sales Pty. Ltd., 7-9 Osmond Terrace, Norwood, S.A. Tel. 63 4844
Tas.: K. W. McCulloch Pty. Ltd., 57 George Street, Launceston. Tel. 2 5322
W.A.: Athol M. Hill, 613-615 Wellington Street, Perth. Tel. 21 7861

Ask your ears.

We'll be happy to supply you with all the reading material you like on Sansui amplifiers and stereo units.

That's why we put a coupon in this ad.

But if you're really serious about getting the best out of your stereo system then reading isn't the answer.

Listening is.

Why not ask your nearest Sansui retailer to arrange a demonstration for you.

And let your ears be the judge.

You've a complete range to choose from. 18 Sansui models altogether. Priced from $159 to $559.

Simon Gray Pty. Ltd.

Head Office: 28 Elizabeth St., Melbourne, Vic. Tel. 638101. 3000.

Please send me your folders on Sansui amplifiers and your brochure on the complete Sansui Stereo System.

Name .....

Address .....

.....

..... Postcode .....

AU101 15 RMS Watts per channel. Music Power 44.

AU222 18 RMS Watts per channel. Music Power 46.

AU555A 25 RMS Watts per channel. Music Power 60.

AU666 35 RMS Watts per channel. Music Power 80.

AU999 50 RMS Watts per channel. Music Power 140.

All power ratings are at 8 ohms.

18 Sansui amps. to choose from $159 to $559

Sansui

Masters of Sound.



SPASM 4222/SGM

The Wharfedale 'Melton'
"Designed for use with your present tape or record system. It gives a fuller width and depth of sound, and the most remarkable performance throughout the frequency range at all listening levels."

See the Wharfedale speaker range, including the very popular Super Linton and Denton, at Hi-Fi specialist stores or dept. stores priced from $69.50 to $424.00.
(*Maximum retail price.)

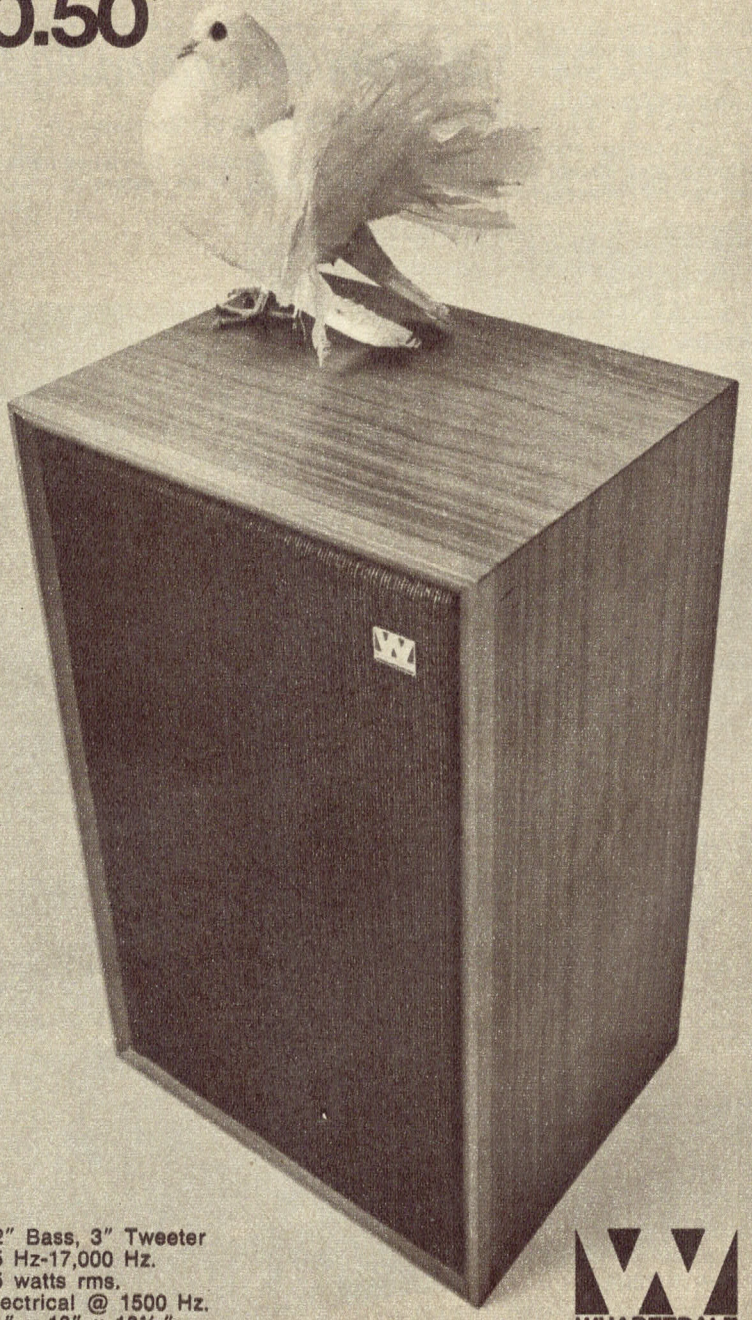
GET MORE DETAILS.
Simon Gray Pty. Ltd.,
28 Elizabeth St.,
Melbourne, 3000. 63 8101.

Please send folders on the Wharfedale speaker range pronto. ☐ Tick
Also send details of your complete Modular Hi-Fi Systems. ☐

Name: Mr/Mrs/Miss.....
Profession:.....
Street.....
Suburb.....P/code.....

SPASM 1253-SGM

Improve your music system $130.50*



Melton data:

2 Loudspeakers:	12" Bass, 3" Tweeter
Frequency Response:	45 Hz-17,000 Hz.
Power handling:	25 watts rms.
Crossover:	Electrical @ 1500 Hz.
Cabinet:	21" x 13" x 10¼"
	Weight 30 lbs. (packed)
	Oiled Teak or Polished Walnut
	Blackden mesh front

WHARFEDALE

closer to the original sound.



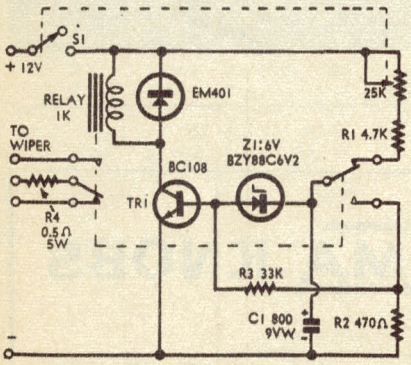
A READER BUILT IT

More on pulsed windscreen wipers

Previous contributors have dealt with pulsed windscreen wipers and the problems created by modern dynamic braking systems. Here is a simple pulser suitable for both old and new cars.

As stated in the August 1970 issue most car manufacturers are now using permanent magnet wiper motors, with dynamic braking. This last "feature" has meant the scrapping of the simple SCR controlled unit, and it is now almost essential to return to the relay system.

The circuit to be outlined can be used with all wiper systems (both positive and negative chassis) provided the builder can decide how many relay contacts the system requires, and where they should be placed.



Circuit of the complete wiper control system. It initiates a single wipe, followed by up to 20 seconds pause, as selected.

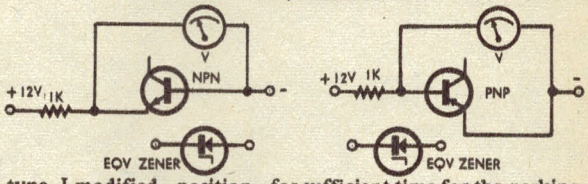
The circuit operates as follows: On closing S1, C1 will charge slowly through R1, VR1, and the N/C (normally closed) relay contacts. The charging time of C1 can be varied within the range of three seconds to 20 seconds by adjustment of the dash mounted VR1. The charging continues until the voltage across the capacitor reaches about six, at which point Z1 breaks down, passing current through the base/emitter junction of TR1, turning this transistor on and energising the relay.

The relay contacts changeover to supply TR1's base current from C1 via R3. Also connected is R2, which takes about one second to discharge C1 to 0.75V, at which point TR1 releases the relay. With the return of the relay contacts to their original position, the cycle continues.

The result is a variable "OFF" time followed by a fixed "ON" time. The "ON" time allows the wiper to reach a position where the braking contacts open and the parking contacts close, thus completing a single "wipe" for each relay operation. Resistor R4 reduces the starting current, and prevents the motor overheating.

For correct operation, the relay contacts in the capacitor circuit should be of the make before break type. I modified a standard changeover set simply by "dishing" the N/C spring leaf downward near the indexing tab. This creates a gap between the tab and the buffer block and, when the relay is energised, the modified spring travels upward with the central leaf until the control and upper contacts meet. The result is a make before break contact set.

Simple test setups for determining "zener" voltage of BVebo of silicon transistors for use in place of a zener diode.

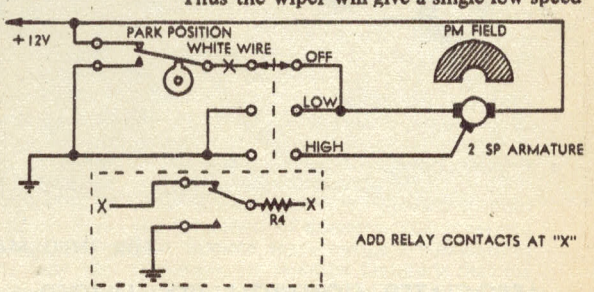


Zener diode Z1 can be replaced with a silicon transistor if use is made of the emitter to base breakdown voltage. (This is in the range four to 10V for most transistors.) One method of finding the approximate BVebo of a transistor is shown.

Zener voltages in excess of 6.5V may prevent the unit from operating with low battery voltage. With the recommended values the unit will operate with voltages as low as 10. The transistor used to replace the zener diode was a 2N2646 (NPN), but a 2N3638 (PNP) also breaks down at 6V. Unfortunately, BC108s break down at eight to 9 volts and are not suitable.

The housing I used for the unit is a baby powder tin. This is modified by removing the sprinkler assembly (hit the inside of the sprinkler with a hammer while supporting the surrounding lid on blocks of wood) and covering the resulting hole with a square metal plate bolted at each corner.

Setup for modern wiper systems using permanent magnet motors and dynamic braking. (Holden HK series and similar)



Attached to the lid is a bracket to support the relay along with the remaining components on a Veroboard panel. Other work required is a hole for the wiring to pass through the lid, a metal strap around the body of the unit for mounting, and a coat of paint. Prior to painting, the glossy finish should be removed with emery paper.

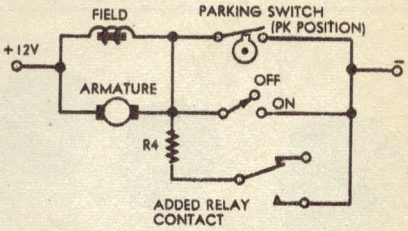
The installation of the unit differs for each make and model of car. As a guide I include two examples.

(1) Early wiper systems: This system has a single speed motor with a wound field. (Circuit illustrated is for an early Holden.)

In operation the relay bypasses the dash switch, which remains in the "OFF" position, for sufficient time for the parking switch to make and continue for one sweep.

(2) Recent system: This system has a permanent magnet field, two speed armature, and dynamic braking. (Circuit is for the HK series Holden.)

To modify an HK or HT Holden locate the white wire at either the switch or at the wiper motor. Cut this wire and connect the relay contacts as shown.



Setup for older wiper systems.

The changeover contacts open the brake circuit and then apply power to the armature low speed brush. (Dashboard switch is off.) Once the wipers are in motion the cam operated contacts parallel the relay contacts, allowing the relay to be released and the wiper action to continue until one complete sweep has been made. Thus the wiper will give a single low speed stroke for each relay operation.

The relay used should have a coil resistance within the range 500 ohms to 1500 ohms. Before using, connect the relay to a nine or 10 volt supply and confirm that it will operate from this voltage.

Submitted by: Mr I. Robertson, 20 Harper St, Helensburgh, NSW. 2508.

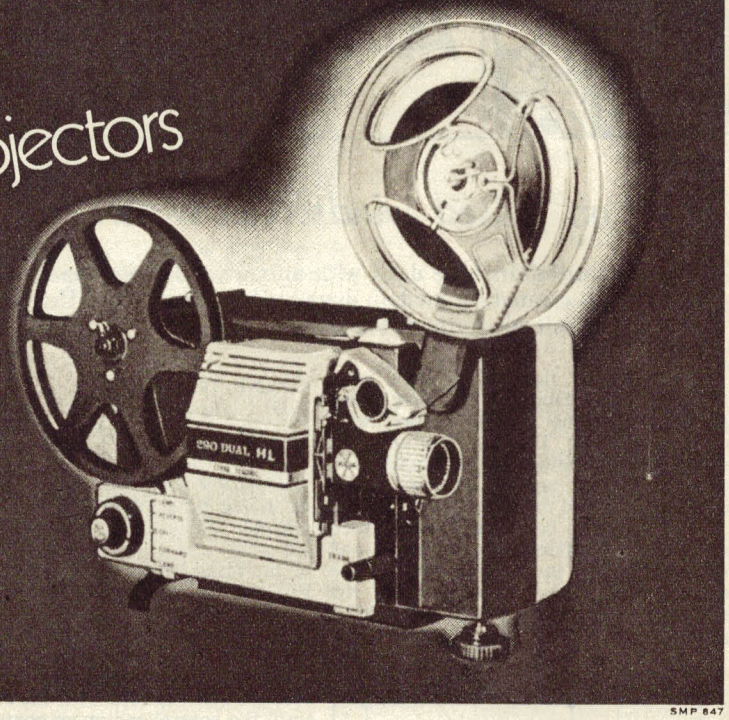
Copal Sekonic

Dual 8 Movie projectors

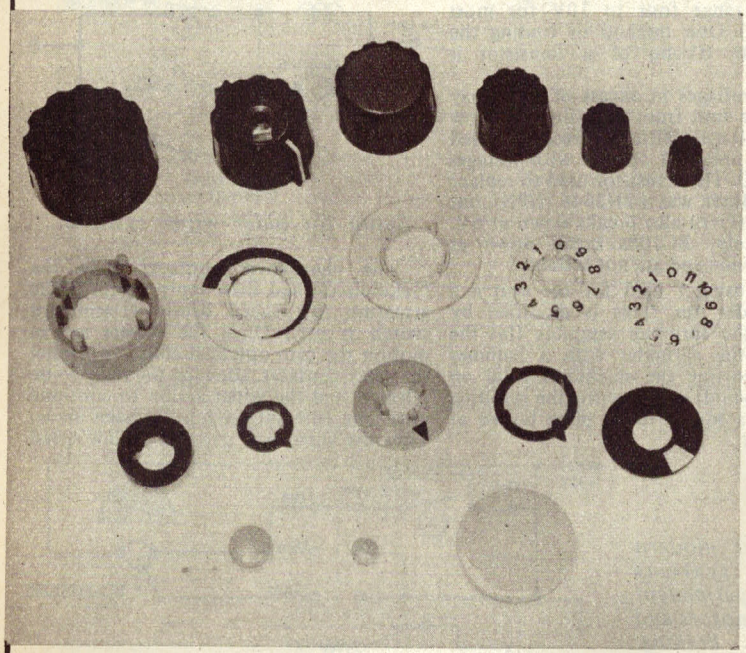
Foolproof — and you can switch to slow motion while it's still running.

Foolproof . . . the auto-loop-former keeps the correct loop for smooth running . . . no chance of damaged film as with sprocket or conventional sprocketless projectors . . . reverse projection — still picture — slow motion at 4 fps can be switched whilst the projector is running . . . quick rewind . . . and easily change by flick of a switch format from Regular 8 to Super 8 . . . new bright 100 watt mirror backed halogen lamp gives brighter picture. f1.4/18-30 mm zoom lens permits change of projected image over varying distances. Price, $169 — others from $125.

Free brochures from Photimport Pty. Ltd.,
153 Barkly Street, Brunswick, Victoria, 3056.
Also Sydney, Brisbane, Adelaide, Perth.



SMP 847



ELMA KNOBS

★ Designed for professional equipment

★ Reasonably Priced

★ Large range of accessories

★ Selection of colours

★ Positive collett fixing

FOR INFORMATION CONTACT

ASSOCIATED CONTROLS PTY. LIMITED
14 Enterprise Avenue, Padstow, NSW 2211
Telephone: 771 3833 (4 lines)
NSW

ASSOCIATED CONTROLS (VIC.) PTY. LTD.
Suite 30, 73 Mahoneys Rd., Forest Hill Vic. 3131
Telephone: 878 6555
VICTORIA

A READER BUILT IT . . . continued

Metalworking for the home constructor

While ready made metal boxes are readily available in a wide variety of styles and sizes, there are times when the home constructor would like to make his own. This article discusses the basic principles and practice of sheetmetal working.

The finished appearance of any radio or electronic project depends more upon its mechanical construction (or "blacksmithing" as some call it) than the neatness of its wiring and component layout.

For this reason many hobbyists are turning to the use of factory built cases and chassis. Other readers, however, like to make their own, either because they are working on a shoestring budget, or for the satisfaction of having constructed the whole project from start to finish. From an educational point of view the second alternative enables the youthful constructor to develop his skill at reading mechanical drawings, marking out and general metal working.

Aluminium of about 18 or 20SWG has for many years been popular with home constructors because it is easy to work and does not require plating or painting. Unfortunately it is more expensive than steel, and is almost impossible to solder. The method commonly used for chassis connections is to fit solder lugs under a number of component mounting bolts and join these with tinned copper wire to form chassis network.

Sheet steel is not only cheap but is also easily fabricated by fusion, bronze or spot welding. Number 20SWG is suitable for most purposes. Unfortunately steel requires some treatment to prevent corrosion and rusting. Manufacturers usually achieve this by cadmium plating and passivating. This gives a golden khaki colour which is resistant to finger marking and will not corrode. It can be soldered easily with non-corrosive flux, assuming a soldering iron of 100 watts or more.

Alternatively steel can be zinc plated, which is cheaper, but does not solder readily with resin cored solder. Should economy be a major consideration, the chassis can be painted with enamel or aerosol "Hammertone" type finish.

In the case of painted chassis, chassis connections can be easily provided as follows. Using an old quarter inch drill ground to a very obtuse angle – almost 180 degrees – clean a number of spots on the underneath of the chassis at points where you are likely to need chassis connections. (Do not drill right through – simply clean off the surface oxide.)

Using a good hot iron and paste flux tin each of these points leaving a "blob" of solder. The chassis is then painted in the usual way and access to any of these points is easily obtained by simply removing the paint with a hot soldering iron.

Other materials such as copper and brass may be used. Both of these can be readily soldered, but will oxidise and discolour with time. These materials are also relatively expensive, and are usually only justified for small boxes and chassis used for VHF and UHF work, where good conductivity in the chassis, and reliable chassis connections are vitally important.

If you use copper for VHF or UHF work because of its good electrical conductivity, remember that its thermal conductivity is also very good, and you will need a much larger soldering iron than you would with steel or brass.

A suitable component layout is one of the first things to be determined. One approach to this is to lay out the components on a sheet of drawing paper on a drawing board. When the final placement of the components is settled, the centres of the holes and their sizes are marked on the drawing paper, which is then cut to shape and lightly glued to the metal chassis.

Hole centres and other structural details are thus transferred directly from drawing board to chassis without the need for re-marking – of course the original drawing is not of very much use after the holes have been drilled through it!

Cutting sheet metal with tin snips stretches the edge which has been cut, and inevitably buckling occurs. For this reason it is difficult to do neat work without using a guillotine. If you do have a guillotine available you will find it easier to cut accurately on a given line if you make a half inch cut at each end. These cuts are then bent down and hooked over the lower knife of the guillotine to position the metal for cutting.

Unless you have access to a box type folding machine it is difficult to fold the metal in more than one plane. Some simple machines such as the Jabel Panbrake folder do overcome this to a limited extent by slotting the top clamping bar.

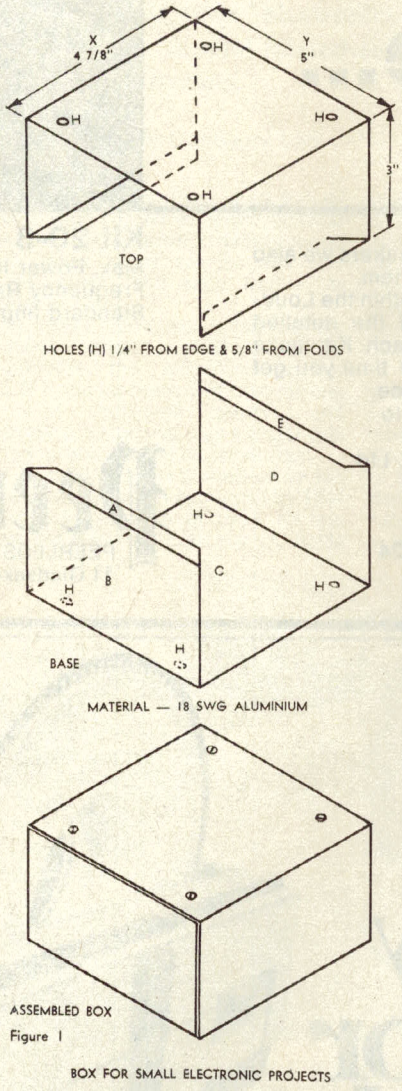
Holes whose diameter exceeds half an inch are best cut with a hole punch. For larger holes, a manually operated "nibbling" tool can be used.

Most constructors prefer the neatness and practical utility of a totally enclosed unit with, of course, adequate ventilation. Mains operated equipment must, from a safety point of view, have all live terminals enclosed or suitably protected from accidental contact.

(Details of the mains earthing and safety requirements of electronic equipment can be found in S.A.A. Approval and Test Specifications No C100 – Definitions and General Requirements for Electrical Materials and Equipment – and No C159 – Radio and Television Apparatus.)

Most electrical projects require one of two broad types of construction. The first is a plain box such as would be used for the battery chargers described in "Electronics Australia" May and June 1966. The second is a case, with an internal chassis on which is mounted most of the components, and to which is attached the front panel.

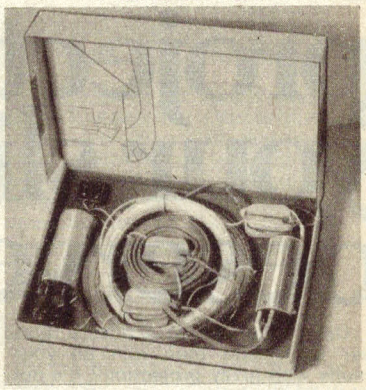
Figure 1 shows how to make a simple box for a small battery charger or similar project without welding, and using only a simple panbrake folder or two pieces of



Simple design for small boxes. Dimesions suit the charger in the May-June 1966 issues.

***Registered Trade Mark**

AF-1 NOISE REDUCING AERIAL KIT



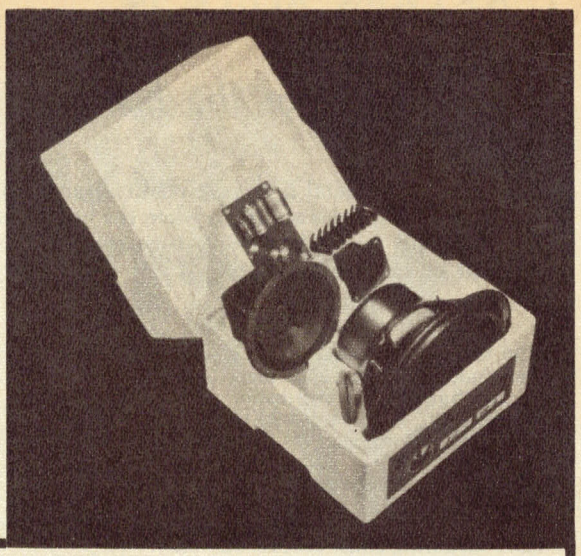
This AF-1 aerial system is for use in noisy locations for clearer reception. It is designed to cover both M/W and S/W broadcast bands (from 500 to 1500 KHZ and 2 to 15 MHZ. Approximately). Available in all States. Write for our illustrated leaflet.

AEGIS COMMUNICATIONS

AEGIS PTY. LTD.

347 Darebin Road, Thornbury, Vic., 3071. Phone: 49-1017.

The demands become greater, of course...



and as a specialist factory of Loudspeakers we also make greater demands - and meet them.
In our new Kits the latest progress within the Loudspeaker field have been used and the detailed mounting instructions included in each Kit make the mounting effortless. At the same time you get a quality product at a reasonable price.
For further information please apply to

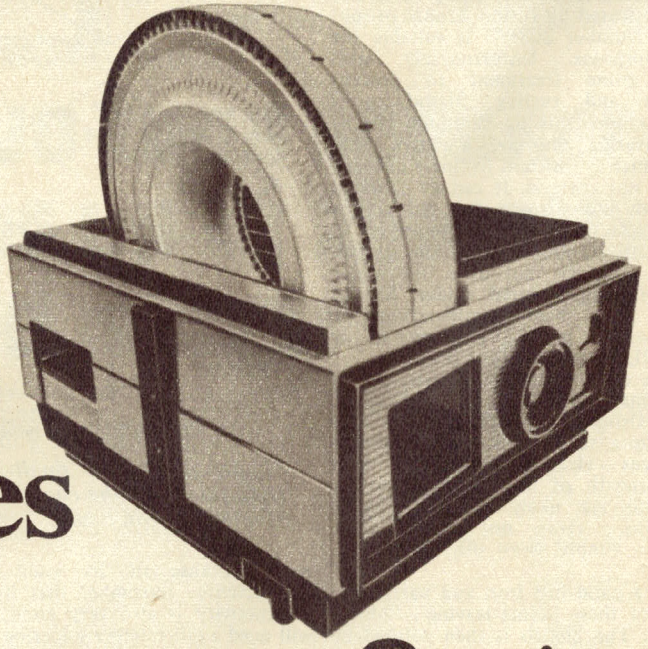
Messrs. Magnecord International Pty. Ltd.
276 castlereagh Street, Sydney 2000
Phone 61 9881
Messrs. G.R.D. Instruments Pty. Ltd.
698 Burke Road, Camberwell, Vic 3124
Phone 82-1256

Kit 20-3
Max. Power Input: 40 watts
Frequency Range: 40-20.000 c.p.s.
Standard Impedance: 4Ω, 8Ω or 16Ω

Peerless
PEERLESS FABRIKKERNE A/S
11 Gladsaxe Ringvej . 2860 Copenhagen Denmark

PP850

This is the only projector your slides deserve



Do you fiddle with exposure, fuss over focus and then ruin all your results with fuzzy projection? It's not right! Your slides need a Paximat. Paximat needle sharpness is what they deserve. Only Paximat top quality optics will do justice to your slides.

Paximat 5000 & 3000 model projectors have Autofocus. A measuring beam adjusts the sharpness electronically. All you do is . . . insert the magazine, focus the first slide, set the interval timer (18, 15 or 30 secs.) and sit back. Also changes slides manually and by remote control.

The 5000 model Paximat changes slides by radio control. A transmitter held in the palm of the hand changes slides forward and reverse over a distance of 18 ft.

With Paximat Automatic 35 mm projectors you can have the following accessories: condenser lens for super slides, lamp-economising switch, interchangeable lenses from 55 mm to 200 mm focal length and tape recorder synchroniser.

Paximat

Brochures from
Photimport Pty. Ltd. Melbourne, Sydney, Brisbane, Adelaide, Perth.

Select a Paximat projector from **$62.50.**

5 models to choose from: Pico S, 1000, 1800, 2000, 3000, 5000.

See your camera store, department store, or chemist. Ask about the Paximat range of slide projectors.

A READER BUILT IT...continued

angle iron held in a vice. If you use the latter device you will find it much easier if you join the two pieces of angle iron with a loop of about 1in x 1/8in flat bar. This will ensure that both angles are always at the same height when clamped in the vice.

Referring to figures 1a, 1b and 1c it will be seen that for a square box both top and bottom are identical and that dimension X should be about 1/8in or 1/16in smaller than Y to allow for the thickness of the metal. The sequence of folding is as follows:

1. Clamp B and fold up A
2. Clamp C and fold up B
3. Clamp D and fold up E
4. Clamp C and fold up D.

inspection or repairs, all components should be mounted on the base only and kept ½in clear of the edges of C to leave room for the ½in cover flanges.

The material used will depend upon cost and availability. If you use aluminium, 18 SWG will be easy to bend and will provide sufficient rigidity for the four corner edges which are not fastened together. For sheet steel or zinc anneal 20 SWG would be sufficient.

A case with a chassis usually involves the twin problems of welding and making bends which are at right angles to one another. Figure 2 shows a method of construction which reduces welding to a minimum. A notable advantage is that even with the top cover removed it can be

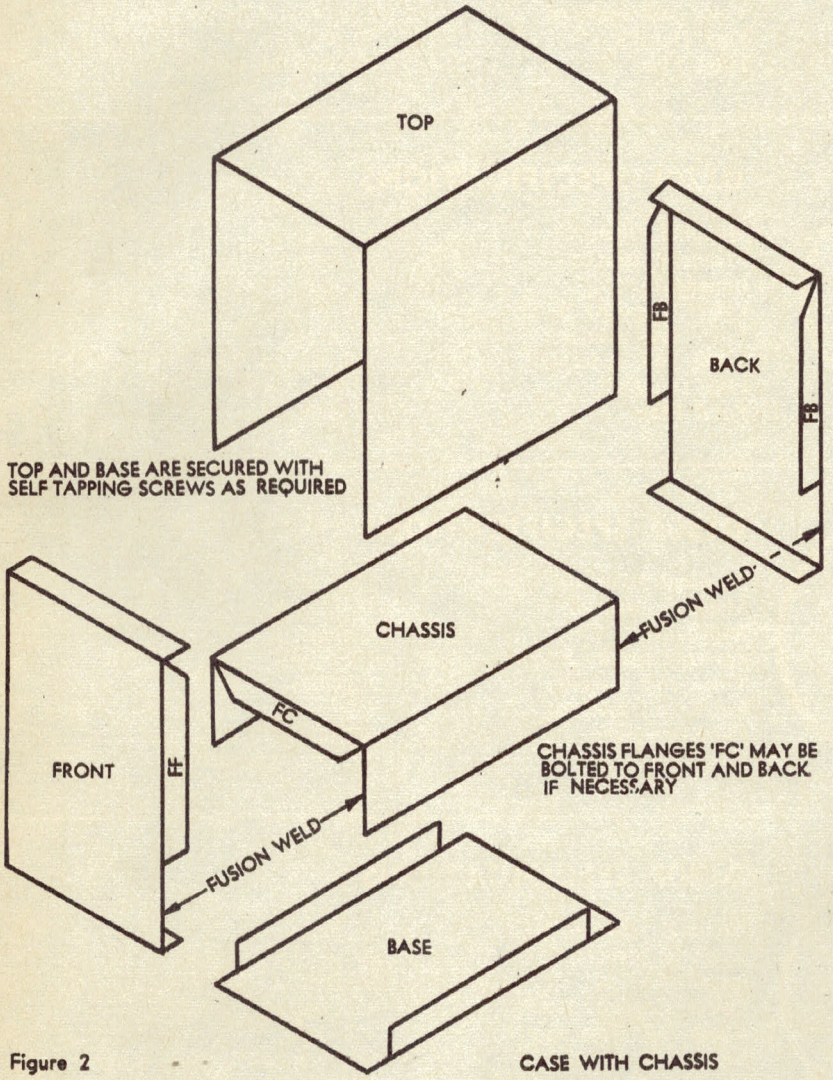


Figure 2 CASE WITH CHASSIS

In place of fusion welding, the flanges on the front and back can be extended and spot welded or pop rivetted to the chassis.

When folding it is possible to gain or lose the thickness of the metal and the above sequence should ensure that this occurs at the same point for all four sides.

The eight clearance fixing holes marked H should be drilled before folding, whilst the corresponding holes (NOT shown in diagram) in the ½in outer flanges should be scribed through after folding to ensure accurate alignment. The holes marked H should be ¼in from the edge and 5/8in from the fold.

For ease of assembly and future placed upside down on the workbench without having to be propped up.

The main thing to avoid in sheet metal work is stretching and distortion. When cutting, use a guillotine or even a hack saw in preference to tin snips, and use 'pop' rivetting, spot welding, or self tapping screws in preference to gas welding.

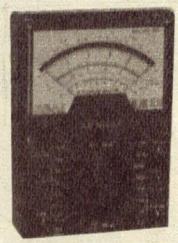
Finally, remember the old proverb "Measure your cloth many times, for you can cut it only once!"

Submitted by: Mr P. Emery, 26 Ryrie Avenue. Como, WA, 6152 ■

INDEVA

NOW arrived — MODEL US 106

A new Multimeter to the JEMCO range — extending 11 years of reliable service. Unique of combination:



- Highest sensitivity — 50,000 O/V
- Widest Measuring ranges:
  DC Current: 25 Microamp—10 Amp
  AC Current: To 10 Amp
  Resistance: To 200 Megohm
- Double overload protection (Diode and Fuse)
- Shockproof
- Unbreakable Back, Carrying handle/stand
- Polarity Reversing switch
- Combination Test Leads: (Pin and Alligator).

SPECIFICATIONS

RANGES	US—106
DC VOLTAGES	0~0.25/1/2.5/10/50/250V (50,000Ω/V)/1,000V(20,000Ω/V)
AC VOLTAGES	0~2.5/10/50/250/1,000V (10,000Ω/V)
DC MICROAMP	0~25μA (250mV DROP)
DC MILLIAMPS	0~1/25/500 mA (250mV DROP)
DC AMPERE	0~10A (250mV DROP)
AC AMPERE	0~10A
RESISTANCE	0~200MΩ (CENTER SCALE200) RX1/RX10/RX100/ RX1K/RX10K
DB SCALE (0db 1mW 600	-20~+10/+22/+36/+50db

Price Incl. S.T.: US106 $34.50
US100 (20.000 O/V $29.90.
Cowhide Black De Luxe Carrying Case $4.60
3 Month's Warranty — Service and Spare Parts always available.

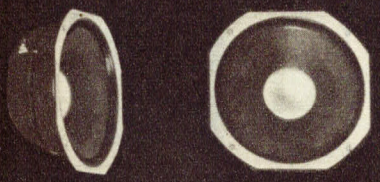
Order from your Dealer or from Sole Australian Distributors

INDEVA PTY. LTD.
24 BELLEVUE ROAD,
BELLEVUE HILL, NSW 2023.
TELEPHONE: 36 4401

Mail this coupon for details of:
Other Multimeters & Test Equipment
Wide range of Stereo Headphones & other Audio Accessories
Other requirements: .....
Firm: .....
Name: .....
Address: .....
Post Code: .....
Telephone: .....

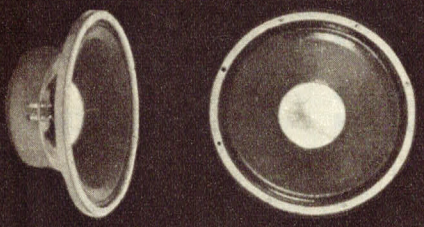
JBL

Musical Instrument Loudspeakers



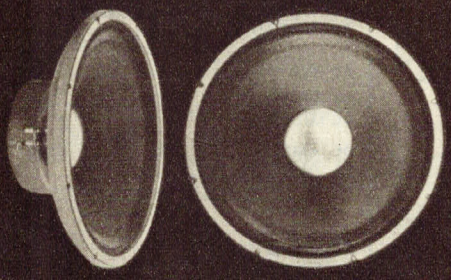
D110F SPECIFICATIONS

Nominal Diameter	10 inches
Magnetic structure	6 pounds
Impedance	8 ohms
Power Capacity RMS	100 watts
Voice coil diameter	3 inches
Voice coil material	Edgewound Aluminium Ribbon
Flux Density	10,200 Gauss
Total Flux	170,000 Maxwells



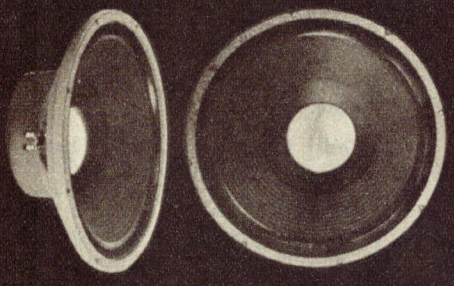
D120F SPECIFICATIONS

Nominal Diameter	12 inches
Magnetic structure	11 pounds
Impedance	8 ohms
Power Capacity RMS	100 watts
Voice coil diameter	4 inches
Voice coil material	Edgewound Aluminium Ribbon
Flux Density	12,000 Gauss
Total Flux	275,000 Maxwells



D130F SPECIFICATIONS

Nominal Diameter	15 inches
Magnetic structure	11 pounds
Impedance	8 ohms
Power Capacity RMS	100 watts
Voice coil diameter	4 inches
Voice coil material	Edgewound Aluminium Ribbon
Flux Density	12,000 Gauss
Total Flux	275,000 Maxwells



D140F SPECIFICATIONS

Nominal Diameter	15 inches
Magnetic structure	11 pounds
Impedance	8 ohms
Power Capacity RMS	150 watts
Voice coil diameter	4 inches
Voice coil material	Edgewound Copper Ribbon
Flux Density	11,500 Gauss
Total Flux	260,000 Maxwells

JBL DEALERS

ALDERSONS CAMERA & HI FI CENTRE,
THE NEWTON BUILDING,
THE KINGSWAY,
CARINGBAH, 2229.

BRISBANE AGENCIES,
78 WICKHAM STREET,
FORTITUDE VALLEY, QLD., 4006.

CONVOY INTERNATIONAL,
449 KENT STREET,
SYDNEY, 2000.

GLEN-DOR CAMERA & HI FI CENTRE,
43 THE CORSO,
MANLY, 2095.

ENCEL ELECTRONICS (STEREO) P.L.,
257 CLARENCE STREET,
SYDNEY, 2000.

KEITH ABERNATHY STEREO,
92 BOURKE STREET,
MELBOURNE, 3000.

HOMECRAFTS HI FI CENTRE,
PETRIE STREET,
CANBERRA CITY, A.C.T., 2601

ALVIN COMMUNICATIONS,
38 PEGNULL STREET,
PIMLICO, 4810
TOWNSVILLE, NTH. QLD.

ALLANS MUSIC CENTRE,
276 COLLINS STREET,
MELBOURNE, 3000

INSTROL HI FI CENTRE,
91A YORK STREET,
SYDNEY, 2000

KENT HI FI,
432 KENT STREET,
SYDNEY, 2000.

PFITZNER'S MUSIC SALON,
BOX 2289, P.O.,
DARWIN, N.T., 5794.

W. WATERS & SONS P.L.,
CNR CROWN & STATION STS
WOLLONGONG, 2500.

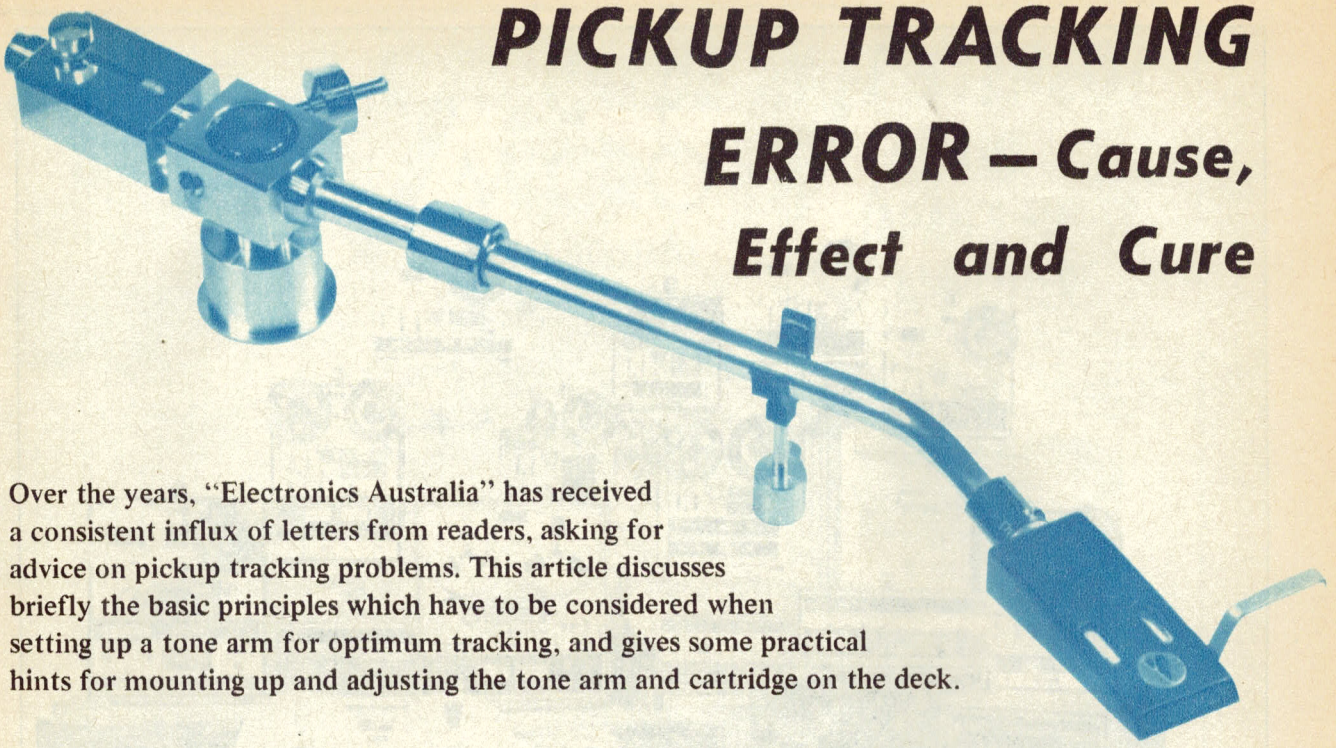
STEREO SOUND SYSTEMS,
56 RUSSEL STREET,
MELBOURNE, 3000

SHOP 12,
PRINCES GATE ARCADE,
FLINDERS STREET,
MELBOURNE, 3000.

PARISE SOUND SYSTEMS,
P.O. BOX 14,
ELIZABETH, S.A. 5112.

THE MUSES SOUND SPECTRUM,
33 REGENT ARCADE,
RUNDLE STREET,
ADELAIDE, S.A., 5000.

PICKUP TRACKING ERROR — Cause, Effect and Cure



Over the years, "Electronics Australia" has received a consistent influx of letters from readers, asking for advice on pickup tracking problems. This article discusses briefly the basic principles which have to be considered when setting up a tone arm for optimum tracking, and gives some practical hints for mounting up and adjusting the tone arm and cartridge on the deck.

Based on an article which was originally published in "Radio, Television and Hobbies," in February, 1962.

The basis of the tracking problem is probably known well enough to most audio enthusiasts, but here it is again in brief.

The grooves are produced, in the first instance, by a cutting head, which is transported across the face of the disc on a suitably driven lead screw. The geometry of the system is such that the cutting stylus moves inward along a perfectly straight line (which is actually a radius of the disc) as it impresses the modulation on the disc's surface.

Looking at it another way, it may be said that the axis of the cutting stylus's suspension is aligned with the tangent to the groove being cut by the stylus at any instant.

Ideally, a pickup stylus tracing the same groove should also move inwards along a radius, and the support axis of the stylus should also be tangential to the groove being traced.

If this requirement is not satisfied, the "axis of reproduction" is such that the stylus tip is not able to move in the same manner as the original cutting stylus – that is, at exact right angles to the groove tangent. Instead, it moves at a slightly oblique angle, and is therefore not able to recreate the exact voltages which were used in the first instance to actuate the cutting stylus. The result is distortion in the reproduced waveforms.

Distortion can, of course, originate in any part of the reproducing chain, and it is virtually impossible to distinguish between distortion from one source, or from another. However, it is safe to say that distortion from tracking error will contribute to the overall distortion, and the greater the tracking error, the more distortion will originate from this cause.

Unfortunately, however, desirable it is to have the "axis of reproduction" exactly tangential to the groove, it is not practical to satisfy this requirement in record reproducing equipment as we know it today. In the first place, for a number of very practical reasons the pickup head cannot be mounted on a lead screw, as is done with the cutting head in the recording process. It has to be supported by a radial arm.

Use of a very long pickup arm is a possibility which approaches the ideal, because the stylus would then be tracing an arc which would be a very small part of a very large circle, and therefore reasonably close to a straight line. If the tip of the stylus were then accurately aligned with the centre of the turntable, we should be fairly close to tracing a radius across the disc.

But there are practical difficulties which limit the length of arm we can use. One is the mass and inertia of a very long arm. The other is the difficulty of accommodating such an arm in a cabinet of practical dimensions.

Some years ago an attempt to overcome the problem was made by designing an arm with an elaborate system of pivots attached to the pickup head, which allowed the head to adjust to correct tangential relationship to the groove as it tracked across the disc. Whatever the merits of the system, it apparently did not prove attractive to purchasers, as it apparently disappeared from the market in a short time. And, while it may have met tracking requirements, the extra mechanical complication may well have made it more difficult to meet the equally important requirements of a well designed arm – freedom of vertical and horizontal movement, dynamic balance, controlled internal resonance, and so on.

Another more recent attempt to provide a system with zero tracking error is the Rabco servo-controlled straight-line tracking arm which relies on information supplied by the head itself to maintain the correct tangential relationship between stylus and groove. However, this is expensive (retail price in the USA around $150) and requires a somewhat clumsy and bulky mounting arrangement. Whether this will succeed, or suffer the fate of earlier attempts to overcome the problem, remains to be seen.

It is undoubtedly significant that virtually all pickups currently available, including a variety of specialist types, use relatively short, radial arms., with varying degrees of care and attention paid to other characteristics such as those mentioned above.

Fortunately, a relatively simple measure is available to pickup designers to reduce the tracking error with radial arms, though it cannot provide a complete solution. This involves placing the axis of the stylus so that it does not lie parallel with a line drawn from the stylus tip through the main pivot centre of the arm; rather does it make with the line a deliberate angle. This practice is commonly referred to as "offsetting the head."

In practice, the required offset is secured in a variety of ways. Some pickup arms describe a gentle curve practically all the way from the pivot to the stylus end.

Some arms are straight, with only the head shell offset.

Some arms are straight, head shell and all, with only the pickup cartridge inclined within the shell.

As far as tracking is concerned, it is quite immaterial which of these methods is used. They might have varying degrees of aesthetic or "professional" appeal, but the only dimensions that really matter, for tracking, are the distance from stylus point to pivot, the inclination of the stylus support to the line joining the two, and ultimately the position of the arm relative to the turntable.

As we have already said, many other important factors do intrude in the overall design of pickup arms. These include the mass of the arm, its stiffness and the tendency to exhibit internal resonance effects, excited by the vibration from the stylus. Then there is the whole question of dynamic balance, or how sensitive the pickup assembly is to tilt or movement of the motor board as a whole. Mechanical convenience also has to be considered – the degree to which various shapes impede or facilitate particular pivot systems or lend themselves to the receipt of different cartridges.

However, to get back to tracking, as

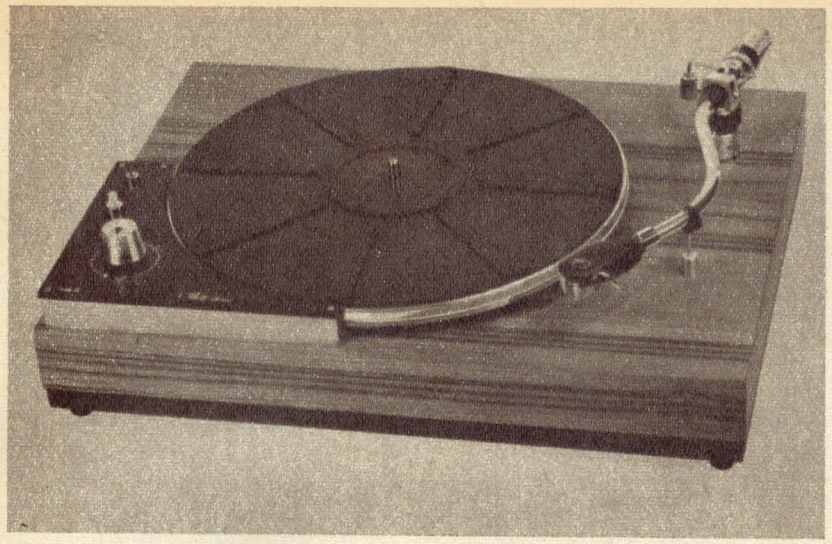


An "AKAI CHRISTMAS" Has Something for Everyone

AKAI has more to make your Christmas musically merry and your new year happily harmonious. There is an AKAI instrument just right for you or someone very special to you. Take a closer look. All AKAI instruments are also designed to blend in with the decor of your home. An AKAI instrument is built to belong. Then there's AKAI performance. In all honesty, AKAI is the renowned leader in all stereo aspects. And its portable video tape recorder is second to none. AKAI has everything you need to build a full, perfect stereo system.

①Model CS-50 ②SW-30 ③SW-125 ④Model VT-100 ⑤Model X-6000SS ⑥Model AA-8300 ⑦SW-165 ⑧Model X-2000 ⑨Model X-1800 ⑩Model 1800L ⑪Model AA-8000 ⑫Model X-600VT ⑬Model X-V ⑭Model 2500 ⑮Model 1720W ⑯Model X-5000(W) ⑰Model CP-50 ⑱Model AA-8500 ⑲Model X-1800SD ⑳Model X-220D ㉑Model AA-8600 ㉒Model M-10 ㉓Model 4000D ㉔Model X-365D ㉕SW-145

AKAI AUSTRALIA PTY. LTD.: 276 Castlereagh St., Sydney, N.S.W. Tel: 61-9881 / 146 Burwood Rd., Hawthorn, VICTORIA Tel: 81-0574 / 399 Montague Rd., West End, Brisbane, QUEENSLAND Tel: 4-0171/8 Arthur St., Unley, S.A. Tel: 71-1162/579 Murray St., Perth, W.A. Tel: 21-2561 SONNY COHEN & SON: 20 Isa St., Fyshwick, A.C.T. Tel: 9-1551 P & M DISTRIBUTORS PTY., LTD.: 87A Brisbane St., Launceston, Tasmania Tel: 2-5282



Three different methods of obtaining offset angle. The Lustre arm (left) uses a continuous curve, with an outrigger type counterweight to maintain dynamic balance. The turntable is a Compax belt drive unit. The Grace arm (immediately below) uses a straight arm with an offset section near the head, dynamic balance being maintained by careful distribution of weight on each side of the axis. The popular and inexpensive Decca Deram arm (bottom) has only the headshell offset.

distinct from these other considerations, the angle of offset is not just an arbitrary bend in the arm – or it shouldn't be!

It has been the subject of a good deal of mathematical and graphical analysis, as will be evident from a number of the more advanced audio textbooks.

By assuming that a pickup has a certain dimension between the stylus and pivot points, and that it is to track across a 12-inch disc with a minimum tracking error, it is possible to derive the two remaining vital figures:

(1) The optimum offset angle, and

(2) The distance from the centre of the turntable spindle at which the pickup pivot must be located. The distance can alternatively be nominated by the position of the stylus, when swung towards the turntable spindle – whether it falls short of the spindle or rests upon its centre or overhangs.

In fact, optimum tracking normally involves some overhang of the stylus beyond the centre line of the turntable spindle, as well as a specific amount of offset.

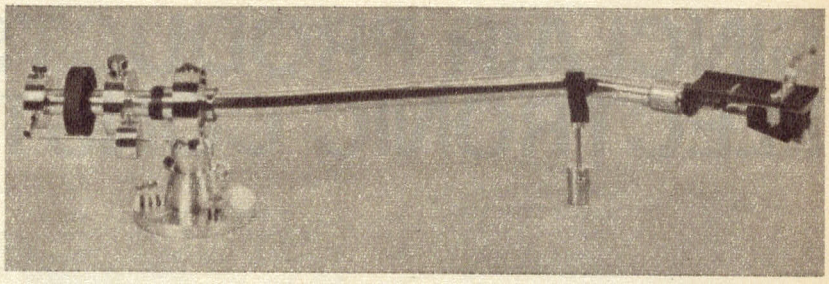
In his book, "High Quality Sound Reproduction," James Moir quotes the following mathematically derived figures:

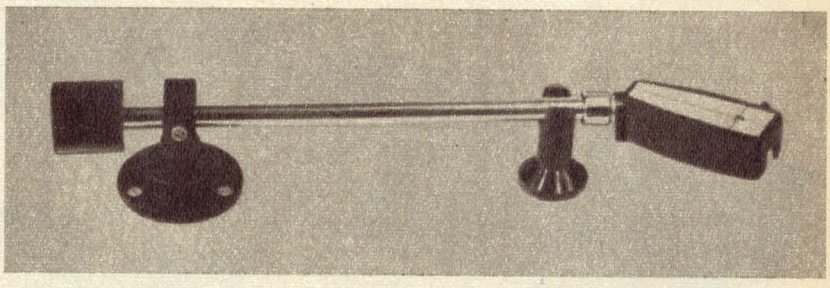
Dimension, pivot to stylus tip	Optimum offset angle	Optimum overhang inches
7in	26°	0.6
7.5in	24°	0.56
8in	22°	0.52
9in	20°	0.47
10in	17°	0.42

One point emerges from this which is not always appreciated: There is not just one point on the motor board which is optimum for the particular pickup. For the deduced minimum tracking error, the pickup pivot can be centred anywhere on a complete circle around the turntable spindle, at any point which will give the required amount of overhang.

In practice, the choice is generally limited to the small arc of the circle which will put the arm into a convenient position for handling, for placing on its rest, and to clear the sides of the enclosing cabinet.

At this point a word of warning might be appropriate. A common trap in mounting tone arms is not to allow sufficient clearance for the arc covered by the rear end. In many modern tone arms, the adjustment of the counterweight involves a rearward movement of the whole tail section, so it is necessary to ensure that the counterweight is in the fully extended position when checking for clearance.





If one could be sure that all pickup arms were designed according to these figures, the story would end right there. It would simply be a matter of measuring the point-to-point distance, assuming the angle to be as quoted and mounting to give the right overhang.

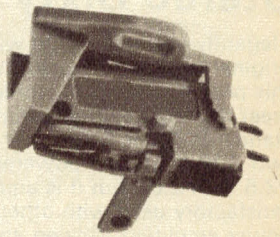
But can one be sure? It is difficult to answer this question with an unequivocal "yes", but experience suggests that the optimum overhang deduced by observation generally seems to come out very close to the figures listed above.

(continued on page 111)

ACOS REPLACEMENT LONG LIFE CARTRIDGES

Acos 90 Series — a family of pick-up cartridges covering all the main types needed today, each fitted with Diamond Stylus at no extra cost.

GP91-1 MONO CRYSTAL Stereo Compatible .. $5.95
GP91-2 HIGH OUTPUT MONO CRYSTAL Stereo Compatible .. $5.95
GP92 MONO CERAMIC Stereo Compatible .. $6.55
GP93 STEREO CRYSTAL .. $7.55
GP94-1 STEREO CERAMIC .. $7.95
GP94-5 STEREO CERAMIC FOR TRANSISTOR AMPLIFIERS .. $8.95

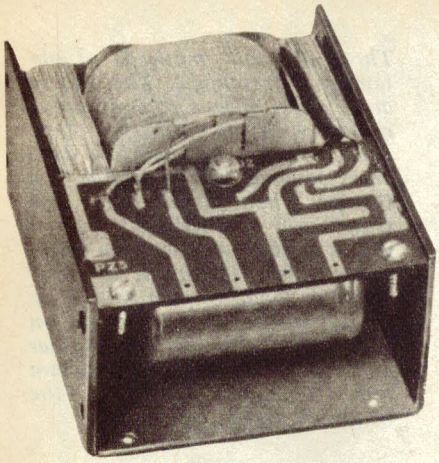


fitted with DIAMOND Stylus at no extra cost.

TECHNICAL DATA SHEETS SENT FREE ON REQUEST

Sole Australian Agents:
AMPLION (A'SIA) PTY. LTD. 29 Majors Bay Rd., Concord, Sydney, N.SW. Phone 73 1227

PZ.5 and PZ.6 Power Supply Units



Two types of mains-power supply units are available for use with Sinclair high fidelity equipment. For the majority of domestic applications the PZ.5 will be found completely adequate. Where very low-efficiency loudspeakers are used, however, it will be necessary to use a PZ.6 Stabilised Power Unit. Use of the latter is also indicated where maximum outputs are required from the amplifier system under extreme operating conditions.

PZ.5
Unstabilised power supply unit recommended for two Z.30 amplifiers and Stereo 60 for all average requirements.

Specifications

Output:
30 volts/1·5 amps maximum.

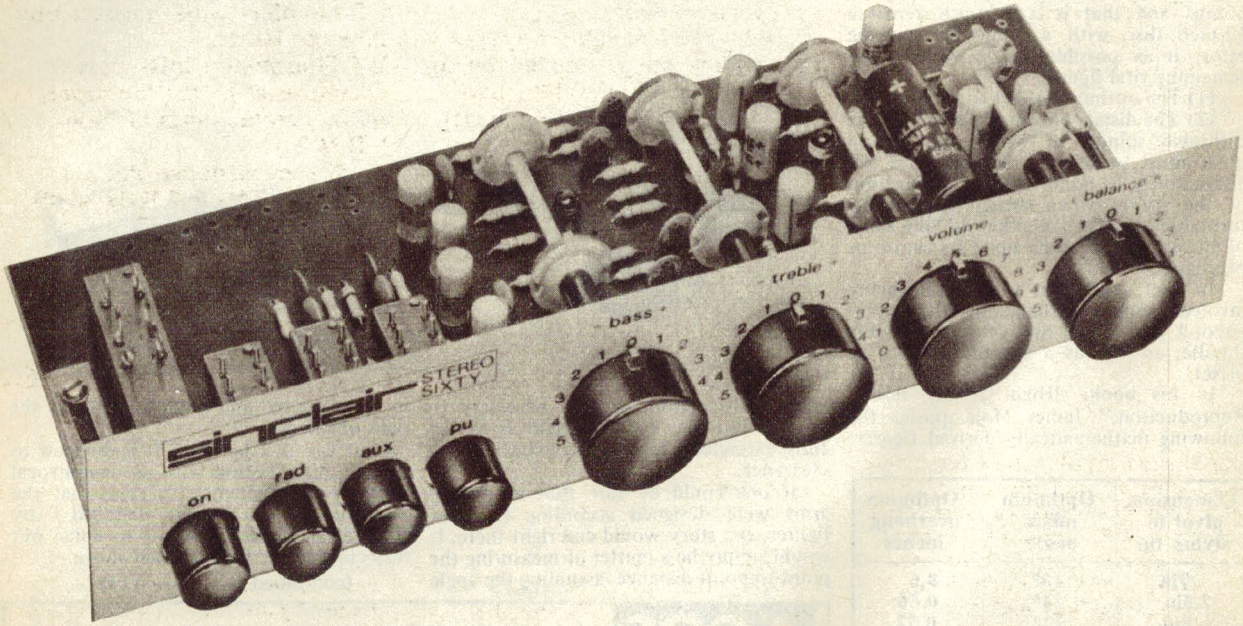
Mains input:
110-240 volts ± 20% 50/60Hz.

Size:
3·9″ × 2·8″ × 1·6″

PZ.6
Stabilised mains supply unit delivers 35 volts at 1·5 amps with ripple less than 20mV at any output up to maximum current.

Size:
3·9″ × 2·8″ × 1·6″.

SINCLAIR PRODUCTS for the ELECTRONIC CONSTRUCTOR



Stereo Sixty Pre-amplifier and control unit

Elegantly modern design with original concepts in circuitry make this pre-amp and tone control unit meet the most stringent high fidelity standards. Basically it is for use with two Z.30 amplifiers powered by a PZ.5 (or PZ.6), but it is equally satisfactory used with other good power amplifiers. Silicon epitaxial planar transistors are used throughout and a very high signal-to-noise ratio has been achieved together with excellent channel separation. The unit is very easy to mount in cabinet or modern plinth with motor and pick-up assembly.
Input selection is by means of four push buttons and accurate equalisation is provided for all the usual inputs. The tone controls are also very carefully designed and tested.

Specifications

Input sensitivities:
Radio: up to 3mV
Magnetic pick-up: 3mV
correct to R.I.A.A. curve ± 1dB
20 to 25,000Hz
Ceramic pick-up: up to 3mV
Auxiliary: up to 3mV.

Output:
250mV.

Signal-to-noise ratio:
Better than —70dB.

Channel matching:
Within 1dB.

Tone controls:
Treble +15dB to —15dB at 10kHz
Bass +15dB to —15dB at 100Hz.

Power consumption: 10mA. max.

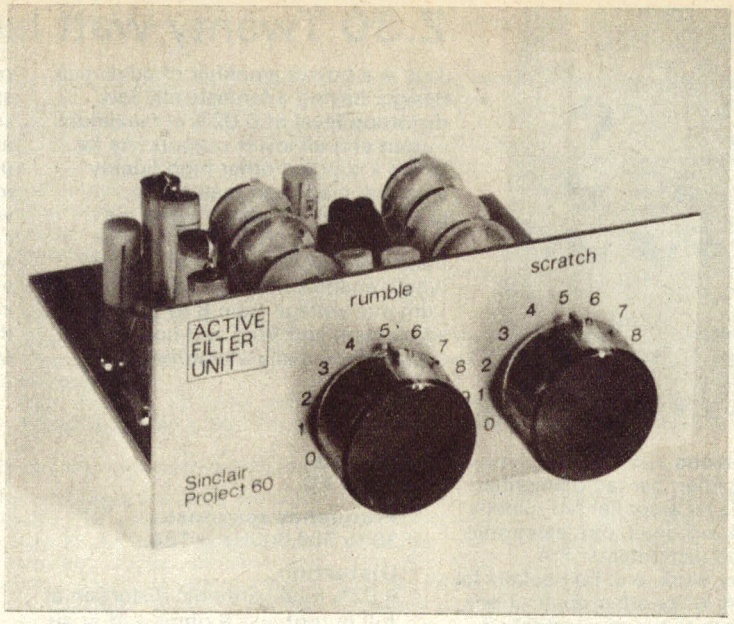
Front panel:
Brushed aluminium with black knobs and controls.

Size:
$8\frac{1}{4}$″ × $1\frac{5}{8}$″ × $3\frac{1}{2}$″.

GE P560 A

Active Filter Unit

The Sinclair Active Filter Unit is a new addition to our Project 60 range of high fidelity modules and is designed to complement the other modules in the range. Its performance is such, however, that users of other amplifier systems might well consider adding it to their assemblies.
The purpose of a filter unit is to reject frequencies above (scratch) or below (rumble) a specific cut off frequency when these frequencies contain unwanted interference. The Sinclair A.F.U. is unique in that the cut off frequency is continuously variable for both the scratch and rumble units and, as the attenuation in the rejection band is rapid (12dB per octave), the removal of interference can be achieved with less loss of the wanted signal than has previously been possible.
Each channel of the A.F.U. has an overall gain of unity and, as the input impedance is high and the output impedance is low, it may be connected between the pre-amplifier and power amplifier sections of any amplifier. Both amplitude and phase distortion have been made quite negligible by the careful design and the large amount of negative feedback employed.



Specifications
Designed for connection between the Stereo 60 pre-amplifier and two Z-30 or Z-50 power amplifiers.
Employs two Sallen & Key type active filter stages, the first being a rumble (high pass) filter and the second a scratch (low pass) filter. The two stages use complementary transistors to minimise distortion.
Supply voltage 15 to 35V
Current 3mA max. Gain at 1kHz, filters flat 0.98 (—0.2dB)
H.F. cut off (—3dB) variable from 28 kHz to 5kHz
H.F. filter slope 12dB/octave
L.F. cut off (—3dB) variable from 25 Hz to 100 Hz
L.F. filter slope 12dB/octave
Distortion at 1kHz (35v supply) 0.02% at rated output (250m V R.M.S.)
Frequency response, flat position, 35 Hz to 20kHz—1dB
25 Hz to 28 kHz—3dB
Built, tested and guaranteed



IC.10 Integrated Circuit 10 watt amplifier

The Sinclair IC.10 is the world's first monolithic integrated circuit high-fidelity amplifier and pre-amp. It has 5 watts R.M.S. output (10w. peak). The circuit is a specially processed silicon chip, one-twentieth of an inch square by 0·01 inch thick, containing 13 transistors, 3 diodes and 18 resistors. This, together with its connecting pins, is bonded to the supporting heat sink which runs through the solid plastic package in which the circuit is encapsulated. The resultant product is infinitely more rugged than any amplifier ever made available before to the public. The IC.10 is a true high-fidelity amplifier possessing distinct advantages over conventional types. The most important are complete freedom from thermal runaway and very low distortion level. Thus battery operation is perfectly satisfactory. As an audio amplifier, the IC.10 requires only the addition of components such as tone and volume controls. However, it can also be used in many other applications including servo amplifiers, etc, since the circuit is d.c. coupled in both its sections. The manual provides details of an extraordinarily wide range of applications together with all necessary instructions.

Specifications

Output:
Class AB. 10 watts peak, 5 watts R.M.S. into 3 Ω with 18v. supply.

Frequency response:
5Hz to 100kHz ± 1dB.
Total harmonic distortion less than 1% at full output.

Power gain:
110dB (100,000,000,000 times) total.

Supply voltage:
8-18 volts.

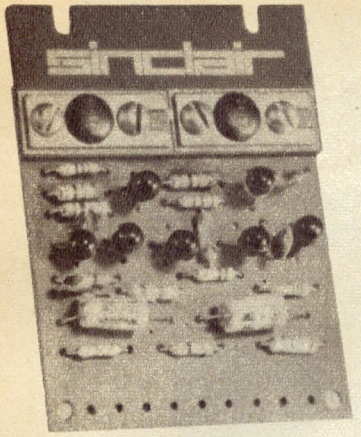
Sensitivity:
5mV.
Input impedance adjustable externally up to 2·5 MΩ for above sensitivity.

Size:
1" × 0·4" × 0·2".

Circuitry:
3 transistors in pre-amp; 10 (including two power types) in power amplifier. Both sections are d.c. coupled, and a high level of negative feedback is applied over all. With a transistor cut-off greater than 500MHz, the pre-amp can be used as an RF or IF stage and the whole IC.10 used as a radio receiver without the need to add further transistors.

Full range of Sinclair Products obtainable from Goldring Engineering (A'asia) Pty. Ltd.
See over for address details.

GE P560 B



Z.30 Twenty watt high fidelity amplifier

This is a power amplifier of advanced design, having a fantastically low distortion level of 0·02% at maximum output and all lower outputs. As far as we know, no other high fidelity amplifier made can match this specification, no matter what the price. Nine silicon epitaxial planar transistors are employed in circuitry which enables the Z.30 to operate from any voltage from 8 to 35 without adjustment and from any power supply. Essentially a high fidelity power amplifier of the very highest standards, the gain of the Z.30 is such that it can be fed directly from a crystal pick-up enabling it to be used in an economy battery operated record player for example. The versatile Z.30 has very many applications, however, ranging from high fidelity to P.A. and laboratory work and these are fully detailed in the comprehensive manual included with the unit, which is supplied built, tested and guaranteed.

Applications
Hi-fi amplifier: car radio amplifier: record player amplifier fed directly from pick-up: intercom: electronic music and instruments: P.A.: laboratory work, etc. Full details for these and many other applications are given in the manual supplied with the Z.30.

Specifications

Power output:
15 watts R.M.S. (30 watts peak) into 8 ohms using a 35 volt supply: 20 watts R.M.S. (40 watts peak) into 3 ohms using a 30 volt supply.

Output:
Class AB.

Frequency response:
30 to 300,000Hz ± 1dB.

Distortion:
0·02% total harmonic distortion at full output into 8 ohms and at all lower output levels.

Signal-to-noise ratio:
Better than —70dB unweighted.

Input sensitivity:
250mV into 100K ohms.

Damping factor:
> 500.

Loudspeaker impedances:
3 to 15 ohms.

Power requirements:
From 8 to 35 volts d.c. (the Z.30 will operate ideally from batteries if required).

Size:
3½" × 2½" × ½".

Z-50 Forty Watt RMS (80 watt peak) High Fidelity Power Amplifier

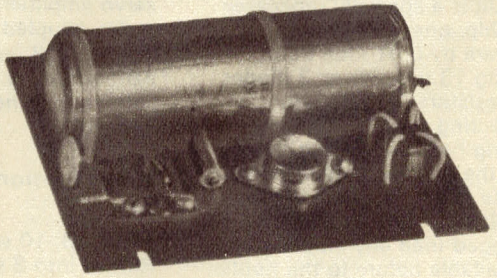
The Z-50 has been designed for applications requiring higher output power than the Z-30. The maximum supply voltage is raised to 50 Volts and the output power is 40 watts continuous R.M.S. in to 3 or 4 ohms and 30 watts continuous into 8 ohms. The Z-50 is otherwise identical to the Z-30 in design and specification, the increased power being obtained by using much higher current power transistors used well within their rated limits.

The Z-50 is, of course, compatible with the other Project 60 modules, such as the Stereo 60.

Where the full output power is not required the Z-50 may be used with the PZ-5 or PZ-6 but for the full output power the PZ-8 should be used. This unit is a stabilised power supply providing 45 volts at up to 3 amps. It is supplied without mains transformer as it is designed for use with a readily available "Radiospares" unit. Z-50 built, tested and guaranteed

PZ·8 Power Supply Unit

PZ-8 45 volts power supply unit for use with **Z-50** amplifiers Available with or without mains transformer.



Distributed by

GOLDRING Engineering (A'asia) Pty Ltd

New South Wales 443 Kent Street Sydney 2000 Telephone 29 5802
Victoria 162 Pelham Street Carlton 3053 Telephone 34 5105
Queensland 415 Adelaide Street Brisbane 4000 Telephone 2 3247
South Australia 207 Flinders Street Adelaide 5000 Telephone 23 3488
West Australia 32 Northwood Street Leederville 6007 Telephone 8 4988

SINCLAIR Products available from the following distributors:-
New SouthWales ☐ General Accessories ☐ George Brown Pty Ltd ☐ Kit-Sets ☐ Martin de Launay Pty Ltd ☐ PrePak Electronics **Victoria** ☐ Douglas Radio ☐ J H McGrath Radio Parts Pty Ltd **West Australia** ☐ Athol M Hill Pty Ltd ☐ Atkins (WA) Ltd ☐ Carlyle & Co ☐ General Accessories ☐ Willis Trading **Queensland** ☐ General Accessories ☐ Lawrence & Hanson ☐ Chandlers (Aust) Ltd

GE P560 C

However, it seems that there could be no ultimate guarantee that originators of individual arms did not modify the kind of figures quoted, in line with individual ideas. The offset angle and overhang may conform to the above table – or they may not!

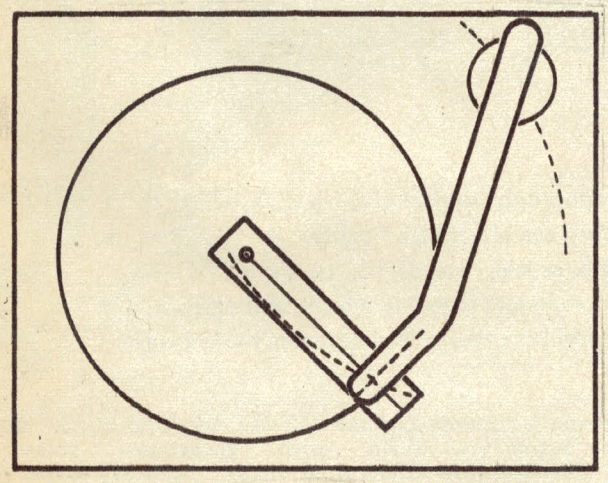
Another complication can arise from the substitution, in an arm, or a pickup cartridge different from the one originally intended. Though most pickup cartridges, these days, mount with two screws on half-inch centres, there is no standardisation as to the distance between the stylus tip and these mounting screws.

Taking extremes, it is conceivable that changing a cartridge in an arm could shift the stylus tip relative to the spindle by as much as half an inch. Therefore, what was intended as a 7.5in arm with 26 degrees offset, could effectively be reduced to 7in or increased to 8in, without the facility of modifying the offset angle by the required 2 degrees.

Serious tracking error would be introduced if, in addition to this departure from optimum offset, alteration of the stylus position meant that the stylus overhang was reduced to almost nothing or increased to over an inch.

From this, a very important rule can be deduced:

When substituting cartridges in pickup arms, whose position on the motor board cannot be varied, the distance from stylus point to pickup pivot must be checked and, if appropriate, maintained at the existing figure.



A simple method for locating a tone arm for optimum tracking angle. It requires only a piece of card about 6in x 1in with a hole at one end to take the turntable spindle, and a line down the centre. The method is explained in the text.

The qualification "if appropriate" at the end of this statement is included purely to cover the possibility of error in a previous substitution.

Whatever the circumstance, there is fairly obvious room for doubt if the stylus does not overhang the centre of the turntable spindle by about half an inch, in the case of a normal short arm, and by about 3/8in for a somewhat longer arm.

These requirements may mean that, in odd cases, certain cartridges will not be suitable for certain arms, whose position on the motor board is fixed by autostop, changer mechanism, etc.

Where the mounting of the arm can be varied, the problem is easier, because the pickup can be shifted bodily to readjust the amount of overhang and thus compensate for variations in the stylus position.

Many tone arms purchased separately nowadays come with a card template intended to assist the purchaser in installing the arm correctly, with the minimum of trouble. This template has a hole at one end which is slipped over the turntable spindle, and the centre of the mounting hole which will accommodate the shaft of the pivot is indicated by a small hole, or perhaps a cross, at the other end. The proper position of the stylus in the head shell is usually indicated also, and should be observed.

Where circumstances leave a doubt as to the proper mounting position for an arm, it is possible for anyone with a critical eye to determine a suitable position visually using only a carefully scribed piece of cardboard, as illustrated.

Take a strip of good quality card, about an inch wide and eight inches long. Draw a clean, bold line straight down the centre. Near one end make a hole, centred on the line, and forming a neat fit for the turntable spindle. Slip the card over the turntable spindle and lightly mark on the line the distance from centre of the inner and outer grooves of a full 12in LP disc.

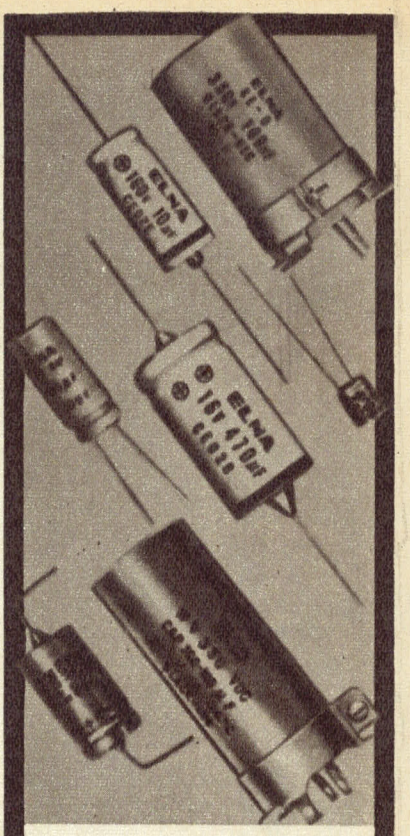
Now examine the pickup to see whether the axis of the stylus support – and probably the cartridge as a whole – can be related visually with the shape of the head shell. If need be, draw a line along the head shell with grease pencil, corresponding with the axis line of the stylus support.

With the pickup supported in a likely tentative position on the motor board, rest the stylus carefully on the line of your piece of cardboard about midway between the marks representing the inner and outer grooves. Looking vertically downward, the line along the pickup head shell and the line on your cardboard should form something very close to a right angle.

Without altering the position of the pickup pivot on the motor board, rest the stylus on points along the line, to the outside groove, then to the inside groove. Note how the tracking angle varies from the optimum right angle toward the extremes of groove radius.

By now moving the pickup pivot slightly closer to the turntable spindle or further away – thus varying the amount of overhang – the influence on tracking error can be observed.

While it might be thought reasonable to select a position where the errors at the two extremes are about balanced, there is good support for the idea that the selection should be biased slightly toward reducing tracking error at the inner grooves, accepting somewhat greater error on the outer grooves. This is based on the fact that the wavelengths on the outer grooves are greater and the angle of the stylus approach therefore somewhat less critical. ■



every month
50,000,000

ELNA

Electrolytic Capacitors, are wired into quality equipment throughout the world . . . proof that ELNA capacitors are fully accepted and wanted by manufacturers everywhere.

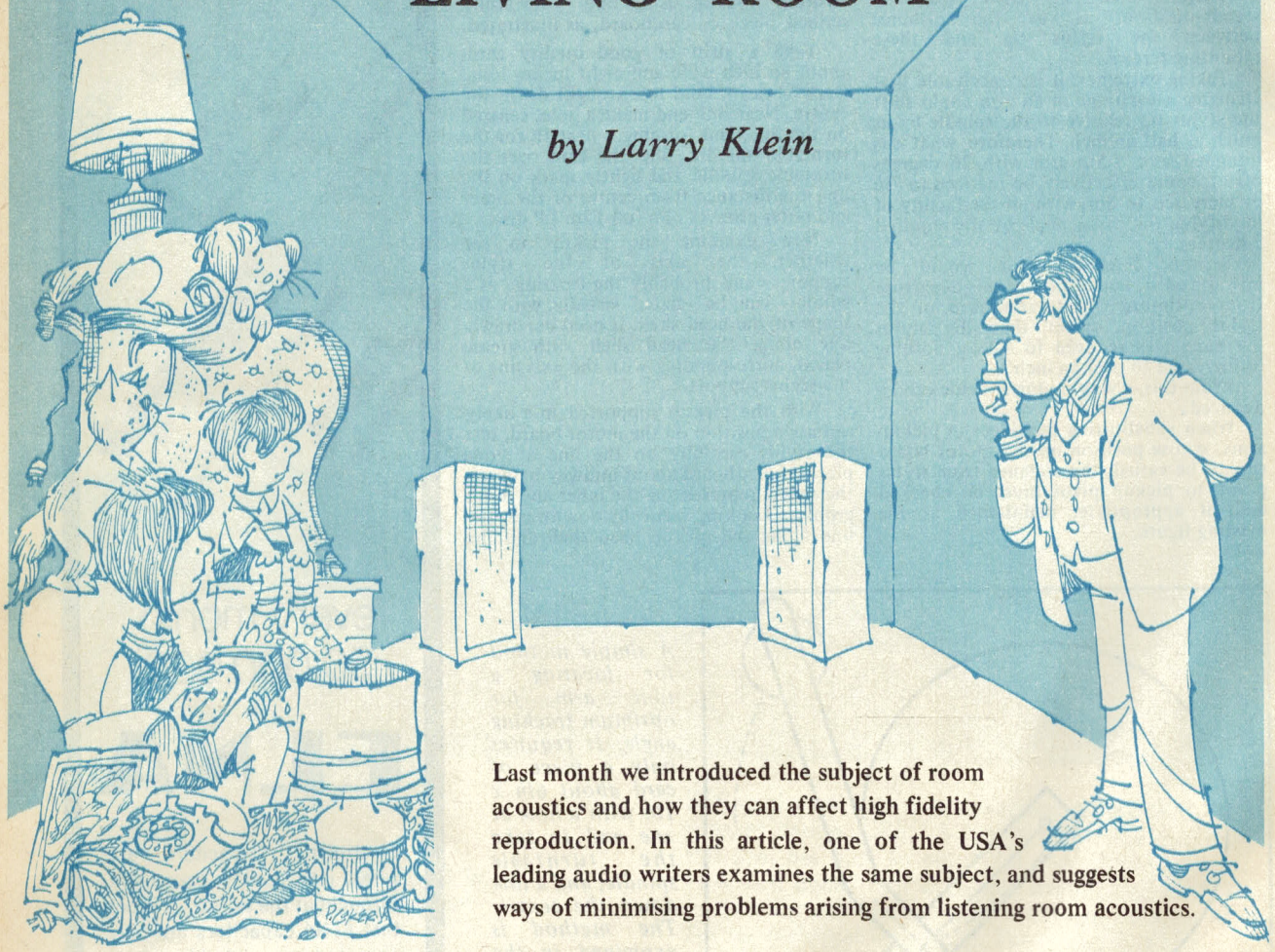
Catalogue now available

SOANAR ELECTRONICS Pty. Ltd.

SALES OFFICES
VIC.: 30-32 Lexton Rd., Box Hill. 89 0238.
NSW: 62 Carlton Cr., Summer Hill. 798 6999.
SA: 470 Morphett St., Adelaide. 51 6981.
INTERSTATE AGENTS
QLD: R. A. Venn Pty. Ltd., Valley. 51 5421.
WA: Everett Agency Pty. Ltd., West Leederville. 8 4137.
Sole Australian Agents

THE LOUDSPEAKER and the LIVING ROOM

by Larry Klein



Last month we introduced the subject of room acoustics and how they can affect high fidelity reproduction. In this article, one of the USA's leading audio writers examines the same subject, and suggests ways of minimising problems arising from listening room acoustics.

At best, the setting-up instructions that accompany loudspeaker systems can usually be charitably described as minimal. A possible reason for this is the complexity of the problem. Most people instal their loudspeakers where they look good – or at least unobtrusive – and that is that.

"Why cause trouble," thinks the manufacturer, "by bringing up questions of room acoustics and how well a loudspeaker system interacts with them, when it's easier to leave well alone?"

However, one characteristic of the audiophile is his inability to be satisfied with "well enough," and it is to all seekers after high fidelity, old hands as well as newcomers, that this article is addressed.

First of all, there are unfortunately no hard-and-fast rules about exactly where to put your stereo loudspeakers. The acoustic characteristics of listening rooms vary tremendously from one to the other, and certainly loudspeakers are not famous for their consistency from brand to brand – or even model to model. One way of approaching the question, then, is to look at the range of variation in room properties, then the variations in loudspeaker characteristics, and to try to relate the two sensibly.

The normal-size listening room has properties that can affect the sound from a speaker in various ways. If a room has bare walls, uncarpeted floors, and sparse furnishings, acousticians would describe it as "hard" or "bright." If you were to stand in such a room and clap your hands – once, and hard – after the clap you would hear a sort of "ringing" or "reverberation echo" that might take up to a second or so to die down. At the other extreme, if the listening room is filled with goosedown sofas, overstuffed chairs, and heavy drapes and rugs, the same handclap in such a room will sound rather "dead" or dull. Most of the "snap" in high-frequency sounds will be gone and, in an extreme case, handclapping might sound more like feet stamping.

Music reproduced – or played, for that matter – in the two above-described rooms would, of course, be subject to similar sonic aberrations. In the "bright" room, everything played through the speakers would sound excessively shrill; pizzicatto passages would be blurred, the stereo effect would be mostly lost, and tape and record-surface noise might be unbearable. The same speakers playing in the "dead" room would sound dull, muddy, perhaps boomy, and would lack instrumental definition. For best results, of course, the acoustic properties of the

Copyright (C) 1970 by the Ziff-Davis Publishing Company. Reprinted from the August 1970 issue of "Stereo Review" by permission.

listening room should be somewhere between these two extremes. Happily, they usually are. If you feel your room is too "live" try additional "damping" such as is provided by rugs, heavy drapes, wall hangings, well-cushioned furniture, and so forth. If your room is too dead (a very unlikely situation with today's approach to interior decoration), try removing some of the above-mentioned items.

The only other room acoustics problem that can cause difficulties is the phenomenon called *standing waves*. Since the dimensions of most listening rooms are such that they correspond to low-frequency wavelengths (actually half-wavelengths), you may conceivably run into standing-wave trouble – a persistent bass heaviness that is heard in some parts of the room but not in others. In general, you can minimise the problem by, in effect, changing the room boundaries: instal tall heavy bookcases or similar furniture as room dividers, relocate your speakers, or relocate your listening area. Standing waves, when troublesome, tend to be at maximum pressure extremes along walls and in the corners. Speakers located at the maximum pressure points will tend to aggravate the situation, whereas speakers located at the low-pressure points will minimize the problem.

In order to determine the best locations for your speakers you could do a mathematical analysis of your room and the troublesome wavelengths, but it's simpler to use your ears as null detectors. With your speakers playing in some other part of the room (standing waves remain in the same location no matter where your speakers are located) move your head around in the area where you intend to locate your speakers. With heavy bass material playing you should be able to hear areas where the bass is very strong and other areas where it is comparatively weak. For minimum activation of standing waves, locate your speaker in the weak areas.

The same technique can also be used for the positioning of your favourite listening chair. A test-tone record or audio generator will make the job much easier. Other possible remedial measures you can try include turning up the mid-range and tweeter controls on your speaker so that the relative bass level is lower, and/or cutting back on the bass response with the tone controls on your amplifier. You might be able to establish some compromise setting that eliminates most of the standing-wave problem without simultaneously getting rid of all your bass response.

Obviously, the lower and more powerful the bass response of your speakers the more likely they will activate the standing waves in the room. Unfortunately, there are some severe standing-wave problems that



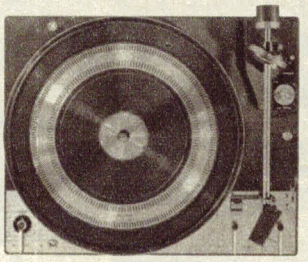
Prices Slashed for Xmas and New Year!

COMPLETE HI-FI SYSTEM

Absolutely complete—ready to plug in—no extras to buy. Here's a wonderful opportunity to obtain a splendidly matched Hi-Fi System, with superb sound, at far, far below usual price. Normal price for this system is $644, but for Christmas and New Year we have cut the price to $490.50. What a buy!

~~$644~~ **$490.50**

NEW Dual RECORD PLAYER

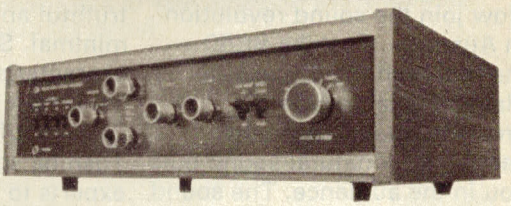


MODEL 1209 MANUAL OR AUTO

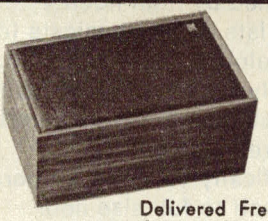
4 pole shielded motor, non magnetic T/T4.2lb weight, Quality Tone Arm, Anti-Skate Adjustment, Pitch Control, Cue Control, 3 speeds — wow and flutter less or equal to 0.09%. Fitted with Shure M55E Magnetic Cartridge (Elliptical Stylus) and complete with player base and perspex cover. Charger facilities if required.

MONARCH AMPLIFIER

Monarch A500 Specifications. 30 watts RMS per channel at 8 ohms. Harmonic Distortion 0.2% at 25 watts. Frequency response 20-40 KHZ. Hum and Noise—60dB. Controls—Input selector, mode switch, tape monitor, volume, balance, treble, bass controls, speaker switch A, B or A plus B, loudness, HI filter, Low filter and phone jack. Walnut housing.



WHARFEDALE "MELTON" SPEAKER



TWO-WAY SYSTEM

Size 21 x 13 x 10¼ — Response 45 — 17000 Hz — 12 inch bass unit — 3 inch Tweeter — 4 element crossover — power rating 25 watts R.M.S. Walnut finish.

Delivered Free in the Metropolitan area.
Write for details or call in for a demonstration NOW.

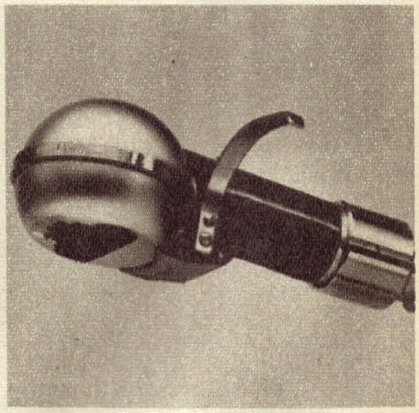
AE ARROW ELECTRONICS
NOW AT 342 Kent St. SYDNEY 29-6731
Opposite 2UW between KING & MARKET Sts.

the revolution in natural sound

starts with the **TOSHIBA** SR50 new

photo electronic cartridge





Now join the sound revolution in Australia. Toshiba SR50 — the first high fidelity record player available with the amazing photo electronic cartridge — natural sound puts you in the audience. The sound is so pure and new that at first it is a shock to the senses. Artificial tones are eliminated. The SR50 gives you these revolutionary advantages over recorders with conventional magnetic cartridges.

* Frequency range 20-40,000 Hz. Compliance 30 x 10^{-6} cm/dyne. Cross talk 32d B (1kHz).
* Lineality is much more truthful and distortion is minimal. Superb transient characteristics.

TOSHIBA SPEAKER SYSTEMS — scientifically designed by Toshiba sound engineering experts to give you a real revolution in sound.

The entire range of Toshiba speaker systems have been acclaimed by high fidelity specialists and enthusiasts for its uncoloured natural sound. The only sound that stays with you. Cabinets are engineered from precision cut, scientifically selected timbers. Bookshelf to full size floor models.



Fill in the coupon and we'll send all technical data on the SR50 and the revolutionary photo electronic cartridge — or information on any other Toshiba appliance.

JOIN THE REVOLUTION IN NATURAL SOUND.

Toshiba **TOSHIBA**

T18/105

To:— Sun Electric Company Pty. Limited, 26-52 Queensbridge St., South Melbourne. Vic. 3205.

Please send me technical brochures for the following:-

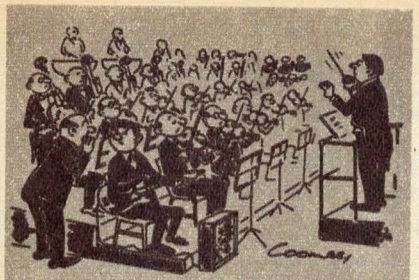
SR 50 ..... Record Players: ..... Tape Decks: .....

Amplifiers: ..... Tape Recorders: .....

Name: .....

Address: .....

.....



Sure you haven't got your dates mixed, son? ("TV TIMES")

admit of no easy solution. Changing the dimensions of the listening room or using some type of room-equalisation technique are possibilities, but they demand what some would regard as radical surgery on your walls or bank account.

Assuming that your listening room's acoustic properties fall within a normal range and present no special problems, let us consider some of the other speaker-installation questions that commonly arise.

How far apart and how high should stereo speakers be installed? The maximum and minimum permissible distances between your speakers is determined both by your speakers' high-frequency dispersion characteristics and the dimensions of your listening room. The better your speakers are in respect to their ability to radiate the higher frequencies over a wide area, the less critical will be the distance from speaker to speaker and from speakers to listener. In general, the closer you have to sit to the speakers (because of room dimensions), the smaller the permissible spacing between them. A good starting point is a separation of eight feet – and then adjust to taste.

The goal, of course, is to achieve the speaker-to-speaker spacing that provides a continuous stereo image across the area between them. Admittedly, some program material is not intended to provide that sort of image, but with well-recorded large symphonic works, the orchestra should be spread out smoothly between the speakers and even slightly beyond their sides.

The general rules for locating speakers are these: the closer to the room corners, the more bass will be heard. For maximum bass, a speaker system should be installed in a corner at a junction of two walls and the floor – or ceiling. For less bass, a speaker should be installed at a midwall location, and for minimum bass, a system should be moved away from the walls a foot or so. In effect, all the same rules discussed earlier that apply to controlling standing waves also apply for bass reproduction.

You should be aware that the most bass is not necessarily the best bass. What you want is bass performance that does not overpower the mid-range and treble, but is smoothly co-ordinated with it. Some bookshelf-size systems, if operated standing on the floor, not only become bass-heavy, but also tend to have their upper frequencies soaked up by rugs and furniture. The result is an unbalanced, muddy sound quality. Bookshelf systems are best installed at ear level (for a listener who is seated, that is). If you want to put them higher, tilt them so they face down at the listening area. If you place your speakers against the short wall of, say, a 10 x 15ft room, you may get excessively heavy bass because of their proximity to the room corners. But, on the other hand, if your speakers can use help in the bass end, the short wall may be the preferred location. Again, it's a matter of trial and error.

The tweeter and mid-range level controls on the back of your speakers are there to be used. Don't simply set them to "normal" and let it go at that. I have found that some speaker manufacturers (including one of the biggest ones) have peculiar notions as to what constitutes a "normal" setting. Pick a good new classical disc and use it to set your speaker controls. Set the tweeter so that you hear smooth reproduction of cymbals and triangles, but not excessive scratch or tape hiss. Set the mid-range so that there is neither an excessively "forward" nor "remote, withdrawn" quality in the music. Listen particularly to brass when setting the mid-range control, and try to minimise any nasal or "honky" quality that may appear.

Another common question concerns the best kind of speaker wire to use. Avoid, if possible, the thin "hi-fi" speaker cable sold by most stores. This is suitable for runs of perhaps 10ft or so, but to prevent loss of power on longer runs, use ordinary rubber-or-plastic insulated lamp cord. Make sure that the wire is connected so that the speakers are properly phased. Some two-conductor wires have the undoubted advantage of a kind of coding to differentiate one conductor from the other. The coding may consist of a ridge or flat on the plastic insulation, a coloured thread inside the insulation, or even different colours in the wire itself (copper and silver are commonly used). Make sure that the same wire of each pair goes to the "hot" or "plus" terminal on the speaker and the amplifier.

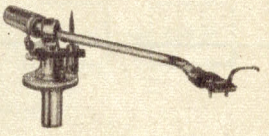
One last point: if your amplifier or receiver does not have provisions for multiple speaker switching, think twice before buying a speaker switch out of a catalogue and hooking a batch of extensions to it. A wrong choice of switch and you may blow out the power transistors in your amplifier. If the amplifier manufacturer's instructions do not include data on connecting extra speakers, write for his suggestions before going ahead on your own and making what could be a very costly error. ■

MADE FOR EACH OTHER...

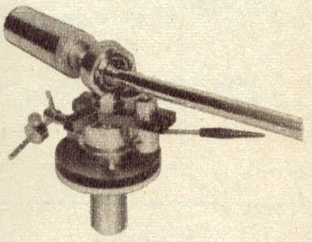
Grace G 840 Arm and Grace F-8C Cartridge

Encel offers this famous Hi-Fi duo at the unbeatable price of **$99.00** (inc. sales tax).
The ultra lightweight headshell accepts all standard ½" mounting cartridges.
There is no better arm than the renowned G 840. It is specially shaped and tapered for torsional and resonant stability and fully compensated for side thrust. It moves with minimal friction on high precision gimbal mountings and is fitted with in-built oil damped lift and lower control. A calibrated rotary counterweight gives perfect adjustment of stylus pressure.

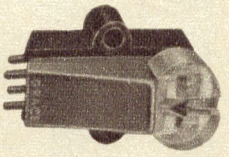
For maximum performance team the G 840 with the top ranked Grace F-8C magnetic cartridge (Encel price for cartridge alone — **$49.50** (inc. sales tax). This fine unit, with replaceable elliptical diamond stylus, has virtually flat frequency response and is ideally suited for laboratory testing of audio equipment. It maintains excellent separation well above 10kHz and tracks at minimal stylus pressure of 0.5 — 1.5 gms.
Frequency range 15 — 25 kHz + 2.5 db — 1 dB, with cross talk less than —30 dB (1 kHz).
Write now for full technical specifications of these top line components.



G 840 — $49.50



F-8C — $49.50



EE28

ENCEL ELECTRONICS PTY. LTD.

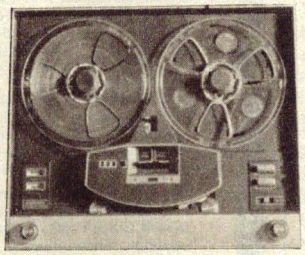
HEAD OFFICE: 431 BRIDGE ROAD, RICHMOND, VIC. 3121
TEL. 42 3762
SYDNEY STORE: GROUND FLOOR, 2 SM BUILDING, 257 CLARENCE STREET, SYDNEY, N.S.W. 2000
TEL. 29 4563, 29 4564
■ AUSTRALIA'S GREATEST HI-FI CENTRES
■ TRADE-INS ACCEPTED ■ TERMS

COME TO RECORDED MUSIC SALON

For the World's Best Genuine Hi-Fi Record Playing Equipment.

We Are Sole Agents In Australia For Armstrong-England, Jordan-Wetts-England, Rogers-England, Empire-USA, Era-France Harman-Kardon-USA, Schaub-Lorenz-Germany

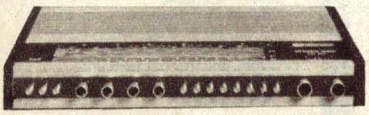
AMPEX



AMPEX MONITOR STEREO TAPE DECK MODEL 750

Enjoy famous Ampex quality and professional features at an attractive price. This quality engineered Ampex deck features three heads . . . separate Deep Gap Head for Playback and Monitor lets you hear the tape exactly as it is being recorded . . . and enables Sound-on-Sound, Sound-With-Sound and Echo effects. Other quality features include exclusive Ampex Dual Capstan Drive and Rigid-Block Head Suspension. May be custom mounted in your present system, or in a handsome walnut base (optional). Another of the Ampex Incomparables . . . the finest in reel-to-reel tape decks!

ITT SCHAUB-LORENZ



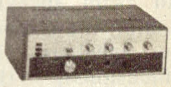
WAVEBANDS: VHF/FM, SW (bandspread 41 m and 49 m bands), MW, LW.
SOUND: Push-pull output stages with a continuous sine-wave power of 2 - 20 watts, harmonic distortion 0.3%. Music power: 2 x 30 watts. Frequency range: 20-20,000 Hz. Power bandwidth: 15-40,000 Hz. Volume control switchable to tone-compensated control or linear control. Switchable rumble filter. 2-stage equalising pre-amplifier for magnetic cartridges.

ROGERS



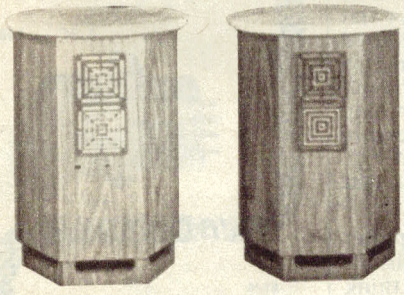
TECHNICAL

Power Output:
10 + 10 watts R.M.S. into 15 ohms. 1 kHz.
15 + 15 watts R.M.S. into 8 oms. 1 kHz.
(Both channels driven simultaneously.)
Total Harmonic Distortion:
Less than .1% at 10 watts into 15 ohms. 1 kHz.
Less than .25% at 10 watts into 15 ohms. 100 Hz-10 kHz.



TECHNICAL SPECIFICATIONS

Power Output 25 plus 25 watts R.M.S. into 15 or 8 ohms. 13 plus 13 watts R.M.S. into 4 ohms. 25-25,000 Hz. Harmonic Distortion. Better than .06 per cent up to 15 watts into 15 ohms at 1,000 Hz (.1 per cent average at 25 watts). Intermodulation Distortion. Better than .25 per cent up to 15 watts into 15 ohms (.5 per cent average at 25 watts) (50 Hz and 6,000 Hz mixed 4:1). NFB, 36 dB. Damping Factor, 60 at 1,000 Hz. Signal to Noise Ratio.



Empire's newest Grenadier Model 6000 stands 24 inches high and has a diameter of 18 inches. The 3 way system can handle 75 watts of power (with imported marble top) and is available in walnut or dark oak finish. Frequency response from 30-20,000 Hz.

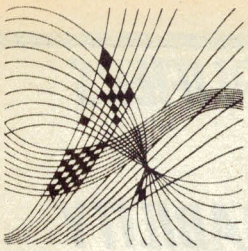
Write for a free Guide to Sound Design for 1971: Empire Scientific Corp., 1055 Stewart Avenue, Garden City, N.Y. 11530.

For further details about our range of Hi-Fi Record - Playing Equipment please write or call.

RECORDED MUSIC SALON

C. Pinczewski — **True Fidelity**

11 Collins Street, Melbourne, 3000.
Telephone 63 6257



CLASSICAL RECORDINGS

Reviewed by Julian Russell

JANACEK – Jenufa. Complete Opera. Libuse Domaninska; Vilem Pribyl; Nadezda Kniplova; Ivo Zidek; Marie Mrazova, with the Prague National Theatre Chorus and Orchestra conducted by Bohumil Gregor. Recorded by EMI in association with Supraphon, Prague. Angel Series Stereo SAN256/7.

This new recording of Janacek's most popular opera is more than welcome. I still have the old Supraphon set which was issued here, it must be nearly 20 years ago and which was anything but impressive in the way of sound even back in those days. The new set, by an entirely different cast, has what might be described as good average sound but the performance is full of vitality.

If you haven't heard a Janacek opera before you're in for a new and exciting experience in Jenufa. Janacek's style is right out of the main line of the development of Western music. He made his first studies under a Czech nationalistic musician and owing to his parents' poverty did not obtain a more conventional musical education – at Leipzig – until he was 25 and his style more or less firmly formed. It is therefore not surprising that his Leipzig studies meant little to him.

All his life Janacek was deeply interested in Moravian folk song and even in the inflections of Moravian speech. It was on these that he modelled to a great extent his melodic line, both vocal and instrumental. His scoring tends to exploit the characteristic timbre of each instrument, even when it is used in combination with others. To exploit, too, the maximum of expression he used the extreme registers of both instruments and voice. He abandoned thematic development in favour of rhythmical and melodic repetition, and achieved additional emphasis by the unusual shortness of the themes. Thus his inimitable style produced no heirs or successful imitators. His influence on the general progress of music has so far been nil. There was only one Janacek and a successor using his highly individual style seems improbable.

When you listen to this recording I must warn you to put aside all preconceived ideas on singing in either the bel canto style, the more forward French method, or the best of German voice production. Most Eastern European singers – and though Czechoslovakia is in Central Europe its musical culture, as manifested in its singers, more closely approximates the Eastern European style – sound, to our ears, untutored and without refinement, almost as if the singers are untrained. But this in no way impairs their effectiveness in expressing deeply felt emotions. The sopranos may sound hard and wobbly, the tenors rough edged and, in Janacek's high tessitura, strained. But I have found this to be the case with most Czech, Bulgarian and Russian recordings. Only the basses seem to conform to our ideas on voice production.

But once you have crossed that hurdle you can settle down to a rewarding experience in listening to this new set. I must first mention the conductor, who has just the right flair to ignite the score into the brief emotional flare-ups that are characteristic of all Janacek's music. These laconic phrases, often repeated immediately after their first statement, never cease to surprise by their unerring stirring of emotion. Not a note is wasted on decoration.

Every character is stripped down to his or her soul and Janacek perceives their idiosyncracies with unerring insight. The story is too long to relate here, and, like Il Trovatore, its understanding demands of the audience some knowledge of what has gone on before the curtain rises and, more important, the close though complicated family relationship between the characters. It is an opera of violent clashes of personalities, of deeply felt resentments, of obstinate pride that can be softened by a sense of justice, of loyalty and betrayal – in short, every ingredient that might make a successful musical play.

All these features call for great subtlety of expression by singers and orchestra alike and despite what I have written above about the quality of the Czech voices, the validity of the different characterisations and their motivations is never in doubt. I must warn that Jenufa will not jump immediately into your lap. But the better you get to know this unique work the more you will find to enjoy in its unfaltering honesty, vivid chacterisation, and from time to time, among the apparently scrappy material, the sudden unexpected comfort of a glowing melody.

* * *

HILL, Alfred Francis – Violin Concerto. Alwyn Elliott, violin; The Sydney Symphony Orchestra, conductor Joseph Post. Trumpet Concerto. Donald Johnson, trumpet; The West Australian Symphony Orchestra, conductor Thomas Mayer. Serenade for Solo Flute and Strings. Owen Fisenden, flute; The Oriel String Quarter. EMI stereo OASD7556.

This is the centenary year of the birth of Alfred Hill, who was born in Melbourne, was taken by his parents to New Zealand as a child, and returned to Australia where he died in 1960 at the age of 90. His music was unmarked by any of the upheavals of 20th century trends. His dominating influence was Brahms, the gentle feminine side of Brahms, not the forceful one. It seems anachronistic that a composer who died only a short 10 years ago was content to write, all his life, music in the style of 100 years earlier. For it must be remembered that during Hill's lifetime the music of Richard Strauss, Debussy, Ravel, Mahler, Bartok and the Second Viennese School flowered and ripened, a fact that could never be guessed from Hill's amiable compositions. His was not a major talent, but a graceful one. For the most part his music is placid and lyrical. There are no complexities. He never displayed either the musical enterprise or the ebullient vitality of his compatriot, Percy Grainger.

The Violin Concerto is a charming work to be listened to without difficulty, with a slow movement full of poetic musings. It receives an affectionate performance here but I would have liked a little more fire in the Finale which seems to me to drag a little. Some of the work's sequences are as predictable as tomorrow's tide. Indeed the feature that I often find tedious in Hill's music is the lack of any element of surprise. The trumpet is usually an assertive instrument but the treatment of it in his Trumpet Concerto – about as gentle as can be imagined – gives the work a consistently sentimental atmosphere, though this is never allowed to degenerate into bathos.

The Serenade is a short pastoral piece, very neatly written and continuingly melodious. Unfortunately the sleeve notes omit to mention what might well have been a point of interest – the dates of composition of the three pieces.

* * *

RAVEL – L'Enfant et les Sortileges. Complete Opera. Flore Wend; Marie-Lise de Montmollin; Genevieve Touraine; Adrienne Migliette; Susan Danco; Juliette Bise; Gisella Bobillier; Hugues Cuenod and others with the Motet Choir of Geneva and the Swiss Romande Orchestra conducted by Ernest Ansermet. World Record Club S/6216.

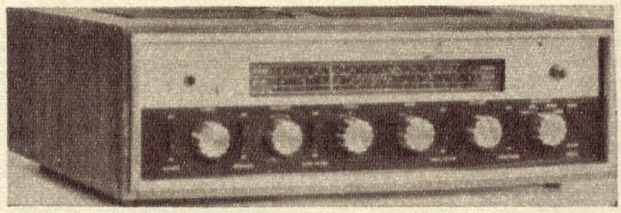
This altogether delicious disc was first issued back in 1955, I think, on mono only. Later it was reissued on stereo which greatly improved the distribution of the sound, especially the enchanting final chorus. This stereo version is the second time round for the World Record Club and usually I would have let it pass unnoticed. However in the hope of bringing it to the attention of those who are unaware that it has been previously issued and have consequently missed a delightful experience I am again giving it a notice, though this time only a brief one. The little opera is the result of a collaboration between the famous French novelist Colette and Maurice Ravel. It is a fairy story about a naughty child who wilfully damages the furniture in his house, torments the domestic pets – and other little animals in the garden. These things come to life, start to talk, and finally reform the child.

Ravel furnished the delicate text with an exquisite score, full of entrancing melodies, some of them brilliant parodies. The cast is a large one with some doubling of roles. All are enjoyable to listen to though I must admit to preferring the two cats who performed so brilliantly in the old 78 version.

The nature of the opera makes it peculiarly suitable to home listening. Away from the theatre it is even more evocative than in it. For similar examples I can quote, as one, The Ride of the Valkyries. What theatre could mount a scene that makes this music as vivid to the eye as it is to the ear alone. Indeed in even the best equipped opera houses – and I

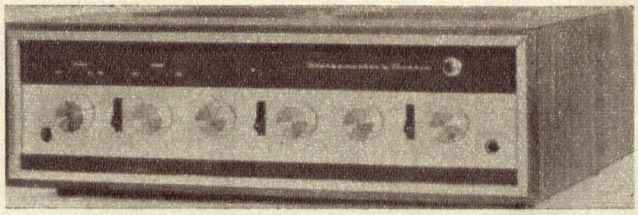
NEW ALL TRANSISTOR STEREO AMPLIFIERS
WITH IN-BUILT A.M. TUNER
ULTIMATE IN DESIGN—LONG DEPENDABILITY
USING ALL SILICON TRANSISTORS
40 WATTS—RMS

SPECIFICATIONS:
20 watts per channel R.M.S. Total out put 40 watts R.M.S.
FREQUENCY RESPONSE:
From 20 cycles to 20,000±1db.
HARMONIC DISTORTION:
Less than·5 per cent at rated output.
HUM AND NOISE:
Aux. 70db. Mag. 50db.
INPUT SENSITIVITY:
Mag. 3mv. Aux. 200mv.
SPEAKER IMPEDANCE:
8 ohms.
EQUALISED:
Mag. RIAA.
TONE CONTROLS:
Bass, 50 c/s ± 12db. Treble 10 kc/s 12db.
LOUDNESS CONTROL:
50 c/s 10db.
SCRATCH FILTER:
(High filter) at 10 kc/s 9db.
RUMBLE FILTER:
(Low filter) at 50 c/s 5db.
PROVISION FOR TAPE RECORDER:
Record or play-back with din plug connection.
PROVISION FOR HEAD PHONES:
With headphone/speaker switch on front panel.
DIMENSIONS:
16½in x 5½in x 11in deep.
TUNER:
This unit can be supplied with either valve or transistor tuner with a coverage of 530 to 1,600 K.C. Calibrated dial available for all States.
THE CIRCUIT INCORPORATES regulated power supply with transistor switching protection for output transistors. 26 silicon transistors plus 5 diodes are used.



MODEL C300/20/T

$129.00 PLUS FREIGHT
(cabinet extra)



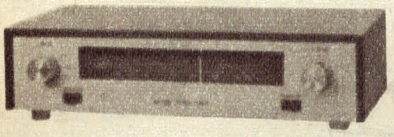
MODEL C400/20

$103.00
PLUS FREIGHT
(cabinet extra)

AMPLIFIER ONLY. Specifications as above but with the added feature of front panel switch which allows selection of two speaker systems.

CABINETS FOR ABOVE AMPLIFIERS IN OILED WALNUT OR TEAK WITH METAL TRIM $10.00 EXTRA

NEW ALL-TRANSISTOR A.M. TUNER WITH PRE-AMPLIFIER



Suitable for use with all valve transistor Hi-Fi amplifiers, tape recorders or P.A. amplifiers.
SPECIFICATIONS
Frequency coverage 530 to 1600 K.C. bandwidth 9 K.C. Inbuilt aerial, provision for external aerial. 240 volt A.C. operation. Dimensions 10¾ x 6in x 3½in. Output variable from 50mv to 700mv.
$44.00 Post and Packing. $1.50.

CLEARANCE OF VALVE AMPLIFIERS WITH TUNERS BASED ON THE PLAYMASTER 106 AND 118 FROM $80.

POWER OUTPUT: 9 watts per channel R.M.S. FREQUENCY RESPONSE: 20 to 20,000 cycles incorporating Ferguson O.P.412 grain oriented output transformers. VALVES USED: 4-6GW8, 12AX7 or 12AU7, 6AN7, 6N8, EM84 and 2 silicon diodes.

CLASSIC RADIO
245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE 798-7145

include Bayreuth among them – the scene lets the music down. Any attempts to stage this scene realistically with real horses on the stage and mounted warrior-maidens riding though stormy clouds ends up by looking slightly comical. At Bayreuth, where the last production I saw was formalised, it was just dull.

I saw a very good performance of L'Enfant et les Sortileges at the Volksoper Vienna in 1965. True the majority of the cast were German or Austrian and a little out of step with French music. But so far as the staging was concerned – and the Volksoper has quite splendid stage equipment – it was ingenious but never quite convincing. If you listen to this recording, while following it with the libretto provided, you will, in the mind's eye, recreate for yourself much of the fairy tale atmosphere that is inevitably lost in a stage production. I am sure that if you spring the modest sum necessary to acquire the recording at the club price asked, you will enjoy many hours of delighted listening.

* * *

SCHONBERG – Pelleas and Melisande. Tone Poem. New Philharmonia Orchestra conducted by Sir John Barbirolli. World Record Club Stereo S/6352.

This is not an operatic setting of the Maeterlinck play as used by Debussy, but a tone poem in four parts which, however, are played without a break. The story is the same as that used by Debussy, and Schonberg retained most of the scenes used by the French composer. I don't have to point out that Schonberg's and Debussy's style were quite different, even though this is a very early Schonberg work. Schonberg's score has much of the chromatic romanticism of "Tristan" and "Transfigured Night", though polyphonically it is far more complex than either of these works. But Schonberg uses leading motives in a way that makes the narrative easy to follow with the aid of the sleeve notes.

The music is sometimes Wagnerian, sometimes Straussian (Richard) and now and again you might be listening to Mahler. It is all very juicy, even perhaps a little overripe, but it's full of luscious sounds and builds up to a truly ecstatic extended climax. If you would like to stretch out in an atmosphere of luxuriant romanticism – even romanticism in decay – this is certainly for you. The performance and sound are excellent.

* * *

SIBELIUS – Lemminkainen and the Maidens of Saari. Finlandia.
BERGMAN – Aubade. Helsinki Philharmonic Orchestra conducted by Jorma Panula. Decca Stereo SXL6434.

The Lemminkainen piece on this disc might well surprise those who think Sibelius, despite his many manifest beauties, a stern composer. They will hear always warm, often passionate music. The scoring is unusually luxuriant for this composer. The sound is splendid – rich string tone, clean woodwind (except for a slightly untidy attack on the first bar) – and brass with just the right Sibelian bite. There are typical protracted crescendos with the texture growing more and more complex as the excitement mounts, and a full-blooded romantic climax that leaves the hero's success with the maidens in no doubt. A fundamentally graceful work, it still has the most solid of underpinnings.

Finlandia is a patriotic work that had a great vogue some years ago on light music programs, though, to do it justice, a large orchestra is needed. The Helsinki Philharmonic is, not surprisingly, outstanding in its performances of the music of this great Finnish composer and they make "Finlandia" sound very exciting indeed. The piece is played on most Finnish patriotic occasions, and listening to it here one is never in doubt why.

An Aubade is a dawn song, and Bergman's was inspired by a morning fog lying over the Bosphorous. This does not mean that the 60-year-old composer tried to make it sound Turkish – or even Finnish, for that matter. His style is straight post-Webern with the customary fragmentation of melodies employed by that school. But this does not make it difficult ot listen to even at first hearing. The music is perhaps not strikingly original, but it is highly evocative of the mood the composer intended to convey and a very useful piece to have in any record library to return to when one seeks moments of relaxation.

Altogether this disc offers an abundantly varied recital admirably played and recorded.

* * *

HOLST – The Planets (Suite). London Philharmonic Orchestra and Chorus conducted by Bernard Herrmann. Decca Phase 4 Stereo PFS4184.

Frankly I found this issue more than a little disappointing. I had expected Phase 4 sound to provide something more vivid in the way of impact. That the result is considerably below those expectations I can only attribute to the conductor. This famous suite should be well enough known to all record buyers to make it unnecessary for me to describe it in detail except perhaps to point out to those who have never heard it that Holst uses the planets in their astrological significance – Mars the Bringer of War, Venus the Bringer of Peace, Jupiter the Bringer of Jollity and so on. Disappointment comes early – in the first movement, Mars. There is no push to the rhythm and the music lumbers along, not like a terrifying juggernaut, but more like an overloaded, horse-drawn farm wagon.

It is difficult to make the lovely Venus movement sound merely dull, but Herrmann manages to do so. The orchestral tone is quite without lustre. I found the whole exercise, from beginning to end, numbingly mediocre. If you're in the market for a really fine performance of this still exciting suite I recommend you not to overlook the Boult version. In this, performance and sound are really quite terrific.

* * *

SCHUBERT – Piano Sonata in C Major (D.840); Allegretto in C Minor (D.900); Sonata in A Major (D.664). Wilhelm Kempff DGG139322.

The C Major Sonata was left unfinished by the composer and though later musicians have tried to supply the missing movements veteran pianist Kempff is satisfied to leave it as it was. It has many beautiful moments, all of them perceptively realised by Kempff. In the form he offers the piece you have only the first two movements but both are lovely examples of Schubert writing.

Kempff's playing is perhaps a little too unbuttoned for some tastes. The elasticity of his phrasing and impulsive little gusts of

PRINTED CIRCUIT ASSEMBLIES

A production problem? Contact us and we'll assemble your circuits promptly at a reasonable price.

ELECTRONIC PRODUCTIONS
PO Box 30, Waverley, 2024. 57 8621.

H. B. RADIO SALES STEREO SPECIALISTS

Manufacturers of equipment cabinets and speaker cabinets in wide variety. Complete or in kit form.

Also agents for Kenwood, Sansui, Maxamp, Monarch Amplifiers, Dual Garrard, B.S.R. Players, Shure Cartridges, Wharfedale, Goodmans and Magnavox Speakers and all worth while Hi Fi equipment.

Write for Stereo catalogue and player Guide.

H. B. RADIO SALES
Established 38 years.
105 Catherine Street,
LEICHHARDT, SYDNEY.
Telephone: 56 5580.

PRINTED CIRCUIT BOARDS
See:
SUMMIT ELECTRONIC SYSTEMS
Advertisement in this issue.



ATTENTION all short wave radio enthusiasts

JUST ARRIVED **SONY**
Versatile 13 band (FM, MW, LW, 10SW), 2 FET's, 16+3 transistors, 9 diodes, etc. AC/DC and car. This sensational receiver has JUST ARRIVED.

ARRIVING SOON **SONY**
Sensational 23 band (2FM, MW, LW, 19 SW), 3 FET's, 27+18 transistors, 32 diodes, etc. AC/DC and car.
As only limited supplies are available, don't hesitate to book now for further information and demonstration. Contact:

A. VICTOR
196 ELIZABETH STREET,
SYDNEY 2000. 61 2967
Specialists in HI-FI amplifiers, speakers, turntables, Tape Recorders.

now...



the cassettes with the assets!

asset/one
professional quality low noise tensilized polyester tape.

asset/two
designed and built for optimum performance in modern cassette recorders.



asset/three
Flanged idler rollers ensure perfect tape tracking.

asset/four
Mu metal shield gives extra 5dB of quality sound.

asset/five
Polyester liners reduce friction, gives trouble-free operation, longer life.

asset/six
Beryllium copper and felt pressure pad.

asset/seven
sonically welded high precision base and cover of Dow Styrene No. 456 — gives exceptional strength.

asset/eight
backed by professional experience. Plessey has for many years built professional recording equipment for professional users all over the world.



Look for these distinctive packs when you next buy tape — and ask for Plessey professional quality recording cassettes — in 30, 60, 90 or 120 minutes playing time.

PLESSEY
Rola

Plessey Rola Pty Limited
The Boulevard Richmond Victoria 3121
Telephone 42 3921 Telex 30383
NSW PO Box 2 Villawood 2163
Telephone 72 0133

AR32

passion might perhaps be best described as Schumannesque rather than Schubertian. But however unorthodox they may sound they make for enjoyable listening – for me, at any rate. And the slightly plummy acoustic of the DGG sound suits this style of reading admirably.

I need not qualify Kempff's playing of the C Minor Allegretto in any way. I found it wholly satisfying and the tempo a true allegretto through which the shining innocence of the music is allowed to glow without encouraging the need to look for technical achievements. Not that it's easy to play at Kempff's pace. On the contrary, everything is so exposed that only perfection will convince. And it does.

* * *

CHURCH BELLS – Plain Bob and Grandsire Doubles (6 Bells). Recorded at St Andrew's Church, Bradfield, Berks, England. Cambridge Surprise Major (8 Bells). Recorded at St Mary's Church, Thatcham, Berks, England. EMI Mono OXLP 7525.

There has always been to me something peculiarly English in the practice of change ringing. On the continent, bells are used not to ring changes, as in England, but in the form of a carillon on which tunes can be played – mostly hymns and chorales, often with simple harmonies – "sprinkling their quarters over the sleeping town" to quote from memory a poem by A. E. Housman. There are a few carillons in England and Sydney University has one, but change ringing is much more frequently practised. Change ringing means simply that the order in which the bells are rung is changed every time they are all struck. With three bells you can ring only six changes: with 12 bells the number of changes mounts to the astounding figure of nearly 480 millions. The heaviest peal of 12 bells in the world hangs in St Paul's Cathedral in London and it has been reliable estimated that to ring all the possible changes on this peal would take 30 years of continuous ringing.

Bells are both ancient and universally known. Their weight varies with their pitch – the smaller the higher – and their tuning involves a complicated technique because any vibrating body produces several notes simultaneously. The fundamental note is the strike note and as that dies away various harmonics are heard and, even louder than these the hum note, which should be an octave below the strike note. To tune all these notes correctly can only be done by the most expert of bell founders. It is done by minute changes in the shape and proportions of the bell, many of which weigh many tons. Experience has shown that the best proportions of the metal used is 13 parts of copper to four parts of tin.

Change ringers in England are dedicated men who, alas, are fast dwindling in numbers. The complete ringing of a set of changes on only a small peal may take many hours, consume much physical energy, and demands enormous mental concentration. Several English church belfreys carry notices to the effect that such and such a peal was rung there in so many hours. To date the ringing of 21,000 changes in 12 hours is the record. And it must be remembered that one can become a good ringer only after many years of practice. Bells can be rung in two main ways – chiming, in which the rope pulls the clapper over to strike the side of the bell and produce a gentle tone, and ringing, a more vigorous method in which the bell is pulled around in a full circle. It may not be generally known that the bell starts from an upside down position with its mouth up. To those who wish to do further reading on this subject I recommend Dorothy Sayers excellent detective story "The Nine Tailors". a book which sparked off my interest in change ringing although for physical reasons I have never done any myself.

Everyone knows that bells sound better at a distance than close up and in the recording under review one might almost be in a belfry. It is issued in mono only and to hear it to best advantage one would probably have to turn the volume up as high as it can go, then go outside some distance away to listen to it. For considerations of neighbourly harmony – no pun intended – I have refrained from doing this. Indeed I have played my pressing at greatly reduced volume for that reason. Church Bells is not a record I can recommend to anyone living in a flat or indeed near anyone else who does not share an interest in change ringing.

A word of explanation about the names of the peals on this disc. Grandsires are peals of an odd number, Bobs those of an even number. The peals make a merry noise – and most people would agree that "noise" is perhaps the best way to describe the sound – but I think the record's use might be limited to the very small number of change ringing enthusiasts and to churches which could broadcast the peals by means of a large amplifier.

High Quality Recorder Tested by Police



A police officer uses a stereophonic tape recorder to tape occurrence reports received by radio during an exercise in Shropshire, England. A low cost, high quality machine, it is suitable for broadcast, military, industrial and research use. It is claimed by the makers to give high quality even in extreme climatic conditions. Called the Tape-Riter 4000, the recorder is manufactured by Hartly Electromotives Ltd, Monkmoor Road, Shrewsbury, Shropshire, England.

From Paul Frolich . . .

MUSIC ALL POWERFUL: To Entertain Queen Victoria. Works by Sullivan, Mendelssohn, Prince Albert, Chaminade and others; sung by the Purcell Consort of Voices, directed by Grayston Burgess; with Jennifer Partridge, piano; Iona Brown, violin; Alan Lumsden, ophicleide. Argo stereo ZRG 596.

During the Purcell Consort's Australian tour last year, the singers made gleeful references to some recent recording sessions during which they had recorded a wide range of 19th-century music. The experience had been a novel one for them musically and they spoke with such gusto that I felt sure the occasions had been purely humorous. Since I knew that the most gorgeous atrocities against what we now regard as the canons of good taste were commonplace in Victorian England, I expected to laugh, perhaps to point the finger of scorn, but I did not expect to hear anything like this performance.

There is material here to feed one's prejudices, of course; several of the pieces are quite sublimely awful, particularly one of Sullivan's songs "I Would I Were a King," which Christopher Keyte sings with enormous enjoyment. Almost as bad are two Mendelssohn songs which enjoyed a huge vogue 100 years ago. Most of the other items are of quite surprising quality and well worth getting to know.

Prince Albert is poorly represented by a violin piece; we do know that he was indeed a gifted composer and I believe Argo will devote another full disc to his works. Among the genuinely interesting items are pieces by Berthold Tours, Ciro Pinsuti, Joseph Barnby, H. Klose, William Beale, N. W. Galkin, T. F. Walmisely and others, all going to prove that the Victorians could be tastefully original whenever they were not too hard pressed by considerations of imperial loyalty or forced to use the dreadful lyrics supplied by Poets Laureate.

All the vocal items on the disc are quite marvellously sung and they are agreeably interspersed with some instrumental pieces. The most enjoyable of these is a set of variations for the now extinct ophicleide. This wonderful instrument, now alas superseded by the more agile saxophone, had a grand braying capacity, used by Mendelssohn for his original ass's music in his "Midsummer Night's Dream." The variations are not great music, but the instrument surely deserves reviving – perhaps someone will write a full concerto for it?

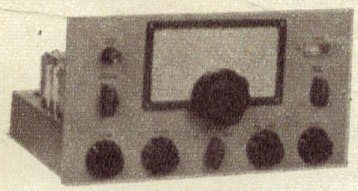
To sum up, the disc offers quite wonderful singing, good instrumental playing and a range of music which is almost completely unknown today. The recorded sound is quite excellent, stereo balance outstanding and the full texts for the songs are supplied. The music is hilarious in part, always of interest and certainly very instructive!

KITS

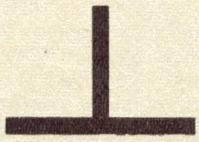
AMPLIFIERS — PREAMPLIFIERS — TUNERS — CONTROL UNITS — GUITAR UNITS — INSTRUMENTS — INVERTERS — CONVERTERS — RECEIVERS — TRANSMITTERS — REGULATED POWER SUPPLY — TRANSISTOR AND VALVE TYPES.

KITS

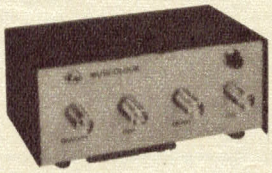
SERIES 1967-ALL WAVE 3 TO 7



Dec. 1967



MUSICOLOR
OCT. 1969



I/C STEREO 3-3



OCT. 1967

FULL KITS — OR ANY SINGLE PART

POPULAR KITS - TOP QUALITY - LOWEST PRICES

INSTRUMENTS
C.R.O.
1. 5in wide range.
2. 1963. 3in cal.
3. Audio.
4. 1966. 3in.
5. 1968—Audio.
6. Electronic SW.
7. W/band Preamp.

MULTIMETERS and V.T.V.M.'s
8. 20K ohm/Volt protected M/M.
9. Probe for above.
10. Protected D.C. M/M.
11. Meterless V'meter.
12. A.C. Millivoltmeter
13. A.C. Solid State Millivoltmeter.
14. Solid State A.F. Millivoltmeter.
15. Noise Distortion Millivoltmeter.
16. Standard V.T.V.M.
17. 1966—V.T.V.M.
18. 1968—V.T.V.M.

BRIDGES
19. Standard R/C.
20. 1966. R/C.
21. 1968 R/C and Signal Injector.

TV INST.'s
22. Sweep and marker Generator.
23. Dual sweep Gen.
24. Silicon diode sweep Gen.
25. Silicon diode noise Gen.
26. Pattern Gen.
27. Trans. pattern Gen.
28. Wild range pulse gen.

AUDIO INST.'s
29. 1960 Audio Osc.
30. 1962 high perf. audio Gen.
31. Crystal locked std.
32. Electronic tuning standard.
33. 1965. Solid State audio osc.
34. Direct reading A.F. meter.
35. Sq. wave Gen.
36. 1967 transistor audio Gen.
37. Additive frequency meter.
38. A.F. tone burst gen.
38A. 1968. Solid state A.F. Generator.

R.F. INST.'s
39. 6-band service oscillator.
39A. Trans. wave meter.
40. "Q" meter.
40A. Crystal Calibrator —Solid state.
40B. Digital freq. meter
40C. 1969. Dip Osc.— Solid state.
41. G.D.O. wide range.
42. G.D.O. adaptor.
43. Trans. service osc.
44. Simple signal injector.
45. Transistorised signal tracer.
46. Transistorised osc.
47. Basic test osc.
48. Transistor test
48A. IF. Align Osc.

MISCELLANEOUS INST., ETC., KITS
49. 1950. Trans. Tester.
50. 1968. Transistor test set.
51. Valve and Transistor tester.
52. Electronic Stethoscope.
53. Moisture alarm.
54. Electronic Pistol range.
55. Transistor Geiger Counter.
56. Light beam alarm.
57. Burglar alarm.
58. Flasher unit.
59. Transistor alarm.
60. Electronic switch.
61. Photo Timer.
62. Direct reading impedance meter.
63. Electronic anemometer.
64. S.W.R. indicator.
65. Simple proximity alarm unit.
66. Metal Locator.
67. Electronic metronome.
68. Bongo Drums.
68A. Keyless organ.
68B. Theremin.
68C. Laser unit.
68D. Color organ.
68E. Stereo Headphone Adaptor.

BATTERY CHARGERS
69. Universal unit.
70. 1 amp unit.

REGULATED POWER SUPPLIES
71. Transistor, 9v.
72. Transistor, fully protected supply.
73. 1968 H.T. unit.
74. 1968 lab. type. 0-30v supply.
74A. Simple pwr. supply

VOLTAGE-CURRENT CONTROL UNITS
75. Vari-watt unit.
76. Vari-tach. motor speed control.
77. 2KW auto-light dimmer.
78. 4KW auto. light dimmer.
79. Model train control unit.
79A. Vari Light Dimmer.
80. Model train control unit with simulated inertia.
81. Above-hi-power.
82. No. 81 with simulated inertia.

TACHOMETER UNITS
83. 6 or 12v Std.
84. 6 or 12v Mullard.
85. 6 or 12v with dwell angle.
86. Tachometer and dwel angle unit for service stations.

TRANSISTOR IGNITION
87. Ro-Fo. 6 or 12v.
88. Hi-Fire 6 or 12v (transformer).
88A. C.D.I. unit.
88B. Electronic Ignition.

POWER CONVERTERS
89. D.C.-D.C. 60w.
90. D.C.-D.C. 40w.
91. D.C.-D.C. 40w. 12v—input.
92. D.C.-D.C.70w. 12v—input.
93. D.C.-D.C. 100w 12v—input.
94. D.C.-D.C. 140w. 24v—input.
95. D.C.-D.C. 225w 24V —Input Q.

HIGH-FIDELITY AMPLIFIERS MONO UNITS
96. Hi Fi 3.
97. Mullard 3.3.
98. Mullard 5-10.
99. Mullard 5-10. transistor.
100. Transistor 20w.
101. Transistor 50w.

STEREO UNITS
102. Mullard 2-2.
103. Mullard (v) 3-3.
104. Mullard (t) 5-5.
105. Mullard (t) 5-5.
106. Mullard (v) 10-10.
107. Mullard (t)10-10.
108. Philips Twin 10.
111. Hi-Fi 60 Plus 60. P/M 128.
112. Playmaster 2-2.
113. Playmaster 3 plus 3.
114. Playmaster unit 3.
115. Playmaster unit 4.
115. Playmaster 10 plus 10
117. Playmaster 101.
118. Playmaster (t) 105.
119. Playmaster (t) 113.
120. Playmaster (t) 115.
121. Playmaster (v) 116.

P.A. UNITS
122. 10 watt std.
122A. Mullard 20w Solid state.
122B. Mullard 40w. Solid state.
123. 25 watt std.
124. 35 watt std.
125. 50 watt (t).
126. 100 watt std.
127. Stereo P.A.

GUITAR UNITS
128. 10 watt std.
129. 25 watt std.
130. 35 watt std.
131. 50 watt std.
132. 70 watt (t).
133. Playmaster 102.
134. Playmaster 103.
135. Playmaster 40w. 116
136. Playmaster 60w 117.
137. Guitar fuzz box.
138. Guitar Wah-Wah.
139. Reverb unit.
140. Guitar preamp.
140A. Guitar 50w. Solid State P/M 125.

STEREOGRAMS
141. Playmaster 105.
142. Playmaster 106.
143. Playmaster 107.
143A. Playmaster 124.

CONTROL UNITS
144. Playmaster No. 9.
145. Playmaster No. 10.
146. Playmaster No. 104.
147. Playmaster No. 112.
148. Playmaster No. 120.
149. Mullard 2v.
150. Mullard 3v.
151. Philips Miniwatt.
152. P/M 127.

PREAMP UNITS
153. Transistor—Mono.
154. Transistor—Stereo.
155. Transistor—Silicon. mono.
156. Transistor F.E.T. mono.
157. Transistor dyn. mic. mono.
158. Above-Stereo.
159. Playmaster 115 F.E.T. Stereo.
160. Playmaster 115 mag.
161. Sound projector.

MIXER UNITS
162. Trans. 4 ch. (1966).
163. Trans—4 ch. (1967).
164. Valve—4 ch.

TUNER UNITS
165. Playmaster u/style.
166. Playmaster No. 11.
167. Playmaster No. 114.
168. Playmaster No. 122.
169. Playmaster No. 123.
170. Philips Miniwatt.
180 Trans—Long range.

TAPE UNITS
181. Trans. Preamp.
182. Playmaster 110 (M)
183. Playmaster 110 (S)
183 Power Unit 110.
184. Adaptor 110.
185. Playmaster 119 Adaptor.
186. Transistor V.O.X.
187. Tape Actuated relay.
188. Mullard Trans Tape Amp.

RECEIVERS
189. Fremodyne 4. 1970.
190. Fremodyne 4 R.F.Sect only.
191. Synchrodyne.
192. Communications RX.
193. Deltahet RX.
194. 3 Band Double Change S/het RX.
195. Explorer VHF Transistor RX.
196. Interceptor 5 Semi-Comm. RX.
197. 1967 All-Wave 2.
198. 1967 All-Wave 3.
199. 1967 All-Wave 5.
200. 1967 All-Wave 6.
201. 1967 All-Wave 7.
202. Transporta 7.
203. Transistor 8 3 Band.
204. 3 Band 2V RX.
205. 3 Band 3V RX.
206. All Wave 1970 i/C 2.
207. Versatile Mantel Set
208. All-Wave Transistor 3
209. A.B.C.
210. 1968 F.E.T.
210A. I/C TRF RX.
210B. R.F. Preamp.
210C. "O" Multiplier.
210D. 1970 Communications. Solid state.

TRANSMITTERS
211. 144 MHz 50W. Linear Final.
212. 144 MHz 20W.
213. 144 MHz 20W.
214. 144 MHz 10W.
215. 144 MHz S.S.B.
216. 3 Band A.M.
217. Basic 3 Band.
218. 5 Band. S.S.B.
219. 1967 S.S.B.

CONVERTERS
220. 50 MHz
221. 144 MHz. 1970.
222. 50 and 144 MHz Crystal Locked.
223. 1965 S/W.
224. 1965 S/W 2 Band.
225. 1966 3 Band.
226. Basic S/W.

V.F.O. UNITS
227. Remote Unit.
228. 7 8 and 9 H.F. and V.H.F.
229 All transistor.

Phone 63 3596

E. D. & E. (SALES) PTY. LTD.

Phone 63 3596

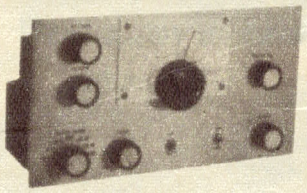
232 FLINDERS LANE, MELBOURNE, VICTORIA. 3000.

KITS

Public Address Units — Geiger Counters — Metal Locators — Decade Boxes — Mixers — Battery Chargers — Oscillators — Bridges — Parts Supplied for Projects in Electronics (Aust.), Wireless World, Practical Wireless, Electronics World, Electronics Illustrated, Practical Electronics, etc.

KITS

E/A 110 RECEIVER

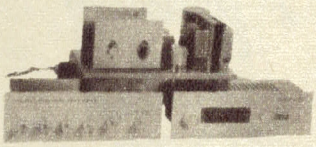


AUGUST 1970

COMPLETE KIT OR INDIVIDUAL PARTS

STEREO 60W + 60W R.M.S.

P/M 128 JAN. 1970.



1968 Solid State. V.T.V.M. ELECTRONICS (Aust.), Dec., 1968.

BATTERY CHARGER 1A
ELECTRONICS (Aust.), Feb., 1966



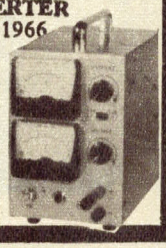
PLAYMASTER 116 and 117 and 125 GUITAR AMP.
Electronics Australia
June 1967 — 40 watt
July 1967 — 60 watt
July 1969 — 50 watt

3-BAND SHORT-WAVE CONVERTER
ELECTRONICS (Aust.), May, 1966

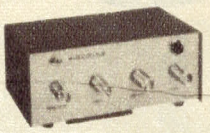
LAB QUALITY

Regulated Power Supply (0-30v) ELECTRONICS (Aust.), September, 1968.

1966 R/C Bridge May, 1966.



PLAYMASTER 129 (OCT., 1970) 3 WATTS PER CHANNEL I/C STEREO AMP.



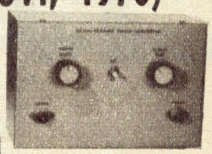
1966 3in CRO
ELECTRONICS (Aust.), May, 1966.



Playmaster 122 Program Source. Electronics (Aust.), August, 1968.

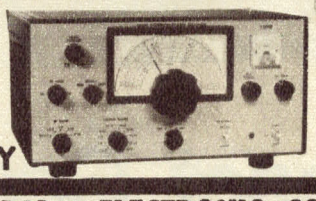
FOUR-CHANNEL AUDIO MIXER
ELECTRONICS (Aust.) Feb., 1966 & 1967.

SWEEP GENERATOR (NOV., 1970) CERAMIC FILTER



1970 - COMMUNICATIONS RECEIVER - 240 SOLID STATE

FULL KIT OR INDIVIDUAL PARTS ONLY



MAJOR STOCKISTS OF ALL GENERAL RADIO & ELECTRONIC COMPONENT PARTS -- YOU NAME IT -- WE WILL QUOTE

VALVES — TRANSISTORS — ZENER & POWER DIODES — SEMI-CONDUCTORS — DIACS — TRIACS — S.C.R'S. — I/C'S. SPEAKERS — MICROPHONES — COILS — IFT'S. TRANSFORMERS — INST CASES — METALWORK. PLAYERS & CHANGERS — METERS — RELAYS — CONDENSERS — RESISTORS — BEZELS — STYLII — CARTRIDGES — RECORDING TAPE — PROBES — INSTRUMENTS — POTENTIOMETERS — CRYSTALS — FERRITE BEADS — CORES — BALUNS — TERMINALS — CO-AXIAL PLUGS & SOCKETS — MULTI CONNECTORS — PRINTED CIRCUIT BOARDS — COPPER WINDING WIRE — ETC. — ETC. —

Phone 63-3596 **E. D. & E. (SALES) PTY. LTD.** Phone 63-3596

232 FLINDERS LANE, MELBOURNE, VICTORIA 3000

NEW SOUND IN MINI

BASF



BASF Compact Cassette



- Loaded with the world's finest recording tape
- Your choice of either LH-hifi or Standard
- Your choice of packaging "trans or plastic"
- Preferred and used throughout the world by leading Musicassette manufacturers
- Choose the "New Sound in Mini" — you'll love it!

Australian Distributors:
MAURICE CHAPMAN & COMPANY PTY. LIMITED.
276 Castlereagh Street, Sydney. N.S.W. 61 9881.
146 Burwood Road, Hawthorn. VIC . 81 0574

MC21/FP

VARIETY FARE

By HARRY TYRER, NEVILLE WILLIAMS, PHILIP PIK

Devotional Recordings

WE WISH YOU A MERRY CHRISTMAS and a Happy New Year. The World Vision Korean Orphan Choir. Stereo, Word WST-8361-LP. (Available from Sacred Production Aust, 181 Clarence St, Sydney and other capitals.)

Interest: Christmas and the Choir.
Performance: Competent and charming.
Quality: Very clean.
Stereo: Well spread.

There will certainly be plenty of other Christmas records on offer this year but I doubt that there will be any of them with a greater depth of charm and sincerity than this one by the Korean Orphan Choir.

Sponsored by the missionary organisation "World Vision Incorporated" and organised by Dr Bob Pierce, the Choir was on its third tour of the United States when this recording was made. Because of their background, the children have a natural claim on the listener's responses but they also have a purity of tone and blend which makes these numbers a delight to listen to:

We Wish You A Merry Christmas – Carolling, Carolling – The Morning Star – O Leave Your Sheep – At The Sweet Birth Of Our Lord – Birthday Of The King – Silent Night – Deck The Halls – O Holy Child We Welcome Thee – Angels O'er The Fields Were Flying – Sleep Of The Child Jesus – Lo, How A Rose – We Wish You A Merry Christmas.

A Christmas wish that we most heartily reciprocate. Recommended. (W.N.W.)

* * *

A TIME FOR GREATNESS. A Service from St Stephen's Church, Sydney, 3rd May, 1970. Attended by Queen Elizabeth II, The Duke of Edinburgh and Princess Anne. Mono, HMV Series 395, OXLP-7526.

Interest: As per title.
Performance: Not appropriate.
Quality: Excellent recording.

Many people would have heard this service when broadcast through the National network, though others would have missed it because it coincided with their own services. Either way, this recording, made by the Australian Broadcasting Commission and released through EMI may be welcomed as a memento of a notable occasion. The lessons were read by the Governor of NSW, Sir Roden Cutler and by the Duke of Edinburgh. The sermon was delivered by Rev Graham Hardy, MA, BD, STM.

While undoubtedly the point of the particular recording is the occasion, the only reference to personalities is a brief and appropriate acknowledgment of the members of the Royal party. Beyond that, the service is purely one of Divine Worship, culminating in the challenge of the sermon to exchange our too-often shallow and materialistic thinking for a more meaningful set of values.

Not everyone will have a place in their collection for a recording like this but then, records of complete church services are few and far between. If you are inclined towards purchase, you can proceed with confidence. All royalties from the sale of the record are being diverted to inter-church aid for underdeveloped countries. (W.N.W.)

* * *

GOIN' SOMEWHERE. Young And Free. Stereo, Word WST-8503. (Available from Sacred Productions Aust, 181 Clarence St, Sydney and other capitals.)

Interest: Youth group Gospel.
Performance: Capable.
Quality: Clean.
Stereo: Well spread.

On a generation raised to the group sound of rhythm guitars, close harmony and protest lyrics, it is not unreasonable to assume that the greatest impact will be from this same kind of music. Nor is it surprising that the generation should produce its own breed of Gospel artists, no less talented than their uncommitted counterparts.

The Young And Free are just such a group of young people – I judge six or seven in number – seeking to make an impact through High School assemblies throughout the United States. Their sound is modern, but not way out. Their titles likewise have a with-it ring but the lyrics are straight Gospel witness: Goin' Somewhere – I Can't Live That Way – Love's The Answer – Love – Hey, Little Girl – Lost And Found – I Heard About Him – It Means Love – A Day Like Today – Wooden Cross – Help Me Care.

Primarily for young people and a good album for study by budding groups who may want to emulate the Young And Free. (W.N.W.)

* * *

THE BIRDS SING HIS PRAISE, Volume 2. Featuring Ralph Platt, Whistler, with Lorin Whitney at the Organ. Stereo, Word LPS-7-4041. (Available from Sacred Productions Aust, 181 Clarence St, Sydney, and other capitals.)

Interest: Happy, informal Gospel.
Performance: Excellent in its way.
Quality: Excellent.
Stereo: Modest.

Ralph Platt, a businessman from Flagstaff, Arizona, is one of those happy souls who loves to whistle and he does it well enough to have warranted the issue of a second album. And, lest the sound of a lone human whistler grow monotonous, the recording engineers have skilfully dubbed in the happy notes of a variety of bush singers.

Laying a foundation for all this is Lorin Whitney playing a theatre style pipe organ – and a fine job he does too. The tracks are all very familiar: Hallelujah, What A Saviour – In Times Like These – It Took A Miracle – In The Garden Of My Heart – Just When I Need Him Most – The Cross Is Not Greater – How Can I Be Lonely – My Jesus, I Love Thee – I Choose Jesus – Near To The Heart Of God – More About Jesus – I Surrender All.

Ralph Platt's notes are not always spot on pitch, but, for all that, it's a happy sound. If the idea appeals, you'll enjoy it. (W.N.W.)

Instrumental, Vocal and Humour

EXTRAVAGANZA. Andre Kostelanetz and his Orchestra. CBS (Australian Record Company) stereo SBR 235386.

Interest: Light classics.
Performance: Typically excellent.
Quality: Good standard.
Stereo: Evenly spread.

This is the latest in the pleasant musical *pastiches* which Andre Kostelanetz makes regularly for CBS. Like its predecessors, this has a mixture of the well-tried and familiar light classics, mingled with less often played (but still eminently tuneful) works. Side one is devoted to three items by Tchaikowsky (Cossack Dance, from "Mazeppa" – Barcarolle, June, from "The Months" – Marche Militaire from Suite No. 1 in D minor); plus Rimsky-Korsakoff's Overture to "The Tsar's Bride." Side two has: Overture to "La Revoltosa" (Chapi) – Meditation from "Thais" (Massenet) – Ballet Music from "Othello" (Verdi) – Intermezzo from "I Quattro Rusteghi" (Wolf-Ferrari).

Every one of these items is pleasingly melodious, and should appeal to lovers of light classics who have already built up a collection of the more often played works. The piece by Chapi is the overture to one of those characteristic Spanish operettas known as zarzuelas, which are gradually achieving a degree of popularity outside Spain. "La Revoltosa" is my personal favourite in this genre, and the tuneful overture is characteristic of the work as a whole – a feast of delightful melody in the typically Spanish style. Those who like this overture may care to know that CBS released an entire disc of zarzuela overtures earlier this year. The only other piece requiring comment is the Wolf-Ferrari item. The work from which this is taken may be known by its English title "The Four Ruffians," an opera which has not gained any great success. However, like some of Schubert's incidental music, the overture seems certain to live on after the opera is forgotten.

The Kostelanetz orchestra provides



with film-met, only the case is the same.



inside, its a whole new trimmer

The element is made by an exclusive Amphenol patented process. We use a vacuum deposition chamber to evaporate 100% metal alloys onto insulating substrates—then protect them against oxidation with noble metal overlays. The result is trimmer performance neither wirewounds nor cermets can match. Only Film-Met offers both infinite resolution and a low temperature coefficient of 100 ppm/°C. (50 ppm/°C is available on request.) Film-Met trimmers have excellent high frequency and pulse characteristics and low contact resistance variation. Their low thermal and current noise features are comparable to metal film fixed resistors. The new Amphenol Film-Met trimmer line isn't designed to replace wirewounds and cermets in every application. What Film-Met performance does is eliminate circuit design compromise. By adding these trimmers to our line of cermets and wirewounds, we can now match your performance needs perfectly. This could be what you've been waiting for. A whole new trimmer!
For further particulars please contact your nearest distributor.

MSP

MANUFACTURERS SPECIAL PRODUCTS PTY. LTD.
47 YORK STREET, SYDNEY. 20233.

ADELAIDE 51 0111 • BRISBANE 31 0341 • HOBART 34 3836
LAUNCESTON 2 1804 • MELBOURNE 67 9161 • PERTH 28 6400

their usual well-drilled, polished performance, and the technical quality of the disc leaves no cause for complaint. (H.A.T.)

* * *

THE PLANETS (Gustav Holst). The London Philharmonic Orchestra, conducted by Bernard Herrmann. Decca Phase Four Stereo (EMI) PFS.4184.

Interest: Popular English suite.
Performance: Very lame.
Quality: Excellent sound.
Stereo: Well spread.

The stirring tunes and brilliant orchestration of Gustav Holst's very popular "Zodiac" suite would seem to be ideal material for Phase Four treatment, and in this respect high fidelity enthusiasts should have nothing to complain about in this new recording. The clarity, wide dynamic range and carefully arranged stereo spread are all very impressive, but unfortunately this performance, however impressive technically, falls down badly musically.

The worst features are to be found in the "Mars" movement, which is lacking in tension, while the march tempo is lacking in the springy vitality found in the Sargent and Boult versions; the solemn treatment of the "Jupiter" section, which should be bursting at the seams with the joy of life (the splendid "Land of Hope and Glory" tune has none of the truculent pride which the above-named conductors realised so well); and the "Neptune" section, in which the pianissimo choral section sounds more weary than mysterious. The other sections are passable but, with better versions available on economy price discs, I can see no reason to recommend this one, apart from its superior sound. (H.A.T.)

* * *

SZELL'S GREATEST HITS. The Cleveland Orchestra, conducted by George Szell. CBS (Australian Record Company) stereo SBR 235382.

Interest: Classics sampler.
Performance: Brilliant.
Quality: Very good.
Stereo: Nicely spread.

Apart from their popular series of "Greatest Hits" of composers, CBS has been assembling collections featuring the famous artists and orchestras which have graced their catalogue in recent years. Here it is the turn of the orchestra which George Szell moulded into what critics have called "the best precision instrument in the orchestral world." Not surprisingly, the collection comprises familiar war horses: Wedding March from "A Midsummer Night's Dream" (Mendelssohn) – The Moldau (Smetana) – Viennese Musical Clock from "Hary Janos" (Kodaly) – Overture to "Marriage of Figaro" (Mozart) – Farandole from "L'Arlesienne" (Bizet) – Troika from "Lt Kije" (Prokofiev) – Blue Danube Waltz (Strauss) – Overture to "The Thieving Magpie" (Rossini) – The Ride of the Valkyries (Wagner).

Familiar fare indeed to those with as many years of listening behind them as I have, but the main purpose of this series is undoubtedly to cater for those with an awakening interest in the classics. For these, this disc should be an enchanting experience. Every item has that special quality which gives it immediate appeal, yet ensures that one never tires of it with repeated hearings. And with the Cleveland/Szell combination living up to

READER'S DIGEST ALBUM

SOUTH OF THE BORDER. 48 Lively Latin Favourites. Stereo, 4-Record Set by Reader's Digest/RCA Dynagroove.

Interest: Latin fiesta, dance.
Performance: Lively.
Quality: Virtually flawless.
Stereo: Outstanding.

The contents of this new Reader's Digest album are described as "lively" – a word that seems unduly modest if you start off as I did, listening to the contents of records 1 and 2. If you're feeling fresh and relaxed, they might be just fine, but the unbounded enthusiasm of the Latin Quarter is a bit much after a hard day at the office! Still, whose fault is that?

Record 1 introduces two themes. On side 1, a gay "South Of The Border" mood is built by half a dozen tracks including "Carioca", "Tea For Two" cha cha and "Besame Mucho". Side 2 further emphasises the "lively" theme with another six tracks including "Perfidia", "The Peanut Vendor" and "Cielito Lindo".

Record 2 provides a spirited encouragement to dance latin, with a dozen assorted rhythms including "Patricia", "Mambo Jambo", "Dye Negra", "Tampico, Carnival", "Taboo" and "Uno". For the more studious dancer or listener, each track has its own separate jacket note indicating its origin and its particular claim to fame.

The mood quietens a little for side 1 of record 3, "Mexican Fiesta". Included here are "Guadalajara", "Mexican Hat Dance", "La Mamba" and "La Negra". But on side 2, things get moving again, as befits a "Mardi Gras in Rio". Among the half-dozen tracks on this side are "Frenesi", "Come To The Mardi Gras" and "Madalena".

But the disc most likely to please the jaded office worker is record 4 with its themes "Spanish Eyes" and "Hasta La Vista" which apparently means "Till We Meet Again". Included is "Always In My Heart", "Time Was", "Spanish Eyes", "La Paloma", "Preciosa" and "Adios".

Featured in the set are the orchestras of Perez Prado, Xavier Cugat, Mariachi Vargas, Los Indios Tabajaras, and others. The playing is of a consistently high standard, and I think I can fairly say that I did not hear a single whisper of noise or distortion in any of the many tracks which I sampled or listened through.

If the contents appeal, you can buy this 4-record boxed set with complete confidence. (W.N.W.)

its reputation as one of the world's great orchestras, this is a disc which can be recommended without reservations to those seeking to enlarge their musical knowledge.(H.A.T.)

* * *

GRANADA. Frank Pourcell and his Grand Orchestra. Columbia (EMI) stereo SCXO 7928.

Interest: Popular light music.
Performance: Very competent.
Quality: Excellent.
Stereo: Good even spread.

Frank Pourcell and his orchestra have featured in a number of excellent discs of light classics as well as modern popular and dance music in the past two or three years – but here we have Pourcell with his "Grand Orchestra." Presumably this is growing into something the size of a symphony orchestra, and it certainly sounds a very impressive body of players in this selection, demonstrating a high degree of musicianship. Pourcell has also used his outstanding skill as an arranger in six of the eight numbers presented, and nowhere is this more in evidence than in his rendering of Ketelby's "In a Persian Market." One particularly pleasing touch in this performance is the omission of the ridiculous loud chord at the end. Here, the camels are allowed to fade gently into the distance to an accompaniment of jingling harness – much more effective.

The two sides of the disc have been carefully balanced for content. Side one has: Granada (Lara, the original scoring being used) – In a Persian Market – Ballet Egyptian (Luigini) – Andante from Concerto for Two Mandolins (Vivaldi). On side two there is: Espana (Chabrier) – In a Monastery Garden (Ketelby) – Grand March from "Aida" (Verdi) – Extracts from Christmas Concerto (Corelli). The similarity in content of the two sides should be obvious.

In its own sphere of popular light music, this is well worthy of an "Excellent" rating, and should give considerable pleasure to those to whom the titles appeal.(H.A.T.)

MUSIC OF VIENNA (Volume 2). The Vienna Symphony Orchestra conducted by Robert Stolz. Stereo, World Record Club WRC S/4410.

Interest: Viennese music. What else?
Performance: Sentimental.
Quality: Normal.
Stereo: Again normal.

Seven selections go to make up this, the latest to hand of a very large number of broadly similar Viennese albums. Originally on the Eurodisc label, it has been released in Australia through the World Record Club.

Five of the selections are by Johann Strauss, Jnr: Tales From The Vienna Woods – Lagoon Waltz, Op 411 – High Spirits, Fast Polka, Op 319 – Excursion Train, Fast Polka, Op 281 – Vienna Blood, Op 281.

Johann's younger brother, Josef, contributes: Woman's Heart, Polka Mazurka, Op 166 – Village Swallows, Waltz, Op 164.

The jacket notes give the background to the various compositions, then go on to comment on Robert Stolz, a prolific writer of operettas and film music and a "sprightly octogenarian" when this recording was made. There is comment also on his "unpredictable" tempos which will irk some and intrigue others.

Close to the centre the recorded sound acquires a slight edginess but, on the whole, it is fairly routine. In fact, the word would sum up my reaction to the disc both technically and musically. (W.N.W.)

* * *

FROM FRANCE WITH LOVE. The Capitol Symphony Orchestra conducted by Carmen Dragon. World Record Club stereo S/4741.

Interest: French selection.
Performance: Nicely played.
Quality: Very good.
Stereo: Normal.

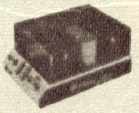
Here is an interesting collection of French music which includes traditional and folk as well as popular classical

FOR CHRISTMAS
THE WORLD'S BEST AT
Convoy
TECHNOCENTRE

Select from the World's best Audio Equipment at The Convoy Technocentre where all equipment is covered with a minimum Warranty of 12 months.

Select your equipment from our wide range of products, ranging in price from $300 to $10,000.

McIntosh



McINTOSH Amplifiers are regarded as the World's best and provide years of trouble-free operation.

BOWERS AND WILKINS



B. & W. Speakers have exceptional performance that will delight the critical ear of both music-lovers and audiophiles, electrostatic above 400Hz.

TEAC



TEAC offers a wide range of Tape Decks, Tape Recorders and Hi-Fi Equipment with built-in quality.

Ferrograph



FERROGRAPH, long regarded as quality high-performance equipment, ideal for the professional user.

JBL



JBL equipment is used by Audiophiles and Professional Users alike and offers the widest range quality speakers in the World.

PIONEER



PIONEER provides a wide range of high-performance Amplifiers, Speakers, etc., at prices most can afford.

Peerless



PEERLESS hand-tuned Danish Speakers provide high-quality performance at low cost.

At the CONVOY TECHNOCENTRE, service to the customer comes first with a fully equipped repair department, free suburban delivery, free technical advice and a minimum of 12 months' Warranty on all equipment sold by us.

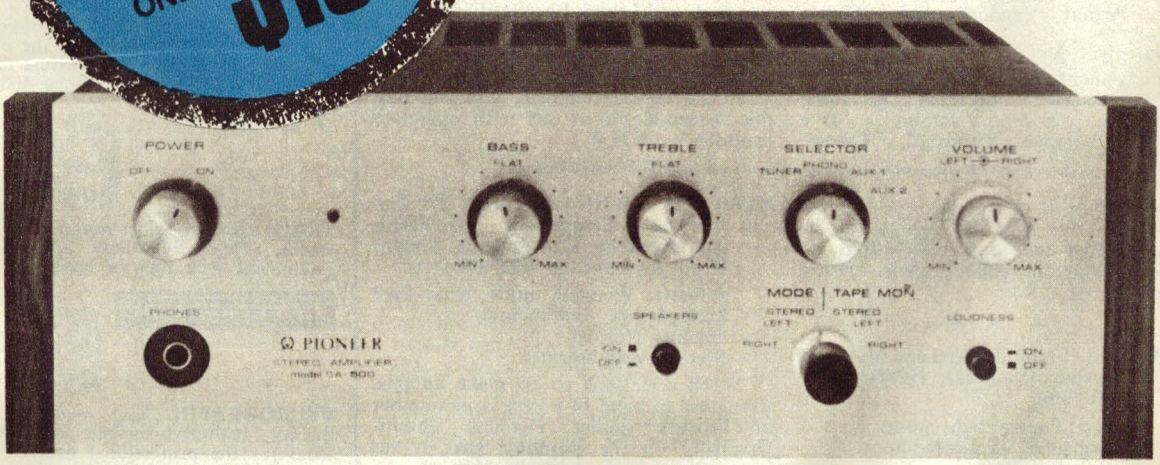
Convoy
TECHNOCENTRE
449 KENT STREET,
SYDNEY. 29 6475

PIONEER®

NEW LOW PRICE
NOW ONLY **$134**

Due to vastly increased sales it has been possible, even in the days of spiralling prices, to REDUCE the price of the PIONEER SA 500— now only $134. Enjoy true stereophonic realism with this power performer — the leader in the field of stereo amplifiers.

PIONEER SA500



Circuitry:
Quasi-complementary single ended push-pull circuitry
Continuous Power Output: (R.M.S.) (both channels driven)
12W+12W at 4Ω (distortion below 0.5% at 1 kHz)
Frequency Response:
20 Hz to 50 kHz ±1 dB (AUX)
Power Bandwidth:
20 Hz to 40 kHz (distortion below 0.5% constant/IHF)
S/N Ratio:
PHONO 75 dB (volume; maximum, tone;
AUX 90 dB flat, at the rated output)
Inputs and Gain, Input Impedance (at 1 kHz):

PHONO	2.5 mV	47 kΩ
TUNER	200 mV	100 kΩ
TAPE MONITOR	200 mV	100 kΩ
AUX	200 mV	100 kΩ

Damping Factor:
Better than 40 at 8 ohms (at 1 kHz)
Simultaneous tape recording jack
Tape recording/playback connector (DIN standards
Equalization Curve:
PHONO NFB type RIAA
Tone Controls:
BASS −13.5 dB to +13 dB (at 50 Hz)
TREBLE −11 dB to +8 dB (at 10 kHz)
Loudness Contour:
Switchable to ON-OFF; 12 dB at 50 Hz;
5.5 dB at 10 kHz (at the volume level of -40dB)
Residual Noise:
Less than 0.7 mV at 8Ω (volume: minimum, tone: flat).

ASTRONICS
AUSTRALASIA PTY. LTD

A MEMBER OF ELECTRONIC INDUSTRIES LIMITED GROUP OF COMPANIES

MELBOURNE:	161-173 Sturt St., South Melb.	Tel: 69 0300
N.S.W.	121 Crown St., East Sydney.	Tel: 31 6721
S.A.:	81-97 Flinders St., Adelaide.	Tel: 23 4022
W.A.:	28 Belmont Ave., Belmont.	Tel: 65 4199
TAS:	199 Collins St., Hobart.	Tel: 2 2711
QLD:	596 Tarragindi Rd., Salisbury North.	Tel: 47 4211

Sole Australian Distributor For:
THE WORLD'S FINEST RANGE OF HI FI STEREO EQUIPMENT.

PIONEER

See and hear the SA 500 at all good Hi-Fi Dealers and Music Houses or ASK THE MAN WHO OWNS ONE.

Please send me:
PIONEER STEREO SOUND SYSTEMS BROCHURE.
NAME .....
ADDRESS .....
..... POST CODE .....
OCCUPATION .....

numbers, presented in their usual highly competent fashion by the Capitol Symphony Orchestra under the baton of Carmen Dragon. This orchestra has specialised in this type of light confection for many years, and judging by the large number of discs they have made, their efforts find considerable favour with the record buying public. In this selection they present entirely listenable arrangements by Carmen Dragon of: Can-Can from "Orpheus in the Underworld" (Offenbach) – Frere Jacques (trad) – Adagietto and Farandole from "L'Arlesienne" (Bizet) – Golliwog's Cakewalk (Debussy) – The Maid with the Flaxen Hair (Debussy) – Amaryllis (Louis XIII) – Faust Waltz (Gounod) – Polonaise from "Mignon" (Thomas) – Arabesque No 1 (Debussy) – Pavane for a Dead Princess (Ravel) – Alouette (trad) – La Plus Que Lente (Debussy) – Sur le Ponte d'Avignon (trad) – Waltz from "Coppelia" (Delibes).

The 15 tracks give a very generous playing time well over 40 minutes, so at the club price it is quite a bargain. The disc was first issued only about 2 years ago, and the technical quality is of excellent standard. (H.A.T.)

★ ★ ★

SEMI-CLASSIC FAVOURITES. The Monaco Strings. MPS Records, stereo MPS 15227. Available in Australia through Quality Records International, Box 937, GPO Adelaide, SA 5001.

Interest: Lesser known light music.
Performance: In fine style.
Quality: Excellent.
Stereo: Well spread.

Different people have their own ideas of what they would classify as "semi-classical", and the term "favourites" implies well known pieces. Frankly, I do not feel that this title is accurate, as the contents are in fact light music by lesser known composers, mainly of the type which enjoyed a vogue in the early years of the century. Despite many years of listening to this kind of music, I cannot recall ever having heard a single item on this disc. It is pleasant enough music, to be sure, and I believe I could very well come to appreciate these items more after a few further playings, but "favourites" – hardly.

It is, of course, highly possible that the items are better known in Europe, and if you are from that part of the world, you may know these items: Ballszenen; Teufelstanz (both by J. Hellsmesberger) – Bijoux; Der Spieler (both by H. Kiessling) – Bruder Leichtsinn; Amoroso; Flotte Madchen (all by Wal-Berg) – Kleines Erlebnis in einer Grossen Stadt (Gert Wilden) – Gluckliche Errinerung (Ulrich Sommerllatte). The piece by Gert Wilden is of the type made popular as "piano concerto-ettes" in films, and is very reminescent in style of George Gershwin; while the Sommerllatte item has a fine flowing melody which breathes nostalgia throughout. On reflection I would classify all these items as typical "Palm Court" music, pleasant, undemanding, and entirely melodic.

I have not previously had the opportunity to hear recordings from the catalogue of the Germany company MPS Records GmbH, and this first experience with their products made a very favourable impression by its high quality packaging, its silent surface and excellent sound, characterised by smooth bass and mid-range, and bright treble. There was no trace of shrillness, nor of production faults such as tape hiss and pre-echo, while the stereo spread is wide and smooth, as it should be. All this adds up to a company which turns out a high quality product in which the greatest care is taken all along the line. The orchestra plays very well throughout. (H.A.T.)

★ ★ ★

GERMAN FOLK SONGS (Deutsches Volkslieder) – Brahms. Elisabeth Schwarzkopf, soprano; Dietrich Fischer-Dieskau, baritone; Gerald Moore, piano. World Record Club stereo S/4790-1 (two record set, not available separately).

Interest: Settings of folk melodies.
Performance: A fine collaboration.
Quality: High standard.
Stereo: Normal.

When three such eminent artists as those presented collaborate in a large scale venture, they are certain to provide a noteworthy performance. True the material makes no great demands on any of them, but nevertheless the result is a very pleasurable experience for anybody who finds lieder singing enjoyable. Elisabeth Schwarzkopf and Fischer-Dieskau are both at the peaks of their careers, both recognised as outstanding performers, and both very experienced in the elusive art of lieder singing. Gerald Moore, as always, provides an exemplary piano accompaniment. Scharzkopf's voice does not have the dewy freshness which made it so attractive in the early days of her career, but her technique is superb, and the clarity of her diction a joy. Fischer-Dieskau cannot be faulted anywhere – his voice control and phrasing are all one would expect from an artist of his stature.

The work as a whole is by no means well known nowadays, although certain songs have become favourites and are often heard in lieder recitals. I think the reason is that it is too long to present as one program normally, and its undemanding nature does not attract top ranking performers very often. I cannot recollect ever hearing it performed complete, either live or on disc, so this recording offers a definite opportunity for those interested in lieder. It was published by Brahms towards the end of his life, and it has been suggested that he collected the tunes from various sources over a long period. However, it is known that he drew heavily on two volumes of German folk songs published earlier in the 19th century, and some of the tunes are "spurious" – that means, he wrote them himself as original works.

The issue is presented by World Record Club in separate sleeves (how much more preferable a boxed set would have been) complete with an illustrated German/English text with an introductory essay. It is excellent value at the club price. (H.A.T.)

* * *

THE DIABELLI VARIATIONS. (Beethoven). Friedrich Gulda, piano. MPS Records stereo MPS 13000. Available from Quality Records International, Box 937, GPO, Adelaide, SA 5001.

Interest: Piano masterpiece.
Performance: Admirable.
Quality: Very well recorded.
Stereo: Not significant.

Friedrich Gulda has been criticised in some quarters (quite unfairly in my opinion) for his interest in, and performance of, modern jazz. He always was, and still is, a very fine classical pianist, and his interpretations of

LESA OFFERS AUTOMATIC TURNTABLE PERFECTION

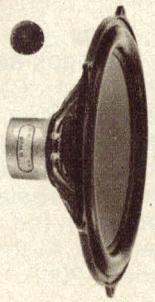


Encel offers you this Italian masterpiece of precision engineering for the first time in Australia, priced most attractively at **$149.00** (inc. sales tax), complete with tonearm. Price in America is **$179.00.** The American High Fidelity Magazine (August, 1970) describes the Lesa PRF 6 as a "superb automatic turntable that performs admirably and is a joy to use, both as an automatic and as a manual. It can be adjusted to any of its three speeds with complete accuracy with built-in vernier and illuminated strobe dial. The Lesa's tonearm is also of excellent design. Our editorial hat is off to the people in Milan who created the new Lesa!"

Write in now for copies of this review and technical data on this outstanding unit, which incorporates all the most advanced devices to ensure superb hi-fi reproduction.

THE FINE SCANDINAVIAN SOUND OF SEAS SPEAKERS . . .

These outstanding speakers give sound quality you would expect from much more costly units. Eight and ten inch woofers and the amazing soft dome diaphragm tweeter. Write in for the full technical details of the base models 21 TV-EW/(8 inch), 25 TV-EW/(10 inch), and the matched 1½" 87H tweeter. Encel prices them at **$24.80, $29.80** and **$19.80.** (all prices inc. sales tax).



EE70C

ENCEL
ELECTRONICS PTY LTD.

HEAD OFFICE: 431 BRIDGE ROAD, RICHMOND, VIC. 3121
TEL. 42 3762
SYDNEY STORE: GROUND FLOOR, 2 SM BUILDING, 257 CLARENCE STREET, SYDNEY, N.S.W. 2000
TEL. 29 4563, 29 4564
■ **AUSTRALIA'S GREATEST HI-FI CENTRES**
■ **TRADE-INS ACCEPTED** ■ **TERMS**



TEAC®

BI-DIRECTIONAL PLAYBACK & RECORD A2060 STEREO TAPE RECORDER

Bi-direction gives you continuous playback and record in both tape directions automatically. You can have longer hours of continuous music. There is no more need to interchange the reels. All you do is record in the normal forward direction. At the end of the reel the A-2060 automatically reverses direction, changes tracks, and continues to record. The same thing happens during playback. It's not just a gimmick. The A-2060 is a quality built recorder with many unique features. Why not write to us for full report, including laboratory test data.

SPECIFICATIONS

- Four heads.
- 4-pole hysteresis synchronous motor.
- Frequency response 7½ i.p.s. 30-20,000 Hz 3¾ i.p.s. 30-15,000 Hz
- Power output 20 watts (RMS) 10 per channel.
- Dimensions 16⅛" x 17⅝" x 8½".
- Wooden or metal cabinet.

AUSTRALIAN MUSICAL INDUSTRIES PTY. LTD.
155 Gladstone St., Sth. Melb., Vic., 3205. Phone 69 7281. Telegrams AMUS Melb.

RETAIL ENQUIRIES:

Vic: Brashs Pty. Ltd. 63 6701 Melbourne & Suburbs
Suttons Pty. Ltd. 60 1201 Melbourne & Country
Southern Sound Moorabbin. 97 7245

NSW: Convoy International Pty. Ltd. Sydney. 29 6475

SA: Ern Smith & Co. Ltd. Adelaide. 51 6351
Truscott Electronics Adelaide 23 3024

WA: Alberts TV & Hi-Fi Centre Pty. Ltd. Perth. 21 9902

Tas: B.B.C. Radio Centre Pty. Ltd. Burnie. 31 4415
Wills & Co. Launceston. 2 4641

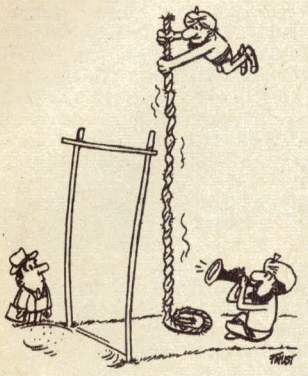
Qld: Brisbane Agencies Audio Centre Brisbane. 2 6931
Stereo Supplies Brisbane. 21 3623

ACT: Homecrafts Petrie Street Canberra. 47 9624

AMI-115

Beethoven, in particular, are worthy of every respect. His version of the 33 Diabelli variations shows that his technique is quite equal to the demands of this musical obstacle course, and for most of the time his performance evokes admiration.

Perhaps not surprisingly, his attention seems to fall off towards the end, which could possible indicate that he played the work in one session. If this is the case, sheer physical tiredness could account for the noticeable deterioration in the last part. But taken as a whole, this is an eminently satisfying performance of a very difficult work, and can be recommended to those who want to add this masterpiece in its class to their collection. (H.A.T.)



(From "Program, Deutche Welle")

MISTY. Andre Previn and his orchestra. Music for Pleasure stereo MFP A8165.

Interest: Piano, orchestra, popular tunes.
Performance: Ideal background music.
Quality: Very good for the price.
Stereo: Normal.

The stylish piano playing of Andre Previn will need no introduction to most buyers of popular music – in fact, he is probably the best known musician in this field in the world. Here he plays the first number – "Misty" as a piano solo, thereafter he collaborates with his orchestra in presenting pleasingly relaxed renderings of nine more numbers: What's New – P.S., I Love You – Gone With the Wind – Over the Rainbow – Stormy Weather – I've Got the World on a String – One For My Baby – When the Sun Comes Out – Lost in the Stars. Like most MFP releases, the disc is for those with middle of the road tastes. While I would hesitate to guest the age of these tracks, the good quality sound would indicate they are of recent origin. (H.A.T.)

★ ★ ★

GOLDEN CLARINET. The Royal Grand Orchestra, Stereo, Regal (EMI) Series SREG 2051.

Interest: Clarinet favourites.
Performance: Good.
Quality: Mostly clean.
Stereo: Normal.

With a versatile clarinet lead and a sound reminiscent of the late 1940's in many tracks, the Royal Grand Orchestra features on this album a collection of favourites, including those made popular by such famous clarinettists as Acker Bilk and Sidney Bechet.

"Stranger on the Shore" is one of the tracks and, although the arrangement and style of Acker Bilk have been closely followed, I feel that some of the haunting quality he imparted to this tune is missing here. But all the other numbers are beautiful, expecially "Petite Fleur" and "Clarinet Polka". Other tracks are: Let's Dance – Don't be that Way – Memories of You – Begin the Bequine – Stomping at the Savoy – Sing, Sing, Sing – La Cinquantaine – Io Sono Il Vento – Goodbye.

With such a wide selection of tunes, this record should appeal to those who like some old favourites, plus an assortment of the not-so-old. Despite a low price of $2.59 the sound quality is very good. Surface noise, tape hiss and distortion are low, which all make for pleasant listening. (J.P.P.)

★ ★ ★

RHYTHMS OF THE SOUTH. Edmundo Ros and his Orchestra. World Record Club stereo S/4800.

Interest: Latin American dance music.
Performance: Expert.
Quality: Excellent.
Stereo: Normal.

Most of the items in this selection are musical "chestnuts" which have been recorded innumerable times by hundreds of orchestras, including, I am sure, quite a few times by Edmundo Ros and his orchestra. Included are: What a Difference a Day Makes – The Peanut Vendor – Alla En el Rancho Grande – Amapola – La Golondrina – Malaguena (Lecuona) – Yours – The Breeze and I – Say "Si Si" – Latin Shalom – Maria, My Own – Jungle Drums. Here they are played by an expert group, specialists in Latin American style, and utilising the popular LA rhythms such as cha-cha, mamba, beguine, tango, merengue, and so on. While intended mainly for dancing, this disc is one of few featuring LA style music which also makes good listening material. Originally from the Decca catalogue, the disc has excellent sound, and the pressing is of the usual high standard of the World Record Club. (H.A.T.)

★ ★ ★

I GOT RHYTHM. Jack and Glennis Carter. W & G stereo WG. 25/S/5467.

Interest: Australian piano duettists.
Performance: Fully professional.
Quality: Some defects.
Stereo: Normal.

Artists who have made their name in the "Showcase" series on television are now appearing regularly on disc. This is a good thing, since many of them are definitely of world standard. Jack and Glennis Carter who are featured here could hold their own anywhere in the world with their entirely professional piano duet playing, which demonstrate not only a fluid keyboard technique but also an ability to present tunes in very pleasing arrangements. If you saw and heard them on television, you should need no further remarks from me to decide whether this is for you. If you did not, and you have any interest in this type of material, I suggest you try to persuade your dealer to let you hear a track or two – I think you will be agreeably surprised.

With competent backing by a small orchestra, the pair present the following tunes: Hello Dolly – The Girl from Ipanema – The Breeze and I – El Cumbanchero – Masquerade Waltz – The Carioca – I Got Rhythm – Samba Sud – A Taste of Honey – Mexican Samba – The Lonely Goatherd – Jamaican Rhumba – Rondo Alla Turca. Each number is played in dance rhythm (fox trot, waltz, cha cha, rhumba, etc.) and is

MPS

World-renowned MPS-records and Pre-recorded tapes of superb quality and excellence of production, imported from Germany, are now available on these three labels:

TOP FIVE	Series TF 4000
CENTRE	Series CEN 17000
M P S	Series MPS 14000
MPS-KLASSIK	Series MPS 13000
MPS-ALBUMS	Series MPS 52000

Popular and Light Entertainment/ German and International Folk Music and Classical.

MPS-JAZZ Series 15000 with the world's biggest line-up of the internationally known Jazz Giants. Beautifully presented albums of the finest quality featuring such talented artists and orchestras as the Oscar Peterson Trio (7 LPs); Art van Damme Quintet (7 LPs); Chet Baker; Count Basie's "Basic Basie"; Francy Boland; Miles Davis; Erroll Garner; Friedrich Gulda, John Coltrane; Etta Jones; Sonny Rollins; Brother Jack McDuff and many others.

All brand-new recordings from MPS's own Sound Studios in Villingen, Black Forest.

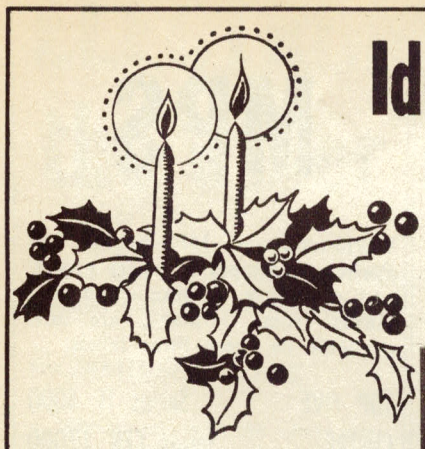
Also available the new MPS-ARCHIFIX-Discobox, which stores your records safely, protected against their main enemy — Dust! For a BETTER RECORD at the SAME PRICE ask your local retailer for TOP five and CENTER (low priced), and full-priced MPS/ SABA-records.

If not available in your area, write for information on nearest supplier. Send 60c in postage stamps for illustrated catalogue and future details of new releases.

QUALITY RECORDS INTERNATIONAL Co.

G.P.O. BOX 937, ADELAIDE, SOUTH AUSTRALIA 5001

Hear MPS records on your local radio station or in TREFFPUNKT, Saturdays, 7-8.30 pm (Central Time) on 5 DN.



Ideal Gifts for Sound Enthusiasts

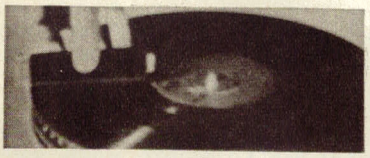


"PARASTAT" HI-FI RECORD AND STYLUS CLEANING KIT

Designed for use on records in new condition which are to be played with pick-ups requiring very low tracking pressures. The 30,000 finely pointed tips of the Hi-Fi Parastat Brush positively explore the record groove to provide the high degree of record cleanliness necessary when using ultra lightweight pick-ups tracking at 2 grams or less.
Perfectly clean records must be played with a perfectly clean stylus and an entegral part of the kit is the new Watts Stylus Cleaner.
Complete with instructions, 1oz New Formula dispenser, Distilled Water dispenser, spare pad cover and ribbons. **$9.75.**



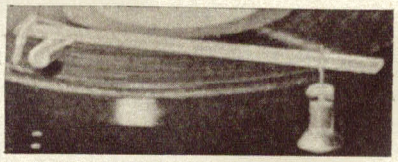
STYLUS CLEANER complete with instructions. Available separately $1.20.



"PARASTATIK" DISC PREENER $2.10.

Keeps new records like new. Expressly designed for use with records which have not had previous antistatic treatment. Complete with instructions.

The original "Dust Bug"



Automatic record cleaner, easily fitted to any transcription type turntable. Provides a simple and effective method of removing static and dust while the record is being played. Surface noise and record and stylus wear is reduced, resulting in cleaner reproduction. Complete with ½oz New Formula Dispenser and instructions. $5.60.

MASTERSOUND SALES

Headquarters for Musical Reproduction

Mastersound Sales Pty. Ltd., 400 Kent Street, Sydney, 2000. 29 1527
Please send me the following:—

..... Disc Preeners at $2.10 ..... Hi-Fi Parastats at $9.75
..... Dust Bugs at $5.60 ..... Stylus Cleaners at $1.20

I enclose cheque/P.N., value .....
(Do not send stamps) Add 30 cents for postage

Name .....

Address .....

..... Postcode .....

therefore suitable for dancing, but even if you are not a dancer, the disc is worth its place in a collection just for listening. The sound, while good, is perhaps not the equal of the best modern recordings, and the disc surface was rather too well endowed with plops and "prickle", but as the sound level is fairly high throughout, this is not too disturbing. (H.A.T.)

★ ★ ★

PARTY HITS. Ambros Seelos Show Band, Stereo, MPS Records, MPS 14267.

Interest: As per title.
Performance: Good variety in arrangement.
Quality: Very clean.
Stereo: Normal.

Externally, this disc makes an immediately favourable impression, with its high quality cover artwork featuring a most attractive lass, but you cannot judge a disc by its cover. However, this disc falls into the category of those where hopes raised by external appearances are fully realised by subsequent investigation of the contents.

Ambros Seelos Show Band has recorded some music that's really on the go, with plenty of variety in tunes and arrangement – something so often lacking in party records. Each side has a selection of four medleys and include such numbers as: Happy Heart – Give Peace a Chance – Exodus – Land of a Thousand Dances – Cotton Fields – Lonely Bull – Aquarius.

The numbers are well presented on a record equally well recorded and for all you party fans this one is a must. (J.P.P.)

★ ★ ★

GREEK SOUL. Gus Valli, flute, with orchestra. United Artists Festival stereo SUAL-933923.

Interest: See review.
Performance: Intriguing.
Quality: Excellent sound.
Stereo: Good even spread.

This unusual and interesting disc appears to be a marriage of traditional Greek style with modern beat style. It is plain from the start that the disc is out of the ordinary, when Gus Valli plays a sinuous and enticing flute melody in the lower register, then after a short pause, a largish orchestra belts out "Those Were the Days" in typical American fashion. The rest of the material is a mixture of modern popular songs and Greek numbers, which may be modern or traditional – I could not say. Here are the titles: Aquarius – Istes Ginekis – Mi Tharis – Ela Ela – Good Morning Starshine – Vatikiottisa – Silver and Gold – The Windmills of Your Mind – Popi.

The bouzouki, flute and vibraphone play a major part throughout, adding a slightly exotic touch to the popular numbers, while the Greek numbers are as lively and interesting as such numbers usually are. As music with a difference, this is worth a trial. (H.A.T.)

★ ★ ★

THE FERRANTE AND TEICHER CONCERT, Part 2. Sunset (Festival) stereo SUS-96,139.

Interest: Piano duettists in concert.
Performance: Pleasant enough.
Quality: Good for live recording.
Stereo: A bit exaggerated.

I suppose somewhere there is a Part 1 of the Ferrante and Teicher Concert, but it has never come my way. As this is on the Sunset label, it is presumably a reissue, but there is no clue to its age, except possibly the inclusion of "Never On

Sunday" and "A Taste of Honey". If the disc was made when these were enjoying a vogue, it would place the date of first issue about six years ago. The sound quality is no guide, as the disc was recorded live, and cannot compare with studio production.

In addition to the titles mentioned above, there are: Rhapsody in Blue – Dark Eyes – Theme from "The Apartment" – Ol' Man River – Ave Maria (the Schubert version) – Gypsy Overture. The last named is a pot pourri of tunes from Bizet's "Carmen". Rather different fare from the selections of current hits which are normally featured in Ferrante and Teicher discs, but the treatment is about the same – the theme being taken up by the two pianos alternately, while the other fills in with rippling arpeggio, or simple harmony, while the orchestra provides solid support. Not very profound material, but a lot of people like it, and in my opinion rather more interesting than the duo's normal offerings. (H.A.T.)

Five popular organ recordings

FARFISA ROMANTICA. Jackie Brown plays the Farfisa 60 50 Organ. Stereo, AR AD-RHYTHM SFL-933833 (Festival).

Interest: A different organ.
Performance: Smooth, melodic.
Quality: Not startling.
Stereo: Plays its part.

For those who have grown accustomed to the sound and the techniques associated with the popular brands of American electronic organs, this performance on a Farfisa instrument will be a not unwelcome change.

From the illustration, it would appear to be a "middle weight" instrument, not large, but nevertheless large enough to have a fairly solid bass register, a two-speed Leslie, effective vibrato and tremulant and an adequate supply of high-pitched voices.

Jackie Brown uses these latter to give a string-though-reed tone to much of the lead, with fairly frequent use of the tremulant-repeat facility. He plays smoothly and competently but attempts no keyboard antics. His numbers are in the same "Romantica" mood:

On A Clear Day – Maria – Soprani's Serenade – Summertime – Maybe Tonight – With A Song In My Heart – Stranger In Paradise – Carmenita – Smoke Gets In Your Eyes – Adriatic Moonlight – The Man I Love – Misty Melody.

The quality is mostly clean but, just here and there with the heavier bass, something somewhere is on the edge of cracking. But I found the album interesting, nevertheless. (W.N.W.)

★ ★ ★

HAMMOND HITS HOUSE NR.1. Dance Party with Mister Hammond. Stereo, CS (Cornet Special) 16054. Available from Quality Records International Co, 280 Payneham Rd, Payneham, SA 5070.

Interest: Hammond in dance time.
Performance: Fine in its way.
Quality: Very clean.
Stereo: Used to advantage.

The jacket on this release from the continent identifies the musicians purely as "Mister Hammond and His Rhythm", the most obvious members of the group being an organist, a drummer and a bass player. Each makes his own capable contribution to a program which is strictly for dancing. The titles are a mixture of English and German but the former include: All Kinds Of Everything – Fantastic – Oh Lady Mary – Let It Be – Arizona Rain – That's Life.

The rhythms include waltz, shake, rock-waltz, latin-shake, foxtrot, shake polka, medium foxtrot, stomp, and a couple of others I'm not too sure about.

Mister Hammond is adept at winning unusual sounds from the organ, and the rhythm boys are tops but, unless this holds a special fascination for you, the record will be most acceptable in the role for which it was intended. Playing time is about 35 minutes. (W.N.W.)

★ ★ ★

HAMMOND HAPPENINGS. Tony Back plays the Hammond Organ. Compatible stereo, Ad-Rhythm (Festival) SFL-933,798.

Interest: For somebody, maybe!
Performance: Contemporary style.
Quality: Normal.
Stereo: Normal.

Tony Back, aged 28, is introduced in the jacket notes as England's most popular club organist, an artist who normally teams with percussionist Baron Gocher. A former member of the "Chimes" group, Tony Back has toured extensively in Europe and has been accompanist to many big-name stars during his residency at Caesar's Palace.

Working with percussion backing, Tony Back exploits his own characteristic "swirling" sound and the atmosphere of the group and the club is consistently in evidence. If you like it, okay; if you don't, you'll find it plain monotonous.

There are 15 tracks, all told. Some of them are: Knock! Knock! Who's There – Don't Cry Daddy – Let It Be – Sugar Sugar – Venus – Love Grows – Something – House of The Rising Sun. My advice would be to sample a few tracks before you reach for your money. (W.N.W.)

★ ★ ★

HAMMOND SHOWCASE, Volume 1. Featuring Keith Beckingham at the Hammond Organ. Stereo AR Ad-Rhythm (Festival) SFL-933678.

Interest: Hammond recital.
Performance: Easy on the ear.
Quality: Completely clean.
Stereo: Normal.

Here's a record that I can commend to all those who prefer the popular organ played in traditional theatre style, with the emphasis on melody and with plenty of weight at the bass end. The instruments used here, of course, are Hammond electronics but they give a very good account of themselves in the role. Keith Beckingham uses three models during the course of the recital, an A100, a T200 and a J300, all used in conjunction with a Leslie 122 tone cabinet. If you like this kind of recital you'll also like the numbers that are featured:

There's No Business Like Show Business – Blue Hawaii – Just One Of Those Things – Poeme – Caravan – On The Mall – It's Only A Paper Moon – Granada – Highland Mist – Sway – Over The Rainbow – A Taste Of Honey.

A record that should prove very popular. (W.N W.)

★ ★ ★

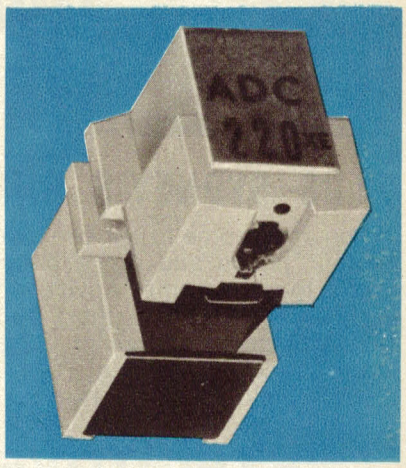
BALDWIN MAGIC. Featuring Vic Hammett at the Baldwin Organ. Stereo, AR Ad-Rhythm (Festival) SFL-933.832. Interest:

Interest: Who but Vic Hammett?
Performance: Dexterous.
Quality: Normal.
Stereo: Separates melody, rhythm.

Having on a couple of occasions watched Vic Hammett perform – at close

(Continued on page 135)

GREAT STEREO STARTS HERE!



If you're becoming serious about listening to stereo equipment, here's the cartridge to get you started on the right track the ADC 220XE. Like its more expensive brothers. It is carefully crafted by hand with our exclusive induced magnet design. It tracks accurately and yields faithful sound reproduction with virtually any changer or tonearm. As you can see, the 220XE is really a great first cartridge. And even its low price of $27.00 will be music to your ears.
Of course, when you're ready to move up to more sophisticated stereo equipment, you can choose from ADC's complete line of superior cartridges. Isn't is nice to know we won't desert you on the way up?

ADC 220XE SPECIFICATIONS

Output: 6 mV at 5.5 cms/sec. recorded velocity.

Tracking Force: 1 to 2½ grams.

Frequency Response: 10 Hz to 18 kHz ± 3 dB.

Channel Separation: 20 dB from 50 Hz to 10 kHz.

Compliance: 20 x 10^{-6} cms/dyne.

Vertical Tracking Angle: 15°.

Rec. Load Impedance: 47,000 ohms nominal.

Price: $25.95 Suggested Resale.

Write for detailed specifications on other "X" series cartridges.

ADC AUDIO DYNAMICS CORPORATION
PICKETT DISTRICT ROAD,
NEW MILFORD, CONNECTICUT 06776

AUDIO FOR AUDIOPHILES

Exclusive Australian Agents,
J. H. REPRODUCERS CO.,
293 Huntingdale Road, Chadstone, Vic., 3148. Telephone: 277 3066.



Peter Clark says:— Come to Mag-Sound where the Bargains are!!!

PLUS SYDNEY'S BIGGEST LIST OF FREE SERVICES AND EXTRAS!

If you can't come to our two luxurious town showrooms, 'phone and invite one of my experts to come to your home. Advice and quotes on the type of Hi-Fi system most suitable to you will be given at no charge or obligation. Our prices are "discount" prices! Our guarantee is a TWELVE MONTHS' guarantee! Free installation!

Free membership of our tape-cassette exchange club! 10 experts to serve you. And remember we always have, in addition to the world's top-brand equipment, LOTS OF "DEMO" MODELS, guaranteed "USED" MODELS, all well-nigh perfect, many at HALF-PRICE, for CASH or TERMS UP TO 2 YEARS, with tiny deposits! Come to where the action is! ! !

"EXECUTIVE"

4-piece Hi-Fi system with amplifier, turntable, 2 speakers.

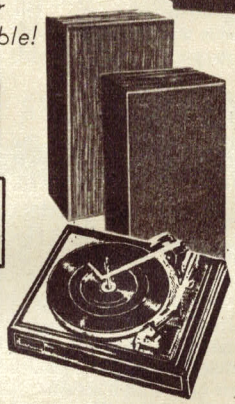
60 Watt Solid-state Stereo Hi-Fi Phono System

"Kenwood" TK 250 amplifier with B.S.R. McDonald Turntable!

The Complete System $349

You Save $75
from individual component prices





DEPOSIT $39, ONLY $3.50 WEEKLY. This special M.S. ensemble is one of the best values ever offered! The Kenwood TK 250 amplifier is an all-transistor wizard with a frequency response from 20 to 50,000 Hz. The slightest musical nuance is reproduced with uncanny fidelity. Turntable is famous B. S. R. McDonald stereo with magnetic cartridge in cabinet with plexiglass cover. Speaker system is the M.S.I. GT500 special with an 8 inch and 2 inch co-axial speaker, each in large cabinet of Danish Walnut. Tiny deposit and $2 weekly for this Model M.S.I. power-packed amplifier in smart modern walnut finish! TOP-NOTCH performance.

"JUNIOR EX."

Four pieces: Amplifier, 2 speakers, Garrard auto or Sony manual player

20-Watt Stereo Player Hi-Fi Phono System

Featuring Model M.S.I. Silicon Transistor Amplifier for $2 weekly



The Complete System $169

You Save $99
from individual component prices

Tiny deposit and $2 weekly for this Model M.S.1. power amplifier in smart modern walnut finish. 'TOP-NOTCH mance'. Garrard Automatic or Sony manual 4-speed player unit on base. V-10 Cartridge with Sapphire stylus f 1000 playings. Two GT50 Acoustic Suspension Speaker S designed for bookshelves, each in a cabinet. One BASS sp one Tweeter speaker, cross-over network. Cabinet, acous designed in Scandinavian Walnut.

Magnetic Sound INDUSTRIES

City at 387 George St., one door from Kodak, Tel.: 29-3371
Parramatta, op. Astra Theatre, 20 Macquarie St., Tel.: 635-0830

quarters I have shared the admiration of other onlookers for his complete mastery of the popular organ. He has a quite uncanny ability to change registration during phrases without any hint of discontinuity.

This visual element is, of course, missing from a recorded performance and while the characteristic style is there, the techniques by which the sound is produced tend to be overlooked. Judged on sound alone, the album is well presented, varied and bright but above average rather than outstanding. The numbers: Mountain Greenery – Bali Ha'i – I'll See You In My Dreams – Waltz Of My Heart – Mame – Lot Of Livin' To Do – Toot Toot Tootsie, Goodbye – I Dream A Little Dream Of Me – Dancing Feet – Charade – Birth Of The Blues – La Mer.

A reminder of Vic Hammett's recent local recitals on Baldwin organs – in this case on models HT2R and 81R. (W.N.W.)

★ ★ ★

SABA STEREO SOUND. Saba SB 15000 ST. Distributed in Australia by Quality Records International Co, GPO Box 937H, Adelaide, SA 5000.

Interest: Continental music sampler.
Performance: Good standard.
Quality: Excellent sound.
Stereo: Well spread.

Although this disc is issued under the Saba label, it is in fact a sampler of tracks from disc listed in the MPS Records company catalogue. Saba, of course, are manufacturers of the well-known stereograms, radio and combination TV/radiograms, but what the tie up is is not obvious. Sufficient to say that this disc came from the distributors of MPS recordings, Quality Records International Co, of Adelaide.

As a sampler featuring modern dance and jazz type music, this disc is no better nor no worse than many others of its type. However, it did introduce me to the art of one Eugen Cicero, who plays a sparkling "modern interpretation" of C.P.E. Bach's "Solfeggio in C minor" with bass and percussion accompaniment. This is virtually the same treatment that Jacques Loussier accords the works of the older Bach, but on the evidence of this one track, I would be prepared to nominate Cicero as a superior performer, and I look forward to hearing more of him.

I feel there is no point in listing the German orchestras and numbers included but if such names as "Erwin Lehn und sein Sudfunk-Tanzorchester" and "Ole Olafsen und seine Solisten" mean anything to you, you will have Continental connections. In this case, this sample may prove an attractive proposition to introduce you to some of the MPS discs available. It should certainly convince you of the high quality of sound to be found on MPS discs – these tracks are the equal of any others in this respect, wherever their origin. Incidentally, Quality Records have two catalogues available of the records they handle, which they will no doubt be prepared to supply on request. (H.A.T.)

★ ★ ★

THE SHADOW OF YOUR SMILE. Gordon Macrae. Stereo, Music For Pleasure, MFP-A8126.

Interest: Popular vocalist, songs.
Performance: Well up to expectations.
Quality: Clean, well balanced.
Stereo: Normal.

Gordon Macrae's career got under way with a win in a newspaper talent quest which, at the age of 19, earned him a two-week engagement at the New York World's Fair. Except for two years military service as a flying cadet, he has made his way from that first major spot, through radio, television, films, Broadway – the lot.

Though he often shares his appearances with his Australian wife, Sheila, this is a solo album, and a thoroughly enjoyable one it is, too. The track titles: If She Walked Into My Life – Yesterday – Somewhere – Young And Warm And Wonderful – The Impossible Dream – Strangers In The Night – I Want To Be With You – Michelle – The Shadow Of Your Smile – Dear Heart – Who Can I Turn To?

Excellent value at the MFP price. (W.N.W.)

VIENNA PHILHARMONIC ON HOLIDAY. This record, reviewed last month, is a World Record Club release, cat. No. S/4194. We apologise for omitting this information.

SOMETHING. Shirley Bassey. United Artists (Festival) stereo SUAL-933851.

Interest: For Bassey fans.
Performance: One of her best.
Quality: Excellent.
Stereo: Normal.

I take back all the unkind things I said about Shirley Bassey, when I discussed her recent recording taken live at "The Talk of the Town" night club. She may find the strain of live appearances a bit too much nowadays, but she is still a superlative recording star. This is vintage Bassey once again, and provided with a competent arranger, and good orchestral support, as she is here, she is at her peak. There is none of the breathlessness and slurred diction which made her live recording such a distressing experience for her admirers. Here, every word is clearly enunciated, while her timing and phrasing are as good as ever.

Much of the material here was new to me, and is more the type of quizzical philosophising one associates with Vicki Carr rather than with the dynamic Shirley Bassey: Something – Spinning Wheel – Yesterday, I Heard the Rain – The Sea and Sand – My Way – What About Today? – You and I – Light My Fire – Easy to Be Hard – Life Goes On – What Are You Doing the Rest of Your Life – Yesterday, When I Was Young. The sound quality is excellent throughout. (H.A.T.)

★ ★ ★

THE SOUND OF THE SEEKERS. The Seekers. Columbia (EMI) Stereo SOEX 9642.

Interest: The Seekers!
Performance: True to form.
Quality: Very good.
Stereo: Effective.

The Seekers, the "old" Seekers that is, have left behind many fond memories. There is no doubt that of the talented foursome, Judith Durham gave the group their distinctive individual sound and character which has been recaptured on this fine LP. The tracks on it are not necessarily those that were big hits for them at some time or other, but rather a selection to which they have given their own individual sound.

Tracks are: Colours of My Life – On the Other Side – Love is Kind, Love is Wine – We're Moving On – Nobody Knows the Trouble I've Seen – Myra – All I Can Remember – When the Stars Begin to Fall – Sinner Man – Rattler – The Sad Cloud – Music of the World a Turnin'.

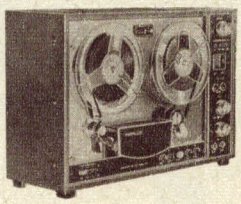
I think for those who do not already

IT'S ENCEL FOR SUPERB 'DITTON 15' SPEAKERS



Encel, Australia's leading hi-fi specialists, offers you famous Celestion "Ditton 15" speakers at the bedrock price of $109.50 (inc sales tax). "Ditton 15" is the most advanced 3-element compact speaker yet produced. An extract from a recent review, translated from the authoritative Dutch magazine "Disk" — reads "Why the Celestion is so good is because of its radiant tones, its open, brilliant and honest reproduction of all frequencies. Thanks to the flat middle reproduction and the brilliant high, there is a lot of 'presence.' High, middle and low are perfectly balanced. In short, a tremendously fine speaker, easily installed." Write now for full details.

AND TOP-CLASS MARLUX TAPEDECKS



The authoritative magazine "Audio" acclaims this high-quality stereo tapedeck in a recent review. "Astrocom/Marlux has produced a terrific tapedeck, whose performance and features put it right alongside the top 4-track decks . . . Good design, standard components, neat and well-planned wiring and attention to shielding and routing detail are responsible for the outstanding recording/playback performance of this unit. It would make a fine addition to any good-quality stereo system bar none." Encel price for this fine unit is only $398.00 (inc sales tax). Write now for full details!
Head Office: 431 Bridge Road, Richmond, Victoria, 3121. Tel 42 3762.
Sydney Store: Ground Floor, 2SM Building, 257 Clarence St, Sydney, NSW, 2000. Tel 29 4563, 29 4564.
- Australia's Greatest Hi-Fi Centres
- Trade-ins accepted
- Terms available

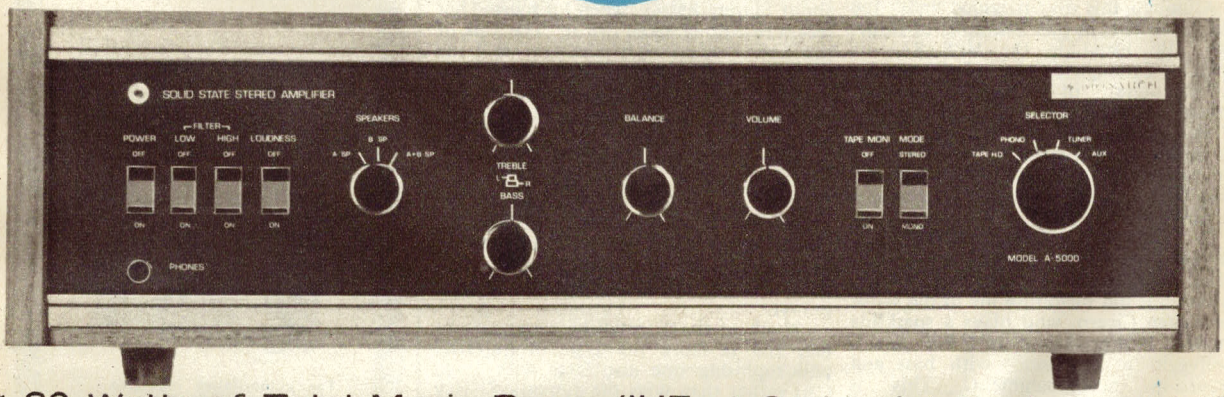
EE70A

ENCEL ELECTRONICS PTY LTD

HEAD OFFICE: 431 BRIDGE ROAD, RICHMOND, VIC. 3121
TEL. 42 3762
SYDNEY STORE: GROUND FLOOR, 2 SM BUILDING, 257 CLARENCE STREET, SYDNEY, N.S.W. 2000
TEL. 29 4563, 29 4564
■ AUSTRALIA'S GREATEST HI-FI CENTRES
■ TRADE-INS ACCEPTED ■ TERMS

$ FOR $

The MONARCH A5000 sounds better than any Amplifier Ad. you've ever read!



* 80 Watts of Total Music Power (IHF at 8 ohms) * Dual-channel IC Equalizer for perfect balance * Special Protection Circuit against overload * Latest all-silicon transistor circuitry

Here is a truly solid state stereo amplifier which combines a noise-free preamplifier and a ruggedly built main amplifier in one gracefully laid-out chassis. It utilizes every engineering know-how of the very latest advances in transistor audio technology to offer laboratory precision performance for your home entertainment. The newest types of silicon transistors are used throughout the circuitry.

The well-designed and tightly regulated power supply assures the total music power of 80 watts (IHF) into 8 ohms. The ability of the power supply is such that the amplifier runs cool with 30 watts RMS each channel operation, without causing current drain to any section of the circuitry even during high level of musical transients.

The direct coupled driver stage, because of elimination of transformers, achieves extremely low distortion. At 25 watts output level the distortion falls as low as 0.2% to produce the pure clarity of sound.

The special protection circuit is proved to guard the driver and output transistors against overload or short-circuit. This is a device to automatically reduce or cut out input signal when over-load or short-circuit occurs. It is also automatically self-resetting to permit the amplifier to resume normal operation. An IC (integrated circuit) of a special type, which contains in one single unit a complement of both channel components in equalizer circuit, is used to provide perfect balance of input for optimum stereo.

Complete array of the front panel controls and switches offers versatile yet easy-to-operate facilities. Dual controls permit separate boost and cut of TREBLE and BASS for each channel. Speaker selection switch provides for operation of either one or two pairs of speaker systems separately, or both simultaneously. On the rear panel a MAGnetic-CERamic switch for choice of phono cartridge is provided. A continental DIN jack is also used for convenience for tape recording and playback.

Housed in the oiled walnut wooden cabinet with the distinctive style of the black panel, the A-5000 fits and enchances your decor.

Recommended Retail Price $189.

Australian Distributors

W. C. Wedderspoon Pty. Ltd.

Showroom: 193 Clarence Street, Sydney. 29-6681

A.C.T. Homecrafts Petrie St., Canberra

VIC. Douglas Trading 191 Bourke St., Melb. Southern Sound, 963 Nepean H'way Moorabbin.

QLD. S. G. Hughes 154-158 Arthur St., New Farm.

W.A. Leslie Leonard London Court, Perth.

TAS. P & M Distributors 87 Brisbane St., Launceston.

have a Seekers' album, this one can't be missed. It truly reflects the foursome's distinctive sound. On the technical side, this is one of EMI's better quality releases of the Seekers – some of the earlier ones left something to be desired. Distortion and tape hiss are low and at $2.59 it is certainly good value.(J.P.P.)

★ ★ ★

SING ALONG WITH MITCH. Mitch Miller and the gang. Music for pleasure stereo MFP-A 8163.

Interest: Sing along favourites.
Performance: Mitch's usual standard.
Quality: Average.
Stereo: Disappointing.

At first my impression was that this record was just another one of the many of the "Sing Along" series that Mitch Miller has been churning out since 1958, with nothing in particular to distinguish it from the others. But, playing it a second time, I found that the combination of spirited tempos, rousing tunes and all-round enthusiasm of the gang held my attention throughout the 16 numbers on this LP.

The only disappointment I had was in the lack of full stereo reproduction. True, the voices and accompaniment are split up in three sections – voices on either side and orchestra in the middle – but having an accompaniment coming "mono style" from the middle only detracts from the interest of the sound. Apart from this criticism, the record is one of good quality with only minor inner groove distortion. If you're a Mitch Miller fan, you'll like it.

Tunes include: That's My Weakness Now – I Love My Baby, My Baby Loves Me – Indiana – Yes! We Have No Bananas – Alabamy Bound – The Trail of the Lonesome Pine – My Melancholy Baby – Side by Side – Anniversary Song – Wagon Wheels – The Prisoners Song – Beautiful Ohio. (J.P.P.)

Popular Jazz

reviewed by Gil Wahlquist

DUKE ELLINGTON'S 60TH BIRTHDAY CONCERT. The Ellington Orchestra. United Artists (Festival) stereo SUAL-933,853.

Interest: Jazz Orchestra.
Performance: Superb.
Quality: Good.
Stereo: Concert hall presence.

The elegance of Ellington today is captured on this two-LP set. Those who heard the Duke and his men in Australia will be delighted to discover that for this album the band plays the same program. This is a virtual history of the band's 40 years, played by today's members. They will also be relieved to learn that the noisy rock and roll gentleman who toured with the band is not included on the album.

From the opening "Rockin' in Rhythm" through "Satin Doll" and "Perdido" down to the romance and sentiment of the ballad medley, climaxing with "Mood Indigo" it is apparent that Ellington is indeed the musical giant of our century, equalling Stravinsky and Sibelius in achievement. Five hundred years from now, when musicologists are re-creating the music of our era, Ellington will be the one held to be most representative. This album is well worth securing for your private time capsule.

★ ★ ★

HELLO HERBIE. Oscar Peterson Trio with Herb Ellis. MPS stereo 15262.

Interest: Hot piano.
Performance: Swinging.
Quality: Superb.
Stereo: Good separation.

It sounds like old times as Ellis plays guitar again with pianist Peterson, recalling the jazz at the Philharmonic sessions of the early 1950s.

Peterson replaced Ellis in those days, converting his trio to piano, bass and drums. The return of Ellis for one session has encouraged Peterson to jam as he used to years ago.

The flawless Peterson technique is fired by the presence of Ellis. The two trade solos, Ellis using a single note solo on "Exactly Like You" for instance, as a challenge to the two-handed performance of Peterson.

TRIBUTE TO FLETCHER HENDERSON The Henderson All-Stars, under the direction of Rex Stewart. Concert Hall Record Club stereo SJS-1268

Interest: Mainstream jazz.
Performance: Representative.
Quality: Good;
Stereo: Splits the band.

"Wrapping' It Up", performed on this LP, must be as close to perfection as you could get in a big band performance. The band which trumpeter Rex Stewart gathered together for the Great South Bay Festival, New York, in 1957, blew their hearts out thinking about their days together 20 years before in Henderson's band. The LP was cut after the festival.

Three of the tracks are re-creations of Henderson arrangements which were written for the Benny Goodman band – a rollocking "Sugar Foot Stomp", an incredibly sophisticated rendering of "King Porter" and the splendidly laid out "Wrappin' It Up". The line-up of Coleman Hawkins, Ben Webster, Dickie Wells, Buster Bailey, Benny Morton and others play solo after delicious solo in between wonderful brass and reed ensemble passages. No museum piece this, but a vigorous exercise by the greats.

★ ★ ★

OPEN SPACE. Down Beat Pool Winners in Europe. MPS stereo 15259.

Interest: Modern jazz oddity.
Performance: Ambitious.
Quality: Excellent.
Stereo: Normal.

The idea was to assemble musicians who had been placed top of their category in the annual poll of jazz critics conducted by the world's leading jazz magazine. They were to be Europeans who had been nominated for the poll, presumably by the large number of European jazz writers included in the annual survey.

Assembling a jazz band on this basis is something akin to selecting marriage partners by computer. Such unions are rarely completely satisfactory.

There is the usual mismatch, of pianist Francy Boland and soprano saxophone player John Surman, but then Surman gets on well with bass player Niels Henning Oersted-Pedersen. The organisers allowed for this, splitting the group of duet, trio and quartet performances within the quintet. The most interesting feature is the linear vocal style of Karin Krog. Miss Krog is representative of the jazz art vocal style of Scandinavia, not heard here. ■

"INNERBOND"

(Regd.)

BONDED ACETATE FIBRES

FOR PACKING IN

SPEAKER ENCLOSURES

A new resilient Bonded Wadding made from ultra fine Cellulose Acetate Fibres that gives high efficency for Sound Absorption.

"INNERBOND" is light, clean, dust-free and easy to handle. Because al the fibres are bonded "INNERBOND' will hang as a "curtain" and will not fracture or break down due to vibration.

"INNERBOND" is odourless, highly resistant to attack by bacteria or fungus and is vermin repellant; "INNERBOND" at 16oz sq. yd. has a normal thickness of 1" and at this density is recommended as a packing in Speaker Enclosures for Sound Absorption.

STOCKISTS:

SYDNEY: Arrow Electronics Pty. Ltd. 342 Kent St.; Instrol Hi-Fi Pty. Ltd., 91a York St.; Convoy International Pty. Ltd., 449 Kent St.; Encel Electronics Pty Ltd., 257 Clarence St. Kent Hi-Fi, 432 Kent St.; Mastersound Sales Pty. Ltd., 400 Kent St.; Rad o Daspatch Service, 869 George St.; Peter Shalley Electronics Pty. Ltd., 127 York St.; Stereo Music Systems, 193 Clarence St.; Circuit Components (A/sia) Pty. Ltd., 460 Bexley Rd., BEXLEY; Classic Radio, 245 Parramatta Rd., HABERFIELD; Dyna Stereo Pty. Ltd., 331 Prince's H'way, ST. PETERS; Albert Wright Radio Service, 795 New Canterbury Road, HURLSTONE PARK; H. B Radio Products, 103-105 Catherine St., LEICHHARDT; Semicon Electronics, 172 Carlingford Rd., EPPING.

CANBERRA: Kitchen and Hi-Fi Specialists. Cnr. Giles and Kennedy Sts., Kingston.

NEWCASTLE: Martin de Launay Pty. Ltd., King and Darby Streets; Dynamic Sound, 587 Hunter Street.

WOLLONGONG: Dapto TV Service, 156 Prince's Hwy., Dapto.

MELBOURNE: J. H. Magrath and Co. Pty. Ltd., 208 Little Lonsdale Street.

BRISBANE: Chandler's Pty. Ltd., cnr. Albert and Charlotte Streets; Brisbane Agencies, 78 Wickham Street, Fortitude Valley. Stereo Supplies, 100 Turbot St.

IPSWICH: Robert N. Smallwood, 205 Brisbane Road, Booval.

NORTH QUEENSLAND: Alvin Communications and Electronics, 38 Pegnall St., Pimlico, Townsville.

ADELAIDE: Duncan Agencies, 57 Woodville Road, Woodville; General Accessories, 81 Flinders Street; Trustcott Electronics, 62-64 Hindmarsh Square.

PERTH: Atkins (W.A.) Ltd., 894 Hay Street; Carlyle and Co. Pty. Ltd., 1 Milligan Street; General Accessories, 46 Milligan Street.

HOBART: Homecrafts-Tasmania, 199 Collins Street.

If unobtainable

For 1 sq. yd. as above send $2.00
For 2 sq. yds. as above send $3.75
For 4 sq. yds. as above send $6.50

Postage paid in Australia and Territories to the manufacturers.

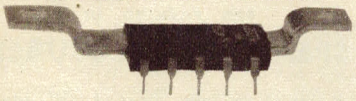
WONDER WOOL PTY. LTD.

87 JAMES STREET, LEICHHARDT.
N.S.W., 2040.
Box 548 — G.P.O., Sydney. 2001.
Phone: 56-2780.

PRE-PAK electronics

Mailing Address:
P.O. Box 131,
KINGSGROVE, N.S.W. 2208.
Sales Centre:
103 Regent St.,
REDFERN, N.S.W., 2016.
Telephone 69 5922.
Our New Showroom:
429 Pitt St.,
SYDNEY.
Telephone 211 2826.

INTEGRATED CIRCUIT



Plessey SL403/A.
3 watt R.M.S. Amplifier
Special Price $8.90.
With full information.

8 16Ω STEREO HEADPHONES

Wide Range. From **$5.90.**
57.D Deluxe Stereo Headphones, 25Hz-17Hz, with volume control.
$11.65.

Belt-driven Turntables. Special price for Christmas.
From **$36.00.**

COMPUTER BOARDS

Containing a variety of NPN and PNP germanium transistors and a host of other components, these 4in x 2½in boards are supplied with free technical information on all parts. Each board has a minimum of 4 transistors.

	PRICE POST
100 Boards	20c ea. 50c
25-99 Boards	25c ea. 25c
10-24 Boards	30c ea. 25c
1-9 Boards	35c ea. 10c

Stocks are running low. To avoid disappointment, order now.

PEAK STEREO AMPLIFIER

3.5 watt per channel
50HZ to 20KHZ
200mu Input.
$34.50 Post $1.00

HI-FI TWIN-CONE SPEAKERS

8 ohm or 15 ohm.

6½in 30Hz-15KHZ 6W. R.M.S.	$12.00
8in 30Hz-15KHZ 8W. R.M.S.	$12.00
10in 30Hz-15KHZ 10W. R.M.S.	$12.40
12in 30Hz-15KHZ 10W. R.M.S.	$12.84

TWEETERS

3½in 5KHz-16KHz
12w R.M.S., $3.30.
3½in 5KHz-18KHz
15w R.M.S. $4.10.
Post 50c.

HIGH-POWER SPEAKERS

Suit guitar amps., etc.

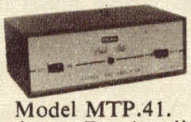
12in Aust. 15w Twin Cone.	$20.00
12in Aust. 50w	$50.00
15in Aust. 30w	$50.00

Freight $1 each.

MAGNETIC CARTRIDGES

AT66
20HZ-20KHZ±2db
Tracking weight .5-2.5 grams.
$8.50
At 215, **$11.50**
At 33, **$13.95**
Post $0.25
Simple fitting instructions included

PEAK STEREO PRE-AMPLIFIER



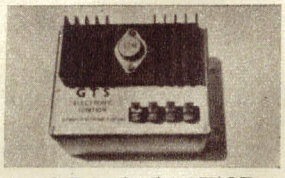
Model MTP.41.
All transistor Pre-Amplifier for tape or magnetic cartridge. Complete in grey metal case.
$19.50

SEASON'S GREETINGS

To all
PRE-PAK ELECTRONICS
CLUB MEMBERS
And all of our CUSTOMERS.

SPECIALS FOR CLUB MEMBERS

BC108 transistor	40c
BC109 transistor	45c
2N3055 transistor	$1.90
2N3054 transistor	$1.90
Em404 Diode	25c
OA91 Diode	20c
2N4443 6A.400V SCR	$1.90
2N3638	50c
2N3646	50c
2N2160	$1.50
2N5459	$1.50
1N914 Silicon	20c

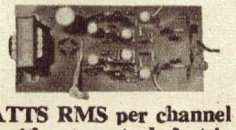


G.T.S. CAPACITOR

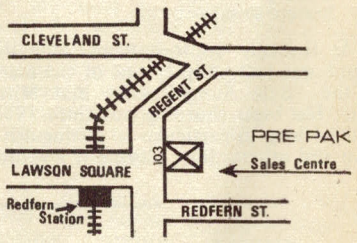
Discharge Ignition
by Summit.
A MODEL TO SUIT EVERY MOTOR.
6 months' guarantee.

Deluxe	$39.95
Competition (higher output)	$48.00
Munne	$64.00

NEW RELEASE! Basic Stereo Amplifier. Completely wired and tested on printed circuit board. Power supply included. $21.50.



3 WATTS RMS per channel supplied without controls but including simple instructions for fitting bass S Treble or tone controls. 50c Post.



SINCLAIR PRODUCTS

Stereo Sixty Pre Amp and Control Unit.
Retail Price **$34.25. Post 50c.**
Club Members' and Trade prices are available on application.
Z30 Twenty Watt HI-FI Amplifier.
Retail Price **$14.90. Post 50c.**
Z50 Forty Watt Hi-Fi Amp.
Retail Price $18.75.
PZ5 Power Supply Unit.
Retail Price **$17.60. Post $1.00.**
PZ6 Power Supply Unit.
Retail Price **$32.45. Post $1.00.**
P2 8 Power Supply Unit.
Retail Price **$26.50.**
IC.10 Integrated Circuit.
Retail Price **$14.90. Post 50c.**

Active Filter Unit
Rumble and Scratch Filter.
Retail Price **$26.50.**

PUBLICATIONS MULLARD

Semiconductor Devices	$1.60
Demonstrations and Experiments in Electronics	$1.50
Electronic Counting Circuits, Techniques and Devices	$3.30
Valve Tube and Semiconductor Guide	$1.50
P.A.L. Colour T.V.	$2.50
Semiconductor Interchangeability list	$1.00
Voltage Regulator (Zener Diodes)	$1.00
A Programmed Book on Semiconductor Devices	$1.50
Enlarged Data Sheets	$0.30
Simple Transistor Measurements	$0.55

Post $0.10

PUBLICATIONS MINIWATT

Miniwatt Valve and Transistor Data Book.
Latest (7th) Edition **$3.05**

TAPES, CASETTES, SPOOLS

Compare Our Prices:

C60 Casette	$1.20
C90 „	$1.80
C120 „	$2.40
3" x 500ft	$1.30
5" x 1800ft	$3.25
7" x 2400ft	$4.45

Many others in stock.

PRE-PAK electronics

KITS

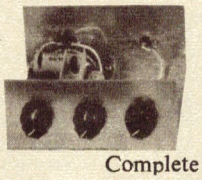
A NEW RANGE OF ELECTRONIC KITS

DELUXE MONO AMPLIFIER KIT

A 3-watt mono amplifier with bass and treble controls.

SPECIFICATION

Sensitivity	2.7 watt	160mV R.M.S.
Frequency response		15Hz-50KHz
Tone control range	Bass (40Hz)	−17db +10db
	Treble (15 KHz)	−15db +11.5db
Distortion		Less than 1 per cent
Noise level	(Ref. 2.7 watt)	−80db
Hum level	(Ref. 2.7 watt)	−72db



$15.90
Post 25c

Complete with chassis and knobs.

KIT MA4

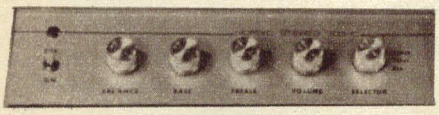
DELUXE MONO AMPLIFIER KIT

As above, but with built-in power supply and mains lead.
$23.90. Post 50c.

KIT S.A.1

DELUXE STEREO AMPLIFIER KIT

A 3+3 watt R.M.S. Stereo Amplifier complete in every detail. Separate bass and treble controls.



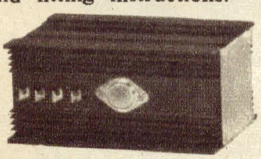
Complete with case and knobs, $46.00
Chassis only, without case .. $42.00
Post 50c.

Sensitivity		(2.7 watt)	160mV R.M.S.
Input impedance		Vol max	700KΩ
		Vol min	2mΩ
Frequency response			15Hz-50KHz
Tone control range	Bass (40Hz)		−17db +10db
	Treble (15KHz)		−15db +11.5db
Distortion			Less than 1 per cent
Noise level	(2.7 watt cont. level)		−80db
Hum level	(2.7 watt cont. level)		−72db
Cross talk level			−40db

KIT P.S.5. A power supply kit for use with any of the above amplifiers. Output 18V. Max. current 1A.
Price **$6.40.** Post 50c.

KIT C.D.1

Deluxe Capacitor Discharge Ignition Kit. All parts required to build this proven system with full assembly and fitting instructions.



$27.75 Post 50c

SPECIFICATIONS:

Voltage Supply, 3V to 18V DC, Peak DC output (100 pps loaded with coil), 400V, Rise Time 1.5ky per microsecond. Secondary voltage (with standard coil), 20Kv over 2cM GAP. Dimensions: Height 4 inches, width 2⅞ inches, length 6 inches.

Improves starting, petrol consumption, points life, plug life, acceleration, general performance.

KIT C.D.2. As above but for positive earth. Price and availability on application.

KIT P.S.1



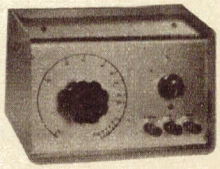
$27.50
Post $1.00

REGULATED VARIABLE POWER SUPPLY KIT
SHORT CIRCUIT PROTECTED.
ESSENTIAL FOR ANY ELECTRONICS WORKSHOP.

A four-transistor, overload protected, DC power supply with metering facilities. Features: Max. voltage 22V, max. current 1 amp, low ripple, easy to assemble and use.

KIT A.O.1

HIGH PERFORMANCE AUDIO OSCILLATOR KIT

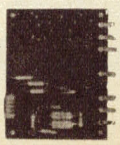


Specification:

Frequency Range:	15Hz—20KHz.
Output Voltage:	0-1V 0-5mV R.M.S.
Distortion:	Less than 0.1 per cent 60Hz-20KHz.
Output Level:	Within 0.5db over frequency range.

A most useful piece of test equipment for any service shop or workshop.
Price includes recommended battery. **$14.50.** Post 25c.

M.P.1. MONO PREAMPLIFIER FOR MAGNETIC CARTRIDGES **$4.90**
M.P.2. STEREO PREAMPLIFIER FOR MAGNETIC CARTRIDGES **$9.00**
M.P.3 MONO PREAMPLIFIER FOR TAPE HEADS (state speed) **$4.90**
M.P.4 STEREO PREAMPLIFIER FOR TAPE HEADS (state speed) **$9.00**
Metal case and input/output sockets **$3.00** extra.
POWER SUPPLY FOR ANY OF ABOVE **$4.90**



PARTS and Truscott's sound house ACCESSORIES

East side of Hindmarsh Square, Adelaide 23 3024

TRANSFORMERS

Low voltage equipment types

6.3v. 1A	$3.85
6.3v. 1.2A	$3.85
6.3v CT. 2.25A	$5.15
6.3v CT. 3A	$6.90
6.3v CT. 3A Plus 6.3v. plus 3A.	$8.30
6.3v x 2, 1.1A x 2	$4.65
6.3v x 2, 1.25A x 2	$6.10
6.3v x 2, 2A x 2	$5.30
12.6v CT. 150mA	$3.75
12.6v x 2, .5A x 2	$4.15
12.6v x 2, 2.5A x 2	$7.50
15v. 2A	$4.50
17v. 1.25A	$6.30
17v T11.5v. 400mA	$5.60
17v T11.5v. 4AMP	$10.10
22v x 2, 1.25A x 2	$6.60
30v. 1.6A	$8.35
30v T25, T20, 2A	$10.35
32v. 2A	$9.35
32 x 2, 1A x 2	$8.35
36v CT. 2.5A	$12.80
38.8v CT. 1.5A	$7.10
40v CT. 2A	$6.40
50v CT. 1.5A	$11.00
70v CT. 750mA	$9.10
75v CT. .750mA	$9.30
15v. 1A T12.6, 9.5, 8.5 7.5, 6.3	$4.85
30v. 1A. T27.5, 24. 20, 17.5, 15	$5.70

Add Pack-Postage.

AC TO DC CONVERTORS

3 types 9 volt — 7.5 volt — 6 volt. Plugs into cigarette lighter of car — permits the use of tape recorder from 12 volt car battery.

$11.95

CAPACITORS

Low voltage pigtail electrolytics

2500	MFD	35VW	$1.44	250	MFD	35VW	51c
2500	MFD	25VW	$1.25	250	MFD	25VW	49c
2500	MFD	15VW	$1.01	100	MFD	35VW	40c
2500	MFD	6VW	77c	100	MFD	25VW	35c
1000	MFD	35VW	88c	50	MFD	35VW	32c
1000	MFD	25VW	81c	50	MFD	25VW	31c
1000	MFD	15VW	65c	50	MFD	15VW	30c
500	MFD	35VW	67c	25	MFD	35VW	30c
500	MFD	25VW	50c	25	MFD	25VW	30c
500	MFD	15VW	49c	10	MFD	35VW	29c
500	MFD	6VW	40c	10	MFD	15VW	35c

Quality West German Make. Add pack, postage.

P. Circuit End-mounted Miniature Electrolytics

		1-9	10-99	100+
5MFD	10VW	12c	11c	9c
10MFD	10VW	12c	11c	9c
10MFD	30VW	15c	13c	11c
30MFD	10VW	15c	13c	11c
50MFD	10VW	17c	14c	12c
100MFD	10VW	19c	15c	13c
200MFD	10VW	24c	20c	18c
500MFD	10VW	33c	27c	24c

(Add Pack-Postage)

Large Capacity — Insulated Can Electrolytics

1000MFD	63VW	1.9" H	1.375"D	$1.45
1000MFD	100VW	3.15"H	1.375"D	$2.30
2200MFD	50VW	1.9" H	1.375"D	$2.20
2200MFD	63VW	2.35"H	1.375"D	$2.30
2200MFD	100VW	3.15"H	2" D	$4.25
4000MFD	75VW	4" H	1.6" D	$4.10
8000MFD	75VW	4.5" H	2.5" D	$9.80

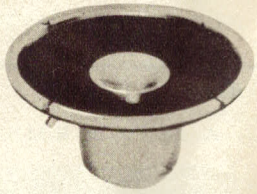
(Add Pack-Postage)

SEMI-CONDUCTORS

Some popular types from our extensive stocks.

A15A	BA102
AC125	BC107
AC126	BC108
AC128	BC109
AC187	BC177
AC188	BC178
AD161	BF115
AD162	BFX13
AF116N	BRY39
ASZ15	BZX61
BA100	BZX70
BZY88	2N3053
OA91	2N3055
OA95	2N3638
PA40	2N5457
TAA300	2N5458
TT797	2N5459
TT798	2N5485
TT800	40250
DIACS	40408
2N443	40409
2N2102	40410

(Please send us your complete kit list for a T.M.Q.*)



HOKUTONE HA 201 8" HI-FI TWIN CONE SPEAKERS

Response 40 HTZ to 15,000 HTZ 6 Watts RMS.

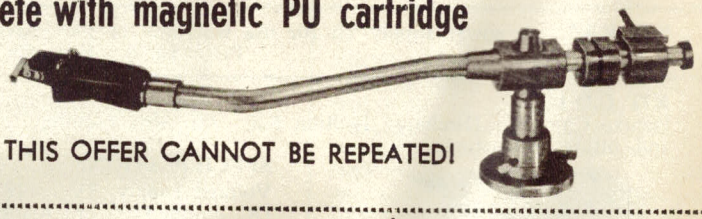
$8.55

PIEZO PU402 TONE ARM---complete with magnetic PU cartridge

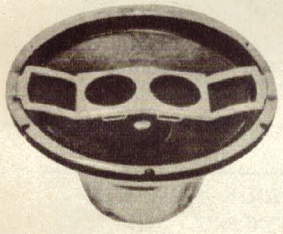
$24

(IF LIFT REQUIRED ADD $8.50)

Cartridge specifications: 5 MV output 20-20,000 HTZ plus or minus 2DB compliance 10 x 10—6 CM/DYNE tracking 1½ to 2 grams.



THIS OFFER CANNOT BE REPEATED!



HOKUTONE HS 300 12" HI-FI BASS SPEAKER WITH 2 3" TWEETERS ENCL.

Response 35 HTZ to 20,000 HTZ, 20 watts RMS.

$35.70

KH 24-4000-OHM PHONES

Ceramic magnetic with adjustable head band.

$2.75

E.A. PRINTED CIRCUITS etc.

63/A4	$3.06	69/T5	$2.55
65/P10	$2.55	70/A1	$2.55
68/A8	$2.86	70/A2	$5.10
68/T8	$3.32	70/BF08	$2.04
69/C10	$3.06	70/CD1	$2.04
69/F10	$1.84	70/G7	$2.04
69/01	$5.10	70/R1	$2.55
69/P5	$3.06	70/SL1	$2.55
69/P9	$3.06	"TAA300"	$1.84

Many Others Available (Add Pack-Postage)

1 Grid matrix boards
3in x 3in . . 45c
6in x 6in . . $1.30
9in x 9in . . $2.70
12in x 12in . . $4.90

COOPER LAMINATE BOARDS
6in x 3in, 6in x 6in, 9in x 6in, 12in x 3in, 12in x 12in. T.M.Q.*
ETCHING KIT, $1.25.
1/16in CIR-KIT 35c

FOR LINING IN SPEAKER ENCLOSURES "INNERBOND"

1 sq. yd	$2.00
2 sq. yd	$3.75
4 sq. yd	$6.50

(Add pack-postage) (Bulky)

OVER 80 TYPES OF SPEAKER CLOTH

Samples — T.M.Q.*

IN SOUTH AUSTRALIA

You can't afford to go past . . .

NEAT STYLUS PRESSURE GAUGE

Accurate type. measures 1 to 10 grams.

$1.50

DESPATCH

All orders received by 8.30 a.m. are despatched by 1 p.m.; after 1 p.m. by 5 p.m.

POSTAGE

Please add pack-postage to all orders for multiple items. Heavy items often sent by rail or road.

QUALITY

All components have quality emphasis, carefully selected; all are new and guaranteed.

*TMQ
TRUSCOTTS Mail Quote

the sound house TRUSCOTT ELECTRONICS

62-64 HINDMARSH SQ. ADELAIDE, 5000 Phone: 23 3024 23 3278

TRADE REVIEWS AND RELEASES

SONY TA-1010 Amplifier

In the January 1967 issue we reviewed the Sony TA-1120 stereo amplifier and found it one of the finest available, at that time. The Sony TA-1010, reviewed here, represents a less ambitious design concept, but one which offers good performance and interesting front panel styling. It was submitted for review by Jacoby, Mitchell and Company.

Overall dimensions of the amplifier are 16½ x 9¾ x 5in deep. A wooden case is fitted and is included in the basic price. The front panel is brushed aluminium, with insets painted in grey enamel. The volume control knob is the dominant feature of the panel styling, which is a logical approach. Below the volume control is the balance control, which takes the form of a horizontal slider. On the left of the panel are three knobs, which comprise the bass and treble controls and the speaker selector. Below these are the power switch, pilot lamp and headphone socket.

On the right-hand end of the panel is the input selector switch, together with four toggle switches controlling the following functions: Loudness, High filter, Mode (stereo or mono) and Tape Monitor. Also on this side of the panel is a jack socket for a high level input.

On the whole, the styling of this amplifier is both logical and eye-appealing. A large number of control functions are accommodated without bewildering the user, and as a result it is a pleasure to use. Perhaps the only feature of the controls which did take some time to adjust to was the fact that all toggle switches operate according to the American convention, being "on" in the up position.

Phono sockets are arrayed on the rear panel, providing inputs for two magnetic cartridges, tuner and auxiliary, tape inputs and also tape outputs. A five-pin DIN socket is also provided, for single-cable connection to a tape recorder. Two switched and one unswitched AC 2-pin outlets are provided, for connection of turntables and other accessories.

Two sets of loudspeaker outlets are provided, and these take the form of screw connections which are intended to be used in conjunction with spade lugs. Both or either set of loudspeakers can be used or they can be switched out entirely, using the front panel speaker selector. When both sets are used they are connected in parallel, with a series resistor to protect the amplifier from excessive loading.

Removal of the wooden case of the amplifier reveals a layout which is straightforward and designed for easy servicing. The rear and base panels of the emplifier are perforated to allow cooling of the heatsink for the four output transistors. Three printed boards accommodate most of the circuitry.

One feature which came to light during our inspection of the sample amplifier was that the three-core power flex, apparently fitted by the Australian distributors to satisfy local regulations, was actually wired up incorrectly. The unit was not unsafe, but the three AC outlets had power applied to them at all times, whether or not the amplifier was on. Apart from this error, we would prefer to see the power cord securely anchored where it entered the chassis, instead of merely knotted as at present.



As may be seen the SONY TA-1010 presents a neat and functional appearance. The front panel has a brushed aluminium finish with insets in grey enamel.

The power transistors are mounted on a heatsink inside the chassis, and this is a good feature since it places them out of reach of shock-sensitive fingers. Also they are not likely to be shorted inadvertently by a carelessly wielded screwdriver or other implement.

We did not have reference to the circuit diagram of the amplifier so cannot offer comment in detail on this point. However, the circuit appeared to follow conventional lines with the output stages using the familiar quasi-complementary configuration.

Rated power output of the amplifier is 30 watts continuous (15 watts per channel) into 8-ohm loads. Total harmonic distortion is rated at less than 0.5 per cent at 1KHz, for rated output.

In our tests of the sample unit, continuous power output at the onset of clipping was measured at 15 watts per channel, with both channels working into 8-ohm loads, and 19.5 watts with only one channel driven. The THD at 1KHz for 15 watts per channel was 0.4 per cent and the same figure was achieved at 19.5 watts with one channel driven.

Power output into 16-ohm loads was 12 watts per channel, with both channels driven singly or together, and the THD at 1KHz at this power was 0.3 per cent. We also measured total harmonic distortion at 1 watt for the range of frequencies between 100Hz and 10KHz, and found it to be commendably low at 0.27 per cent or less for the whole range. Incidentally even at 50KHz and at high power the output waveform was still a clean sine wave. On all measurements we found the harmonic distortion to be mainly lower order harmonics, and at no time was there evidence of crossover distortion.

Frequency response at 1 watt, and power bandwidth at 15 watts into 8-ohm loads checked out the same, with minus 3dB points at 15Hz and 70KHz, which is excellent. Separation between channels, referred to 15 watts was good, at minus 40dB or better over the range from 500Hz to 10KHz. This was measured with the non-driven channel input unloaded. Square wave response was good over the whole range and stability with capacitive loads was quite satisfactory.

The tone controls gave a range of plus or minus 10dB at 10KHz and plus or minus 9dB at 100Hz. This is adequate, when the extra boost contributed by the loudness switch facility is taken into account. The latter switch gave 8dB boost at 100Hz, and 4dB boost at 10KHz at the "9 o'clock" setting of the volume control.

The "high" filter gave modest attenuation at only 6dB/octave above 5KHz, and as noted before in these columns, this is not really adequate. It can really only be considered as a preset treble cut control. Unfortunately use of the high filter on the sample amplifier was found to cause instability, as evidenced by bursts of high frequency oscillation at power levels above about 5 watts. This was quite audible on music reproduction and most unpleasant, but may only be due to a fault in the particular amplifier tested.

All the above measurements were made using the "auxiliary" input, which has a sensitivity of 250mV for 15 watts output. The magnetic cartridge input sensitivity was 1mV for full output, somewhat higher than the claimed 3mV. However the phono inputs could handle only 30mV RMS at 1KHz before audible overload occurred. This is not really sufficient to cope with some medium output magnetic cartridges, which can deliver in excess of 30mV on signal peaks. With such cartridges some sort of input attenuator (shielded) may thus be required.

On listening tests, the amplifier gave a good account of itself. All controls, with the exception of the "high" filter, operated smoothly, and the amplifier was commendably quiet, even at extreme control settings.

To summarise, we found this amplifier a pleasure to put on test. It conforms closely to its specifications, is easily serviced and has attractive styling.

Retail price of the amplifier is $189.95, including tax, and is available from retail outlets throughout Australia. Trade inquiries should be directed to Jacoby, Mitchell and Company Pty Ltd, the Australian distributors for Sony equipment, at 469-475 Kent Street, Sydney, NSW 2000. (L.D.S.) ■

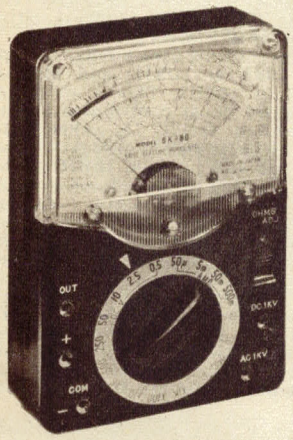
AUSTRALIAN RADIO DX CLUB

Covering the reception and verification of overseas and distant (DX) broadcasting stations. Monthly bulletin: "The Australian DX News"

For full details write to:
Secretary,
ARDXC, P.O. BOX 227,
Box Hill, Victoria 3128

NEW RH (Radio House) RANGE OF MULTIMETERS

Model RH-80 $18.00 Postage 50c



20,000 Ohms per Volt DC
10,000 Ohms per Volt AC

Specifications:

DC Volts. 0.5, 2.5, 10, 50, 250, 500, 1000 V

AC Volts. 10, 50, 250, 500, 1000 V

DC Current: 50uA, 5mA, 50 mA, 500 mA

Resistance. 5 kΩ, 50kΩ, 500kΩ, 5 MegΩ

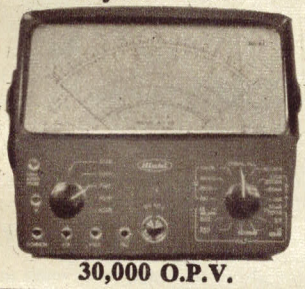
Decibels. —10 + 62 lb

Accuracy. DC±3%, AC ±4% (of full scale)

Batteries. Two 1.5V dry cells. Size AA, "Eveready" 915 ● Overload-protected by dual silicon diodes. ● Mirror scale. ● Double-jewelled ±2% meter. ● ± 1% temperature-stabilized film resistors.

6" FACE A-10 MULTIMETER AND SIGNAL INJECTOR

With Test Leads and Injector Probe



30,000 O.P.V.

SPECIFICATION: 6in x 2½in scale.
DC Voltage: 0-0.5, 2.5, 10, 50, 250, 500, 1,000 V at 30,000 o.p.v. 5,000 and 25,000 V at 10,000 o.p.v
AC Voltage: 0-2.5, 10, 50, 250, 500, 1,000 V at 10,000 o.p.v.
Volume Level in Decibels.
DC Current: 0-50 uA, 1, 50, 250 mA, 0-1 and 10 amps.
AC Current: 0-1, and 10 amps.
Resistance: 0-10K, 100K, 1M, 100 Megohms, Signal Injector Output Jack, Zener Diode Overload Protection.

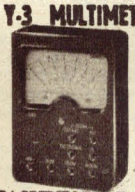
Xmas Special $48.75

BOOK TYPE



The latest model portable Tape-recorder. 4 transistor, 3in reels, 2 tracks. Instruction manual. Size 10½in x 7in x 1¼in.
Just open the book and record. Supplied complete with tape, microphone and batteries. Special discount price, $20.50, posted anywhere.

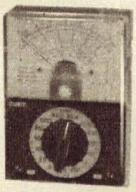
NEW TYPE Y-3 MULTIMETER



MEASURING RANGE: D.C. Voltage: 6V, 30V, 150V, 600V (2000 ohms/V). A.C. Voltage: 6V, 30V, 150V, 600V (2000 ohms/V). D.C. Current: 150 mA. Resistance: 0-100,000 ohms. Complete with 1.5 volt battery and test leads. Size: 3¾" x 2¾" x 1⅜".

Checked, Packed and Posted — $9.50. Limited Stocks.

"HANDYMAN" RH 150 $11.50



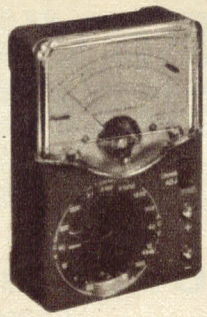
CHECKED PACKED & POSTED FREE

Pocket-size 3¼" x 4½" x 1¼". Instruction sheet and circuit.

SPECIFICATIONS

DC Volts 2½, 10, 50, 250, 1000.
AC Volts 10, 50, 250, 500, 1000.
DC Current, .1, 25, 250 M/amps.
Resistance, 20K and 2 megohms.
Decibels, —20db = +62db .7K/c.
Capacitance, .0001, .01, .0025, .25 mfd.

Model RH-20 $13.95. Postage 50c



20,000 Ohms per Volt DC
10,000 Ohms per Volt AC

Specifications:

DC Volts: 0.25, 2.5, 10, 50, 250, 1000 (20,000/V)

AC Volts: 10, 50, 250, 500, 1000 (10,000/V)

DC Current. 50 uA, 25mA, 250mA

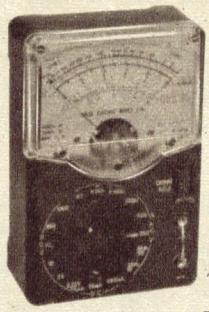
Resistance. 7kΩ, 700kΩ, 7MΩ

Decibels. —10 +22 (at AC/10V) +20 +36 (at AC/50V). Upper frequency limit 7kc.

Batteries: Two 1.5V dry cells.

With Meter Protection $15.00

Model RH-55 $20.00 Postage 50c



30,000 Ohms per Volt DC
14,000 Ohms per Volt AC

SPECIFICATIONS:

*DC Volts: 0.6, 3V, 12V, 60V, 300V, 1200V (30,000 ohms/V.

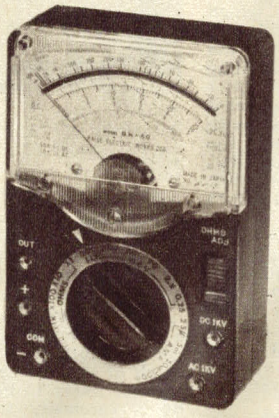
*AC Volts: 12V, 60V, 300V, 1200V (14,000 ohms/V).

*DC Current: 60 A, 12mA, 300mA.

*Resistance: 10K ohm, 1Meg ohm, 10Meg ohm.

*Decibels: -10 db +23 db.

Model RH-60 $25.00 Postage 50c



50,000 Ohms per Volt DC
10,000 Ohms per Volt AC

Specifications:

DC Volts: 0.25, 2.5, 10, 50, 250, 500, 1000 V

AC Volts. 10, 50, 250, 500, 1000 V

DC Current. 25 uA, 5 mA, 50 mA, 500 mA

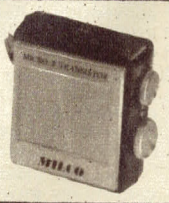
Resistance: 10 kΩ, 100 kΩ, 1 MegΩ, 10 MegΩ

Decibels. —10 +62 db

Accuracy: DC±3%, AC± 4% (of full scale)

Batteries. Two 1.5 V dry cells.

Models RH-80, -55, -60 are:—
● Overload-protected by dual silicon diodes ● Mirror scale ● Double-jewelled ±2% meter ● ±1% temperature-stabilised film resistors.



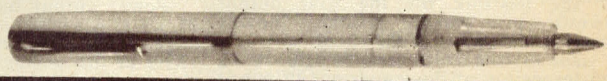
LATEST MODEL MICRO RADIO

7 transistors, uses 1 standard Penlite battery size 2½in x 2½in. The only miniature radio using standard batteries (refill battery 10c). Complete with instruction leaflets.

Pack and post $39.75.

FLASHLIGHT BALL POINT PEN S-88

Lights up automatically when pen cover is in position for writing. **$2.00 posted.**
Bright illumination. Modern shape with silver finish. You can write when it is dark. Spare parts available. Two batteries 30c. Pen refill 15c. Globes 15c..

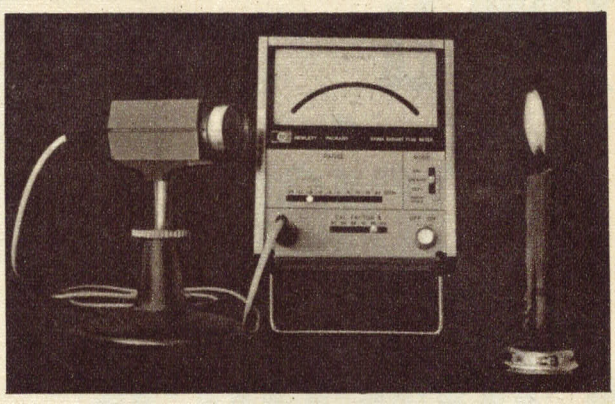


RADIO HOUSE PTY. LTD.

306-308 PITT STREET 61-3832 26-2817 760 GEORGE STREET SYDNEY. 211-0171

New Instruments from Hewlett-Packard

Recent additions to the Hewlett-Packard family of high quality measuring instruments include a multipurpose broadband optical power meter with absolute calibration, a frequency multiplier to improve digital counter resolution at low frequencies, and two new strip-chart recorders which use a linear motor for pen drive.



The Model 8330A Radiant Flux Meter, together with the Model 8334A detector unit and a familiar light source.

The 8330A/8334A is a direct-reading optical power meter system, calibrated in absolute units at any wavelength in the infrared, visible and ultraviolet. No calibration or correction charts are needed. The system measures irradiance from 100 nanowatts/cM^2 resolution limit to 100mW/cM^2 full scale in ten overlapping ranges. Radiant flux, from 10 nanowatts resolution limit to 10 milliwatts full scale, and radiance, from 10 nanowatts/cM^2/steradian resolution limit to 10 milliwatts/cM^2 /steradian, can also be measured due to the accurately known active detector area (0.1 cM^2) and detector field of view (0.1 steradian solid angle).

A logarithmic dBm scale is also provided, useful for comparing power levels. Higher powers can be measured using neutral density filters and diffusers. The taut-band meter is fully overload protected and is individually calibrated for maximum reading accuracy. Repeatability is better than 1 per cent and absolute measurements of irradiance are specified to be accurate to better than ±5 per cent of full scale traceable to NBS to the extent allowed by the Bureau's calibration facilities.

Many convenience-orientated features are incorporated into the instrument including AUTO-ZERO whereby, with the quick push of a front panel switch, the meter reading can be automatically zeroed to either ambient or zero input.

A front panel calibration factor control makes it possible to normalise readings when desired. For example, when a filter with a known transmission factor is inserted in the optical path, a precise adjustment in system sensitivity can be made to correct for the transmission loss of the filter.

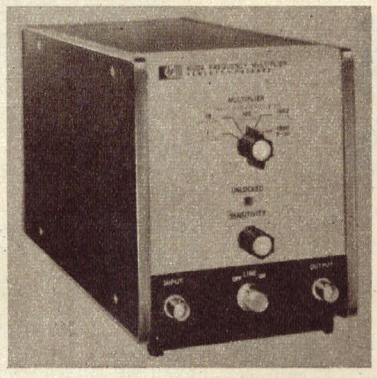
The key to the instrument's broadband, rapid (as fast as 70mS on the higher ranges) measuring capability is the unique design of the Hewlett-Packard thin-film thermopile detector. Manufactured using thin-film vacuum deposition and etching techniques, the detector array consists of 64 individual series-connected, thermocouple junctions.

Practical experience indicates that optical detectors, regardless of type, tend to change sensitivity with temperature, overload, mechanical shock, and aging. However, a correlation has been found to exist between the optical sensitivity of the type of detector employed and the sensitivity of this detector to an electrically injected, low frequency calibration signal. This principle is used to advantage in the 8330A/8334A system and is the foundation of the system's guaranteed high overall measurement accuracy. In operation, a pushbutton control system injects a precision low frequency calibration signal into the system and automatically adjusts gain to match the sensitivity of the particular detector in use, regardless of temperature or detector aging.

Various types of detectors can be supplied for general purpose or specialised applications. The standard detector is equipped with an optical-quality fused quartz window and exhibits essentially flat spectral response from 0.3 micron to 3.0 microns. Spectral response is extendable from atmospheric absorption in the ultraviolet to the far infrared with appropriate window materials.

The 8330A Radiant Flux Meter is priced at $650, and its companion 8334A Radiant Flux Detector is priced at $450 including an adjustable stand.

The Model 4022A Frequency Multiplier is a new low-cost instrument which multiplies input signal frequencies by 10, 100 or 1000. It works for CW or pulses, at frequencies from 5Hz to 100KHz. It gives high resolution in measuring low frequencies without resorting to period measurement, which requires calculation of the reciprocal to obtain frequency. With the Model 4022A, users with conventional digital counters get the higher resolution normally only obtainable with a reciprocal counter.



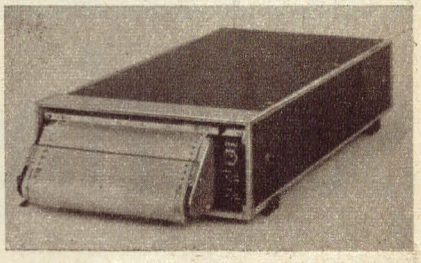
For example when measuring a 60Hz signal over a 1 second gate time, a conventional counter will read 60 ± 1 count. Multiplying the frequency by 1000 with the Model 4022A, the counter reading becomes 60.000 ± 2 counts for the same 1 second gate time. Alternatively, measurement time can be reduced to 1 millisecond and reading of 60 ± 1 count again obtained.

The instrument is fully automatic in operation, which assures a correct reading at all times. If the input signal is not phase-locked to the internal oscillator, a front panel lamp warns that the system is unlocked, and the counter displays only zeros. Accuracy is the same as counter accuracy on the x1 and x10 ranges. Accuracy on the x100 range, and on the x1000 range below 500Hz, is (±1 count ± counter accuracy) for a one-second gate time. Above 500Hz on the x1000 range, accuracy is (±2 counts ± counter accuracy), also for a one-second gate time.

The Model 4022A measures signals as low as 100 millivolts rms, and either positive or negative pulses as low as 500 millivolts peak. Pulse duty cycle can be as low as 5 per cent. The instrument may be operated from either 115 or 230 volts (±10 per cent), 48 to 400Hz power. It weighs 6.5 pounds, and is priced at $760.

The two new 3½in high strip-chart recorders use a unique linear servo motor pen drive to achieve extremely high reliability. The Model 7123A/B uses chart paper with a 10in wide grid; the Model 7143A/B takes paper with a 5in wide grid. The recorders conserve rack space, yet have a versatile chart drive and chart viewing system. A choice of available configurations allows the customer to "customise" a recorder to fit his application.

Adapting the linear motor to a chart recorder has resulted in a pen drive system with only one moving part – the motor/slider/pen assembly. Because the entire radial field of the motor is produced by a permanent magnet, the motor consumes little power and has virtually no internal temperature rise. Also, the motor can be driven continuously off scale with no noise and no damage to the recorder.



At left is the Model 4022A Frequency Multiplier, while above is the Model 7143A Strip-Chart Recorder. The latter features a linear motor pen drive system, and offers very high reliability.

To further enhance reliability, a new conductive feedback element is used instead of a wirewound slidewire. It requires little maintenance except for an occasional dusting and lubrication.

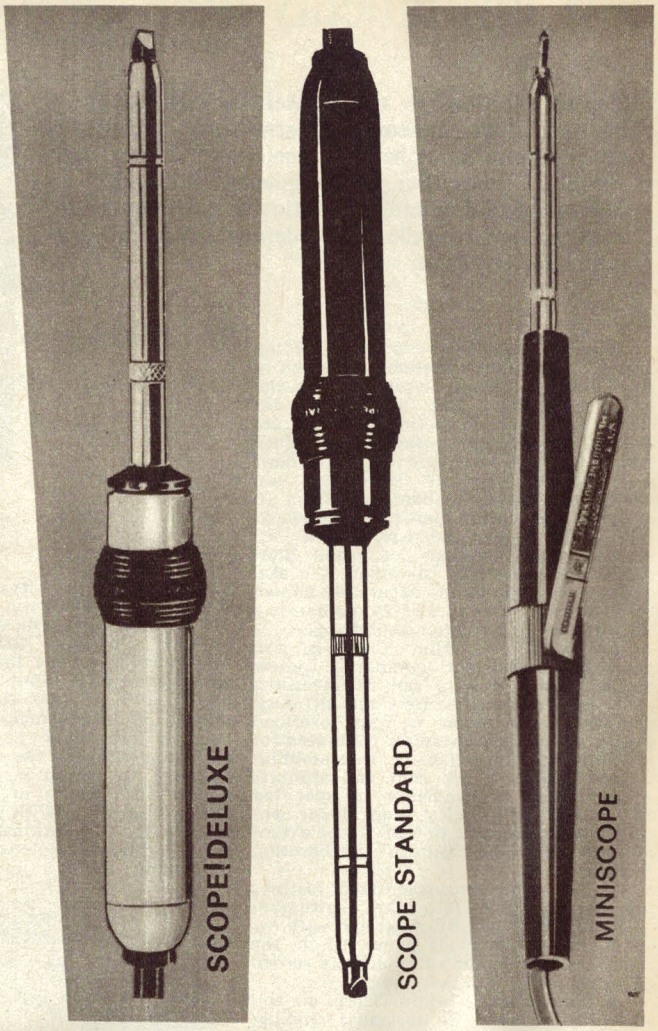
Both recorders have quick response. Full scale response of the Model 7123A/B is less than 1/3 second, and less than ¼ second for the Model 7143A/B. Response to step inputs is good, with less than 1 per cent overshoot.

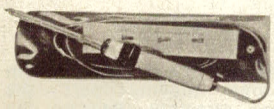
Input ranges from 1mV to 100V, single span, are specified by option. Chart speed is also determined by option choice. Electric writing is also an available option.

Basic price of both the 7123A/B and 7143A/B is $750.

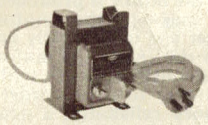
Inquiries regarding any of the instruments described may be directed to Hewlett-Packard Australia Pty. Ltd., at 22-26 Weir Street, Glen Iris, Victoria 3147, and 61 Alexander Street, Crows Nest, N.S.W. 2065. ■

for a happier Christmas choose a SCOPE soldering iron





Both Irons are beautifully presented in a handy re-usable plastic pouch-pack, complete with one spare tip and two spare elements.



TRANSFORMER BY NATRONICS
Both operate on voltages from 2.5V to 6.3V A.C. or D.C. or from 240V A.C. mains through a NATRONIC Scope Transformer" fitted with 6ft. 3-core flex and 3 pin mains plug.

Fully approved by electricity authorities APP. No. N/360/6894 - 5

ECONOMY
Consumes current only whilst in use. Scope De Luxe performs all the functions of other irons from 40 to 150 WATTS. MINISCOPE—up to 75 WATTS.

LABOUR SAVING
Fast warm-up — always ready, cuts wiping, retinning and filing of tips to a MINIMUM.

VERSATILITY
Copes with all soldering jobs—from miniature components to large solder lugs. Can even be operated from a 6 volt car battery

CONTROL
Temperature control at your finger tips. Heat only when, where and as much as needed.

CONVENIENCE
Ideal for those almost inaccessible spots. No burning of adjacent insulation.

SPEED
ONLY 5 to 6 seconds initial heating up time from cold, then practically instantaneous.

MINI WEIGHT
Scope De Luxe weighs only 3½ ozs. complete. Miniscope 1¾

GUARANTEE
Fully guaranteed with time tested dependability.

SAFETY
Low voltage operation. Heat sensitive components protected.

LESS MAINTENANCE
Longer tip life. NO expensive heating elements to replace. Maintenance without special tools. Spare tips and elements readily available from your Scope Distributor.

IRH Components Pty. Limited
The Crescent, Kingsgrove,
N.S.W. 2208. Phone: 50-0111

INTERSTATE TELEPHONES

MELB. VIC.	44.5021
HOB. TAS.	34.2811
LAUN. TAS.	22.844
PERTH W.A.	8.2271
ADEL. S.A.	23.1971
BRIS. QLD.	211933

IRH THE COMPONENT DIVISION OF IRH INDUSTRIES LIMITED

SCOPE PRODUCTS ARE AVAILABLE FROM ALL MAJOR ELECTRICAL WHOLESALERS AND HARDWARE STORES — THE FULL GUARANTEE APPLIES ONLY WHEN THE IRON IS USED WITH THE APPROVED 'SCOPE' TRANSFORMER. MANUFACTURED BY NATRONICS PTY. LTD.

SCOPE — VOTED FIRST BY A HOST OF SATISFIED USERS.

Please Post free illustrated SCOPE literature

NAME _____

ADDRESS _____

CITY _____ POSTCODE _____

Tektronix announces new 2600 system, additions to 7000-series oscilloscopes

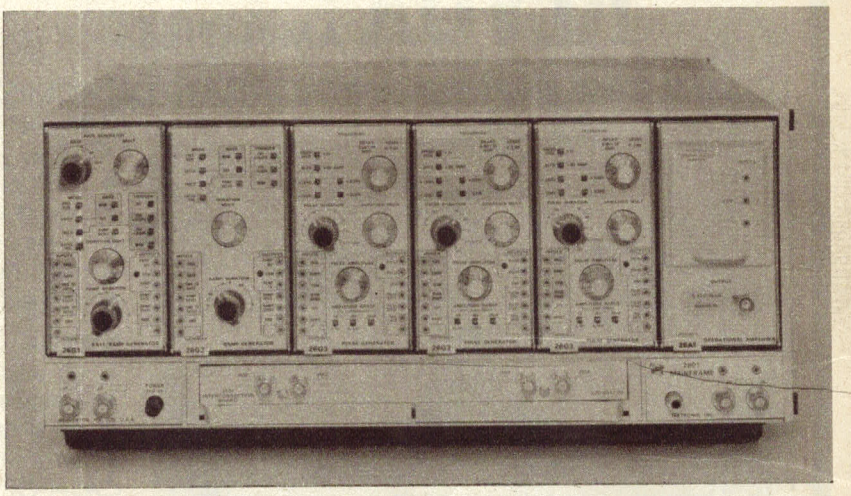
Tektronix Australia Pty Ltd has recently introduced the first of a new "2600" series of instruments designed to generate, condition, mix, and amplify signals useful in research laboratories and industrial applications. Tektronix has also added two more mainframes and three more plug-ins to its popular, and rapidly growing 7000-Series Oscilloscope system which was introduced only one year ago.

The 2600 Series presently consists of the 2601 mainframe and four plug-in modules: the 26G1 Rate/Ramp Generator, the 26G2 Ramp Generator, the 26G3 Pulse Generator, and the 26A1 Operational Amplifier. Input and output levels are designed to be compatible with both TTL and other IC logic levels. Variable analog voltage, current, and time outputs are also available. Therefore, the 2600 Series is a general-purpose system that fits applications in medicine, data processing, testing, etc.

Provision is made for customer modification and adaption to meet unusual requirements, through the use of plug-in construction kits. These kits contain the necessary mechanical and interconnecting hardware to add special circuitry to the 2600 Series.

The 2601 mainframe houses up to six plug-in modules and provides power to and signal interconnection between plug-in modules. An electrically identical rackmount version, the R2601, is also available.

The 26G1 ramp/rate generator generates voltage ramps of calibrated variable durations, at calibrated variable rates. The ramps can be triggered or gated (or both) externally, manually, or from its rate generator. The range of the internal rate generator is 0.01Hz to 11KHz, continuously calibrated. Ramp – 10 μs to 110s, continuously calibrated. Outputs – Rate, +3V, 1.5μs duration; Ramp, +10V, 3kΩ and +1V, 50Ω.



The 2601 mainframe with 26G1, 26G2, 26G3 and 26A1 plug-ins.

The 26G2 ramp generator generates voltage ramps and is the same as the 26G1 without the rate generator.

The 26G3 pulse generator generates current or voltage pulses of continuously calibrated duration and amplitude when triggered by system or external waveforms. When a 10-V ramp is used as a triggering source, the 26G3 generates a calibrated time delay pulse. Pulse duration – 1μs to 11s. Output – Simultaneous positive and negative, continuously calibrated; 0 to 10V or 0 to 20mA.

The 26A1 operational amplifier features wide output voltage swing, wide common-mode range, and high slewing rate suitable for final processing of signals generated in the 2600-Series system. Plug-in adapters contain the necessary operational amplifier input and feedback elements; the characteristics of the operational amplifier can be altered by simply changing adapters or the clip-on components. Open loop gain – 10,000. Common mode rejection ratio – 10,000:1. Unity Gain Bandwidth – 5MHz.

The 2600 Series is compatible with the 601, 602, 611, and other CRT monitors.

The new 7514 oscilloscope is a 90-MHz, four-plug-in, split-screen storage instrument which is designed to use all seventeen 7000-Series plug-in units. The 7514 uses the time-tested rugged bistable storage that has proven so successful for Tektronix in its Type 549 and Type 564B storage oscilloscopes. A unique WRITE THRU mode of operation makes its debut in the 7514. WRITE THRU, one of the most significant developments in storage scopes in several years, allows stored and conventional displays in the same area of the CRT, ideal for precise comparison of waveforms.

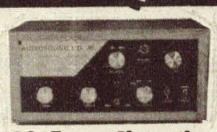
The 7514 has both vertical and horizontal mode switching in the mainframe. By electronically switching between pairs ofhorizontal and vertical plug-ins, the 7514 provides measurement options which are only available in Tektronix 7000-Series oscilloscopes. This flexibility allows the operator to combine: multi-trace, differential, high-gain, current, sampling, delayed and delaying sweep, and the new digital plug-ins. The 7514 also

NEW FROM AUDIO SOUND AUDIOSOUND

LOW DISTORTION, HIGH FIDELITY EQUIPMENT HAND MADE HIGH FIDELITY



A.M. 100 Wide range tuner $80

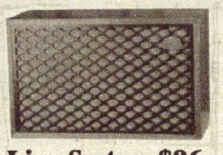


L.D. 30 Low-distortion amplifier $225

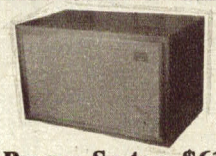
Power output: 20 watts RMS per channel max., 8 ohm load.
Total Harmonic distortion: 15 watts RMS or lower .08% at 1KHz. Less than .15% between 30Hz and 20KHz.
Damping factor—greater than 60 at 20Hz.



Haffner System $182



Linz System $96



Prague System $61

for free booklet phone 982 1147 or write to AUDIOSOUND ELECTRONIC SERVICES TRADE ENQUIRIES WELCOME 35 Heather Street, Collaroy Plateau, 2098.

YOUR ULTIMATE SOUND STARTS FROM

REVOX

TAPE RECORDERS
TAPE DECK
AMPLIFIERS



LET MAX CUMMINGS SHOW YOU WHAT YOU'RE MISSING



Revox Taperecorder

- Three motors.
- Push button micro switching
- Sound on sound
- Three Heads.
- 10½" reels.
- Professional quality.

Revox Amplifier

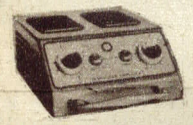
- 80 watts R.M.S.
- Complete matching of all inputs.
- All silicon transistors.
- Swiss quality.

CASH OR TERMS — HIGHEST TRADE-INS
FROM SYDNEY CITY DISTRIBUTOR

PHOTO HI-FI

367 PITT STREET,
SYDNEY, 61 2049
JUST UP FROM LIVERPOOL ST.

My servicentre repairs all amplifiers, turntables, tape recorders and speakers with the utmost care and attention. All servicing fully guaranteed.



New All Silicon 30/60 WATT P.A. PORTABLE AMPLIFIER

12-16 volts, 2 inputs. 5MV and 100MV. Dimensions 6½in W x 3¼in H x 8½in D. 15 ohm output No. 763D. . . $62 For 125,250,500 ohm output 592D. $62. For 240v op., $33 extra.

10 WATT P.A.

Inputs 5 MV and 100 MV 10w R.M.S. at 1%. Frequency 40cy.—30Kc. For use with 1 4 ohm 2 8 ohm or 4 16 ohm speakers in parallel. Same cabinet and dimension as 30w above, complete with 240v power supply. Wired and tested No. 485 . . . . $40
Freight extra in both cases.



R.C.S. COMPLETE DO-IT-YOURSELF KITS

Peak reception. low price. No expensive test equipment. Everything fits. 1954 RF Transports 7.

Complete kit — No. 640 . . . . $43.50
Portable car radio. Identical to 640 above, plus extra switch and car coil. etc. No. 642 . . . . . $46.00
Postage $1
(Write for booklet on 640 and $42.)

NEW TRANSISTOR PREAMP KIT

SIZE 3 x 2 x 1in. 2 reg. for Stereo. LOW IMP. Input 2 trans. 672C $6.50
Wired ready for use 672D $8.00
HIGH IMP. 2 tran. 680C $6.50
Wired ready for use, 680D $8.00
HIGH IMP silicon 3 tran. 682C $8.00
Wired ready for use. 682D $9.50
Postage 10c each. Write for data.

COILS and IF's 455 Kc

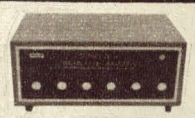
Aer. R.F., OSC. and IF's $2.00
Ferrite Aer. $2.40
No. 265 Universal tape OSC. Coil, $6
Postage 10c. Write for details and price.

NEW SPECIALS FROM R.C.S.

HI-FI BROADCAST TUNER UNIT 4 TRANSISTORS — H1 SENSITIVITY



R.F. mixer, I.F., pwr. dectr. stages, adjustable aerial coupling. Complete as illust., wired and tested with 461 dial, knobs and switch pot No. 474D, $31. Postage $1. WHISTLE FILTER for above set for 8kc bandwidth (can be altered to 9, 10 or 11Kc). No. 128, $4. Post 10c.



10W STEREO

MULLARD 10 x 10 watts R.M.S.

With output transistor PROTECTION. Frequency response 40cy to 30KC. Distortion 0.5%. Treble, bass, boost 20DB.

Complete kit of parts No. 480C $74.00
Wired and tested No. 408D $79.00
Cabinet as illustrated . . . . . extra $10.00
Magnetic pick-up pre-amp. No. 762D extra $11.50
Inbuilt b/c tuner with w/filter . . . . extra $35.00
Plus freight. Write for brochure. For special Sat. demo. ring 59 6550.

R & H and E.A. PRINTED CIRCUITS

Clearly coded for easy assembly. With blueprint parts list. Immediate dispatch. Add 20c postage for each. Specials to your drawings — write for particulars and drafting aids.

578—61.9.C	686—65.P.12B	726—68.A.8 . . .	$2.80
585—61.11P	694—66.R.2	753—69.F.10 . . .	$1.80
587—61.11P1	704—67.P.2	771—70.P.6 . . .	$2.00
577—52.1.C	707—67.P.3	772—70.G.7 . . .	$2.00
576—53.A.10	708—67.A.3	776—70.A.2 . . .	$4.00
563—64.M.7	708—67.P.4		
579—64.A.8	711—67.A4	717—68.P.1	669—65.T.3
683—64.A.9	723—68.S.T	741—69.P.5	727—68.8.T
678—65.O.9	731—68.M.12	747—69.C.10	728—68.O.9
679—65.M.9	736—69.S.T	746—69.P.9	
684—65.P.10	750—70.A.1	$3.00	$3.20
685—65.P.12A	756—70.R.1		
769—70.K6	758—10P.1	734—59.O.1	742—69.C.9
All above $2.50		728—68.S.3	748—69.D.10
		740—	754—69.C.11
		68.10.CL	749—69.C.12
		759—70.C.1	751—70.TX.1
		$5.00	



TRANSFORMER

Tap 6v and 9v D.C. at 100 milliamps

Filter, condensers, rectifier, resistor, case, etc. $6.50. Post 20c.

NEW STEREO MAGNETIC PRE-AMP

$11.50

Hum free. 5MV input. 250MV out. Size 3" x 2" x 1". Wired ready for use. No. 762D.

Post 10c



NOISE FILTER for radio and TV

No. 27 line filter, 2 amp. $6.50
No. 29 10 amp. No. 29B 20 amp. line filter $35
No. 30 pulse filter. 2 amp. . . . $11.50
No. 11 aerial filter $13
Order direct. Pack. and post 50c.



MAGNETIC STEREO PRE-AMP

In 5MC out 250 Mv. Bass and treble 20DB. No. 724C $29
Wired ready for use $31
Postage 30c each.
For crystal ceramic No. 722D . . $27



NEW AUDIO AMPLIFIER

4 transistors ½ or 1 watt. Small size. cabinet 3in x 2in x 1in plastic. Suitable crystal P./up. Intercom. microphone. radio etc. (9 volt.)

DO-IT-YOURSELF KIT 665 . . . $10 (Post 10c). Wired ready for use 665 D, $11.50.

R.C.S. Order by Mail Order, Postal Note or Money Order (add post.), direct to —
RADIO PTY. LTD., 651 FOREST ROAD, BEXLEY, N.S.W., 587 3491, 587 5385

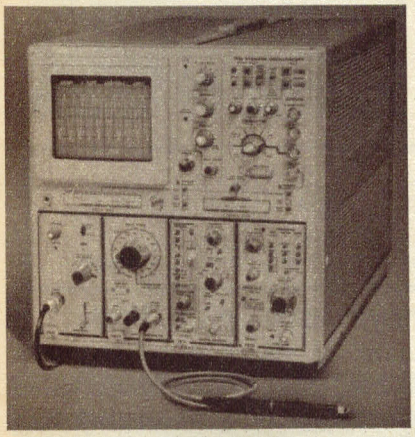
features AUTO SCALE-FACTOR READOUT, exclusive to Tektronix.

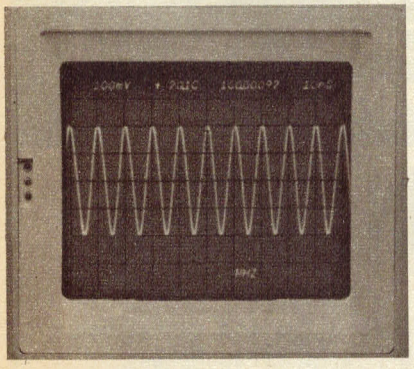
The R7704 is a 150-MHz rackmount, four-plug-in non-storage oscilloscope also designed to use all 17 7000-Series plug-ins. Like the 7514, it also has both vertical and horizontal mode switching in the mainframe, AUTO SCALE-factor readout and the new auto-focus circuit. The R7704 occupies only seven inches of height in a standard 19-inch rack.

First of the new plug-ins is the 7A15, an amplifier designed for use with any of the five Tektronix 7000-Series mainframes. The 7A15 has calibrated deflection factors from 5mV/div to 5V/div. Bandwidth is 75MHz in 7704 and R7704 mainframes, 60MHz in 7504, 7503 and 7514 mainframes and is constant for all deflection factor settings.

Both of the remaining plug-ins are digital units, and are again compatible with all 7000-Series oscilloscope mainframes; they will function in any plug-in compartment. The alphanumeric readout for both units is displayed on the CRT, a unique feature which is standard with Tektronix 7000-Series oscilloscopes.

The 7D13 and 7D14 digital units are not just "me too" units. The 7D14 is a





At top is the type 7514 Storage Oscilloscope, with 7A15, 7D13, 7D14 and 7B50 plug-ins fitted. Beneath is the very comprehensive CRT display.

Frequency Counter, directly gated to 500MHz, without a prescaler . . . the first digital frequency counter with this capability. Many counters reach 500MHz or above, but they use prescalers or special techniques. The direct gated approach makes possible "single event" counting which is frequently very desirable in rapid burst measurements. Also, whenever a prescaler is used, resolution is lost by the factor of the prescaler division ratio. For example, if the prescaler divides the input signal by 10; the resolution of the signal that's counted will only be 1/10 that of the original signal. This can be an important factor where measurement time is at a premium, which sometimes occurs when a high frequency signal has to be measured to high precision.

(continued on page 190)

1970 Fairchild Planar Award to Racal SSB Linear Amplifier

The 1970 Fairchild Planar Award, presented annually for practical application of semiconductors in a unique concept or design, has been won by Racal (Aust) Pty Ltd, who entered a power amplifier which is used in their range of high quality, high frequency SSB transceivers.

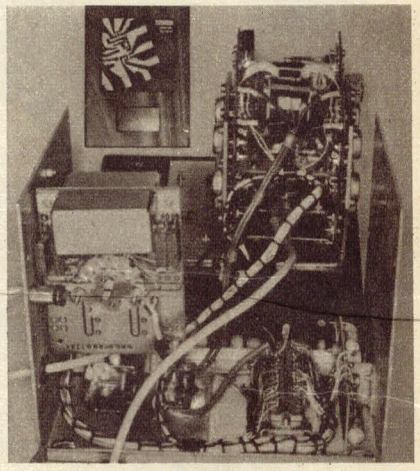
The award, a bronze plaque featuring an engraved microcircuit design, was presented to Mr John Jackson, Chief Engineer of Racal, by Mr John Baldwin, General Manager of Fairchild (Aust) Pty Ltd, at a function at the Wentworth Hotel, Sydney, on November 11, 1970.

"We believe that this amplifier was the first commercially available fully solid state 100 watt linear high frequency amplifier in the world", said Mr Jackson, accepting the award.

Transceivers incorporating the new technology are now exported world-wide. They are also used extensively in Australia, particularly for post office outback radio stations.

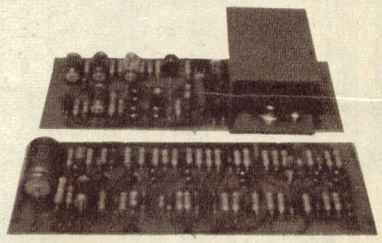
Presenting the award, Mr Baldwin said, "The enterprise shown by Racal engineers in designing and developing this range of transceivers, and in winning the Planar Award, is just further evidence of the potential we have in Australia. When we tackle challenges in the right way, we take our place among the world's leading technological nations".

The Planar Award may be won by organisations or individuals and may be for a technique or product. ■



An interior view of the award-winning Racal design, a fully solid state 100 watt linear amplifier for SSB transceivers. At the top of the picture is the Fairchild Planar Award.

Professional Quality Amplifier Modules



POWER AMPLIFIER 001

Specifications include

- ★ R.M.S. Power per channel.
  20 watts into 15 ohms
  30 watts into 8 ohms
- ★ Total distortion less than 0.1%.
- ★ Response 15-35,000 Hz.
- ★ 7 Silicon transistors, 6 diodes
- ★ Fibreglass printed circuit board
- ★ **PRICE $16.35 plus TAX**

PREAMPLIFIER 002

- ★ Response 10-50,000 Hz
- ★ Inputs: Magnetic 3mV R.I.A.A. Crystal-Ceramic 150mV, 1 M ohm. Auxiliary 500mV, 500K.
- ★ Distortion less than 0.1%
- ★ Bass, treble range ±16d.b. at 100 Hz and 10,000 Hz
- ★ 6 transistors and fibreglass board
- ★ **PRICE $14.56 plus TAX**

For complete information send coupon.

AUDITEC
AUSTRALIA
P.O. BOX 200,
NARRABEEN,
N.S.W. 2101.

Please send details of 001 and 002 modules.

Name .....

Address .....

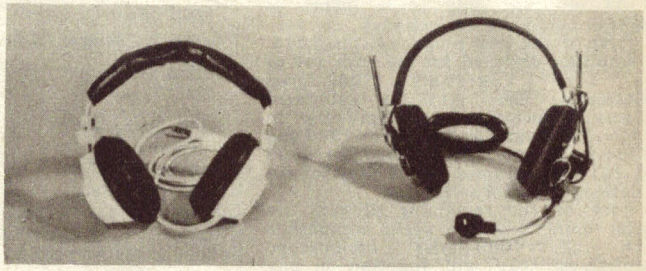
.....

..... Postcode .....

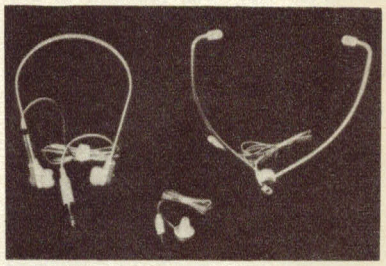


Choice of the Connoisseur

foster ® **Hi-Fi Equipment**



Full range
of stereophonic
Headphones, Headsets
and Earphones
available



Agents:			
	N.S.W. Hartley Electromotive (Aust.) Pty. Ltd. 181 High St., Willoughby	S.A. Neil Muller Pty. Ltd. 8 Arthur St., Unley	Tas. Homecrafts Tasmania 199 Collins St., Hobart
	Qld. T. H. Martin Pty. Ltd. 56 Edward St., Brisbane	W.A. D. K. Northover & Co. 1 Dunvegan Rd., Apple Cross, Perth	Nichols Radio & TV 91 Wellington St., Launceston

M2/70

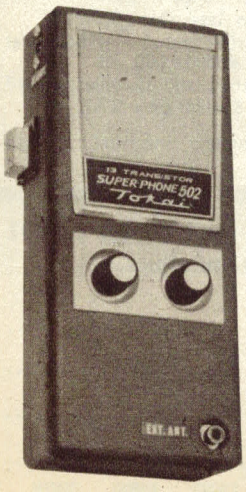
zephyr products pty. ltd.
70 Batesford Road, Chadstone, Vic., 3148. Tel. 56 7231

PETER SHALLEY ELECTRONICS Pty. Ltd.

127 YORK STREET, SYDNEY **29-7021 29-3767**

WALKIE TALKIE TRADE-IN MONTH

Let's get rid of all those illegal Walkie Talkies. Here's your chance to get real money back for those old sets that you are not really game to use. It's not worth risking a fine and confiscation. Your sets are worth real money if you trade in on the famous TOKAI range of equipment.



TOKAI TC502

- ★ 1 watt
- ★ all steel case
- ★ Sep. leather case
- ★ Ext. aerial con.
- ★ Ext. power con.
- ★ Mic input
- ★ Squelch

Nick cad bats AC adaptor base aerial

Price $132.00 ea.



TOKAI TC512

- ★ 300 MW
- ★ 11 transistor
- ★ Squelch
- ★ Tone call
- ★ Cow hide case Supplied
- ★ All metal const.

Price $70.00 ea.

We also repair and hire C.B. equipment

TRADE RELEASES — in brief

ROYSTON ELECTRONICS PTY LTD, 22 Firth Street, Doncaster, Vic 3108. **Frequency sensitive switch, type FX101.** A monolithic MOS IC which accepts sinewave or pulse input signals and operates an integral semiconductor switch when the input frequency reaches an accurately predetermined value. The FX101 may also be arranged to switch on when the input frequency lies anywhere above a single datum value or, alternatively, within a preset band of values. The frequency is determined by the values of two external resistors and two capacitors.

The FX101 is hermetically sealed in a TO-100 ten-lead package. Features include: very high order of set point stability; very sharp set point thresholds; fast response time; high immunity to random signal noise; operates over tempetature range from -30 to +85°C.

ZEPHYR PRODUCTS PTY LTD, 70 Batesford Road, Chadstone, Vic 3148. Agent for CGD Resistance Co Ltd, UK. **Aluminium housed power wirewound resistors,** type HS. Designed to use the heat sink effect of a chassis, the HS series resistors are available with power ratings from 5 to 200W, resistance values from .05 ohms to 86K, and in the following tolerances: 1%, 2%, 5% and 10%. Features include: temperature coefficient (depending on power rating and resistance value) between 25 and 90ppm/°C; insulation resistance, 10,000M minimum, 1,000M minimum after moisture test at 100V DC; dielectric strength, 1000V AC to 5000V AC, depending on power rating; momentary overload, five times rated power for five seconds.

CODI INTERNATIONAL, 30 Church Street, New York, NY 10007, USA. **Logarithmic diodes, LD series.** Accurate to ±2mV, these diodes are designed to perform the functions of multiplication, division, root extraction, and raising to powers in analog circuits. They are fabricated to meet the equation:

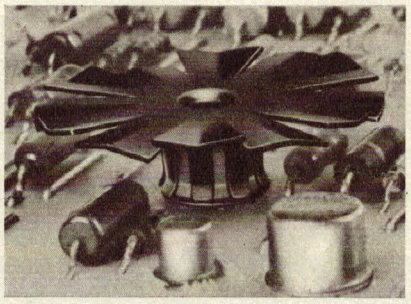
$$Vf = A \log If + BIf + C$$

where Vf is the forward voltage, If is the forward current, and A, B and C are constants.

The constant A determines the slope of the voltage vs log current characteristic of the diode; B is the ohmic resistance of the diode; and C is the offset (the point at which the voltage vs log current curve crosses the horizontal axis). For diodes to operate successfully in this logarithmic mode, constants A and C must be the same for each diode, and B must be extremely small.

Codi International guarantees the accuracy of these constants, and also guarantees compliance with the theoretical equation. A computer is used to check each diode at over 800 points in the Vf vs log If characteristic. From these data, the exact equation generated by the diode and real deviations at specified points are obtained. The mathematical equation is provided at three temperatures: -50°C, +25°C and +125°C. If desired, Codi will provide diodes to meet specific equations which take into consideration the temperature coefficients of the constants at temperatures selected by the customer.

McMURDO (AUSTRALIA) PTY LTD, PO Box 321, Clayton, Vic 3168. Agent for International Electronic Research Corp (IERC), USA. **Super fan top dissipator,** type TXBF2-032-036B. A low-cost, high-efficiency device to greatly increase the power dissipation of transistors and ICs in TO-5 cans. It combines a beryllium



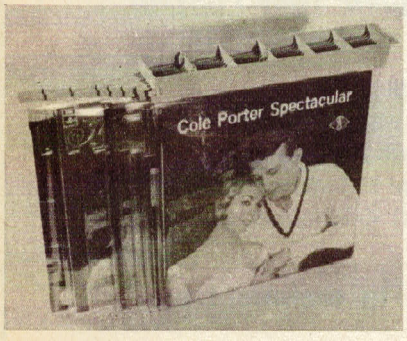
copper retainer and a 1¼in diameter brass fan. No additional board space is required because the dissipator is positioned above adjacent components. Spring fingers on the retainer provide a smooth installation without special tools. A case temperature reduction exceeding 60C at 1W in natural convection is typical.

LETRASET AUSTRALIA PTY LTD, 346-348 Kent Street, Sydney, 2000. **Self-adhesive PVC lettering system,** Letrasign. For professional signwriting, display and exhibition work, Letrasign letters are die cut from high quality PVC film to give clean cut edges and good definition. The styles and sizes have been chosen to conform to the most frequent needs. Fonts available are: Helvetica medium, a modern display style, in upper and lower case and numerals; Franklin Gothic, for maximum prominence for displays in confined spaces, in upper case and numerals. Both styles are produced in 25mm, 50mm and 75mm heights. Helvetica is available in black or white, Franklin Gothic in black only.

RUTHERFORD ELECTRONICS PTY LTD, PO Box 30, North Balwyn, Vic 3108. Agent for National Semiconductor Corporation, USA. **Dual 32-bit shift registers,** types MM4050/MM5050 and MM4051/MM5051. Two MOS integrated circuits (each available in military and industrial temperature ranges) employing P-channel enhancement mode techniques to provide bipolar compatibility, +5 and -12V. High frequency operation from DC to 1.6MHz is achieved with a single-phase clock. The MM4050/MM5050 has a common clock for the two 32-bit registers, while the MM4051/MM5051 features a "split" clock to provide independent control of each register.

The MM4050/MM5050 has its Vdd pin accessible to allow for possible power savings. The input circuits and push-pull outputs of both devices provide improved operating speed, drive capability, and direct TTL interface.

RECORD STORAGE



Illustrated above is a new record storage system from the UK which is being distributed in Australia by Vealls Electrical and Radio Pty Ltd, 520 Bridge Road, Richmond, Vic 3121. The system is supplied in sets with storage for ten 12in discs. It comprises a moulded plastic track unit and ten clear plastic storage pockets. The pockets have a rigid plastic sealing bar which slides smoothly into the track unit. The whole thing is intended to be mounted by screws under a shelf or cabinet top so that the sleeves hang downward. The price of the set is $8.50 retail, including tax. Normal trade discounts apply.

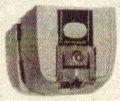
ENCEL'S LOW PRICES MAKE IT EASY TO STEP UP TO MICRO!



MICRO MR-111 TURNTABLE:
Engineered throughout to the fine tolerances demanded for top-quality reproduction. Vibration-free belt drive from 4-pole synchronous motor assures constant speed at 33 1/3 or 45 rpm. A high-precision tone arm with gentle hydraulic lift and lowering control is in-built. Automatic low inertia shut-off switch protects cartridge and motor. Encel price, only $72.50 (inc sales tax), complete with arm. Base and Cartridge optional extras.



MICRO MA-77 Mk II TONEARM:
A static balance arm offering every high precision refinement you could wish for. Precisely adjusted by revolving counter-weight. Bias compensation eliminates skating and inside force distortion. I-built hydraulic lift. Headshell accepts all standard cartridges. Encel price only $44.50 (inc sales tax).



MICRO 3100/e CARTRIDGE:
The top quality magnetic cartridge approved for use in broadcasting stations in systems that meet Australian Broadcast Control Board standards. Fitted with replaceable elliptical diamond stylus. Tracks effectively at 1.5 gm. The outstanding performer among lower-priced cartridges. Encel price only $26.50 (inc sales tax). Write now for copies of reviews!



MICRO 2100/5 CARTRIDGE:
At only $15.50 (inc sales tax), this renowned cartridge offers high quality output, coupled with rugged durability. Replaceable diamond stylus. Write for full details today on this fine unit and the Micro 2100/7 Cartridge.

EE70D

ENCEL ELECTRONICS PTY LTD

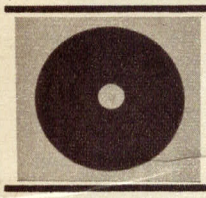
Head Office: 431 Bridge Road, Richmond, Victoria, 3121. Tel 42 3762.
Sydney Store: Ground Floor, Sydney, NSW 2000. Sydney, NCW 2000. Tel 29 4563, 29 4564.
- Australia's Greatest Hi-Fi Centres
- Trade-ins accepted
- Terms available

S.T.A. ELECTRONICS PTY. LTD.

392 CENTRE ROAD, BENTLEIGH, VICTORIA 3204
Phone: 97 4832
(Brenda and Charles Rener)



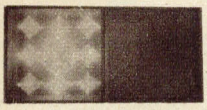
STOP ear POLUTION
KEEP YOUR HEADs CLEAN
8 Track Stereo Cleaning Cartridge. A must for your Home or Car Stereo. **$3.95** plus postage 30 cents.
Compact Cassette-type Cleaner, suit all cassette recorders and portables. $2.50 plus postage 25 cents.



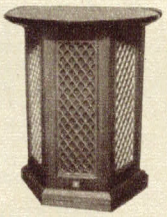
THIS IS NO U.F.O.
BUT THE MOST RELIABLE WAY OF TESTING YOUR ANTI-SKATING DEVICE.
10" Blank Acetate-coated Metal Disc. **$3.95** plus 50 cents postage.



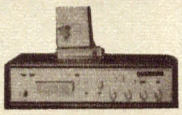
EXCLUSIVE FIRST RELEASE
The CASSADAPT unit Converts all types of 8-Track machines into Philip Cassettes **$52.50.** Plus 50 cents postage



M.U.S.I.C.O.L.O.R Y.O.U.R X.M.A.S
Now available, Mains-operated color display units that flash to your favourite music. Simply connect to any speaker.
$39.95 plus postage $1.50 (each).



We stock and manufacture Speaker Enclosures of all types to suit YOUR requirements, Large and Small. To suit YOUR pocket. Illustrated: Model SS-666 SONOCO 5 Speaker 4 way System 60 w. 30/21,000 Hz.
$298.00 each. Postage free.



"SKANDIA" I.C. RS —82
First, most advanced and versatile 8 track Stereo tape cartridge recorder with built-in 3 watts per channel Amplifier.
$238.00. Postage free.



SUPER SPECIAL XMAS GIFT
This most attractive PEN with built-in TORCH is our suggestion for that special personalised present.
DECEMBER and JANUARY ONLY at **$2.75,** postage paid
(name engraved 30 cents extra).

WE ARE PROUD TO ANNOUNCE THAT WE HAVE NOW A COMPLETE RANGE OF ELAC TURNTABLES AND CARTRIDGES, ALSO P.E., DUAL AND MANY OTHERS

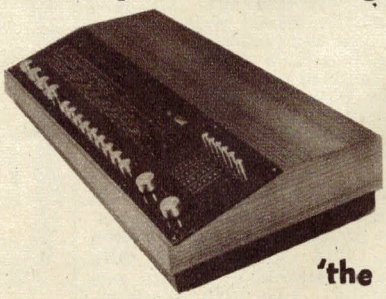
ATRAM PTY. LTD.

The Way To Tomorrow

YOUR 'EG-A TO TOMORROW

'The NEW Tuner-Amplifier Generation' with NEW Look—desk-type style 'sloping face' profile and Large Panoramic Dial Control

Wega 3105 Hi-Fi with fine electronic tuning pre-amp magnetic system DIN 45500 Hi-Fi Standard



for operation from your chair — the new and easy way — 2 x 20 watts RMS into 8 ohm load. 20-25,000 cps. 5 wave bands incl. future FM stereo transmission (at no extra cost) 4-16 ohms speaker input.

'the ultimate in technical perfection'

ATRAM PTY. LTD.

UHER

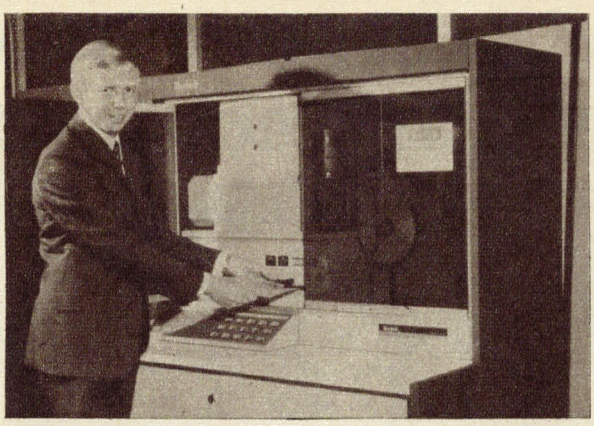
PE

Available directly from Importer only
Ask for our special quote

5 McLAREN STREET, NTH. SYDNEY. 92-4177

TAPERECORDER PROFESSIONALS
THE FINEST COMBINATION EVER
TURNTABLES FOR BEST SYSTEMS

Digital Data Recorded on Microfilm



The KOM-90 microfilmer is demonstrated by Malcolm Jameson of the federal customer equipment services division of Kodak.

KODAK (A'SIA) PTY LTD, 173-199 Elizabeth Street, Coburg, Vic 3058. **Microfilmer, type KOM-90.** A system that converts digital information on magnetic tape into readily readable film images. The unit's main advantage is its speed in condensing data, to reduce or bypass entirely the miles of paper produced by conventional impact printers. It processes up to 90,000 computer characters a second, or the equivalent of 300 pages of readable information a minute.

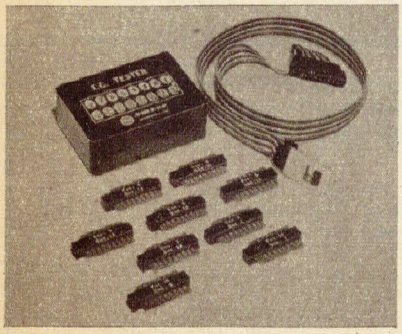
Computer data from magnetic tape is decoded and displayed on a CRT, and the complete displays photographed on 16mm film. An indexing code is recorded on the film simultaneously with the information from the tape. Rolls of exposed 16mm film may be packaged after processing in magazines or reproduced as microfiche.

Job setup control cards are available to control such functions as reduction ratios, image rotation, vertical line skip, and horizontal tabbing. Interchangeable overlays can superimpose charts, grids, or other standard forms on displayed material.

Other features include: tape format, 7 or 9 channel NRZ tapes, fixed or variable length records, blocked records are supported; tape density, 200, 556 or 800 bytes per frame; image format, 132 characters per line, 64 lines per frame; format control, standard line spacing and nine channels of skip control, with horizontal tabbing positions; font styles, regular, italics and bold face may be intermixed within a line; vertical parity and invalid character checking is performed automatically.

LEROYA INDUSTRIES PTY LTD, 266 Hay Street, Subiaco, WA 6008. Agent for Ferrograph Co Ltd, UK. **Magnetic tape recorders,** Series Y. A range of recorders designed for sound and instrumentation recording in industrial and science applications. They can be remotely controlled by time switches or a signal operated switch (optional extra). An endless loop facility permits continuous, non-stop recording for monitoring purposes. Four-channel simultaneous record/replay machines will soon be available. Single and double channel recorders are immediately available. Standard speeds and track widths are used. The machines are supplied in a metal case and are designed to withstand the rigours of continuous use.

EMCEE ELECTRONICS INC, 177 Old Churchman road, New Castle, Delaware 19720, USA. **IC tester.** A self-powered unit, the tester features a clip probe and a flexible cable for in-system testing of both 14- and 16-pin dual-in-line TTL or DTL integrated circuits. It displays the logic states of all pins simultaneously; tester



lamps are on for logic highs and off for lows. Thus, when clock rates are slowed, sequential operating relationships among pins can be seen at a glance to greatly facilitate troubleshooting.

WESTINGHOUSE BRAKE ENGLISH ELECTRIC SEMICONDUCTORS LTD, Avon House, Upper Cocklebury, Chippenham, Wilts 0249-4800, England. **Thyristor, type D1184.** Now in full production, the D1184 has a voltage range of 4.1 to 5.5KV and maximum surge current capabilities of 6.7KA at 125°C junction temperature (for 3mS).

PYE PTY LTD, a division of Associated Telecommunications Australia Ltd, PO Box 105, Clayton, Vic 3168. **Crystal filters.** A series of filters designed for manufacturers of equipment to meet the new PMG regulations which require the changeover to SSB operation of all AM HF communication networks. The filters come in three types: two are designed as upper and lower sideband filters, the third is an AM filter. All filters have a flush base for printed wiring board mounting.

PHILIPS INDUSTRIES LTD, 69-79 Clarence Street, Sydney, 2000. **Coulometric sulphur dioxide system, type PW9700.** A monitor for measuring atmospheric sulphur dioxide as an indication of the general pollutant content of the atmosphere. One of the features of this instrument is its relative insensitivity to other substances which could give rise to false readings. Except for methyl mercaptan, the system appears to respond to few substances potentially present in the atmosphere. A monitor will shortly be available for viewing in Sydney. (See "Electronics Australia", October 1970, page 29.)

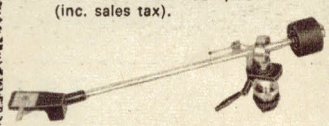
WAYNE COMMUNICATION ELECTRONICS, 757 Glenferrie Road, Hawthorn, Vic 3122, has been formed by Mr Wayne Yunker to sell new and disposal equipment. Mr Yunker intends to stock the more sophisticated type of electronic equipment as well as the usual equipment required by the amateur radio operator or hobbyist. Of interest is the entire Gove tracking station equipment which is now on view and for sale. Mr Jim Gardiner has been appointed manager. ■

UP-GRADE TO CONNOISSEUR from Encel



Connoisseur BD2 Integrated Transcription Unit. "An attractive, medium priced turntable with a highly satisfactory standard of performance — well made and beautifully finished — robust enough for all domestic requirements."
The authoritative magazine "The Gramophone" describes the Connoisseur BD2 in these glowing terms in a recent review. Encel offers you the BD2, complete with Connoisseur SAU2 high-precision arm for only **$82.50** (inc. sales tax). Price complete with base and acrylic plastic cover, **$99.50.** Inbuilt stop and start control knob and hydraulic lift control set at front edge of baseplate. Special precision ground rubber belt drive from synchronous motor.

Connoisseur BD1 Turntable. Similar 'no compromise' specification as the BD2 but without tonearm and fitted with smaller baseplate to permit simple mounting of any type of arm.
Available ready to play **$39.50** (inc. sales tax), or in easily assembled kit form, only **$34.50** (inc. sales tax).



Connoisseur SAU2 Tonearm. A high-precision unit with special design features to ensure accurate tracking. Gimbals set at 45/45 degrees permit a small bias weight or the inner gimbal ring to correct skating and inward pull. Inbuilt oil damped lift.
Encel price **$29.50** (inc. sales tax).

Connoisseur SCU1 Ceramic Stereo Cartridge. Diamond replaceable stylus. Armature system gives high vertical and horizontal compliance without forward or backward movement giving high channel separation and flat response over a wide frequency spectrum.
Price **$13.50** (inc. sales tax).

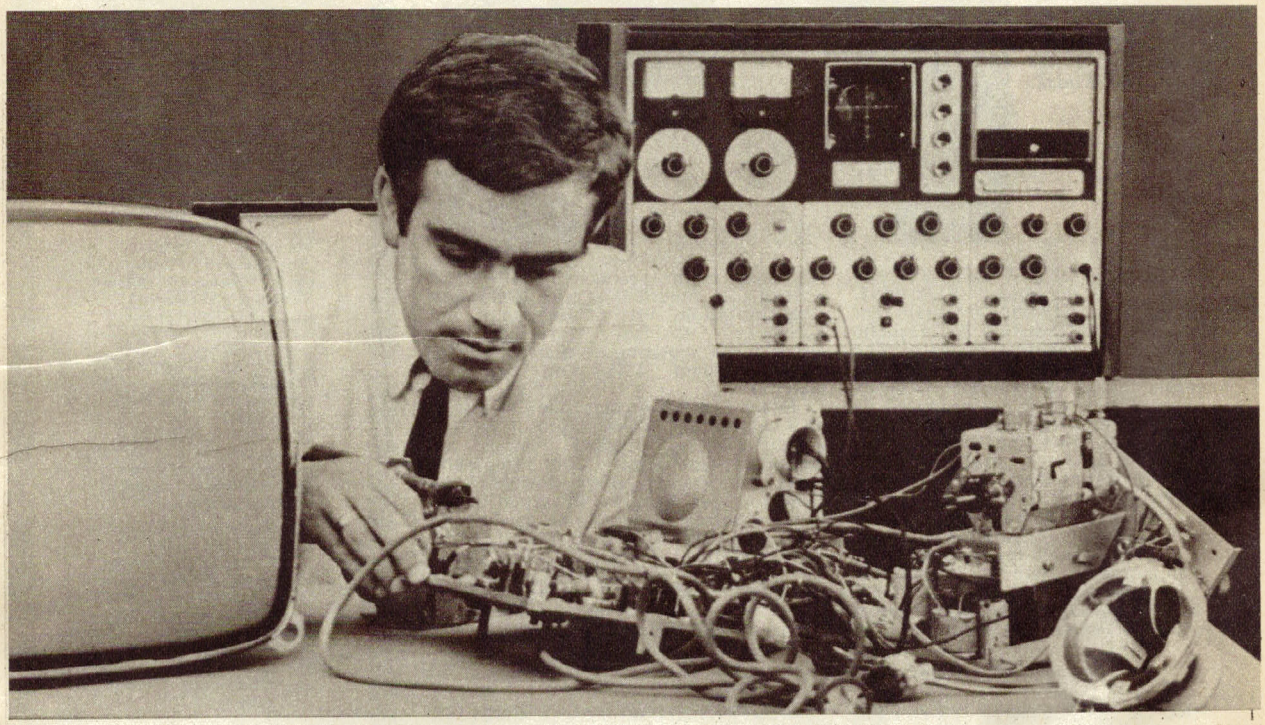
Please write for full details and reviews of all these famous Connoisseur products.

EE24

ENCEL
ELECTRONICS PTY LTD

HEAD OFFICE: 431 BRIDGE ROAD, RICHMOND, VIC. 3121
TEL. 42 3762
SYDNEY STORE: GROUND FLOOR, 2 SM BUILDING, 257 CLARENCE STREET, SYDNEY, N.S.W. 2000
TEL. 29 4563, 29 4564
■ AUSTRALIA'S GREATEST HI-FI CENTRES
■ TRADE-INS ACCEPTED ■ TERMS

you can be fully *trained* and *equipped* to start your own business in electronics



without giving up your present job.

It can be done through our unique electronics training programme. It combines the theory and practical application of electronics in a simple, logical and effective manner. We call it the TECHNIPAC system.

The training programme consists of 26 separate TECHNIPACS. There is no contract to sign, you order and pay for each TECHNIPAC as you are ready for it. You carry out over 400 experiments on electronic circuits and see how they work . . . including the assembly of a first class testing console, the TECHMARK II.

The TECHNIPAC system includes highly specialised tools and parts enabling you to assemble your own first class professional testing console (see above). The tools and console **are yours to keep.** You are ready to start your own business without any further outlay!

For further information about the TECHNIPAC system and how you can earn big money full —or part time, send for **free,** comprehensive literature now.

We guarantee that no salesman will call on you.

TECHNIPAC

Technical Training International Pty. Ltd. Head Office: 955 Pacific Highway, Pymble, N.S.W. 2073. Tel. 449 5756. Send coupon to: Technipac Systems Pty. Ltd., P.O. Box 328, Chatswood, N.S.W. 2067.

To: **Technipac Systems Division, Technical Training International, P.O. Box 328, Chatswood, N.S.W. 2067**

Please send me the free literature, including the brochure, "Electronics, Technipac and You". I understand no salesman will call.

Name:.....

Street:.....

City:..... Age:.....

State:..... Postcode:.....

TECHNICAL BOOKS AND PUBLICATIONS

Electric wiring

ELECTRIC WIRING, THEORY AND PRACTICE. By W. S. Ibbetson. Tenth Edition, SI Units, revised by M. A. Stothers. Stiff paper covers, 275 pages, illustrated by diagrams and photographs. Published by E. & F. N. Spon Ltd, London. Price in Australia $4.70.

If ever a book has stood the test of time, this one surely has. First issued some 60 years ago, it is now in its tenth edition, revised and up-dated during the present year to include reference to SI units.

From the title, it might simply be assumed to be a guide book for household electricians and therefore of dubious value outside the country of origin and the wiring regulations which apply in that country.

But the book is much more than that. Aligned with the syllabus of the City and Guilds of London Institute, it is really a basic textbook for electrical students and tradesmen, and is concerned far more with basic principles than with the codes of a particular supply authority. And in scope, it gets well into the realm of industrial electrical installation.

It opens with chapters on general electrical principles, units, resistance (notably of conductors) and Ohm's Law applied to DC and AC circuits. Then follow chapters on instruments, insulating materials and cables, distribution and wiring systems, and overload safeguards.

More specialised subjects include: simple communication systems, illumination, primary and secondary cells, private generating plants, motors, heating. There are chapters also on testing and fault finding, and on common installation faults.

Even this list of subjects does not really convey the full coverage of the book, giving no hint that it deals, en route, with motors and tariffs, amongst other things. A useful book indeed, for those who are active in this field. Our review copy came from Hicks Smith & Sons Pty Ltd, 301 Kent St, Sydney, 2000. (W.N.W.)

Broadcast stations

AM/FM BROADCAST STATION PLANNING GUIDE. By Harry A. Etkin. Vinyl covers, 190 pages, 11 x 8½ inches, freely illustrated with charts, diagrams and photographs. Published by TAB Books, Blue Ridge Summit, Pa 17214, USA. Price in Australia $16.20.

So you'd like to establish, own and operate a radio broadcast station?

Well, you find yourself a community that needs a broadcast service; only small communities will be left but, you never know, you might pick up extra listeners from a more populous centre nearby. You will need, of course, to find a frequency that is reasonably clear in the area: and you will need to have field strength contours plotted, and to make sure that no one else has already applied for use of the frequency. You might get the green light from the FCC, or you might be told to go and search out the FM band instead.

However appropriate this kind of thinking is in the USA or elsewhere, there isn't a great deal of scope for it in Australia – that is unless the forthcoming FM Inquiry opens an unlikely floodgate to lots of channels for the asking!

However, while Harry A. Etkin's book is not likely to fulfil its original idea in Australia, it does contain a lot of useful information for anyone who, for any reason, wants to build up his knowledge of radio broadcasting stations and their operation.

On this basis, the early chapters about planning, frequencies and engineering data, while related to American FCC regulations, would at least give a broad clue to the kind of responsibilities which broadcasters inherit under most administrations.

The chapters which follow are much more universal in their application and the headings (abbreviated) will give a good idea of the ground covered:

4. Basic Floor Plans.
5. Planning Transmitter Plant.
6. Audio and Power Wiring.
7. Towers and AM Antennas.
8. FM Antennas.
9. Transmitter Remote Control.
10. Studio & Monitoring Equipment.
11. Program Automation.
12. Microphones.
13. AM/FM Transmitters.
14. Preventative Maintenance.

The last two chapters "AM/FM Proof Of Performance" and "Prestige Broadcast Operations", again revert to the American scene but would have some interest as background.

Thanks to the quarto-size format, the publishers have been able to present generously proportioned diagrams and pictures and this is very much in the book's favour. But, then it needs to have something going for it, because $16.20 is not the kind of money one is likely to spend on a book, unless one has a very definite need for the information it contains. Our review copy came from Grenville Publishing Co Pty Ltd, 201 Pitt St, Sydney 2000. (W.N.W.)

Test instruments

HOW TO USE TEST INSTRUMENTS IN ELECTRONIC SERVICING by Fred Schunaman. First edition, first printing April 1970. Hard covers, 256 pages, 8½ x 5¼ inches, illustrated by circuits and photographs. Published by TAB Books, Blue Ridge Summit, Pa 17214, USA. Price in Australia $9.95 or $6.15 for the stiff paper bound edition.

For this reviewer, as for possibly many enthusiasts, a book like this was never much of a necessity, because we had picked up a fair background in theory and instrumentation long before we had access to instruments, let alone being able to own any of them. Times have changed, however, and it is not at all unusual to be faced with the question: "I have built (or bought) a multimeter (or a VTVM or a CRO or a valve tester); now how do I use it"?

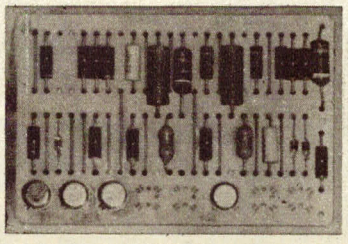
There is no concise or instant answer to such a question, any more than to one such as: "I have a stethoscope; how do I diagnose chest and heart complaints"? Proper and adequate use of electronic test instruments is only possible if the person concerned has a proper and adequate knowledge of the devices which he proposes to test.

However, as I remarked earlier, times have changed and there is a place for a book which seeks to classify and explain test instruments likely to be in the hands of enthusiasts and to show how they are typically employed in servicing radio and TV receivers, amplifiers and other such equipment.

And I am pleased to say that Fred Schunaman has made as good a job of compiling such a book as one could possibly wish for. It aims to assist informed experimenters, technicians and servicemen and should pose no problems of understanding for anyone around this technical level. It is freely illustrated with pictures of typical instruments and with circuits and diagrams to assist in explaining how they operate, and what parameters they measure and display from typical circuits.

The chapter headings are as follow: 1 – The Oscilloscope; 2 – Servicing With

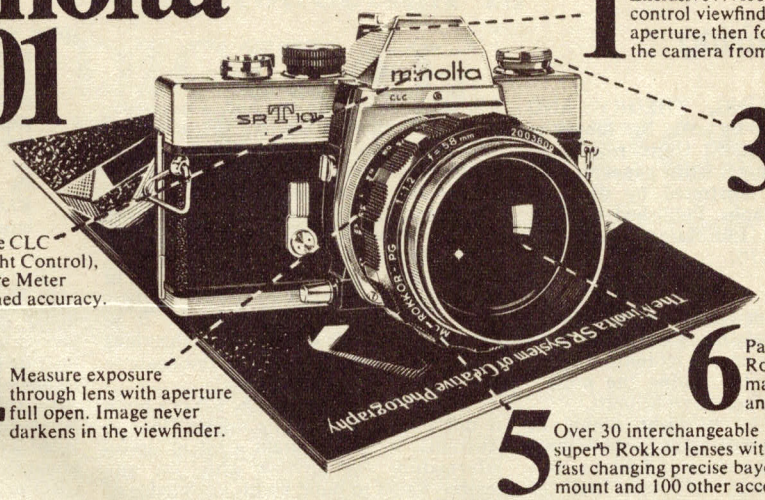
BIG SAVINGS ON COMPUTER BOARDS



1-10 BOARDS 35c per board, pack and post 25c.
11-25 BOARDS 30c per board, pack and post W.A. 35c, Interstate 50c.
26-100 BOARDS 25c per board, p. and p. W.A. 50c, Interstate 80c.
100 BOARDS and OVER 20c per board, p. and p. W.A. 80c, Interstate $1.00/100.
Average 3-4 transistors per board.
Technical information supplied with order.
ADEQUATE STOCKS FOR IMMEDIATE DELIVERY.

COLSTOK ELECTRONICS
Box 178, KELLERBERRIN, 6410.

Six reasons why we should charge more for the Minolta SRT 101



1 Exclusive . . . look through the total control viewfinder, set shutter speed, aperture, then focus without moving the camera from your eye.

2 Also exclusive CLC (Contrast Light Control), TTL Exposure Meter with unmatched accuracy.

3 Load a roll of film in seconds with easy loading system.

4 Measure exposure through lens with aperture full open. Image never darkens in the viewfinder.

5 Over 30 interchangeable superb Rokkor lenses with fast changing precise bayonet mount and 100 other accessories.

6 Patented double coated Rokkor lenses for maximum sharpness and hi-fi colour.

. . . but we wont!

Special booklet offer
Creative Photography by Minolta can be yours for only 40 cents (postage paid). Enjoy this colourful story of useful photographic techniques by writing to Photimport Pty. Ltd., 153 Barkly Street, Brunswick, Victoria.

Choose a Minolta SR-T101 with one of three superior standard Rokkor lenses, f1.7 $229.50, the more versatile f1.4 $254, or supreme f1.2 $336.60.

Minolta outclasses all others

STEP DOWN TRANSFORMERS.

SECONDARY VOLTS	TYPE NO.	RATING DIMENSIONS V.A.	AMPS	H.	W.	L.	WEIGHT LBS.
FUSEMASTER RANGE – Enclosed In Steel Cases							
6	TS6/60B	60	10	5	3⅜	7	6½ lb.
12	TS12/12B	12	1	2¾	2⅜	5⅜	2 lb.
12	TS12/30B	30	2.5	4½	3	6	4 lb.
12	TS12/60B	60	5	5	3⅜	7	6½ lb.
12	TS12/125B	125	10.42	5¾	4¼	9	11¾ lb.
24	TS24/30B	30	1.25	4½	3	6	4 lb.
24	TS24/60B	60	2.5	5	3⅜	7	6½ lb.
24	TS24/125B	125	5.2	5¾	4¼	9	11¾ lb.
24	TS24/200B	200	8.33	5¾	4¼	9	14½ lb.
32	TS32/30B	30	.94	4½	3	6	4 lb.
32	TS32/60B	60	1.88	5	3⅜	7	6½ lb.
32	TS32/125B	125	3.9	5¾	4¼	9	11¾ lb.
32	TS32/200B	200	6.25	5¾	4¼	9	14½ lb.
32	TS32/300B	300	9.4	5¾	4¼	9	18 lb.
32	TS32/500A	500	15.6	6¾	5¼	6½	26 lb.
32	TS32/750A	750	23.44	8¾	6¼	6¾	38 lb.
32	TS32/1000A	1000	31.35	8¾	6¼	8¾	51½ lb.
115	TS115/30B	30	.26	4½	3	6	4 lb.
115	TS115/60B	60	.52	5	3⅜	7	6½ lb.
115	TS115/125B	125	1.09	5¾	4¼	9	11¾ lb.
115	TS115/200B	200	1.74	5¾	4¼	9	14½ lb.
115	TS115/300B	300	2.61	5¾	4¼	9	18 lb.
115	TS115/500A	500	4.35	6¾	5¼	6½	26 lb.
115	TS115/750A	750	6.53	8¾	6¼	6¾	38 lb.
115	TS115/1000A	1000	8.7	8¾	6¼	8¾	51½ lb.
115	TS115/2000A	2000	17.4	10½	8¾	8¾	79 lb.
SOLDERING IRON TRANSFORMERS – Enclosed in pressed steel cover – suitable for Mico or Oryx Soldering Irons.							
5, 6, 7,	TS7/20	20	2.85	3⅜	2⅝	2¼	2½
10, 11, 12,	TS12/40	40	3.33	3⅜	2⅝	3¼	3½

FERGUSON

All transformers in this range are suitable for connecting to a 240 volts, 50 Cycles, Single phase supply and, where applicable, comply with Australian Standard C126 - 1950 under approved Number N158.

FUSEMASTER RANGE:—

All transformers housed in steel cases ("A" and "B") fall into the above category.

A TYPE

- Fuse protection of output
- Three core primary Flex 6'6" long
- Conduit or grommet knockouts
- Primary and Secondary Terminal Blocks
- Carrying handle
- Provision for wall mounting
- Two outlets provided on 125W rating and over.

B TYPE

- Fuse protection of output
- Three core primary Flex 6'6" long
- Carrying Handle
- Provision for wall mounting

Available from recognised electrical wholesalers

FERGUSON TRANSFORMERS PTY. LTD.

331 HIGH STREET, CHATSWOOD, N.S.W. • P.O. BOX 301, CHATSWOOD, 2067.
TELEPHONE 40-0261 (8 LINES) • TELEGRAMS: "FERTRAN."

The Scope; 3 – Multimeters; 4 – Putting Multimeters To Work; 5 – Signal Generators; 6 – Sweep And Colour Generators; 7 – Audio Servicing Instruments; 8 – The Capacitor Checker; 9 – Probes; 10 – Tube, Transistor & Special Purpose Checkers; 11 – Signal Tracing Instruments; 12 – Maintenance.

As you will observe, this is both down to earth and up to date and, with colour television at least looming on the horizon, chapter 6 is well worth preliminary study.

All told, this appeals as a most useful book and a good Christmas present for someone inclined to study in this field. Our copy came from Grenville Publishing Co Pty Ltd, 401 Pitt St, Sydney, 2000. (W.N.W.)

Solid state text

PHYSICAL PRINCIPLES OF SOLID STATE DEVICES, by R. A. Holmes. Published by Holt, Rinehart and Winston, Inc, New York, 1970. Hard covers, 6in x 9¼in, 332pp, many diagrams. Price in Australia $13.60.

This book is intended as a text for senior undergraduate and first-year graduate electrical engineering courses. The reader is assumed to have a basic engineering background, including junior courses in modern physics, differential calculus and vector analysis. The author is currently Dean of Engineering at the University of South Carolina, but the book was based on lecture notes developed for senior undergraduate and graduate level core courses at Purdue University.

The book concentrates on the basic physical principles which are involved in the functioning of modern solid state devices. Its philosophy is to develop the concepts of currently useful physical phenomena from an atomistic point of view, instead of the more usual approach wherein axiomatic continuum equations are initially introduced as statements of fact. Elementary quantum mechanics is used to develop the concepts of electron states in a solid, this approach being used by the author in the belief that it provides an "atomic intimacy of thought" with solids, and consequently a greater facility and creativity in dealing with new and different devices.

A reasonably large part of the text is devoted to the concept sequence dealing with the electron states available in solids, how these states are filled in equilibrium, and the effects of a disturbing force field on equilibrium conditions. The application of the developed concepts to semiconductor devices is then described. The two major semiconductor phenomena discussed are minority carrier injection and the field effect. The last third of the text deals with electric and magnetic polarisation phenomena.

The text of the book is written in a concise but readable style, and is well illustrated by diagrams and examples. Each chapter ends with tuitional problems, while the book itself ends with a bibliography and subject index.

A well produced volume, and one which should be found of interest and value by college lecturers and students.

The review copy came from Holt, Rinehart and Winston (Aust) Pty Ltd, who advise that copies are obtainable at all major bookstores. (J.R.)

Introduction to transistor amplifiers

THE SYNTHESIS OF TRANSISTOR AMPLIFIERS, by M. Kahn and J. M. Doyle. Published by Holt, Rinehart and Winston, Inc, New York, 1970. Hard covers, 6½in x 9½in, 400pp, many circuits and diagrams. Price in Australia $11.55.

An introductory textbook on the design of bipolar transistor LF amplifiers, intended primarily for use in basic electronics courses in universities and technical colleges. However it would also be very suitable for the "valve era" engineer, technician or radio amateur seeking an easy-to-follow, practical and thorough introduction to the subject. The authors are respectively Assistant Professor of Electrical Technology at New York City Community College, and Manager of Research and Development at Electronic Aids, Inc, of Baltimore.

The book differs from many others of its type, in a number of respects. One is that it is devoted entirely to the basic principles of amplifier design and operation; the usual chapters on oscillators, RF amplifiers, inverters and so on are not provided, as the authors believe these should be treated separately. Another difference is that no attempt is made to cover all of the so-called "standard" circuit configurations, because the authors believe that the continuing trend towards the use of integrated circuits will make this type of knowledge redundant. Instead, they concentrate on such basic concepts as biasing, gain, distortion and impedance matching, which should always remain relevant despite changes in design implementation.

A further difference is that the authors have adopted an "inductive" method of introducing concepts, in place of the more usual deductive approach. Illustrative circuits with full numerical values are used as the basis for drawing general conclusions regarding circuit operation, the authors holding that this method is more appropriate at first-introduction level. They also place considerable emphasis on the use of worked numerical examples to demonstrate how component values and device parameters affect each particular aspect of circuit performance.

The chapter headings give a good idea of the content and its order of treatment: 1 – Volt-Ampere Characteristics; 2 – The P-N Junction Diode; 3 – The Transistor; 4 – The Elementary Transistor Amplifier; 5 – DC Bias Circuits and Stability; 6 – Amplifiers in Cascade; 7 – Feedback Amplifiers; 8 – Frequency Response; 9 – Power Amplifiers; 10 – Amplifier Design.

The aim of the book is not to enable the reader to become a circuit designer, but simply to provide a thorough basic introduction to the operation of transistor amplifiers, and a modest but useful insight into the techniques of amplifier design. And it seems to this reviewer that the authors have achieved this aim particularly well. The book starts right at the beginning, and carefully progresses through the subject in a most concise and methodical fashion. This combined with a high standard of writing and the frequent use of numerical examples has produced a most readable and informative volume.

In short, I find this book highly commendable.

The review copy came from the local office of the publisher, Holt, Rinehart and Winston (Aust) Pty Ltd, who advise that the book is in stock at all major bookstores. (J.R.)

PLAN YOUR FUTURE

CHOOSE a career in the field of ELECTRONICS* — the Nation's most progressive and fastest expanding industry.

Advancement in this modern science demands technical ability, a sound knowledge of basic principles and applications.

YOU can master the subject by training at the MARCONI SCHOOL and be ready to grasp the opportunities that occur in the three fundamental branches of Radiotechnology.

KNOW WHERE YOU'RE GOING

A = APPLIED SERVICING

Comprehensive training in the maintenance and repair of radio and television receivers offers substantial rewards to competent technicians. Marconi School training covers all aspects of radio and television receiver circuit applications, practical exercises in fault finding and alignment procedures.

B = BROADCASTING

A thorough and practical grounding is available to students in broadcasting transmitter performance standards and maintenance techniques, with individual instruction in station operation and studio control and testing.

C = COMMUNICATIONS

Combines all the foregoing, together with radio aids to navigation, mobile telephony, marine service application and international wireless telegraph regulations, qualifying the successful student for the Commonwealth Government Certificate of Proficiency and the Marconi School Diploma in Radiotechnology.

Classes are conducted at
21 Pier Street, Sydney
(at the foot of Goulburn Street).
Daily: 9.30 a.m. to 4.30 p.m.
Evenings: 6 p.m. to 8.30 p.m.
or by Home-Study Courses (except practical instruction on equipment).

STUDY NOW

Send for training syllabus. There is no obligation.

NAME.....
ADDRESS.....

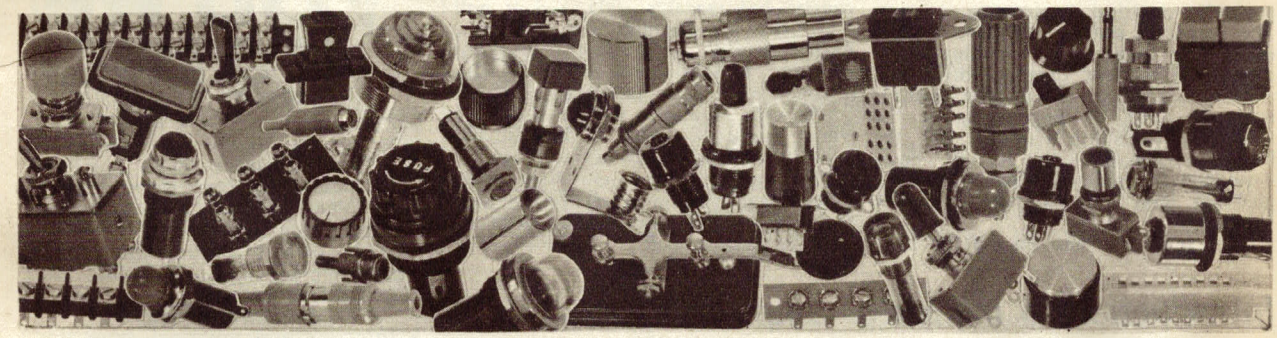
the MARCONI SCHOOL of wireless
G.P.O. Box 2516, Sydney
A Service of Amalgamated Wireless (Australasia) Ltd.



Like being proud of their Kangaroo, Sato's large variety of electrical parts is the favorite choice by Australians. Your inquiries are welcome.

SATO PARTS

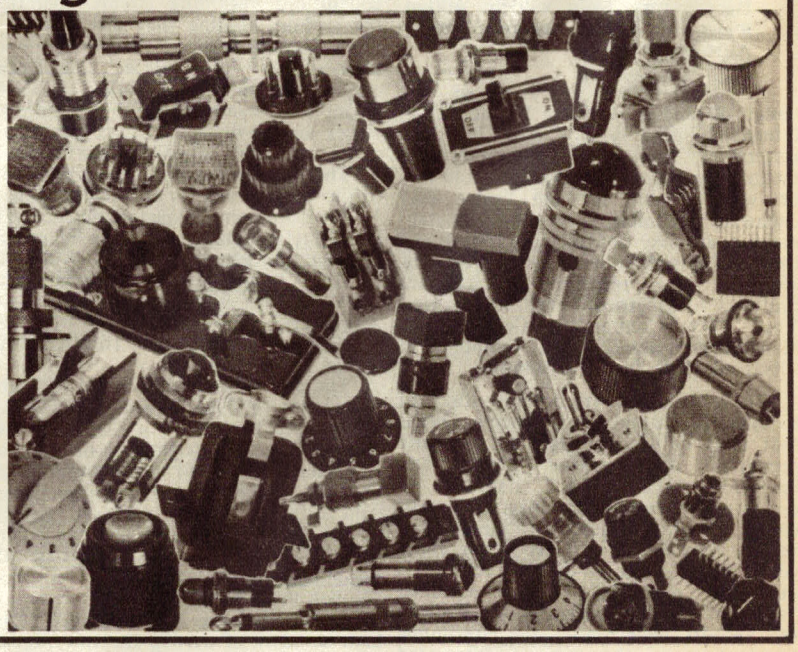
SATO PARTS CO., LTD. *HEAD OFFICE: EBISU, SHIBUYA-KU, TOKYO, JAPAN TEL: (442) 8506~8*
BANK ACCOUNT: MITSUBISHI BANK



A vast range of SATO Parts

- For manufacturers
- For TV
- For radio
- For instruments
- For amplifiers
- For kitset builders
- For sound equipment
- For industry
- For stereo equipment
- For educational purposes
- For electronics
- For tape recorders

Distributed by



GENERAL ACCESSORIES

AVAILABLE AT FOLLOWING BRANCHES:

46 Milligan Street, Perth.
116 Clarence Street, Sydney.
81-97 Flinders Street, Adelaide.
50-54 Lt. Edward Street, Brisbane.
443 Concord Rd., Rhodes, N.S.W.
153 Sturt Street, South Melbourne.
Cnr. Ingham Rd. & Echlin St., Townsville.
Homecrafts, Tas P/Ltd. 199 Collins St., Hobart.

Tape recorder guide

TAPE RECORDING FOR FUN AND PROFIT, by Walter G. Salm. Published by TAB Books, Blue Ridge Summit, Pa 17214, USA. Stiff paper covers, 222 pages 8½ x 5½in, illustrated with half-tone illustrations, line diagrams and circuit diagrams. Australian price $6.15, or with hard covers $9.95.

Plenty of people use tape recorders for fun, but I doubt whether there is any profit to be looked for, especially in Australia. In any case, there is no indication in this book as to how profit may be gained from the use of a tape recorder, so that one may possibly assume that this part of the title is just an eye-catching phrase for the benefit of the profit-minded members of the public.

What the book does contain is some very sound advice to prospective purchasers of tape recorders, to help them thread their way through the mass of conflicting claims for the various systems and arrive at the important initial decision – what kind of recorder to buy. After this, there is some equally sound advice in the use of the machine, written by somebody who obviously knows the field thoroughly. Another distinct virtue, and a fairly rare one at that, is that the text is right up to date, covering all systems currently in use, including video recorders as well as sound recorders. General interest chapters, dealing with recorded tape manufacture and "bugs", round off the discussion.

There are 21 chapters, and space will not allow a summary of each, but the titles alone should give a fair idea of the arrangement of the book: 1 – How Tape Recorders Work. 2 – Scorecard for Tape Format 3 – Choosing a Tape recorder. 4 – Battery-Operated Recorders. 5 – Microphone Basics. 6 – Getting to Know Your Mic. 7 – Wireless microphones. 8 – Amplifiers and preamps. 9 – Microphone Mixers. 10 – Remote Control and VOXs. 11 – Switching Adds Versatility. 12 – Plugs, Jacks and Cables. 13 – Integration with a Stereo System. 14 – Recording from a Telephone. 15 – Recording Film Soundtracks. 16 – Maintaining Tapes and Recorders. 17 – Special Effects in Recording. 18 – Foreign Recorders and the Future. 19 – How Tapes are Duplicated. 20 – Video Tape Recording. 21 – The Snoopers Around Us.

Some of the chapters, such as that dealing with the various types of microphones, could possibly be regarded as too detailed for the average user, but this reviewer's opinion is that the inclusion of such information is justified even if only on the grounds of interesting reading. For example, it is not too likely that the readers of this book will be involved in the use of ribbon microphones, but it is still interesting to learn that these hardy perennials are still in use in some broadcast studios, where they perform a valuable and unique function.

The author's style is straightforward and unambiguous, and has a professional polish, which is often missing in books of this type. Australian readers may be slightly taken aback by the apparent casual acceptance of snooping devices in everyday life, but this chapter makes interesting background reading. At $6.15 the book is by no means cheap, but in view of the advantages it has as a comprehensive, well-written, up-to-date text, many readers may find it preferable to lower-priced texts without these virtues.

Our review copy came from Grenville Publishing Co Pty Ltd, 401 Pitt St, Sydney 2000. (H.A.T.)

PROGRAMMING COURSE IN A BRIEFCASE

Computeach, a briefcase kit for the home training of computer programmers, will shortly be available in Australasia.



Mr Anthony Stephens, a director of the manufacturing company, recently toured Australia and New Zealand to conclude sales agreements.

The computer course is designed to enable executives and trainee programmers and systems analysts to study at home or while travelling. The kit comprises a cassette tape recorder, a series of 20 pre-recorded lectures key-referenced to programmed manuals, a set of data cards, and a mechanical binding machine, all of which fits into a briefcase.

After 150-hours of self-training, executives should have a good knowledge of computers and the tasks they can perform. The course for programmers and analysts involves an extra 100 hours of study, and can be followed by a 75-hour practical programming project for a City and Guilds of London examination (available in Australia, according to the manufacturer).

Computeach is manufactured by Data Processing Services Ltd, 10c Hagley Road, Stourbridge, Worcs, England.

LITERATURE — in brief

AEROSPACE FOOD TECHNOLOGY, NASA SP-202. Published by the National Aeronautics and Space Administration, USA. The 204-page book contains the principal addresses given at a conference sponsored by NASA and the National Academy of Sciences, and held at the University of South Florida. Among the items covered are spacecraft programs, airline experience, and long mission duration programs. NASA's Skylab, scheduled to be launched in the latter part of 1972, is a program designed to take advantage of Apollo hardware to conduct long duration missions while in earth orbit. One of the problems on a Skylab mission is that the food must be able to withstand temperatures ranging from 40

ANNOUNCEMENT

WAYNE COMMUNICATION ELECTRONICS

Have opened in the suburbs for your convenience. EASY PARKING — LOWER PRICES — MORE SPACE. We recently purchased the entire GOVE TRACKING STATION EQUIPMENT.

Come and inspect the huge range.

Receivers **COLLINS ARR15** 1.5-18.5 MHz. Inbuilt 100 KHz. Xtal. Calib. $80.00. **RAIB** 150 KHz-15MHz $40.00. TEKTRONIX 585 85 MHz Oscilloscope. With 4 B 2 Dual Trace Plug-In P.U.R. SPECIAL: Transformers 240V PRT 24V 3A SEC. Limited Quantity $5.00 each.

Large range of transformers available.

WIRE WOUND RESISTORS. 6 watt 1.8-620 Ohm 5 cents each.

WAYNE COMMUNICATION ELECTRONICS

757 GLENFERRIE ROAD, HAWTHORN. VIC. 3122.
PHONE 81 2818.



SHARP

CBT-81 6-CHANNEL PORTABLE TRANSCEIVER

Here is a precision 6-crystal controlled transceiver incorporating the most advanced space-age IC (Integrated Circuit). Automatic noise limiter, tuned RF amplifier, dual conversion, centre loaded antenna ensure sensitive, stable 6-channel crystal controlled operation even under weak signal conditions. IC miniaturization assures greater portability and increases stability and performance.

FEATURES

Advanced space-age IC (Integrated Circuitry).
All silicon transistorized superior circuitry with tuned RF amplifier, dual conversion and center loaded antenna ensure sensitive, stable 6-channel crystal controlled operation even in weak signal conditions.

SUPERIOR RECEPTION

Noiseless, distortion-free sound with adjustable squelch control, automatic noise limiter and mechanical filter ensure noiseless, clear reception.

SOLID CONSTRUCTION

Rugged, rain-proof design for all-weather operation. Ideal for mobile or base station use.

AC-BATTERY OPERATION

Operates on rechargeable nickel-cadmium batteries or on AC using provided charger.

ULTRA SENSITIVITY

Modulation boost circuitry for superior modulation sensitivity and boosting communication range.

SPECIFICATIONS

RECEIVER

Circuit: Dual conversion with tuned RF amplifier, crystal controlled, mechanical filter, integrated circuit, series gated noise limiter, adjustable squelch and Automatic Gain Control.
Frequency: 6 channel in any of 26.96 to 27.27 MHz CB, crystal tolerance: ±0.005%.
Sensitivity: Better than 1.2 μV at 10 dB s+N/N.
Selectivity: 6 dB down at ±2.5 kHz, 40 dB down at ±10 kHz.
Intermediate Frequency: 1st Intermediate frequency: 4.225 MHz; 2nd Intermediate frequency: 455 kHz.
AF Output: 600 mW.

TRANSMITTER

Circuit: Crystal controlled, 2-stage RF amplifier with modulation booster circuit, 4-transistor modulator.
Input Power at Final Stage: 3 watts.
Range Boost: Yields high level modulation at average voice level.
Carrier Deviation: ±0.005% maximum (at temperatures ranging from −20° C~+60° C).
Harmonic Suppression: Exceeds 50 dB.
External Antenna: 50 ohms nominal.

AVAILABLE FROM:

SHARP

OLIMS TRADING CO. PTY. LTD.

SYDNEY	PERTH	ADELAIDE	BRISBANE	VICTORIA	CANBERRA
67 6011	8 4988	23 3488	21 7388	42 4236	95 8248

OL109

to 85 deg F for a period of at least eight months. Copies of the book may be purchased from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va 22151, USA for $3.

MI CONTACT, Issue 17. A 4-page news bulletin published by Marconi Instruments Ltd, UK. Contents include: New wide band RF power amplifier; A versatile bridge for only 65 pound sterling: FM deviation measurements at high accuracy and low cost; Automatic testing for torpedoes; Big range of instrumentation at Paris show; Saving space in radiograph storage areas; New rotary vane attenuators cover 5.3 to 18.0GHz; Customer demand stimulates new production of UHF signal generators. Inquiries to Amalgamated Wireless (A'sia) Ltd, PO Box 96, North Ryde, NSW 2113.

STANDARDS ASSOCIATION OF AUSTRALIA, 80 Arthur Street, North Sydney, NSW 2060, has endorsed as Australian standards three International Electrotechnical Commission publications in the field of semiconductor devices. These standards form the basis of a series on semiconductors to be published progressively, establishing parameters essential to the selection of semiconductor devices for electronic equipment and the interchangeability of similar devices for maintenance of equipment.

As C366, Part 0, endorses IEC Publication 147: Parts 0, 0A and 0B. It deals with essential ratings and characteristics and general principles of measuring methods, including terminology for thyristors, rectifier diodes, Hall effect devices, and integrated microcircuits.

AS C379, Part 1, endorses IEC Publication 191, Parts 1 and 1A. It establishes the method of preparation of standard drawings, showing the dimentional characteristics required to ensure mechanical interchangeability of electronic equipment.

AS C379, Part 2, is the endorsement of IEC Publication 191, Parts 2, 2A and 2B. In loose-leaf form it shows standard drawings with standard dimensions.

The Standards Association considers that the compliance of Australian manufactured semiconductor devices with these international standards will promote the acceptance of these devices on the world market.

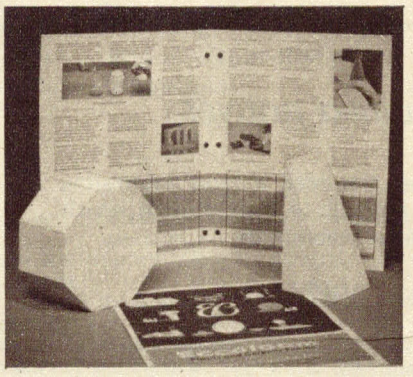
Copies of ASC366, Part 0, at a cost of $16.75, and C379, Part 1 at $8.80, and Part 2, at $23.10, may be obtained from the various offices of the association in all capital cities and Newcastle.

RCA MOSFET PRODUCT GUIDE. A 20-page guide, published by RCA in the USA, devoted entirely to MOS insulated-gate field effect transistors. As well as constructional and handling information, the book contains a quick selection guide for many applications and a section on typical circuitry for consumer, communications and industrial uses. Inquiries, on company letterhead, should be addressed to Amalgamated Wireless Valve Co Pty Ltd, Private Mail Bag, Ermington, NSW 2115.

THE MICROPHONE, Vol 6, No 1 July/August 1970. The official journal of the Australian Tape Recording Society, PO Box 9, Crows Nest, NSW 2065. Contents include: Microview, Toshiba KT 20P cassette recorder; Audio-visuals; FM for Australia; Tape editing; Esperantists aid Japanese couple; Automatic radio station programming by RCA; ATRS tape library.

DISTRIBUTORS CORPORATION PTY LTD, 24 Johnston Street, Fitzroy, Vic 3065, has available a limited number of copies of the IRIG 106-69 telemetry standards prepared by the telemetry working group of the Inter-Range Instrumentation Group, Range Commanders Council. Also available are applications notes on the Alfred model 8000/7051 sweep network analyser for RF and microwave frequency domain reflectometry measurement techniques.

EMERSON & CUMING INC, Canton Mass 02021, USA, has published a four-page folder describing the Eccofoam range of plastic and ceramic foams. It contains descriptions of four foam-in-place types, three types of foam sheet stock, three types of syntactic foam, and six types of foams specially suitable for microwave applications. Basic foam materials included are polyurethanes, silicone rubbers, epoxies, polystyrenes, silica, and glass. The folder contains an



application table listing, for each foam, such properties as cell structure, colour, service temperature, density range, compressive strength, thermal conductivity, water absorption, and dielectric properties.

APPOLLO 12: PRELIMINARY SCIENCE REPORT, NASA SP-235. Published by the US National Aeronautics and Space Administration. A 227-page book with extensive black and white photographs and charts which outlines the initial findings of the Apollo 12 flight to the moon in November, 1969. Among the experiments discussed are: passive seismic, lunar surface magnetometer, solar wind spectrometer, suprathermal ion detector, lunar atmosphere detector, solar wind composition, and multispectral photography. The book includes discussion of the preliminary examination of lunar samples and preliminary results from Surveyor 3 analysis. The report may be purchased from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va 22151, USA, for $3 a copy.

TECHNICAL COMMUNICATIONS, Vol 11, No 105, May 1970. Published by Mullard Ltd, UK. Contents: Transformerless field timebase for 90 deg 625-line colour, by B. E. Attwood and B. J. Simpson: Ratings of Mullard carbon film resistors; The basis of a design for reversible drive with regenerative braking, by J. M. Lavallee and J. Merrett. Inquiries should be addressed to Mullard-Australia Pty Ltd, 35-43 Clarence Street, Sydney, 2000.

P. R. HOFFMAN CO, 367 Cherry Street, Carlisle, Pa 17013, USA, has published a six-page bulletin giving application data and US prices of the company's line of manual and automatic planetary lapping machines for simultaneous finishing and polishing of both sides of silicon wafers, ceramic substrates, quartz, metal and other parts.

OVERVIEW 21. Published by Molybdenum Corporation of America, 280 Park Avenue, New York City, NY 10017, USA. A four-page study which documents and interprets the trend toward the use of rare-earth oxides (particularly ceria, lanthana, and neodymia) in making capacitors for electronic circuitry. With 17 references, two charts and two diagrams, the study covers a range of rare-earth doping of barium titanate from the original "very small amount" to 34 mol per cent to achieve negative or zero temperature coefficients in "commercially acceptable dielectrics".

A.R.R.L.

RADIO AMATEUR'S HANDBOOK

1970 EDITION

The handbook has long been considered an indispensable part of the amateur's equipment.

Price $6.50. Post 40c

R.S.G.B.

RADIO COMMUNICATION HANDBOOK

Theory and practice of the latest techniques have been blended together to form a book essential to both student and constructor.

Price $10.50. Post 50c

COLLINS BOOK DEPOT

363 SWANSTON STREET,
MELBOURNE, VIC., 3000.
Phone: 663 3787.

Stock lists available free of charge on any subjects of interest to you.

RADIO ENTHUSIASTS

Learn amateur radio in your spare time.

Whatever your interests are in amateur radio, there's a Stott Radio course for you. Easy to follow. Practical. Modern. Guidance all the way by top-flight radio engineers.

Radio For Amateurs Course: Learn the exciting skills of building modern radio receivers. Learn about the latest advances in electronics, design, construction and operation. Let Stott's show you how.

Amateur Operator's Certificate Course: Broadcasting is fascinating. Stott's offer an entirely new course that enables you to sit for the Amateur Operator's Certificate of Proficiency examinations with complete confidence. Get full details now.

POST THIS COUPON TODAY

Stotts

TECHNICAL CORRESPONDENCE COLLEGE

159 Flinders Lane, Melbourne, 3000
383 George St., Sydney, 2000
290 Adelaide St., Brisbane, 4000
45 Gilles St., Adelaide, 5000
89 St. George's Terrace, Perth, 6000

Please send me, free and without obligation, full details of your courses in Radio for Amateurs.

Mr, Mrs, Miss .....

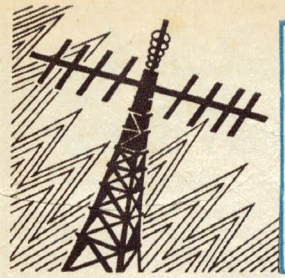
Address .....

..... Age .....

No sales representative will call

EA1270

STC295



AMATEUR BAND NEWS AND NOTES

Amateur thanks New Guinea natives

A visitor to Sydney during October provided a most interesting first-hand story of a sentimental journey to New Britain which resulted in a beneficial result for a native community.

by Pierce Healy, VK2APQ

The visitor, Fred Hargesheimer, W0EBG, was the guest of the Sydney Chapter of the Quarter Century Wireless Association at the October meeting. Fred is a member of the QCWA in the United States.

As a lieutenant in the US Air Force during World War II, Fred was shot down over eastern New Britain in June 1943, and parachuted to safety.

After 31 days of extreme hardship in the dense jungle, he was found by a group of friendly natives of the Nakani tribe and taken to their little village of Nantambu, a cluster of grass huts on the edge of a lagoon near the sea. For five months this was to be Fred's haven, being warned of the approach of enemy aircraft and patrols by the friendly natives.

When recovering from a severe attack of malaria, through which the natives had nursed him, he received word that three Australians with a wireless were in the hills. They were members of the coast watchers' patrol landed on the island to report on enemy movements and to rescue fliers shot down in the area. Fred joined them in a hide-out on a high ridge and was able to let the American base at Port Moresby know by wireless that he was safe.

Shortly afterwards, two Australian fliers joined them at the hide-out. They also had been shot down and guided to safety by friendly natives. By means of the wireless, rescue arrangements were made and they were finally picked up by a submarine.

After the war, Fred married and lived in Saint Paul, Minnesota, where he raised a family of two sons and a daughter. As time passed he found himself thinking more and more of the natives who had sheltered him at the risk of their own lives. Finally, the urge to see them again became irresistible and in mid-1960 left on his sentimental journey.

He was joined in New Guinea by Matt Foley, one of the coast watchers who had helped to rescue him. Together they went to Rabaul, then by an old trawler to Nantambu. Here Fred was greeted by Lauo, the old chief, who gave a feast in Fred's honour, announcing that it was "Mastah Freddy" whom they had sheltered during the war some 17 years earlier.

While flying home and thinking of the needs of his native friends, particularly their most pressing need of education, he decided to try to raise funds to build a school for the natives. This at first seemed an almost impossible task. But back home he discussed the idea with missionaries and friends. On the advice and encouragement he received, Fred proceeded to raise $15,000, an amount that, with the help of volunteer labour, would build a simple but practical school.

By speaking to club and church groups, by the generosity of many people, and the assistance from many of his fellow amateur radio operators who sent donations or arranged for him to speak to clubs in their towns, the target was achieved after 2½ years.

Preliminary plans for the building of the school were made through the Methodist Mission in Rabaul, Fred keeping in contact by amateur radio. Jack Sharp, an Australian, arranged the procurement of materials in Rabaul. Matt Foley also assisted and a Rabaul contractor agreed to supervise the construction.

In June 1963, Fred and his 17-year-old son Dick set out for New Britain. They arranged for cement and other material to be shipped to Nantambu. A site at a village called Ewasse, about a mile and a half from the beach, was chosen for the school. A three acre area was cleared by the natives and on the arrival of the contractor a week later construction began. Six weeks later when Fred and his son returned home the work was nearly finished.

In February, 1964 the school, consisting of three airy buildings surrounded by lawns and connected by covered walks, was officially opened. The buildings contain three class rooms and an assembly hall, which also serves as a community meeting place.

Known as "Airmen's Memorial School" the project has flourished. The attendance has increased from a total of 85 in 1964 to over 200 in 1970.

Considerable progress has been made in other directions. In 1969 two leases were taken out, one for 280 acres of fertile land, adjacent to the school which will become a cocoa plantation, and one for 625 acres of virgin timber land nearby. It is estimated that the income derived from these projects will cover the school's current expenses. One of the highlights in 1969 was the opening of a hospital adjacent to the Airmen's Memorial School which raised the level of medical care available in the area.

The headmaster is Jim Bye, an Australian who has administered the school since it opened. Mrs Bye, a trained nurse, looks after the hospital and gives sewing lessons at the school. There are five native teachers on the staff. Last September two American teachers, Mr and Mrs Jerry Parks, arrived at Ewasse to join the school staff.

The Airmen's Memorial School is a project of the Airmen's Nantambu Memorial Foundation. The foundation's trustees are:

Matt Foley
Fred Hargesheimer
Reverend Simon Gaius
J. Greenlee Haynes
Fred Kaad
General George Kenney, USAF (Retd)
John Kumpf
Wesley Lutton
Air Vice-Marshal W. Townsend, OBE (RAAF)
Bankers, First State Bank, White Bear Lake, Minnesota, USA.

Season's Greetings

to all readers of these notes

To those who have expressed their interest in various aspects of amateur radio, and to those who have sent notes on local and overseas events and other items of interest, a very sincere "Thank you". To these, and to all readers of these notes, best wishes for 1971. I look forward to hearing from you in the year ahead.

VK2APQ.

News and notes of Divisional and Club activities submitted for inclusion in these columns should be forwarded direct to Pierce Healy, 69 Taylor St, Bankstown, NSW 2200.

CALLING ALL PROSPECTIVE AMATEURS

The 1971 series of Personal Classes will commence on 16th February. Classes limited. Applications accepted in order of receipt. Correspondence classes available at any time.

Apply:

WIRELESS INSTITUTE CENTRE

14 ATCHISON STREET,
CROW'S NEST, N.S.W. 2065.
TELEPHONE: 43 5795

Under the reciprocal licensing agreements between Australia and the United States of America, Fred Hargesheimer operates under the call sign VK9FH when in New Britain.

"Airmen's Log", the Airmen's Memorial School report for 1969, left no doubt as to the progress and success of the project. The report contained many photographs of the project, the students and persons associated with the school.

HC9EBP-Estation Balsa Pacifica

As these notes were being compiled at the end of October, Sydney amateur radio operator, Sid Molen, VK2SG, had been maintaining contact with the crew of a balsa wood raft that had drifted across the Pacific Ocean.

The expedition aboard the nine-metre long by five-meter wide raft, constructed of balsa wood logs, set out from Guayaquil, Ecuador on the north-west coast of South America, on May 29. On October 31 it was about 200 miles off the Australian coast, south east of Rockhampton and drifting in a south easterly direction.

In a telephone conversation, Sid gave the following details:

The expedition is of Mexican origin and has four members. When they set out from Ecuador it was not known for certain in what direction the ocean currents and winds would take them, so no arrangements were made for Australian amateur radio operators to keep in contact with them.

However, Mexican amateur operators, XE1EEI and XE1IEB, were in constant contact with the expedition which was operating on 14.1MHz under the call sign HC9EBP. As the voyage progressed and the raft drifted into Australian waters, a fault in the microphone aboard the raft made voice communication impossible. Sid, VK2SG, and other Australian operators assisted in relaying messages from the raft to the control stations in Mexico. Message handling became a slow process as the microphone press-to-talk button was used to key the transmitter.

Indications at the time were that the raft was drifting towards the coast of NSW and could make Sydney. In case skip conditions on the 14MHz band made it impossible to maintain contact with the raft from Sydney, arrangements were made for ZL1RO in Auckland, New Zealand, to take over the relay of messages from the expedition.

By the time these notes are read it is hoped that the crew have received the welcome that Sid was planning to give them should they reach Sydney.

It is understood that the expedition had received assistance in the form of charts and food from the Mexican Navy prior to commencing the voyage. The aim of the expedition was to prove that travel between continents could have taken place by drifting in the ocean currents.

REGION 1 NEWS

The August issue of the Region 1 News, the journal of the International Amateur Radio Union Region 1 Division, was published in a new format. In booklet form measuring 8¼in x 5¾in the issue contained 40 pages of news and information. The editor Roy Stevens G2BVN, is to be complimented on the "new look" given to the journal.

French Ballon Experiments

The following report on French experiments was given in the August Region 1 News.

In 1969 the Jeunes-Sciences Club of Nancy, France, launched a meteorological

COMMERCIAL AND AMATEUR CRYSTALS

.01 per cent $4.25, .005 per cent $5.50 inc. S. Tax and Postage. Style HC-6U Holder Frequency Range 6 to 15 MHz Commercial Crystals in HC-6U Holders .005 per cent Tolerance Frequency Range 6 to 15 MHz $6.00 plus S. Tax

Write For Free Comprehensive Price List.

FOR THE PAST 36 YEARS

BRIGHT STAR CRYSTALS

Have been preferred by leading Manufacturers throughout the country for —

ACCURACY - STABILITY - ACTIVITY - OUTPUT

Consult us for Crystals for any Mobile Radio. All types available.

DISCOUNT FOR QUANTITY ORDERS

AMATEUR AIRCRAFT and ULTRASONIC CRYSTALS also AVAILABLE

Our modern Factory equipment allows us to offer you PROMPT DELIVERY for all your CRYSTAL requirements.

DEVOTED EXCLUSIVELY TO THE MANUFACTURE OF

PIEZO ELECTRIC CRYSTALS

Contractors to Federal and State Government Departments

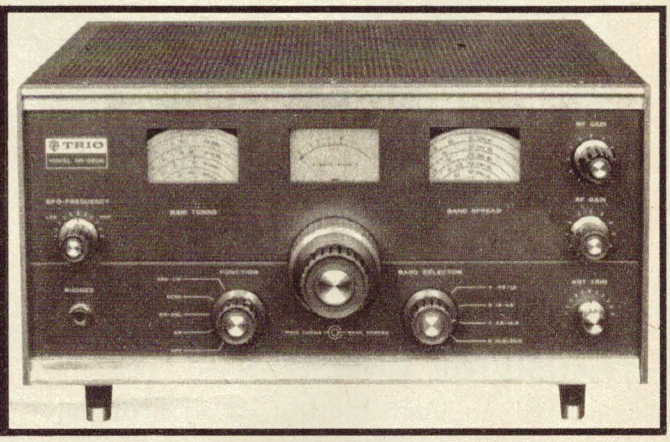
REPRESENTATIVES AUSTRALIA AND NEW ZEALAND: Messrs CARREL & CARREL BOX 2102, AUCKLAND.

MESSRS ATKINS (W.A.) LTD., 894 Hay Street, PERTH.
MESSRS. A. E. HAROLD PTY. LTD., 123-125 Charlotte Street, Brisbane.
FARR ELECTRONICS, Waterman Buildings, 408 King William Street, Adelaide. Phone 84977.
MESSRS LAWRENCE & HANSEN ELECTRICAL (VIC.) PTY. LTD., 34 Brisbane Street, Hobart, and 29 St. John Street, LAUNCESTON, TASMANIA.
PARIS RADIO ELECTRONICS, 7a Burton Street, Darlinghurst, N.S.W. Phone 31 3273.

BRIGHT STAR RADIO

LOT 6 EILEEN ROAD, CLAYTON, VICTORIA. 546 5076

TRIO 9R–59DS



COMMUNICATIONS RECEIVER

- 4 BANDS COVERING 540 Kcs. TO 30 Mcs.
- TWO MECHANICAL FILTERS ENSURE MAXIMUM SELECTIVITY.
- PRODUCT DETECTOR FOR S.S.B. RECEPTION.
- AUTOMATIC NOISE LIMITER.
- LARGE TUNING AND BAND-SPREAD DIALS FOR ACCURATE TUNING.
- CALIBRATED ELECTRICAL BANDSPREAD.
- "S" METER AND B.F.O.
- 2 MICROVOLTS SENSITIVITY FOR 10 dB S/N RATIO.

PRICE: FOR/FOA SYDNEY: $178.50

Weston electronics PTY LTD
SYDNEY, AUSTRALIA

(A unit of Jacoby Mitchell Holdings Ltd.)
376 EASTERN VALLEY WAY, ROSEVILLE, N.S.W.
Cables and Telegraphic Address: 'WESTELEC, Sydney. Phone: 40 1212

CONSULT YOUR LOCAL RADIO DEALER, OR

MAIL THIS COUPON *today*

Please forward free illustrated literature and specifications on Trio equipment.

Name.....

Address.....

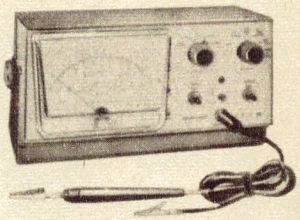
EA/5

XMAS SELLOUT !

Heathkits at greatly reduced prices

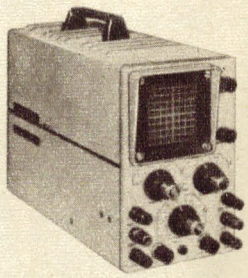
METERS

1M16	Transistorised Bench VTVM	$60
1M17	V.O.M.	$29
1M18	V.O.M.	$34
1M25	VTVM	$105
1M28	VTVM	$50
1M38	VTVM	$52
1M36	Transistor Tester	$85



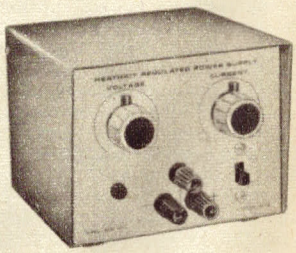
C.R.O.

1017	3" General Purpose C.R.O.	$128
1018	5" Wideland CR.O.	$152



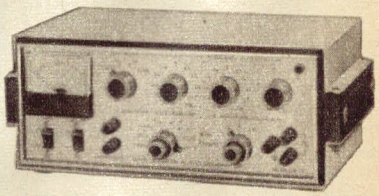
POWER SUPPLIES

1P17	Variable Regulated 400V	$120
1P18	1-15V D.C. Power Supply	$39
1P27	50V Variable Power Supply	$138
1P28	1-30V Regulated Power Supply with current limiting	$82



SIGNAL GENERATOR

1G18	Sine-Square Wave Generator	$95
1G42	Laboratory Signal Generator	$89

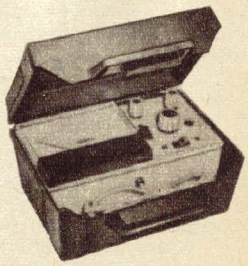


TRANSISTOR CHECKERS

1T18	Portable In Circuit Transistor Tester	$35
1T27	Transistor/Diode Checker	$9

MISCELLANEOUS

1N17	Decade Resistance Box	$34
1N27	Decade Capacitance Box	$22
1N37	Resistor Substation Box	$9.50
1N47	Capacitor Substation Box	$10



For further information contact:

WARBURTON FRANKI

- ADELAIDE 56-7333
- BRISBANE 51-5121
- HOBART 23-1841
- LAUNCESTON 31-3300
- MELBOURNE 69-0151
- MT GAMBIER 2-3841
- NEWCASTLE 61-4183
- PERTH 8-4131
- SYDNEY 648-1711
- WOLLONGONG 2-5444

balloon into the stratosphere. This was primarily a biological experiment but the balloon carried a 144MHz beacon with an output power of 0.3 watts. This beacon, provided by F1NK, was heard in the United Kingdom, Holland and Germany.

Another balloon was subsequently launched in October. In addition to a biological experiment using a 27MHz transmitter, the second balloon carried two beacons. One beacon was on 145.220MHz with an output power of one watt, tone modulated. The second beacon operated on 1296.6MHz with a power of 0.3 watt, tone modulated by a one second pip. It was estimated that the balloon would take 70 minutes to reach the maximum altitude of 25,000 metres and a further 20 minutes to decend.

QUAX MAGAZINE

For operators mainly interested in the 10-metre band, QUAX – the magazine devoted exclusively to activities on the 10-metre band – is back in circulation. Allan Taylor, G3DME, has undertaken the editorial responsibility and has requested all persons interested to contact him and supply him with information.

Annual subscription via sea mail is ten IRCs or equivalent. The address is – Allan Taylor, G3DME, "Altadena", South View Road, Crowbrough, Sussex, England.

In case the choice of title is not clear – QUA = Here is the news of; X = Ten.

IRAC NEWS

The Annual General Meeting of the International Amateur Radio Club, located in Geneva, Switzerland, was held March 16, 1970. The president reviewed the club's activities and in particular the activities of VU2ITU, the club station, set up with the assistance of Indian amateurs in New Delhi on the occasion of the International Telecommunication Union, CCIR Plenary Assembly, from January 21 to February 11, 1970. Officers elected for the ensuing year were:– President: Jack Herbstreit, HB9AJI Vice-president: Mirek Joachim, OK1WI Secretary: Ted Robinson, F8RU Treasurer: Renato Brossa, HE9RMH Newsletter Editor: Gerald Lander, HB9AJU

CPR AWARD

Since 1963, when the International Amateur Radio Club instituted the "CPR Award" (Contributed to Propagation Research), using contacts between amateur radio stations throughout the world as a means of improving theoretical calculations of propagation possibilities between different areas of the world, 556 awards have been issued to amateurs in 41 countries. A total of 423,599 reports had been processed up till March 1970.

One of the more important contributions for the award has been made by a novice operator, Jiri Kliment, OL6AIU, of Gottwaldov, Czechoslavakia. All of his 105 QSOs reported were made on the 1.8MHz band with a 10-watt, three-stage transmitter (ECO-BA-PA). The antenna was a 78 Metre Windom.

All told, OL6AIU has had a total of over 9,000 QSOs, and has worked 34 countries, including all continents, with the same transmitter.

SALES TAX REDUCTIONS

The following is the text of a letter dated 14th October, 1970, received from the Taxation Office Sydney.

Mr P. J. Healy,
Federal Councillor,
WIA.

Sales Tax

As you know, parts for radio and television receivers are covered by the Second Schedule of the Sales Tax (Exemptions and Classifications) Act and are taxable at the rate of 27½%.

It has been decided, however, where such parts have uses in radio transmitters as well as in radio and television receivers and are sold by the manufacturers or wholesalers to licensed amateur operators for use as parts of their radio transmitters, that no objection will be raised to tax at the general rate of 15% being charged on the parts provided the purchaser furnishes the appropriate certificate.

The certificate to be furnished by the licensed operator should be in the following form:

To the Commissioner of Taxation and the Commonwealth of Australia.

I hereby certify that the .....

(Name(s) of component part(s))

Purchased from .....

(Vendors name)

On .....

Date .....

is/are for use by me as part/parts for my licensed radio transmitter.

(Licence No) .....

Call sign .....

Signature .....

Date .....

The above remarks do not apply to thermionic valves used in radio or television transmission or reception. The 27½% rate applies to these valves whether sold to licenced amateur radio operators or to other persons.

Yours faithfully,
R. R. Gray.
Deputy Commissioner of Taxation.

WIRELESS INSTITUTE ACTIVITIES

Following a request from the New South Wales and Queensland Divisions, and concern expressed by other Divisions on the proposed increase in the amateur licence fees, the Federal Secretary of the Institute sent the following lettergram to the Postmaster-General.

"The Wireless Institute of Australia refers to the Wireless Telegraphy Regulation Bill and asks that the licence fee increase to $6.00 be reviewed. Our request is justified on the following grounds:

1. The amateur service deserves special consideration because of community interests served in times of disaster.
2. The amateur service educates and encourages technical expertise.
3. Amateurs have no recourse to claim licence fees as tax deduction.
4. The Wireless Institute is the only organisation representing a Licensed Communication Service. By co-ordinating individual requests with active self-policing committees, your Department's costs associated with administration and technical supervision are minimal.
5. Many amateur licensees are pensioners and should be accorded similar concessions to those that they

UNITED TRADE SALES

PTY. LTD.

TRANSISTOR V.H.F. CONVERTER Tunable 108-136 Mhz Aircraft Band 1F-600Kc to 1,000Kc. No connecting wires needed, 9V Battery, self-contained, just place alongside broadcast radio. Price only **$14.40** plus **45c** postage.

RESISTORS 100 for $2 in Poly Packed Bags. Mixed Values only. P. and P. 25c.

Computer Boards, contains Diodes and Resistors. **75c** ea. P. and P. 25c.

PIANO 5-Key Switches **$1** ea. P. and P., 25c.

MULTIMETERS, 200H, 20K ohms per volt, **$11.25,** inc. tax. CT 500 20K ohms per volt, **$15** inc. tax. CT 330 20,00 ohms per volt, **$17.25** P. & P. 45c.

C1000 Pocket Multimeter $6.50. P. and P. 25c.

Crown Level Meters and 2-Track Tape Heads, **$1.50** ea. P. and P. 25c ea.

CAPACITORS

80 for $2 in Poly Packed Bags. Mixed values only.

TAPE HEADS

Cassette Recorder Type Replay Heads. 2-track Mono Current Manuf. **New $1.50 ea. PLUS 10c pack. and post.**

MU-METAL SHIELDS

To suit 5BP1 and other 5in CRTs mfd. by Magnetic Shields Ltd. **Brand-new, $5 ea. plus 30c pack. and post.**

3,000 TYPE RELAYS.

Large range. **Only 50c each.**

TRANSISTORS

2SD65, 2T76, **25c** ea. or in 100 lots **20c** ea. P. and P. 10c.

OC400, **20c,** SB346, **25c;** OC468, **70c.**

VALVES

6J8	$1.75	6J6	30c
6K8	$1.00	ECC33	50c
6BF6	$1.00	6J7	50c
6SJ7	60c	TT15	$1.00
6SL7	$1.00	807 (ATS25)	50c
6U7	60c	QVO4/7	$1.00
6G8	$1.50	5B254M	$1.00
815	50c	13E1	$1.50

Tinsley 50HZ Tuning Forks, as new, $40.00. P. and P. $1.50.

All prices subject to alteration without notice. All items PLUS POSTAGE.

WANTED TO BUY
RECEIVERS, TRANSMITTERS
TEST EQUIPMENT.

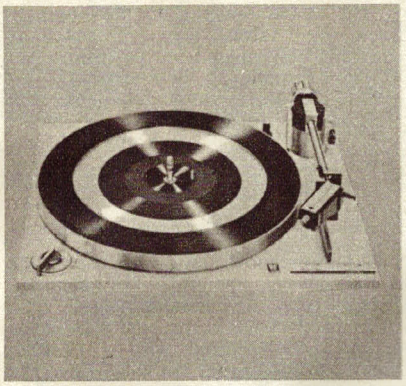
280 LONSDALE STREET, Melbourne. Phone 663-3815.
(Opposite Myers)

PE

PERPETUUM-EBNER.. PRECISION GERMAN ENGINEERING



PE 2010



PE 2020



PE 2018

PE Turntables are precision engineered in the Black Forest, Germany.

General Accessories are now co-distributors in Victoria and exclusive distributors in N.T., W.A. and S.A.
All models feature 4 pole motors, automatic record size discrimination and single lever operation of all functions, low friction tubular tone arms moving in ball bearings in both planes, manual or automatic play of single records or changer facilities and continuous repeat.
The hi-fi models also incorporate calibrated tracking weight and anti-skate adjustments, vernier speed controls, interchangeable headshells, and viscous damped arm lowering.

The features of these precision turntables are many. For fully illustrated catalogue giving complete specifications, send the coupon to your nearest state branch address.
General Accessories are proud to be associated with this fine range of precision turntables.

NAME.....

ADDRESS.....

.....STATE.....

GENERAL ACCESSORIES

AVAILABLE AT FOLLOWING BRANCHES:

46 Milligan Street, Perth.
116 Clarence Street, Sydney.
81-97 Flinders Street, Adelaide.
50-54 Lt. Edward Street, Brisbane.
443 Concord Rd., Rhodes, N.S.W.
153 Sturt Street, South Melbourne.
Cnr. Ingham Rd. & Echlin St., Townsville.
Homecrafts, Tas P/Ltd. 199 Collins St., Hobart.

currently enjoy as holders of broadcast and television viewers licences.

We urge favourable reconsideration of the proposed licence fee increase.

NEW SOUTH WALES

A very interesting and distinguished visitor to the October meeting of the New South Wales Division, was Bob Booth, W3PS. Bob is a lawyer and is the legal councillor for the American Radio Relay League, in which capacity he represents the ARRL on amateur radio matters to the Federal Communication Commission of the United States.

Speaking to the meeting on a number of aspects of amateur radio in the United States, he referred to such subjects as the Space Frequency Conference of the International Telecommunication Union Conference to be held at Geneva in 1971. Also, the licensing of amateur repeater installations which is causing some concern to the ARRL at the present time.

Referring to the increase in the amateur licence fee in Australia, Bob told the meeting that in the United States the licence fee has recently been increased from $4.00 to $9.00 but for a period of five years. This is even less than the old licence fee in Australia of $2.00.

Bob is also a member of the Quarter Century Wireless Association and met several members of the Sydney Chapter at the meeting.

Central Coast Branch: The Central Coast Branch have introduced a new activity on meeting nights – a pedestrian hidden transmitter hunt on 144MHz, prior to the lecture. At the October meeting members heard a lecture on a topical subject, DC – DC Convertors, given by Ross Mudie, VK2ZRQ.

Meetings are held at the club rooms at Kariong, located just off the Pacific Highway at the Woy Woy turn-off.

Visitors are welcome at the meetings which are held on the third Friday of each month.

Illawarra Branch: Reports from the Branch indicate that the Dapto moonbounce project is making good progress. The receiving system is now working and the power supplies for the frequency multiplier and final amplifier are nearly completed. The multiplier and final are both in an advanced stage of construction and it is only a matter of a few weeks before high power tests can be carried out.

Members of the Branch are very active in promoting amateur radio activities. Unfortunately, details came to hand to late for publicising before the event, of their Cook Bi-Centenary field operation from Bass Point. The Shellharbour Council having given permission for AX2AMW, the Branch's station, to be set up and operated from that location on the weekend November 28 and 29.

Special Morse code practice sessions are being given before the general meeting commences. The meetings are held in the Town Hall Committee Room at Wollongong, on the second Monday of each month, commencing at 7.30 pm. Visitors are always welcome.

South West Area: The Annual Field Day of the South West Area, held at Wagga during the holiday weekend October 3-5, was very successful. The attendance at the field day was over 100, while 78 were present at the Convention Dinner held at the Postal Institute on the Saturday night.

A feature at the dinner was the presentation of the Wagga Centenary Prize to Stan Dixon, VK3TE. The prize, awarded for making the greatest number of contacts with Wagga amateur stations during the period September 12 to 20, 1970, was a medallion and a plaque of the coat of arms of the city of Wagga, presented by the city's Council.

The field events were well contested. The first three 144MHz hidden transmitter hunts being won by VK2ZDD and team; the fourth by VK3AJM and VK2ZZQ; the 7MHz Scramble by Bruce Richie. VK2BAR; the 144MHz Scramble by Jack Flynn, VK2AY. The prize for the longest distance travelled to the convention was presented to Basil Whitmee, VK4ZW, of Cairns, Qld.

The organisers of the convention, the Wagga Radio Club, express their thanks and appreciation to all who attended and in particular to the trade houses and others interested in the convention for their generous donations of prizes.

QUEENSLAND

The "Outwards QSL" office of the Qld Division, Bill Jehn, has found it necessary to retire from the position after efficiently conducting the outward bureau for the past four years.

Fred Lubach, VK4RF, has taken over the task and cards should now be sent to – F. J. Lubach, 21 Bovelles Street, Camp Hill, Qld, 4152.

Central Queensland Branch: The Central Queensland Branch has finalised plans for AOCP classes to commence in November. The lecturer will be Claude Singleton, VK4UX. Details of the classes may be obtained by writing to the Secretary, PO Box 496, Rockhampton, Qld, 4700.

WESTERN AUSTRALIA

The WICEN Co-ordinator, Ted Gabriel, VK6TG, reports that progress made over the past 12 months has exceeded expectations. Already, in a small way, WICEN has been of assistance in emergency communications and its potential has been recognised by several authorities.

Ted emphasises the importance of the duties of an area net controller as he represents the amateurs in his area and is responsible for the recruitment and training in emergency procedures of members of his net.

VHF Group Incorporated: The committee of the Western Australian VHF Group Inc are investigating the proposal by the Melville City Council to convert the "Old Wireless Station" at Applecross into a museum.

Members of the group feel that the project offers a challenge which they can handle capably. Participation in the project will render a worthwhile community service. It will also provide a highly interesting and rewarding activity for the group.

WIA Youth Radio Club Scheme

During the past year, the Youth Radio Club Scheme has continued to make progress. The number of youths, through the interest created by active participation

CASSETTE SALE

Made by Audio Magnetics U.S.A.

Fit all compact cassette recorders — Philips, Sony, National, Sharp, etc. Less than wholesale.

C.60, 99 cents; C.90, $1.65; C.120, $2.25. Post 10c.



At last, direct from America, the unique cassette head cleaner. Removes deposits from the recording head with a non-abrasive polishing action. Fits all compact cassette recorders and playback units.

$1.50

DIAMOND STYLII



Single **$3.00**
Double **$4.00**
1 Diamond, 1 Sapphire

Send your old stylus or make and numbers for correct replacement.

TAPE ON REELS
Boxed
5 inch, 1800ft **$3.25**
7 inch, 2400ft **$3.95**

BATTERY CHARGERS
12 volt 1 amp **$6.75**

Lock down car aerials **$4.00**

Stereo Headphones .. **$5.50**

RADIO MART

338 PITT ST.,
SYDNEY, N.S.W.
BOX 4913, G.P.O. 2001

PERTH ELECTRONIC PARTS CENTRE

BARGAIN PACKS!

SEMI CONDUCTOR PACKS GUARANTEED BRAND NEW AND TESTED SILICON & GERMANIUM TYPES

10—Low noise Audio Type similar BC-109, 4010 . . . $3.00
10—Audio Type Sim. 2N2926 . . . $2.95
10—Audio Type similar BC108 . . . $2.95
10—RF Type, similar BF115, 3693 $2.95
10—RF High Gain . . $2.95
10—RF Low Noise VHF sim. 2N3564 $3.50
10—Audio Output NPN Silicon. Matched pairs . $3.25
10—Audio Silicon PNP sim. 2N3638A . . . $3.25
5—Silicon Pair Complementary Output 22V 500mW $3.25
1—NPN Output, 2N3055/BDY20 $2.00
Or 2 for . . $3.75
1—PNP RF IF Type, sim. AF-116, AF117, ea. .35
or 10 for $3.00
1—PNP Power Output, sim., 2N-301, 2N2148 AD 149 . . . . . $1.30

FETS

MPF 102 . . . ea. $1.10
MPF 105—2N5459 $1.10
MPF 106—2N5485 $1.30
MPF 107—2N5486 $1.30
2N3819 . . . . . $1.10
TIS88—2N5245 . . $1.10
3N140 . . . . . $2.10
3N142 . . . . . $1.95

NEW BRANDED SEMICONDUCTORS

AC125	.75	BC109	.60
AC126	.75	BF115	.65
AC128	.70	OC44	.60
AC187/8	1.90	OC45	.60
		OC74	.60
AF116N	.70	40250	1.50
AF117N	.70	40408	1.95
AD161/2	2.90	40409	1.60
		40410	1.70
BC107	.50	PA40	5.50
BC108	.50		

DIODES

OA90 Type, 25c ea. or 10 for $2.30
OA91 Type, 25c ea. or 10 for $2.30
OA95 Type, 27c ea. or 10 for $2.50
BA100, each 30
Similar BA100. 10 for $1.70

INTEGRATED CIRCUITS

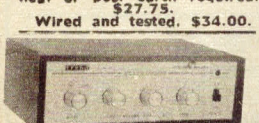
SINCLAIR 1C-10 . . $11.50
PLESSEY SL403A . $10.00
Or 2 for $19.00
Philips 1-watt $3.60
GE 1W RMS . . . $3.95
GE 2W RMS . . . $5.57
GE 5W RMS . . . $8.57
709C op. amp . . . $2.99
BENDIX 15 RMS $21.88
PHILIPS Pre-amp and Tape
MOTOROLA, NATIONAL,
FAIRCHILD—Flipflop, etc.

BRIDGE RECTIFIERS

20V . . . 1A . . . 80c
100V . . . 2A . . . $1.60

CAPACITIVE DISCHARGE IGNITION SYSTEM KIT

Suitable for cars, boats and trucks. Increases performance, points and plugs last longer.
All components including ready wound transformer. 2-silicon transistors and circuit board. State whether neg. or pos. earth required. $27.75.
Wired and tested. $34.00.



7W stereo Amplifier, 50-20,000 Hz. In oiled timber Cabinet.
$34.50 Complete.
Plus $1.00 Post and Pack.

E/A 3 WATT PER. CH. Amplifier Kit Comp. Bass and Treble Controls—Uses 2 Integrated Circuits. $48.00. P.-P. 60c.

SILICON RECTIFIERS

50v, 25c ea. or 10 for $2.25
100v, 25c ea. or 10 for $2.25
200v, 30c. or 10 for $2.25
SPECIAL 400v 28c ea. or 10 for $2.25
600v, 55c 800v 60c
1000V 1 Amp . . . 95c
3 Amp 100V Surge Protected ea. . . . 75c
SCR 400v 6A . . . $3.20
D13T1 . . . . . $1.40
ST2 . . . . . 90c

MURATA CERAMIC FILTERS

BFB 455 35
SFB 455 66
SFD 455B 78

TRIO COMMUNICATION RECEIVER MODEL 9R-59D $178

4 band receiver covering 550 Kc/s to 80 Mc/s continuous and electrical bandspread on 10, 15, 20, 40 and 80 metres. 8 valve plus 7 diode circuit, 4/8 ohm output and phone jack. SSB-CW ● ANL ● Variable BFO ● S meter ● Sep. bandspread dial ● IF 455 Kc/s ● Audio output 1.5 W. ● Variable RF and AF gain controls. 115/250V. A.C. Mains. Beautifully designed.

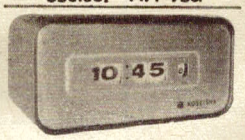
STEREO HEADPHONE SPECIAL



BRAND NAME—8 Ohm. Res. 20-12 KHz. Wide Range. $5.95. Post. 50c.



100,000/0.P.V. DC Mirror SCALE MULTIMETER Diode protected 22 ranges. $36.00. P.P. 75c.



DIGITAL CLOCKS 240V, 2W
12 Hour, plus Seconds. Dimensions 169 x 72 x 79mm
SPECIAL—$11.75
Pack and Post, 60c
Also new models 24 Hr type from $16.60.

An attractive alternative for the enthusiast prepared to assemble these excellent modules to make a stereo assembly. Z30 24 watt Power Amplifier (2 required). Stereo Sixty Control/Preamplifier PZ.5 Power Supply Unit.
SINCLAIR PROJECT 60 package deal price. Write for quote.

PRINTED CIRCUIT BOARDS
For E.A. Projects.
1 Watt Philips 1C. Board 65c.

BASIC POWER
Supply Kit 6-12V. Contains Transformer, Rectifier, Capacitor and Instructions. $3.85. P. and P. 50c.



SMALLEST RADIO KIT IN AUSTRALIA
1 5/8in x 1 5/8 x 15/16in Uses 2 Silicon Transistors and High Impedance Magnetic Earphone.
5-Stage Reflex Circuit and Ferrite Aerial.
Complete Kit with Instructions $6.75. 35c Pack-Post.
Batteries required: 2 Mercury Cells Type RM675.

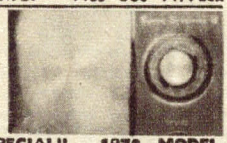


NEW 1970 TRANSISTOR RADIO KIT
6 Silicon Transistors and complete with instruction book, carrying case and earphones.
Special Price . . . $10.25
Wired $11.75
Post and pack 75c.

NEW MODEL



3 Transistor Radio Kit with Speaker, and Instructions $8.75. Plus 50c P./Pack



SPECIAL!! 1970 MODEL 8 TRANSISTOR RADIO KIT. USES SILICON TRANSISTORS AND DIODES. COMPLETE with Instructions. Carrying Case and earphone. $16.50. Wired, Tested $18.50. Post and Pack 75c.



BOYS' CRYSTAL SET KIT
Complete with plastic Cabinet, earphone and instructions.
$2.50 plus post 50c.
Extra—Add-on Kit. Convert your crystal set to a one Transistor Radio.
$1.50 Plus Battery.

RESISTORS
¼w and ½ watt 4c ea. or $3.00 per 100.

ELECTROLYTIC CAPACITORS
All Values—5mf. 12c.
Send S.A.E. for List.

POLYESTER CAPACITORS
100V—all values. .001uf—.01uf 7c. 400V price 1.25 qty.

	ea.		ea.
.001uf	10c	.033 uf	15c
.0022	10c	.047	15c
.0033	12c	.056	16c
.0047	12c	.068	17c
.0056	12c	.082	19c
.0068	12c	.1	19c
.0082	12c	.22	27c
.01	12c	.33	36c
.022	14c	.47	42c

All components, transistors and diodes at special prices. Send S.A.E. for new list.

Postage Add 10c
Minimum for all
Small orders add 30c.
Certified Post 30c.

WILLIS TRADING CO.

PERTH G.P.O. BOX X2217, W.A. 6001.
Shop Address: 155 SCARBOROUGH BEACH ROAD, MT. HAWTHORN, 24 2454

in club projects, who have commenced their working llife in the field of electronics has been a very worthwhile contribution to the industry as a whole. In the January issue of these notes more details of the operation of the scheme will be given.

NEW SOUTH WALES

Successful candidates from various clubs in NSW who have passed in the Junior YRCS Certificate examination are:

Yawarra Youth Radio Club:

Robert O'Donnell	Credit
William Baker	Credit
Ronald Webb	Credit
Lawrence Paisley	Credit
Paul Thomas	Pass
Robert Ardle	Pass
Gregory Amos	Pass

Homebush Boys High Radio Club:

Mark Krieger	Honours
Geoffrey Grayhurst	Honours
Nicki Klunicki	Credit
George Perry	Credit

Goulburn Youth Radio Club

Brian Fitzpatrick	Credit
Robert Pearce	Credit

Maitland Radio Club

E. B. Millen	Pass
J. Murray	Pass

Randwick Boys High Radio Club:

Samson Voron	Pass

This list brings the total number of Junior YRCS Certificates issued in NSW to 200.

Westlakes Radio Club: Members are expressing their appreciation to two of their number who have made generous donations to the club and are looking forward to the day when the club station VK2ATZ, will be making a name for itself on the DX bands. The donations were a beam antenna from Bill Hall, VK2XT; and a beam rotator from Reverend Father J. B. Doran. The antenna and rotator will be installed on top of a 60ft pole positioned at the rear of the club rooms.

Two more members of the Westlakes Radio Club have received their full call signs, they are Arthur Day, VK2ZDE, now VK2BBI; and Paul Lorentzen, VK2ZQI, now VK2ATR. These two members, who have progressed to their full licence standard through their studies at the club, have gone about as far as they can go in gaining awards for their studies. They have both gained the many YRCS certificates as well as the club's "Broadcast Ten Award".

Another successful candidate at the AOCP Morse code examination was Bill Munn, VK2ZWM. Bill is awaiting the allocation of his full call sign.

The Westlakes Radio Club "Monthly Newsletter" contains many useful and practical hints and details of equipment to be constructed. All the necessary components for club projects may be obtained by members through the club store, which is efficiently operated by store officer Ken Cunningham, VK2BSL.

Classes are held at the club on Wednesday and Friday evenings and on Saturday afternoons. Full details may be obtained by writing to the Secretary, Eric Brockbank, PO Box 1, Teralba, NSW, 2284.

Maitland Radio Club: The Maitland Radio Club building program is going ahead. The theatrette is under construction. This will be a 50ft x 20ft building with a seating capacity covering two thirds of the total area. It will also contain a stage, projection room, kitchen and toilets. The building will be used for

club socials, lectures and to accommodate the overflow of classes for the YRCS certificates.

The club's magazine, "MRC News" is celebrating its third year of publication with a brand new cover. This publication has news of club activities, technical articles. and news of interest from overseas.

The subscription rate is $1.00 per year in Australia, $2.00 per year for overseas subscribers, paid in advance to the publishers, MRC News, Box 54 PO East Maitland, NSW, 2323.

VICTORIA

A number of changes in the administration of the Victorian Division of the YRCS will be announced shortly. Since Michael Plummer's departure for Canada last year, his work has been carried on by Don Reid and Harry Smith. Because of the swift growth of the scheme the work load on these two officers far exceeded their available time and energies.

Several people have now expressed their willingness to assist, and to undertake the tasks associated with the various administrative positions. It is hoped that the details will be available for next month's notes.

QUEENSLAND

At the Elementary Certificate examination held at the Sunshine Coast Amateur Radio Club the following students were successful: Pass: N. Johnston; K. Paris. Credit: B. Marks. Honours: J. Blee; G. Gossey; N. McRae; S. Colless; Mrs D. Ivins; J. Hannaford; L. Kuskopf.

All have received their certificates and are now preparing for the Junior Certificate Exam. The club's instructor is Ray Ivins.

Competition between clubs is very close for: a. The most successful student award. b. The most progressive club award.

All of the clubs whose members have gained certificates during the year are in the running for the club award.

At the Technicians School Radio Club, successful candidates at the recent YRCS examination were:– Junior Certificate: Credit, P. Jones. Honours: B. Rampton; J. Rounsefell; K. Walker. Elementary Certificate: Pass, D. Hill; L. Baker. Credit: S. Sheridan; B. Burley; C. Howard; I. Parminter; G. Serow; N. Walker; R. Coox; R. Cavanagh; C. Richards; P. Harbort; A. Long; W. Stephens; B. Born; T. Cobine; R. Sampson; H. Borcherdt; T. Lynn; J. Crowley. Honours: S. Brown; P. Statham; G. Macnish; G. Silverthorne; G. Dobbs; P. Wood; R. Dagan; R. Beyer; J. Hill; B. Clay.

The club leader, Graham Schott, of the Everton Park High School Radio Club, reports that good progess is being made. Members are awaiting the results of the Junior Certificate examination.

Members of the Church of England Grammar School Amateur Radio Club have sat for the Elementary certificate exam and are confident of obtaining good passes.

The club leader of the Indooroopilly and District Youth Club – Radio Club, Owen Nattress, VK4ON, reports that four members are preparing for the Elementary Radio Certificate.

Youth Radio Club Scheme notes and information relating to the activities of the scheme in Queensland may be obtained from the YRCS Supervisor, Ron Everingham, 30 Hunter Street, Everton Park, Brisbane, Qld, 4053.

SOUTH AUSTRALIA

The YMCA Electronics Club, whose initial membership grew very quickly to around 80, has now settled down to a regular attendance of 40 members. Recently a visit was made to the club by the South Australian president of the Wireless Institute of Australia, John Allan, VK5UL, and the YRCS state secretary Allen Dunn, VK5FD. Under the direction of WIA instructors, quite a strong club has emerged. Facilities provided by the YMCA are good and the current projects are the construction of short-wave receiver.

The Port Pirie Youth Radio Club have finished the Friday night theory lesson sessions for 1970, and are now concentrating on practical work on Saturday afternoons until the Christmas recess. The club's activities will recommence in February 1971, on Saturday afternoons.

A new club has registered with the South Australian Division. This is the Woomera Youth Amateur Radio Club. Tom Marlow is the club leader and instructor. At the inaugural meeting a president, secretary, treasurer, and committee were elected from the 14 members enrolled. The club also has facilities to put its own station on the air.

The St Marys Scouts Radio Club is another club on the air. They have both HF and 52MHz facilities available.

The Barossa Valley Youth Radio Club participated in the South Australian VHF Field Day Contest, setting up camp at the trig-point on Menglers Hill. Signals were few and far between. However they did receive an inch of rain. Compared with 55 contacts in the 1969 event, only 8 were made this year.

Club Leader Grant Thomas, VK5ZGI, was naturally disappointed with the results but will most likely be out with the club members again next year.

Members of the Port Augusta Youth Radio Club had an interesting visit to the Commonwealth Railways Communication Centre, where they inspected the HF transmitter used for direct communication with Darwin; also, a cross-bar telephone exchange, station and train VHF equipment, and audio equipment for pre-recorded taped music and announcements as used on trains. ,

Some members as still pursuing the requirements for the SWL certificate, Grade III. Two of the members are having a private competition between themselves to see who will be the first to attain the goal.

The studios of ADS Channel 7 were visited by members of the Elizabeth Youth Radio Club on August 14 and October 27. A very detailed inspection of the studios and television equipment, in general, was made.

A Parents and Visitors night was held on November 7 to mark the end of activities for 1970. Enrollments were alsc made for 1971.

Successful candidates at recent YRCS examinations were: **Elementary Certificate:** Kym Nelson, Barossa Valley YRC, Pass. Maurice Dunn, Elizabeth YRC, Honours. David Grove, Elizabeth YRC, Pass. Junior Certificate: John Norrington, Elizabeth YRC, Credit, Michael Chenowith, Elizabeth YRC, Pass. Intermediate Certificate: Peter Gheude, Elizabeth YRC, Pass. Christopher London, Elizabeth YRC. Pass.

"OXFORD"

RADIO CHASSIS—
INSTRUMENT CASE—
ENGRAVE & PRINTED PANEL

"MINI BOXES"
(Aluminium)

Any kind of metalwork

All stock from our distributors:

N.T.
TOP END RADIO
P.O. Box 2059
Darwin

N.S.W. (NEWCASTLE)
MARTIN DE LAUNAY P/L
Darby Street,
Newcastle. Phone 2 4741

HEATING SYSTEMS
PTY. LTD.

19-21 The Boulevarde,
Caringbah 2229
Phone 525-5222
5 lines



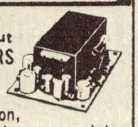
Brand New "Pocket Tester"
MULTIMETERS $6.95
Post 25c. Brand new circuit tester with high sensitivity and ruggedly built for checking any electric apparatus; and truck ignitions, motors, shorts, broken leads, etc. Measures all voltages to 1,000 volts A.C. and D.C. . . . D.C. current (amps.) resistance, etc. Complete with full instructions and probes.



Huge purchase from liquidation of famous manufacturer.
P. and P $1.50.
12" 40 watt $17.50

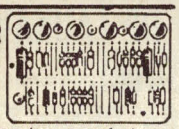
TRENT "PIONEER" Hi-Fi SPEAKERS
Brand new in cartons, 1970 models, these beautifully made superb speakers are selling at 1/3rd of usual price.

Voice Coil	12"
Impedence Nominal	8 ohms
Power	40 watt
Frequency Response	70-5000 c/s
Sensitivity	102 2db/watt



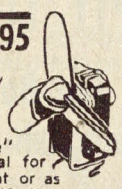
4 Transistor, 3 Watt Output
AUDIO AMPLIFIERS $7.95
Fresh 1970 current production, brand new in cartons, complete with instructions. Specially designed to provide a complete and reliable basic unit for portable gramophones, radios, intercoms, tape recorders, P.A. systems, etc. Latest printed circuit design suitable for 3 to 15 ohm speakers. For use with 9v. transistor radio battery. Frequency response 150-10,000 c-s. A pair are ideal for stereo. Size only 3" x 2". p. and p 25c

COMPUTER BOARDS



Enormous purchase from famous computer manufacturer. Each board comprises a minimum 4 transistors and up to 6 transistors, plus host of resistors, diodes, capacitators, inductors, etc. Transistors are NPN & PNP germanium type TO5 & TO18 for R.F., audio, hi-speed switching, etc. 100's of uses. Size of board 2½" x 4". 4 boards with minimum of 16 transistors $1.50 post 20c.
8 Boards with minimum of 32 transistors **$2.75**, post 25c.
16 Boards with minimum of 64 transistors $4.95, post 60c

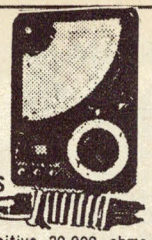
A.C. FAN $2.95
Post 60c.



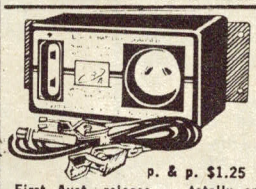
Small but very powerful 240v. mains motor by "VARLEY" England. With 5½" 3 blade fan, ideal for cooling equipment or as extractor fan. Self-aligning bearings, silent but very efficient. Mounts from back or front. Brand new. Motor separate **$2.45**. Post **60c.**

0-10 amp. D.C. moving iron ammeters. English $1.95. P. & P. 20c. Rugged construction.

Famous 200 H Model
20,000 OHMS MULTIMETERS $9.75
P & P 50c



Extremely sensitive 20,000 ohms complete with full instructions and probes with overload protection **RANGES:— D.C. VOLTAGE:** 5-25-50-250-500-2.5K (20,000 ohms per volt). **A.C. VOLTAGE:** 10-50-100-500-1000 volts (10,000 ohms per volt). **D.C. CURRENT:** 0-50 uA, 0-2.5 MA, 0-250 MA. **RESISTANCE:** 0-6K, 0-6mg. (300 ohm and 30K at centre scale). **CAPACITANCE:** 10 uuF to .001 uF, .001 uF to 1uF. **DECIBELS:** -20 to +22DB

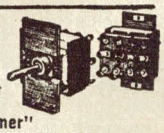


p. & p. $1.25
First Aust. release — totally encapsulated 12 volt 2 amp. Trickle Chargers. Mount permanently in vehicle or boat. 12 months guarantee fully approved by S.E.C. $18.50. A must for all automatic vehicles, absolutely no fire risk. Impervious to all weather conditions.

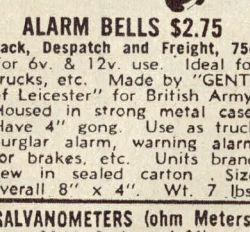
HALF-PRICE SPECIAL HI-FI RECORDING TAPE
Fantastic purchase of "MYLAR" professional recording, computer tape (the best money can buy). Famous 3-name brand (one we can't mention due to huge price reduction). Silicone lubrication. Suits all tape recorders, hi-fi and stereo. Selling well under half price. ABSOLUTELY BRAND NEW
post — 3" and 5", 10 cents
7", 20 cents

3" 225'	**65c**
5" 600'	**$1.75**
7" 1200'	**$2.95**
LONG PLAY	
5" 900'	$2.45
5½" 1200'	$2.75
7" 1800'	$3.95

Empty spools 3" 25c 5" 35c Post 10c each.



Magnificent
"Cutler Hammer" TOGGLE SWITCHES
Post pack 10c). 4-Pole, 3-way (3 position) panel switches (centre off). Handles 10 amps. at 12 or 24/32 volts D.C. Ideal for panels, control boards, 75c.



ALARM BELLS $2.75
Pack, Despatch and Freight, 75c
For 6v. & 12v. use. Ideal for trucks, etc. Made by "GENTS of Leicester" for British Army. Housed in strong metal case. Have 4" gong. Use as truck burglar alarm, warning alarm for brakes, etc. Units brand new in sealed carton. Size overall 8" x 4". Wt. 7 lbs.

GALVANOMETERS (ohm Meters)
$4.50 (Pack, post $1)
Originally for testing line circuits for gelignite charges. Checks to determine if breaks in the lines occur. Meter is housed in carrying case with battery compartment.

WRITE FOR FREE GENERAL CATALOGUE



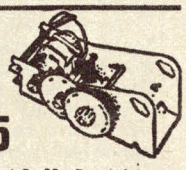
Brand New 40-Piece
TAP & DIE Sets $10.50
Freight $1.50. 40-piece stock and dies covering the full range S.A.E. and WHIT. in the one box. **TUNGSTEN STEEL** 1/8"-½" Complete with dies, stock, tap wrench, tap holder, pitch gauge, driver — in strong metal case. A bargain ½ price.

NEW DOUBLE EARPHONES $1.65

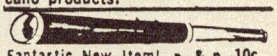


P. and P. 45c
Famous English make. Suberb for crystal sets, transmitters/receivers, silent radio and TV listening, etc., Complete with long lead. New double earphones with microphone has press to talk switch. $2.40, P. and P. 60c.

MODEL MOTOR & GEAR TRAIN



$1.65
$1.65, P. and P. 25c. Powerful permanent magnet model motor in steel chassis, with all metal English reduction gear train, produces considerable torque, operating voltage 1½ to 4½ volts DC (torch batteries), final drive speed approx. 100 r.p.m. at 1½ volts. Size 4" x 2½" x 1¾" high, brand new, originally designed for Meccano products.



Fantastic New Item! p. & p. 10c
PEN TELESCOPE $1.95
10-Power pocket telescopes. 4½" closed; 8" long extended. Very clear image. Has clip for pocket. Closed,can also be used as a 50-Power microscope. Post free.
Use also for inspecting record stylus needles.

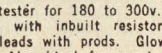
ANTENNAE RODS — 69c post 10c. 6 Section telescopic, chromed brass, fits most transistor radios, extends from 5½" to 27", female threaded base.

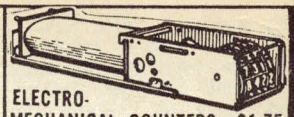
INDUCTION MICROPHONES
Will pick up sound waves from a distance. Has suction cap, long cord and plug for tape recorder, etc. Sticks to wall or case of telephone for recording speech. $1.25. Post 10c.

NIFE BATTERIES—95c
(Pack, despatch and post 20c ea.)
Brand new! Nickel iron, spill-proof, leak-proof cells— Lasts forever, 4 A.H., 1.2 volts. Sizes 3½" x 2½" x 1". Couple together for any voltage— superb for spotlights, lamps, bells, flash equipment, etc. **Set of 10 gives 12 volts 4 A.H. $7.95 (Pack post $1); Set of 5 for 6 volts, 3.95 (Pack post 75c).**



STEREO HEADSETS $8.50,
P. and P. 60c.
Beautifully made and top quality, complete with jack plug. 8 Ohm frequency range 50 to 40,000 cps. sensitivity 118 DB. Usually sells at $17. Fantastic realism of pure stereo sound.

ENGLISH NEON TESTERS
4 for 80c  P 5c.
Voltage tester for 180 to 300v. A.C. Complete with inbuilt resistor and flexible leads with prods. Glows on contact. Also ideal for panels, etc. **Special price for quantity.** Us. 95c ea



ELECTRO-MECHANICAL COUNTERS—$1.75
Post 60c. Ultra modern miniature style, precision made units reading 0-9999. Fitted with 300 ohm. coil. Size overall only 3¾" long x ¾" square. In excellent guaranteed condition. For 12V or 24V use.

BRAND NEW
Famous English Automatic GARRARD RECORD CHANGER — $29.50
P. & P. $1.50. Usually $52
Quality checked by Garrard. automatic record changer and player wired for stereo. Latest 240V 1970 model just released. Takes all size records 45's, 10" and 12"—up to 9 records at a time. Features many refinements: 4 speed laboratory series motor, adjustment for pick-up height, adustment for stylus pressure, etc. Brand new in cartons.

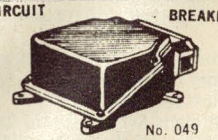


1970 Issue
Famous English "ACOS" complete PICK-UP cartridges with STYLUS. Current issue to fit "Garrard" player. GP 91-2. Mono Crystal Sapphire STEREO COMPATIBLE, usually $6—now $2.50. GP 93-1 stereo Crystal Sapphire, usually $7.55—now only $3.50. GP 93-1 stereo Crystal Diamond, usually $8—now only $4.50. GP 94-1 stereo Ceramic Diamond, usually $9—now only $5.50. Cartridges sold separately, fit nearly all make players.



P & P 25c
MORSE KEYS $1.45
Adjustable, beautifully made for British Army, new.
BUZZERS 1.5V. TO 3V., 65c.

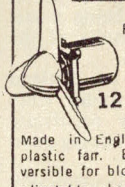
CIRCUIT BREAKERS



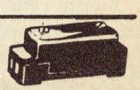
No. 049
Totally enclosed type in diecast housing. Fitted with twin solenoids and adjustable contacts, intended for operation at 12, 24, 32 volts D.C. 85 and 150 amps. Brand new **$5.50 p. and p. 75c.** Specify 85A or 15[illegible]



RECORDING TAPE
P & P 20c.
Top quality Philips type cassettes by famous maker sells at half price. Individually packed in plastic library box. C60 (60 min. recording time), **$1.45**; C90 (90 min. recording time), **$1.95.** C120 (2 hours) $2.75.



P. and P. 30c.
12 VOLT D.C. FAN $2.85
Made in England has 5" 3 blade plastic fan. Bargain. Motor is reversible for blowing or extracting air. adjustable rheostat to control RPM 49c.



Magnetic Relay Switch
Single contact normally open continuously rated at 20 amps., for 12, 24, 32 volts, coil resistance 255 ohms, size 4" x 1¼" x 2" for horns, etc. New **$1.50, p. and p. 30c.**

DIRECT DISPOSALS TRADING COMPANY
AUSTRALIA'S BIGGEST RANGE OF MAIL ORDER BARGAINS
MAIL ORDERS: DIRECT DISPOSALS 36 HELEN ST., VALLEY, BRISBANE 4006
Est. 25 yrs.
Micro switches 10 amp. 125v AC 5 amp. 240v AC. $1.25. P & P 10c.

ROSS HULL MEMORIAL CONTEST

The Federal Contest Committee of the Wireless Institute of Australia invites all Australian and overseas amateur operators and shortwave listeners to participate in the 1970-71 Ross Hull Memorial VHF/UHF Contest, which is held annually to perpetuate the memory of Ross Hull whose interest in VHF/UHF did much to advance the art.

A Perpetual Trophy is awarded annually for competition between members of the Wireless Institute of Australia in Australia and its Territories, inscribed with the name and life work of the man whom it honours. The name of the winning member of the WIA each year is also inscribed on the Trophy. In addition the member will receive a suitably inscribed certificate.

Object: Australian amateur operators will endeavour to contact as many other amateurs in Australia and overseas under the following conditions.

Date of Contest: From 0001 hours Eastern Australian Time, December 12, 1970, to 2359 hours Eastern Australian Time, January 24, 1971.

Duration Any seven calendar days within the dates mentioned above, not necessarily consecutive. These periods are to be at the convenience of the operator. A calendar day is from 0001 hours EAT to 2359 EAT.

RULES

1. There are two divisions, one of 48 hours duration, and one for seven days. In the seven-day division, there are three sections:—
   (a) Transmitting, Open.
   (b) Transmitting, Phone.
   (c) Receiving, Open.

2. All Australian and overseas amateurs may enter the contest whether their stations are fixed, portable or mobile.

3. All amateur VHF/UHF bands may be used, but no cross-band operation is permitted. Operators are cautioned against operating transmitting equipment on more than one frequency at a time, particularly when passing cyphers. Cross-band operation to assist contest working is prohibited.

Such operation will be grounds for disqualification. Cross mode contacts will be permitted.

4. Amateurs may enter for any of the transmitting sections. The seven-day section winner is not eligible for the 48-hour award.

5. Only one contact per band per station is allowed each calendar day.

6. Only one licensed amateur is permitted to operate any one station under the owner's call sign. Should two or more operate any particular station, each will be considered a contestant and must submit a separate log under his own call sign.

7. Entrants must operate within the terms of their licences.

8. Cyphers: Before points may be claimed for a contact, serial numbers must be exchanged. The serial numbers of five or six figures will be made up of the RS (telephony) or RST (CW) report plus three figures commencing in the range of 001 to 999 for the first contact, and will then increase in value by one for each successive contact. When a contestant reaches 999 he will then commence again with 001.

9. Entries must be set out as shown in the example, using only one side of the paper. Entries must be postmarked not later than February 8, 1971, and clearly marked "Ross Hull Contest" and addressed to: Federal Contest Manager, Box N1002, GPO, Perth, WA, 6001.

10. Scoring for all sections will be based on the attached table. Approximate distances must be shown in the log entry as shown in the example. Failure to make this entry will invalidate the particular claim. Some typical distances are given in the attached table. Operation via active repeaters or translators is not allowed for scoring purposes.

11. Logs: All logs shall be set out as in the example and in addition will carry a summary sheet showing the following information:

Name .....
Address .....
Call sign .....
Division .....
Claimed Score .....
Operating Dates ..... (7 calendar days)
Highest score over a 48-hour period was
..... points.
.....Operating period:
From .....hrs, EAT.
To .....hrs. EAT.

Declaration: I hereby certify that I have operated in accordance with the conditions of my licence and abided by the rules of the contest.

Signed .....
Dated .....

12. Entrants not abiding by the rules of this contest will be disqualified.

13. The ruling of the Federal Contest Committee of the WIA will be final. No dispute will be entered into.

14. Awards: Certificates will be awarded to the winners of each section in each VK and overseas call area. The VK contestant who returns the highest score in the transmitting section and who is a financial member of the WIA, will have his name inscribed on the trophy which will be held by his division for the prescribed period. A certificate will be awarded to the contestant who shall not be the trophy winner and who returns the highest scoring log covering a period of any consecutive 48 hours.

Also, certificates will be awarded for operating in the Ross Hull Contest and breaking any Australian VHF/UHF distance record.

RECEIVING SECTION:

1. Shortwave Listeners in Australia and overseas may enter for the contest, but no transmitting station may enter.

2. Contest times and logging of stations on each band are as for the transmitting sections. However, there is no 48-hour sub-section.

3. To count for points, logs will take the same form as for transmitting sections, but will omit the serial number received. Logs must show the call sign of the station heard (not the station worked), the serial number sent by it, and the call sign of the station being worked.

Scoring will be on the same basis as for transmitting stations, ie, on the distance between the listener's station and the station heard. See example given. It is not sufficient to log a station calling "CQ".

4. A station heard may be logged only once per calendar day on each band for scoring purposes.

5. Awards: Certificates will be awarded to the highest scorer in VK and overseas countries. ■

EXAMPLE OF TRANSMITTING LOG (Brisbane Station)

Date/Time E.A.T.	Band MHz	Power Emission	Call Sign	RST/No Sent	RST/No Rec'd	Dist. Miles	Claimed Points
24th Dec. 0110	52	A3(a), 50W.	VK7ZAI	59001	59004	1110	15
0110	52	A3(a), 50W.	VK4NG	58002	57051	330	20
0230	144	A3, 150W.	VK5ZK	56003	55043	990	35
0235	144	A3, 150W.	VK3ZJQ	45004	46021	850	35

SCORING TABLE

Distance	52MHz	144MHz	420MHz	576MHz	Higher
Up to 25 miles	1	1	2	5	10
26 to 50 miles	1	1	5	10	25
51 to 100 miles	5	5	15	30	50
101 to 200 miles	10	10	25	50	100
201 to 300 miles	25	15	50	150	250
301 to 500 miles	20	25	100	250	300
501 to 1050 miles	10	35	200	300	350
1051 to 1500 miles	15	100	250	350	400
1501 to 2500 miles	25	125	300	450	500
2501 to 3500 miles	35	200	400	500	600
3501 to 5000 miles	50	300	450	550	650
5001 miles and over	100	400	500	600	700

DISTANCE TABLE

	SYDNEY	CANBERRA	BRISBANE	MELBOURNE	HOBART	ADELAIDE	N. ZEAL.	DARWIN	PERTH
SYDNEY	0	160	460	460	660	710	1300-1500	1950	2040
CANBERRA	160	0	600	290	530	670	1300-1500	1930	1940
BRISBANE	460	600	0	850	1110	990	1500-1700	1790	2240
MELBOURNE	460	290	860	0	400	400	1500-1700	1930	1720
HOBART	660	530	1110	400	0	710	1300-1500	2280	1880
ADELAIDE	710	670	990	400	710	0	1900-2100	1620	1330
NEW ZEALAND	1300-1500	1300-1500	1500-1700	1500-1700	1300-1500	1900-2100	0	2550	3000-3200
DARWIN	1950	1930	1790	1930	2280	1620	2550	0	1650
PERTH	2040	1940	2240	1720	1880	1330	3000-3200	1650	0

TUDOR RADIO

L. E. CHAPMAN

ESTABLISHED 1940

103 ENMORE ROAD, ENMORE, NSW 2042.

PHONE 51 1011

NEW POSTAGE RATES PLEASE ADD EXTRA

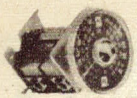
Knobs long shaft, push on. Dozen **$1.20**
Knobs for concentric shaft. Dozen **$1.20**
250 mixed screws. BA, Whit., self-tapper bolts, nuts, etc. **$1** bag plus **25c** post.
Crystal microphones, good quality, ideal tape recorders, etc. **$2.80.**
Transistor speaker transformers, single ended, 5 watt. **$1.50.**
Pick up shielded Wire .. **20 cents** yard.

SPEAKERS

MSP 8-inch dual cone **$7.50**
M.S.P. 12 inch dual cone **$9.50**
MSP 7 x 5 15 ohm **$4.00**
SPEAKER 3¼ ohm 4 inch **$2.50**; 6 inch M.S.P. Dual cone 6 or 8 ohm **$6.50**
Rola 6 x 4 15 ohm **$3.50**
Rola 5 x 3 15 or 27 ohm **$2.50**
MSP 6 x 9 15 ohm **$5.00**
3-inch single cone 15 ohm **$4.20**
MSP 12-inch 8 ohm **$8.50**
MSP 8-inch dual cone, 8 ohm .. **$6.50**
MSP 3-inch 15 ohm **$3.00**
National 8-inch built-in tweeter and crossover network **$13.00**
MSP Electro Dynamic, 8in, **$4**, or 6 x 9.
MSP 6 x 2 15 ohm, **$3.**
MSP 6 x 4 15 ohm, **$3.50.**
Peak 6o7 16 cm Hi-Fi Cone Dual Tone 6in **$7.50**
MSP 20-watt radial beam 12pqb **$21.50**
2 gang tuning condenser **$1.00**
Peak H50 horn type tweeter .. **$12**
MSP 8-inch speakers **$4**
Pioneer 15-inch 8 ohm 60 watt .. **$40**
M.S.P. 3 inch tweeter. **$3.50**
Sharp 12 inch TV cabinets. .. **$17.50**
Sharp TV Picture Tubes 12 inch. **$29.50**
Sharp Yokes Fly Back Transformers.
Pots, Diodes, Transistors, Speakers, Tuners, etc.

Speaker Cabinets cut for 12in and tweeter **$15**
Reconditioned record - changers, 3-speed **$9.50**
M.S.P. dual cone 12 UA 8 or 15 ohm **$17.50**

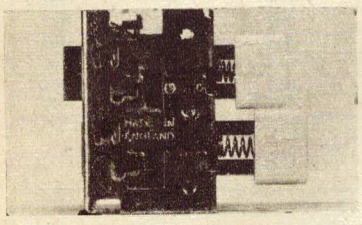
TRANSISTORS 2N1110 .. .. each **40c**
SILICON DIODES EM484 .. .. **75c**
DIODES OA79 .. .. **40c**
DIODES HR15 .. .. **50c**
DIODES OA81 .. .. **40c**



SMALL 2-GANG TUNING CONDENSERS

Complete with direct drive scale **$1.75**

Tapes, top brand, 1,800ft **$3.20**
Pots 10K dual-ganged log **50c**



English push-button on/off switches, 75c each. Pack and post 10c.

MIXED RESISTORS, 3.5 and 10 WATT I.R.C., **25 for $2.**

TRANSISTOR AMPLIFIERS. Peak stereo in oiled teak cabinets 3¼ watts per channel **$39**

Curled expanding shielded wire approx. 7 yards **$1.50**
Miniature valve sockets 7 and 9 pin **15 cents** each.
Speaker Crossover network Condensers 2 MFD — **60 cents.**
Philips IFT's 455KC ..... **75c** each
Aerial and oscillator coils .. **50c** each

Transistor IFs, medium size, **75c** each



PHILIPS GRAMOPHONE MOTOR, $5.
6 volts, 4-speed.

Speaker transformers 15,000 and 25,000 to 3 ohms 6 watts ....**$1.50** each
5,000 to 3 and 15 ohms .. **$1.25** each

POTS

1 meg. 2 pole switch **95c**
100K switch 2 pole log **50c**
10K carbon or wire wound **50c**
1.5 linear **50c**
½meg log **50c**
250 Dual Ganged Log Pots. .. **$1.25**
20K switch **75c**
10K switch **75c**
1.5 dual ganged log **$1.00**
2 meg Dual Ganged Lin. **$1.25**
Dual 3 meg ganged log **$1.00**
500 ohm WW **50c**
50K Lin **50c**
15K T5K **50c**
Dual ganged concentric
2 meg log 2 pol **$1.25**
7.500 log **50c**
200K 1in **50c**
250K log **50c**
2K 1in slotted **25c**
50 ohm **50c**
250K 1in **50c**
100K 1in **50c**
½meg 1in **50c**
50 log switch **75c**
1 meg dual ganged log **$1.25**
2 meg 1in **50c**

HEAT SINKS, 4 inch x 2 x ¾, **$1** each

9-PIN VALVE SOCKETS .. **15c** each

BELLWIRE .. .. **2c** yard

50-OHM POTS, ideal for Ext. Speakers, **50c** each



STEREO AMPLIFIER KIT SETS

TU 10, 3.5 watt per channel .. **$19**
TU 11, 3.5 watt per channel, has facilities for tape and microphone channels **$23**
TU 12, 5 watt per channel .. **$22.00**
TU 13, 5 watt per channel, with TU 11 facilities **$27**
Each kit set includes valves and all components. Front face plate, if required, **$1** extra.
Single stage amplifier kit set:
5 watt per channel **$22.00**
Transistor ear plugs .. .. 3 for **$1.00**
Tag strips, mixed types .. Dozen, **60c**
Switches, oak 4 position .. **50c** each
2 position .. .. **40c** each

3¼ AMP. FUSES $3.50 100.

Din Plugs, 3 or 5 pin .. .. 50c each.

ELECTROS:

3 in one		
50	250	415
8	350	415
10	350	415

75 cents each.

SOLID STATE STEREO TAPE RECORDER

Oki 300 10 transistor **$130** pack and post $1.50.

CAR RADIO. Solid State Push Button 8 .. .. **$55**

B.S.R. 4-SPEED GRAMOPHONE MOTOR AND PICK-UP $12.50.
Pack and Post 60 cents.

METAL RECTIFIER, 150 watt, ½ amp, **$1 each.**

TV aerial lead in .. .. .. **10c** yard
Tuning Condensers, 2 gang or 3 gang —**$1** each.

2 amp fuses .. .. .. **$3.50** per 100
Transistor plastic outer case, **50c** each
Stereo pick-up arms, with Xtal, **$6.00** ea.
Metal rectifiers for battery and electric portables .. .. **50c** each, post **10c**
Pilot lamp holders .. .. **60c** per doz.
100 Mixed Knobs including TV channel changers **$10.00**
3¼ amp Fuses .. .. .. **$3.50** per 100
10 for **50c**

AMPLIFIERS SOLID STATE

8 watts R.M.S. per Channel .. **$65.00**

STEREOGRAM CHASSIS

7 valve microphone and tape recorder connections **$50.00**

Morganite and IRC resistors. At least 33 values. Suit transistors, radios, TV etc., **$2.00** per 100. Pack and post, **25c.**
100 mixed condensers, micas, ceramics, tubular. Fresh stock.
$2.00. Pack and post **25c.**
50 + 24, 350 vw + 100 mf 25 vw, **75c** each
30, 30mf 300 vw 350vp .. **75c** each
Many others. Invaluable for service.

2 meg. Lin Pots **50c**
R.C.A. 7 INCH TAPE SPOOLS 75 cents



SPEAKER CABINET, 16 x 10 x 8½, COMPLETE WITH BACK SUIT 6in or 8in SPEAKER, **$10**

Pots .25 meglog **50c**
Dual concentric.

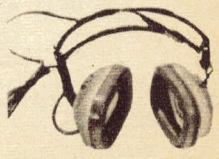
PILOT LIGHTS, Plug in .. **10 cents**

SWITCH WAFERS
20 cents each.

Vibrators, 6 or 12-volt synchronous **$3.50**
4-volt sync. **$2.50**
24-volt sync. **$2.50**
32-volt now sync. **$3.50**
Electros 500 MFP 10 v.w. Vp12 . **40c**

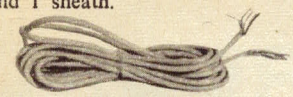
GENERAL TV CABINET, 9 inch, **$12**

M.S.P. E.H.T. TRANSFORMERS, 40773 BK9, **$4.50.**



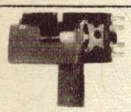
Stereo Head Phones, good quality, **$7.75**

5½ yards **MULTI-STRAND CABLE** 5 and 1 sheath.

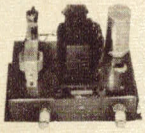


MINI CABLE 4 STRAND ONE SHIELDED, lots of uses including microphones, etc. .. .. .. **10c** yard

CABLE, 9 STRAND, including 1 shield and OCTAL PLUG LENGTH, 6 yards, **$2**

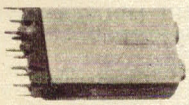


B.S.R. CERAMIC CARTRIDGE STEREO **$5**



AMPLIFIERS, 3½ watts, size 7½ x 5 x 4½ **$14**

9-INCH PICTURE TUBES. General 9UPE **$20**



TV IF COILS, IDEAL FOR COIL FORMERS .. .. **$1 dozen**



SPEAKER CABINETS

13 x 6¾" **$5.00**
10 x 6 x 4½ **$3.50**
12½ x 8¾ x 6 .. .. **$5.00**

STEREOGRAM CHASSIS, 8-valve push-pull, famous make **$75**



MICROPHONES ACOS CRYSTAL $2.80.



TRANSISTOR AMPLIFIER AND TUNER

AMP size 3½ x 1½ x 1¼ tuner 3¼ x 1¾ x ½ famous-make 6-valve stereogram chassis, famous make **$35**

Lenco transcription motor and pick-up arm traded in. Perfect order .. **$35**

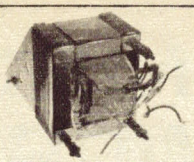
SHARP 12-INCH TV CABINETS, $20



Car radio push button tuner .. **$4.50**
Pack and post 30c, Interstate 60c.

Transistor miniature speaker transformers .. .. **50c** each
Transistor speaker transformers 3.85 to 3.50 C.T. **$1.00**
Portable TV car Cradle **$4.00**
Portable TV Aerials **$4.50**

DIAL DRUMS, 5 inch, 3¼, 3¾, **50c ea.**



TV POWER TRANSFORMER, $8. 300 mil. Two 6.3 windings, 200 volt secondary for Bridge Type Rectifier.

50 M CHOKE $1.
Pack and Post 30 cents, Interstate 60 cents.
300M Choke $2.50.





SPEAKER CABINET, 9½ x 9½ x 5½, **$4.**
Suit 8in Speaker. or 6in.

M.S.P. MODEL 2MBC TWEETER SPEAKER. RANGE 5KHZ TO 20KHZ. NEW RELEASE, $4.50.

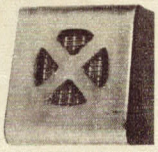


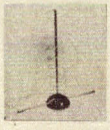
BATTERY SAVER, 6 or 9 volt DC 100MA **$8.50;** 300MA, **$10.00.**



SPEAKER ENCLOSURE, complete with 8in M.S.P. dual-cone speaker, 8 or 15 ohm **$17.50**
Cabinet without speaker **$10**
Cabinet size 16 x 10 x 8.

TRANSISTOR EXTENSION CABINETS
Complete with 5-inch speaker and lead. **$3.50.**





INDOOR TV AERIALS $1.50.
Pack and Post 25c.

STEREO AMPLIFIER 10 watts per channel solid state AT6 Garrard record changer, oiled teak cabinet, complete unit **$125**
Same unit with Garrard 3000 changer, **$115.**

Pots 1,200 wire-wound **50c**

POTS

1 meg. Dual Ganged Log **$1.25**
1 meg. Dual Ganged Lin **$1.25**
½ meg. Switch Pot double pole log **75c**

6 VOLT PILOT LIGHT, screw in .. .. **ea. 10c**

RESIN CORE SOLDER 5 yards 75c

Electrolytic Capacitors
8MFD 450 WK 550 surge. **4 for $1.00**

SHARP FLYBACK TRANSFORMERS, 8ft 604 .. .. **$7 each**

SHARP TUNERS for 12 inch, **$19** each

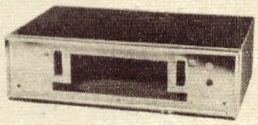
SHARP TRANSFORMER 9T7171, $2

SHARP DEFLECTION COIL DC179. **$18**

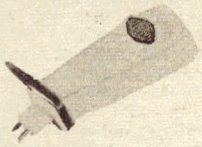
SHARP SPEAKERS, 8 ohm 1107P 244 **$4**

LOT OF OTHER PARTS FOR SHARP INCLUDING DIODES, POTS, KNOBS, TRANSFORMERS, COILS, ETC.

STEREO SPEAKER LEAD, 10 cents yd.



DISCATRON CABINETS $2 EACH.

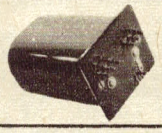


GARRARD PLUG IN STEREO CARTRIDGE, $6.00

SOLID STATE AMPLIFIER IN OILED TEAK CABINET, COMPLETE WITH MA70 B.S.R. RECORD-CHANGER, $85.

Speaker Cabinets size 10 x 7 x 4½. **$3.50**

SPEAKER ENCLOSURES FOR 12in SPEAKERS, SOLID OILED TEAK. $27.50 each.



600 ohm to 600 multi tap line output transformers **$1**



B.S.R. UA5c 4-speed record-changer, **$21.50**

American or Japanese 2 pin power plugs rubber complete with 2½ yards flex **50 cents.** Pack and post 10 cents.

MICROPHONES MAGNETIC OR CRYSTAL **$1.75**

SPEAKER CABINET, 16 x 10 x 8, complete with 6 inch M.S.P. dual cone Speaker tweeter, 3 inch and Crossover network **$18.75**

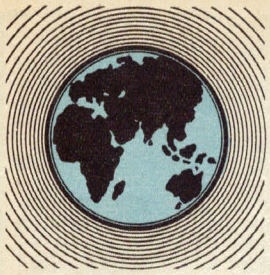
B.S.R. tape decks, 4-track, 3-speed **$40**

Speaker Plugs, 4 pin .. .. .. **15 cents**
Speaker Sockets .. .. **15 cents**

TRANSISTORS

2N1110 .. .. **40c**

ELECTROS 20 MFD 200 P.V. .. 20c



LISTENING AROUND THE WORLD

New Australasian service from Sweden

Radio Sweden, Stockholm, has initiated a daily hour-long program to serve listeners in Australia and New Zealand, in English as well as Swedish. The direct transmission is received at good strength.

by Arthur Cushen

Since November 1, Radio Sweden in Stockholm has been broadcasting a 60-minute special transmission to Australia and New Zealand, which is on the air 0515-0615GMT. The first 30 minutes is in English and the second section is in Swedish. The frequency for Australia and New Zealand is 11895KHz, while at the same time the program is beamed to South Asia on 11780KHz.

The writer was asked to inaugurate the new transmission on November 1, and so a short tape-recorded message of greetings to listeners in this area was sent to Stockholm for the initial broadcast. Radio Sweden made this request as the writer had been instrumental in getting this transmission under way, having raised the matter during discussions in Stockholm last year. Radio Sweden changes its programs at 1200GMT, so this transmission to Australia and New Zealand will carry the programs of the previous day. This means that the DX Session will be broadcast on Wednesday at 0530GMT, though it is first broadcast on Tuesday at 1245GMT.

CBC USING 250KW

The Canadian Broadcasting Corporation's International Service, with its transmitters at Sackville, New Brunswick, is installing five more 250KW transmitters. During the November-March frequency period the first two of these transmitters are scheduled to test, with programs beamed to Europe. The aerial systems are expected to be completed early 1972, and in the meantime transmissions to other parts of the world will be carried on the existing three 50KW units. The schedule for the test transmissions is as follows:

GMT	KHz
1230-2000	11850
1200-1600	15363
1600-2000	15375

During the summer months Radio Canada will continue to use 9630 and 5970KHz for the service to Australia and New Zealand, and operate 0830-0930GMT.

INDONESIAN AIR FORCE

The Indonesian Air Force station at Djarkarta, Radio Angkatan Udara, has recently been received by Ray Crawford of Lake Colleridge, NZ on the new frequency of 11320KHz. The station is heard around 1200GMT with request music and all announcements are in Indonesian.

For many years the broadcasts of Radio Angkatan Udara have been heard on 11905KHz, and the station was frequently heard opening its daily program with the sound of an aircraft in flight. The station is still using this channel, though it is reported at times on 11940KHz, and this new off-band frequency gives much better reception in our area.

MALI USING 7110KHz

A new high-powered transmitter of Radio Mali, at Bamako, has been received on 7110KHz at good level. Our reception has been from 0645GMT, when a program of African music is broadcast; at 0700GMT a full announcement in French is given, followed by news in that language. The news in French concludes at 0710 and then follows further African music.

Bob Padula, in Melbourne, reports a similar listening pattern, with fadeout about 0745GMT. It is understood that the transmitter was a gift from the Chinese Government. It has been also reported by listeners in Europe. The station address is PO Box 171, Bamako, Mali. It is understood that Mali is to operate four 50KW transmitters, and this appears to be the first one to go into operation.

ZYR206 ON 15415KHz

The Brazilian station ZYR206, operated by the Radio Club of Ribeirao Preto, has been heard in New Zealand with a new sign off time of 0405GMT. According to the World Radio Handbook the station is scheduled to leave the air at 0300GMT. Our reception has been later than this. The station has typical Brazilian music, with frequent announcements and commercials. The announcements are often difficult to distinguish because the station generally appears to use an echo effect on its recorded spoken jingles and station breaks. Though reception is fairly good, there is adjacent channel interference from AFRS on 15410 and the BBC on 15420KHz.

The address of the station is PO Box 18, Ribeirao Preto S.P., Brazil.

BROADCASTS FROM NIGERIA

Radio Nigeria, in Lagos, is using some new frequencies for its International Service. A schedule received by Sam Dellit, of Brisbane, includes the following:

GMT	KHz
0530-0730	15185
0530-0730	15200
1330-1430	15200
1430-1530	15200
1530-1700	15200
1800-1930	15120
1930-2030	15120
1330-1430	11770
1530-1700	11770
1800-1930	11770
1930-2030	11770
0530-0730	7275

BAGHDAD USES 9745KHz

Radio Baghdad, Iraq, in its service to Europe 1800-2200GMT, is now using a third test channel in the 31M band. The station has been noticed on 9745KHz at good level at 2110GMT, when the service in French begins. Of the three frequencies, this is the best received here.

Baghdad stopped the use of one of its 49M band channels, some weeks ago, and moved to 9610KHz, but this frequency did not provide good reception and so a further move was made to 9635KHz. Bob Padula, of Melbourne, reports that the service on Sunday and Thursday is still carried on 9635KHz, and on other days the new channel of 9745KHz is in operation. The programs include English at 1930, German at 2020 and French at 2110GMT.

On its other channel of 9635KHz Radio Baghdad does not provide such good reception, and from our own observations the major trouble is interference from Prague on 9630KHz.

Radio Baghdad verifies reception with a card showing a map of Iraq. They transmit 37 hours daily with programs in nine languages, Arabic, Kurdish, Turkish, Turcoman, Persian, Urdu, English, French and German. Medium-wave programs are carried on 1350, 908 and 764KHz, while short-wave transmissions cover from 19 to 92M bands.

VERIFICATIONS RECEIVED

KENYA: An airletter verification has come to hand from the Voice of Kenya, Nairobi. This has colour photos of the broadcasting house and the transmitting station. The following short-wave frequencies are used for the various services. 4915 or 7140, 9665, 11765, 4885 or 7240, 4804 or 7125, 4855 or 7295, 4950 or 7150, 4934. The

OSLO'S NEW SCHEDULE

Radio Oslo, Norway, has a new schedule now in effect, and this includes the use of new frequencies. The transmissions are daily in Norwegian, but on Sunday the first half-hour is in English. The full schedule is:

GMT	KHz	Area
0700-0830	17795, 21655, 21730, 25730, 25900	Australia, New Zealand
1100-1230	6130, 21655, 21730, 25730, 25900	Australia, New Zealand
1300-1430	9610, 21655, 21730, 25730, 25900	Asia
1500-1630	17795, 21655, 21730, 25730, 25900	Africa
1700-1830	11850, 21655, 21730, 25730, 25900	Africa
1900-2030	9610, 11850, 17795, 21655	Europe
2100-2230	9610, 11850, 11860	South America
2300-0030	9610, 9645, 11850	Eastern North America
0100-0230	9610, 9645, 9550	Eastern North America
0300-0430	9610, 9645, 9550	Central North America
0500-0630	9550, 9645, 17795	Western North America

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, New Zealand. All times are GMT. Add 8 hours for WAST, 10 for EAST, and 12 hours for NZ.

verification was signed by the Engineering Division, Voice of Kenya, PO Box 30456, Nairobi.

SAUDI ARABIA: The Saudi Arabia Broadcasting Service has recently verified Heather McIntosh, Invercargill, NZ, with a card posted in Munich, Germany. This seems to be frequently the point of mailing, rather than from the studios at Riyadh. The verification was signed by Werner Storg, and the station address was given as PO Box 37, Riyadh. Another report gives the box number as 2476, and in this case the report was verified also on a card mailed from Munich. The World Radio Handbook lists no postal address, but gives it only as the Saudi Arabian Broadcasting Service of the Kingdom of Saudi Arabia, Riyadh.

SYRIA: A verification from Damascus is seldom reported by readers, and it seems the station verifies reports only spasmodically. A report in "Contact" shows that an English listener received a verification by registered airmail five weeks after he sent his report. The verification was signed by Atieh El Joudeh, the Director General of Broadcasting and Television, Damascus.

NEW STATIONS FOR INDIA

An increase in power for many stations, as well as new transmitters to be sited in remote areas, are included in the fourth plan for the strengthening of the All India Radio medium-wave network.

"Sweden Calling DXers" reports that a very high-power transmitter for Rajkot, built in Yugoslavia, has arrived, and is expected in service late next year. High-power stations are also planned for Simla, Jodhpur, Najibabad, Bareilly, Jammu, Srinagar, and Imphal. Low-power transmitters are planned for Tawang, Niasa, Aijal, Lungle, and Uttarkashi. The high-power medium-wave station at Bhuj is already in use, while another one at Leh is under construction.

XERH EXTENDS SCHEDULE

Station XERH, Mexico, on 11880KHz has extended its schedule to sign off at 0800GMT, and reception is excellent in New Zealand for the last hour of broadcasting. In the past the call of XERH has been assigned to this frequency, but in recent months the medium-wave call of XERH has been used on both 1500KHz and 11880KHz. Typical Spanish music is featured, and a station jingle announcing that XERH is number one for music in Mexico is played between each item. The slogan "Radio Diffusion Tricolor" is given when the station closes, as well as its location, Mexico City. Our verification from XEHH some years ago was the smallest card we ever received, as all the details were printed on a visiting card.

DELHI ON 15190KHz

All India Radio at Delhi, in its service opening at 1000GMT, has programs for North East Asia, Australia and New Zealand. Reception of the program is fair on the new frequency of 15190KHz throughout the period. According to the opening announcement the transmission to North-East Asia is on 15105, 17380 and 21555KHz. To Australia and New Zealand they use 17725, 15205, 11935 and 11775KHz. Most of these channels suffer some degree of interference, and the off-band frequency of 17380KHz runs into interverence from communications channels.

POPULARITY POLL

The regular popularity poll to find the most popular short-wave station in the world is now being conducted by the International Short-Wave Club in London. Readers can send a list of their five favourite short-wave stations, numbered in order of preference, with a short comment of about 30 words giving the reasons why they chose their number one station.

Entries should be at the International Short-Wave Club headquarters, 100 Adam Garden Estate, London SE16, by the end of December.

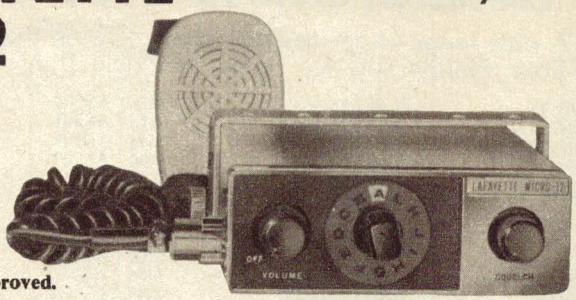
The voting in recent years has shown that Radio Australia, for some years the most popular station, has been displaced

LAFAYETTE 27 MHZ Two-Way Radio

Micro-12

$139.50

(Crystals Extra)

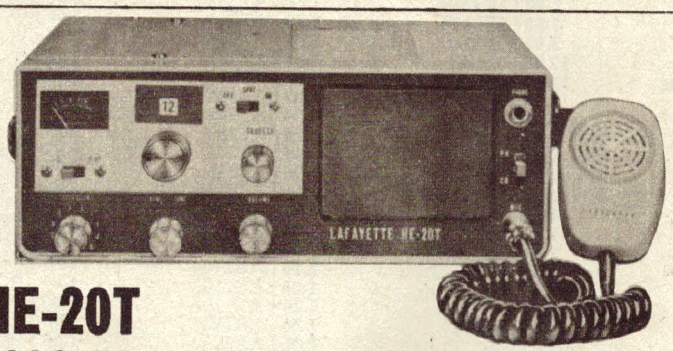


P.M.G. Type Approved. (Licence Required).

5-Watts 12 Channels Only 5" W x 1¾" H x 7½" D

- Operates on 12 Volts DC Negative Ground (Easily convertible to Positive Ground).
- Highly Sensitive Receiver with R.F. Stage.
- Variable Squelch for Silent Standby.
- Automatic Noise Limiting.
- Mechanical I.F. Filter on 455 KHz for High Selectivity.
- 0.7 Amp. Drain on Transmit.
- Zener Diode Voltage Regulation.

The Lafayette Micro-12 embodies exceptional performance with compact size. Incorporates the design features which have made Lafayette world leaders in 27 MHz Two-Way Radio. Supplied complete with microphone, power leads and bracket.



HE-20T

$169.50 (Crystals Extra)

P.M.G. Type Approved (Licence Required).

5-Watts 12 Channels Plus Tuneable Receiver

- 12 Volts DC Negative or Positive Ground and 117 Volts AC (also available for 240 Volts AC).
- Crystal Controlled Transmit and Receive.
- 455 KHz Mechanical Filter.
- T.V.I. Trap and Pi-Network Output.
- May also be used as P.A. Amplifier with External Speaker.
- Automatic Noise Limiting.
- Size 11 3/8inW x 4 3/8inH x 8¼inD.

.5 Watt Walkie-Talkie



- Metal Case.
- Switchable 3-channel Operation.
- Battery Meter.
- Adjustable Squelch
- Noise Limiter.
- Range Boost for Extended Talk Power.
- Supplied with 27.240 MHz Crystals.

HA-305, $57.25 Each.
P.M.G. Type Approved (Licence Required).

1 Watt Walkie-Talkie



- 3-Channel Operation.
- Range Boost for Maximum Range.
- Sturdy Metal Case.
- Battery Meter.
- Socket for External Power Supply.
- Noise Limiter.
- Supplied with 27.240 MHz Crystals.

HA-310, $72.50 each.
P.M.G. Type Approved (Licence Required).

ACCESSORIES—A large range of 27 MHz accessories is available. Crystals, Antennas, Coaxial Cable, Connectors, etc.

LAFAYETTE ELECTRONICS

Division of Electron Tube Distributors Pty. Ltd.

94 HIGH STREET, ST. KILDA, VIC., 3182. Phone 94 6036

QUEENSLAND STOCKIST: CUSTOM SCIENTIFIC ELECTRONICS PTY. LTD., 48 Annerley Road, Woolloongabba, Brisbane. 91 6433.

Trade Representatives

S.A. Tyquin Distributors Pty. Ltd., 13 Deacon Ave., Richmond. Phone 57 8153
W.A. Athol M. Hill Pty. Ltd., 613-615 Wellington St., Perth. Phone 21 7861.

IMPORTED COMPONENTS—Offer the largest range of Semi-Conductors available in this country.

A wide range of devices from the following manufacturers: AWV, Fairchild, G.E., I.T.T., Motor-Rola, Philips, R.C.A., Texas, available from stock. Please enquire for any not shown.

2N174	5.46	2N3643	1.26	AS300	0.77	AY8109 (AY8104)	3.00	OA10		0.87
2N251A	4.10	2N3644	1.13	AS301	0.80	AY8112	6.75	OA47		0.65
2N270	1.07	2N3645	1.44	AS306	0.81	AY8113	6.08	OA90		0.32
2N277	3.77	2N3646	0.90	AS307	0.81	AY8114	4.72	OA91		0.33
2N278	4.32	2N3691	0.85	AS308	0.81	AY8115	2.25	OA95		0.39
2N301	2.66	2N3692	0.90	AS310	0.81	AY8116	1.80	OA202		0.75
2N301-A	3.84	2N3693	0.86	AS311	0.77	AY8117	9.15	OA670		1.68
2N384	2.88	2N3694	0.90	AS312	0.77	AY8135	5.40	OA675		0.60
2N388A	2.36	2N3702	1.01	AS313	0.81	AZ069	0.51	OC20		6.38
2N394A	2.13	2N3703	0.96	ASY73	2.12	BA100	0.44	OC22		3.03
2N404	1.50	2N3704	1.77	ASY76	2.10	BA102	1.46	OC23		3.80
2N404-A	1.74	2N3705	1.73	ASY77	1.83	BA114	0.39	OC24		3.45
2N406	1.01	2N3706	1.65	ASY80	1.68	BA122	0.53	OC44N		1.11
2N417	1.77	2N3707	1.14	ASZ15	2.81	BC107	0.83	OC45N		1.11
2N441	3.08	2N3731	3.17	ASZ16	3.03	BC108	0.76	OC74		0.96
2N443	3.51	2N3819	1.77	ASZ17	2.60	BC109	0.91	2-OC74N		1.92
2N456A	4.20	2N3826	1.68	ASZ18	2.91	BC147	0.76	OC75N		1.49
2N458A	6.12	2N3827	1.74	ASZ20	0.98	BC148	0.68	OC140		1.95
2N489B	14.76	2N4036	2.01	ASZ21	2.16	BC149	0.79	OC141		2.60
2N591	1.05	2N4121	1.04	AT316	0.68	BC157	0.89	OC201		3.78
2N649	2.12	2N4250	1.17	AT318	0.68	BC158	0.76	OC202		3.68
2N657	4.79	2N4354	1.28	AT319	0.69	BC159	0.89	OC915		2.21
2N696	1.13	2N4355	1.65	AT321	0.69	BC177	0.91	SD55		0.63
2N706A	1.08	2N4356	1.65	AT322	0.63	BC178	0.84	SE1001		1.13
2N929	1.50	2N4360	1.58	AT323	0.68	BC179	0.92	SE1002		1.20
2N930	1.80	2SB474	3.30	AT324	0.68	BC186	0.79	SE1010		1.80
2N1038	3.92	3N140	2.55	AT325	0.83	BCY10	2.59	SE2001		0.98
2N1046	17.94	3N141	2.34	AT331	1.02	BCY11	3.24	SE2002		1.20
2N1073B	11.60	AB1101	1.20	AT337	0.75	BCY12	3.14	SE3030	(AY8112)	6.75
2N1100	7.23	AB1102	0.87	AT338	1.50	BCY39	5.19	SE3031	(AY8112)	6.75
2N1132	2.25	AB1136	0.54	AT341	0.69	BCY71	2.05	SE3032	(AY8113)	6.75
2N1302	1.01	AC107	2.28	AT350	1.14	BCZ10	1.95	SE3033	(AY8114)	4.72
2N1303	1.01	AC125	0.96	AT355	0.98	BCZ11	2.37	SE3035	(AY8114)	4.72
2N1304	1.13	AC126	0.96	AT356	0.75	BCZ12	2.16	SE4001		1.05
2N1305	1.13	AC127	1.16	AT1138	2.66	BDY20	3.51	SE4002		1.13
2N1306	1.32	AC127/128	2.21	AT1138A	3.84	BDY38	2.59	SE4010		1.20
2N1307	1.32	AC127/132	2.16	AX1101	1.53	BF115	87c	SE5001		2.10
2N1308	1.64	AC128	1.05	AX1103	1.70	BF145	64c	SE5002		2.10
2N1309	1.64	2AC128	2.10	AX1104	1.86	BF167	1.08	SE5003		2.48
2N1540	4.08	AC132	1.05	AX1107	1.37	BF173	1.15	SE5020		4.05
2N1546	5.96	AC172	1.20	AX1108	1.86	BF177	1.63	SE5023		3.15
2N1563	5.45	AC187	1.20	AX1127	1.50	BF178	1.80	SE5025		1.35
2N1639	1.02	AC187/188	2.36	AX1130	1.50	BF179	2.04	SE6001		0.75
2N1671-A	5.16	AC188	1.16	AX1131	1.70	BF180	1.80	SE6002		0.90
2N1671-B	5.73	2AC188	2.31	AX1132	1.50	BF184	0.72	SE7001		4.05
2N1908	24.47	AD139	2.52	AX1142	1.20	BF185	0.72	SE7002		3.60
2N2101	2.55	2-AD139	5.04	AX1143	1.58	BF194	0.67	SE7010		4.05
2N2147	2.24	AD149	2.45	AX1144	1.44	BF200	1.32	SE7020		5.40
2N2148	1.68	2-AD149	4.89	AX1166	1.37	BFY51	5.19	SE8001		4.05
2N2188	2.79	AD161/162	4.32	AX1284	1.41	BSX19	2.16	SE8002		4.50
2N2189	3.57	AD4004	0.63	AX1285	1.28	BSY11	8.43	ST2		1.47
2N2270	2.64	AF114N	1.08	AX1298	1.37	BY126/200	0.48	T1C31		4.44
2N2613	1.83	AF115N	1.08	AX1304	1.44	BY126/400	0.56	T1C44		1.68
2N2646	2.19	AF116N	0.93	AX1305	1.49	BY126/500	0.63	T1C45		1.92
2N2996	3.15	AF117N	0.93	AY1101	0.68	BY127/800	0.78	TIC46		2.03
2N3005	5.32	AF118	2.52	AY1102	1.04	BZX70 Series	1.95	T1C47		2.27
2N3053	2.48	AF185	2.40	AY1103	1.35	BZY88 C3V3 to C11	0.83	T1S37		2.36
2N3054	2.63	AF186	4.46	AY1104	1.35	BZY88 C12 to C30	0.98	T1S43		2.36
2N3055	2.63	AN1101	0.60	AY1108	1.65	BZY94 (Obsolete)	0.98	T1S68	Pair	17.40
2N3525	3.17	AN1102	0.68	AY1110	1.50	BZY95 Series	2.16	TIS88		2.63
2N3563	0.90	AN1103	0.60	AY1112	0.69	BZY96 Series	2.16	40250		1.78
2N3564	1.08	AN1104	0.60	AY1113	0.69	BZZ14 to 29	2.37	40360		2.48
2N3565	0.86	AN1105	0.60	AY1114	0.60	C106Y1	2.10	40361		2.49
2N3566	1.01	AN2001	0.45	AY1115	0.60	D13-T1	1.95	40362		2.69
2N3567	1.08	AN2004	0.60	AY1116	0.68	MB05	1.88	40406		1.80
2N3568	1.08	AN7102	0.90	AY1117	0.68	MB1	2.03	40407		1.31
2N3569	1.23	AN7105	0.68	AY1119	0.60	MB3	2.65	40410		1.65
2N3638	0.90	AS43	0.65	AY1120	0.98	MB6	3.39			
2N3638-A	1.13	AS147	0.66	AY1121	0.98	MJE2955	4.55			
2N3641	1.13	AS148	0.63	AY6108	1.65	MJE3055	3.06			
2N3642	1.26	AS149	0.68	AY6109	1.65	OA5	0.65			
		AS208	1.25	AY8108 (AY8103)	3.75					

ORDER FORM
To IMPORTED COMPONENTS, P.O. BOX 1683P, G.P.O., MELBOURNE. 3000.

Name .....

Street .....

City .....

State ..... Postcode .....

Please supply items indicated thus ☐

I enclose cheque/postal note—money order. Goods forwarded freight free.

ALL PRICES INCLUDE TAX AND POSTAGE

by Radio Nederland. The BBC, Voice of America, Radio Sweden, Radio Prague, and Radio Canada have always polled well.

Readers interested in making their preference known should send their votes by airmail to arrive at the London address by the end of this month. The most popular station receives an award, and the listener with the best comments is also rewarded for his effort.

STAMPS WITH RADIO THEME

Most listeners who receive verifications from various countries sooner or later become stamp collectors, as DXing is an easy way to add to a collection. Many interesting stamps come on mail, some from the more exotic countries.

In a recent issue of the Radio Canada SW Club bulletin, this aspect was covered with a series of illustrations of stamps with a radio theme. Almost all the nations of the world have issued stamps featuring radio and television and its related scientific fields. In 1965, during the centenary of the ITU (International Telecommunication Union), over 100 nations issued postage stamps to commemorate this occasion. Many countries have featured their short-wave broadcasting facilities on stamps.

Recently, stamps have been issued to mark the opening of Radio Nederland's relay station at Bonaire, and the BBC relay at Ascension Island. A person who decides to collect stamps on telecommunications may also decide to collect those stamps dealing with the many scientific achievements in telecommunications. For example, stamps were issued in 1964 and 1965 to commemorate the Year of the Quiet Sun. Certainly, a collection of stamps picturing the radio stations that you have listened to, or hope to listen to, is an excellent asset to any serious DXer.

AWARDED FIRST LICENCE

The New Zealand Broadcasting Authority, which is now issuing licences for private radio stations, has taken steps to ensure that 4XD in Dunedin, the oldest radio station in the country, is recognised for this fact. The licence issued to 4XD, operated by the Otago Radio Association since 1922, is WF1. With this, the Authority recognises that 4XD was the only private radio station operating in the country before the Authority was constituted. According to "FM News" the warrant has been so endorsed, and gives 4XD recognition for its long service in the field of private broadcasting in New Zealand. 4XD is non-commercial, and its history is that of a band of radio hobbyists, who pioneered broadcasting in the early days, and have continued to operate the station as a voluntary enterprise up to this day.

BROADCAST BAND NEWS

AUSTRALIA. The Australian Broadcasting Control Board has invited applications for a new commercial station at Nowra, on the south coast of NSW. As a result of the recent frequency agreement between Australia and New Zealand, some frequencies have become available. The 1000KHz channel is clear at present on the Australian east coast, and looks like a possible channel for new stations in the eastern states. The plan for a new station at Alice Springs, which was due to open this month, suffered a setback, when it was decided that the site previously chosen was too close to the Alice Springs Airport. A new site has been chosen three miles south of the town. Ian Stanley, Glen Iris, Victoria, has advised that the station will use 900KHz, have the power of 2KW, and use a 200ft mast. In the meantime, the area is served by 8AL on 1530KHz, which is an ABC relay station in Alice Springs. This transmitter was verified to us when it was 5AL, and using 30W.

FIJI: The Fiji Broadcasting Commission made some frequency changes to medium wave stations on October 16. The English program broadcast from Lautoka

NEW SCHEDULES OPERATING

CHANGES FROM HILVERSUM

Radio Nederland in Hilversum, Holland, is making some changes to its transmission schedule, for the period up to March 7, 1971. This includes the use of five new frequencies, 7275, 15320, 15390, 21640 and 21690KHz, listed below.

GMT	KHz	Area	Language
0930-1050	7275, 6140, 6020	Europe	English
1100-1220	21690, 21570	South-East Asia	Dutch
1800-1815	21640	South America	Spanish
1830-1950	21640	North and Central Africa	Dutch
2000-2120	15390	Europe	English
2300-0020	15320, 11845, 6085	South America	Spanish

AUSTRIAN SCHEDULE

The transmissions of Austrian Radio, Vienna, are carried on 100KW transmitters except for a transmitter on 6000KHz, which has the power of 1KW. The new schedule in effect to March 7 includes the use of eight new frequencies.

GMT	KHz	Area
0400-2305	6000	Europe
2000-2200	11925	Europe
1000-1200	9770	Europe
0400-0600	7245	Europe
1200-1400	11875	North Africa
0600-0800	7245	Europe
0400-1200	6155	Middle East
0800-1200	7245	Middle East
1200-1600	9770	North Africa.
1400-1600	11855	North Africa
1600-2200	6155	Europe
2000-2200	7110	Middle East
2300-0400	6155	North America
2300-0400	9770	North America (East)
2400-0200	15145	Central America
2300-2400	9575	South America
0200-0400	11790	South America
1800-2200	15210	South America
0800-1000	17795	South Africa
1600-1800	17870	South Africa
1800-2000	15200	East Africa
0600-1000	15410	Middle East
1600-1800	9610	Middle East
1800-2000	9745	Middle East
0400-0600	17740	South-East Asia
1400-1600	17710	South-East Asia
1000-1200	17785	Australia, New Zealand
0600-0800	21670	East Asia
1200-1400	11735	East Asia

FIJI BROADCASTING FREQUENCIES

The latest information from the Fiji Broadcasting Commission shows some changes of frequency. The complete list of stations and schedules is given below:

GMT	KHz	Station	Language
1800-1030	560	Suva	English
1800-1030	640	Lautoka	English
2000-2400 (Sat)	1210	Suva	English
1800-1030	810	Labasa	Vernacular
1800-1030	930	Sigatoka	Vernacular
1800-1030	680	Rakiraki	Vernacular
1800-1030	710	Suva	Fiji, Hindi
1800-1030	890	Lautoka	Fiji, Hindi
1800-2115	3230	Suva	English
2115-0345	6005	Suva	English
0345-1030	3230	Suva	English
1800-2130	3284	Suva	Fiji, Hindi
2130-0330	5955	Suva	Fiji, Hindi
0330-1030	3284	Suva	Fiji, Hindi

All programs are extended to 1100GMT on Saturday. The stations shown as "Vernacular" at times carry English programs.

NEW ZEALAND PRIVATE BC STATIONS

The following callsigns have now been allocated to the new private broadcast stations.

Call	Slogan and Location	KHz	KW
1XW	Radio Waikato, Hamilton	930	2
1XP	Radio Plains, Thames	1020	1
1XK	Radio Waitomo, Te Kuiti	1170	1
1XA	Radio Hauraki, Auckland	1480	5
1XI	Radio International, Auckland	1590	5

RADIO SWEDEN

New frequencies come into force for Radio Sweden on November 1, and the details are:

GMT	Area	KHz
0515-0615	New Zealand-Australia	11895
0515-0615	South Asia	17840
1230-1330	Far East	9715
2015-2115	Far East	9715
1400-1530	South Asia	15240
1600-1700	Middle East	11930
1830-1930	Middle East	11780
1400-1530	North America	21585
0300-0430	Western North America	9725

RADIO HOUSE PTY. LTD.

306-308 PITT STREET, 6 ROYAL ARCADE and 760 GEORGE STREET, SYDNEY

NEW FROM GERMANY



THE OXFORD CORDLESS ELECTRIC RAZOR
Battery Operated

Twin blades rotary cutting head, spare batteries. 15c
Size 5in x 1¼in.

Posted $8.75

CHROME VAN

German screwdriver and pocket tester.

1. 6-12 volt model auto test.
2. Sparkplug tester.
3. 110-380 volt mains tester.

$1.25



Actual Size

"KEYLITE" 3.95

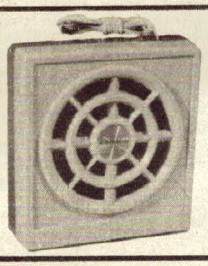
Free. One spare mercury cell.

With fob keyring, attractive gold finish case. Simply squeeze. Illuminates car and house locks, etc.

$4.00 Posted anywhere

Cordless battery-operated Electric scissors cut most materials fast and clean. 1 torch cell fits in handle. Complete Posted **$4.95**

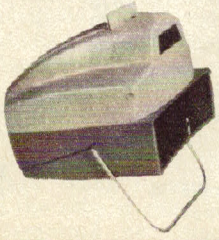




BUG AUTO KEY
Only $25.50
Professional model.



MORSE CODE PRACTICE SET
$11.75
With Oscillator and Key.



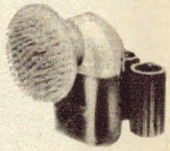
COLOUR SLIDE 35mm VIEWERS
Battery operated with 2 penlite Batteries. Special large Reflex picture.
Only $2.25 posted.

DOOR MAT SWITCH

Operates instead of press button when stepped on. **$15.00**
Size 28in x 18in. Thin Plastic.

"RIAM" Swiss-made battery-operated Vibratory complete with two batteries, three applicators and instruction sheet.
$8.50 or $9.00 posted.





BRAND FIVE TAPE

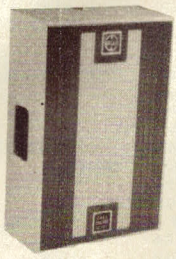
			$
		7in REELS	
1200ft	15D7	1.5 ACETATE	3.00
1800ft	10D7	1.0 ACETATE	3.25
1800ft	10D7M	1.0 MYLAR	3.99
2400ft	5D7M	.5 MYLAR	4.75
2400ft	5D7MT	.5 TENSIL MYLAR	5.25
3600ft	5D7MS	.33 MYLAR	6.75
		5½in REELS	
1200ft	10D57	1.0 ACETATE	2.55
1200ft	10D57M	1.0 MYLAR	2.95
1800ft	5D57M	.5 MYLAR	3.75
		5in REELS	
600ft	15D5	1.5 ACETATE	1.80
900ft	10D5	1.0 ACETATE	1.98
900ft	10D5M	1.0 MYLAR	2.25
1200ft	5D5M	.5 MYLAR	2.50
1200ft	5D5MT	.5 TENSIL MYLAR	2.75
1800ft	5D5MS	.33 MLYAR	3.75

CORRESPONDENCE TAPES

		3½in REELS	
900ft	3D32MS	.33 MYLAR	1.95
		3in REELS	
150ft	15D3	1.5 ACETATE	.50
225ft	10D3	1.0 ACETATE	.65
225ft	10D3M	1.0 MYLAR	.70
300ft	5D3M	.5 MYLAR	.85
600ft	3D3MS	.33 MYLAR	1.60

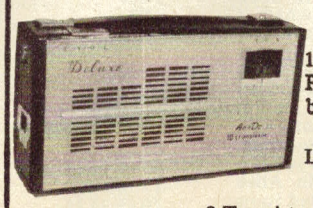
CASSETTES

C30	.99
C60	.99
C90	1.65
C120	2.25



NEW DOOR SHINE

With batteries included
2-Note Model — $7.25
1 press button.
6-Note Model — $12.75
2 press buttons, 1 for front and 1 for side door.

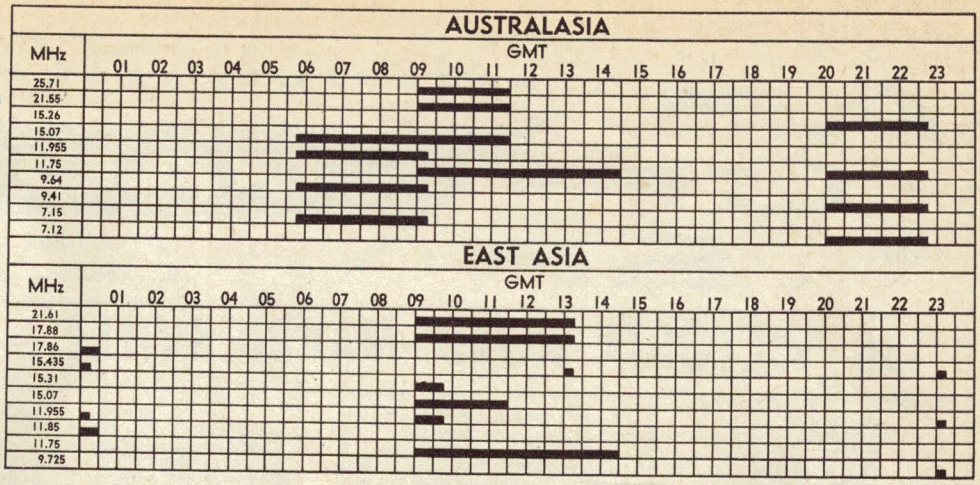


10 Transistor AC/DC Deluxe Portable Radio operates from batteries or from the 240V supply.
Leather case and carry handle.
Post free — $35.00.

8-Transistor — $19.75
6-Transistor Deluxe — $15.00
6-Transistor HI FI — $10.95
Add 50c postage.

WORLD SERVICE SCHEDULE

This chart shows the regular BBC World Service frequencies and times for December, 1970. (Published by arrangement with the BBC.)



was moved from 1320KHz to 640KHz. The recently established transmitter at Labasa was moved from 840 to 810KHz, to avoid interference with Radio Tarawa, Gilbert and Ellice Islands, on 844KHz.

HONG KONG: Radio Hong Kong has made a frequency change from 545 to 555KHz. The station has been heard closing at 1603GMT, as Hong Kong reverted to standard time at the end of October. Radio Hong Kong is received with a news bulletin at 1600GMT then follows the weather information and signoff with the National Anthem.

PHILIPPINES: Information received by Merv Branks of Invercargill, NZ, indicates that there are now 19 stations in Cebu City, which is indeed a boom city as far as radio broadcasting goes. The stations are DYLV (1450), DYHP (900), DYRC (600), DYBU (820), DYBC (660), DYUL (1240), DYDR (1590), DYBB (1520), DYSS (1020), DYNC (760), DYVM (1260), DYMX (1080), DYRB (690), DYCB (570), DYMR (1410), DYRF (1180), DYLA (1550), DYMB (970), DYTM (1380).

FLASHES FROM EVERYWHERE

EUROPE

ALBANIA: According to the "World Bulletin", Tirana is using 11990KHz for its English program from 1530-1600. Badly mixed with Prague on the same frequency.

POLAND: Radio Warsaw intends to start a Radio Club, and is keen to hear from listeners about the contents of the program and suitable transmission times. English transmissions from Warsaw have been received at good level at 0630GMT on Sunday, when the 30-minute session consists of answers to letters from listeners and request music, on 7145KHz.

BELGIUM: ORU Brussels has been heard on the new frequency of 21460KHz at 1000GMT. Our reception of the signal has been good, but there is interference later from the BBC. The station opens in French, and then has light music, the program being beamed to Africa. Another new frequency, 21695KHz, has been heard at 1230GMT, also at good level. Sam Dellit, of Brisbane, reports the interval signal and sign-on at 1230GMT on this new frequency. It is the strongest signal he has ever heard from Belgium.

AFRICA

GHANA: Radio Ghana, at Accra, has been heard with an English news bulletin at 1815GMT. Our reception was on 1528KHz and signals were only fair. Another transmission in English 1445-1530GMT is carried on 21545, 17870, and 21720KHz.

NIGERIA: According to the "World Bulletin" a new station has emerged to replace Radio Biafra. This is the Eastern Central State Broadcasting Service, operating on 7315KHz, at 0500-2200GMT. The station has news in English every hour on the hour GMT, except for 0900, 1600 and 1900GMT, when the news is in the Ibo language.

MOROCCO: According to Robert Chester, Cheltenham, SA, a schedule from the Moroccan Broadcasting System gives details of their English transmissions. These are on the air 1700-1800GMT on 7225KHz, via the transmitter at Sebba-Aioun, using 10KW; and on 11735KHz, via the Tangiers transmitter, using 50KW. An Arabic transmission from the Sebba-Aioun transmitter can be heard on 15345KHz, 0600-0900GMT and 1200-1800GMT, and on 6190KHz, 1800-2400. Verification is in the form of a folding card, which lists the transmission times and powers of most of the frequencies used by the Moroccan Broadcasting System.

MALAWI: Radio Malawi has been heard on the frequency of 5995KHz by Sam Dellit, of Brisbane, to signoff at 1600GMT. According to the schedule received from the station, this is the signoff time for the English transmission on this frequency. As well as sending a schedule, the station confirmed reception with a verification card.

BOTSWANA: Broadcasts of BBC news from Gaberone are being received on 4845KHz at 1800GMT. This is followed by a music program, and the station closes at 1902 after closedown announcement and the national anthem.

ASIA

JORDON: Radio Amman in Jordon has been reported in "Sweden Calling DXers" as using 7160KHz. The reception has been at 2100GMT, and there has been slight interference on the channel.

SINGAPORE: Radio Singapore is using two short-wave frequencies, 5050 and 11940KHz. The station signoff is at 1630GMT. Reception at 0905GMT has also been observed on 11940KHz, and at this time a request session in English is broadcast.

Registered Trade Mark

ELECTROLUBE 2A-X

IMPROVES ELECTRICAL CONTACTS
INCREASES RELIABILITY AND
LOWERS MAINTENANCE COSTS

SAFE ON POLYSTYRENE, P.V.C. MAKROLON, PAINTS, NATURAL AND SYNTHETIC RUBBER NON-HAZARDOUS VAPOUR

Write for free Products Summary on the range of electrical and mechanical oils and greases

RICHARD FOOT (AUSTRALIA) PTY. LTD.
63 HUME STREET, CROWS NEST, N.S.W. 2065. Phone: 43-0326.

Available from leading electrical wholesalers.

A. AMPLIFICATION
C. COMMUNICATION
E. ELECTRONICS

★★★★★★★★★★★★★★★★★★★★

PHONE 51-3845
51-7008

RADIO

37 VICTORIA AVENUE, MIDDLE COVE
WEEKENDS & AFTER HOURS 40-5391

136 VICTORIA ROAD MARRICKVILLE — 51-3845



AUDIO GENERATOR

De Luxe Model TE—22D.
Freq. range, Sine 20 cps—200KC. SQ. 20 cps—25KC. Output Voltage Sine 7V. SQ. TV P.-P. Output Impedance 1000 ohms Acc. 5 per cent. 4-range attenuation. 1/1, 1/10, 1/100, 1/1K. Printed circuit. 240V A.C.

$42.95

SIGNAL GENERATOR

De Luxe Model TE20D.
Freq. Range 120 KC—500 Msc 7 Bands. Accuracy 2 per cent Output 8V. Provision for Xtal. Suitable for self-calibration Marker generator. Printed circuit. 240 V.A.C.

$31.50

NEW C.R.O. TUBES

3AP1-906 3in	$2.75
CV112 5in	$2.00
VCR97 6in	$3.75
ACR10/VCR139A 3in	$3.00
CV1522 1¾in	$2.25

3 WAY HI-FI

Speaker System. Imp. 8 ohms
20 watt 8" woofer, 30-3000 cps — $17.50
30 watt Mid Range 6", 600-10000 cps — $9.50
40 watt horn tweeter. 5000-22000 cps — $7.95

BLANK ALUMINIUM CHASSIS

6in x 4in x 2in	$1.80
8in x 5in x 2in	$2.25
9in x 6in x 2in	$3.40
10in x 5in x 2in	$2.75
13in x 7in x 2in	$3.65

Pack and Post. 0c.

NEW POWER TRANSFORMERS

240VAC, 50cps. Primary standard fil. windings.

385VCT 80MA	$3.75
325VCT 80MA	$3.75
385VCT 60MA	$3.00
385VCT 50MA	$3.00
325VCT 40MA	$3.00
240/240 60MA	$5.50
125MA filter choke	$2.00
100MA filter choke	$2.00
50MA filter choke	$1.25

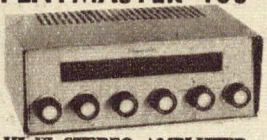
Add Pack and Post.

NEW SPEAKER TRANSFORMERS 3 WATTS

10K	15 ohms
10K	8 ohms
10K	3.7 ohms
15K	3.7 ohms
5K	15 ohms
5K	8 ohms
5K	3.7 ohms
7K	3.7 ohms
8K	15 ohms

$1.50 EACH
Post. 35c.

PLAYMASTER 106



HI FI STEREO AMPLIFIER
10 watts R.M.S. per channel. Freq. Response 30-20,000 cps. Inputs—crystal or ceramic cartridge, Tape. Separate bass, treble, balance. High gain broadcast band tuner. Slide rule dial. Excellent reception in country areas.
WIRED AND TESTED $94.75

Rotating Distress Emergency Beam



Red—Visibility ½ mile.
12V D.C. operation. Waterproof. Complete with heavy duty suction Cap. Size 3½in dia. x 5½in.
$5.75.
Pack and Post. 25c.

CAPACITOR DISCHARGE IGNITION SYSTEM

Kit of parts as per E.A. Aug. 1970
$27.95

TOP MOUNT CAR ANTENNA

Complete with Coax lead and plug

Standard Telescopic	$3.65
Lock down	$4.75
Spring Loaded	$4.75

LOTRING LIGHTWEIGHT SOLDERING IRON

240V AC, 30 watts	$6.50
12V DC 30 watts	$6.50

Weight 2½ozs.
Heating Time 1.8mins.

MODEL TS-175

85-1000 MCS.
Complete with cal. book and crystal.
$150.00

TV BOOSTER

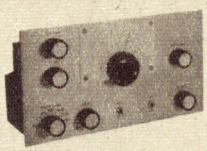
240 V.A.C. Especially designed for fringe area reception. Also up to 3 TV sets can be operated off common aerial for improved signal strength.

$15.95
Post Free

MODEL TE-65 V.T.V.M.

D.C. V 0-1.5-5-15-50-150-500-1,500 V. Rms. A.C.V.0-1.5, 5.5-15-50-150-500-1,500 V. Rms. 0-1.4-4-14-400-1,400-1,400-4,000 V. P.P. Resistance: RX10, 100.1K, .10K, .100K, 1M, 10M, Decibel—100dB minus-plus 65db.
240 V.A.C.

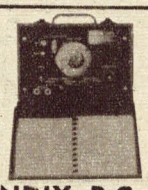
$43.75
TECH. P.V.58, $40.50.



SOLID STATE HIGH PERFORMANCE SHORT WAVE RECEIVER

AS FEATURED AUG. 1970 E.A.
Complete kit of parts .. $99.50
Constructed ready for operation, complete with speaker

$119.50



BENDIX B.C. 221

Frequency Meter. 125 KC—20 MCS. Complete Calibration book —100 KC crystal. 240 V AC supply.
BRAND NEW .. $75.
USED GOOD ORDER .. $49.50

G.D.O. UNITS

Post: N.S.W. 50c. I'state 75c.
T.E. 15 Transistorised, 7 Band. 360 Kc to 270 Megs.

$39.75

BRAND NEW LIGHTING PLANTS

Johnson 1 h.p. Engine 12V, 30 amp. Generator.

$72.00

Reverberation Units

Latest design to suit organs, stereo, guitar, any hi-fi equipment.

$5.75
Post Free.

SOLENOIDS—RELAY

12V DC Coil resistance 120 Ohms. 4-pole change over contacts, 10 amps.

$1.75
Pack and post. 25c.

12V 2 AMP. TRANSFORMER

240 VAC 50CPS prim.

$3.00
Pack and Post. 50c.

NEW GRAMMO MOTORS

240V. A.C.
3 Speeds, $2.75.
Post: 40c.

DYNAMIC LO-IMP STEREO PADDED HEADPHONES

With cord and stereo plug.

$3.50
Pack and Post., 50c.

No. 19 TRANSCEIVER

2—8 MCS. Fully tunable power output 15 watts. Complete with 12v DC genemotor power supply. Variometer, headphones, microphone.

$30.00

3" VERNIER DIAL

8:1 Ratio
$2.95, Post 25c.

TR-1935 TRANSCEIVER

V.H.F. 10 channels Crystal locked Freq. 100—155 MCS. Inbuilt 28 V DC Supply. AM. 10 watts power output.

$35.00

AN/APX-6 TRANSPONDER TXRX

900-1200mcs.
Complete with cavity tuning resonator, digital counters. 2C42-2C46 lighthouse tubes. 28V D.C. blower motor.

$17.50

HI-FIDELITY TWIN CONE SPEAKERS

Aust. made. 8 to 16 ohms.

6in	$9.00
8in	$7.50
8in	$9.50
10in	$10.75
12in	$12.75

Postage:
Interstate 80c.
N.S.W., 50c.

PORTABLE TRANSCEIVER

Battery operated, 3-7 MCS. Variable tune or crystal locked. Complete with speaker, headphones and microphone. 15in x 9in x 6in.

$19.95

INDICATOR UNIT

6in CRO Tubes, 12 standard miniature valves, 1 crystal complete with EHT supply, no HT supply. Suitable for conversion to Oscilloscope. 19in x 8in x 8in.

$19.75

Receiver-Indicator UNIT

Type R-65/APN-9. 3BPI C.R.O. tube with Mu-Metal Shield and Socket. 33 valves. 2 x 2—5Y3 — 6Y6 — VR105 — 6SA7 — 6N7 — 2 x 2 SJ7, 3 x 6 SL7, 3 x 6SK7, 7 x 6H6, 13 x 6SN7.
Inbuilt super-het. Receiver designed for reception of pulsed waveform.
4 channels, 1750KC—2020KC.

$19.75

WANTED

Communications Receivers Test equipment, P.A. Gear. Large or small surplus stock. Best prices. Call, write or phone any time.

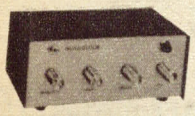


GUITAR AMPLIFIERS

14-watt, 4 Inputs. Base and Treble Boost. 2 Twin-cone Speakers. $63
17-Watt 4-Channel. Base and Treble Boost. Two Twin-cone Speakers $76.25

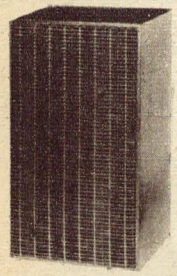
35 WATT

4-Channel. Bass and Treble Boost 4 Twin-cone Speakers. $109.05
Vibrato with foot control and 2 preset controls for frequency and intensity. $10.50 extra on above models.



MUSICOLOR

Sound control of coloured lights. As described E.A. Oct. 69.
Wired and Tested $60.00
6 Channel unit $99.75



MULLARD MAGNAVOX

Designed bookshelf enclosure with 6WR twin cone and 3TC tweeter $24.75 ea
Super bookshelf enclosure with 2 x 6 WR .. .. .. $36.75 ea.
Hi-Fi enclosures with magnavox 8WR or Rola C8MX .. 8 watts RMS .. .. $36.75 ea.
With 2 x 8WR or 2 x 8CMX 15 watts .. .. .. $45.00 ea.
With 12WR—10 Watts $45.00 ea.
8 or 15 ohms available.
All cabinets are constructed of Pineboard and Veneered with Oiled Teak Formica and are complete with crossover network — Tweeter — Innerboard packing

PLAYMASTER 127 STEREO CONTROL UNIT

For tape replay. Magnetic, disc, and crystal cartridge input. Radio fully described Nov. 69 issue E.A



KIT SET $49.50

Wired and Tested $59.50.
Pack and Post 75c.

128 STEREO AMPLIFIER

64 Watts per channel
Kit set $95 00
Wired and Tested $109.00

PIGGY BACK GUITAR AMPLIFIER

30 Watt $79.75
45 Watt $89.75
60 Watt $119.75
4 Inputs, Bass and Treble Boost Vibrato if required, $10.50 extra.

PIGGY BACK GUITAR AMPLIFIER

Complete with Speakers and Cab.
30 Watt Lead $138.75
30 Watt Bass $146.75
45 Watt Lead $158.75
45 Watt Bass $166.75
50 Watt Lead $218.00
60 Watt Bass $234.00
Vibrato if required extra $10.50

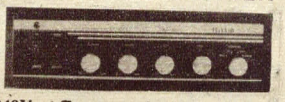
50 WATT SOLID STATE GUITAR AMPLIFIER

E.A. July and August Issue
Kitset, including Cabinet.
$98.00
Wired and Tested.
$114. 00
Speaker Enclosures to suit 4 M.S P. Speakers.
$104.00
2 Pioneer 15in Speakers.
$94.00
2 Rola 50 watt Speakers.
$128.00

GUITAR AMPLIFIER 150 WATT SOLID STATE

Multi-purpose wide range frequency response. 2 Channels, 4 inputs, separate Bass and Treble Controls, also separate volume controls. Can be operated Mono or Stereo. Black Vynex covered Carry Cabinet $190.00

ALL SILICON TRANSISTOR SOLID STATE STEREO AMPLIFIER



240V AC powered, 8 watts RMS per channel inputs for magnetic ceramic, and crystal cartridge, also recorder and radio tuner. Hi-Fi frequency response speaker matching 4-16 ohms. Size 10½in x 6½in x 3½in. Attractive oiled teak cabinet.

$54.00

STEREO RECORD PLAYER

AUTOMATIC
Famous Continental Brand.
4 speeds, turntable dia. 9¼in. Base 12in x 10in.
Plug-in Ceramic Cartridge with spare stylus. Balanced tone arm with counterweight. 240 vac 50 cps. $26.75.
PACK and POST $1.00



LEADER SIGNAL GENERATOR LSG II

240 V AC operated. 6-band 120 KC to 390 Megs. Provision for crystal.
Post N.S.W., 75c; Interstate $1.25.

$39.50

ORGAN KEYBOARDS

49-Note. Complete with Switching System.
$72.00
13-note. Pedal Claviers. Complete with Switches.
$39.95

WIDE BAND OSCILLOSCOPES

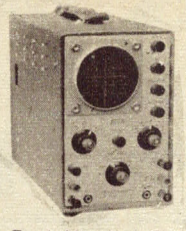
VERTICAL AXIS

Deflection sensitivity (at 1 kc) 0.1 V p-p/cm.
Frequency Characteristics, 1.5 cps —1.5 MC.
Input Impedance, 2 M ohms 25pF.
Calibration Voltage IV p-p/cm.

HORIZONTAL AXIS

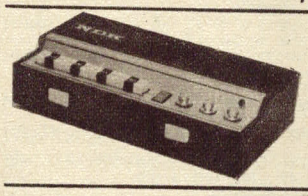
Deflection Sensitivity 0.9V p.p /cm
Frequency Characteristics 1.5 cps —800 KC.
Input Impedance 2 M ohms 20 pF.
Sweep Oscillator (5 Range) 10 cps —300 KC.
Synchronisation Devices Internal (Positive and Negative, External).
Power 240v AC 50/60 cps.
Cathode Ray Tube 3KFIF.

3-inch $102.75



5 Meg Bandwidth Push-Pull vertical and Horizontal Amplifiers. 8 positions, high sensitivity, vertical Amplifier Frequency Compensated on all positions. Calibrated .02 to 600 volts. Hard time base, 20 cycles to 75K. Latest American R.C.A. circuitry. Complete with probe.

5-inch $118.75



AUTOMATIC RHYTHM BOX

12 RHYTHMS
9 PERCUSSIVE INSTRUMENTS
240v A.C. OPERATION.
$145.00

RHYTHMATIC ELECTRONIC RHYTHM UNIT

Solid-state, battery operated, Excellent accompaniment for guitarists. 6 rhythms, variable tempo control, volume control. Can be powered from external supply.

$67.00

Post., 50c.

B.S.R. 4 TRACK

STEREO TAPE DECK.
3 speeds, 7in spools. 3-digit counter Fast forward—fast rewind.
$48.50.
Fitted with third head for monitoring. $55.50.
PM119 STEREO TAPE ADAPTER with bias osc. and erase circuitry. 240V AC operation.
$90.00



PIANO BASS fully transistorised

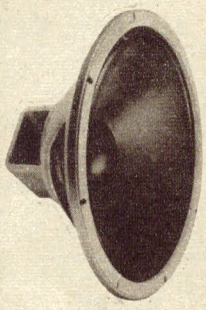
240 V.A.C. Operation. Suitable to operate with instrument amplifier. Portable In black vynex carry case.

19in x 14in x 6in.
Keyboard. C1-C3. 2 Octaves.
Models, Mellow — Bright — Sustain — Percussion.

Slow and fast decay.

Fine tuning adjustment control which matches piano bass to other instruments.

$74.50



15" PIONEER

15in Pioneer Low Frequency Speaker. Imp. 8 ohms.
Power, 30 Watts. R.M.S. Designed especially for use with Bass Guitar or Electric Organ. Also ideal for Stereo Woofer Speaker.
$30.00

STEREO RECORD CHANGER

Current models, 4 speeds, automatic or manual operation.
Standard model $28.50
Ceramic cartridge, Sapphire Stylus Standard model with 12in turntable $34.00
Deluxe model with 12in turntable. Cueing device, Ceramic cartridge Diamond Stylus $40.00
Deluxe model as above with — adjustable counter balance, 2 spindles, calibrated stylus pressure control added $46 50
Deluxe model as above with 12in Diecast Heavyweight Turntable, 4-pole Shielded motor, Suitable for Magnetic cartridge .. $56.50
The latter two record-changers can be supplied with magnetic cartridge and diamond stylus at $10 extra.

PLATFORMS

Teak Platforms, suit above changers, $9.00. Fully moulded tinted perspex covers, suit platforms 17¼in x 13½in x 4in

$9.00

T.E. 46 RESISTANCE CAPACITANCE

Bridge and Analyser.
Capacity 20pf to 2000mfd
Resistance 2 ohms to 200 megs.
Also tests power factor, leakage, impedance, transformer ratio, insulation resistance to 200 megs, at 600V.
Indications by eye and meter.
$53.75

VOLT A.C.

VARIABLE TRANSFORMER.
0-260V, 10 amp $49.50
0-260V, 5 amp $37.50
0-260V, 2½ amp $25.50

A.C.E. RADIO

AMPLIFICATION · COMMUNICATION · ELECTRONICS

★★★★★★★★★★★★★★★★★★★★

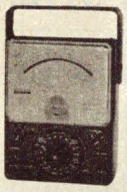
PHONE 51-3845
51-7008

37 VICTORIA AVENUE, MIDDLE COVE
WEEKENDS & AFTER HOURS 40-5391

136 VICTORIA ROAD MARRICKVILLE — 51-3845

KAISE
MODEL SK-100

VOLT-OHM-MILLIAMMETER



HIGH SENSITIVITY
100,000 Ohms per Volt DC
10,000 Ohms per Volt AC

SPECIFICATIONS:
- DC Volts: 0.6, 3, 12, 60, 300, 600, 1200V.
- AC Volts: 6, 30, 120, 300, 1200V.
- DC Current: 12uA, 300uA, 6mA, 60mA, 600mA, 12A.
- AC Current: 12A.
- Resistance: 20K ohms, 200K ohms, 2M ohms, 20M ohms.
- Decibels: Minus 20 to plus 17, 31, 43, 51, 63.
- Accuracy: DC plus minus 3%, AC plus minus 4% (of full scale).
- Overload Protected by Dual Silicondiodes.
- Double-jewelled plus minus 2% Meter.
- Plus minus 1% Temperature-stabilised Film Resistors.
- Polarity Changeover Switch.
- Scale with Mirror.

Price $34.75. Post 75c. Interstate $1.00.

K 20 CT330



K 20 CT500

CT. 330 20K. OPV

D.C. Volts 6, 6, 30, 120 600 1200, 3,000, 6 000 AC Volts 6, 30, 120, 600, 1,200. D.C. Current .06-6, 60, 600mA Resistance, 6K, 600K, 6meg., 60meg., D.B. minus 200 to plus 62, 5 Ranges. Specially suitable for transistor use.

$16.45

CT. 500 20K OPV

D.C. Volts, 2.5, 10, 50, 150, 500. 1,000 A.C. Volts 10, 50, 250, 500, 1,000. D.C. Current, .05. 5.50, 500mA. Resistance, 12K. 120K, 1.2meg., 12meg. D.B. minus 20 to plus 62.

$13.25

200H 20K. OPV

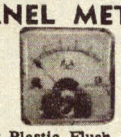
D.C. Volts 5, 25, 50, 250, 500. 2500 A.C. Volts 10, 50, 100. 500, 1 000. D.C. Current 50uA. 2.5 250mA. Resistance, 6K, 600K, Capacitance, 2 D.B. Ranges.

$10.95 POST 50c.

P.T. 34 1000 OPV

D.C. Volts, 0, 10, 50, 250, 500. 1,000.
A.C. Volts, 0, 10, 50, 250, 500 1,000.
M.A. 1-100-500 RESISTANCE.
$6.50
Post 50c.

PANEL METERS



Clear Plastic Flush Mounting
1¾ins, 2ins, 3ins, 4ins.
Full range available.
From 50uA—10A DC, 15 VDC, 500 VDC, 300 VAC, VU and S.
Also
Edge Mtrs,
VU—Stereo Balance.
Send for price list, S.A.E.

TEST PROBES
75c PAIR

MODEL SK-70
30K OHMS PER VOLT D.C.
10K OHMS PER VOLT A.C.

D.C. Volts: 0.5, 2.5, 10, 50, 250, 500, 1000.
A.C. Volts: 10, 50, 250, 500, 1000.
D.C Current: 50uA, 5mA, 50mA, 500mA.
Resistance: 7K, 70K, 700K, 7 meg.
Decibels: Minus 10 cps plus 62 db.
OVERLOAD PROTECTION
$19.95.
Post 50c, Interstate 75c.

MODEL SK-60
50K OHMS PER VOLT D.C.
10K OHMS PER VOLT A.C.

SPECIFICATIONS:
D.C. Volts: 0.25, 2.5, 10, 50, 250, 500. 1000.
A.C. Volts: 10, 50, 250, 500, 1000.
D.C. Current: 25uA, 5mA, 50m, 500mA.
Resistance: 10K, 100K, 1 Meg. 10 Meg.
Decibels: Minus 10 cps plus 62 db.
OVERLOAD PROTECTION.
$22.75.
Post 50c, Interstate 75c.

MODEL SK-55
30K OHMS PER VOLT D.C.
14K OHMS PER VOLT A.C.

SPECIFICATIONS:
D.C. Volts: 0.6, 3, 12, 60, 300, 1200.
A.C. Volts: 12, 60, 300, 1200.
D.C. Current: 60uA, 12mA, 300mA.
Resistance: 10K Ohms, 1 M ohm, 10 M ohms.
Decibels: Minus 10 cps plus 23 db.

S.W.R. METER
0-100MCS.
1KW. POWER OUTPUT.
$14.75
Pack and post 75c.

SIGNAL INJECTOR
MODEL 250-B.
TRANSISTORISED.
$7.95

SIGNAL TRACER
Operates in conjunction with 250-B
$4.95

Low Loss Microphone Cable PVC covered.

Single Core	15c per yd
Twin Core	20c per yd
Twin Speaker Flex	$4.00, 100yds

DYNAMIC MICROPHONES



CARDIOID. UNI-DIRECTIONAL
On-off switch. Hand held or stand mount.
Freq. response: 80-10,000 cps.
Sensitivity—60DB/1000 cps.
Model—UDM-103.

50K-600 ohms	$16.45
Model UDM-104. 50K	$13.95
Model UDM-3. 50K	$12.95
(Stand mount only.)	
Hi Imp Dynamic DM 401	$8.75
Hi Imp Dynamic DM 203	$8.75
Crystal Lapel	$1.75

AMPLIFIERS PUBLIC ADDRESS RANGE 240V-AC



MINIATURE P.A. AMPLIFIER
15 WATTS OUTPUT

Multi Match Ferguson O.P. transformer input for crystal mike and pick-up with electronic mixing

P.P. EL-84 output	$42.50
30 Watt. As above, EL-34 P.P.	$57.50
40 Watt. As above, EL-34 P.P.	$85.50
60 Watt. As above, 6D06 P.P.	$105.50

Public Address Range.
All models available with either multi-tapped 600 ohm line or 15 ohm Voice Coil.
Solid State 240V A.C.

20 Watt	$49.50
50 Watt	$69.50
50 Watt 240 A.C. plus 12v. D.C.	$89.00

All have input for 2 microphones or 2 Magnetic or Crystal P.U. With Mixing.



P.A. SPEAKERS

8 WATT.
8in Units in Waterproof Projection Horns.
15 Ohm Voice Coils.
$15.25
Line Output Transformers to suit.
$1.75 extra.

MICROPHONE STANDS

Floor Model. 6ft adjustable with heavyweight cast-iron base.
$11.75

8" TABLE MODEL
$3.50

Flexible Goose Necks.

9in	$2.75	18in	$4.35
12in	$3.50	24in	$5.00

ELECTRIC GUITAR
PICK-UP UNITS.
Separate volume, tone control.
$9.75

SPEAKER COLUMN
VINYL COVERED—TEAK—
33in x 10in x 10in. Complete with 4 heavy duty 6in Speakers. 25 watts— 4, 8, or 16 ohms.
$32.50

TAPE CASSETTES
TENSILISED MYLAR

C 60	$1.25
C 90	$2.00
C120	$2.75
Head Cleaners	$1.75

MECCA-SOUND MATE SOLID STATE CASSETTE TAPE RECORDER

2 track, mono. 8 transistors. Battery operated. Auxiliary input for recording records, TV, radio. Complete with microphone with remote control switch and table stand. Provision for external 7½V DC supply. Battery record level indicator.
$54.00
Pack and post 75c.

"ORAL" CASSETTE
TAPE RECORDER
Transistorised. Battery operated.
$28.75
Pack and post 75c.

NEW RECORDING TAPE

7in Mylar L.P. 1800ft	$3.75
7in Mylar D.P. 2400ft	$5.00
7in P.V.C. 1200ft	$2.50

Postage: N.S.W. 15c,

HI-FI STEREO HEAD PHONES



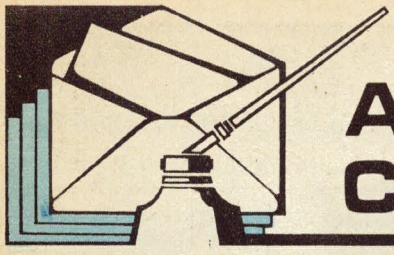
DE LUXE MODEL WITH INDIVIDUAL TONE CONTROL
$12.95

20—12000	cps	$6.75
20—18000	cps	$9.00

Pack and Post 35c.

NEW SPEAKER SPECIALS
8-16 OHMS

5¼ins	$3.35
6ins	$4.15
8ins	$4.85
4ins x 2ins	$3.45
5ins x 3ins	$3.45
6ins x 4ins	$4.25
7ins x 5ins	$4.85
9ins x 6ins	$6.25
3in Pillow Phone 8 ohm	$2.45



ANSWERS TO CORRESPONDENTS

SOLDER HINT: Many times I have had trouble in soldering various components, and have used excessive heat on the joint in a effort to make the solder run properly. I have overcome this by using a plumber's soldering paste obtainable from any hardware store for about 25c. I have found that the solder flows more freely and without prolonged heat. I feel I can recommend this paste to anyone who has similar troubles. **(B.H., Blayney, NSW.)**

● We thought that the use of solder pastes for electrical and electronic work went out in the "bad old days", several decades ago! If joints require a plumber's treatment to make solder run, the user needs a lesson in correct soldering techniques. Soldering pastes, such as you describe are intended for sweating together capillary fittings for water pipes and similar activities around the home. They normally contain corrosive agents designed for oxide removal and surface preparation for blowlamp and torch techniques related to plumbing. When applied to wiring, they can corrode connections, support leakage paths, remove tin plating and cause a host of other unpredictable results.

For readers who are not experienced in soldering techniques, "Electronics Australia" published two articles in the November, 1962 and January, 1963 issues dealing with this subject. These are available through our reprint service in the usual way. (File No. 8/DT/7.) The use of cored solder with a 50/50 or 60/40 tin/lead alloy is strongly recommended for all electronic and electrical work. If solder refuses to "take", the correct course to follow is to clean all leads and wires properly, pre-tin them if necessary, and then solder them in their desired positions.

TV CONVERSION: Recently I received a television set from relatives living in Wagga, NSW. What components would I need to convert this for use here, and what procedure should be employed to insert these components? **(G.F., Norman Park, Qld.)**

● If the receiver is relatively modern, employing 13 channels, no conversion should be necessary. Even if it is an older 10 channel set, it is likely that it will still work in your locality, since the Wagga area uses channels 0 and 2, which are also used in Brisbane. Provided the original channel 7 and channel 9 circuits have not been disturbed in the process of providing channel 0, you should be in line for all four Brisbane channels. If it will not receive all channels for any reason, the amount of work involved will depend on the type of set. If it employs a turret tuner then new coil assemblies ("biscuits") will need to be fitted to cover the missing channels. If it is an incremental tuner it will probably have to be returned to the manufacturer for re-alignment.

COMPUTER BOARDS: Is "Electronics Australia" contemplating some articles on the uses of transistors available on computer boards? A few of my friends and myself have many of these boards and cannot find any use for them except for multivibrators. **(J.S., Vaucluse, NSW.)**

● It is difficult to know whether these types of transistors are suitable for linear applications, such as audio circuits. Because these transistors are used in computer memory and pulse circuits, there is a strong possibility that they have been designed specifically for switching service and the high speed operation required in this. These transistors often carry a "foreign" type number intended for the computer manufacturer's reference and, generally, information on these is unprocurable. It is doubtful if the numbers have any cross-reference to standard RMA or CCIR coding. If you have access to a curve tracer, it would possibly be the only way in which you can establish their characteristics. You will probably find that the transistors in question will work in the majority of circuits, but this could not be guaranteed. In this field, the problem is entirely in the experimenter's hands.

WIRE GAUGES: Re the "1970 All Wave Two", published in the April, 1970 issue of "Electronics Australia". The coil winding data published for this receiver specifies enamelled wire gauges in "SWG". Are these gauges "B&S" or "AWG". All suppliers ask me this. Regular suppliers cannot supply me with either 25 or 40 gauge, but wholesalers can supply me with it if I can tell them if it is B&S or AWG; as both are different dimensions for the same gauge. **(W.C., Como West, NSW).**

● Your letter suggests a surprising degree of confusion on the part of both yourself and the dealers you quote. The article states the wire gauge as "SWG" (Standard Wire Gauge) and that is exactly what it means. Any dealer who knows the first thing about wire gauges should understand this. Secondly, B&S and AWG are exactly the same gauge, and not different dimensions for the same gauge as you suggest. Respectively, they stand for "Browne and Sharpe" gauge, and "American Wire Gauge". The B&S gauge seems to be emerging as the standard gauge in Australia, and we are now endeavouring to use this in our projects wherever practicable. More specifically, we are trying to limit the wires used to the B&S even number gauges between the limits 18 to 34, inclusive. These are available from at least one of our advertisers in 4oz reels and also by the yard. Since this was a recent decision older projects, including the "1970 All Wave Two", were constructed using SWG wires on hand. We published a handy wire table in the May, 1968 issue, as a centre lift-out. This table will enable you to convert from one system to another, and also gives the thickness and resistance for given lengths. Reprints are available from the information service for the usual fee. (File No. 8/LT/8).

PRICE LIST: In the August issue of "Electronics Australia" there was an article on capacitor discharge ignition system. Could you please send me the price list for the parts, excluding sundries? **(R.S., Amberley, Qld.)**

● We can only repeat what we have said many times before, R.S. "Electronics Australia" does not supply components and is not in a position to quote prices. These should be obtained from our advertisers.

REFRIGERATOR INTERFERENCE: When using a magnetic pickup head in my stereo system, a very loud "plop" occurs whenever the refrigerator switches on or off. This does not occur when I use a ceramic cartridge in the pickup. The magnetic preamplifier is fed from a rectifier arrangement across a 15 volt winding on the turntable motor. Do you

"ELECTRONICS Australia" Information Service

As a service to readers "ELECTRONICS Australia" is able to offer: (1) Photographs, dye-line prints and other filed material to do with constructional projects and (2) A strictly limited degree of personalised assistance by mail or by reply through the columns of the magazine. Details are set out below:

PROJECT REPRINTS: For a 20c fee, we will supply data, as available from our files. The amount of data available varies but in no case does it include material additional to that already published in the magazine. For complicated projects involving material extracted from more than one issue, an extra fee may be requested. As a rule, requests for project data will be answered more speedily if the projects are positively identified and the request is not complicated by questions requiring the attention of technical personnel. Where articles are not on file, we can usually provide a photostat copy at 20c PER PAGE.

PHOTOGRAPHS, DYE-LINE PRINTS: Original photographs are available for most of our projects, from 50c plus 8c postage for a 6in x 8in glossy print. In addition, metalwork dye-line prints are available for most projects for 50c each; these show dimensions and the positions of holes and cut-outs but give no details of wiring.

BACK NUMBERS: A fairly good selection is available. On issues up to six months old the cost is the face value, plus 5c surcharge. From seven to 12 months, 10c surcharge; over 12 months, 20c surcharge. Package and postage is 10c extra per issue. Please indicate whether a PROJECT REPRINT may be substituted if the complete issue is not available.

REPLIES BY POST: This provision is made primarily to assist readers in matters relating directly to articles and projects published in "ELECTRONICS Australia" within the last 12 months. Note, however, that we cannot provide lengthy answers, undertake special research or modifications to basic designs. A 20c query fee must be enclosed with letters to which a postal reply is required; the inclusion of an extra fee does not entitle correspondents to special consideration.

OTHER QUERIES: Technical queries which fall outside the scope of "Replies by Post" may be submitted without fee and may be answered through the columns of the magazine at the discretion of the Editor. Technical queries will not be answered by interview or telephone.

COMMERCIAL EQUIPMENT: "ELECTRONICS Australia" does not maintain a directory of commercial equipment, or circuit files of commercial or ex-disposals receivers, amplifiers, etc. We are therefore not in a position to comment on proposed adaptation of such equipment, or on its general design. "ELECTRONICS Australia" does not deal in electronic components. Prices, specifications or other assistance must be sought from the appropriate advertiser or agent.

REMITTANCES: These must be in a form negotiable in Australia. Where the charge may be in doubt, an open cheque, endorsed with a limitation, is recommended.

ADDRESS: All requests for data and information, as set out above, should be directed to The Assistant Editor, "ELECTRONICS Australia," Box 2728 G.P.O., Sydney, N.S.W. 2001: 5/69

HAM RADIO SUPPLIERS
Mail Order Specialists

323 ELIZABETH STREET,
(2 Doors from Little Lonsdale Street)
MELBOURNE, VIC. 3000
TELEPHONES: 677329, 674286

CRYSTALS
CITIZENS BAND and MODEL RADIO CONTROL FREQUENCY CRYSTALS

HC18 Miniature, ½ inch spacing.

26,540 MHz	26,995 MHz	27,240 MHz
26,590 MHz	27,045 MHz	27,245 MHz
26,640 MHz	27,095 MHz	27,425 MHz
26,690 MHz	27,145 MHz	27,740 MHz
26,785 MHz	27,195 MHz	27,785 MHz
26,790 MHz		27,880 MHz

PRICE $3.50 EACH.

AMATEUR CRYSTALS
VHF Band — 144 MHz FM

HC6 Holders, ½ inch spacing.

Channel A	Transmit	4,051.55 KHz
Channel A	Receive	10,275.35 KHz
Channel B	Transmit	4,055.5 KHz
Channel B	Receive	10,285.71 KHz
Channel C	Transmit	4,059.61 KHz
Channel C	Receive	10,296.14 KHz
Channel Z	Transmit	4,048.88 KHz
Channel Z	Receive	10,411.55 KHz
Channel 4	Transmit	4,066.66 KHz
Channel 4	Receive	10,278.57 KHz
Channel 1	Transmit	4,058.33 KHz
Channel 1	Receive	10 257.14 KHz

PRICE $5.50 EACH.

MARKER CRYSTALS

100 KHz Marker	**$12.00**
1,000 KHz Marker	**$12.00**
3,500 KHz Marker	**$5.50**
5,500 KHz Marker	**$5.50**

COMMERCIAL FREQUENCY CRYSTALS

HC6 Holders, ½ inch spacing.

2,182 KHz	2,637 KHz	4,535 KHZ
2,524 KHz	2,739 KHz	6,280 KHz
2,603 KHz	2,979 KHz	6,735 KHz
	4,095 KHz	

PRICE $5.50 EACH.

VERNIER DIALS
Ratio 8 to 1 Reduction, Scale 0-10
Type T 501 1½ inch diameter **$2.00**
Type T 502 2 inch diameter **$2.75**
Type T 503 3 inch diameter **$3.30**

LOW PASS FILTERS
A "Cabena" Low Pass Filter will fix TVI. Cut-off frequency, 30 MHz; attenuation at 60 MHz better than 30 dB; insertion loss, negligible. Impedance 50-72 ohms.
PRICE $11.50. Postage 10c.

WIRE WOUND POTENTIOMETERS
50 watts, 200 ohms. **Price $3.00.**

SOLID STATE STEREO AMPLIFIER
8 watts r.m.s. per channel. Input for magnetic, crystal and ceramic type microphone, P.V. cartridges, tape recorder input and output, tuner input, stereo headphone jack.
Reduced to $55.00. Postage $1.20.

PACK OF RESISTORS
100 Resistors of ¼ and 1 watt rating.
Price $1.75. Postage 20c.

SIGNAL INJECTOR
Model SE250B. **Price $7.00.** Post 20c.

FIVE-CORE CABLE
5 x 5/0076. Ideal for Intercoms., Telephones, etc. New. **100yds rolls, $17** (postage 75c), or **20c yd.**

STEREO HEADPHONES
Professional quality (well known brand). Large earpads, standard stereo plug, 6ft lead.
Price $5.75. Postage 50c.



CHRISTMAS SPECIAL
1 WATT TRANSCEIVER
13 TRANSISTOR, 3 CHANNEL and Call System.
Specifications:
Circuit: 13 Transistors, 1 Diode, 1 Thermistor. Range: Up to 10 miles (depending on terrain, etc). Frequency: 27.240 MHz (PMG approved). Freq. Stability: Plus or minus 0.005 per cent. Transmitter: Crystal controlled, 1 watt. Receiver: Superheterodyne, Crystal controlled. Antenna: 13 Section Telescopic. Power Source: 8 UM3 1.5 volt pen batts. Size: 8¼in x 3¼in x 1¾in. Weight: 25oz. Other features: Leather carrying case, battery level meter, squelch control, earphone jack, AC adapter jack, etc.
PRICE $115 A PAIR
Usual price $165.
Single units available $59.50 each.
BE EARLY.

BRAND NEW SPEAKERS

3DX	8 ohms	**Nett Price $3.95**	Post 20c
3DX	15 ohms	" " **$3.95**	Post 20c
6A7	8 ohms	" " **$5.50**	Post 40c
6A7	15 ohms	" " **$5.50**	Post 40c
8A7	8 ohms	" " **$7.20**	Post 40c
8A7	15 ohms	" " **$7.20**	Post 40c
12CMX	8 ohms.	**$10.75**	Post 80c
12CMX	15 ohms.	**$10.75**	Post 80c

DELCO TRANSISTORS
Type 2N441 .. **Price $2.40.** Post 10c
Type 2N278 .. **Price $6.00.** Post 10c
Type 2N301 .. **Price $7.40.** Post 10c

LT91 RECTIFIER
20 Volt 2 Amp.
Price $1.50. Postage 10c.

TE-16A TRANSISTORISED TEST OSCILLATOR
Frequency range: 400 KHz to 30 MHz in five bands. Modulated 800 Hz sine wave. Modulation 30% approx. 5¾ x 5¾ x 3¾ inches. Weight 1.5 lb.
Price $24 tax paid. Postage 75c.

AUTO CAR AERIALS
Hirschmann, type 300N, side mounting, new.
Price $4.50. Postage 20c.

INSTRUMENT CASE
Sloping front panel. Plastic case, metal front panel 7½ x 4½ x 5 inches. Suitable for radio, test equipment, projects, etc. **Price $3.50** inc. tax. Postage 10c.

TAA300 INTEGRATED CIRCUIT
1 Watt Audio Amplifier
The TAA300 is a monolithic integrated circuit for use as a complete AF amplifier. With a supply voltage of 9v, outputs of up to 1w are obtainable into a load impedance of 8 ohms. A voltage range of 4.5 to 9 volts coupled with very low crossover distortion and low current drain (8 mA) makes this circuit ideal for battery operation.
TAA300 Integrated Circuit, **$3.50.**
Postage 10c.

TRANSISTORS AND DIODES

OC71	**75c**	AF114 ...	**80c**
OC44	**90c**	AF116 ...	**80c**
OC45	**90c**	BC108 ...	**70c**
AC125 ...	**80c**	BC109 ...	**80c**
AC128 ...	**80c**	BF115 ...	**80c**
BA100 ...	**30c**	OA90	**30c**
OA91	**20c**	OA95	**30c**

Postage 10c.

AC ADAPTOR—BATTERY SAVER
Type PS64—240 volts to 6 or 9 volts, 300 mA **$12.50**
Type PS62—240 volts to 6 or 9 volts, 100mA **$8.50**
Postage 30c.

SOLDERING IRONS
ADCOLA M70 1/8inch tip, 240 volt **$8.00**
ADCOLA M64 3/16 inch tip, 240 volt **$8.40**
SCOPE 4 volts AC/DC, 100 watts, **$6.40**
MINISCOPE **$6.00**
SCOPE De Luxe **$7.00**
Postage 20c.

SOLDERING IRON TRANSFORMER
240 volts/3.3 volts, 100 V/A .. **$6.40**
Postage 40c.

RESIN SOLDER
Five-Core, 60/40 ..... **$2.50**
Fice-Core, 40/60 ..... **$2.20**
Solder Pack, 42 inches **18c**

MICROPHONE CABLE
Type 15P1/24, E3748, 1/16 inch diam.
Price 15c yard, or **100 yds, $14.00**

STEP-DOWN TRANSFORMERS
Type 5506—240 volts to 115 volts, 20 watts **$12.00**
Type 5578—240 volts to 115 volts, 40 watts **$12.50**
Type 2164—240 volts to 115 volts, 100 watts **$16.30**
Type 2166—240 volts to 115 volts, 250 watts **$32.00**
Postage $1.

MINIATURE SPEAKERS

2½ inch	8 ohm V.C.	Price	**$1.50**
2½ inch	8 ohm V.C.	"	**$1.75**
2¾ inch	8 ohm V.C.	"	**$2.00**
3 inch	8 ohm V.C.	"	**$2.25**
4 inch	8 ohm V.C.	"	**$2.50**

Postage 20c.

We sell and recommend Leader Test Equipment, Pioneer Stereo Equipment and Speakers, Rola Speakers, Peak Stereo Equipment, Kew Brand Meters, A & R Transformers, Mullard Valves and Transistors, Ducon Condensers, etc.

BULK STORE, 104 Highett Street, Richmond. Phone 42 8136.

Monday to Friday 10.30 a.m. to 5 p.m. **Saturday 9 a.m. to 12 Noon.**

ANSWERS – continued

have any copies of suitable circuits or any suggestions that would eliminate this problem? (A.S., Bayswater, WA.)

● Switching transients of this kind are quite common and can be difficult to eliminate. They are generally most troublesome where high gain amplifier systems are used in conjunction with low output pickups, such as the magnetic types. Unfortunately, it is not always possible to nominate the path by which the interference reaches the amplifier and this is so in your case. It is conceivable that the interference could be intruding via the power supply overwind on the turntable motor, particularly if this is not fitted with an electrostatic shield. Alternatively, if a shield is fitted, it may not be earthed. A useful experiment would be to operate the preamplifier, temporarily, from a battery having the same nominal voltage as that of the power supply. If this confirms that the trouble is entering through the power supply it may just be possible to control it by fitting a line filter such as that described in the October 1969 issue (File No. 2/LF/3). Such a filter should be effective against high frequency transients, but not low frequency ones caused by mains voltage changes due to sudden application or release of heavy loads. This latter problem may respond to a zener diode regulator fitted to the power supply, provided this latter has enough reserve voltage to cope with likely surge values. Another suggestion is that of installing a series RC combination across the refrigerator thermostat contacts. A suggestion along these lines was published in the October 1970 issue in the Reader Built It section (File No. 2/LF/4). It may be worthwhile to operate the preamplifier from batteries and, if the current drain is only a few milliamps, the life of the battery would probably be almost equal to its shelf life.

CIRCUITS: I would like to compliment you on a fine magazine. Have you any circuit diagrams for a three transistor receiver, four transistor receiver, and a simple but effective intercom and telephone. (G. McG., Bentleigh, Qld.)

● Thank you for the compliment, G.McG. We endeavour to please all our readers as much as possible. A simple three transistor receiver was described in March 1968 (File No. 4/TR3/3) and plug in coils for this were described the following month (File No. 4/TR3/4). "A Simple Receiver of Novel Design" (a four transistor receiver) was described in November 1966 (File No. 4/TR4/3). A "Two Unit Transistor Monitor Intercom" was described in August 1962 (File No. 1/IA/9), and a simple telephone in November 1967 (File No. 1/TA/11). Any of these projects may be obtained from this office for the usual fee.

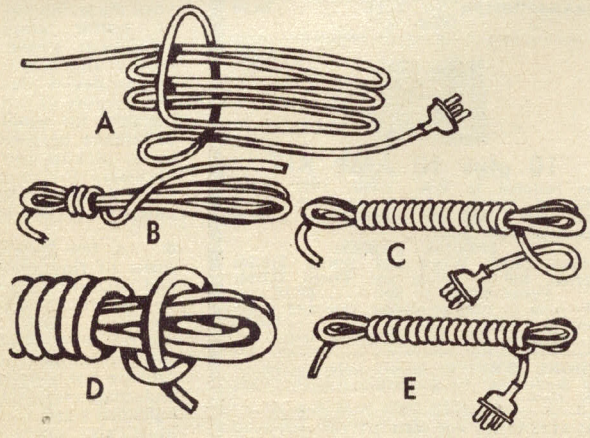
BATTERY CHARGER: I have a 240/12 volt 200 watt transformer with a secondary current of 16 amps that I wish to use as a battery charger. What type of diodes would I require for a full-wave bridge rectifier and what value of capacitor would be needed? If I put a resistor in circuit, could I use lower powered and cheaper diodes? (G.F., Strathfield, NSW.)

● Four diodes such as the BYX21L-200 automotive press-fit diodes, or similar, would possibly handle the load you mention with some margin. It is unnecessary to use a capacitor with a battery charger. It is essential to provide current limiting as, with a flat battery, the current has to be limited to 16 amps into the equivalent of a short circuit. A resistor of 1 ohm at 250 watts dissipation would be needed for this. There would be no point in limiting the current to allow the use of lower powered diodes, as the price of the mass produced automotive type of diode is similar to that of the more specialised lower rating type. Consult the diode manufacturer for heatsink specifications.

QUESTIONS FROM A STUDENT: I am an 18-year-old high school student and enjoy reading your magazine. Recently I was given the school's old PA amplifier, and have learned a lot just fiddling with it. It uses a Rola 12-20 loudspeaker, and I was wondering where I could obtain the data on it. Other questions that come to mind are as follows: Has "Electronics Australia" ever published any details on helical antennas? Is it possible to substitute flat strips of copper in lieu of the tubular sections, keeping in mind that the diameter of the helix and wavelength have a ratio of 0.02:1 for tubular sections?

Bunching a mains lead

The neatest method of dealing with the mains lead of a piece of equipment is to tie it in a bunch similar to the way that the leads of some new equipments are supplied. The knack of making a neat bunch can be acquired with a little practice. Once mastered it is as quick as any other method and gives a most professional appearance. The lead is first folded backwards and forwards across the palm of one hand to form a number of loops.



The number of loops and their size will depend on the total length of the mains lead. Two or three loops of about 6 to 9in should be enough for an average length lead. Leave about 12 to 18in for winding around the loops.

Finish the last loop at the equipment end (a) and start winding the free end round the loops leaving about 1 or 2in exposed at the equipment end (b). Continue winding until there is about 4in of lead left. If the lengths have been judged accurately, this should be within about 1 or 2in of the other end of the bunch.

Form a loop in the free end of the lead so that the part with the plug attached passes under that part from the winding (c). If it is formed in the opposite way, the whole bunch will unwind. The loop so formed should now be slipped over the end of the bunch (d) and pulled tight (e). This may seem a complicated method, but it is much easier than it appears at first.

XMAS SPECIAL

MULTIMETER CT-500

Range Selection by Rotary Switch
20,000 ohms per volt D.C.
10,000 ohms per volt A.C.
D.C. VOLTS: 0-2.5, 10, 50, 250, 500, 5000.
A.C. VOLTS: 0-10, 50, 250, 500, 1000.
D.C. CURRENT: 0-0.05, 5, 50, 500 MA.
RESISTANCE: 0-12K, 120K, 1.2Meg, 12Meg. (60, 600, 6K, 60K midscale).
DECIBELS: Minus 20 to Plus 62 db.
Complete with battery and test leads.
SPECIAL PRICE
WHILE THEY LAST
$13.95 including sales tax.
Plus postage Vic. 0.40
Other 0.70

CADET SPEED CONTROLLER

Will control speed of electric hand tools down to stop, without loss of torque. Complete with flex and plug.
2 amp rating **$11.00**
10 amp rating **$18.50**
Plus pack and post, Vic. 0.40
Other, 0.70

AMPLIFIER MODULE KIT

Easy to wire with wiring diagram and circuit supplied. Kit consists of 3¼" x 2¼" printed board, 4 Fairchild transistors, 6 resistors and 5 capacitors. Power output 3.5 watts R.M.S. with 20 volt supply **$5.95**
Plus pack and post 0.15

MAKE YOUR OWN PRINTED CIRCUIT BOARDS

Kit consisting of one 12" x 12" copper backed board, etching materials and instructions **$3.00**
Plus pack and post, Vic. 0.40
Other 0.70

INSTRUMENT CABINET

Plastic with sloping aluminium panel. Ideal for test gear, intercomms, ext. speakers, etc. 7.5" x 4.5" x 4.5" approx. size **$3.50**
Plus pack and post, Vic. 0.40
Other 0.70

BASIC POWER SUPPLY KIT

Consists of transformer—240/6.3, 7.5, 8.5, 9.5, 12.5 and 15 volts. Sel. bridge rectifier and 1000/16 filter capacitor. Will give D.C. voltages from 6 to 12 at 600 ma. Wiring diagram and instructions supplied. Suitable for transistor radios, tape recorders, record players, etc. **$4.95**
2 Amp. version of above **$6.95**
Plus pack and post, Vic. 0.40
Other 0.70

BROADCAST BAND TUNER

Solid state, mounted on printed board with 8" rod aerial. High quality output of .5 volt suitable for use with Hi-Fi amplifiers, tape recorders, high impedance headphones, etc. Operates from 9-volt battery. Complete ready to use.
$18.95
Plus pack and post 0.25

Quotes with pleasure for special power and stepdown transformers. Also all sizes of wire wound resistors.
FREE Resistor Color Code with every order.

LANTHUR ELECTRONICS

69 BUCHANAN AVENUE, NORTH BALWYN, 3104
VIC. Telephone 85 4061

Semiconductors — New, Guaranteed

2N2926	75c	AC187/188	$1.90
2N3638	50c	AD149	$1.65
2N3055	$2.00	AD161/162	$2.85
2N5459	$1.10	AF115N	90c
2N5485	$1.98	AF116N	70c
40408	$1.98	AF117N	70c
40409	$3.50	BC107	69c
40410	$3.70	BC108	50c
40250	$2.20	BC109	50c
MPF105	$1.10	BC177	75c
AC125	74c	BC178	70c
AC126	74c	BC179	75c
AC127	94c	BF115	63c
AC127-128	$1.70	BDY20	$2.00
AC128	64c	OC44N	48c
AC132	80c	OC45	48c
AC172	99c	OC71	48c
ASZ15	$2.50	OC72	48c
OC81	60c	OC74N	79c
		D13T1	$1.85

Diodes

AA119	30c	OA91/1N60	17c
2-AA119	60c	OA95	32c
BA100	36c	OA202	62c
BA102	96c	BY100	60c
BA114	32c	BYX38/600	$1.20
OA5	65c	BYZ12	$1.00
OA90	26c	BYX21L/200	$1.30

GENERAL PARTS

Alligator Clips, Red or black	15c ea
Bezels, miniature, with 6.3V fil	50c ea
BATTERY CLIP, 9V, 216	10c ea
BATTERY HOLDER to take 4 penlight cells	40c ea
CRYSTAL EARPIECES, with cord	55c ea
TUNING CAP, solid dielectric, 2 gang	95c ea
2.5 mH R.F. choke	65c ea
FERRITE RODS, 6in long, 3/8in diameter	55c ea
ROTARY SWITCHES, 3 x 3 pole	$1.20
Rubber Feet, tapered	40c doz
GROMMETS, mixed bag of 1 doz	25c
SOLDER, resin core	15c per yd
SLIDE SWITCHES, 2-position	16c ea
PRE-SET pots, all values	15c ea
CERAMIC FILTER SFD-455B	$1.00
CERAMIC FILTER SFB-455A	70c ea
HOOK-UP WIRE, various colours	4c yd
SPEAKER LEAD, figure eight	10c yd
TAG STRIPS, 10 lug	10c ea
KNOBS, black plastic pointer	10c ea
FUSE HOLDERS, panel mount	45c ea
FUSE HOLDERS, Chassis mount	15c ea
FUSES to suit above	12c ea
BRIDGE RECT. 20V at 1 amp	98c ea

PHILIPS 400 V.W. POLYESTER CAPACITORS

0.001 MFD	10c	0.033 MFD	15c
0.0022 "	10c	0.047 "	15c
0.0033 "	12c	0.056 "	17c
0.0047 "	12c	0.082 "	19c
0.0056 "	12c	0.1 "	19c
0.0068 "	12c	0.22 "	27c
0.01 "	12c	0.33 "	36c
0.022 "	14c	0.47 "	43c

RESISTOR PACK

Pack 56: Contains 3 resistors of 57 values between 10 ohms and 1M totalling 171. All 5 p.c. types. 1/4W **$4.75** 1/2W: **$4.84.**

POTENTIOMETERS

STANDARD: log or lin. **38c** ea.
SWITCH (log or lin), **75c** ea.
DUAL GANG: (log or lin), **$1.45** ea.
RANGE 1K-2M. All 2in shafts.

SEASONS GREETINGS

We wish to thank our many clients for their valued support over the past 12 months, and assure you of our continued prompt and efficient service in the future. We pass on season's greetings to you all. From the management and staff at **KITSETS AUST. PTY. LTD.**
(Garry, Bill, Gary, Bob, Joy and Sue.)

Signal Injector

$3.50

5,000 hz to 2 Mhz. Employs 2 transistors. Size: 1in x 1in. Complete with probes.

Etching Kit

$2.20

Contains all the chemicals, paint, resin, etc., to etch your P.C. boards. 6 x 3 unetched board 40c. Instructions provided.

I.F. Coils

98c each

10mm miniature type, 1st 2nd and 3rd. Osc. coil also 98c.

1971 CATALOGUE

Is now available, complete with all the new lines. The catalogue is available FREE upon receipt of your stamped 9 x 4 envelope. Also supplied free with all orders, upon request.

ZENER DIODES

Philips BZY88 series. All voltages from 3.3V to 12V at 55c each. From 13V to 30V at 79c each.
Phillips BZX70 series (1.7W). All voltages from 10V to 75V at $1.45 each.

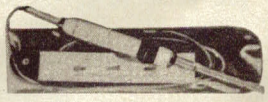
$5.95



3W RMS AMP KIT

Employs 4 transistors, circuit is one channel of 3 plus stereo amp—E.A. Sept '69. 8 ohm output inpedance gives full 3W with 150mV input. Outstanding performance. Kit complete to last item, inc. P.C. board. Special prices:
SINGLE CHANNEL, as illustrated, **$5.95**
STEREO VERSION **$11.80**
WIRED and TESTED: Mono **$6.95**
Stereo, **$12.80.**
POWER SUPPLY TO SUIT, **$6.35**
(Postage on above units, 50c)

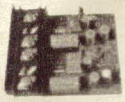
SCOPE SOLDERING IRONS



SCOPE DE-LUXE	$6.95
MINI-SCOPE	$5.85

(Free tips and elements supplied)
Postage on irons 45c each.
TRANSFORMER TO SUIT **$6.80**
(Post 50c)

$19.60



10 plus 10 AMP KIT

As featured in E.A., April, 1969. Kit contains complete power amplifier. Gives full 10W. RMS per channel into 8 ohm speakers, 28V supply.
SPECIAL PRICES:
Mono, **$9.85;** Wired and Tested, **$10.85;** Stereo, **$19.60;** Wired and Tested **$21.00;**
Power Supply to Suit .... **$9.15.**
Pre-Amp to suit, employing base and treble controls, balance, etc. **$10.73**
(Postage 50c on all above units.)

C.O.D. To use this service add 50c.
ORDER FORMS: Sent free with each order.

PHONE SERVICE: Simply order on phone an dorder will be despatched C.O.D. within the hour.

DESPATCH: All orders are received at 9 a.m. at the P.O. and despatched to meet the 1 p.m. clearance the same day. This gives you a 4-hour service.
POSTAGE: Add 15c packpost to all orders, unless stated otherwise.

QUALITY: All our parts are new and fully guaranteed. No surplus or rejects.
CATALOGUE: We will send our new FREE catalogue upon receipt of your 9 x 4 envelope with 9c stamp, or with your order. Illustrated.

KITSETS AUST. PTY. LTD.

MAIL ORDER DEPT.: Box 176, P.O. DEEWHY 2099, N.S.W.
SALES DEPT.: SHOP 14, STONES ARCADE, 673 PITTWATER RD., DEE WHY
PHONE: 982 5571 2099.

ANSWERS

What is the purpose of a 10K resistor and a 0.01uF capacitor across the primary of a push-pull output transformer? Have you ever published details of a valve ignition system? Can an LDR be used for the photoelectric ignition system described in the September issue? **(J.Y., Milang, SA.)**

● Your first question can be answered quite simply – contact Rola for data on the 12-20 loudspeaker. Helical antennas are specialised types used for highly directional communication work, such as satellite tracking. We have no information on design procedures for these type of antennas to date. The series RC combination found connected across some output transformers is to prevent the generation of excessive peak voltages from high frequency transients. With effective negative feedback, the provision is not necessary. Valve ignition can only be possible using a thyratron, and certainly not small signal valves such as a 12AX7. Solid state devices are used in electronic ignition systems because of their low cost, mechanical reliability as far as shock and vibration is concerned, no heating up time, high current carrying capacity – plus a number of other reasons. An LDR cannot be used for a photoelectric distributor, as its response time is much too slow.

STROBOSCOPE: I have been experimenting recently with a strobe light, but with only limited success as I have been using only a crude mechanical trigger. I feel that your magazine would be justified in describing an adjustable stroboscope. Its uses would be varied, but a high flash rate would not be justified for display lighting at parties, etc. On the other hand it would also be useful as a timing light and for multiple flash photography. **(G.L., Morningside, Qld.)**

● As you may have seen by now G.L., we described a stroboscope in the September issue (File No. 7/SC/3). While the light output is rather low for special lighting effects, it is ideally suited as a true stroboscope. We are investigating the possibility of obtaining a higher light output to suit display lighting, and methods of triggering it from a spark plug to permit its use as a timing light. However, for the display lighting we may have to await the availability of suitable components.

GUITAR PICKUP UNITS: Over the years your magazine has given up-to-date designs of guitar amplifiers and associated equipment. I have never seen details of the theory and construction of the magnetic pickup device placed under the strings for the purpose of generating the drive voltage suitable for amplification. Is there any difference between a "lead" and "bass" guitar pickup unit? What components are necessary for tone colouring of the basic string-derived voltage produced by these units? **(R.K., Auckland, NZ.)**

● A few hundred or a few thousand turns of fine wire around a magnet pole and adjacent to a steel string will produce an electrical signal capable of being amplified. There never has been any "secret" about this. The art in producing a fully developed guitar pickup unit is to provide a side-by-side array of pickup coils and magnets which will produce suitable balanced signals from all the strings. They must also produce as large a signal as possible, to simplify amplifier design, without getting the pole tips so close to the strings that they will actually touch. And, of course, there is the very important matter of compactness and appearance, since no one would want a rough or clumsy unit hung on an otherwise good-looking instrument. These considerations have discouraged home construction of pickup units in recent years. The positioning of the pickup unit along the strings has a bearing on the tone of the signals delivered to the amplifier

—continued

and, in fact, quite a few guitars have two or three similar pickup units to give the player a choice of a "sharp" or more sonorous tone, suitable for a lead or supporting role, as required. Over and above this, a great deal of tone colouration is performed in the amplifier with the aid of circuits and controls which boost or cut bass or treble by an amount far beyond that commonly used in domestic hi-fi systems. Naturally, people who build guitars and amplifiers know a lot of the tricks but they are not usually the people who write books about their work. In fact, we can't recall having seen an up-to-date book on the subject, giving the kind of detail you apparently have in mind.

BATTERY RECEIVERS: Have you ever published any circuits for a three to five valve receiver? I would like it to operate on batteries so it can be used as a portable set. I would like to receive the broadcast band. **(F.J., Warwick Farm, NSW.)**

● The last battery-operated valve receiver we published was in 1956. We cannot recommend any of these early designs because of the limitations of the valves involved and the problems posed by the batteries required. Why not build a transistor portable, or even a receiver built round an IC? We published an article describing simple crystal and transistor sets in July 1969 (File No. 4/TR1/11) and another describing a microcircuit receiver in April 1969 (File No. 4/MC/1.) Larger designs are also available. Copies of these articles can be obtained through the Information Service for 20c each.

GUITARS: I was reading an article in an American magazine recently describing a "Compression Sustainer" for use with electric guitars. The unit is supposed to increase the volume on soft passages and decrease it on louder passages. Because of the compressing action, the note tends to keep a constant volume as it starts to sustain. Has "Electronics Australia" ever described a similar unit? I feel that such a unit would be an interesting project if you haven't. My congratulations on a fine magazine. I am 17 years of age, and can say that most of my knowledge of electronics has come from your magazine. **(R.V., Niddrie, Vic.)**

● "Electronics Australia" has never published a "Compression Sustainer" or similar unit, R.V. We have published more conventional volume compressors in two past issues (June 1968 – File No. 1/M/12 and February 1970 – File No. 1/M/13) and these are intended to be used as volume limiters in such equipment as PA amplifiers, tape recording gear and transmitter modulators. Something like the effect you describe could possibly be achieved with one of these units connected to a guitar amplifier at a suitable position on the preamplifier circuits. There is plenty of room for experiment here. We thank you for the kind remarks about the magazine.

REPRINTS, VALVE DATA: What happened to the circuits you used to reprint in these columns? Have you developed an aversion to valve circuits? Also, I think the person who writes these columns could be more helpful on occasions. Anyone who writes in for data on a valve is as likely to be told to look it up in a valve data book. This is illogical because, if he had access to a book, he would not be writing a letter! Answers To Correspondents is a basically interesting section but the writer needs a shakeup! **(R.B., Earlwood, NSW.)**

● These columns are not written by an individual person. All staff members share the job of answering correspondence. Answers are, however, framed within certain guidelines. As do most (if not all) other magazines, we take a deliberate stand against pressures which might lead us into becoming a central reference for data on valves, transistors, integrated circuits, coil and transformer connections and so on. Not only would this kind of "heritage" cripple our productive effort but, if we accepted the principle of publishing data as requested by any one of a hundred thousand readers, we would very soon be accused of filling our columns with material which rightly belonged in data books or manufacturers' specification sheets. If we need a "shakeup" in this respect, so does virtually every other journal! We published a series of circuits, partly because we knew they would be of interest and partly because we happened to have sufficient backnumbers or tear-sheets on hand to meet the

100 tips for superior soldering

Adcola Australia lead the world with over 100 different standard tips, covering the entire field of production and servicing. Micro-miniature and instrument work; printed circuits; heavy tag, chassis and wire soldering. All are sealed to prevent seizing in the barrel.
Each tip is matched to one of the seven long-life, fast-heating Adcola 'M' Series soldering tools — from ¾ oz. to 5 ozs. — each of which is available in at least three temperature ranges.
Benefits — swift work, durable joints, no damage to components, no joint embrittlement, lower soldering and maintenance costs. When it comes to soldering, the best tip is Adcola.



ADCOLA

Selection is simple; from our brochure. Yours for the asking.

ADCOLA PRODUCTS PTY. LIMITED

VIC.: 22 Firth St., Doncaster, 3108 (Tel. 848 3777)
NSW: 17 Burwood Rd., Burwood, 2134 (Tel. 747 1606)
S.A.: F. R. Mayfield Pty. Ltd., Adelaide (Tel. 8 4131)
QLD.: T. H. Martin Pty. Ltd., Brisbane (Tel. 21 5644)
W.A.: Everett Agency Pty. Ltd., Perth (Tel. 8 4137)

RA5

NEW RANGE OF RESISTORS CONDENSERS AND POTENTIOMETERS

The resistors are mainly I.R.C. and Morganite and are in a wide range of values from 100 ohms to 3 meg. in ¼, 1 and 2 watt and include wire wound. LIST PRICE **$9.00** per 100. OUR PRICE **$2.00** per 100. Post and packing 35c extra.

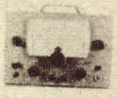
The condensers are in most popular brands and include Polyester, Paper, Mica, Ceramic and Electrolytic in values up to 8mfd. LIST PRICE **$11.00** per 100. OUR PRICE **$2.00** per 100. Post and packing 65c.

The pots, are all current types and include switch pots, and dual concentric, tandem, tab pots. etc. LIST PRICE **$12.00** per dozen. OUR PRICE **$2.50** per dozen. Post and package 60c extra.

FREE With each lot of resistors, condensers or pots. we will supply one new valve. Type 6U7G, 1T4.

Regret special values in resistors, pots and condensers cannot be supplied.

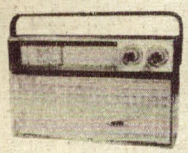
LEADER SIGNAL GENERATOR LSG11



240V A.C. operated, 6 band 120KC to 390 Megs. Provision for crystal. **$39.50**
Post N.S.W., 75c; Interstate, $1.25.

NEW TRANSISTOR 8 KIT SET

SPECIAL PURCHASE ENABLES US TO OFFER THIS KIT SET AT $24.00



- Complete kit of parts with circuit and full instructions.
- Eight transistors.
- Magnavox 5X3 speaker gives excellent fidelity.
- High sensitivity, suitable for city or country use.
- Heavy duty battery for economical operation.
- Modern design, plastic cabinet with gold trim.
- Dial calibrated for all States.
- Available in colours of off-white, red, black.

DIMENSIONS 9" x 5" x 3" deep

Post N.S.W., $1.25; Interstate, $1.75.

A TRANSISTOR PREAMP FOR MAGNETIC PICK-UP OR TAPE HEAD

Using 3 transistors per channel as featured in Electronics Aust. Complete kit of parts including transistors. P.C. board and resistors and condensers. Circuit and full details supplied.



Stereo Kit **$8.50.**
Mono Kit **$4.50.**
240V Power Supply **$4.50.**

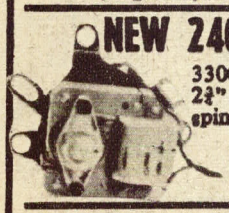
State if required for Pick-up or Tape Head.

NEW HIGH STABILITY CARBON RESISTORS 1 p.c. and 2 p.c. TOLERANCE

These imported resistors are in ½ and ¼ watt with values from 50ohm. to 1 meg. 1% and 2%. In packets of 50 mixed values.

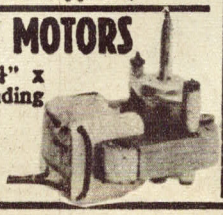
LIST PRICE 20c each.
OUR PRICE $2.00 per packet of 50.
Post and packing, 20c extra.
(Regret special values cannot be supplied.)

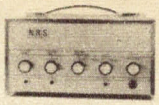
NEW 240V ELECTRIC MOTORS



3300 R.P.M. Size 3½" x 2¾" x 3¼", including spindle.

$2.75
plus 60c postage





NEW 25 WATT P. A. AMPLIFIERS

These amplifiers are suitable for installation in clubs, schools, restaurants, factories, etc. Wherever the amplification of speech or music is required.

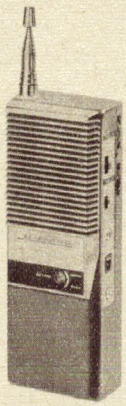
$63 Freight extra

SPECIFICATIONS

- Output impedance Line output (100, 166, 250, 500 ohms) Nominal power 25 watts.
- Inputs two microphone and pick-up radio with separate controls and mixing facilities.
- Tone control.
- Frequency response 30 to 18,000 CPS.
- Output impedance Line output (100, 166, 250, 500 ohms) or can be supplied with V.C. output (2, 3, 7, 8, 15 ohms).
- Dimensions 11in x 6in x 8in. Weight 25W 23lb. Freight extra.

NEW COLUMN SPEAKERS

Suitable for above Amplifier in walnut finished cabinet containing four 8" Rola Speakers Imp. 8 ohms. **$37.50.** (Freight extra.)



At last a breakthrough in the cost for high quality portable radio transceivers of the walkie-talkie hand-held type. We are introducing and offering for sale a fully PMG approved

MIDLAND 1 WATT TRANSCEIVER

for 27,240 kHz operation with switch provision for two additional channels, tone call signal, background noise squelsh control, battery voltage indicator, steel case with separate cover, good for five miles distance communication under average field conditions, with penlite cell-batteries for

ONLY $37.50 PER UNIT, FULLY GUARANTEED.
Postage extra.

NEW POWER SUPPLY KIT

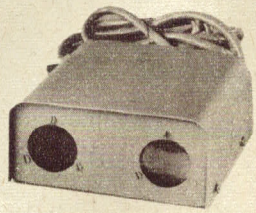
Ideal for small amplifiers, stereo or mono, test equipment, etc. Input 240v. A.C. Output 20v. D.C. at 1 amp.

Kit contains transformer, rectifiers, filter, condenser and circuit.

$4.50 Post 75c.

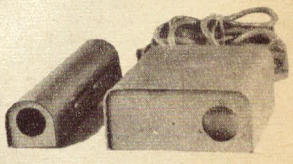
New Photo-Electric Burglar & Door Alarms at less than half price

DOOR ALARMS



240V A.C. operation
$12.00
Post & Packing $1.25 extra.
Buzzer $1.25 extra.

BURGLAR ALARMS



240V A.C. operation
$16.00
Post & Packing $1.50 extra.
Buzzer $1.25 extra.

NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE 56-7398

ANSWERS — continued

anticipated — and inevitable — requests for extra information. We have other circuits which could be reprinted but we do not have a substantial number of copies of the original aarticles ready to hand. Support material would have to be supplied in the form of individual photostats and our Query Service simply could not cope at present with the additional load. If we are to reprint circuits as a continuing policy, they would have to be complete with supplementary data in condensed form, to minimise the load on our postal reply arrangements. No, we don't have any aversion to valve circuits and, in fact, like most other technical groups, we have staff members who are more at home with valve technology than solid-state technology. But the facts of life are that the main pressures of demand and development centre around solid-state devices.

DEAD LETTER: We are holding a letter, originally addressed to Mr. R. A. Jones, Radio Officer, M.V., Lake Sorrell, A.N.L., Box 2238T, G.P.O. Melbourne, Victoria, which has been returned by the postal authorities marked "Paid off this vessel". Would the writer please advise us of his current address?

PEN FRIEND WANTED: We have a letter from the Australian Radio DX Club giving the address of an enthusiast from Ghana who wishes to correspond with an interested party in Australia. For anybody who is interested, his name and address is: **Joseph Appiah Yorke, Mails Office GPO, Accra, Ghana.**

CONFERENCE ON BUGGING: The enclosed newspaper clipping indicates that a conference was recently held in Brussels attended by 400 delegates from 20 nations. Organised by the Council of Europe, its job was "to consider the rights of individuals and the duties of the Governments to secure protection from what has become accepted as a post-war explosion in surveillance techniques." Best wishes and congratulations on your continually improving magazine. **(F.B., Forestville, NSW.)**

● We had not seen this particular clipping and thank you for bringing it to our notice. We did not reproduce it, mainly because it mentions matters which we had already covered at length in the August 1970 issue.

ADAPTING PLAYMASTER 129: Can a microphone and units such as the Autodrum and Electronic Bongos be fed through the Playmaster 129 stereo amplifier? I congratulate you on a most interesting and helpful magazine. **(T.H., Mudgee, NSW.)**

● The Autodrum and Electronic Bongos will operate directly into the "Auxiliary" inputs of the Playmaster 129, but a microphone will need to be operated through a microphone pre-amplifier. If a dynamic microphone is to be used, the pre-amplifier described in our issue of July, 1965 would be a good choice (File No. 1/PRE/14); while for a crystal microphone, the Crystal Microphone Impedance Transformer, June 1968 (File No. 1/PRE/21) would be suitable. Thank you for the compliment.

FLASHER: I was wondering if you could send me a circuit for a lamp flasher. It needs to be very fast and very bright, and run off mains power. If possible I would like a Strobe. **(P.W., Boronia, Vic.)**

● We have described two light flashing systems in recent issues. One was a stroboscope described in September 1970 issue (File No. 7/SC/3) and the other an incandescent lamp flasher described in the November 1970 issue (File No. 2/PC/10). Reprints of both articles are available through the Information Service, each for the usual 20c fee.

VOLUME EXPANDER: I have enclosed for your information a copy of an article describing an IC volume expander from a recent issue of an American magazine. My interest in the article was revived after reading Chapter 17 of the Fundamentals of Solid State, which contains an explanation of hot carrier diodes. Perhaps you could describe something similar as a companion to the volume compressor, published in February 1970, for general hi-fi use. Also, how about a new tuner using ICs? It is over two years since the last high quality program source was described. Finally, congratulations on a fine magazine. I look forward to it every month. **(J.K., Mosman, NSW.)**

● Thank you, J.K., for your remarks and suggestions. Although ambitious claims are made for volume expanders, we have reservations about their real value in a domestic hi-fi situation. It is unlikely that we will be publishing another program source in the near future as the latest ones (August-September, 1968 and October, 1968) are completely modern designs which should not date for several years.

RADIO: Unofficial history

Your "Unofficial History" column has included reference to country picture shows, so I guess that it would not be stretching things too much to include something from one who has spent a lifetime coaxing voices through wires strung on poles! Three anecdotes come to mind, all of which I can personally vouch for.

The first involved a friend who, many years ago, had to install a phone for an extremely house-proud customer. The phone was one of those enormous devices that used to mount on the wall, with a hook and earpiece on one side, a handle on the other and a large mouthpiece protruding from the front.

The customer wanted the phone, to be sure, but he was equally determined that none of his walls were going to be plugged or cluttered. After everywhere else had been vetoed, there was only one place left for the instrument to go – screwed to the back of a very stout door. And, since the door was normally left open against the wall, the phone would be handy, yet normally out of sight.

So, behind the door it went, with the leads looped so that they would withstand the flexing.

All went well till a particular day, when the customer was standing behind the half-closed door, deep in conversation on the phone. Without warning, someone came hurtling into the room and gave the door an almighty shove to clear his path. For the next two or three weeks the customer got around with the largest lips you'd see in a lifetime, the pair of them surrounded by a circular sore that bore a remarkable resemblance in size to the business end of a telephone mouthpiece!

The second story happened sometime later and involved a much later and smaller wall telephone. This, too, was not acceptable in any of the usual places and – believe it or not – it ended up screwed to the large, old-fashioned skirting board.

Apparently, the customer argued that he'd be able to make himself heard by simply leaning down from his recliner chair and talking loudly towards the mouthpiece. For local calls it might have worked that way, when a call came up on a poor line, there was only way to use the phone – lying prostrate on the carpet!

Finally, there was the public telephone that the Department installed, some years ago, in a street in Glebe, Sydney. The concrete slab was poured, provision made for line and power and, a few days later, a gang took out a brand new telephone booth and bolted it in place. A couple of mates followed on, installed and connected the phone and the lighting circuit. Only one detail had to be attended to, namely the coin box.

Next morning, another man headed for the phone with a new coin box, but he couldn't find the phone booth anywhere. When he rang to check the street and location, he was directed back to the place where he had originally gone. There followed some rather caustic remarks, in which each party accused the other of being all kinds of a clot.

Finally, one of the men, who had actually installed the booth, grabbed a vehicle and headed off to pick up the inquirer and show him where the so-and-so phone booth was.

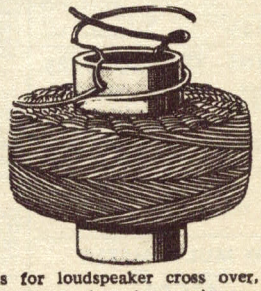
But it wasn't. All that remained was a slab of concrete and two pairs of wires which had parted when the booth had been hoisted from its base.

I can only assume that, somewhere in Sydney, a householder has a garden tool shed or an aviary that looks remarkably like a Post Office telephone booth! (D.W., Glebe, NSW.)

Readers are invited to submit contributions to "RADIO: Unofficial History" and a publication fee will be paid for those used. Stories must be humorous and they must be true. Letters must be signed and the locale of the story indicated as a mark of good faith. The Editor reserves the right to re-phrase contributions as necessary to preserve uniformity of style. ■

*AEGIS

*Reg. Trade Mark



Coils for loudspeaker cross over, and other heavy duty low resistance networks

Write for list of standard values and prices. Distributors in all States.



AEGIS PTY. LTD.

347 Darebin Rd., Thornbury, 3071.
49 1017, 49 6792.
P.O. Box 49, Thornbury, Vic., 3071.

SOUND PROJECTORS

Cinevox Prefect and Harmour and Heath 16mm in good working order. 240v operated, complete with speaker and amplifier.

from $90.00

CIRCULAR SLIDE RULE

3¼in diameter. Will do the same work as the conventional slide rule. Instruction book included.

$1.25 each
Post 10 cents.

P.M.G. TYPE TELEPHONES

Standard desk type with magneto bell calling device. Range 30 miles. Uses standard batteries at each phone. Any number can be connected together on single line.

$23.00
(2 TELEPHONE SETS)

30c cartage to rail. Freight payable at nearest attended railway station.

Please note we are now able to include ½ mile of telephone cable FREE with each set of Phones.

BATTERY CHARGERS

240 volt A.C. Input.
Each battery Charger will charge either 6 or 12 volt batteries.
2 amp. without meter, **$13.75**
2 amp. with meter, **$15.75**
Post N.S.W. 70c; Interstate 95c.

MINIATURE ELECTRIC MOTORS

1½ to 3 volts D.C Ideal for model boats, cars, planes, etc. Strong torque. Only
65 cents each or 10 for $4.00.
(Post 7c).

TRANSCEIVER

(2-way radio) R.C.A. America RT 68, 24 volt, operated 10 watt output 38-54 megacycles F.M. crystal locked. Transmitter and receiver using frequency synthesiser in 100 K/cs: step 10 channel per meg/cycle with power supply. Leads, mike and headphones **$45**, 60c cartage to rail. Freight payable at nearest attended railway station.

TRANSCEIVER

(2-way radio) 62 set ideal small ships, Hams, etc. 1.6 to 10 megs. Crystal locked or V.F.O. controlled 5 watt output. Complete with antenna, headphones and mike **$60.** 60c cartage to rail. Freight payable at nearest attended Railway Station.

HEAD PHONES

Low impedance moving coil fitted with rubber muffler to reduce external noise, fitted with press to talk, dynamic hand microphones. Ideal for use with all types of transceivers. $3.50 pair. Same with black felt muffler, $4.50 pair.
Post N.S.W 25c; Interstate 30c.

COLLINS TRANSCEIVERS

Auto-tuned 100-150 megacycles, 10 channels . . . . . .

$65.00

MICROSCOPE

500 x magnification, 3 turret. **$6.50.**
Post., N.S.W., 55c; Interstate, 85c.

AVO MULTI METER

Type CT 38
$75.00

A.W.A. AUSTRALPHONE

Transceivers 12 V.
New Complete Station.
1.6 to 10 megs on transmit.
0.54 to 16 megs on receive.
$150.00

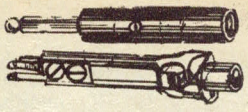
LAVOIE HETERODYNE FREQUENCY METERS

10-100 Megs. LA5. **$250.00.**

100-500 M/cs. **$350.00.**

ADLER FREQUENCY METER

100Kc-20 M/cs. **$175.00.**



P.M.G. Phone Jack and plugs, 25c each, 45c the pair.
Post 7c.

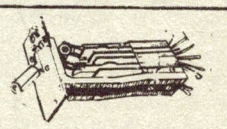
NIFE CELLS

1.2 Volt fully charged, 4in x 3in x 1in 4 AH.
$1.00 each
Post, N.S.W., 25c; interstate 35c.

3.6V 10AH. set of 3 batteries in wooden holder. $7.50 per set. Post. N.S.W., $1.10; Interstate, $2.72.

WALKIE TALKIE TWO-WAY RADIOS

P.M.G Approved Citizen Band. 9 Transistor. $55.00 per set of 2. Post, N.S.W. 50c; Interstate, 60c.



P.M.G. TYPE KEY SWITCHES.
45c each. Post, 15c.



45 x 40 coated Lens with tripod.
$10.95

30 x 30 Power Coated Lens
Brand new.
$3.75

60 magnification with a 60mm coated objective lens.
With tripod.
$23.00

As illustrated.
Postage, 95c; Interstate $1.20.

BC 221

Frequency Meters
$55.00

SMALL COMPUTOR PANELS

3in x 2in containing 2 valves, qty. of resistors, etc.
only 75c
Post 21c.

STEREO headphones, brand new, $7.50. post N.S.W. 60c. Interstate 85c.

TYPE S POWER SUPPLY

(240 Vac supply for AT 5-ARB) suit most types of Disposal transmitters and receivers outputs 250 volt. 10ma 550 volt 200ma, 300 volt 100ma. **$30.00**

TELEPHONE WIRE

21 gauge copper, plastic covered. Ideal telephone or bell wire. 1.320ft coil of twin (equal ½ mile) **$7** per coil.
Post, N.S.W. 70c; Interstate $1.20.

SCOOP PURCHASE

Gramo Motors. New. Made in U.S.A. 4-speed 240 volt A.C. 50 cyc. Only **$2.75** each.
Post, N.S.W. 30c; Interstate, 40c.

CO-AXIAL SWITCH

70 ohms 4 positions, can be motor driven completely waterproof 70 ohms type connectors. Housed in metal case 9in x 8in x 8in $5.00 each. Post N.S.W 70c. Interstate $1.20.

ELECTRONIC COUNTER

(Austronic) 0-100 K/cs. 240V operated. **$150.00**

Cossor Double Beam Oscilloscope 1035. Tested. **$150.00**

Kleinschmidt 5 Unit Punch Reader and Tape Printer with Key Board. **$95.00.**

VALVES

BRAND NEW

IN CARTONS

Special discount for quantity

807	75c	CV850	$1.50
6SN7GT	95c	1H6G	30c
8989	$1.00	832	$8.00
5U4G	95c	6AK5	$1.50
EF50	35c	6X4	$1.00
5Y3	$1.75	12SK7	80c
6C4	80c	VR65	25c
2 x 2	75c	VT4C	75c
6AQ5	80c	AU5	$1.00
12AU7	$1.00	80	$1.25
X61M	$2.20	6AK5W	$1.50

CATHODE RAY TUBES

3FP7	$2.95	5DP1	$3.80
3JP1	$2.95		
V1669 4/1	$2.95	CY2184	$2.95

PLEASE ADD POSTAGE ON ALL ARTICLES

TELESCOPES

30 x 40 with Tripod
$7.95
Post N.S.W., 70c; Interstate $1.20

PETROL MOTOR GENERATOR SET

BRAND NEW EX-ARMY

300 watt, 15 volts, 20 amps. Made in Canada. Complete with tools, instruction book, spares, etc. Only **$75.00**

$1 cartage to rail, freight payable at nearest attended railway station.

SELSYN MOTORS MAGSLIP Mk. II . . . . . **$5.25 ea.**

No. 19 TWO-WAY RADIOS
Sold as is without power supply, leads, accessories, etc. Only $15.
Or complete with above gear, $35.

BINOCULARS

PRISMATIC. Coated Lenses
Brand new. Complete with case.

6 x 30	$12.50
8 x 30	$16.75
7 x 25, wide angle	$29.50
7 x 50	$22.15
10 x 50	$23.07
12 x 5	$23.95
20 x 50	$26.50

Post, N.S.W., 70c; Interstate, $1.20

3000 TYPE RELAYS

P.M.G. 200 Ohm — 1,500 Ohm Coils, **$1.25** each.

TOGGLE SWITCHES

Brand new, 3 amp, 240 volt, S.P., S.T., 39c each or 10 for **$3.00.**
Add postage.

Cintel Oscillator and Electronic Counter, type 388. **$250.00.**

522 TEST SET

100-155 M/cs. I.F. Generator, crystal locked R.F. Power Meter, A.C. Supply Meter. **$25.00.**

SPECIAL lucky dip valve offer, 15 new valves in cartons for only **$2.00.** We haven't got time to sort them, so you reap the benefit.
Post 60c.

MINE DETECTORS

Ex A.M.F with Instruction Book. Complete in wooden case. Ideal for plumbers, councils for locating buried pipes, etc. Freight payable at nearest attended railway station.
$39.00

4 DIGIT RELAY COUNTERS

50-volt D.C., suit slot car. Lap counters, etc.
$1.25 each. Post 13c.

ALTEC STUDIO MICROPHONES

639B Western Electric, top grade, original cost **$250**, ideal Broadcast Studio, music recording, Church and play recording, etc. Fraction of original cost.
Price on Application.

240 VOLT 522 POWER SUPPLY

Supplies all necessary voltages to operate 522 transceiver from 240 V A.C. Complete and ready to plug in **$30.00.**

SOLENOIDS

Plunger Type 12V 300M.A. Suit electric camera control, miniature trains, radio, etc.
$1.25. Post, 10c.
200 Mill. amp., 24 volt, 1/8in push movement.
$1.25. Post 10c.

CONDENSER LENS

2½in DIAM. 2in FL. **$1.50** each or **$2.50** per pair. Post 21c.

CONDENSER LENS

1½in diam. 1½FL. **50c** each.
Postage, 17c.

ZOOM FOCUSING MICROSCOPE

Battery and mirror illuminated, 900 x magnification, complete with disecting kit, slides, etc.
$17.95.
Post N.S.W. 65c, Interstate 85c.

TEN CHANNELS VHF TRANSCEIVER

Types TR1934 100-125 meg/cys. and TR1935 125-150 meg/cycles. 28 volt DC operated AM single crystal locks both TX and RX on same channel complete with generator.

$33.00

RECORDING TAPES

TOP QUALITY BRAND NEW

			POST
3" x 150'	..	65c	... 9c
5" x 600'	..	$1.35	... 13c
5" x 900'	..	$1.78	... 13c
5" x 1800'	..	$3.29	... 13c
7" x 1200'	..	$2.75	... 21c
7" x 2400'	..	$4.45	... 46c
7" x 3600'	..	$6.00	... 46c

CASSETTE TAPES

C60 $1.15, C90 $1.75, C120 $2.25.
Post 13c.

BYER 77 Mk. I

Rack Mounting Tape Recorder, ex A.B.C. 7½-15 I.P.S. Full track tested. **$150.00.**

Microphone, Professional S.T.C. type 4017. **$20.00.**

Marconi Video Oscillator type TF885A 0-12 M/cs. **$75.00.**

Marconi H.F. Sig. Gen. 85 K/cs. to 25 M/cs. **$65.00.**

Pye 4 Channel Crystal Locked Oscillator. 1.5-30 M/cs. New.
$25.00.

TRANSPONDER APX6

with Lighthouse Tubes. Can be converted to 1200 M/cs. **$17.00.**

WHEATSTONE BRIDGE

Top grade
In Multiples up to 1000
$65.00

Deitch Bros.

70 OXFORD STREET, SYDNEY, 2010

SORRY, NO C.O.D.

ANSWERS —continued

ELECTRONIC CROSSOVER: I was most interested in the latest advances that some companies are claiming for high fidelity stereo equipment, in particular, electronic crossover with separate amplifiers and multiple speakers. One manufacturer claims the results as "exciting". Does "Electronics Australia" have any intention of running an article along these lines? Is it necessary to have four or six amplifiers with equal power, or are there larger ones for each bass channel? I would expect that the efficiencies of the different groups of loudspeakers would dictate this when one considers that the present systems using the usual L-C networks are "balanced" (P.R., Glynde, SA.)

● The idea of an electronic crossover is not new but it is only since the advent of solid-state amplifiers that the use of multiple amplifiers has become less than forbidding. Not all loudspeaker/crossover combinations are above reproach but whether this warrants resort to low-level crossover and multiple amplifiers would be open to debate. In the ultimate, a low-level crossover with separate amplifiers might have a theoretical advantage but, having in mind the performance of high quality conventional arrangements, it is difficult to imagine an order of improvement which would justify the description "exciting". At the moment we have no plans to describe such a system. It may be possible to consider a system involving amplifiers with lesser power for the higher frequencies but one of the "fashionable" arguments for high power is that a surprising amount of power is needed to reproduce high frequency transients cleanly. There is also the matter of loudspeaker efficiency which could make a difference of 2:1 in the nominal power required to drive individual types. Since this class of amplifier system is in the exotic class, it is probably inappropriate to speculate too much about economising in power ratings. It should be kept in mind that extra amplifiers mean extra potential sources of trouble and therefore a potentially greater maintenance problem. ■

FORUM . . . . (continued from page 55)

not designed to demand dexterity of the fingertips which is required in playing pachinko.

"It seems to this writer that the special characteristics of the Japanese as revealed in their attraction to pachinko forms the foundation for the development of quality audio equipment in Japan.

"The so-called Japanese audio-fan usually likes to sit alone before a machine with a deadly serious expression on his face and alert to catch even the slightest distortion of sound. The majority of Japanese audio-fans appear more like engineers testing the performance of the machine rather than music-lovers enjoying the music.

"Should such an audio-fan spot even the slightest maladjustment, he would immediately put his own deft fingers to work on repairing whatever is wrong. There is also an unexpectedly large number of audio-fans who would go to any lengths to obtain possession of a newly marketed equipment when he learns that it is better than his current possession. This can easily be believed when one sees the large quantities of imported high quality cartridges each costing several tens of thousands yen carelessly displayed in ordinary record shops.

"In short, the Japanese have a sort of passion for this type of mechanism. For instance, when a Japanese buys a camera he must have the salesman give him a thorough lecture on the various components and capacities such as the number of the lens used, the resolving power and depth of focus. In this respect, probably no other people can compare with the Japanese". ■

AUTOMATIC TESTING . . (from page 57)

instruments are designed so they can be remotely programmed, and systems are being assembled using these instruments. This approach not only lowers initial costs, but also can be expected to enhance reliability and maintainability, since standard instruments are usually well debugged and easily serviced. This approach also makes modular systems possible, so a user can have a system assembled to fit only his immediate needs, and yet be able to expand or modify it as his needs change.

Another problem in the early days was that even the smallest computers were relatively large and expensive by today's standards, so small automatic test systems were impractical. The first automatic systems used paper-tape readers to control the test equipment, and hardware limit comparison to check results. Arithmetic capability was very limited and branching to other tests was awkward. Interfacing between the computers and the test equipment was also difficult because everything had been designed separately. Interface boxes often had to be designed to accommodate the differences in logic levels and timing.

Today there are many small general-purpose computers, costing between about $5,000 and $25,000. It has become economically practical to use computers almost exclusively as automatic test system controllers. Other controlling devices are expensive by comparison when the many capabilities of computers are considered. Progress is also beginning to be made in standardising logic levels, codes, and other programming parameters, and prepared interfaces are often available. Many computers, such as those produced by Hewlett-Packard, accept plug-in interface cards; there are standard cards for standard instruments, and custom cards can be manufactured.

Programming of automatic test systems used to be difficult because programs had to be written in tedious machine language. Engineers and technicians who knew what tests had to be performed had to describe these tests to programmers, who would then write the test program. Often neither group understood or appreciated the technical problems, the possible alternatives, or the language of the other. This also complicated debugging and changes, and made software preparation very expensive.

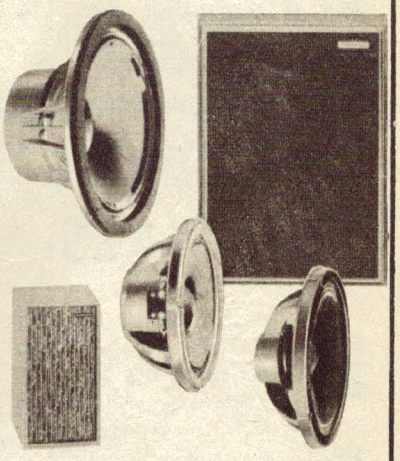
Things are different now. BASIC, AuTest, and other simple, conversational, English-like languages are available. Programs are easily modified and can be written by the test engineer or technician. ■

GOODMANS LOUDSPEAKERS are STILL the BEST

In recent years, many loudspeaker manufacturers have come forth, making unbelievable statements and claims about the performance of their products. Only GOODMANS have lived up to their reputation and withstood the test of time.

STILL, after 20 years in Hi-Fi in Australia, Goodmans loudspeakers are the

BEST!



URD

UNITED RADIO DISTRIBUTORS PTY. LTD.

SHOP 32, ASH STREET, ANGEL ARCADE, SYDNEY

Telephone 28 3718, 28 3926

Please forward details of Goodmans loudspeakers.

Name .....

Address .....

.....

.....

..... State .....

WANTED TECHNICIANS
and
TECHNICAL OFFICERS

with HF, VHF or UHF experience to work on development of a range of transmitter-receivers and other communication devices. An amateur licence or work on aviation equipment could be an advantage.

An attractive salary would be negotiated, and superannuation would be available after a period of 6 months to the successful applicant.

Please write to the:

General Manager,
Martin Electronic Pty. Ltd.,
P.O. Box 358,
Bankstown, N.S.W. 2200.

giving details of experience. Applications will be treated in the strictest confidence and evening interviews can be arranged.

MARTIN ELECTRONIC PTY. LTD.
An associate company of
MARTIN AVIATION PTY. LTD.

ALWAYS RELY ON R.D.S.

SPECIALS

R D S

Philips Tuner Kit consisting of Module. Gang. Cond. and Loopstick $13.26 NETT
Audio amp module 200 M.W. input sensitivtiy 6 M.W. input sensitivity 6
8 watt stereo kit consisting of 2 audio modules 8 watt per side type 601 with heat sink and output transistor assembly 611. Full price $30.00 nett.

The Independent Wholesaler

RADIO DESPATCH SERVICE

Radio and Electrical Distributors

869 GEORGE STREET, SYDNEY.

Corner George and Harris Streets
Telephone 211-0816, 211-0191

Open Saturday mornings

INSTRUMENTS FROM TEKTRONIX

(Continued from page 147)

Another important feature is the externally gated mode of operation. By locating the counter in one of the vertical positions of the oscilloscope and operating the scope in the delaying time base mode, the "B" sweep (delayed sweep) can drive the counter gate. By doing this, the waveform can be displayed on the screen with "A" sweep while "B" sweep intensifies the trace and acts as the counter gate. Using a 7000-Series vertical amplifier, time-base unit, and a 7D14, a signal can be displayed on the oscilloscope screen while simultaneously measuring its frequency to 0.00005% accuracy.

When the 7D14 is used in a horizontal plug-in compartment, a signal connected to a vertical plug-in compartment, can be internally routed to it. This is an important asset when circuit loading is a factor. All the 7000-Series vertical plug-ins are available as signal conditioners for the counter. The 7D14 has eight digit readout, 100mV P-P (35mV RMS) sensitivity, 50ohm and 1M inputs.

The 7D13 Digital Multimeter plug-in is unique to the DMM field. Not only does it have the normal current, voltage, and resistance measurement capabilities, it also measures temperature, right from -55 to +150 C. A transistor is used as the sensing device and temperature is measured by way of a probe tip (a temperature/voltage probe is supplied as a standard accessory) which has the device built in.

A temperature output signal gives 10mV/°C and is suitable for driving a separate analog chart recorder. DC voltages can be measured up to 1000V with an accuracy of +0.1%. The 7D13 input circuit can be floated up to 1000V above chassis potential, this allows considerable flexibility in measuring circuit parameters that have a high common mode voltage. Resistance can be measured to two megohms and DC current to two amps, accuracy in both modes is ±0.5%. The 7D13 has 3 1/2 digit readout.

Inquiries regarding the above instruments should be directed to Tektronix Australia Pty Ltd, of 80 Waterloo Road, North Ryde, NSW 2113, or to branches in other states. ■

AUTOLIGHT

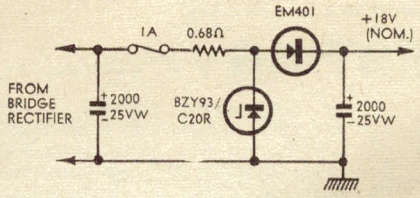
(Continued from page 89)

circuitry is at mains potential. For this reason, it may be wise to seek the advice of your local electrician before attempting to install the unit, or even have him make the actual connections. In any case, the appropriate lighting circuit fuse must be removed and/or the main switch turned off before any work is done on the lighting circuit.

As an additional precaution, make sure that a light is turned on before turning off the power at the switchboard. This will provide an indication that the correct circuit has been opened and also discharge any capacitors, such as fluorescent power correction capacitors, across the line. Such capacitors can deliver a frightening though relatively harmless shock in some circumstances. ■

Notes & Errata

PLAYMASTER 129 (October 1970): There appears to be a temporary shortage of BZY93/C18R zener diodes. Type BZY93/C20R may be substituted, provided the circuit is modified as shown.



This can be done without modifying the pattern on the board. Wire the 0.68-ohm resistor directly between the fuse and the zener diode and place the EM401 diode in the position vacated by the resistor. If the tolerance is such that the voltage across the zener diode is less than 21 volts at no signal, measured on an accurate meter, the EM401 may be removed from the circuit or shorted out.

Note that two 3.2uF/6VW electrolytic capacitors were omitted from the parts lists.

The "half-supply" voltage measured between pin 10 of each integrated circuit and the common earth point is set by adjusting the 100K preset potentiometers in each channel. If a multimeter is used to monitor the voltage, no signal should be applied to the amplifier and 8-ohm loads should be connected across the outputs.

110 RECEIVER (August, 1970): Oscillator wiring diagram on page 77, +12V should read +6V, figures 4 and 6 on L4 are reversed and the rotor of S1c should be shown connected to the collector of T9.

CD IGNITION SYSTEM (August 1970): Under conditions of "worst case" transistor parameters the 470-ohm resistor may be too high to ensure reliable starting. It is recommended that this value be reduced to 220 ohms. ■

OHM'S LAW (AND THE REST) in the EEB

Send for Sample Copy

THE AUSTRALIAN EEB,
P.O. BOX 177, SANDY BAY,
TASMANIA, 7005.

PRINTED CIRCUITS? YES!

Now available in Brisbane

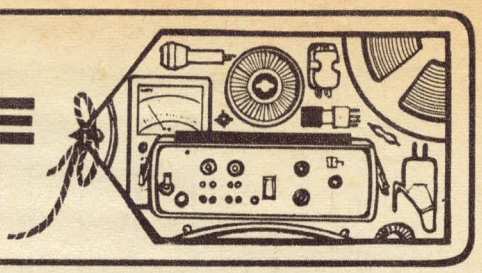
- One off or quantity
- Specialising in Electronics Aust. projects
- Single and double sided
- Plating of all metals, gold, silver etc.
- Glass epoxy
- Paper phenolic

CALL OR PHONE FOR YOUR REQUIREMENTS

WALTON TRENT
Electronic Developments
8 Stark St, Dorrington,
BRISBANE 4060.
Phone 38 5275

MARKET PLACE

Send your ads for this page on the form overleaf



FOR SALE

ANTEX Desoldering Iron. Suction created by compressed air which also deposits solder in external catcher $12. Technical and Scientific Equipment Co. Pty. Ltd., Box 1723P, G.P.O., Melbourne, 3001.

INTEGRATED pencil signal injector used for AF and UHF. One complete only $7.50, or 10 for $70. Post free, Bursik Electronics, P.O. Box 73, Matraville, N.S.W. 2036.

SEMICONDUCTORS. New special prices. BC108, 45c. BC109, 50c. BC107, BF115, OC171, 55c, 2N3055, $1.60, mat. pr. $3.40, 2N3054, $1.50, 2N3053, $1.20, AC187, 80c. AC188, 80c, pr. $1.60, AC127, 75c, AC128, 60c pr. $1.40. AD161, $1.40. AD162, $1.30, pr. $2.70. 2N5459(MPF105), $1.00, 1C TAA300, $2.70. OC44, 45, 72, 40c. Diodes 1A 400V, 35c, 800V 50c 1000V 75c, 6A 400V, 80c. OA91, 17c. OA202, 30c. Zeners, 6, 9, or 12V, BZY 88 type, 60c, 1W type, 90c. SCR 15A plus 470K log or lin, 47K plus 47K log, $1.30, single 470K lin, 47K lin, 35c. Post 10c. Return mail service. T & M Electronics, P.O. Box 57, Haberfield, 2045.

DECCA radar model 212, 10in display 10KW pulse, 6 ranges to 30 miles, handbooks. Complete except genemotor. $350 or offer. Must be sold due to illness. O'Brien, San Remo, Vic. Phone 107.

BACK issues Electronics Australia stocked. 50c each, prompt service, post free. T. Weir, 56 O'Connor St, Haberfield, N.S.W., 2045. Phone 798 7569. Wanted to buy copies also.

CRYSTALS for C.B. 27.240 and 26.785 MHz, ¼in pin, miniature, $6 pair. Post free, Shalley, 127 York Street, Sydney.

MODEL Railways. Call or write for free literature on this fascinating hobby. Ready to run or build-it-yourself kits. HO and N Scale. Australian model kits, HO only. Rivarossi, Atlas, Peco, Triang-Hornby, etc. P.J.P. Productions, 15 Hamilton Street, Gisborne, Victoria, 3437.

SILICON power rectifiers min. type EM4005 50/1A, 20c each or 10 for $1.50. Post 10c per order. Bursik Electronics, Box 73, Matraville, N.S.W. 2036.

FREE postage within Australia until Dec.: PMG 4-digit relay counters $1.25 ea., phone jack, plug, 11ft twin braided flex 95c; key switches 50c each. Bi-ko PD3 soldering iron handles 50c, new lightning arrestors, $3.00 hundred. Box 523, Biloela, Qld, 4715.

NEW matched pairs, 2-OC72. Fully branded, 50c per pair, post free. Slide-N-Dial, P.O. Box 3, Greenacre, NSW, 2190.

CORYA radio magazine closing sale. Many valuable project articles at special prices. The easy to read elementary radio course, 70c. Small components bargains, eg RFCs 2.5mH 30c. IFTs 50c. Communications R IF and RF kitset. Catalogue. Box 469, City, Canberra.

NATIONAL video tape recorder, camera, mic, cables, tripod, tape. Cost $1500. Best offer. Sydney 449 5329.

SELL OC44, 45, 71, 72, 6 for $2 or 40c ea. OC84, AC128, BC108, 109, 2N3638, 5 for $2, or 50c ea. 2N3642, 3643, 3638A, OC171, 2N370, 371, AF116N, 117N, BF115, 2N3694, AC127, 4 for $2, or 60c ea. Power types, 2N176, $1 ea. 2N301, $1.20 ea, OC28, 29, 35, 36, AS215, 16, 17, BDY20, 40250 2N3055, all $1.50 ea. OA210, EM404, 1N4004, 40c ea. OA211, BY100, EM410, 70c ea. UJT, 2N2160, FET, 2N4360, $1 ea. MPF105, 2N5459, 90c ea. BA100, 25c ea. OA81, 85, 91, 95, 12 for $2, or 20c ea. Also SCRs and Triacs. Extra discount on large orders. SAE for stocklist. Post and pack 20c. Custom Electronics, Box 1452, GPO, Adelaide, SA, 5001.

CLEARANCE of old valves, transformers, Decca FFR pick-ups, electronic gear. Sydney, 31 3383.

COMPLETE set of back issue of Radio, Television and Hobbies, Electronics from 1959 to 1970 for sale. Best offer. Ring Mr Muller, Sydney, 439 2688.

NEW resistors IRC and Morganite ¼, ½ and 1W. Useful assortment only, $1.80 per 100. Post free. AC voltage regulator, input 190-260V output, 220-240V, 3KW, $35. Reg DC power supply, 250V 500 mA, $25. Box 130, Kadina, SA, 5554.

TRANSISTOR bargains—gtd, new, branded. "No seconds or rejects," at unbeatable prices: BC107-50c, BC108, 109-45c ea, AC127, 128-60c ea. AC187, 188-80c ea, AD161, 162-$1.35 ea, C106BI-$1.45, EM401-20c, EM404-38c. Post 15c. Micronics, PO Box 175, Randwick, NSW, 2031.

POTENTIOMETERS sale—New, low noise, small type: 10K, 25K, 50K, 100K, 250K, 500K, 1M, 2M. All long shaft, log or lin. Stereo $1.35 ea, Single 38c ea. Skeleton pots 20c ea. Post 15c. Micronics, PO Box 175, Randwick, NSW, 2031.

STEREO Supplies. Queensland agents for Cambridge, Lux, Sound, Rotal, Jorgen amplifiers; Connelsseur, Micro, Lesa turntables; Celestion, Sonics, Tesla, Seas speakers; Grace, Lustre, Micro, Connisseur tonearms; Grace, Micro cartridges; Teac recorders. 100 Turbott St, Brisbane. Phone 21 3623.

FOR SALE

INTEGRATED circuits—new! Plessey SL403A $9.70 ea. Mitsub. M5102AY 3W RMS, input 120mV, only $5.95 ea. Includes tech data. Post 35c. Micronics, PO Box 175, Randwick, NSW, 2031.

AMPEX 1160 tape recorder, prof quality, dual capstan, auto thread, late model, cost $520, little use, $200. GPO Box 5120, Sydney. Phone 439 1782.

ELECTROLYTICS specials—superior quality, new, single end type: 25VW; 4.7uF-15c, 10uF-17c, 25uF-19, 47uF-21c, 100uF-24c, 22uF-28c, 470uF-38c, 1000uF-58c. Post 15c. Micronics, PO Box 175, Randwick, NSW, 2031.

RADIO control system, Bonnor 4RS, digital proportional 4 channel, 2 stick, 6 servos, 84 transistors, 3 ICs, Ni-Cd batteries, $350. Phone Sydney, 604 5664, 5-8 pm.

STROBE light, 5 J, variable rate, $35. Pioneer speaker, 15in 60W with two 5FX tweeters and crossover, needs box, $32. 25 Strathlora St Strathfield, NSW, 2135. Phone Sydney 642 1883.

MODELS. "Tich" steam locomotive, 3½in gauge castings. Bolton, 72 King Street, Sydney. Catalogue $1.55.

SUMMER school in electronics, Jan. 18 to 29, 1971. A course of lectures and laboratory classes on basic modern electronics and circuitry. Suitable for teachers, technicians and chemists. Inquiries to Secretary, Physics Dept, La Trobe University, Bundoora, 3083.

PROFESSIONAL recording studio available at $16.00 per hour. Bands produced to tape performance. Announcers audition tapes prepared and produced to your peak performance. Studio 20, Sydney, 31 3383.

HI-FI cabinets, pre-cuts kits, stereo equipment supplies available from Robert N. Smallwood, Sound Specialists, 205 Brisbane Rd, Booval, Qld 4304. Enquiries welcome. Phone 82 1550, any time.

BURGLAR ALARMS, fantastic value. Self-contained transistor control unit in case ready for use. Compare our price, $13 inc tax, plus 50c pp. Send SAE for further details. BPJ Electronics, 204 Stewart St, East Brunswick, Vic.

PRERECORDED RCA tapes, 900 ft full 5in LP, 90 minutes, 3¾ips. All popular evergreen music in original sealed cartons. Bargain price $3.50 each or five different tapes $15, post free. Denradio Industries, PO Box 113, Maryborough, Queensland, 4650.

LAFAYETTE HA600 receiver, as new, $180 ono, or $140 plus good GDO. Owner going, ham bands only. Inquiries to VK1SWL, 17 Clisby Close, Cook, ACT. Phone Canberra 51 1697.

TRANSISTOR power supply, EA, Jan 69, 0-20V, 1a, $25. Melbourne, 546 8425.

PLESSEY 700 Recorder. Full BC Control Board specifications, 12 months old, little usage in that time. Complete in console form with all log books and instruction manuals. Highly suitable for professional recording studios or perfectionist. NAB or CCIR specs available. POA. Stephen R. Gregory, Technician in charge, Lithgow Broadcasters, Lithgow 3321, or PO Box 21, Lithgow, NSW, 2790.

AWA AGC and compression/limiting amplifier. Still in BCB specs, however phrased out of use. Highly suitable for ham operator with high power SSB transmitter where ALC is essential. Comprises two chassis. One AGC the other compression and limiting amp. Rack mounting size. Complete in going order with P/s, $100. Stephen R. Gregory, Technician in Charge, Lithgow Broadcasters, Lithgow 3321, or PO Box 21, Lithgow, NSW, 2790.

COUNTERS PMG 4 digit, count number of laps, hours, etc. 1: 80c, 2: $1.30, 4: $2.20, post paid anywhere. R. M. Enterprises, PO Box 144, Marrickville, 2204.

READER SERVICE

AUSTRALIAN Tape Recording Society offers tape library, "The Microphone" journal, audio visuals, round robins, tapespondence, sales. Enquiries, PO Box 130, Hornsby, NSW, 2077. Please enclose large, stamped envelope.

BURGLAR alarms, all fittings, foil tape, etc. Send S.A.E. for list. Installation to insurance standards. Phone 848 1386. Post Office Box 42, Doncaster, Vic. 3108.

ELECTRONIC Organs. Do not build yourself an organ without first finding out about the superb Schober (U.S.A.) Assemble-it-Yourself Kits. Inquiries to Schober Organs (Australia). 124 Livingstone Ave, Pymble, N.S.W. 2073. (Mail only, please.)

TAPE to disc service. Take advantage of W. and G. Records' professional experience, when next needing a tape to disc service. W. and G. Record Processing Co., 185 A'Beckett Street, Melbourne. Tel.: 329 7255.

REPAIRS to receivers, transmitters, construction testing; TV alignments; Xtal conv. specialised electronic equip. Eccleson Electronics, 146a Coham Road, Kew, Vic. 80 3777.

WANTED

GELOSO front end 2620B, L. G. Douglas, 123 Flinders Terrace, Port Augusta, SA 5700.

CASSETTE recorder or deck, working or not, any condition. R. J. Maconachie, 8 Mitchell St, Kerang, 3579.

TUNER or receiver, Fremodyne 67 or 70, working. Price, particulars, R.E.C., 10 Jordan St, Clayton, Vic.

NEW or used signal and marker generator. Write R. Harmer, Box 268, Emerald, Qld.

BYER Rola or similar professional tape recorder, in or out of order. Phone Sydney 31 3383.

Q-MAX Grid Dip Oscillator with coils. G. Gray, Phone Sydney 56 6289.

STROBOSCOPE, 25 joules or more. C. Bowler, 93 Hannan St, Maroubra, 2035.

MAGNETS. Powerful permanent and electro types. Suitable for experimental and hobby use. A. Encel, 431 Bridge Road, Richmond, Vic. Phone 42 3762.

POSITION VACANT

GEOLOGICAL consulting company seeks staff for work Australia and overseas, using electrical and mechanical instruments to measure geological data in the field and on oil wells. Salary $70.00 per week, plus expenses while in the field. Minimum age 22. Please inquire in writing to Data Analysis, 261 George Street, Sydney.

ELECTRONIC service technician for work in city on SONY tape-recorders, amplifiers, radios, etc. Good conditions, salary depended on experience. Applications to: Jacoby Mitchell and Co. Pty. Ltd., 469 Kent Street, Sydney, 26 2651.

TELEFUNKEN

STEREO TUNER AMPLIFIER $335
15 watts, 36 trans, diodes with built-in stereo casette recorder 13 trans/diodes.

TELEFUNKEN

AC/DC PORTABLE RADIO $275
7 wavebands, 36 trans/diodes. Fine tuning on SW bands.

CASSETTE RECORDER $42.50
DC with piano-key operation, tape, mike, case, earpiece.

Available only from:

A. VICTOR & CO.
195 Elizabeth Street, Sydney. 61 2967.

SERVICE

BILL TURNBULL offers you service on Hi Fidelity equipment tape Recorders, Communication Receivers and Electronic Test Equipment.

25 years experience
All work guaranteed

BILL TURNBULL
11 ELLALONG ROAD,
CREMORNE, N.S.W. 90 4825

ADVERTISING INDEX

ACE Radio . . . 178, 179, 180
Adcola Products Pty Ltd . . . 185
Aegis Pty Ltd . . . 101, 187
Akal Australia Pty Ltd . . . 106
Amalgamated Wireless (A'sia) Ltd . . . 28
Amalgamated Wireless Valve Co Pty Ltd . . . 76
Amplion (A'sia) Pty Ltd . . . 107
Arrow Electronics Pty Ltd . . . 103
Associated Controls Pty Ltd . . . 100
Astronics Australasia Pty Ltd . . . 78, 128
Atram Pty Ltd . . . 150
Audio Engineers Pty Ltd . . . 50
Audiosound Electronic Services . . . 145
Auditec Pty Ltd . . . 147
Auriema (A'sia) Pty Ltd . . . 104
Australian Musical Ind Pty Ltd . . . 130
Australian EEB . . . 190
Aust Radio and TV College Pty Ltd . . . Outside Back Cover
Australian Radio DX Club . . . 141
Bright Star Radio . . . 161
BWD Electronics Pty Ltd . . . 32
Challenge Recording Co . . . 86, 87
Classic Radio Service . . . 118
Collins Book Depot Pty Ltd . . . 159
Colstok Electronics . . . 153
Control Data Aust Pty Ltd . . . 54
Convoy International Pty Ltd . . . 127
R. H. Cunningham Pty Ltd . . . 90
Deitch Bros . . . 188
Digital Electronics . . . 40
Direct Disposals Trading Co . . . 168
E D and E (Sales) Pty Ltd . . . 122, 123
Electronic Productions . . . 119
EMI (Australia) Ltd . . . 34
Encel Electronics (Stereo) Pty Ltd . . . 19, 41, 55, 115, 129, 135, 149, 151
Ferguson Transformers Pty Ltd . . . 154
Richard Foot (Aust) Pty Ltd . . . 177
General Accessories Ltd . . . 80, 156, 164
Goldring Eng (A'sia) Pty Ltd . . . 6, 7, 108, 109, 110
GRD Instruments Pty Ltd . . . Inside Back Cover
Haco Distributing Agencies Pty Ltd . . . Inside Front Cover
Ham Radio Suppliers . . . 182
HB Radio Sales . . . 119
Heating Systems Pty Ltd . . . 167
Hewlett Packard Aust Pty Ltd . . . 14
Imported Components . . . 174
Indeva Pty Ltd . . . 4, 5, 60, 61
Instrol Hi-Fi Centre . . . 103
International Correspondence Schools . . . 51
IRH Components Pty Ltd . . . 144
Jacoby, Mitchell and Co Pty Ltd . . . 30, 63, 65, 67, 69
JH Reproducers Co . . . 82, 133
Kitsets Australia Pty Ltd . . . 184
Lafayette Electronics . . . 173
Lanthur Electronics . . . 183
Magnecord A'sia Pty Ltd . . . 124
Magnetic Sound Industries . . . 134
J. H. Magrath and Co Pty Ltd . . . 84
Manufacturers Spec Prod Pty Ltd . . . 92, 126
Marconi School of Wireless . . . 155
Market Place . . . 191
Martin Aviation Pty Ltd . . . 190
Martinsound Sales Pty Ltd . . . 132
Miniwatt Electronics Division . . . 43
Mobile Communications . . . 42, 43
Mullard-Australia Pty Ltd . . . 26
National Radio Supplies . . . 186
Olims Trading Co Pty Ltd . . . 158
Peerless Fabrikkerne A/S . . . 102
Philips Electrical Pty Ltd . . . 70, 71
Photimport Pty Ltd . . . 100, 102, 154
Photo Hi-Fi . . . 146
Plessey Ducon Pty Ltd . . . 116
Plessey Pola Pty Ltd . . . 120
Pre-Pak Electronics . . . 138, 139
Quality Records Inter Co . . . 131
Radio Despatch Service . . . 189
Radio House Pty Ltd . . . 142, 176
Radio Mart . . . 165
RCS Radio Pty Ltd . . . 146
Recorded Music Salon . . . 116
Ronec Electronics Pty Ltd . . . 83
Sato Parts Co Ltd . . . 156
Selectronic Components . . . 175
Peter Shalley Electronics Pty Ltd . . . 95, 96, 97, 148
Simon Eray Pty Ltd . . . 98
STA Electronics Pty Ltd . . . 151
Stott's Tech Correspondence College . . . 159
Summit Electronic Systems . . . 94, 119
Technical Training Int Pty Ltd . . . 152
Tokyo Shibaura Electric Co Ltd . . . 114
Trio Electronics Inc . . . 8, 9
Truscott Electronics . . . 140
Tudor Radio . . . 170, 171
Bill Turnbull . . . 191
Union Carbide Australia Ltd . . . 48
United Radio Distributors Pty Ltd . . . 189
United Trade Sales Pty Ltd . . . 193
University Graham Inst Pty Ltd . . . 38
Varian Pty Ltd . . . 20
Veall's Electrical & TV Pty Ltd . . . 59
A. Victor and Co . . . 119, 191
Walton Trent Pty Ltd . . . 190
Warburton Franki Ltd . . . 74, 162
Wayne Communications . . . 157
W. C. Wedderspoon Pty Ltd . . . 36, 136
Weston Electronics Pty Ltd . . . 161
Sydney Willis Trading Co . . . 168
Wireless Institute of Australia (NSW) . . . 160
Wonder Wool Pty Ltd . . . 137
Zephyr Products Pty Ltd . . . 148

CLASSIFIED ADVERTISERS

USE THIS FORM FOR YOUR NEXT ADVERTISEMENT TO APPEAR IN THE

ELECTRONICS Australia MARKET PLACE

☐ FOR SALE
☐ WANTED
☐ READER SERVICE
☐ POSITION VACANT

To the Advertising Manager,
ELECTRONICS Australia,
Box 2728 G.P.O.
Sydney. 2001

- *Please insert the following advertisement in the*

..... *issue*

Endorsement .....

Residential Address .....

..... State .....

- *I enclose P. Note/Cheque for $....*

being full payment for .... lines at $0.80 per line. *(Min. 2 lines)*

Please write in block letters with ink or ball-point pen. **Number of insertions** .....

ELECTRONICS Australia

SPECIAL ORDER FORM

Guarantee yourself a complete set of issues for your library with no copies missing.

SUBSCRIPTION RATES

	PER YEAR
Australia, New Guinea, Fiji, New Zealand	$6.50
Elsewhere	$9.00

POST THIS COUPON TO:

The Circulation Manager, ELECTRONICS Australia, Box 2728, G.P.O., Sydney, 2001, Australia.

Name .....

Address .....

Enclosed is $ ..... for .... years. Start with .....

(Please use cheque, money order, etc. Do not enclose cash).

Bang & Olufsen Denmark

BANG & OLUFSEN presents a new generation of pickup cartridges, which makes it simple to choose the right cartridge for your recordplayer. Bang & Olufsen have carefully considered the audiophiles' problems in choosing a new cartridge, because of the number of models offered by most cartridge manufactures. Bang & Olufsen have designed a family of three cartridges, which together will meet all demands from the devoted audiophiles.
SP 12. elliptical
SP 10. spherical
for 1,0 – 1,5 grams tracking in high quality pickup arms.
SP 14. spherical
for 1,5 – 2,5 grams tracking in standard quality pickup arms.
Bang & Olufsen designed the unique MOVING MICRO CROSS principle (patented) which is a feature of all their cartridges, at the birth of the stereorecords. Still today, the MMC-principle is superior to others.

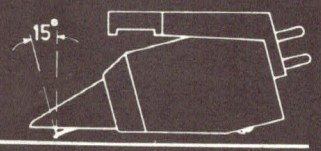
SP12

NAKED ELLIPTICAL DIAMOND STEREO PICK UP CARTRIDGE 1,0-1,5 GRAMS TRACKING

The BANG & OLUFSEN SP 12 cartridge with bi-radial elliptical diamond stylus, has an outstandingly smooth frequency response.
15–25.000 Hz ± 3,0 dB
50–10.000 Hz ± 1,5 dB
And the unique patented MMC-principle extends the tip resonance to 30.000 Hz, thus ensuring absolute linear tracking of audible frequencies with excellent stereo separation.
Leading manufacturers of high fidelity equipment all over the world acknowledge the work of BANG & OLUFSEN, in pioneering many of the technical aspects of the industry – and for advanced designs which win international awards for B&O products year after year.

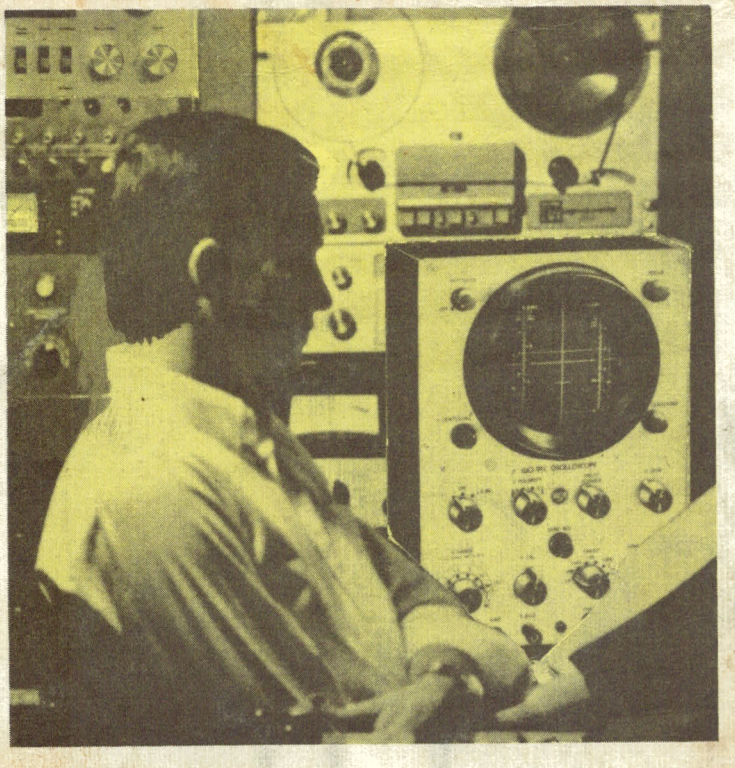
Specifications

This cartridge is designed for low tracking force in high quality pickup arms (½" standard).
Highly polished naked diamond stylii give very low tip mass, allowing high frequency tracking without distortion. Because of its high polish, the naked diamond will not collect dust as an ordinary framed diamond stylus.
5 millivolts output.
More than 25 dB channel separation at 1 KHz.
Frequency responce 15 25.000 Hz.
Bi-radial elliptical naked diamond



Danish Hi-Fi

698 BURKE ROAD, CAMBERWELL, VIC. 3124. PHONE: 82 4839
SOUTHERN CROSS HOTEL, SHOP No 9. PHONE: 63 8930



YOU CAN EARN BIG MONEY IN RADIO-TELEVISION ELECTRONICS

ASK YOURSELF THESE 3 QUESTIONS!

1. Am I in a dead-end job? 2. Could I **earn** more by **learning** more? 3. Could I use my spare time to get ahead?

If the answer is yes, there is room for **you** in radio/television/electronics.

NOW IS THE TIME TO TRAIN!

Does **your** job offer good prospects — real security? Does it hold your interest? If not, now is the time to do something about it. Electronics is expanding daily. It's the most exciting subject you can study. The sky's the limit for the **trained electronic technician** . . . but **only** the trained man. Radio and television technicians are in huge demand. Train for success now, in Australia's fastest-growing industry! **Join the ranks of skilled men** . . . the Australian Radio and Television College can train you for a bright future with unlimited prospects. Send for the free booklet, "Careers In Radio, TV & Electronics" and find out how A.R.T.C. can bring you success—in your own business or as well-paid technical staff!

A.R.T.C. CAN TRAIN YOU AS IT HAS THOUSANDS OF OTHERS

For nearly 40 years A.R.T.C. has successfully trained thousands of progressive Australians who realised how much the training could mean to them. Now they're making big money in radio and television. Training can bring **you** success, too.

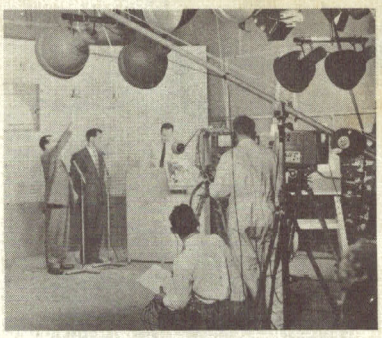
FOR A FEW CENTS PER DAY YOU CAN STUDY THE A.R.T.C. WAY

. . . in your **spare** time, you can equip yourself for a rewarding career in electronics. **The future belongs to the trained.**

A.R.T.C. teaches you from the ground up . . . step by step . . . at your own pace. Remember, opportunity is always knocking for the **trained** man!

PRACTICAL UP-TO-DATE LESSONS

At the work benches and lecture halls of A.R.T.C. . . . or in your own home by correspondence — . . . can learn every necessary aspect of radio, television and electronics. The Course gives you both basic and advanced instruction.



No previous experience or high educational standard required . . . only enthusiasm and normal intelligence. A.R.T.C. will give you all the instruction you need. Each lesson is made easy to understand by numerous illustrations and diagrams. The Course adapts itself to **your** requirements, your speed. It's up to you! Instruction is individual and intensely practical.

THOUSANDS OF SUCCESSFUL STUDENTS HAVE PROVED THIS

Make your spare time earn money for you while training at home.

Many students make extra money after only a few weeks' tuition. Train at the modern A.R.T.C. workshops, if more convenient.

GET INTO ONE OF THESE PROFITABLE CAREERS IN RADIO/TELEVISION ELECTRONICS

There is a career for you in one of the many branches of electronics, including manufacture, servicing, research, sales, executive positions, armed forces, audio, etc., etc.

A.R.T.C. can help you gain one of these sought-after careers. Remember, it's the trained man who wins, every time!

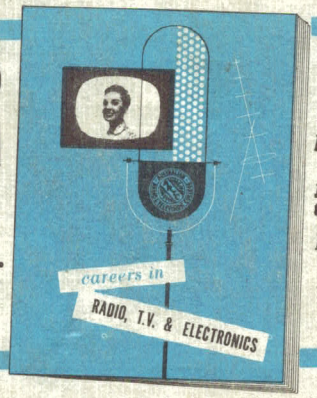
MAIL COUPON NOW!

Safeguard your future! You are invited to send in the coupon below. A.R.T.C. will mail you by return their big free and post-free booklet, "Careers in Radio, TV and Electronics." This exciting book shows you definite steps you can take towards a big future—how you can succeed in life and find satisfaction in doing a worthwhile job well.

AUSTRALIAN RADIO AND TELEVISION COLLEGE PTY. LTD.

E. S. & A. BANK BUILDING,

Cnr. Broadway and City Road, Sydney.
(Opp. Grace Bros.) Phone 211-4244 (3 lines.)



AUSTRALIAN RADIO & TELEVISION COLLEGE PTY. LTD.

206 Broadway, Sydney, N.S.W.

Dear Sir,

Please send me, without obligation, your free booklet "Careers in Radio TV and Electronics."

NAME .....

ADDRESS .....

.....

Printed and published by Sungravure Pty. Limited, of Jones Street, Broadway, at Morley Avenue, Rosebery.