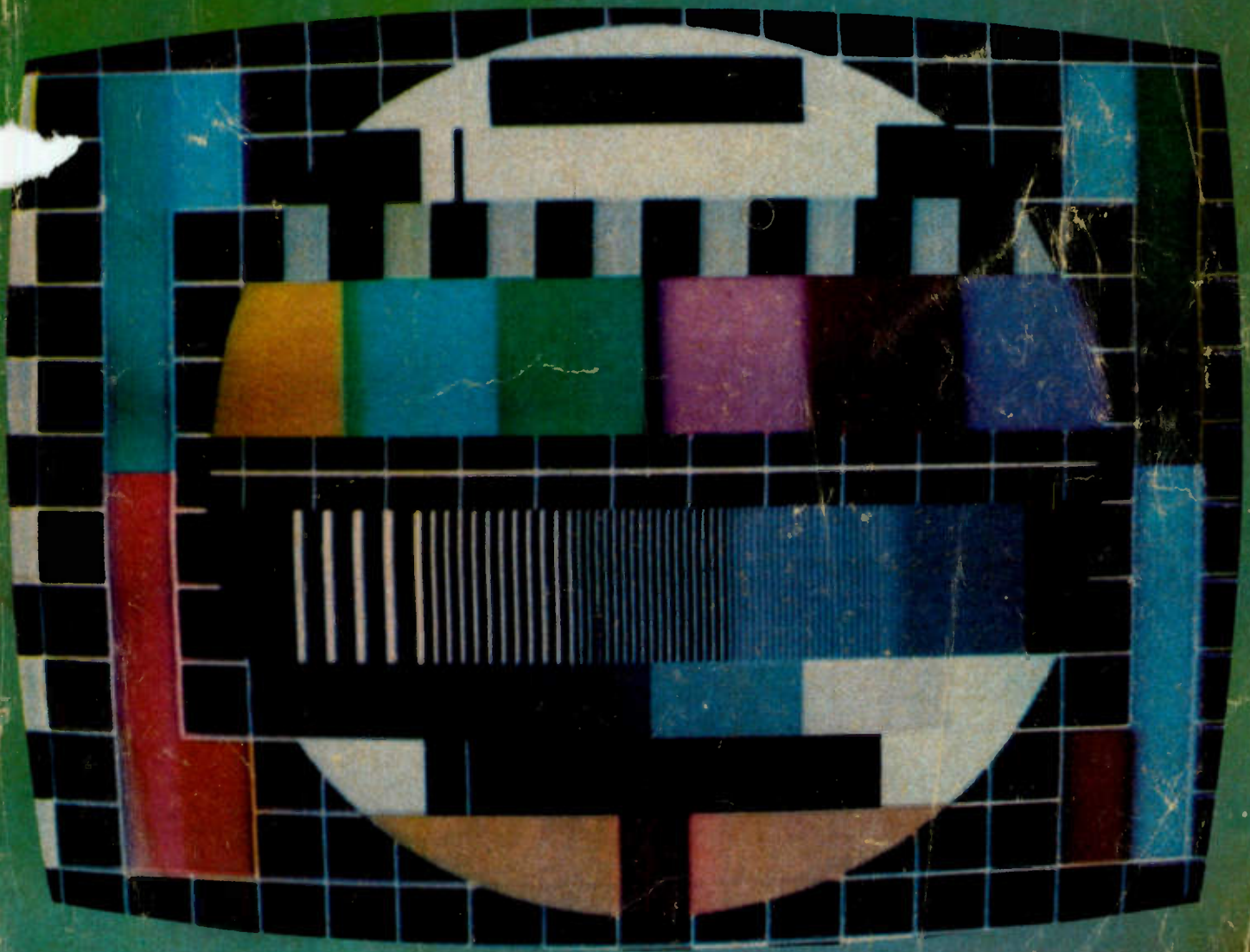
AUSTRALIA'S DYNAMIC MONTHLY

APRIL 1972

40c

electronics TODAY INTERNATIONAL

ALL ABOUT COLOUR TV



ALL ABOUT TRANSDUCERS ▮ COMPUTER INTERFACES ▮ MARS WALK IN 1985?
BUILD YOUR OWN SLIDE/TAPE SYNCHRONIZER ▮ WE TEST 3 TOP TURNTABLES

meet Sony's

big (and little) guns

in truly sensitive sound recording

Here is Sony's front line in a brilliant range of electret condenser microphones. They offer superior quality, great utility and pleasure to all kinds of operators — private and professional in the hi-fidelity field. Despite their comparatively low prices, their sensitivity and the quality of their sound equals the best condenser units available anywhere, as well as possessing additional advantages such as extremely low power requirements, stability, and easy miniaturisation.

The Sony MX-12 Microphone Mixer

One of a range of four microphone mixers, the superbly designed MX-12 is a low impedance, three channel stereo or six channel monophonic microphone and/or line input mixer with independent head type level controls for each channel. It is equipped with phone plug inputs too, and costs about $149.

Here are details of the four illustrated:

ECM-22P
A professional quality microphone with "phantom" power feed system so that it can be used in studios of broadcasting stations. It has a wide range of frequency response with sharp directivity. About $158.

ECM-21
A brilliant performer unidirectional microphone highly suitable for hi-fi recording or broadcasting and adaptable for hand or stand use. About $61.

ECM-19B
An excellent unidirectional microphone with built in wind screen. Ideally suited for outdoor use or interview work. About $36.

ECM-16
A tiny omnidirectional high quality microphone ideal for inconspicuous placement. Can be hung around the neck or clipped on a tie. About $31.

SONY®

JACOBY KEMPTHORNE

SYDNEY: 26 2651, MELBOURNE: 329 6866, ADELAIDE: 93 2388/9, BRISBANE: 44 4488, PERTH: 28 5725, LAUNCESTON: 2 5322. Agents: CANBERRA: 47 9010, NEWCASTLE: 61 4991, WOLLONGONG: 71 1132.

SN 3288

electronics TODAY INTERNATIONAL

APRIL 1972 Vol. 2 No. 1

colour television

general features

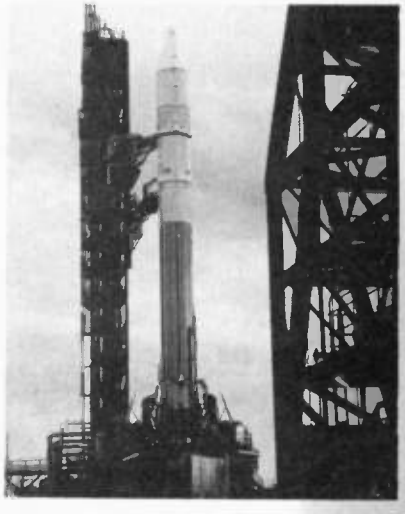
projects

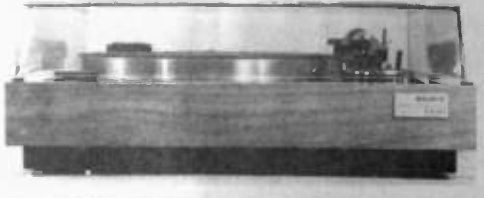
product tests

reviews

news & information

COVER: This TV test pattern was produced by a Philips PM 5544 combined colour/monochrome pattern generator. Our special report on colour TV (24 pages in all) starts page 16.





Published by MODERN MAGAZINES (HOLDINGS) LIMITED, 21-23 Bathurst Street, Sydney 2000. Phones: 26-2296, 26-6129. Cables: MODMAGS SYDNEY. Managing director: Colin Ryrie. Editor-in-chief: Jules Feldman. General advertising manager: Max Press. INTERSTATE advertising – Melbourne: Clarrie Levy, Suite 23, 553 St. Kilda Rd. (51-9776). Adelaide: W.J. Parkinson, A.C.P., 24 Halifax St. (8-4121). Brisbane: David Wood, Anday Agency, 329 Adelaide St. (2-2735). OVERSEAS – United Kingdom: A.C.P., 107 Fleet St., London EC4. U.S.A.: A.C.P., Room 401, 1501 Broadway, New York. Printed by Conpress Printing Ltd., O'Riordan St., Alexandria. Distributors: Australian Consolidated Press. (*Recommended and maximum price only.)

COPYRIGHT.

DOUGLAS TRADING HAS THE WORLD'S FIRST CASSETTE DECK WITH GX HEAD

GXE-400
SPECIAL PRICE
$232

AKAI's latest **GXC-40D Cassette Stereo Tape Deck** is the world's first cassette deck to incorporate the now world-famous GX (glass and single crystal ferrite) Head hitherto employed only in AKAI's professional high grade open reel tape recorders and decks. The AKAI-developed revolutionary GX Head is "dust free" and "wear free" and guaranteed for highest quality sound for over 100 times the service life of conventional permalloy heads! And due to the employment of this hard gem-like head, the use of chromium dioxide tape, which exhibits excellent response, is now possible.

Other outstanding features of the GXC-40D: 2 heads including one recording/playback GX Head, special chromium dioxide tape switch, distortion eliminating Over-Level Suspension (OLS) switch, hysteresis synchronous outer-rotor motor, fast forward, and pause button. **The GXC-40 Cassette Stereo Tape Recorder** is also available

Enjoy open reel quality sound with this fantastic combination from AKAI.

The Biggest Discounts are at Douglas Trading CITY HI-FI CENTRE **191 BOURKE ST., MELBOURNE. Telephone 63 9321.**

Collyn Rivers
Editorial Director

Assistant Editor:
Brian Chapman

Engineering Manager:
Barry Wilkinson

Production Manager:
Bob Izzard

Projects Adviser:
Kim Ryrie

Review Editor:
John Clare

Acoustical consultants
Louis A. Challis & Associates

Art Director:
Clive Davis

Advertising Manager:
Howard Jenkins

Melbourne Manager:
Clarrie Levy

Representative (Sydney):
Terry Marsden

Advt. Production Manager:
John Oxenford

Rob Giumelli
Laboratory Technician

colour TV -with a tinge of politics

CLEARLY, Prime Minister McMahon's belief in economist John Maynard Keynes' 'General Theory of Employment, Interest, and Money' is of a very special kind.

Hence his Government's announcement that we shall have colour television — in March 1975 — was somewhat less than a shattering surprise. Nor was it unexpected that once again temporary political expediency has been allowed to overrule the very real concern that Keynesian economic theory, formulated nearly 40 years ago, may no longer be valid.

But to the Australian electronics industry at least, the decision is more than welcome — for it provides a boost that many companies sorely need.

And for us, the viewing public, the long-delayed introduction has had one positive advantage: it has ensured that we will adopt what is generally accepted to be the best of the competing systems — that known as PAL.

In this issue our new Assistant Editor, Brian Chapman, presents a complete technical exposition of the PAL system — and its implications for Australia.

We have waited a long time for colour television, and at last it's on the way. It will be good to have it — despite the dubious circumstances of its introduction.

TV repair costs

WHEN black-and-white television was first introduced in Australia, some service companies employed inadequately trained and qualified technicians. And whilst subsequent accusations of deliberate overcharging were largely without foundation, some 'technicians', having taken a day and a half to locate a simple fault, were obliged to charge the unsuspecting public astronomic fees for what should have been a ten-dollar repair.

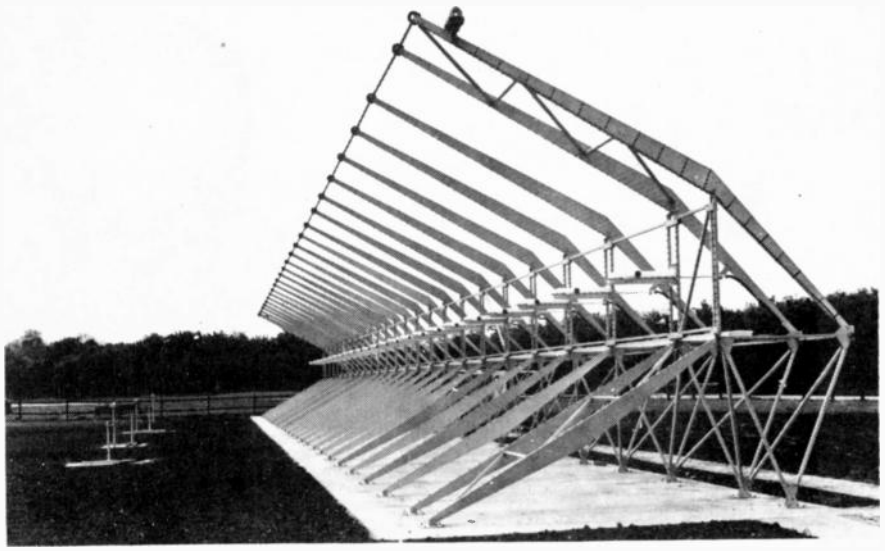
This could happen again when colour TV is introduced — and to even greater extent, for a colour TV receiver is far more complex than its monochromatic counterpart.

Surely now is the time for the Government to establish qualifying standards for TV repair technicians, who should subsequently be registered, to protect the public from the incompetent or unscrupulous minority of servicemen.

All genuine service companies and technicians must welcome such a move. More than this — they should actively campaign for it.

news digest

BRITISH INSTRUMENT LANDING SYSTEM



The highest performance rating in the world for an instrument landing system (ILS) has so far been granted only to Britain's most advanced system, the Plessey STAN 37/38. This is for its performance in its role as the ground guidance element for automatic landing systems planned to operate in the near zero visibility conditions classified as Category 111. Early this year a STAN 37/38 installation at London's Heathrow Airport was the first to be officially promulgated as Category 111 and a second promugation has just been made for a similar installation at Dulles International Airport, Washington, DC.

The installations at Heathrow and Dulles mark a further important step forward in the programmes being carried out in both Britain and America to enable aircraft to land fully automatically in all weathers. In the past two months enquiries for over 50 STAN 37/38 ILS systems have been received by Plessey and the company expects further interest to be shown in it as a result of its recognition by both the British and American governments.

US SPACE SHUTTLE

President Richard M. Nixon and Dr. James C. Fletcher, Administrator of the National Aeronautics and Space Administration discuss the proposed space shuttle vehicle at San Clements, Calif., January 5, 1972. The President announced that day the United States should proceed at once with the development of an entirely new type of space transportation system designed to help transform the space frontier of the 1970s into familiar territory, easily accessible for human endeavour in the 1980s and '90s.

ANTI-MATTER UNIVERSE?

Probably the most fundamental premise of physics is that physical laws are universally valid. But astronomical discoveries made in recent weeks are now causing many astrophysicists quite seriously to doubt even this.

Reason for their doubt is a number of observations — based on red shift — of objects that seem to be moving very considerably faster than the speed of light, meanwhile emitting energy at greater levels than previously considered possible.

Speeds more than ten times the speed of light have been reported.

Faced with this great kink in the curve of previously accepted learning, some very radical theories are now being given serious attention. The most prominent — and most startling — of these is the 'black hole — white hole' theory put forward by Dr. Robert M. Hjellming of Green Bank, West Virginia's National Radio Astronomy Observatory.

Basic premise of the 'black hole' theory is that inward pressure of very large masses of matter could produce objects of enormous density — several billion tons per inch — and with a gravitational field so intense that even light could not escape (Hence the term 'black hole').

But Dr. Hjellming goes beyond this and postulates universes other than our own, existing in other space-time frames of reference.

He contends that matter existing within our universe may be entering a 'black hole' to emerge — via a 'white hole' — into another space-time continuum. Matter could enter our universe in the opposite fashion.

However close to science-fiction this may appear, Dr. Hjellming's theories accord with Sir Fred Hoyle's concept of a steady-state universe. They may explain how new matter can be supplied to maintain Hoyle's concept of a universe that is expanding but internally unchanging.

The theory also resolves the apparent 'one-sided' nature of our universe, in which matter is more in evidence than anti-matter. The concept of 'black hole — white hole' links between differing universes may resolve this apparent physical contradiction.

Dr. Hjellming suggests our universe may be considered as galaxies on the outer surface of an expanding balloon that represents the four-dimensional curvature of space and time. Thus, as the 'balloon' expands, the galaxies become further apart. However, states Dr. Hjellming, on the inner surface of this balloon there is another, matching universe. The two are linked by 'black

(Continued on page 11)

how on earth could you improve the SANSUI AU555A

~and still pay only $237?

With a recommended list price of only $237* the Sansui AU-555A solid state stereo amplifier offers a great deal more to the dollar wise Australian audio enthusiast.

Continuing development by Sansui, Japan's leading audio-only manufacturer, has resulted in a fine stereo amplifier with every desirable feature . . . the total power output is 60 watts into 8 ohm speaker systems, and the frequency response is ±1 dB from 20 Hz. to 40 kHz. at normal listening levels.

There's loads more . . . bass, treble and *mid-range* controls, provision for two pairs of stereo speakers, all the usual Sansui filter and mode controls . . .

And here's the most vital point of all. In terms of *tonal quality* the Sansui AU-555A leaves similarly priced competitors a long way behind. Some dedicated enthusiasts claim there's little perceptible difference in tonal quality between the AU-555A and the top-of-the-line Sansui amplifier, the AU-999.

However, as selecting a new stereo amplifier is a *personal* matter, you are cordially invited to slip along to your favourite Simon Gray franchised dealer. Listen to the Sansui AU-555A *critically*. See how much more *total performance* Sansui offers — and how much more you get for your money. *Call in today!*

Sansui

*Recommended list price only.

Simon Gray Pty. Ltd.,
28 Elizabeth St.,
Melbourne 3000.

Please send me further information about the Sansui Model AU-555A and the name of my nearest franchised Simon Gray dealer.

Name .....

Address .....

Postcode .....

SG-ET-372

Simon Gray Pty. Ltd.

DISTRIBUTORS:
Australia, excepting W.A.: Simon Gray Pty. Ltd. Head Office: 28 Elizabeth Street, Melbourne. 3000. Tel. 63 8101. Telex: 31904. Sydney Office: 53 Victoria Avenue, Chatswood. N.S.W. 2067. Tel. 40 4522*. Canberra Office: 25 Molonglo Mall, Fyshwick, A.C.T. 2609. Tel. 95 6526. Adelaide Office: 301 South Terrace, Adelaide, S.A. 5000. Tel. 23 6219. N.T.: Pfitzner's Music House, Smith Street, Darwin. 5790. Tel. 3801. Qld.: Sydney G. Hughes, 154-158 Arthur Street, New Farm, Brisbane. 4005. Tel. 58 1422. Tas.: K. W. McCulloch Pty. Ltd., 57 George Street, Launceston. 7250. Tel. 2 5322. W.A. Distributors: Carlyle & Co. Pty. Ltd., 1-9 Milligan Street, Perth. 6000. Tel. 22 0191. Sansui equipment is manufactured by: Sansui Electric Co. Ltd., 14-1, 2-chome, Izumi, Suginami-ku, Tokyo, Japan.*

INSTROL

TURNTABLE VALUE!!

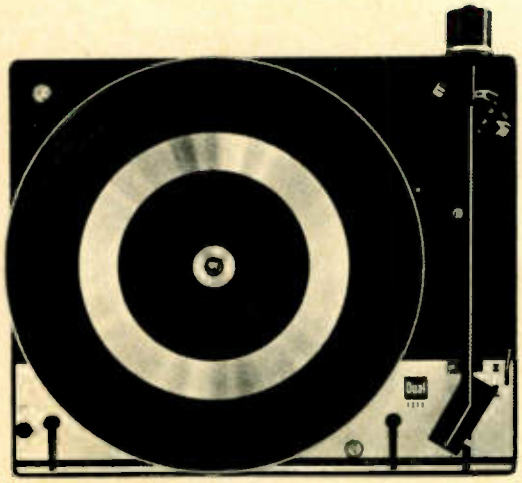
J.H. TURNTABLE (complete)

This outstanding turntable consists of:—

(A) J.H. Turntable	Belt drive, synchronous motor, unmeasurably small rumble, wow and flutter of better than 0.04%, negligible hum radiation, with 12" diameter of platter.
(B) LUSTRE ST510D ARM	A high precision universal arm, stylus pressure is adjusted by calibrated counterweight. Oil damped cueing lift is fitted.
(C) A.D.C. 220X	Magnetic cartridge. Tracking force 1½ to 3 grams, extremely linear and smooth frequency response.
(D) INSTROL 45 STAND	This aesthetically designed player stand is available in either oiled teak or walnut.

ALL THE ABOVE FOR ONLY $90.00 (Hinged perspex cover $11.80 extra)

DUAL TURNTABLE (complete)



This outstanding turntable value consists of:—

(A) DUAL 1215	Automatic turntable. Low-mass, torsionally rigid, counter-balanced all metal tone-arm. Continuously variable stylus force 0 to 5.5 grams, coupled with anti-skate adjustment. Hydraulic Cue control. Pitch control, adjustable over one semi-tone. Three speeds.
(B) A.D.C. 220X	Magnetic cartridge, extremely linear and smooth frequency response.
(C) INSTROL 35 STAND	This attractive player stand is available in either oiled teak or walnut.

ALL THE ABOVE FOR ONLY $120.00 (Hinged perspex cover $11.80 extra)

COMPLETE HI-FI CATALOGUE & PRICE LIST . . . ONLY 50c

Contains full specifications, retail pricing and discount pricing on the following items:—
Turntables, Player Stands and Perspex Covers, Cartridges and Stylii, Amplifiers, Amplifier Kitsets, Tuner Kitsets, Separate Speakers, Speaker Systems, Speaker Enclosures, Speaker Kits, Equipment Cabinets (Built & Kits) for Hi-Fi, Hi-Fi Accessories, Guitar Amplifiers and Guitar Speaker Systems (Built & Kits), Test Equipment Kitsets, Technical Books, Instrol Products, etc.

Please send me your complete hi-fi catalogue and price list. I enclose herewith postage stamps or money order to the value of 50c. I understand that the 50c will be refunded on my first purchase.

NAME.....

ADDRESS .....

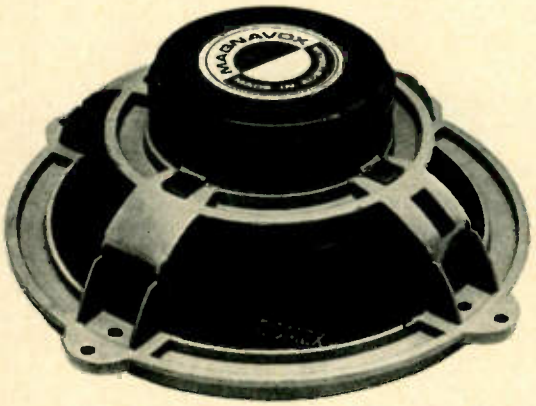
..... PC. . . . . .

T204

INSTROL SPEAKER SYSTEMS

All the systems below are available in kit form. The cabinet kits come in either unpolished Queensland Maple veneer or unpolished teak veneer. All kits are complete, and include speakers, crossover networks (where applicable), cabinet kits, grille cloth and innerbond.

NEW MAGNAVOX 8-30 SYSTEM



Featured in "Electronics Today". It handles 30 watts RMS, features a new high performance 8" speaker, two 3" tweeters, and is available in cabinet 20 7/8" x 12 7/8" x 8 7/8" (1 cu. ft.) or 23 7/8" x 15½" x 10 7/8" (1.6 cu.ft.). Available in teak or maple veneer.

COMPLETE SYSTEM

Kit or Parts	$46.00 (1 cu ft), $58.00 (1.6 cu ft)
Built and Tested	$60.00 (1 cu ft), $76.00 (1.6 cu ft)

SEPARATE COMPONENTS

Enclosure kit (1 cu ft)	$19.00 (maple), $19.50 (teak)
Enclosure kit (1.6 cu ft)	$31.50 (maple), $33.00 (teak)
Built Enclosure (1 cu ft)	$32.00 (walnut), $33.50 (teak)
Built Enclosure (1.6 cu ft)	$48.50 (walnut), $51.00 (teak)

ECONOMY BASS REFLEX SYSTEM

Special 1970 design consists of a Rola C8MX speaker in cabinet 20" x 11" x 9". Ideal for low wattage.

COMPLETE SYSTEM

Kit of Parts (teak or maple)	$26.00
Built and Tested (teak or walnut)	$39.00

SEPARATE COMPONENTS

C8MX speaker only	$9.05
Enclosure kit	$16.50 (maple), $17.00 (teak)
Built Enclosure	$29.00 (maple), $30.50 (teak)

WHARFEDALE SPEAKER SYSTEM KITS

The Wharfedale Super Linton, Melton and Dovedale III are now available as build-yourself kits, featuring INSTROL quality cabinet kits in choice of maple or teak veneer.
The Super Linton kit employs and 8" and 3" speaker, frequency response 40-17,000Hz, cabinet 21" x 11½" x 9½", 15 watts RMS.
The Melton kit employs a 12" bass and a tweeter, cabinet 22¾" x 13" x 10", 25 watts RMS.
The Dovedale III kit employs a 12" bass, 5" mid-range and 1" tweeter. Cabinet 28" x 15½" x 10", 35 watts RMS.

COMPLETE SYSTEM

Super Linton kit (Unit 3)	$49.00
Melton kit (Unit 4)	$93.00
Dovedale III kit (Unit 5)	$133.00

SEPARATE COMPONENTS

Unit 3 encl. kit	$17.00 (maple), $19.00 (teak)
Unit 4 encl. kit	$25.50 (maple),$27.00 (teak)
Unit 5 encl. kit	$34.00 (maple), $35.50 (teak)

KEF SPEAKER SYSTEM

CONCERTO — The KEF Concerto contains B139 bass unit, B110 mid-range and T27 tweeter in teak cabinet 29" x 17" x 12". Frequency range 30-30,000Hz, Power handling capacity 25 watts.
CONCORD — The KEF Concord contains B139 bass unit and T15 tweeter in attractive teak cabinet. Frequency range 30-20,000Hz. Power handling capacity 25 watts.
CHORALE — The KEF Chorale contains B200 bass unit and T27 tweeter in teak cabinet 18½" x 11" x 8 5/8". Frequency range 35-30,000Hz. Power handling capacity 25 watts.

COMPLETE SYSTEM

Concerto System	$220.00
Concerto speaker & enclosure kit	$165.00
Concord System	$149.00
Concord speaker & enclosure	$113.00
Chorale System	$120.00
Chorale speaker & enclosure kit	$ 90.00

SEPARATE COMPONENTS

Concerto speakers & crossover	$140.00
Concord speaker & crossover	$ 89.00
Chorale speakers & crossovers	$ 75.00
Concerto enclosure kit only	$ 45.00
Concord enclosure kit only	$ 36.00
Chorale enclosure kit only	$ 26.00

INSTROL
HI-FI & ELECTRONICS CENTRE

91A YORK ST., (between King & Market Sts.),
SYDNEY, N.S.W. 2000. Phone 29 4258

Please send me the following speaker systems and/or turntable systems. These will be sent by road transport or passenger rail, freight payable on receipt of goods.

. . . . . at $ . . . . .
. . . . . at $ . . . . .
. . . . . at $ . . . . .

I enclose my money order/cheque for $ . . . . .

NAME . . . . . .

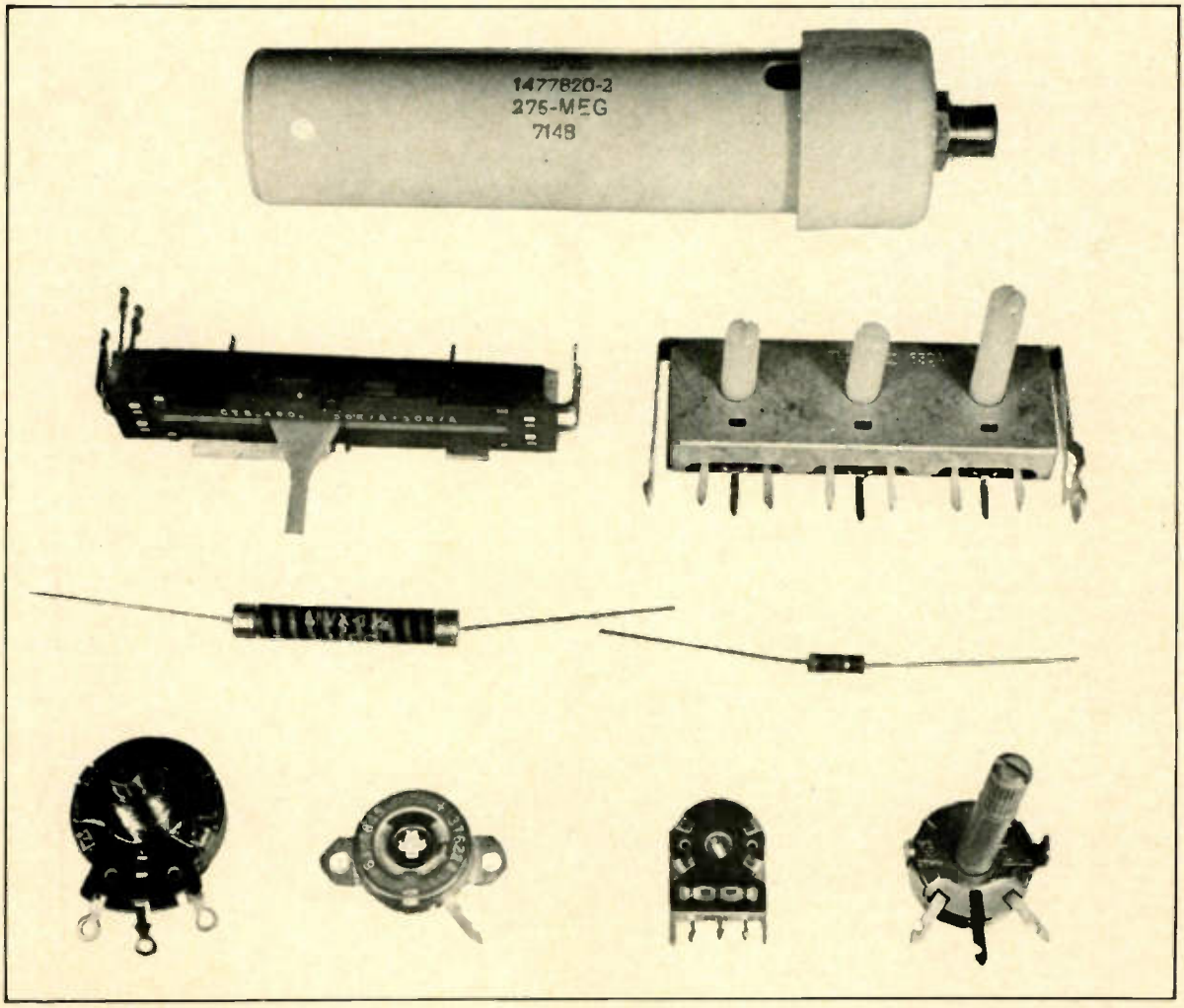
ADDRESS . . . . . .

. . . . . P.C. . . . . .

T204

WE'VE BEEN READY FOR YEARS

With the COMPONENTS needed
With the QUALITY demanded
With the PRODUCTION capacity
With the ENGINEERING know-how



LET IRH COMPONENTS COLOURISE YOUR THINKING

IRH Components Pty. Limited
The Crescent, Kingsgrove,
N.S.W. 2208. Phone: 50-0111
74 Raglan St., Preston,
Vic. 3072. Phone: 44-5021

INTERSTATE TELEPHONES

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

news digest

(Continued from page 6)

holes' and 'white holes'. Matter falling into a 'black hole' in our universe will reappear as antimatter which is entering via a 'white hole' in a complementary universe.

The complementary universe is predominantly of an antimatter nature — thus balancing the converse state of our own.

Dr. Hjellming's theories are by no means accepted by all astro-physicists; but if he is correct — as many reputable scientists believe him to be — he will put the science-fiction publishers out of business once and for all.

NEW VIDEO RECORDER

Two of Europe's leading manufacturers of television broadcasting equipment, Philips and Fernseh, have joined forces to develop a new professional colour video tape recorder.

The first joint development — a helicalscan format video recorder — was presented to European broadcasters during the end of February in Germany and Holland. One demonstration took place in Munich at the German Institute of Broadcast Engineering, and was attended by more than 80 representatives of German broadcasting organisations.

The second demonstration, at Hilversum, was attended by members of the European Broadcasting Union who came from all parts of Europe.

The Philips-Fernseh recorder has an omega-loop tape path and uses a single video head for recording and playback. Two independent sound tracks are provided. This will allow stereo programmes to be broadcast in the future. In addition to the control track there is an auxiliary track available for cue and address code purposes.

Simplicity of operation and low capital capital investment have been two prime objectives of the new development. The Philips-Fernseh colour recorder is considerably less expensive than today's quadruple-head recorders. Tape consumption is reduced to about one-third.

Design has been made relatively simple by employing a single video head and the recorder can be operated after a minimum of training. The new recorder is designed for production and presentation purposes.

The first versions will be available for both PAL and SECAM systems.

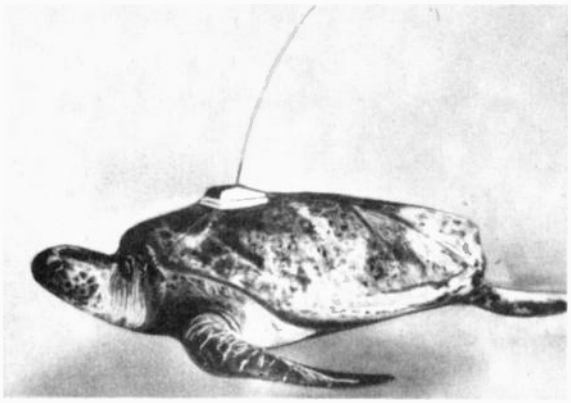
Hi fi?

Best Price

Autel Systems Naturally...

20 Pittwater Rd., Gladesville 'Phone 89-0663

ELECTRONICS ARE GOING PLACES



A radio-equipped turtle is tracked by orbiting satellites to check its migratory voyages in the Atlantic Ocean. One of the million incredible uses of electronics for commerce and industry.

EARN BIG MONEY as an ELECTRONICS ENGINEER

STUDY AT HOME IN YOUR SPARE TIME

You know as well as we do that electronics is the big new field that's here to stay. Industry is using electronics in fields many people hadn't dreamed of a few years ago.

TRAINED MEN ARE NEEDED. Australia's industries need, and must have, Electronics Engineers urgently. Salary scales are rising fast and electronic engineering specialists are making big money. Trained Australian Electronics Engineers can choose jobs anywhere in the world—the lack of these trained men is world-wide. Training is the key—qualifications are what matter.

BE HIGHLY PAID IN THE WORK YOU LIKE MOST. You already have the interest you need to be successful in electronics—you can get the training you need through International Correspondence Schools. You can train for your career in electronics at night, in your own time, with the help of a School of Electronics as close as your mail box.

ACT NOW! Fill in the coupon below and send it to I.C.S.—we will send you by return mail our Free Book "Your Career in Electronics."

Select the career that suits you best

TV, Radio Electronics
Basic Electronics
Colour TV Servicing
Commercial Operator's Certificate
Computer Technician
Electronic Engineering
Electronic Instrumentation and Control Systems
Electronics Technology
Electronics Technician
Fundamentals of Electronic Computers
Hi-Fi and Sound Systems
Industrial Electronics
Maintenance of Electronics Equipment
Radio-Television Engineering
Radio and Television Servicing
Radio Electronic Telemetry
Transistor Radio and Printed Circuit Servicing

Computer Programming
Business Data Processing
Cobol Programming
Computer Systems Analysis
Fortran Programming
General Computer Programming
I.B.M. 360 Computer
Office Automation
Operational Research
Systems and Procedures Analysis

INTERNATIONAL CORRESPONDENCE SCHOOLS ICS

CUT OUT AND POST THIS COUPON TO INTERNATIONAL CORRESPONDENCE SCHOOLS, DEPT. 551—TODAY.

Please send me, without cost or obligation, the I.C.S. book on

_____

Name (Mr., Mrs., Miss) _____ Age _____
please print

Address _____

_____ Postcode _____

Occupation _____ Phone _____ Dept. 551

POST TO:
International Correspondence Schools, 400 Pacific Highway, Crows Nest, N.S.W. 2065.
Telephone 43 2121. Also in all States throughout Australia and in N.Z.
If the career you want is not listed please nominate the course you want.

LB3.2822

news digest

AMPHENOL – AUSTRALIAN CONNECTIONS

The well-known Bunker Ramo Corporation, of Illinois through its Amphenol Components Group, has announced the formation of a new Venture Company in association with Australian interests.

The new company, Amphenol Tyree Pty. Ltd., is 60 per cent Australian owned, with the balance held by Bunker Ramo.

It has been formed to operate under licence in Australia for the manufacture and marketing of the complete Amphenol line of electrical and electronic components, including connectors, potentiometers, switches, keyboards and cable assemblies.

The multi-national Bunker Ramo Corporation has been selling into the Australian market for more than 27 years and Amphenol, its largest division, is a world-leader in its field.

Backed by the continuing research and development of the American Company, the joint venture will be able to introduce new products to this region and add to the technological progress of the Australian electronics industry.

Australian interests in the new company are headed by Mr. Christopher W. Tyree, who becomes managing director of Amphenol Tyree Pty. Ltd. Other Australian directors are Messrs. Christopher G. Wilson and David J. Eisenberg. Bunker Ramo directors are Messrs D.W. Sheehan (vice president, secretary and corporate counsel) and Dr. R.C. Becker (group vice president-affiliated companies, Amphenol Components Group).

In addition to Australia, Bunker Ramo has operations in Canada, India, Japan and Western Europe. Significant studies recently made by Amphenol include the production of electrical penetration assemblies for nuclear power plants and connectors for space projects.

B.W.D. – OVERSEAS TOUR

"Executives of B.W.D. Electronics Pty. Ltd., Melbourne, manufacturers of electronic test equipment, Mr. John Beesley, Technical Director and Mr. Donald R.H. Johnstone, Marketing Manager will leave Melbourne at the end of March for a three week visit to their export markets in the northern hemisphere.

B.W.D. Electronics Pty. Ltd. were winners in 1971 of an Export Award for outstanding export achievement.

Agents will be visited in U.K., Holland, Belgium, Sweden, Switzerland, Germany Germany, Israel, Canada and U.S.A. during this overseas trip.

Later in 1972 visits will be made to New Zealand, Hong Kong, Thailand, Malaysia, Singapore and New Guinea.

These visits are intended to consolidate and expand export markets established in 1970/71 for B.W.D. manufactured oscilloscopes, signal generators, DC power supplies, stroboscopes and 'Lectroflux' magnetic particle flaw detection equipment."

DRAFT STANDARD FOR GRAPHICAL SYMBOLS USED IN ELECTROTECHNOLOGY

The Standards Association is seeking comment on three draft standards forming part of a comprehensive standard on graphical symbols for use in electrotechnology. They are issued as Docs. 1889-91.

Graphical symbols for basic concepts and components for use in telecommunications, electronics or electrical engineering are specified in these drafts. Equivalence with international (IEC) recommendations is indicated.

The areas covered by the drafts include conductors and connecting devices, resistors, capacitors and inductors, as well as qualifying and supplementary symbols for concepts such as variability, type of waveform or modulation and the like.

Copies of Docs. 1889-91 may be obtained without charge from the various offices of the Standards Association in all capital cities and Newcastle.

Comment on the provisions of the drafts is invited from persons or organizations experienced in the use of these symbols, and should reach the head office of the Association, 80 Arthur Street, North Sydney, NSW, 2060, or any branch office, not later than 30 April 1972.

Peter Clark says: Why not become a member of my

FREE TAPE CLUB

The only tape club where you can exchange for $1.00 tapes of your choice.

Music cassettes, cartridges, reels— and FREE Club Membership.

When you buy a tape recorder or cassette machine from Magnetic Sound — City or Parramatta — 100's of pre-recorded music tapes, all at 10% discount to club members, are there for you to choose from. Exchange as many as you like — 1 - 8 - 16 - 20, one a week or every month. No stipulation, nothing to sign. Cassettes, tapes, cartridges, from $3.99, all brand new. Membership is $5.00. If you already own a tape recorder or cassette, enquire now.

GROUND FLOOR

Cassette shop is now open!

BLANK CASSETTES made in U.S.A. C60 99c, C90 $1.50, C120 $2.10. BASF tapes at trade price. Also tapes by Ampex, Teac, Sony, Scotch, Mattel, Capitol, all at big savings.
Head cleaners, Stereo head-phones for $4.95.
Plugs and leads, tapes, empty reels, power adaptors and car adaptors.

FREE

Library box of 3 with every reel of 5", 5¾" or 7" BASF tapes purchased.

REPAIRS

To all tape recorders and cassette machines. Reasonable rates — all work guaranteed.

Magnetic Sound INDUSTRIES

387 GEORGE STREET, CITY 29-3371
One door from Kodak
20 MACQUARIE ST, PARRAMATTA
(Next to O.P.S.M.) 635-0830

MG3246

de-solder quickly no damage

The removal of solder from printed circuit terminations needs to be fast, complete and without damage to the circuit board.
The best tool for this work, and one which you can use with absolute confidence, is the Adcola M207.
Six de-soldering tips of different face sizes are available, all with a stainless steel lining to extend tip life and all sealed to prevent seizure in the barrel.
There are three different re-flow solder heads for removing multi-pin packages and six different non-seizing soldering tips which slip easily in the M207 unit. All are illustrated in our brochure. Please ask us to send it to you.

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) RA6

news digest

DECCA MINI-RADAR

The display console of Decca Radar's new 050 mini radar that was exhibited at the International Boat Show in London. Complementary to the Decca 101 and Super 101, it is of the same rugged design and overall reliability, yet lighter. It is aimed at the world's many pleasure craft and work boats under 40 ft. (12 m. approx.)

The Decca 050 is a two unit system with slotted waveguide scanner, transceiver and power supply housed in a waterproof glass-fibre radome of 57lbs. (26 kg. approx.) This is light enough to enable it to be fitted to the masts of most pleasure craft. The neat completely portable display unit is connected to the aerial by a single plug-in cable, and can be tabletop, bulkhead or deckhead mounted. The radar provides a bright, sharp picture on all ranges up to 12 miles. The large slotted waveguide scanner, claimed to be unique among mini radars, ensures adequate bearing discrimination and absence of false echoes. The solid-state local oscillator and balanced mixer are identical to those employed in Decca's full size RM 916 radar, resulting in a transceiver sensitivity equal to that in the company's new big ship radars.

Always Traditionally The Finest...

now a new era in WHARFEDALE history!

Wharfedale loudspeakers established an enviable reputation from the very birth of the term *"high fidelity"*. British manufacturers have always set the world standards for high fidelity equipment design and manufacture . . . and Wharfedale have consistently *outsold* other U.K. manufacturers on the world loudspeaker markets.

The electronic research laboratories at Wharfedale have not been idle. Their long experience and technical *"know-how"* combined with recent *"state of the art"* electronic developments have been responsible for the design of several completely new Wharfedale products . . . *a complete range of fully compatible audio equipment.*

Here's the new era Wharfedale range: ● LINTON STEREO AMPLIFIER ● LINTON TURNTABLE ● LINTON 2 SPEAKER SYSTEM ● LINTON 3 SPEAKER SYSTEM ● DC9 CASSETTE RECORDER ● DD-1 STEREO HEADPHONES ● DENTON 2 SPEAKER SYSTEM ● DENTON 3 SPEAKER SYSTEM ● MELTON 2 SPEAKER SYSTEM ● DOVEDALE 3 SPEAKER SYSTEM ● TRITON 3 SPEAKER SYSTEM ● ROSEDALE SPEAKER SYSTEM

See them all at your franchised Simon Gray dealer!

Australian National Distributors:

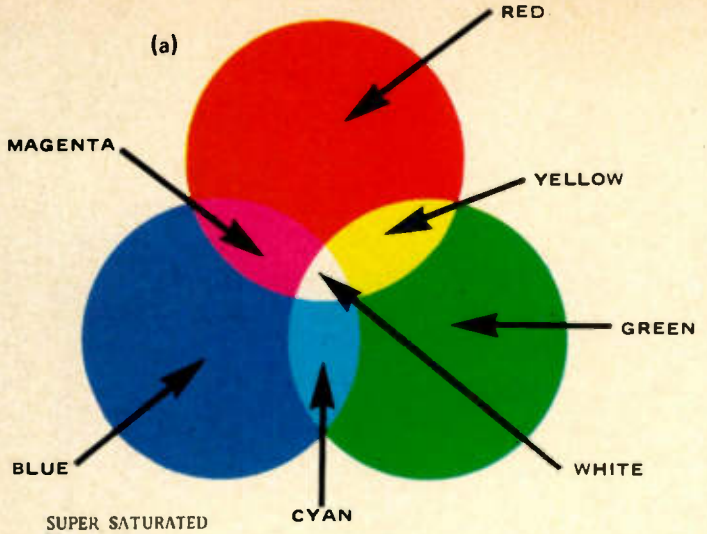
Simon Gray Pty. Ltd.

Head Office: 29 Elizabeth St., Melbourne, Vic. Tel. 63 8101 * Telex: 31804
Sydney Office: 53 Victoria Ave., Chatswood, N.S.W. Tel. 40 4522*
Canberra Office: 25 Melanglo Mall, Fyshwick, A.C.T. Tel. 95 6578
Adelaide Office: 301 South Terrace, Adelaide S.A. Tel. 23 6218

80-ET-472

INTERSTATE REPRESENTATIVES:

N.T.: Pitzner's Music House, Smith Street, Darwin. Tel. 3801
Q'land: Sydney G. Hughes, 154-158 Arthur St., New Farm, Brisbane. 58 1422
Tas.: K. W. McCulloch Pty. Ltd., 97 George Street, Launceston. Tel. 2 5322
W.A.: Athol M. Hill Pty. Ltd., 613-615 Wellington Street, Perth. Tel. 21 7861



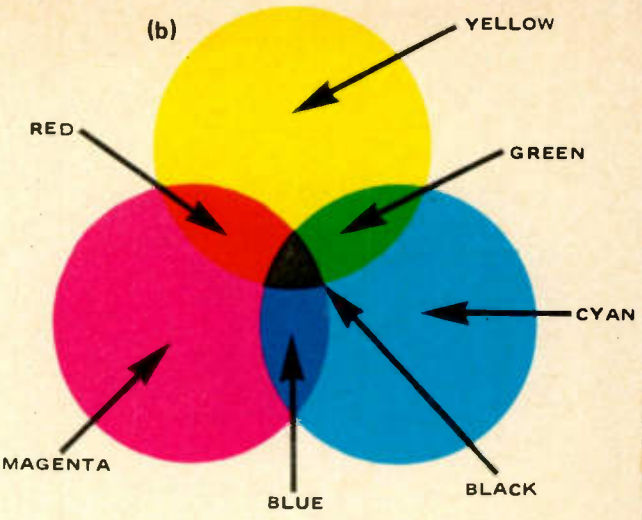


Fig. 3.(a) Additive colour mixing (b) Subtractive colour mixing.

all about colour TV

LIGHT

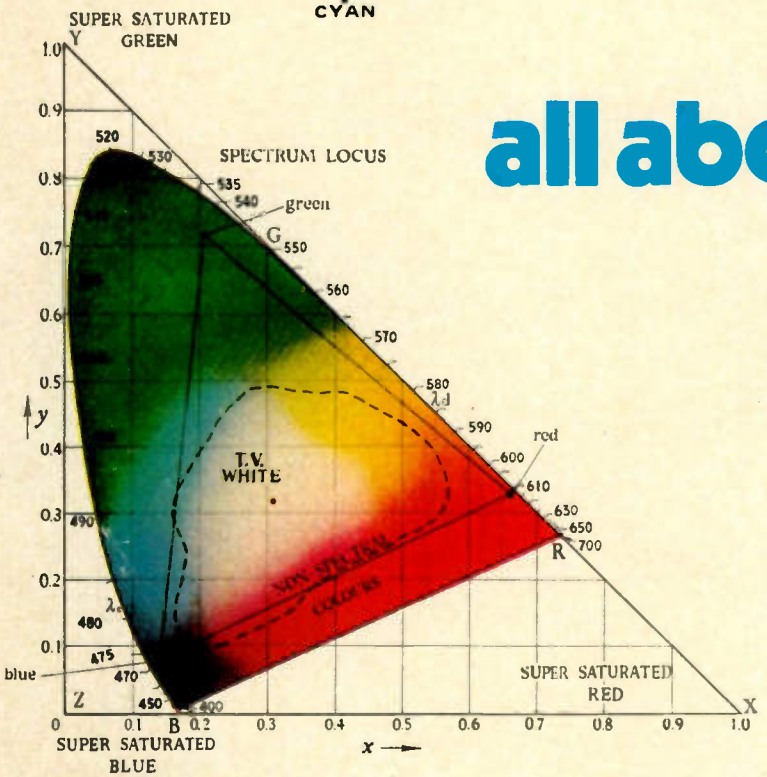
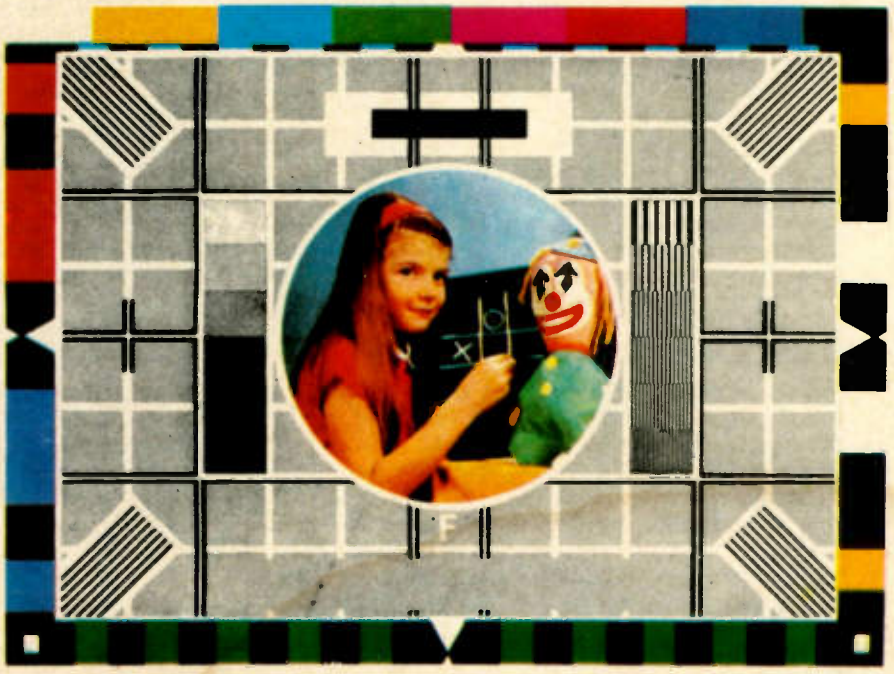


Fig. 4. CIE Chromaticity Chart

Fig. 5. Test Pattern 'F', as used by the BBC.



COLOUR TRANSMISSION

The first practical, fully electronic, colour television system was the NTSC system (National Television System Committee of the USA). This system which is still currently used in the USA, Japan and other countries, is basic to most other systems in use today. The German developed PAL system (Phase Alternating Line) and the French SECAM system (Sequential Colour with Memory) are developments of NTSC which attempt to overcome some of the problems inherent in that system, notably hue distortion due to differential phase shift.

No one system is perfect, all have their defects and there has been considerable international controversy over efforts to establish one standard system throughout the world. However most countries implementing new systems are favouring the PAL system.

Our description will be mainly restricted to the PAL system, as this is the designate system for Australia. The reader is recommended to refer to a good standard text for details of the other systems and their historical development. Such reading will provide a good understanding of the reasons for specific modes of operation.

Further, we have not attempted to describe the operation of devices and circuitry common to colour and monochrome systems. A knowlege of such things as vidicon scanning, line and frame time bases, synchronisation and magnetic deflection etc. is assumed.

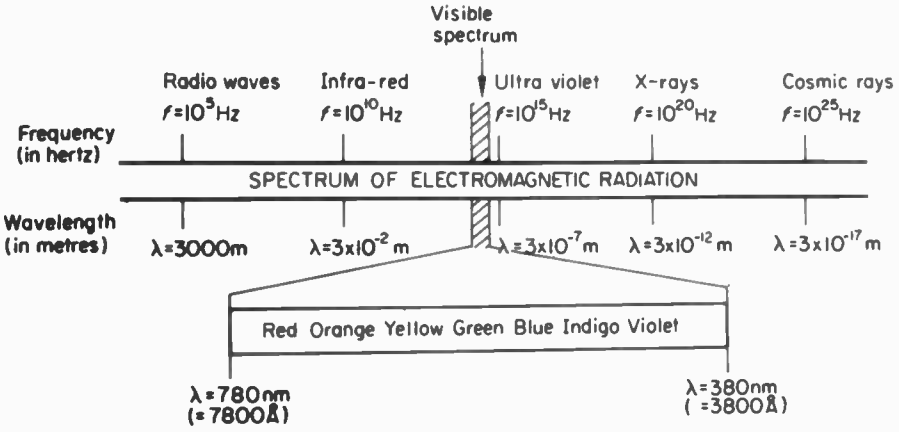


Fig. 1. Electromagnetic Radiation Spectrum

Ian McRae, Breakfast announcer, radio 2SM Sydney: This is the news, I can now release secret details that 2SM has been broadcasting in colour for these past four years without the knowledge of the Australian Control Board. This applies to all programmes, except the Keith Harris show, which is definitely off-colour.

Australian TV stations may commence colour transmissions from the 1st of March 1975. In this multi-part article, Brian Chapman explains the complete operating principle of the PAL colour TV system.

AND COLOUR

THE eye is sensitive to only a very narrow band of the entire electromagnetic spectrum. This band extends from 380 to 780 nanometres (1 nm = 10^{-9}m = 10Å) wavelength.

Red is the colour sensation produced by wavelengths in the region of 780 nm and violet is the colour sensation produced by wavelengths in the region of 380 nm. Figure 1 shows the visible spectrum and its relationship to the entire electromagnetic spectrum.

HUE

As will be seen from Fig 1, the order of the colours in the spectrum is red, orange, yellow, green, blue, indigo and violet, and it is these colours that we see in the familiar rainbow. When all these colours reach the eye simultaneously we see "white light". White light therefore consists of a mixture of wavelengths of the visible spectrum.

When we see a colour, we see light having one or more predominant wavelengths, that is, it could be a pure spectral colour, or it could be basically white light with an excessive red component. A pure spectral colour is said to be a fully saturated colour. If this colour is now diluted by white light it loses some of its colour intensity. For example, red light diluted with white light becomes pink — an unsaturated colour. If there were equal quantities of white and red we would say that the colour saturation was 50%.

When speaking of the predominant wavelength of a colour, eg. whether it is red, green or blue etc. we use the term "hue". Thus speaking again of our pink, we could now define it as a colour having a red hue and being 50% saturated.

BRIGHTNESS

Now assume that we have a pink wall and that more white light is falling on one half of the wall than the other. Obviously the half with more light on it will appear "brighter" but the light coming from this section of the wall *will still have the same hue and saturation* as that coming from the other section. However the term brightness is subjective and conveys no physical measurement information. For example, if a car has its headlights on in the daylight they are hardly noticeable, the same headlights at night are blinding and we say that they are much brighter at night — and yet, the same amount of light is emitted on both occasions.

LUMINANCE

This effect is due to an optical effect known as adaptation. The eye adjusts its sensitivity in accordance with the ambient light level, and therefore light levels can only then be considered on a comparative basis. What we must have is a physical measure of the amount of light being emitted from a source or reflected from a surface. This physical quantity is called luminance and is the quantity we measure with a light meter. The most usual unit of luminance is the lumen per square metre, or lux. We can now completely specify a colour by the three components, hue, saturation and luminance.

The concept of luminance is vital to understanding firstly of black and white television, and secondly, the way a colour television transmission can be made compatible with black and white

INDEX

receivers. Compatability is one of the original criteria laid down for the development of colour television systems.

In monochrome television it is the luminance of a particular point in the scene which determines the amplitude of the video waveform and hence luminance of the corresponding spot on the receiver screen. This signal is also transmitted as a basic part of the colour television signal and is known as the luminance signal 'Y'.

COLOUR VISION

The eye is not uniformly sensitive to light of differing wavelengths and colour response in fact varies widely from person to person. A large number of different factors affect vision and no direct scientific measurement of the response of the human eye can be made. A series of experiments were conducted in 1924 by the International Commission on Illumination. (Commission Internationale L'eclairage) now commonly known as the CIE. From these experiments involving thousands of people, a standard curve was generated for the response of the average eye. This curve is shown in figure 2. From this it can be seen that the eye has maximum sensitivity at 555 nanometres (green) and that the sensitivity falls off dramatically at the red and violet ends of the spectrum. To put this another way, if there were two lights, one green and one red emitting the same radiant power, the eye would see the green light as by far the brighter of the two.

So what does all this have to do with television you might ask? Well now stop and think for a moment what the effect would be when a monochrome camera with a uniform sensitivity versus wavelength viewed a coloured scene. The camera would produce a brightness range *proportional to the emitted radiant energy* and hence when we looked at the receiver the tonal range would appear entirely wrong, the sky would be pure white, the grass would be almost black etc. Obviously the response of the camera must be weighted in the same proportions as the CIE curve. The black and white picture will then be tonally correct. It is also obvious by extending this reasoning that a colour camera must also be so weighted.

COLOUR MIXING

When we see coloured objects under normal white light we are in effect seeing the light which that object reflects. For example an object that appears yellow, reflects yellow and absorbs all other colours, an object that is black absorbs *all the light* that is incident upon it. When mixing paint we may mix one pigment which reflects blue and absorbs all others, with another that reflects yellow and absorbs all others, the resultant being green. This process is known as subtractive mixing and will be discussed in detail later on.

We can also project coloured lights onto a white wall, here the effect is different, we are *adding* colours and now we find that

red + green = yellow
red + blue = magenta
blue + green = cyan
red + blue + green = white (see figure 3)

This is known as additive mixing and is basic to colour television. The colours red, green and blue are known as additive primaries, or more simply as primaries. Yellow, magenta and cyan are known as the subtractive primaries, or more simply as complementaries.

Let us now return to subtractive mixing and see what actually happens. From the above we may determine that

yellow = white – blue
magenta = white – green
cyan = white – red

We said before that yellow and blue pigments gave green. Let us see what happens when we mix yellow and cyan.

yellow + cyan = white – blue – red = green

So it would appear that we made a mistake calling one of these pigments blue, it was really cyan. The trouble of course is that when mixing pigments, we are dealing with colours that are not spectrally pure, and also cyan, from Fig 3B, *is* a kind of blue.

Similarly we find that

yellow + magenta = white – blue – green = red
magenta + cyan = white – green – red = blue

Again when mixing paint we find that the more colours we add, the closer we get to black, in contrast to additive mixing, where adding colours gives white. This is borne out by:–

yellow + magenta + cyan = white – blue – green – red = black.

All very confusing, the colour diagrams of Figure 3 helps somewhat and there have been many more complex diagrams generated to assist in the understanding of colour mixing and colour specification. The most useful of these diagrams is the CIE chromaticity chart (Figure 4).

In the CIE chromaticity chart, three fictitious supersaturated primaries are chosen as the corners of a colour triangle. The spectral colours are plotted on this diagram and form a curve within whose boundaries *all real colours are to be found,* including white. The curved locus of spectral colours is marked in nanometres of wavelength. Note that no calibration is given to the base of the curve as these colours (purples) are non-spectral.

By using this diagram *any* real colour can be specified by its x and y coordinates. Television white for example has the coordinates x = 0.33 and y = 0.33. The three television phosphors are plotted on this diagram and all colours within the triangle formed by these dots may be reproduced on television. The dotted line represents the boundaries of colours reproducible by photography or printing. Colour television, therefore is potentially considerably better. The colours shown on our diagram are only by way of example – remember they have been produced by a printing process and therefore cannot represent the real colours.

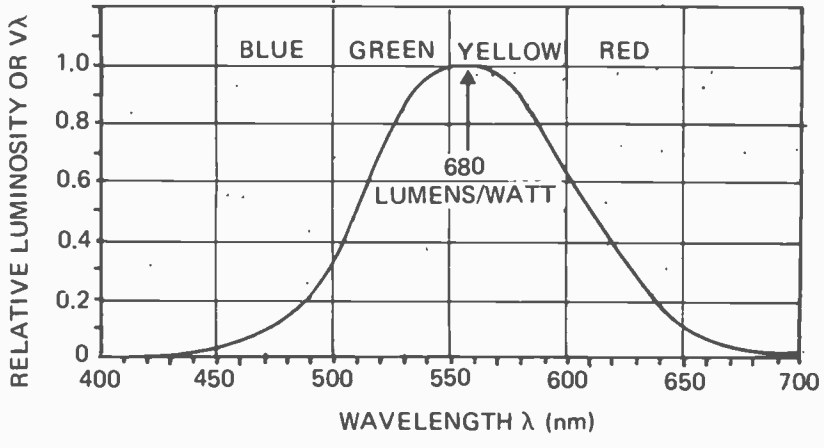


Fig. 2. Response of average eye (CIE).

COLOUR TEMPERATURE

The concept of colour temperature is one that is important in colour television. We know that coloured materials look different under artificial

light from the way in which they look in sunlight. This is because the light is slightly different in colour. Colour rendering therefore depends on the whiteness of the illumination. What do we use as a standard?

As we raise the temperature of an iron bar it firstly glows dull red, then yellow and finally white. A perfect black body (one which reflects no light at all) will go through such a colour progression which is strictly proportional to temperature. The radiation from a black body at different temperatures can then be used as our colour standard.

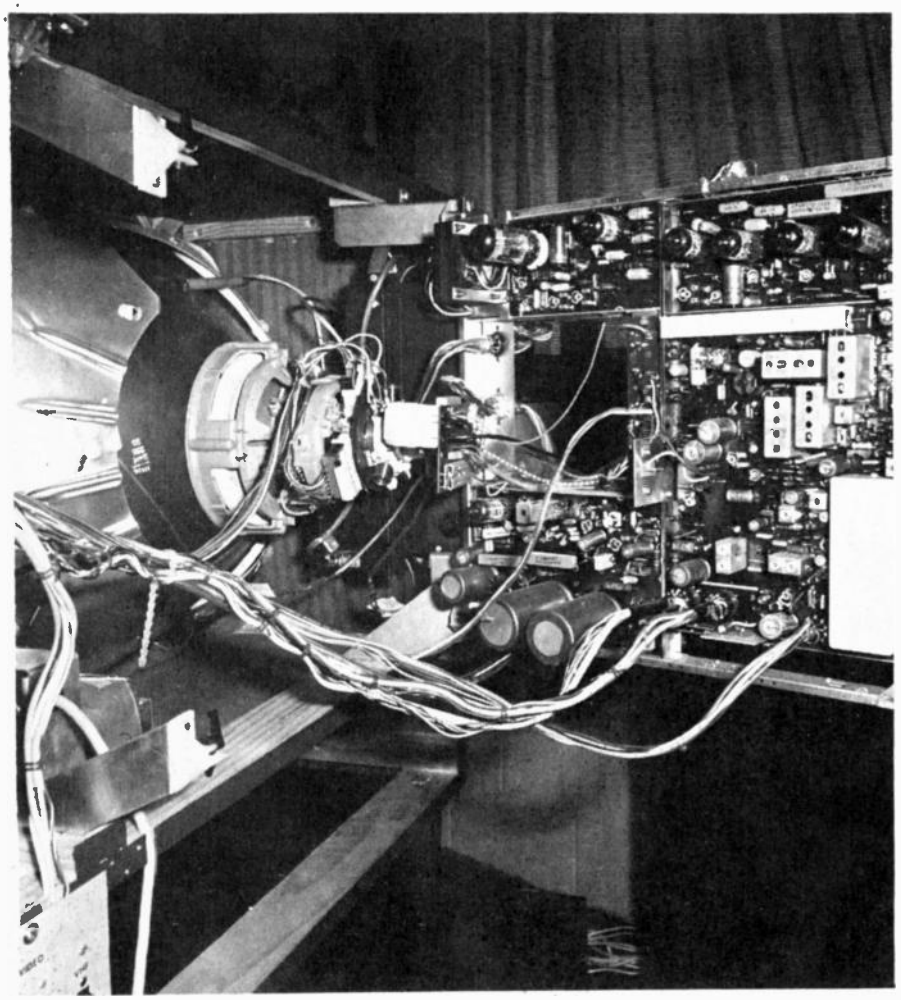
In practice the colour appearance of a white light is matched as closely as possible to the light from a black body by varying its temperature. The temperature of the black body in degrees Kelvin is then called the colour temperature of the light source. Note that a perfect match is not always possible, but the colour temperature concept does supply a useful method of comparison. The locus of black body colour is often plotted on the CIE chromaticity chart and calibrated in degrees Kelvin.

Most colour television cameras have adjustments enabling the response to be corrected for light of different colour temperatures which must be precisely known. The optimum colour temperature for colour television however is in the vicinity of 6500°K and studios attempt to keep as close to this as possible. ●

---

all about colour TV

COLOUR TRANSMISSION



Rear view of a prototype Philips colour receiver.

As stated in the previous section a colour is defined by the three quantities luminance, saturation and hue. The luminance signal conveys scene brightness information only and is the same as the video signal transmitted in monochrome systems.

Let us look at a basic colour transmission system and see how the various signals are derived and transmitted. Refer to Figure 1.

The image as seen by the camera lens is split into the three primary colours red, green and blue by a dichroic mirror, or prism system. These methods are preferred to colour filter systems due to their higher transmission efficiency. Each separate primary colour image is then scanned by a vidicon.

The output signals from the vidicons are then gamma corrected to compensate for the non-linearity of picture tube brightness versus grid/cathode voltage. These signals are designated R^1, B^1 and G^1 to indicate that gamma correction has taken place. To transmit these signals direct, together with a separate luminance channel, would necessitate extreme bandwidth. But in fact the entire colour transmission is restricted to the same bandwidth as monochrome by several measures, the first of these being the method of encoding the colour information, which will now be described.

COLOUR TRANSMISSION

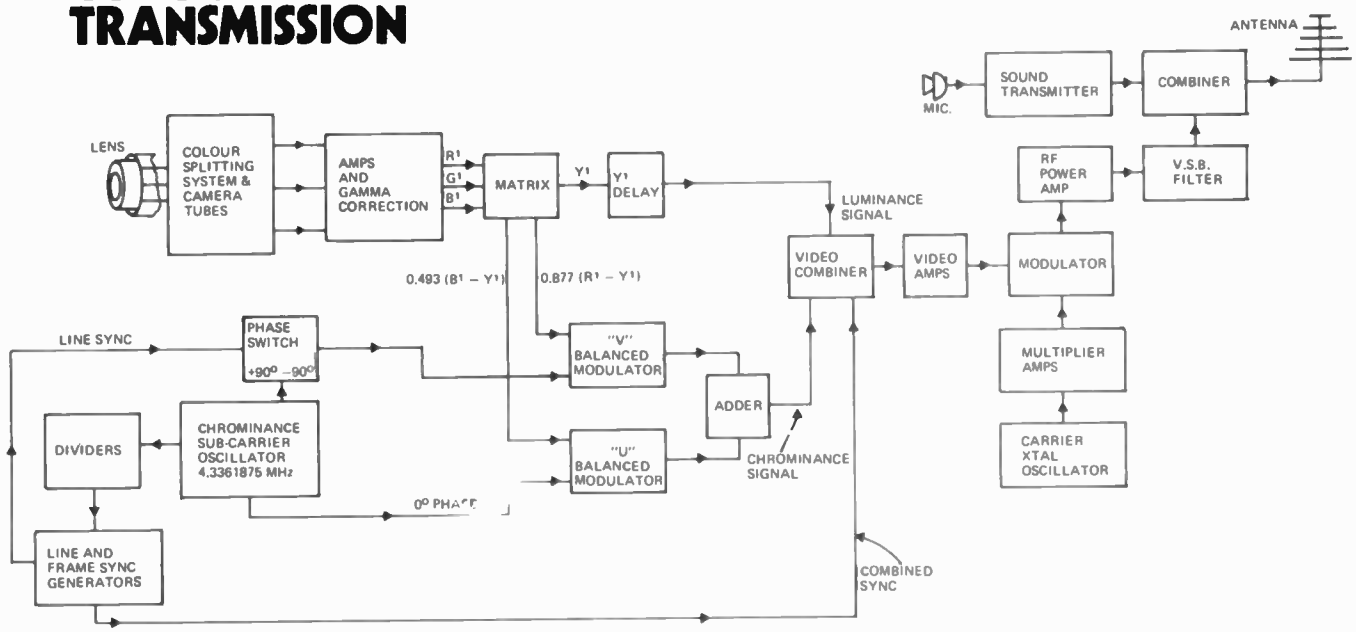


Fig. 1. Basic colour television transmitter.

COLOUR ENCODING

The three signals R^1, G^1 and B^1 are passed to a matrix where they are added proportionately, in accordance with the response of the eye, to produce the luminance signal Y^1.

$Y^1=0.3R^1+0.59G^1+0.11B^1$

In the PAL system the phase of the 'V' signal is switched from 90° leading to 90° lagging on subsequent lines, the 'U' signal being unchanged. By taking the resultant of these two transmissions, phase errors are cancelled, thus providing correct hue automatically. As the 'V' signal must be reversed in phase on alternate lines it must be switched at half line frequency. The frequency of the switch is therefore approximately 7.8kHz.

The three sets of video information, luminance, chrominance and synchronisation are mixed and AM modulate the RF carrier. Vestigial sideband transmission is used as for monochrome systems. The sound carrier is also mixed with the video RF and in all respects the sound channel is identical to monochrome.

FUNCTIONAL CIRCUITS

A colour television receiver consists of the following groups of circuits:

1) Tuner, IF strip and luminance amplifier. These circuits are exactly the same as those used in monochrome receivers.
2) The line and frame timebases and magnetic deflection circuitry. These are again basically the same as in monochrome except that higher powers are required (higher electron beam powers) and they are complicated by the addition of convergence circuitry. This is discussed briefly in the section on colour picture tubes (pages 112-114)
3) The colour decoding circuits, producing the colour-difference signals, and thence the colour drive voltages applied to the three separate electron gun grids in the picture tube.

The block diagram of a typical colour receiver is given in figure 6. As can be seen, the tuner, IF, detector and sound stages are as for monochrome. The luminance amplifier differs only in the inclusion of a notch filter tuned to subcarrier frequency. This is included to reduce subcarrier interference with the video information.

A signal is also taken from the first vision stage or detector to a "colour killer" circuit designed to disable the chrominance amplifier when receiving monochrome transmissions. If this were not done random variations in the chrominance circuits would produce colour fringing and other spurious colour effects.

The chrominance amplifier signals are then fed to the colour decoding circuitry and it is here that we find the main difference between monochrome and colour chassis.

COLOUR DECODING

It will be remembered that the chrominance signal consists of the (B^1-Y^1) and (R^1-Y^1) colour difference signals which are suppressed carrier QAM modulated on to a 4.43 MHz subcarrier having a 2MHz bandwidth and that the $(R^1 - Y^1)$ signal is reversed in phase every second line. We now have to sort this mess out.

The chrominance signal is now routed three ways, to an adder, to a subtractor and to a delay line which delays the signal by exactly one line scan period (just under 64 microseconds). The signals from the delay line are then fed to both the adder and the subtractor.

Now remembering that the $(R^1 - Y^1)$ signal is reversed on every line and that we are comparing successive lines we obtain.

in the adder

$$(B^1-Y^1)+(R^1-Y^1)+(B^1-Y^1)-(R^1-Y^1) = (B^1-Y^1)$$

in the subtractor

$$(B^1-Y^1)+(R^1-Y^1)-(B^1-Y^1)+(R^1-Y^1) = (R^1-Y^1)$$

ie. the adder gives us the (B^1-Y^1) signal and the subtractor gives us the (R^1-Y^1) signal. Remember however

Fig. 2. Diagram showing how luminance and chrominance signals are interleaved to give a bandwidth equal to that of black-and-white television.

that these signals *are still 4.3MHz modulated signals* and have to be demodulated to recover the original colour difference components.

SYNCHRONOUS DEMODULATORS

The demodulation of the subcarrier components must be done "synchronously" with the transmitter subcarrier that was suppressed. The colour burst mentioned previously carries sync information on the rear porch of the horizontal blanking pulse, refer Fig 3, and is used to lock a receiver local oscillator to the transmitter subcarrier. In the PAL system, the colour burst as transmitted, changes phase on alternate lines, first it leads the transmitter subcarrier by 45° and then lags by 45°. This does not disturb the receiver phase lock however, as the local oscillator integrates its phase to the average of the colour burst phase – which is of course 0°.

Having generated a subcarrier, we feed it to two synchronous demodulators of the "balanced ring" type. One demodulator is fed with the reference oscillator at 0° phase and with the (B^1-Y^1) signal which is subsequently demodulated.

In the case of the (R^1-Y^1) demodulator it is fed from the reference oscillator signal which is first of all phase shifted by 90° and then switched 180° (+90° to −90°) on alternate lines.

We now have the (B^1-Y^1) signal and the (R^1-Y^1) signal and still require the (G^1-Y^1) signal. To obtain this the (R^1-Y^1) signal is attenuated by a resistive divider to 0.51 of its value, and the (B^1-Y^1) signal likewise to 0.19 of its value. These signals when summed provide the (G^1-Y^1) signal.

Remember $(G^1-Y^1) = -0.51(R^1-Y^1)-0.19(B^1-Y^1)$. These three signals are then taken direct to the respective colour grids.

Now the cathodes of the guns are all driven by the Y^1 luminance signal and so the net effect for instance for the red electron gun is

$$(R^1-Y^1) + Y^1 = R^1.$$

We therefore now have our direct colour, saturation and luminance information applied to the appropriate picture tube electron guns.

The Y^1 signal is then subtracted from the R^1 and B^1 signals to produce the so called colour difference signals $(R^1 - Y^1)$ and $(B^1 - Y^1)$. You may wonder why these signals are used and not the basic colour signals. There are two reasons:–

1) If there is no colour in the scene the colour difference signals fall to zero.
2) These signals represent *colour only*, they contain no luminance information.

Again you may wonder why we only bother with two colour signals and do not generate the $(G^1 - Y^1)$ signal. This is because we know that the three colour signals when added, give the luminance signal. It is therefore only necessary to transmit two difference signals and the luminance signal in order to define the colour completely. The $(G^1 - Y^1)$ signal is chosen to be suppressed as it allows simpler circuitry to be used in the receiver, since it can be algebraically determined that:–

$$(G^1-Y^1)=-0.51(R^1-Y^1)-0.19(B^1-Y^1)$$

hence it is only necessary in the receiver to attenuate the $(R^1 - Y^1)$ and $(B^1 - Y^1)$ signals by appropriate amounts and add them to regenerate the $(G^1 - Y^1)$ signal.

BANDWIDTH REQUIREMENTS

The eye is much less sensitive to minute colour detail than it is to brightness detail hence less bandwidth is required for adequate transmission of colour information than for luminance information. The colour difference signals therefore are passed through filters which restrict their bandwidth to approximately 1MHz. As filters introduce a delay, the luminance signal must also be delayed to restore coincidence.

Some further processing of the colour difference signals is performed before transmission but we will leave this temporarily to consider the problem of bandwidth.

We now have the situation where we have the following information to transmit:

1) A 5MHz wide video signal, including line and frame sync.
2) A 50kHz wide sound channel.
3) Two 1MHz wide colour difference signals.

Exactly the same arrangement for video and sound channels must be used as for monochrome to maintain compatability – but this even with vestigial side band modulation of the vision carrier, takes up the entire 7MHz of available bandwidth – what do we do with the two colour difference channels?

The answer lies in the nature of the vision channel carrier signal. All information in this channel is a multiple of the line time base frequency and a spectrum analysis of the channel would show groups of modulation products spaced at 15,625Hz intervals as shown by the solid black bars of figure 2. We may, therefore, modulate our colour difference signals on a subcarrier whose frequency is chosen such that the group of sidebands interleave with the video carrier sidebands as per the hollow bars of figure 2.

To obtain such a fit the sub-carrier must be an odd multiple of the line time base frequency. It is not necessary however that the spacing be exactly central (ie half line offset) and in the PAL system quarter line spacing is actually used to allow burst phase to be switched on the 'V' signal as described later.

THE COLOUR SUBCARRIER

The subcarrier frequency must be chosen with consideration for a large number of factors the most important being:–

1) Frequency must be high enough to reduce interference pattern on the video signal.
2) Frequency must be low enough such that adequate subcarrier sidebands can be transmitted.
3) The subcarrier must also interleave with the sound carrier as far as possible to reduce interference.

Choice of frequency must obviously be a compromise, that chosen for the PAL system is 4.43361875 MHz and is the prime reference for the colour signals and line and frame synchronisation.

The colour difference signals are both modulated onto the same subcarrier, again keeping bandwidths in mind, several modulation methods are open to us. Indeed this is the point where most modern systems depart from each other (see glossary-systems).

The basic method used in the NTSC

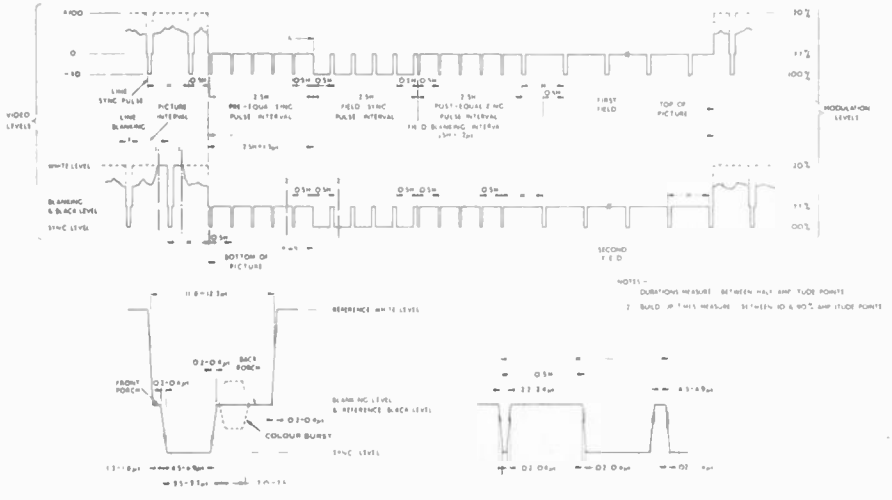


Fig. 3. Video signal timing.

COLOUR TRANSMISSION

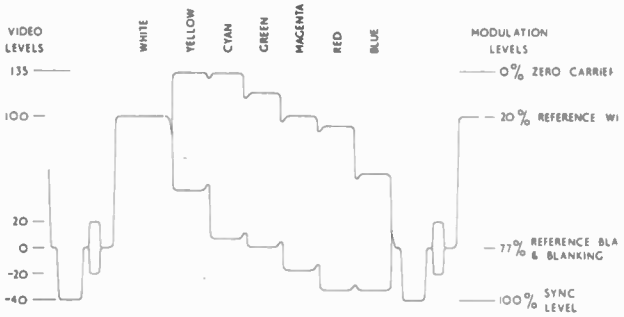


Fig. 4. Video signal corresponding to fully saturated primary and complementary colours.

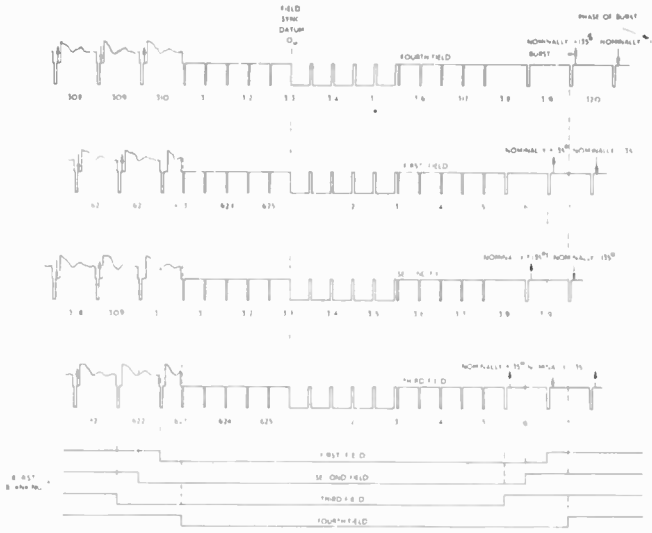


Fig. 5. Four field sequence of burst blanking.

and PAL systems is QAM (quadrature amplitude modulation) where each signal is modulated onto a separate subcarrier – where the $(R^1 - Y^1)$ signal subcarrier has the same frequency but is shifted 90° in phase from the $(B^1 - Y^1)$ subcarrier.

The modulators are of the suppressed carrier type and the resulting two sets of side bands are added to produce a pair of sidebands known as the chrominance signal. These sidebands are the vectorial sums of the $(R^1 - Y^1)$ and the $(B^1 - Y^1)$ signals and therefore convey the full hue and saturation, colour information. The amplitude of the chrominance signal is proportional to saturation and the phase is proportional to hue.

COLOUR BURST

The colour signals it will be remembered, were suppressed carrier modulated and mixed. The receiver therefore will have no reference by which to determine the phase angle of the received chrominance signal. Somehow we must transmit a reference.

In monochrome transmissions the sync pulses are transmitted during the line blanking period. The pulses are 4.7 microseconds wide and are followed by a back porch of 7.35 microsecond duration. We may use this back porch period in a colour system to transmit a subcarrier burst of 10±1 cycle duration. This signal is used in the receiver to phase lock the local subcarrier oscillator thus enabling synchronous demodulation to take place.

To prevent overmodulation of the carrier it is necessary to limit the amplitude of the colour difference signals and these now are modified to 0.493 $(B^1 - Y^1)$ and 0.877 $(R^1 - Y^1)$. In the PAL system these signals are called the 'U' and 'V' signals respectively.

PAL versus NTSC

In the NTSC system demodulation errors in the receiver will be caused by phase shift in the receiver local oscillator, or more seriously, by level sensitive phase shift due to differing carrier amplitude levels with colour. The consequence of this is hue changes in the receiver picture.

Unfortunately the eye is very sensitive to variations in hue, particularly on skin tones and can even detect phase errors of the order of 5°. This is allowed for in NTSC receivers by fitting a front panel "hue" control which is manually adjusted by the viewer to compensate for phase errors.

Manual correction is a major disadvantage and it was to overcome this failing that the SECAM and PAL systems were developed.

(Continued on page 25)

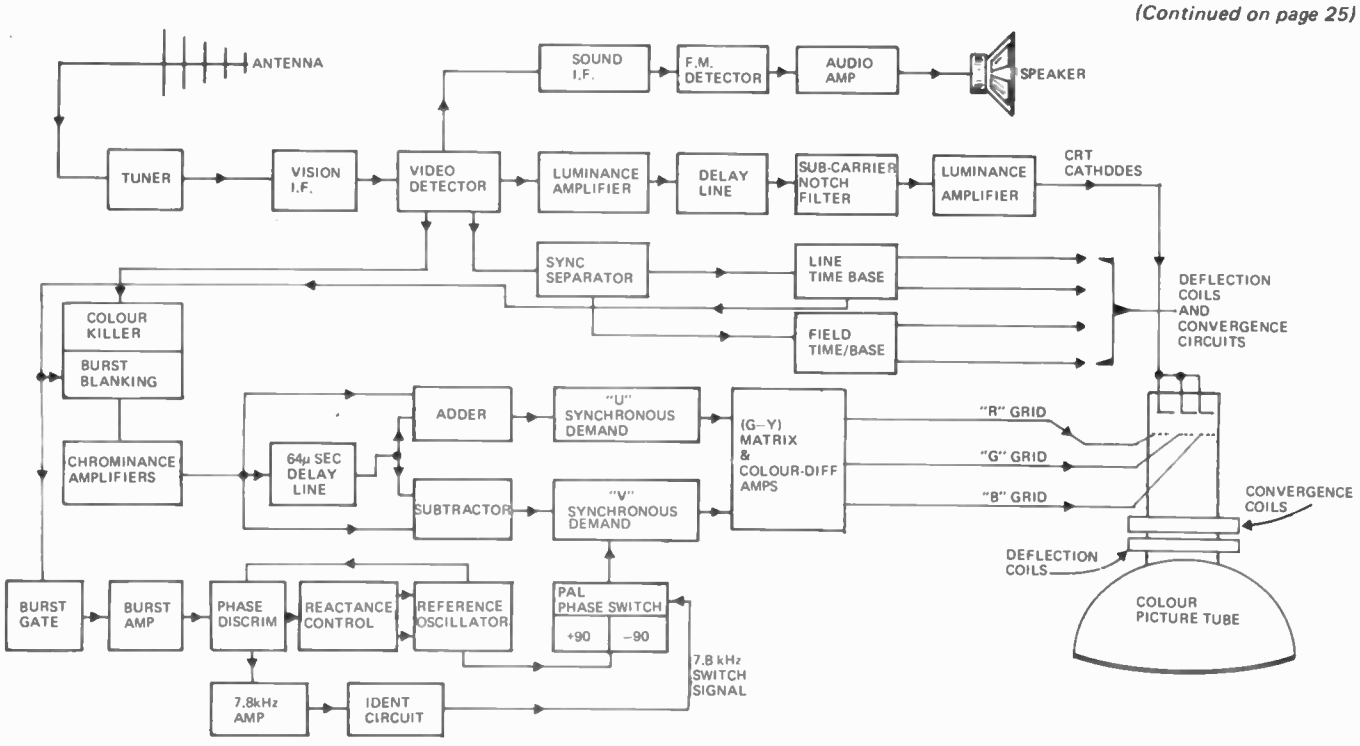


Fig. 6. Block diagram of PAL colour receiver.

For 901 owners and for those who have not yet experienced the sound of BOSE 901.

Now you can read THE ULTIMATE REVIEW by the owners themselves.

You have probably read the unprecedented series of rave reviews* that the BOSE 901 Direct/Reflecting® Speaker System has received from the leading music and equipment critics throughout the world.

HOWEVER, the relevance of the research and the value of the reviews rest solely upon your ultimate appreciation of the product. Every day we receive letters and comments from owners expressing an appreciation that goes far beyond the expected reaction to just another good product.

We decided to share these owner observations with you in a 68 page booklet that we believe makes some of the most fascinating reading in the field of high fidelity. It is entitled "The Owner Reports on the Bose 901". Included are letters from owners, warranty cards and survey replies.

In it you can read the words of the owners on:

1. How different owners describe the esthetic experience of music and the sound of the 901.
2. What equipment owners use with the 901.
3. What equipment owners traded to buy the 901.
4. What happened when a customer tried to buy the 901 from a dealer that was not franchised.
5. What owners would like us to develop next.
6. What owners would like to see improved about the 901.
7. The influence owners have in selling the 901.
8. Candid remarks on many topics by people who, just like you, are searching for the best in stereo.

If your reaction is similar to the response by those who have already seen the booklet, you will read every page before putting it down.

And when you finish, you will know why we get much more satisfaction from our work than could ever be derived from profits alone.

Copies of "The Owner Reports" are available from W. C. Wedderspoon for one dollar**

*Available on request from W. C. Wedderspoon, Sydney.

**Bose owners please contact us for a complimentary copy.

You can hear the difference now.

BOSE®

Natick, Massachusetts

Australian Distributors

WO14/FP

W. C. Wedderspoon Pty. Ltd.

Showroom: 193 Clarence Street, Sydney. 29-6681

ACT. Homecrafts, Petrie Street, Canberra. 2600

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

VIC. Douglas Trading, 191 Bourke Street, Melbourne. 3000

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

QLD. Stereo Supplies, 100 Turbot Street, BRISBANE, 4000.

S.A. Sound Spectrum, 33 Regents Arcade, Adelaide. 5000

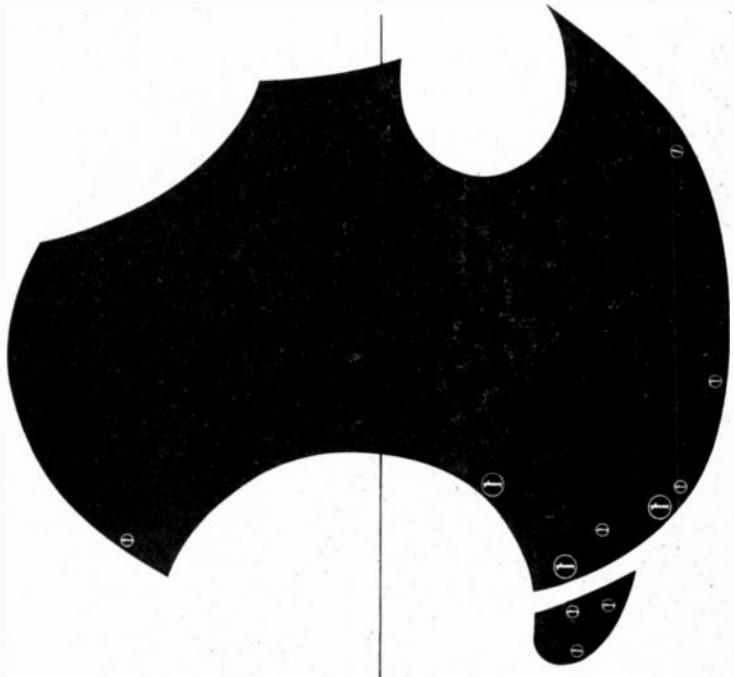
Plessey in Australia

let's check the facts...

Plessey is a major Australian manufacturer employing over 4,500 people, occupying 1,000,000 sq. ft. of plant, and with an investment of more than $30,000,000 in net assets.
We plan an increasing involvement in growth of the Australian electronics industry.

PLESSEY Pacific

HEAD OFFICE: 9-25 COMMONWEALTH ST., SYDNEY, N.S.W. 2000



APP58

COLOUR TRANSMISSION

In the PAL system the phase of the 'V' signal is switched from 90° leading to 90° lagging on subsequent lines, the 'U' signal being unchanged. By taking the resultant of these two transmissions, phase errors are cancelled, thus providing correct hue automatically. As the 'V' signal must be reversed in phase on alternate lines it must be switched at half line frequency. The frequency of the switch is therefore approximately 7.8kHz.

The three sets of video information, luminance, chrominance and synchronisation are mixed and AM modulate the RF carrier. Vestigial sideband transmission is used as for monochrome systems. The sound carrier is also mixed with the video RF and in all respects the sound channel is identical to monochrome. ●

625-LINE COLOUR AND MONOCHROME TELEVISION
Brief specification of transmitted signal

PART A GENERAL (colour and monochrome)

Channel width		7MHz
Spacing between unmodulated sound and vision carriers		5.5MHz
Vision modulation (AM negative)		
Upper sideband		5.0MHz
Lower sideband		0.75MHz
Synchronizing level	As percentage of	100%
Blanking level	maximum vision	76%
White level	carrier amplitude	20%
Sound modulation (FM)		
Peak deviation		50 kHz
Pre-emphasis		50 μs
Ratio of vision power during synchronizing pulses to sound power		5:1
Lines per picture		625
Interlace		2:1
Field frequency (f field)		50 Hz
Line frequency (f line)		15.625 Hz
Gamma		related to a display gamma of 2.8 ± 0.3
Aspect ratio		4:3

PART B COLOUR (PAL system)

RELATIONSHIP BETWEEN COLOUR, LINE AND FIELD SYNCHRONIZING SIGNALS

Colour sub-carrier frequency (f_{sc}) = (284 − ¼) f line + ½f field
= 4.43361875 MHz ± 1 Hz

COMPLETE COLOUR PICTURE SIGNAL

General specification

The colour picture signal corresponds to a luminance (brightness) component transmitted as amplitude modulation of the picture carrier and a simultaneous pair of chrominance (colouring) components transmitted as the amplitude-modulation sidebands of a pair of suppressed sub-carriers in quadrature having a common frequency as defined in paragraph 1 above. The waveform is shown in Figs. 3,4 and 5.

Delay specification

The pre-correction in group delay shall be −0.12 microsecond I 0.05 microseconds at 4.43 MHz relative to low video frequencies.

Luminance component

The *attenuation versus frequency* characteristic of the luminance signal is substantially uniform from dc to 5.5 MHz, except where it may be modified in a region embracing the colour sub-carrier frequency, eg by use of a notch filter.

Equation of the colour picture signal

The colour picture signal has the following composition:

during odd lines of first and second fields, even lines of third and fourth fields

$$E_{M_n} = E_Y' + E_U' \sin \omega t + E_V' \cos \omega t$$

during even lines of first and second fields, odd lines of third and fourth fields

$$E_{M_{n+1}} = E_Y' + E_U' \sin \omega t - E_V' \cos \omega t$$

where $E_Y' = 0.299E_R' + 0.587E_G' + 0.114E_B'$

$E_U' = 0.493(E_B' - E_Y')$

$E_V' = 0.877(E_R' - E_Y')$

$\omega = 2\pi f_{sc}$

E_M is the instantaneous video voltage applied to the mooulator of the transmitter, during the picture period.

E_Y' is the instantaneous voltage of the luminance signal, corresponding to brightness information only.

E_R', E_G' and E_B' are the instantaneous voltages (gamma-corrected) corresponding to the red, green and blue signals. E_U' and E_V' are the amplitudes of the two orthogonal components of the chrominance signal having bandwidths as specified below.

The gamma-corrected voltages E_R', E_G' and E_B' are suitable for a colour picture tube having primary colours with the following chromaticities in the CIE system of specification.

Red: x = 0.67, y = 0.33.
Green: x = 0.21, y = 0.71
Blue: x = 0.14, y - 0.08

Colour synchronizing burst

The burst consists of 10±1 cycles of sub-carrier frequency: it starts 5.6 ± 0.1μs after the line synchronizing datum point (see Figure 1) and is symmetrical about black level. The burst is omitted during nine lines of each field blanking interval (see Figure 2).

The phase of the burst is +135° for + E_V', and +225° for − E_V', relative to + E_U'.

Bandwidth of chrominance signals

The response of the video colour difference signals E_U' and E_V' is

at 1.3 MHz ⩾ 3 dB down,

at 4 MHz ⩾ 20dB down.

Timing of component signals

The delay inequality between chrominance and luminance signals is within ±109 ns.

Chromaticity response

The chrominance signal is so proportioned that it vanishes for an intended display chromaticity of CIE Illuminant D_{65} (x = 0.313, y = 0.329).

Tolerances

Chrominance signal phase errors with respect to the mean phase of the burst and independent of the luminance signal amplitude, are within ±5°.

The ratio of the amplitude of the chrominance signal to that of the luminance signal, measured as an inequality of gain suffered by the two signals, is between +5% and −30%.

Differential gain of the chrominance signal is within ±26%.
Differential phase of the chrominance signal is within ±25%.

3. **PARAMETERS OF COLOUR BAR SIGNAL [100-0-100.25(95%)]**

The table following gives, for a signal of 1V p-p (sync, tips to peak white), the amplitudes of the luminance, chrominance, and colour difference signals, and the phase angles of the chrominance signal for each colour.

	Peak-to-peak chrominance				Chrominance phase angle	
	Luminance E_Y'	U axis $2E_U'$	V axis $2E_V'$	Total	odd lines fields 1 & 2 even lines fields 3 & 4	even lines fields 1 & 2 odd lines fields 3 & 4
	volts	volts	volts	volts	degrees	degrees
White	0.700	0	0	0	–	–
Yellow	0.640	0.459	0.105	0.470	167	193
Cyan	0.543	0.155	0.646	0.664	283.5	76.5
Green	0.483	0.304	0.541	0.620	240.5	119.5
Magenta	0.392	0.304	0.541	0.620	60.5	299.5
Red	0.332	0.155	0.646	0.664	103.5	256.5
Blue	0.235	0.459	0.105	0.470	347	13.0
Burst	0	0.212	0.212	0.300	135	225

4. **INSERTION TEST SIGNALS**

Insertion Test Signal 1 is transmitted on lines 19 and 332. It consists of a 10μs white bar, which may contain an inverted sine-squared pulse (half-amplitude duration, 0.2μs) followed by a sine-squared pulse (half-amplitude duration, 0.2μs), a composite pulse (half-amplitude duration, 1μs) and a five-step staircase. The steps are of equal height and each one has a duration of 4μs. The top step is at white level. A colour sub-carrier signal, having a peak-to-peak value equal to the step height, is superimposed on the whole staircase.

Insertion Test Signal 2, transmitted on lines 20 and 333, contains a 20-μs half-amplitude luminance bar (part of which has full-amplitude subcarrier superimposed) followed by an extended burst of subcarrier covering the second half of the scanning line.

The colour burst is present on both test signals during colour transmissions only. The added sub-carrier in both test signals is locked at a nominal angle of 60° to the axis when the burst is present.

all about colour TV GLOSSARY

SYSTEMS

ART is a system in which an NTSC signal is transmitted without a colour burst. A separate reference transmission is used which reverses phase every line, and is present during the entire line period.

FAM a German system where chrominance sub-carrier is amplitude modulated by the (R^1-Y^1) signal and frequency modulated by the (B^1-Y^1) signal in contrast to the QAM used in the PAL system.

NTSC system was the first all electronic colour system to be introduced (into the USA) in 1953. It suffers from hue distortion which is usually corrected (hopefully) by a manual control on the front panel.

PAL is the German developed "Phase Alternating Line" system where hue distortion due to phase shift is corrected by reversing phase of the "V" signal on alternate lines.

PAL-D, or Deluxe PAL where averaging of adjacent line hues in the receiver is performed electronically by a delay line system. The range of correction is much greater (typically 70^o) than can be accommodated by PAL-S, but greater receiver complexity is required.

PAL-S is a simpler PAL receiver in which no automatic hue correction is applied to the alternate lines. Instead the averaging characteristic of the eye is relied on to give correct hue impression. The phase change which can be tolerated however is only a few degrees.

SECAM, a colour television system adopted in France and the USSR in 1966. The SECAM system "Sequential Chrominance and Memory device "differs from the PAL and NTSC systems in the way that chrominance signals are modulated onto the sub-carrier. The (R^1-Y^1) signal is transmitted on one line and the (B^1-Y^1) on the subsequent line. The chrominance signal is stored in the receiver for one line period by a delay line so that successive lines may be compared and averaged. FM modulation is used on the colour sub-carrier rather than AM.

BASIC DEFINITIONS

CHROMATICITY is the combined colour effect of both hue and saturation.

GAMMA is defined as the ratio of the contrast between two points on a received picture, and the contrast between the corresponding points on the transmitted scene. Ideally this ratio should be unity.

GREY SCALE is a range of tones from black to white representing steps in luminosity. Hue is not present.

HUE is the visual effect by which the eye is aware of the difference between light of various wavelengths — between red, green, blue and yellow, etc.

LUMINANCE is a physical measure of the radiant energy as weighted by the response of the eye. This is in contrast to brightness which is a subjective effect and depends on the adaptation of the eye to the overall level of illumination.

PRIMARY COLOURS (ADDITIVE) as used in colour television are red, green and blue. Any other colour, including white, may be produced by adding proportions of each. No one primary can be matched by adding proportions of the other two.

PRIMARY COLOURS (SUBTRACTIVE) the subtractive primary colours are magenta, cyan and yellow. Magenta is produced by adding red and blue, cyan by adding blue and green, and yellow by adding red and green. Remembering that red plus green and blue gives white, it may be seen that:

magenta = white minus green
cyan = white minus red
yellow = white minus blue

hence the name subtractive primaries.

SATURATION is the measure of colourfulness, or spectral purity, of a colour. It is the difference between a particular colour and white. For example, red and pink light have the same predominating wavelength and therefore the same hue. Red, however, has a greater saturation than pink.

TRANSMISSION AND RECEPTION

ACC-AUTOMATIC CHROMINANCE CONTROL an automatic gain control on the chrominance channel. Is settable manually to maintain colour gain when switching between channels. This signal is generated from the amplitude of the colour burst, in contrast to A.G.C. (automatic gain control) which is generated from sync pulse amplitude.

Completely automatic operation may be obtained by comparing the peak-to-peak colour burst amplitude to the sync pulse amplitude.

CHROMINANCE SIGNAL is that signal which modulates the colour sub-carrier and consists, in the PAL system, of the two modified and gamma corrected colour difference components U and V. These two components are at 90^o to each other in phase, with the V signal being switched 180^o in phase at half line frequency.

The chrominance signals contains all the colour information — ie hue and saturation but no luminance information.

COLOUR BAR SIGNAL a test signal, usually electronically generated producing on a colour receiver eight vertical bars of uniform width. These are:— white, yellow, cyan, green, magenta, red, blue and black.

The six colours are the three additive primaries and the three subtractive primaries. The arrangement from left to right is in order of luminance. Hence this signal produces a progressive grey scale on a black and white receiver. Luminance steps however are not uniform.

COLOUR BURST is 10 cycles of the sub-carrier for the chrominance signal, located on the back porch of the line sync pulse. This signal phase locks the receiver-generated sub-carrier to the transmitter sub-carrier (which is suppressed). This carrier has to be reinserted in order to decode the colour difference signals.

COLOUR KILLER an automatic control in the receiver chromaticity channels which disables these channels if a colour burst signal is not present. Allows black and white programme to be received on colour receivers without spurious colour effects.

COLOUR DIFFERENCE SIGNALS (R^1-Y^1) (B^1-Y^1) (G^1-Y^1). The need for colour transmission to be received on black and white sets has determined to a very large extent the method of transmission. On a black and white T.V. camera, if the output is adjusted to one volt on a pure white test card, the output from the camera when viewing the chosen fully saturated primaries is red 0.3 volts, green 0.59 volts and blue 0.11 volts. Thus the Y signal which is composed of the primaries in the above proportion corresponds exactly to the signal produced by a black and white camera. If we now subtract the Y signal from each of the primary signals the resultant colour difference signals (R^1-Y^1), (B^1-Y^1) and (G^1-Y^1) contain colour information only and will be zero when the camera is viewing a non colour scene. The (G^1-Y^1) signal is not transmitted as it may be generated by adding

OF TERMS

This glossary contains terms peculiar to colour television. A knowledge of black and white television is assumed.

suitable proportions of (R^1-Y^1) and (B^1-Y^1) (see G^1-Y^1 matrix).

COLOUR REFERENCE OSCILLATORS in the receiver re-inserts the suppressed chrominance sub-carrier. Operates at 4.43 MHz in the PAL system and is phase-locked to the transmitter 4,433,168.75 cycle sub-carrier by the colour burst signal.

COLOUR SUB-CARRIER The colour sub-carrier is usually the prime frequency reference of the colour transmission system. Its frequency is chosen such that the side bands interleave with the luminance channel sidebands in order to conserve bandwidth. In the NTSC system it is an odd multiple of half line frequency and in the PAL system an odd multiple of quarter line frequency.

DECODING The process of extracting the colour signal from the combined monochrome – colour signal at the receiver.

DICHROIC MIRRORS are designed to reflect light of one primary colour only and transmit all other light. Two such mirrors, the first reflecting blue and the second reflecting green enable three-colour separation to be performed in television cameras.

ENCODING The process of adding colour signal to the monochrome signal at the transmitter.

GAMMA CORRECTION The light emitted from a television receiver is not directly proportional to the applied grid/cathode voltage. Gamma correction is therefore applied to the luminance and colour signals at the transmitter, these signals are then denoted by Y^1, R^1, G^1 and B^1 to signify that gamma correction has been applied.

(G^1-Y^1) MATRIX Only two colour-difference signals are transmitted (R^1-Y^1) and (B^1-Y^1), from these signals the (G^1-Y^1) component may be determined from the fact that the sum of the primary colour components is equal to the luminance signal.

eg $Y^1 = 0.3R^1 + 0.59G^1 + 0.11B^1$

From the above it may be algebraically determined that

$(G^1-Y^1) = -0.51\,(R^1-Y^1) - 0.186\,(B^1-Y^1)$

Thus the (G^1-Y^1) signal may be obtained by attenuating the (R^1-Y^1) and (B^1-Y^1) signals and adding them in the correct proportions.

We choose to delete the (G^1-Y^1) signal because it allows attenuation rather than amplification in the receiver decoding matrix, thus simplifying receiver circuitry.

HANOVER BARS In the NTSC system large phase errors between chromaticity signals on pairs of lines produce hue distortions. These distortions generate a bar pattern across the picture which tends to move up or down. The bar pattern is known as "Hanover" or "Venetian Blind" effect.

I & Q SIGNALS are the names given to the weighted hue and saturation components of the chrominance signal in the NTSC signal. They are QAM modulated on the colour sub-carrier without the phase reversal as in the PAL system. The signals are given the same weighting as the PAL U & V signals.

LUMINANCE SIGNAL (Y SIGNAL) is the sum of the red (R), green (G) and blue (B) signals which have been weighted to give the equivalent monochrome signal in the proportions below.

$Y = 0.3R + 0.59G + 0.11B$

The luminance signal provides the information on picture brightness and occupies the entire video bandwidth. It is the signal which enables black and white receivers to display tonally correct pictures from colour transmissions.

QAM Two separate sub-carriers differing from each other 90° in phase, are each amplitude modulated by a colour difference signal. The quadrature relationship of these results, when the sub-carriers are suppressed, is sidebands which add to produce one pair of sidebands whose frequency and amplitude convey the two channels of information.

SYNCHRONOUS DEMODULATION Amplitude detection cannot be used to recover the colour-difference signals from the chrominance sub-carriers as the output would contain components due to both signals.

Two synchronous demodulators are used, both of the phase sensitive type. To obtain the $(B'-Y')$ component, a demodulator is fed a reference signal direct from the re-generated receiver sub-carrier. To obtain the (R^1-Y^1) component a second demodulator uses the same sub-carrier shifted in phase by 90° as a reference.

U & V SIGNALS To prevent overmodulation of the vision carrier, the amplitude of the chrominance signal must be restricted. This is achieved by reducing the signals by weighting factors. The resulting modified colour difference signals are known as U & V signals in the PAL system.

$U = 0.493\,(B^1-Y^1)$ and $V = 0.877\,(R^1-Y^1)$.

PICTURE TUBE AND DEFLECTION

DEGAUSSING A shadowmask colour T.V. picture tube is affected by magnetic fields. Even weak fields introduced into the shields by the earth's magnetic field can seriously affect convergence and purity. To overcome this problem regular degaussing must be carried out. Modern receivers have built in automatic degaussing coils which operate momentarily at each receiver switch-on.

DYNAMIC CONVERGENCE Convergence coils around the neck of the picture tube receive parabolic current signals generated in both the line and field time base circuitry. The combined effect of these signals is to maintain the relative orientation of the three colour electron beams over the entire picture screen area.

STATIC CONVERGENCE Errors in the positional relationship of the three colour beams when undeflected are due to errors in gun alignment. These are known as STATIC CONVERGENCE errors and are usually corrected by permanent magnets mounted on the neck of the tube.

PURITY is the ability of a colour picture tube to produce one pure primary colour only, when the other two beams are switched off. If for example, the red beam is on and it excites some of the blue or green phospher dots, the picture tube is said to be impure.

PURITY MAGNETS There are usually two circular "Purity" magnets located around the neck of the tube similar to the shift magnets in black and white television. By rotating the magnets together, or in relation to each other, all three beams are corrected radially in unison thus ensuring that the red gun gives red, etc. Purity magnets do not adjust the relationship of the beams to each other (see convergence).

SHADOW MASK PICTURE TUBE The RCA developed colour picture tube. This has three guns orientated at 120° producing three electron beams which individually excite three different colour phosphors. Each beam is prevented from falling on the incorrect two colours by a built in shadow mask, a steel plate with approximately 440,000 holes (25" tube).

TRINITRON PICTURE TUBE Sony developed picture tube having one gun producing three horizontally in-line beams. A vertical grid is used in place of the shadow-mask. Twice the brilliance is obtainable with much reduced convergence complexity as compared to the shadowmask tube.

INTEGRATED CIRCUITS FOR COLOUR

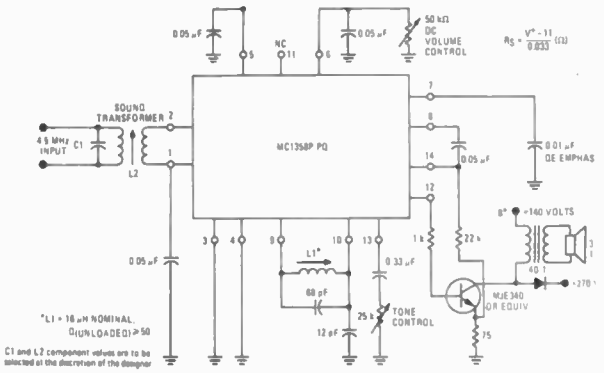


Fig. 1. Television sound IF amplifier, limiter, detector with audio driver and electronic attenuator.

New low priced IC's will replace majority of low level circuitry in colour television receivers.

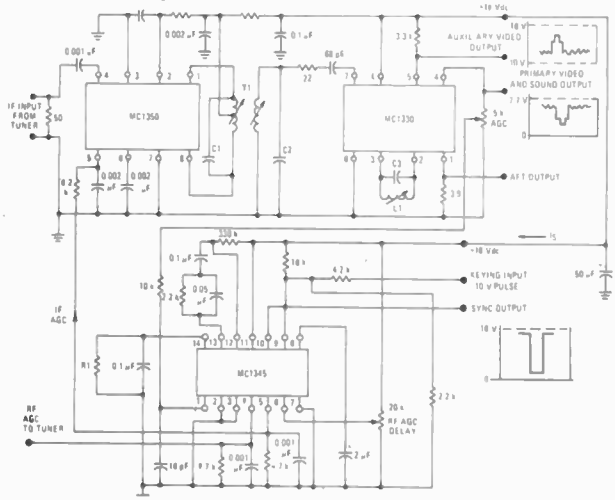


Fig. 2. Integrated circuit video IF and AGC stages use only three packages.

Some sections of the circuitry of colour television receivers are a 'natural' for integration techniques. Typical amongst these are the video IF, the sound IF, FM detector, audio amplifier, video amplifier, chrominance demodulator and sync circuitry. In fact *any* of the low level circuitry of a colour television circuit lends itself to integration.

Whether integration is used, or not, depends entirely on the relative economics when compared to discrete components. Recently the prices of IC television circuitry have become more than competitive and ICs are now appearing in ever increasing abundance in overseas receivers.

It is most likely that Australian receivers will contain four or five ICs which will replace a sizeable part of the discrete components required.

Motorola has invested heavily in the manufacture of ICs specifically for colour receivers and a few examples are given here to illustrate what can be done.

Integrated circuits are available in various levels of integration but the trend seems to be toward single chip colour decoders, single chip IF amplifier, detector and AGC and single chip sound IF, FM detector and audio output stages.

Although the ICs illustrated here are specifically designed for NTSC, others designed for PAL are also becoming available.

Figure 1 shows the application of the MC1358 which is a versatile monolithic device incorporating sound IF amplifiers with limiting, detection, electronic attenuation, audio amplifier and audio driver capabilities.

Figure 2 shows the application of the MC1345P TV Signal Processor, the MC1350 video IF and the MC1330 low level video detector. The MC1345P provides sync separation, noise inversion, AGC comparator and a versatile RF AGC delay amplifier. The MC1350P is an IF amplifier having a typical power gain of 50dB at 45MHz and capable of operating with a 60dB AGC range from dc to 45MHz. The MC1330P is a unique ultra-linear low-level video detector which illustrates how integrated circuits, by use of much more complex circuitry than would be possible with discrete components, can provide vastly superior performance at comparable prices.

Lastly, figure 3 shows a typical chroma applications circuit using the MC1398P and the MC1326. The MC1398P provides chrominance IF amplifiers with auto-chroma control, colour killer, dc chroma control and an injection lock reference system followed by dc hue control. This device of course is specifically for NTSC. The MC1326 is a dual doubly balanced chrominance demodulator with R,G,B matrix and chroma driver stages.

The above examples show dramatically the savings in component count when integrated circuits are used. ●

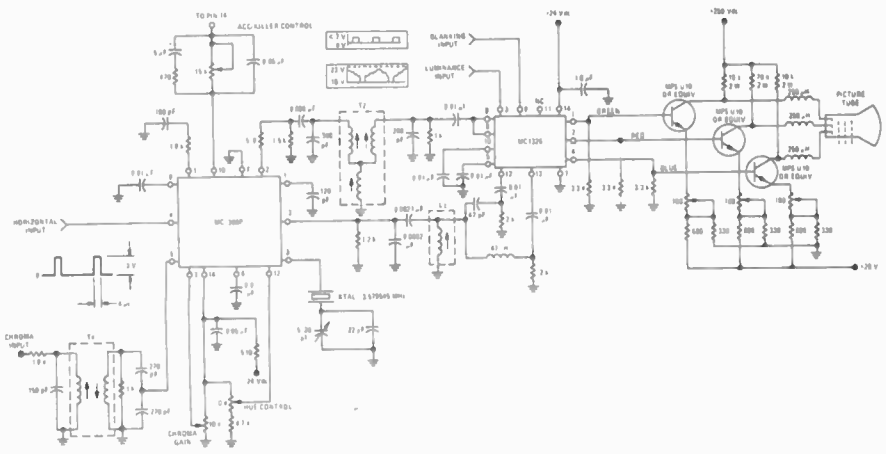
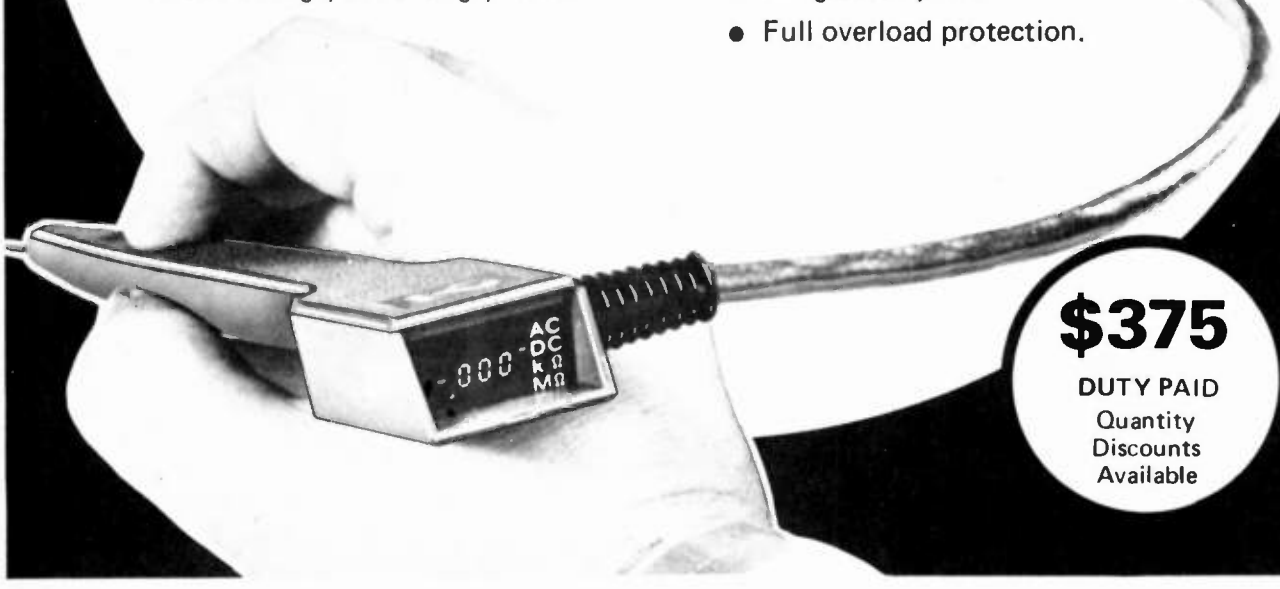


Fig. 3. Typical chroma processing circuit for colour television.

BREAKTHROUGH: 1972

KEITHLEY 167 AUTO PROBE DIGITAL MULTIMETER

- 3½ digit LED display built into probe!!
- Auto ranging.
- AC voltage, DC voltage, ohms.
- Optional AC, DC current.
- Battery operation.
- Long battery life.
- Full overload protection.



$375
DUTY PAID
Quantity Discounts Available

FOR MORE INFORMATION OR DEMONSTRATION CONTACT:

WARBURTON FRANKI

- ADELAIDE 56-7333
- BRISBANE 51-5121
- HOBART 23-1841
- MELBOURNE 69-0151
- PERTH 25-7787
- SYDNEY 648-1711

WF2-17021

all about colour TV

COLOUR

We asked leading industrial companies what the introduction of colour television meant to them – here are their replies.

PLESSEY PACIFIC PTY. LIMITED.

THE announcement of the commencement of colour TV transmission in March 1975 means that the components industry will at last be able to plan for a growth market – a market which for monochrome receivers has been fairly static for the past three years and indeed will show little or no growth for the next three years.

The quantity, or value, of discrete components (i.e. capacitors, fixed and variable resistors, wound components, semiconductors, etc.) is approximately 2½ times greater in colour receivers than in monochrome.

The Plessey Components Divisions in Australia (Ducon in Sydney, and Rola in Melbourne) currently have engineers overseas studying design and production techniques employed by world leaders in component technology.

It was clearly demonstrated from the commencement of monochrome transmission in Australia some years ago that Australian-made components were at least equal to world standards in quality. Indeed, a large percentage of receivers which were manufactured during the early years and which used a majority of locally manufactured components, are still performing satisfactorily.

EXPECTED GROWTH OF COLOUR TV

American Experience

The introduction pattern in the USA was particularly slow due to early development problems. Little headway was made for about ten years but by 1962 growth had accelerated rapidly. Currently more than 6 million colour sets are produced annually, or about 30 sets per 1000 head of population. The system in use is NTSC.

UK Experience

Colour was not as slow to start here, since technology was already well advanced. The system introduced was PAL – as will be the case in Australia. After three years of production, growth is now accelerating and in 1970 production was about 9 sets per 1000 head of population.

Refer Table 1 in Appendix for actual production figures 1964-1970.

Australian Forecast

We expect a more rapid introduction here due to availability of technology and three years notice of transmission.

Some pre-production and selling prior to transmission is anticipated, and we believe about 50,000 sets could be made during 1974/75.

We anticipate production of some 80,000 colour receivers during 1975–76 and 130,000 in 1976/77, which would approach an annual production rate of 10 sets per 1000 head of population.

Refer Table 2 in Appendix for our forecast of television growth to 1976/77.

COMPONENT CONTENT IN TV

Content of Conventional Types

Based on analysis of six monochrome sets and four colour sets (three ex UK, one Australian prototype), the following average number of certain components are anticipated per receiver:

Component	No. per Mono-chrome	No. per Colour
Capacitors	121.4	253
Resistors – fixed	139.4	338
Resistors – variable	11	44
Valves	0.65	–
Diodes	21	64
Transistors	25	67
Integrated Circuits	1	1

GENERAL COMMENTS

Conventional Components

Components currently used in monochrome TV are available in the industry. Use in colour sets will follow the pattern outlined above.

There is currently an ongoing change in mix due to conversion from all-valve, through hybrid, to all-transistor sets and also the limited introduction of integrated circuits.

Colour TV will not appreciably alter performance requirements of these components except that:

some higher voltage ceramic capacitors will be required for the increased EHT voltage

more tantalum capacitors, of higher stability than aluminium foil electrolytics, will be required

more high power resistors will be needed due to higher power consumption of a colour set

wire-wound potentiometers will be required in large numbers, as well as increased numbers of pre-set carbon track types, to cater for the increased complexity of colour circuitry.

New Components

Other than the general increase in usage of conventional components, two major new items will be required:

(i) The shadow mask picture tube

(ii) A precision delay line.

It is possible for either or both of these components to be manufactured locally but they are likely to be imported during the initial production phase of Colour.

Technological Influences

It is uncertain at this time what effect

BREAKTHROUGH IN COLOUR TV CIRCUITRY

An important development in integrated circuit technology has been achieved by the reduction of the complete colour signal processing circuitry of a television receiver on to two optimum scale integration monolithic chips. This achievement has resulted from close co-operation between Plessey and Rank Bush Murphy Limited.

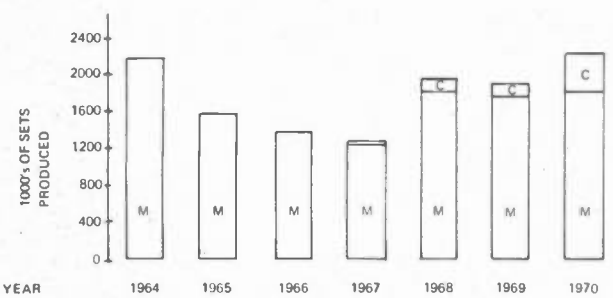
The circuits, which are encapsulated in a 24-lead ceramic package, provide the following eight functions: chroma amplification; gated burst amplifier with 45° switch; reference amplifier; PAL switch; colour killer; internal stabilisation, R–Y and B–Y balanced demodulator; matrixing for red, green, blue outputs.

Both circuits are now in full scale production at Plessey and orders worth £135,000 have been received.

APPENDIX

TABLE 1

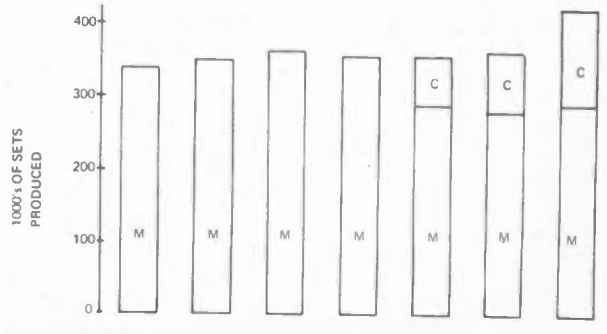
TELEVISION GROWTH IN U.K.



YEAR	1964	1965	1966	1967	1968	1969	1970
MONOCHROME	2183	1591	1396	1240	1823	1760	1725
GROWTH %		–27	–12	–11	+48	–3	–2
COLOUR	–	–	–	32	140	142	488
GROWTH %				+100	+340	+1	+240
RATIO MONOCHROME TO COLOUR				39	13	12.4	3.5

TABLE 2

PROJECTED TELEVISION GROWTH IN AUSTRALIA



YEAR	70/71	71/72	72/73	73/74	74/75	75/76	76/77
MONOCHROME	337	347	357	350	285	275	285
GROWTH %		+3	+3	–2	–19	–3	+4
COLOUR	–	–	–	–	50	80	130
GROWTH %					+100	+60	+62
RATIO OF MONOCHROME TO COLOUR					5.7	3.4	2.2

COMMENT

the following will have on components in colour sets —
(a) Picture tube angle: 50°, 70°, 90°, 110°
(b) Use of integrated circuits

(a) Choice of Picture Tube

Increasing the angle greatly increases the power requirements of the set and the complexity of circuitry due to the need for colour correction over the total screen area.

Beyond a certain power consumption, the conventional mains switch would become inadequate and a separate switch of higher current rating would have to be used.

(b) Use of Integrated Circuits

Integrated circuits are already available which can perform many of the functions in a colour circuit.

A larger number than predicted could be used if the cost effectiveness is improved. This would mean a considerable reduction in some component types — principally resistors, transistors, diodes, and to a lesser extent, capacitors.

Receiver design will go modular for reasons of low cost assembly and ease of maintenance. The impact of this philosophy on component suppliers and set manufacturer, the system design is dictated by the available modules, be they integrated circuits or multichip assemblies on ceramic substrates. One colour TV receiver of European design consists of 22 transistors and 6 integrated circuits, while a recent Japanese design showed a preference for thick film subassemblies — 10 of them plus 9 other semiconductor devices. American designs are going modular. An economic approach is that of RCA, who use ICs for low level circuits and three ceramic circuits where voltage and power requirements are beyond ICs.

PLESSEY CAPABILITY

Plessey Rola first commenced development of colour deflection components in 1964. In 1965 a Rola engineer spent nine months in the USA studying latest developments particularly relating to colour component manufacturing equipment.

Initial studies involved development of components to suit valve-operated receivers based on the United States NTSC system (the only type available at that time.)

In 1965 Plessey Rola designed and produced at their Harrisfield Research and Development Laboratory a semi-toroidal colour deflection yoke winding machine. In the same year the company imported two RCA colour receivers for further developmental study. These receivers were two of the first colour sets imported into Australia.

Development work has continued from that time and has only been limited by the doubt surrounding the date proposed for the introduction of colour transmission services.

In addition to local development plans the company has closely monitored technological changes overseas, particularly in relation to the introduction of valve, hybrid and solid state receivers. Close co-operation has been maintained with other Plessey companies overseas, principally the United Kingdom and Italy where both plants are in full-scale production of colour and black and white componentry.

Plessey Rola have so far expended more than $35,000 on colour development and have already produced in their Richmond plant samples of colour deflection components which have been set tested on a UK manufactured receiver and an Australian produced prototype set.

Some design changes in loudspeakers will be necessary due to the more stringent requirements in colour receivers relating to stray magnetic fields, and methods of reducing stray fields in both Alloy and Ferrite magnet types are being evaluated.

In the field of microelectronics, Plessey UK have the following items currently in production:

SL432	Sound IF
SL403	Audio Power Amp
SL435/436	Colour Signal Processing

In Australia, Plessey can offer design facilities, as well as the assembly into ceramic packages of IC chips from either Plessey or non-Plessey sources, thus broadening the number of design options available to set manufacturers.

Plessey Pacific has also been active in Thick Film Microelectronics over the past year.

TRAINING FOR COLOUR

The servicing of colour television will be an expensive proposition for the receiver owner. Colour sets are finicky things, affected by stray magnetic fields and requiring quite lengthy set-up of convergence — even if the set is only moved to a new position.

Various people in the trade have mentioned a figure of the order of $100 as the probable yearly service insurance charge. Overseas these factors have led to the increase of TV hire in preference to private ownership. This trend throws the onus back on the hire company to ensure that their service staff is adequately trained. The expense of inefficiency now comes out of their own pocket rather than the customer's.

There is no reason to suppose that this trend will not be followed in Australia. Hence it is up to you — if you want to be in the colour scene — get yourself adequately trained.

Most schools offering electronics courses are already running colour television courses, or will introduce them almost immediately.

For those who wish to train for colour television, the time to start thinking about it — is now. Entry to most courses is conditional on previous completion of a monochrome television course and the average course duration is twelve months.

Lastly it would be wise to bear in mind that once colour starts, technician registration would most likely follow. Registration is desirable to protect both the public and the technician himself.

The following companies are running, or will introduce colour television servicing courses in the near future:—

AUSTRALIAN RADIO AND TELEVISION COLLEGE PTY. LTD., 206 Broadway, Sydney, N.S.W.

DEPARTMENT OF TECHNICAL EDUCATION, Cnr. Broadway and Harris Sts., Ultimo N.S.W.

INTERNATIONAL CORRESPONDENCE SCHOOLS 400 Pacific Highway, Crows Nest N.S.W.

MARCONI SCHOOL OF WIRELESS, 21 Pier St., N.S.W.

TECHNICAL TRAINING INTERNATIONAL, P.O. Box 328, Chatswood N.S.W.

all about colour TV

COLOUR COMMENT

SIMON GRAY PTY LTD

WHILST we basically handle equipment designed for audio applications, we are exclusive distributors for the Ampex International range of 1" helican scan video tape recording equipment.

These equipments have been used in the past by many advertising agencies and now that colour is about to be introduced, the Ampex VPR5803 and VPR7903 will be equipments of most interest to these people for submission of advertising matter to their principals for subsequent evaluation, appreciation etc.

Although we understand some commercials have already been produced in colour, it is believed that there will be a tremendous upsurge in the use of colour VTR equipment by advertising agencies now that the introduction of colour transmission is scheduled for March 1975. It is generally considered that advertising agencies will be two or more years ahead of this release date with advertising material and, as a consequence, we are preparing to assist these people with colour VTR equipment as of now. The results obtained from Ampex helical scan colour equipment may be regarded as better than signals received on a high quality receiver in a good reception area.

The video performance of the high band VPR7903 offers a frequency response ±1dB from 30Hz to 5.2MHz, with a noise figure of 51dB minimum P-P signal to RMS noise. The audio performance provides a frequency response ±2dB from 50Hz to 15kHz, with a signal to noise of 50dB at 3% THD, and the excellent time base stability is a direct result of the unique mechanical construction of the video scanner. This scanner provides a natural air bearing, causing low tape to scanner friction. The scanner has its own printed circuit servo motor mounted directly to the scanner shaft which eliminates any servo errors which might be introduced by other scanner drive methods. The maximum time base error of the VPR-7903 is less than .5 micro-seconds.

The Ampex-developed Omega Wrap recording format is the most versatile in the industry. One of its primary advantages is that it permits independent recording of all tracks of information. This of course means that the operator can decide the time and order in which to record video or either of the two audio tracks, thus bringing about true professional quality editing.

The video processing amplifier provides complete control of the video signal by use of the video level, chroma level, pedestal level and burst phase controls.

The Ampex colour dropout compensator eliminates the effects of dropouts in tape recorded TV signals. The compensator is similar to the type used by almost all TV broadcasters and may be regarded as a must when the recorder is used for broadcasting, producing master tapes or for duplicating. The Ampex dropout compensator extends tape life by virtually eliminating annoying dropouts.

An inbuilt monitoring system permits continuous visual monitoring of the video recording process, thus enabling the operator to instantly spot any possible malfunction during video recording mode.

The VPR7903 incorporates the identical 1" single-head helical scan format featured in all Ampex 1" models, and accordingly will play tapes recorded on any other Ampex 1" unit. This tape interchangeability is important and Ampex offers the industry a most complete line of equipment in the 1" format. The Ampex format is considered as a "standard" by many producers of programming material.

Ampex guarantees in writing that the video tapes in a client's library will always be fully playable no matter how much the client's teleproduction equipment may change within the Ampex 1" format.

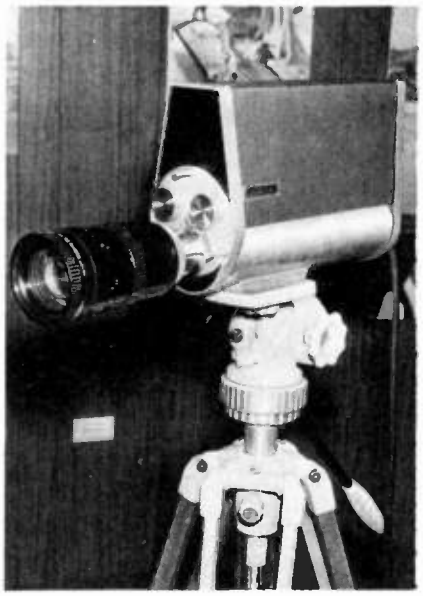
Other equipments distributed by our organisation which will be of interest to the television industry include the CBS Mark II Image Enhancer which provides truly effective enhancing of the vertical and horizontal detail of colour television material. Using the "crispened" comb filter, luminance signals are enhanced without degrading colour signal quality. The Mark II Enhancer analyses each picture element with respect to its surrounding elements and introduces corrective signals to enhance the element's sharpness — the results are spectacular.

CBS also offer the Model 535 Masking Amplifier which enhances Plumbicon camera colour fidelity and saturation. This unit has been designed specifically for use in three-tube Plumbicon camera and compensates for colour distortion caused by optical colour filter overlap and the chromatic response characteristics of the Plumbicon camera tube. Masking correction is applied in the R-G-B channels prior to encoding and is narrow band (below 2MHz) in order to provide the necessary subjective correction and not add objectionable noise to the signal. The Model 535 Masking Amplifier utilises the latest solid-state techniques and integrated microcircuitry for long life, stability and reliability.

Simon Gray has just been appointed Australian National Distributor for Ets Adrien de Backer SA, Belgium, manufacturers of high quality lighting and electrical equipment for colour television studios. Detailed technical information is not yet available but we will be pleased to submit these details on request.

A typical Ampex video tape recorder suitable for production of commercials etc.

The Ampex AVR-1 studio video tape recorder uses 2" tape and automatically locks up to tapes produced on NTSC, PAL or SECAM systems.



An Ampex TV camera suitable for industrial use.

HILLS INDUSTRIES

THE long awaited announcement of a starting date for colour T.V. in Australia can hardly be said to have been a surprise. As the biggest manufacturer of T.V. Antenna and associated equipment in Australasia, Hills Industries have been planning for "C" Day for years.

Research into the technical problems has been a continuing process and Hills Design Engineers have played their part as representatives of the industry on various committees which have been investigating aspects of colour T.V. and its application in Australia and New Zealand.

Technical executives have toured overseas to study the various systems used and in particular to learn some of the problems referring to design, manufactur and installation of antenna equipment suitable for colour T.V. reception and distribution.

This knowledge has already been applied in a variety of Hills activities.

In anticipation of colour many T.V. Stations have in recent years been installing new transmitting antennae ready for the start of colour transmission. These antennae have had to be designed to very tight technical specifications in order to meet the higher standards required for the transmission of colour T.V. Competition for these contracts has not been confined to Australia. In the face of keen overseas competition, Hills have been successful in obtaining and installing a high percentage of these antenna system contracts. Apart from the main T.V. Stations a contract was obtained to supply antenna systems for a number of mining centres in Western Australia.

Much of the research and specialised equipment used to develop these sophisticated commercial transmitting antennae was applied to researching into the requirements for *reception* of colour T.V. signals. As a result, parameters were established which, if strictly adhered to, will produce the most satisfactory results of a colour T.V. receiver.

Having said all this, what are these parameters for colour T.V. reception? It is well known that the Standards Association of Australia are currently preparing standards for antenna and equipment suitable for colour T.V. reception and distribution. Whilst the standard is still in the course of preparation it can reasonably be anticipated that the standards of performance selected will be based on the findings of the I.E.C. (International Electrotechnical Commission), but modified and improved where applicable to suit Australian requirements. An interesting note here is that being one of the last "developed countries" to get colour T.V. it has meant that we have been able to select the best system available and to benefit by the experience of other countries. It is safe to say that the colour picture transmitted in Australia will be of the highest quality, equal to any and better than most other countries.

In our capacity as manufacturers of domestic antennae our aim is to ensure that the same quality of picture as is transmitted reaches the input to the T.V. Receiver. This is where the use of efficient T.V. antennae system becomes important.

It should be noted that we refer to an antenna system and not merely an antenna. A system can be defined as the means of collecting signals off air and delivering them to a T.V. set. This includes the receiving antenna or antennae, the transmission line, the T.V. outlet, and any splitters or other accessories connected to the line. The simplest possible system is one antenna feeding via a piece of transmission line to a single outlet point in the living room of a house. More often nowadays, however, it is normal to use a single antenna to feed two, three or even four points in the one house. The same term, antenna system, can also be used to describe a Master Antenna System (M.A.T.V.) such as that used to serve a block of flats, hotel, or similar large building where many points are to be served.

Obviously the more complex the installation the more important it becomes to ensure that the antenna system is correctly designed and installed. Exactly the same principles however apply to even the simplest installation. A perfect antenna may receive perfect signals, but these signals can be degraded en route to the receiver.

WHY USE A SPECIAL ANTENNA

It is not suggested that all existing antennae will not work at all on colour. Any antenna *will* work on colour. Let's face it, even the simplest type of antenna *will* bring in some sort of picture on present black and white transmissions in strong signal areas. The important thing, however, is in the statement "some sort of picture". We all know that many viewers at present are prepared to accept less than perfect pictures on their black and white sets — that is why we still sell (albeit reluctantly) indoor antennae. However, imperfections which are possibly acceptable on black and white are far more serious with colour. For example:

Ghosting

Will show up on colour T.V. screen as areas of paler colours. In fact, if the ghost is particularly strong, the area of the screen within the ghost can lose all colour and appear as a black and white patch. Imagine the result of this on a moving picture.

Snow

On weak pictures where snow is visible this will show up on a colour T.V. screen as a pattern of coloured dots. This effect is known as "confetti" — very pretty, but irritating.

These are the two main problems about which you are likely to be asked. Obviously, there are other problems such as "smearing", "mismatching," etc. with their various effects.

To avoid these problems, it is important that an antenna is designed to tight parameters as stated previously. The three most important factors are as follows:

1. Frequency Response

Colour is transmitted in three carriers, i.e. Luminance Carrier, Colour sub-carrier and Sound. It is most important to maintain the amplitudes of these carriers in the same proportion as they are transmitted.

2. Impedance Matching (V.S.W.R.)

To avoid losses due to standing waves and mismatch, any receiving antennae, should have a low value V.S.W.R. We are all familiar with the ringing affect of standing waves on black and white pictures. This becomes much more of a problem with colour.

3. Directivity

As stated earlier, ghosting is a serious problem, so it becomes more important than ever to design antennae with a high directivity. The term for measurement of directivity now in use is "Directivity Protection Ratio", and encompasses all spurious lobes other than the main lobe in the antenna polar pattern. A few of the antennae currently in production come close to these parameters, and therefore could produce reasonable results on colour, most others fall well outside the standards generally acceptable as desirable for colour T.V. reception.

I AGREE WITH ALL YOU SAY — BUT PLEASE — SAY IT SOMEWHERE ELSE . . . !

Coaxial Cable

One of the prime requisites for efficient reception of colour pictures is to ensure that the signals received on a quality antenna are not distorted and degraded en route to the receiver. For this reason, all major antennae manufacturers are pushing for the use of coaxial cable with colour and for the use of coaxial entries to colour T.V. receivers. Hills have already commenced selling the idea of coaxial installations, and this will be stepped up rapidly — particularly to the trade.

The main objection to coaxial cable has been the extra cost involved. Previously most high quality T.V. coaxial cables had to be imported. Two years ago, Hills prepared a design specification and as a result, had a coaxial cable locally made (Type S.S.A. 37)

COLOUR COMMENT

to that specification exclusively for Hills, the price is right and all materials used in construction are Australian.

Accessories

Hills have for some time been offering a range of 75 ohm coaxial antenna accessories — "Engineered for Colour". The Hills/Teleng range of splitters and tee units, and the Hills range of outlet plates, have been and will continue to be sold safely under this slogan. Other units have been and will continue to be added — for example we now have a weatherproof Antenna Balun which is compatible with this quality equipment.

To sum up briefly, antennae manufacturers have long realised, and not just for commercial reasons, the importance to picture quality of an efficient antenna system. In anticipation of colour, Hills have for some considerable time, been advocating the use of coaxial cables at 75 ohms, with the complementary coax accessories, Splitters, Tappers, Outlets etc. Hills have also designed and manufactured a range of antennae designed to the higher standards required for colour reception, and these will be released shortly. Like other manufacturers, we do realise that there will always be the customer who is willing to pay a good price for a modern T.V. receiver, but still expects his T.V. antenna installation to cost next to nothing. These people will still exist with colour T.V., we will let the results speak for themselves. Those people who take the trouble and are prepared to stand the small extra expense of a quality antenna installation will get the best results on colour, and others must struggle along as best they can.

PHILIPS INDUSTRIES HOLDINGS LIMITED

"PHILIPS could be ready to supply the consumer market with colour television receivers within two years, chairman and managing director of Philips Industries Holdings Limited, Mr. H.D. Huyer, said recently.

"Although the Government has given the Australian electronics industry three years to prepare for the start of colour transmission, we are geared to meet the demand within two years," Mr. Huyer said.

"We have been ready to move into full production for some time, and the Federal Government's announcement is most welcome."

When asked the cost of colour television receivers, Mr Huyer said he did not believe the cost of a receiver would fall below the introductory price of between $500.00 and $1,000.00, "depending on the degree of luxury you want."

"The cheapest set will start at around $500.00, but I cannot see the price falling the way the price of black and white sets fell when television started in Australia."

The beginning of television in Australia marked the start of a new industry, he said.

"Television is now fifteen years old in Australia and the cost of production facilities of receivers has been amortised over this period.

"These same production facilities will be utilised for the production of colour receivers so the only benefit the consumer will gain is the natural depreciation in the purchasing power of his money.

"What he should gain, however, is a greater degree of reliability from his first colour receiver than he did from his first black and white receiver.

"Apart from being able to benefit from world-wide advances in television technology, the consumer will also have the added advantage of solid state circuitry and integrated circuits to rely on.

Mr Huyer added that the Government's announcement of a starting date for colour television transmissions had lifted from the industry "many uncertainties."

"It is," he said, "a shot in the arm for the electronics industry when it was most needed."

From left to right — the Philips LDL1251 colour video tape recorder, Philips colour monitor and colour camera provide a complete industrial closed circuit system.

"PHILIPS COMBINED COLOUR/MONOCHROME PATTERN GENERATOR PM 5544 (See Pattern on Front Cover)"

THE combined monochrome/-colour pattern generator PM 5544 is a useful instrument for generating a pattern on behalf of T.V. transmitters, set factories and studios. It supplies a picture which is equally well suitable for the various monochrome as for the colour T.V. checks and measurements. The picture content is such that a number of colour T.V. alignments can be made directly from the screen without making use of an additional measuring instrument.

Which pattern?

It is important that the information contained in the pattern should be easily decipherable, and shows errors or misalignments of the T.V. set or equipment to be tested from the screen, both in monochrome and colour. The Philips pattern achieves this objective by placing most of the components inside the circle and by providing a symmetrical design.

Thus inside the circle one finds the four basic components: colour bar scale, grey scale, definition lines and the 250kHz square-wave signal. And additionally five other signals: in the very centre a grid pattern, the black-white step with black needle pulse, the white-black step with white needle pulse, the black rectangle at the top of the circle and finally the yellow-red-yellow step at the bottom.

There are also several signals outside the circle for checking and aligning T.V. receivers, which can be switched in and out.

Why a circle? Why digitally derived?

A circle is generally accepted to be the best method of evaluating picture geometry and linearity. Any defects are immediately obvious as a distortion of the circle.

A digitally derived circle is preferred since the inherent stability of the circle must be high. This, unfortunately, has been a failing with many circles generated by the so-called flying spot scanner and also those generated electronically on an analog basis. In the Philips generator the combination of digital techniques plus a ferrite core memory provides an inherently stable display with a clear yes/no indication of scanning faults.

OTARI

SERIES MX 5500

Compact Professional Tape Deck

The Otari MX-5500 comes from a long line of industry-accepted high-speed tape duplicating systems and is designed for the fastidious audiophile. Three motor system mounted on heavy Aluminium Die Cast Frame. The capstan is operated by a 2 speed Hysteresis Synchronous Motor. Amplifier has a three-stage directly connected IC, in addition, extra circuits such as Sound on Sound, Echo and Auto-Reverse as well as Bias change-over are provided. The MX-5500 compact professional tape deck will satisfy the most exacting user.

SPECIFICATIONS

Tape Width:	¼ inch
Tape Speed:	3¾ and 7½ I.P.S.
Reel Capacity:	7 inch
Tape Heads:	4 heads, 4 track 2 channel Erase, Record, Playback and Reverse Playback
Speed Deviation:	Less than ±0.4%
Wow & Flutter:	Less than 0.08% W. Rms at 7½ I.P.S. – Less than 0.12% W. Rms at 3¾ I.P.S.
Capstan:	2 Speed Hysteresis Synchronous Motor
Spooling:	2 High Torque Spooling Motors
Input Level:	Mic. Input – 55 dB unbalanced 50 K ohm; Line Input – 20 dB unbalanced 100 K ohm
Output Level:	Line Output +4 dB (0Vu) unbalanced 100 ohms – Monitor Output 70 mV (0Vu) 8 ohms headphone (0 dB = 0.775V)
Frequency Response:	7½ I.P.S. ±2 dB 40 – 20 KHz – 3¾ I.P.S. ±3 dB 50 – 12 KHz
Signal/Noise Ratio:	–60 dB below peak level (+12 dB)
Distortion:	1% at standard reference level
Cross Talk:	50 dB at 1kHz.

Please phone or write for brochures giving full specifications.

W.A. AGENT: Severin Distributors, G.P.O. Box E 3002, Perth. 6001.

KLARION ENTERPRISES PROPRIETARY LIMITED

Regent House, 63 Kingsway, South Melbourne, 3205, Australia. Phone 61 3801 Cables Klarionmelb

A.C.E. RADIO

AMPLIFICATION · COMMUNICATION · ELECTRONICS

PHONE 51-3845
51-7008

136 VICTORIA ROAD, MARRICKVILLE, N.S.W. 2204
WEEKENDS & AFTER HOURS 40-5391

SONATA

All silicone solid-state Hi Fi Stereo Amplifier Model NS-1600D

10 watts R.M.S. per channel. Each channel has separate bass/Treble controls.
Inputs for magnetic or ceramic cartridge, crystal mic., radio, tape – tapeout stereo headphones. 8-16 ohms. Instruction booklet, circuit supplied. Timber cabinet. Dimensions: 14½" x 8" x 4". Price **$67.50**. Pack & Post $1.50. Interstate $2.50.

MAGNAVOX WIDE RANGE FREQUENCY RESPONSE TWIN CONE SPEAKERS, 8 or 16 ohms.

30 – 16000 Hz.

6WR Mk.V	12 watts RMS	$ 9.90
8WR Mk.V	16 " "	$10.75
10WR Mk.1V	16 " "	$11.50
12WR Mk.1V	16 " "	$12.50

Pack & Post 65c. Send S.A.E. for Data Sheet.

AUTO-RHYTHM UNIT

Ideal for operation with stereo sound system – electronic organ – guitar amp – suit pop group band.
Specifications:– Size 12" x 5" x 11", Weight 9lbs, 240v AC, 50Hz.
20 RHYTHMS – Rumba, Samba, Cha Cha, Mambo, Bossa Nova, Waltz, Winnesse Jazz, Standard Tango, Standard Argentina, Continental, Rock, Standard Syncopated, Twist, Cool Slow Rock, Medium Slow Rock, Medium Slow Rock, Hot Slow Rock, March, Ballroom, Foxtrot, Swing.
INSTRUMENT SOUNDS – Cymbal, Brush, Snare, Limshot, Clave, Bongo, Hi-Conga, Low Conga, Bass.
Complete with four-pedal switch, cable and instruction book. **$145.00**. Pack & Post $2.00.

NEW MAGNAVOX 8-30 SPEAKER SYSTEM

1.6 c. ft. 8 ohms and 15 ohms. Oiled Teak Formica Veneer.

Complete, ready for use	$65.00
8-30 speaker only	$18.50
3TC Tweeter Only	$3.65.
Fully built Cabinet only	$35.00

THE NEW BSR RECORD PLAYER

Automatic or manual operation. Latest modern style square section brushed aluminium tone arm – fully counter-balanced with calibrated stylus pressure control – anti-skate bias compensator – silicone damped cueing device – lightweight head shell takes any type magnetic cartridge. 11" diecast turntable – dynamically balanced 4 pole motor fitted with click & noise suppressor. Finish – Satin black with brushed aluminium trim. Available with ceramic cartridge and diamond stylus **$54.75**. Or Magnetic cartridge and diamond stylus $62.50.

Pack & Post $1.50.

ROTATING DISTRESS EMERGENCY BEAM

Fire Brigades and Rescue squads use them. So do Car, Truck and Boat owners who value their safety. At home on party nights, have a light show. Red, Blue, Amber – visability ½ mile. 12v D.C. 1 amp operation, waterproof. Complete with heavy duty suction cap. Size 3½" dia. x 5½". **$5.75**. Pack and post 35c.

SOLDERING IRON

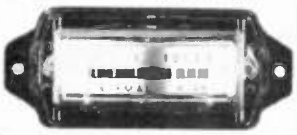
Lightweight – 2½ ozs. 240V A.C. Operation. No transformer required. Heating time 1.8 secs. 30 watts. $7.50 – pp 35c.

PANEL METERS

Clear Plastic, Flush Mounting. Full range available. From 50uA 10A – DC, 15 VDC, 500 VDC, 300 VAC, VU and 5.

ALSO EDGEMETERS

VU – Stereo Balance. Send for price list, S.A.E.



STEREO RECORD CHANGER

C141 – C142 – C142-A3

Current models, 4 speeds, automatic or manual operation.
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**

Model C142 and C142-A3 can be supplied with Magnetic Cartridge and Diamond Stylus at $10.00 extra.
Pre-cut Mounting Platforms are available to suit Changers ..... Price $9.00
Also Fully Moulded Smoke Tinted Perspec Covers ..... Price $9.00

STEREO RECORD PLAYER

240V AC operation. Chromed tubular metal 9" tone arm with adjustable counter balance and rest – ceramic cartridge, sapphire stylus.
4-speed motor and 6¾" metal turntable with mat. $7.90 – post 50c. Mounting platform 15" x 11" x 2¾" with cut-out to suit above record player. $5.50 – post 50c.

ROLA 12 U50

50 watts R.M.S. 12" Speaker. 8-15 ohms. Frequency response 25Hz – 11kHz. Fundamental resonance 40Hz ± 5Hz. Special purchase – **$35.00**. Pack & Post $1.50.

PIONEER MODEL PL-12

Belt-drive Stereo Record Play. 12" heavy-weight cast turntable. Fully adjustable tone arm. Magnetic cartridge. Beautiful base and perspex lid. **$116.00**.

all about colour TV

COLOUR COMMENT

The Marconi Mark VIII automatic colour television camera. A.W.A. Limited are Marconi's Associates in Australia.

AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED

OVER a number of years, AWA has invested substantial sums of money in the study and development of techniques for both receiving and transmitting equipment in readiness for the introduction of colour.

Four years ago, we designed, made and demonstrated the only Australian-made colour transmitter and we shall be in a position to supply this equipment.

Our consumer products division has carried out engineering development of colour receivers, the result of studies of overseas practice. Prototypes have been made and tested at our Ashfield works and receivers will be on the market some months in advance of March 1, 1975.

It has been estimated that colour sets will retail at between $700 and $800.

When black-and-white television began in Australia in 1956, sets were selling at £250 — and as a pound then was worth a lot more than two dollars now, the suggested price of colour sets would be comparable with what black-and-white sets cost 19 years earlier.

There is no likelihood of a drop in retail prices of colour receivers similar to what has happened with black-and-white sets.

Australia enjoys a high reputation throughout the world for the quality of its monochrome television and it is essential that we maintain this quality when colour comes. We have the technical skill to provide the equipment but it is vital that the electronics industry receives a reasonable measure of protection against products from low-cost overseas countries.

Mr. J.A.L. Hooke, Managing Director.

IRH INDUSTRIES

THE Australian TV industry is a large and important employer of highly skilled people. It provides work for many thousands including physicists, electronic, mechanical and industrial engineers, chemists, accountants, technicians, clerks, assemblers of miniature components, solderers and wirers, press and lathe operators, moulders, fitters and turners, storemen and packers . . . in fact, there are very few work classifications not found in the electronics and associated industries.

It is a large user of steel, copper, chemicals, plastics, timber, paper products, silver, and even rare earths from the northern Australian beaches.

Few would dispute that black and white TV sets manufactured in Australia are the equal of any produced throughout the world and there is no doubt in our minds that colour TV's made from Australian materials, using Australian skills, will also be the equal of any of overseas origin.

IRH Industries has had a close association with the Australian electronics industry since about 1935 when a wholly Australian owned Company was formed to manufacture resistors under licence to IRC (USA). The locally produced IRC resistors played a very important part in the 'War effort' and were actually the first components manufactured in Australia to receive the Armed Services Certificate of Approval.

Although the industrial section of the electronics industry has expanded rapidly over the past few years, TV and radio has remained a most important segment of the market and, because of this basic importance, IRH Components Pty. Limited, over the past five years, has been steadily preparing for the advent of colour TV.

Variable resistors comprise a very important section of the componentry required for a colour TV chassis, not only because of the total quantity required, but also the variety. Apart from the normal styles of potentiometers similar to those already used in black and white TV, numerous presets in single and multiple forms are used. Moreover, the gradual but inevitable introduction of integrated and hybrid circuits will increase the usage of presets still further. Fortunately, as a result of the licensing agreement with CTS (USA), we are already supplying a complete range of variable resistors for black and white TV, and radio and will have readily available the specialised styles required for colour TV.

For applications where low resistance is required and stability is critical, a small wire wound potentiometer has been developed. Known as the type AW, it is only 15/16 inch in diameter and yet is rated at 4W — more than sufficient for the power required in the convergence circuits.

For the EHT circuit, special high voltage type MVX resistors have been developed employing highly stable epoxy resistance materials. Depending on individual manufacturers' TV design, they are potted, or mounted in anticorona plastic mouldings.

To cope with the more critical demands of modern colour TV circuitry and the electronics industry generally, the metal glaze resistor, known as type RG, has been developed by IRH Components in conjunction with IRC/TRW (USA). It provides an economical, highly stable and reliable fully insulated resistor with low noise level and low temperature coefficient. Other extremely important developments in the metal glaze technology are now directed towards the need for thick film hybrid circuitry.

The carbon composition resistor, IRC type BT, is still the 'workhorse' of the TV and radio industry. Through continual improvements in chemicals, moulding powders, and in process controls, it is still the most economical, dependable, fully insulated resistor available for the mass production of TV and radio sets. A unique alloy plating process ensures the leads have

Portable microwave link from NET Pty Ltd capable of PAL colour transmissions in the 4.5 to 4.99 GHz range. This equipment was used by OTC to transmit Apollo 12 moon landing to colour receivers in Martin Place.

LIVING WITH COLOUR

Of course you can live without colour T.V. But will you? And for how long. We asked some English friends what it was like for them when colour T.V. started in England. Most important happening since the new baby, they said. Apparently they were quite a status symbol at first (probably still are) . . . The lucky ones who had a set found themselves suddenly popular. A mixed blessing when a few friends dropping round to watch television turned into a nightly party with a consequent increase in the drinks bill. When you first get a set, they say, you watch anything and everything. Football, horse racing all take on a different dimension. Not flat like black and white but really alive. Even the test patterns are fascinating. If you are in the same room as a colour TV you can't ignore it as you sometimes can a black and white receiver. Colours look false at first, but you soon get used to this, and there are a few surprises when you see TV people in colour for the first time. Sometimes their hair colour and eyes are different from your previous mental picture.

If you do decide to be the first person in your street to have colour TV, prepare yourself for instant popularity. All the people who said "No we aren't bothering with Colour" will be on your door step, ready for another of those strange evenings without conversation. Just like when black and white arrived . . . But are the programmes any better — or just more colourful — now that's another question.

COLOUR COMMENT

excellent solderability, an attribute vitally necessary for the production of trouble free printed circuit boards. In spite of the gradual introduction of integrated circuits, the number of discrete components in a colour TV set will, of course, be many more than in black and white, and trouble free solder joints will be of paramount importance.

To meet the growing world wide trend to eliminate fire risk, especially in colour TV, considerable work has been done by IRH Components – in conjunction with IRC/TRW (USA) – to develop non-flammable resistors and protective devices. Designed for use in the power circuitry, the type PW wire wound resistors, are completely fireproof. The addition of a simple but ingenious part during production converts the PW resistor from one which will absorb considerable overloads to one which will fuse at a pre-determined minor overload. This means, of course, that very economical fuses may be built into circuits which would not normally require them, but which could be a fire hazard without fuse protection under abnormal conditions.

Another approach to the fire protection problem has been the development of special metal glaze resistors which, while extremely stable under normal full load conditions, change to very high resistance as a result of a high overload. The effect, of course, is to limit the current to a safe value and thus protect the other components in the circuit.

Because of the heavy input currents which could be experienced in a colour TV power supply, a volume control switch capable of switching 240 volt 3 amps at .7 power factor has been designed by our engineers.

In addition to resistive products, IRH Components has now a mass production facility for a wide range of ceramic capacitors suitable for colour TV. Depending on individual manufacturers' design approach, these capacitors will be available in either low or high voltage styles and can incorporate a spark gap if required.

Although the design and development of certain special components is important to the colour TV industry, equally important is the ability of manufacturers to supply the quantities which will be required.

To-day, our production plant is, in fact, capable of supplying the estimated entire requirements of the TV and radio industry for fixed and variable resistors for at least ten years. Planning for expansion past that point is even now well under way and a close watch is being kept on new colour TV developments which are, of course, occurring continually overseas.

L.H. McCulloch,
Sales Manager,
IRH Components P/L.

SONY ENVISIONS COLOUR TV GAIN

New York – Sony Corp. will produce 1.2 million color television sets this year, a 50 percent rise over last year, Akio Morita, Sony president, said here last week.

The Trinitron colour TV line, which provides 33 percent of Sony's business, also will introduce a 15-inch color TV in 1972.

Export sales rose 32 percent in 1971, accounting for 54 percent of Sony's sales. Exports to the U.S. rose 33 percent. Exports to Europe rose 51 percent.

Mr. Morita spoke at a meeting of the New York Security Analysts.

MUSIC BROADCASTING SOCIETY

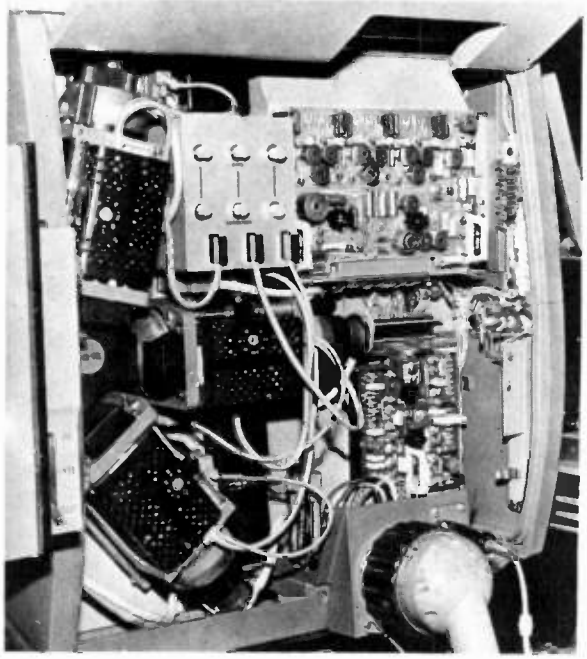
THE Committee of the Music Broadcasting Society of New South Wales, after a meeting to consider the effects of the recent decision to introduce colour television to Australia, wishes to make the following statement:

"This Society is concerned that, after all the time and effort put into its inquiries into Frequency Modulation (FM) broadcasting by the Australian Broadcasting Control Board, and before the Board has even been able to report to Cabinet its findings and recommendations, the Postmaster-General, Sir Alan Hulme, should see fit to state in public that the introduction of colour TV means that nothing can now be done to introduce FM radio to Australia.

"It seems clear that the Postmaster-General cannot have any foundation in fact for his apparent belief that colour TV and an FM broadcasting system are incompatible goals for Australia.

"Although Australians have waited long for colour TV, they have longer been denied what all other countries in the world – with New Zealand being virtually the sole exception – take for granted: an adequate radio broadcasting service.

"The seriously deficient state of radio in Australia, which is particularly apparent in rural areas, has been admitted by leaders in the broadcasting industry, the ABC, and



Interior of typical colour camera from Philips. The three plumbicon tubes can be seen on the left.

Studio colour camera system from Philips comprises plumbicon colour camera, camera electronics and monitor in rack second from right. First rack provides electronics for "Telecine" 16mm film to television system.

important users of radio. Furthermore, any expansion or development of existing services is now known to be virtually impossible. FM solves both of these problems.

"Considering its unique advantages, the cost of introducing FM services to Australia is vanishingly small: approximately 1/30 the cost of introducing colour TV. The Postmaster-General's inference that the effort of introducing FM would be too great may similarly be discounted: leaders of the electronics manufacturing industry have already denied this.

"If the country can afford colour TV (as the prime minister has said it can), then it cannot conceivably afford *not* to have FM radio.

"As Mr. C. Packer, Managing Director of Sydney's Channel Nine TV station has said (The Australian, 16/2/72), now that we have colour TV, all we need is FM radio for Australia to have entered the Twentieth Century."

Authorised by T.D. Jarvie (Secretary).

HITACHI TO UNVEIL 110° COLOR TUBE

Hitachi will introduce a 110-degree deflection tube for color TV at the IEEE Convention in New York in March.

According to a company spokesman, the facilities to mass produce the wide-angle picture tubes have already been completed, but prices and marketing plans are not firm.

A U.S. patent has already been established, and Hitachi plans to produce 19-inch tubes initially, and then go into 17 and 15-inch tubes.

Neck diameter of the new 19-inch tube is 29 millimeters, compared with 36.5 millimeters for comparable 90-degree deflection tubes, the spokesman said.

The spokesman added that the new tube corrects beam-landing errors, which had caused color distortion along the edge of the screen. A special computer-designed beam correcting lens is used.

AWA COLOUR TRANSMITTER

WITH a background of success in the manufacturing of black and white television transmitters – 90 of which are now in operation in Australia and overseas – A.W.A. was the first to produce a colour transmitter.

Designed and made in Australia, the transmitter, the result of three years' development work by a team of A.W.A. engineers, was demonstrated by the Company at its North Ryde works in 1969.

The TVH-5A transmitter made it possible to see PAL colour from picture source to off-air reception. No previous demonstrations had included a TV transmitter in the picture circuit.

In conjunction with its U.K. associate, the Marconi Co., A.W.A. demonstrated a comprehensive range of studio colour equipment, including the Marconi Mk VII studio camera and telecine channel.

The Company has spent considerable sums of money in the study and development of transmitting and receiving equipment in readiness for the introduction of colour.

Prototypes of colour receivers have been made and tested at A.W.A.'s Ashfield works. These will be on the market some months in advance of March 1, 1975.

STANDARD TELEPHONES & CABLES PTY. LTD.

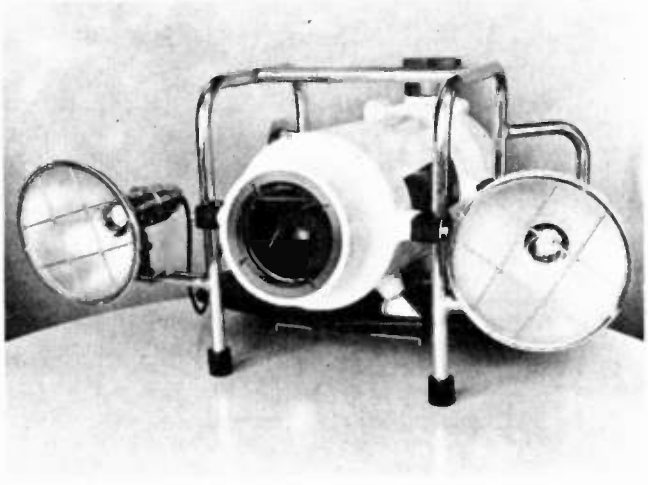
STANDARD Telephones and Cables Pty. Limited will enter the colour television market well equipped in all aspects of manufacture.

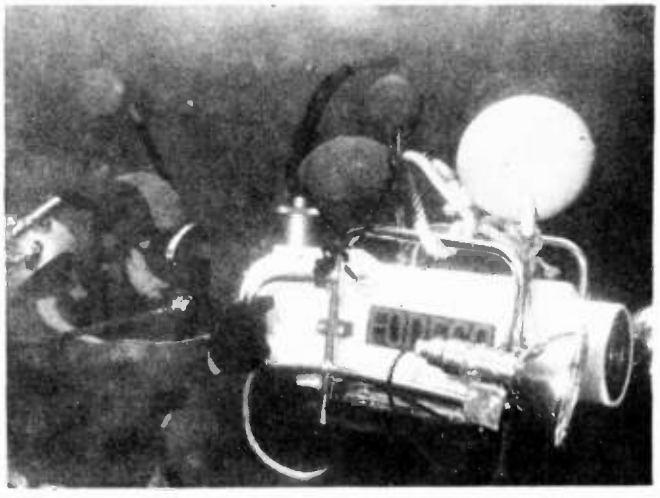
The greatest obstacle to the preplanning stages in the next three years will be obtaining firm Government policies on their attitude on protective tariffs in this industry. Set designers and component manufacturers will be loathe to embark upon heavy development and capital costs without being assured that local industry will receive the needed protection.

Modern electronic industry owes a great deal of its development to the expertise generated by research and application in the consumer electronics industry. In recent months the local component industry has been forced to meet intense competition from Japan and other overseas manufacturers. These overseas manufacturers are now most active because of the present oversupply situation in their own markets. As their situation is resolved by rationalization of their manufacture and the expected upturn in their local markets, there is a danger that this country could be left without protection for certain items.

Standard Telephones and Cables has been firmly established in Australia for 75 years, and for a considerable period of this time has been a leading supplier of locally manufactured components to the electronics industry. We firmly believe that this policy of local manufacture must be continued, and join other Australian manufacturers in maintaining that the local electronics industry must not be dependent on overseas suppliers.

JOHN S. SLACK
Manager
Components Division





NEW UNDERWATER COLOUR TV CAMERA

A new compact colour television camera for use underwater has been developed and successfully tested by Fuyo Ocean Development & Engineering Co., Ltd., of Tokyo in cooperation with Hitachi, Ltd., Nippon Columbia Co., Ltd., and Hitachi Cable, Ltd.

In the test, conducted about 25 meters undersea off the Pacific coast of Izu, west of Tokyo, the camera was operated by a diver with remarkable results. It marked the first time in Japan that a TV camera was successfully operated by a diver to take colour shots at a depth of over 20 meters.

Weighing about 1.5 kilograms in water (26 kilograms in air), the camera consists of the main body in a water-tight case and two floodlight projectors fitted to it. The view-finder is mounted on the rear end of the body.

Unlike previous models using three camera tubes to pick up the three primary colours, the new underwater camera uses a special vidicon which produces colour images by means of a dual stripe interference filter. It can be connected with a video tape recorder for speedy recording and replaying.

Up till now undersea TV photography has been done with black and white cameras. Monochrome images, however, lack perspective and depth, and there has been a growing demand for a good, underwater colour camera. ●

Electronics Today wishes to extend its thanks to the many companies, organizations, and individuals who provided background material for these articles.

SPACE SPECTACULAR

The US National Aeronautics and Space Administration are seriously investigating the possibility of landing men on Mars – in 1985.

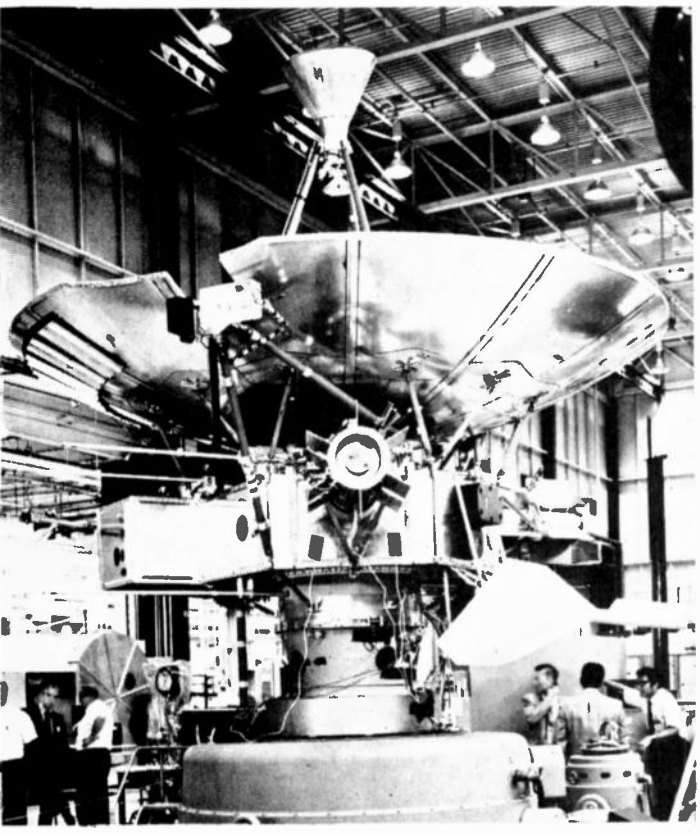
This report – based on a NASA Technical Paper – outlines the proposed mission.

In all likelihood the next body in our solar system to be visited by man will be the planet Mars, for possibly the most intriguing question faced by man today is the prospect of life on other planets, and although recent data from Mariners VI and VII discourage such prospects on Mars, they do not rule them out. Therefore, the search for life has been given the highest priority, followed by the desire to learn more about the origin and evolution of the solar system.

PROPOSED MISSION

Two planetary space vehicles, of essentially the same design, will depart Earth in the Spring of 1985 on a heliocentric transfer to Mars. Each space vehicle will have two principal components: a planetary mission module (PMM) and a Mars excursion module (MEM). After a Venus swingby the space vehicles will arrive at Mars where, after a brief orbital period, one MEM from each space vehicle will descend to the surface. The planetary mission module will remain in orbit. After a 40 to 60-day surface stay-time, the ascent stage of the MEM will rendezvous with the planetary mission module for a direct heliocentric transfer to earth. The approximate dates for the proposed 1986 mission are as follows:

Launch from Earth . . March 26, 1985
Arrive Venus . . . . . .Sept. 12, 1985; 170 days
Arrive Mars . . . . . .March 11, 1986; 350 days
(About 60 days at Mars, 40 days on surface)
Leave Mars . . . . . May 10, 1986; 410 days



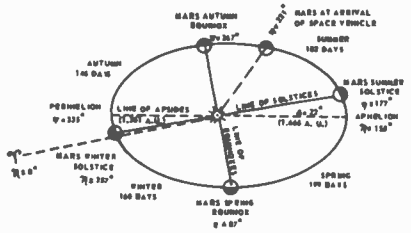


Figure 1. Position of Mars in orbit on arrival.

Preceding the proposed manned Mars space flight are a number of unmanned journeys to the outer solar system.

Here a test model of a Pioneer spacecraft is seen mounted on a shaker table to check its ability to withstand in-flight vibration.

Pioneer F is the first spacecraft designed to travel into the outer solar system and operate effectively there, possibly for as long as seven years. It will travel a distance of one and a half thousand million miles from the Sun, and explore a curving strip of space 620 million miles long extending from the Earth's orbit to Jupiter.

The spacecraft's primary objective will be to take the first close-up look at Jupiter. It will return data on about 20 aspects of the planet, its moons and environment.

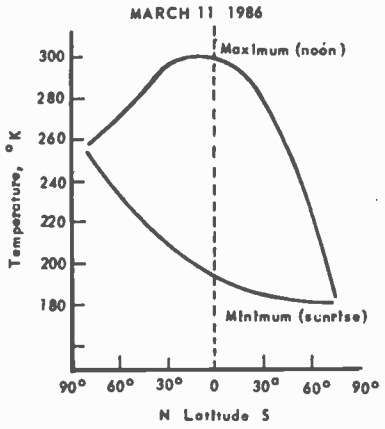


Figure 2. Martian temperature variations with latitude at time of landing.

Arrive Earth ..... Oct. 7, 1986; 560 days.

Some of the important physical features existing at Mars on arrival are illustrated in Figures 1, 2, and 3. Figure 1 presents the locations of Mars in its orbit, Figure 2, the temperature as a function of latitude, and Figure 3, the extent of the polar caps and wave of darkening.

In accomplishing the experimental objectives, the inherent and unique abilities of man will bring a dimension to scientific investigations heretofore absent in the study of any planet other than Earth. Man is the only reliable instrument available that can rapidly adjust observations over the many orders of magnitude resolution needed for some scientific investigations. His judgment is unsurpassed in selecting locations for instruments and for gathering samples and examining complex situations. His ability to interpret experimental results and, if necessary, redirect the investigations will be very valuable. He can manipulate and repair the instruments. His faculty for appraising and correlating interdependent measurements (some occurring simultaneously) of many physical properties and for improvising when unexpected situations occur cannot be overemphasized.

Estimates of the instrumentation state-of-the-art in the early 1980's can be made by extrapolating the advances that have occurred during the last 10 to 15 years. Using these estimates as a guide it is envisioned that most of the measurement results will be transmitted in near real-time to earth.

Earlier space missions will test for the presence of life, and if these tests are positive, scientists will attempt to measure and characterize this life. If any indications of life are found, the question of compatibility or possible pathogenesis and back contamination must be resolved.

Therefore, an additional precursory experiment that may be beneficial, and even necessary, to the manned mission is a lander system which contains numerous earth-type life samples, even possibly including human tissue cultures, that could be exposed to the Martian bio-environment and the results monitored. Because of the highly specific nature of pathogens, a positive result may be a necessary but not sufficient guarantee that man (or any earth organisms) will be safe, but at least such an experiment would be a partial answer.

Some biologists believe that it is necessary to firmly establish before a manned mission whether life exists on Mars and if so, whether it is pathogenic to Earth life. If this is to be done, the number and type of unmanned probes needed, e.g., Viking, and Soft Landers with remote-controlled roving vehicles and with soil samples return capability, may be greater than is currently planned.

THE ORBITAL MISSION

Soon after arrival at Mars a landing module (MEM) will separate from the space vehicle and descend to the surface, leaving in orbit the part designated as the planetary mission module.

The orbital part of the mission will consist of experiments done on the planetary mission module and experiments done on an unmanned spacecraft. The unmanned spacecraft mode is needed because of the orbital characteristics required for in-situ atmospheric measurements in the transition zone. This zone, located at about 80 to 120 km in the Earth's atmosphere and probably below 100 km in the Martian atmosphere, divides the uniformly chemically mixed region and the diffusely separated region. A 100-km altitude would be unacceptable for periapsis of the planetary mission module because of orbital lifetime, aerodynamic heating, and other engineering considerations.

One unmanned spacecraft will be launched from each space vehicle (before MEM descent) and placed into

SPACE SPECTACULAR

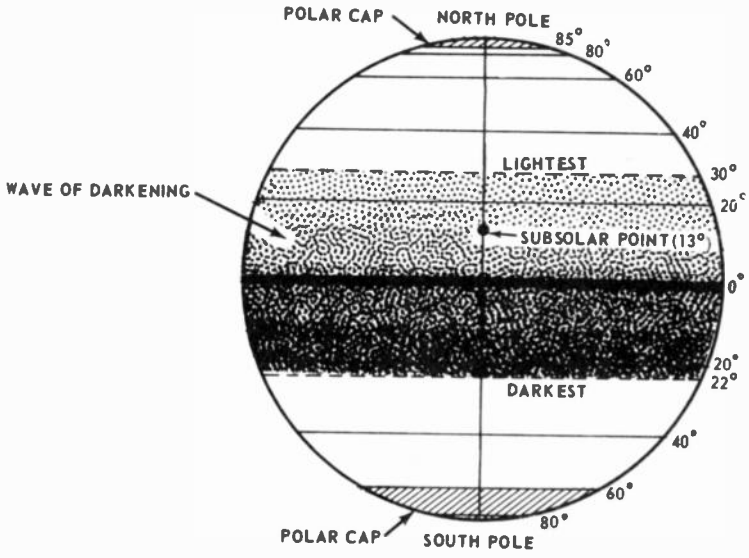


Figure 3. Physical conditions on Mars at time of landing.

an elliptical orbit around Mars with a periapsis and apoapsis of approximately 100 km and 1000 km, respectively. The first orbiter will be deployed soon after the space vehicle orbit is determined. After observation of orbital parameters, the scientist will select and optimize the orbital parameters for the second orbiter.

Although the principal activities on the planetary mission module during the initial orbital phase will be related to preparations for the manned descent, several experiments, in addition to those on the unmanned orbiter, will be accomplished to support the final site selection. Among these will be the topographic and thermal mapping experiments. The scientists will study the most interesting areas determined from precursor data, compare and evaluate the most recent information (in particular noting significant changes from the precursor data), and choose the site with the greatest potential for manned exploration and scientific return.

A very significant experiment to be done from Mars orbit will be the observation of the two Martian moons (Phobos and Deimos). These moons will appear to observers on Mars as smaller objects in the sky than the Earth's moon appears to observers on Earth. Only if the spacecraft approaches within about 1800 km of Phobos (or about 900 km of Deimos) will they appear as large as the earth's moon. However, high-resolution observations can be made with the reflecting telescope if the proper orbit can be achieved. In any case, the observation of the Martian moons by scientists in the planetary mission module will be a major activity.

THE SPACE VEHICLES

The convoy mode (spaceships separated) is recommended over the single mode (spaceships coupled) during the voyage to and from Mars. The convoy mode will enable cooperative experiments between the two spaceships, such as investigation of low-frequency RF transmission through the solar plasma. Also, it may be possible to compute the solar wind velocity by recording the time needed for particles to travel the distance separating the spaceships. Tracking of orbiters about Venus can be done from two points rather than one if the two spaceships are separated. In Martian orbit the separated spaceships can reduce the problem of continuous communication by serving as relay links.

At the Venusian encounter each spaceship will launch an orbiter which will provide information about density, temperature, composition, magnetic fields, charged particles, and electron density. The orbiters will be placed into elliptical orbits with a periapsis of approximately 150 km and an apoapsis of approximately 5000 km. The orbiters will have inclinations differing by about 90 deg. From each orbiter an entry-probe will be launched. Each entry-probe will divide into two probes — an atmospheric drifter and a soft-lander. These will make vertical soundings to measure the atmospheric temperature, pressure, and composition; additionally, the soft-lander will carry a TV camera. The drifter may search for biological activity at an altitude of approximately 25 km.

Each space vehicle will have accommodations for an astronomical observatory, which will house a 25 to 40-cm-size telescope. During the transit part of the mission, opportunities for viewing celestial bodies, including the earth, will exist. In transit and while at Mars opportunities, unavailable from Earth, may occur for the observation of stellar occultations by the outer planets.

On arrival at Mars each space vehicle will launch one unmanned orbiter and several relay satellites. The orbiters will pass through the upper Martian atmosphere and make measurements of the physical properties. This is not possible from the planetary mission module because of its orbit. The orbiters will be placed in equatorial and polar orbits and will have a periapsis and apoapsis of about 100 km and 1000 km respectively.

The relay satellites will provide real-time communication links between the MEM, mission module, remote stations, and other components. A module using a laser system to obtain high data-rate transmission will be separated from each mission module (just before return to Earth) and will serve as a continuous communication link between Mars and Earth. This orbiter will continue to relay data from automated surface measurements to earth after completion of the mission.

The landings should be made at different sites, permitting the investigation of different locations. For this mission two sites have been selected. One is located at about 50 deg. south latitude so as to be on the edge of the polar cap, permitting investigations of this interesting feature. The other site should be at or near the equator, perhaps in the Tithonius Lasus area which is located at 5 deg. south latitude. This area becomes darker earlier than other areas in the region. The equatorial region probably has a greater chance of harboring life because of the higher temperatures, 298°K maximum at the equator).

A manned Martian rover similar in design to the lunar rover will be necessary to fully explore the immediate surface area. It should be able to carry two scientists over a traverse distance of approximately 30 km. The vehicle should also be designed to carry heavy equipment to the remote stations and possibly to pull an automated drill to the drilling sites.

The MEM should be designed to provide adequate transportation to the Martian surface for the scientific instruments and associated laboratory equipment, the drill, and the rover. The five scientists will use the MEM for transportation to the surface, as crew quarters, and as a base of operation. ●

RADIO ASTRONOMY FOR AMATEURS

a series - by Roger Harrison VK3ZRY

In this – the fifth article in this continuing series – Roger Harrison provides further constructional details of receiving equipment.

The converter shown in Fig.6 has been designed to use valves that are readily available from surplus stores (valve types 6AQ4, 6AJ4, 6AM4 etc.). These valves are available at low prices and have excellent characteristics for this type of operation.

A number of 'disc-seal' valves are also available at economic prices. This type of valve may be used in the vhf converter circuit providing care is paid to their operating conditions and inter-electrode capacitances.

Construction of the valve vhf converter follows normal vhf practice using short leads and 'straight' layout. High tension and filament leads must be decoupled, using ceramic feedthrough capacitors and rf chokes.

The coils should be wound on Neosid formers with bases (type 722/1). Neosid type 7100 shielding cans should also be used. Winding data for 140 MHz operation is given in Table 2.

As with the FET converter described last month, the crystal should oscillate at one quarter the local oscillator frequency of the IF range in use. The crystal frequency can be calculated from the following –

$$\text{crystal frequency} = \frac{\text{signal frequency} - \text{IF}}{4}$$

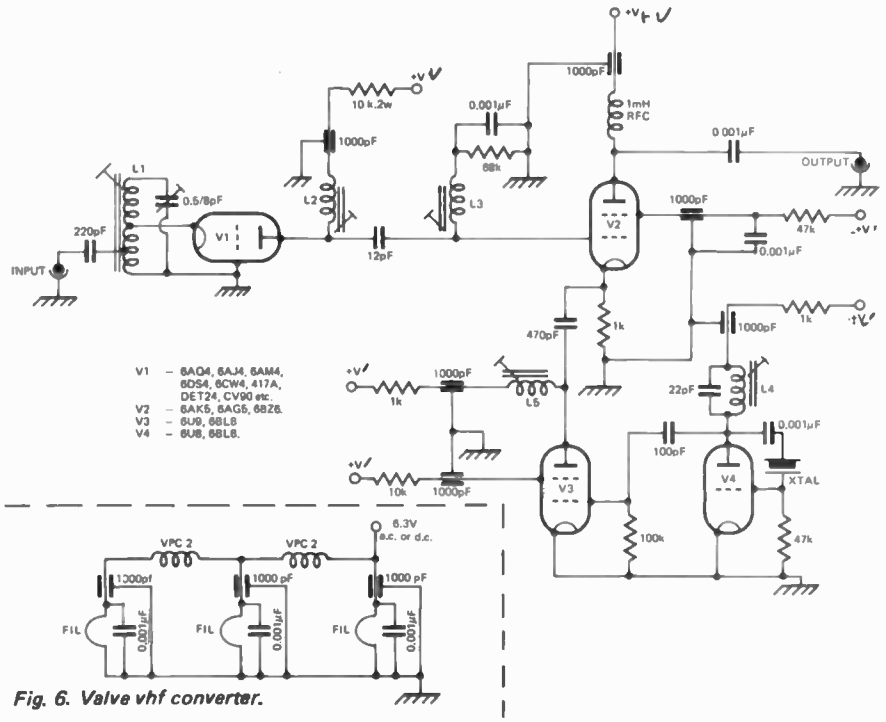


Fig. 6. Valve vhf converter.

POWER SUPPLIES

In order to ensure that the receiver gain remains constant, all power supplies to the receiver circuits should be electronically regulated.

For transistorized equipment, the 'Logic IC Power Supply' (described in Electronics Today, June 1971) is ideal. However, the optional 'external' voltage control potentiometer should not be used. This should be replaced by the preset potentiometer described in the text. This will prevent accidental variation of the supply voltage.

The same power supply may be used to energize the filaments of the valve converters.

High-tension supplies for the valve converters should also be electronically regulated. A suitable circuit is shown in Fig. 7. This circuit will supply between 200mA and 300mA (depending on the specifications of the mains transformer), and may therefore be used to energize several items of equipment. Beyond ensuring that there is adequate space between the heat producing components, (a lot of heat is dissipated at full load), layout of this unit is not at all critical.

Another, simpler, circuit – capable of supplying about 100mA – is shown in Fig. 8.

Whilst for rudimentary radio astronomy it is possible to make do without stabilized power supplies, if any serious experiments are to be performed, even professional communications receivers may require modification, either by modifying the

RADIO ASTRONOMY FOR AMATEURS

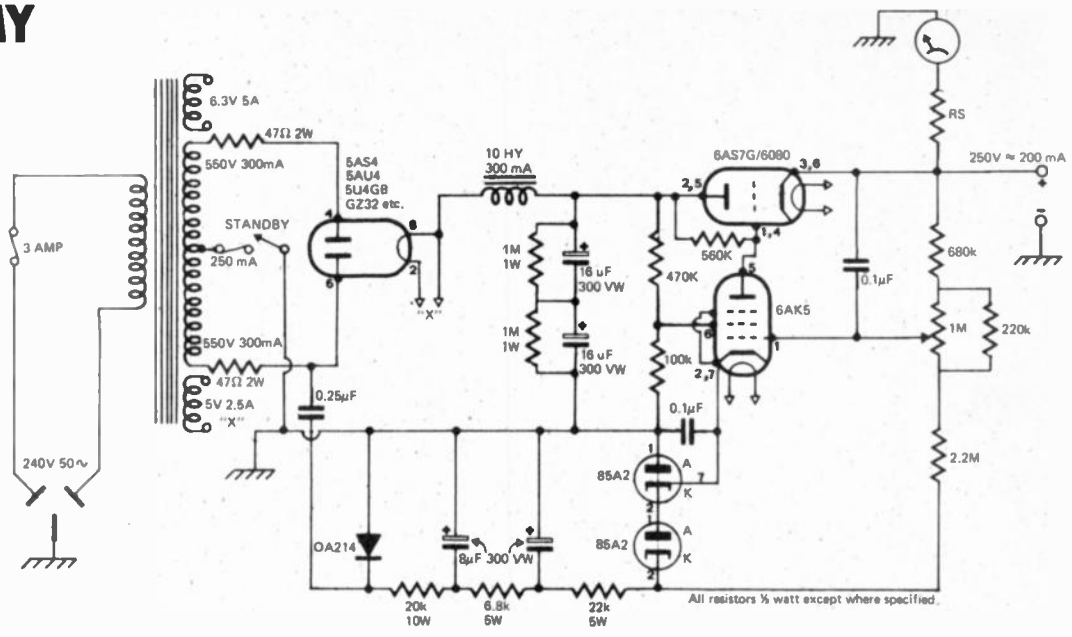


Fig. 7. Regulated power supply — output 250 volts, 200 to 300mA.

TABLE 2

L1	10 turns (antenna tap at 3 turns, cathode at 5 turns)	20 swg spaced over ½"
L2	10 turns	20 swg spaced over ½"
L3	8 turns	20 swg spaced over ½"
L4	10 turns	Aegis RFT-10
L5	11 turns	20 swg spaced over ½"

original system or by operation from the type of supply described here.

PREAMPLIFIERS

It is general practice in radio astronomy to locate the receiving and recording equipment at some convenient distance from the antenna. This involves running coaxial cable from the antenna to the receiver. But long runs of cable attenuate the received signals, thus degrading the signal/noise ratio. To overcome this problem, a preamplifier, mounted as close to the antenna as possible, is used.

TRANSISTOR PREAMPLIFIER

The .npn bipolar transistor, type BFY90 may be used as the basis of a very good preamplifier. A suitable circuit is shown in Fig. 9. and a suggested layout is illustrated in Fig.10.

This preamplifier has a gain of approximately 18 dB and a noise figure of less than 3dB. The coils 'T1' and 'T2' may be peak tuned or broadbanded. The two links should be optimized for gain and noise. No instability should be experienced.

A six volt supply is needed to power this preamplifier. This may be supplied to the antenna mounted preamplifier — simply, and elegantly — via the antenna's coaxial cable centre conductor. It will be necessary to decouple the supply by a small rf choke at each end of the line.

The circuit is usable from hf to vhf — coil winding details will be determined by the operating frequency. If there is insufficient coupling at hf, this may be increased by reducing the screening between coils 'T1' and 'T2'. This will increase their mutual inductance. The coils should be air-wound using heavy gauge (20 B&S) enamelled wire.

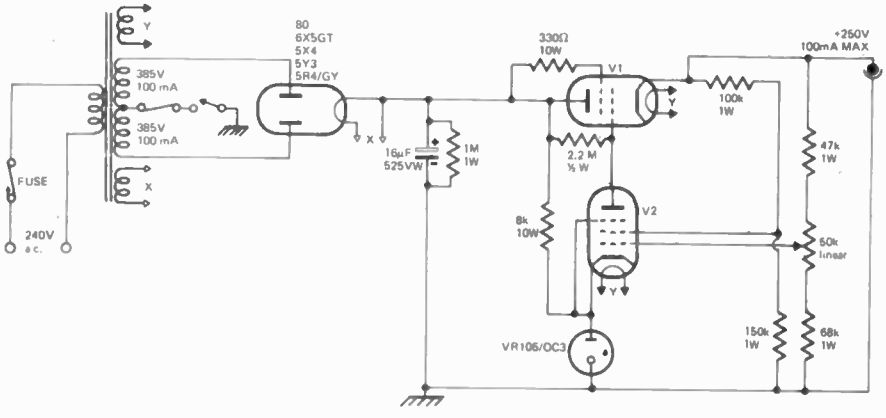


Fig. 8. This regulated power supply has an output of 100mA at 250 volts.

MOSFET PREAMPLIFIER

Compared to a bipolar transistor in a grounded emitter configuration, a grounded source dual-gate MOSFET provides improved cross-modulation (adjacent channel interference) characteristics and freedom from instability.

A circuit incorporating MOSFETS is shown in Fig. 11. This circuit has excellent gain, low noise, and freedom from cross-modulation.

The type 40673 or MPF 121 FET's specified for this circuit have internally diode-protected gates. Because of this they are less easily damaged than the 3N140 used in the FET VHF converter described last month, and may therefore be handled and treated like JFET's or bipolar transistors.

Whilst this preamplifier was originally designed to operate from a 12 volt supply, voltages from 9V to 15V will prove satisfactory. This voltage may be supplied to the preamplifier, via the coaxial line, in the same manner as for the transistor preamplifier previously described.

The MOSFET preamplifier is usable from hf to vhf (hence coil data has not been given). The gate input capacitance and drain-source capacitance are used as part of the tuned circuits at vhf. Parallel capacitors must be added across L1 and L2 if the circuit is to be used at hf.

Layout should follow normal hf practice. The coils 'L1' and 'L2', should be shielded, one from the other, to prevent instability. If the unit is to be used at vhf, all leads should be kept as short as possible.

This article concludes practical details of receivers and receiver systems. Enough information has been given to enable most amateur radio enthusiasts to complete a basic radio astronomy receiving system.

The next articles in this series will describe suitable detectors and recording techniques, calibration techniques and equipment, and details of accurate time interval measurement.

These will be followed by practical articles describing the construction of several different types of antennae. Also to be included – primarily for the more advanced (amateur) students of radio astronomy – will be details of sophisticated receiving and recording systems.

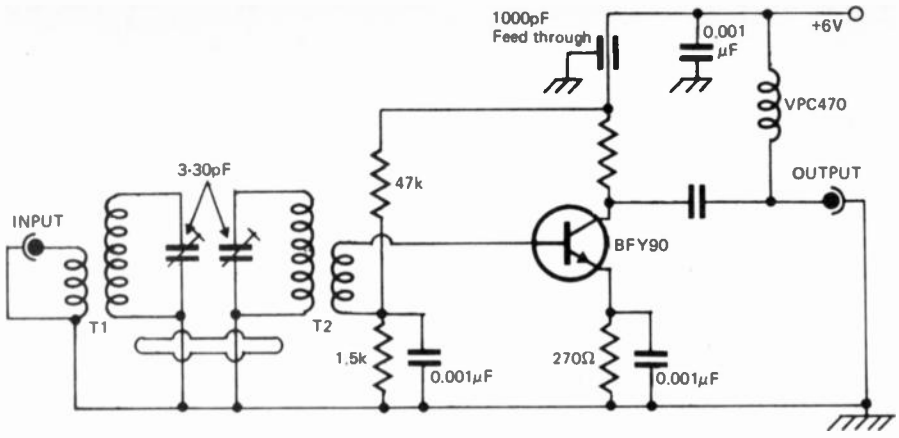


Fig. 9. This solid-state preamplifier has a gain of approximately 28dB and a noise figure of less than 3dB.

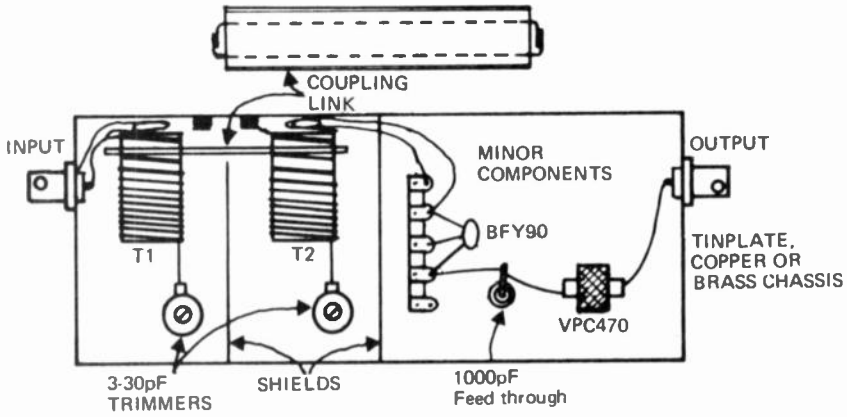


Fig. 10. Suggested layout for circuit shown in Fig. 9.

RADIO ASTRONOMY *(a short bibliography)*

RADIO ASTRONOMY FOR AMATEURS – Frank Hyde, (Butterworth Press). An excellent introductory book with elementary theory and practical constructional details. Techniques described are a little out of date – no usable transistor circuits are included.

RADIO ASTRONOMY SIMPLIFIED – John Heywood, (ARCO Publications). Comments as above.

INTRODUCTION TO RADIO ASTRONOMY – R.C. Jennison, (Newnes). Excellent for beginners and advanced alike. Good reference work with some mathematics. Many techniques, well illustrated.

SPACE PHYSICS AND RADIO ASTRONOMY – Messel & Butler (Macmillan). Good general reference work for high school students and beginners.

RADIO ASTRONOMY – J.H. Piddington, (Hutchinson). Excellent general reference book, suitable for beginners and advanced.

THE SUN – Karl Kiepenheur, (University of Michigan Press). Excellent theory, fully explained and illustrated. Very useful reference and experimental guide.

THE SUN – Patrick Moore, (Frederick Muller). Excellent general reference work. Some useful practical information.

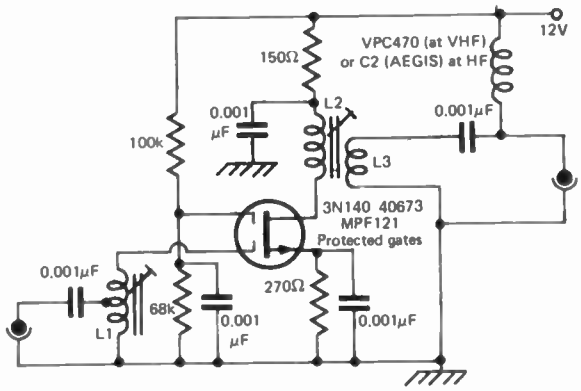


Fig. 11. Dual-gate MOSFET preamplifier

TAPE/SLIDE SYNCHRONIZER

This unit automatically changes slides on an automatic projector. It does this at predetermined times, synchronizing with the commentary prerecorded on a two-channel, cassette or reel-to-reel tape recorder.

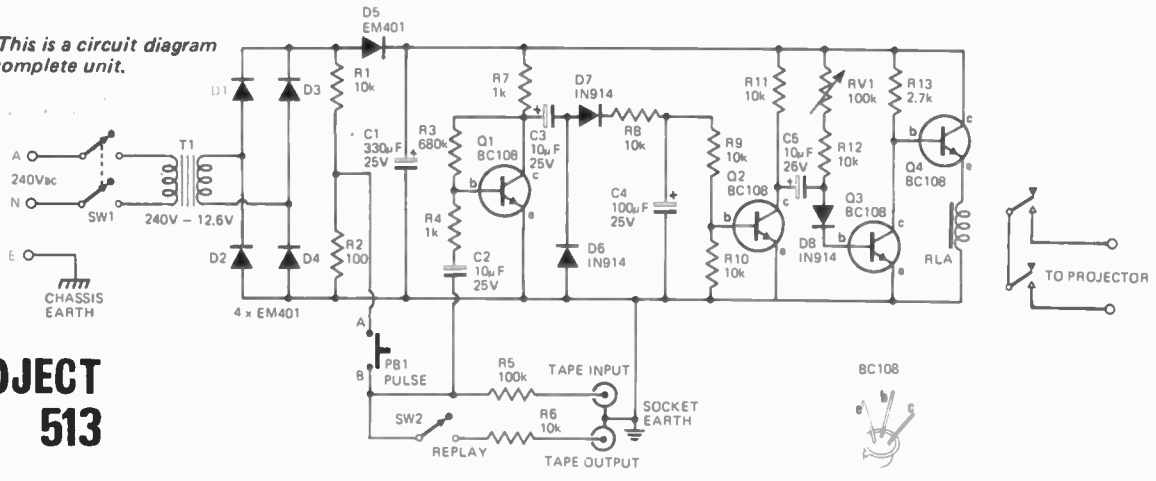
Practically all tape recorders sold today have two-channels, and when used to record commentaries for slide shows, only one of the two available channels is normally used. The automatic slide changer described in this article utilises the second, normally unused channel.

The projector's slide mechanism is actuated by short tone bursts recorded onto this second channel at the points where slide changes are required. The tone that is used for this purpose is derived from the full-wave rectified (but unsmoothed) mains frequency.

To record the tape initially, the slides are loaded into the magazine of the projector in the order in which they will be shown. The commentary is then recorded onto Channel 1 in the normal way, and the pulse button on the front of the control unit depressed whenever a slide change is required. This changes the slide and simultaneously records a control tone onto Channel 2.

Once the tape has been prepared, the control unit can be used automatically to switch the slide projector at the

Fig. 1. This is a circuit diagram of the complete unit.



ETI PROJECT 513

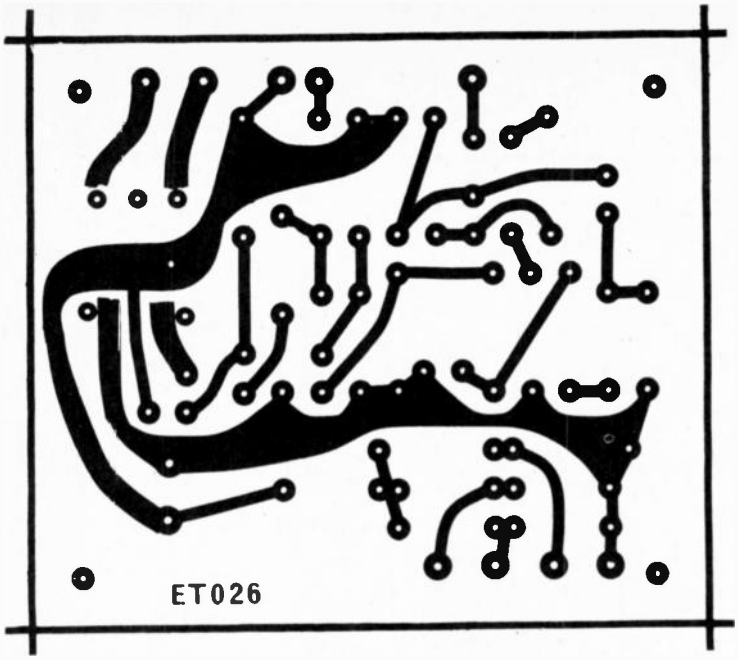


Fig. 2. Foil pattern of printed circuit board — full size.

predetermined times in synchronization with the tape recording.

CONSTRUCTION

The circuit diagram of the complete unit is shown in Fig. 1.

The unit may be assembled on matrix board, tag strips, or, preferably, on the printed circuit board, the foil pattern of which is shown in Fig. 2.

Figure 3 shows how the components are assembled on the printed circuit board. Note that resistors R5 and R6 are mounted on the front panel of the unit — as shown in Fig. 4.

Having completed assembly, check the orientation of diodes, transistors and electrolytic capacitors.

Figure 5 shows how the completed printed circuit board and remaining components are located within the case. Ensure that all wiring carrying 240 Volts is adequately insulated, and that the metal case is well earthed.

CHECKING THE UNIT

Figure 6 shows how the various units should be interconnected — both for checking and for subsequent recording of the tape. The relay output lead of the control unit is connected to the slide projector's external control socket; the second (normally unused) input socket of the tape recorder is connected to the input socket of the control unit, and a microphone is then

HOW IT WORKS

The sync. pulse is derived from the mains. It is simply the 100 Hz rectified but unsmoothed output from the secondary of tranformer T1.

This 100 Hz signal is suitably attenuated by R1 and R2 to achieve a level suitable for recording onto the tape.

Diode D5 isolates the filter capacitor from the pulse generating network.

When push button switch PB1 is pressed, the signal from R1, R2 is fed to the tape recorder and also, via C2 and R4, to the remainder of the control unit.

The 100Hz signal is amplified by Q1 and then rectified and smoothed by D6, D7, C3 and C4. Capacitor C4 takes a few cycles to charge, and when it does Q2 turns on.

The action of Q2 turning on, causes C5 momentarily to remove the bias from Q3. The length of time for which the bias is removed is determined by the setting of RV1.

Transistor Q4 is an emitter follower and applies power to the output relay during the time that Q3 is turned off, and so RV1 in effect controls the length of time that the relay contacts remain closed. The contacts of this relay then actuate the slide change mechanism of the projector.

During the replay period, the control pulses from the tape recorder are fed into the control unit via R5, C2 and R4 and then actuate the unit in the same manner as described above.

TAPE/SLIDE SYNCHRONIZER

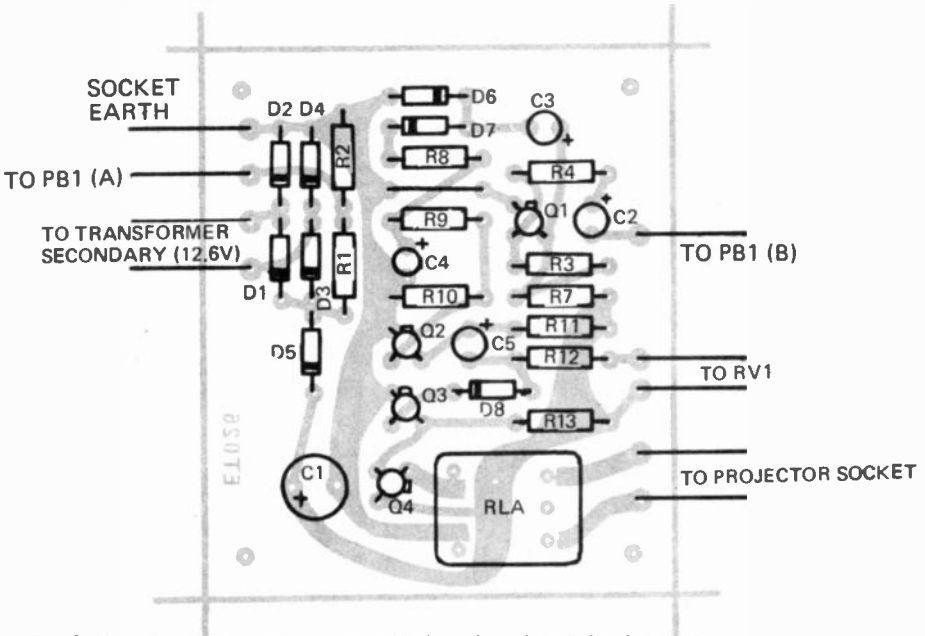


Fig. 3. How the components are assembled on the printed circuit board.

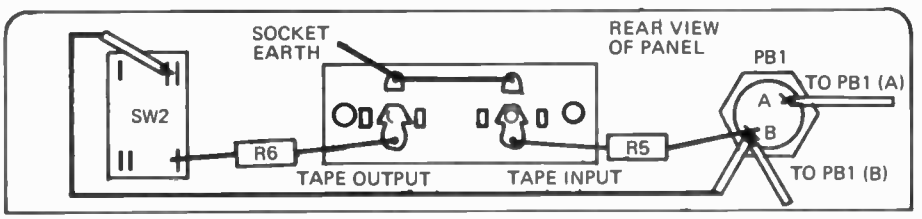


Fig. 4. This drawing shows components and wiring on the front panel of the unit.

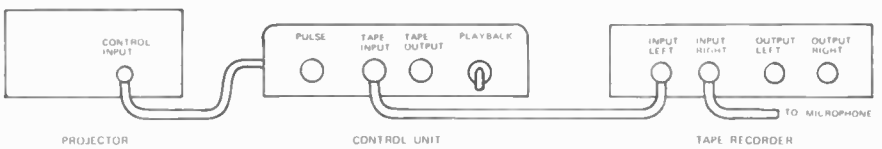


Fig. 6. Interconnections — checking and recording.

connected to the tape recorder (Input Channel 1) in the normal way. The output of the tape recorder is left disconnected at this stage.

Load the slides into the magazine of the projector in the order in which they will be shown.

Switch on all three units. Slides can now be changed by pressing the 'pulse' button on the front of the control unit. It will be necessary to press this button for about one second. The time period is not critical providing it is long enough for the slide to change.

Internal circuitry — controlled by RV1 — ensures that only one slide is changed at a time, this feature is lacking on many proprietary units. If more than one slide is changed — or a slide does not change at all — adjust potentiometer RV1 until satisfactory operation is obtained.

OPERATION

Once the unit has been checked out for satisfactory operation it is ready to use.

A minimum period of about five seconds must be allowed between slide changes to enable the control unit to reset.

Move the first slide in the required sequence into position, start the tape recorder, and record the required commentary, changing the slide whenever required by actuating the button on the control unit. Stop the tape recorder when the last slide has been shown.

Figure 7 shows how the units are interconnected for replay. As can be seen the relay output lead of the control unit is still connected to the external control socket of the slide projector, but the output from Channel 2 of the tape recorder (from preamplifier or speaker output sockets) is now connected to the tape output socket of the control unit. The input to the tape recorder Channel 2 is left disconnected.

(Continued on page 97)

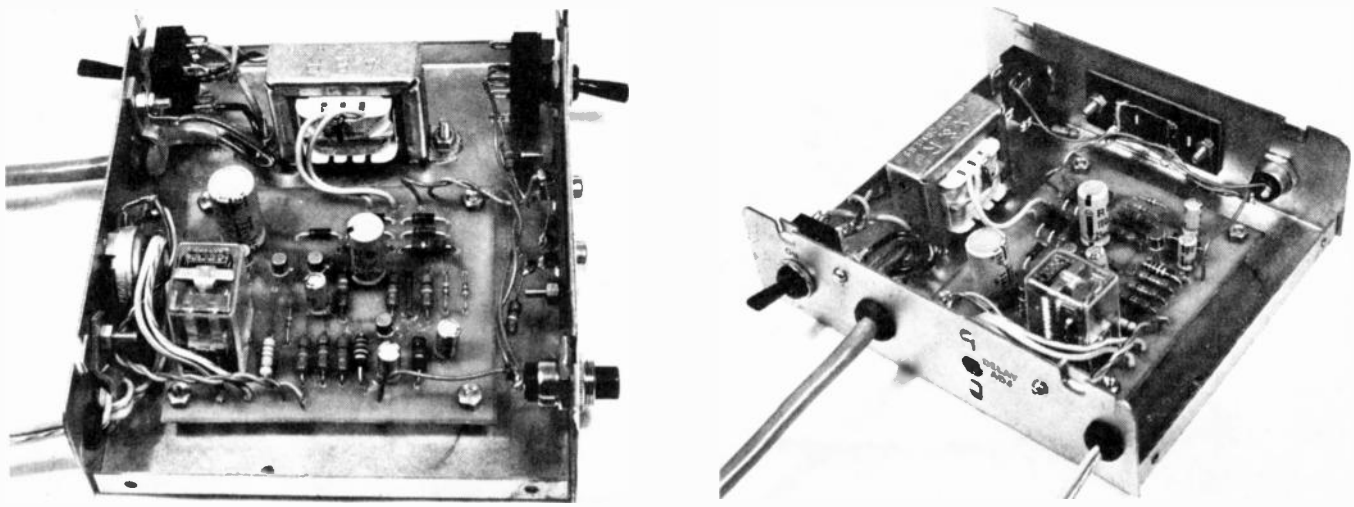


Fig. 5. The printed circuit board and remaining components assembled within the case.

TANDBERG

simply offers you sound reproduction indistinguishable from the original

No *more* and no *less*. Just an accurate encore performance.
Of course TANDBERG quality means greater long term reliability, more long term performance and greater long term satisfaction; these attributes go hand in hand with the TANDBERG name.

You may choose a TANDBERG stereo deck or a TANDBERG self contained stereo system. The Model 3000X stereo tape deck is worthy of the finest stereo amplifiers and the most sophisticated speaker systems; the all new Model 4000X stereo sound centre incorporates twin 10 watts R.M.S. stereo amplifiers, built-in wide range speakers and an input sensitivity of 1.5 mV. for magnetic cartridges as well as a host of other highly desirable and effective features. This versatile recorder can be the "heart" of your new stereo system!

Both TANDBERG models employ the proven TANDBERG Crossfield Head which, in lay terms, provides *wider frequency response*, a far *better signal-to-noise specification* and *more natural sound reproduction*.

See and hear both TANDBERG models at all franchised Simon Gray dealers. ***Listen and compare.*** TANDBERG superiority is clearly evident when you hear a demonstration, when you install your own TANDBERG . . . and years later, after hundreds of hours of musical pleasure.

Move up to TANDBERG!

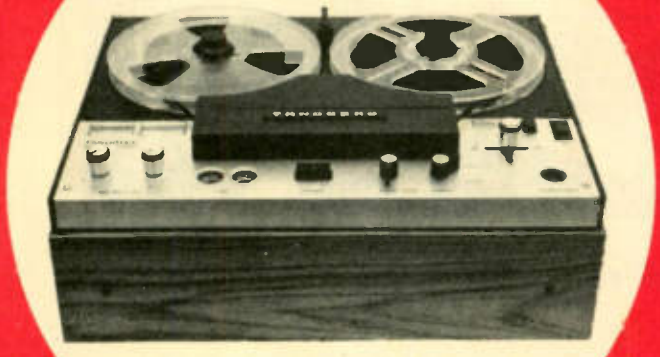
Telex — 31904.
Simon Gray Pty. Ltd.,
28 Elizabeth Street,
Melbourne 3000.
Please send me full technical information about the TANDBERG 3000X/4000X (strike out model not required) and the name of my nearest Simon Gray franchised dealer.

NAME.....

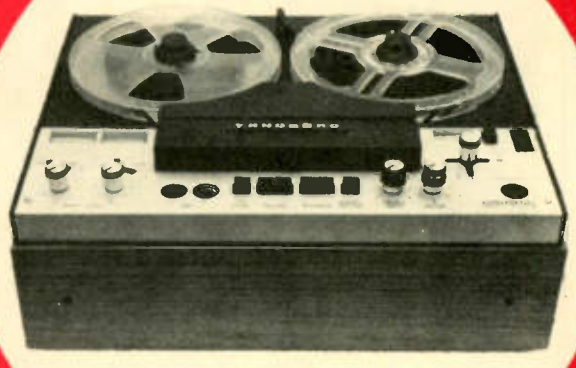
ADDRESS.....

.....POSTCODE.....

ET TB 571



TANDBERG MODEL 3000X.



TANDBERG MODEL 4000X.

ABRIDGED SPECIFICATIONS:

TANDBERG MODEL 3000X.
Stereo tape deck.
• Three speeds — 7½, 3¾ and 1⅞ i.p.s. • Frequency response at 7½ i.p.s. = 40-20,000 Hz. • Signal to noise —60 dB. • Twin VU meters • Inputs for tuners, pickups, microphones • Wow and flutter: 0.07% • 4 sound heads • Sound on Sound • All solid state • All desirable controls

TANDBERG MODEL 4000X.
Complete stereo system.
• Three speeds — 7½, 3¾ and 1⅞ i.p.s. • Frequency response at 7½ i.p.s. = 40-20,000 Hz. • Signal to noise —60 dB. • Twin VU meters • Inputs for tuners, pickups, microphones • Wow and flutter: 0.07% • 4 sound heads • Sound on Sound • All solid state • Twin 10 watts R.M.S. amplifiers

Australian National Distributors:

Simon Gray Pty. Ltd.

Head Office: 28 Elizabeth St., Melbourne, Vic. Tel. 63 8101 * Telex: 31904
Sydney Office: 53 Victoria Ave., Chatswood, N.S.W. Tel. 40 4522*
Canberra Office: 25 Molonglo Mall, Fyshwick, A.C.T. Tel. 95 6526
Adelaide Office: 301 South Terrace, Adelaide, S.A. Tel. 23 6219

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
Tas.: K. W. McCulloch Pty. Ltd., 57 George Street, Launceston. Tel. 2 5322
W.A.: Athol M. Hill Pty. Ltd., 613-615 Wellington Street, Perth. Tel. 21 7861

When all you want is soft romantic music

that's all you get with BASF LH-hifi recording tape—*nothing else.*

The fact that tape "Hhiss" is anything but seductive is one of the reasons why we have virtually eliminated it from BASF LH-hifi recording tape. The gradual narrowing of track widths and lowering of tape speed on domestic tape recorders, places, above all, great demands on tape to head contact and magnetic uniformity.

A natural consequence of this development appeared to be background noise which became more audible during sound reproduction. To counter this, BASF engineers have introduced low noise equalisations and eliminated the background noise, increased sensitivity and achieved dramatic improvement in signal-to-noise ratio of as much as 8dB over other quality tapes.

Whatever music you decide is most persuasive, BASF LH-hifi will give it greater clarity, more realism and less distortion. The rest is up to you.

BASF Compact Cassettes are available in the following playing times:

C30	=	2	x	15	minutes	=	30	minutes.
C60	=	2	x	30	minutes	=	60	minutes.
C90	=	2	x	45	minutes	=	90	minutes.
C120	=	2	x	60	minutes	=	120	minutes.

BASF Compact Cassettes available everywhere in your choice of either "Trans," "Snap" or "Plastic Pack."

BASF HAS THE QUALITY—YOU MAKE THE MUSIC—BASF FOR ENDLESS PLEASURE

BASF

Australian Distributors:
Maurice Chapman & Company Pty. Ltd.,
276 Castlereagh St., Sydney. Phone: 61 9881.
146 Burwood Rd., Hawthorn. Vic.
Phone: 81 0574.

BA137.1A

THORENS MODEL TD 125 TURNTABLE

electronics TODAY INTERNATIONAL
product test

This top-quality turntable uses a Wien-bridge oscillator circuit to maintain constant, yet adjustable speed.

THE Thorens model 125 turntable is electronically speed controlled and is manufactured under licence in West Germany. Thorens have been producing studio quality transcription turntables for over two decades and this company's reputation for quality has ensured product sales to both professionals and amateurs alike.

The TD 125 turntable is the latest product from Thorens to reach Australia, and has the same standard of quality as we have come to expect. It comes with several possible variations, such as with or without tone arm, with or without base, and with or without cover. The unit tested came complete with base and tone arm, but no cover. The cover, we feel, is necessary as protection from dust fall out is essential, even during a protracted evaluation and testing for review.

The unit supplied was well packed in a partially dissassembled state. Only the head shell needs to be plugged in and the turntable installed, to prepare the unit for immediate use. The signal leads, two metres long, are fitted with a pair of moulded R.C.A. coaxial plugs. The mains lead also two metres long, is terminated by a moulded German two pin plug. A separate

THORENS MODEL TD 125 TURNTABLE

earthing lead is supplied which for safety reasons must be used.

The turntable base has separate vibrational isolation from the operational controls, these controls are located on a brushed aluminium panel 1-5/8" wide extending across the full front width of the polished timber base. The control panel which forms part of the base, is independent of the spring mounted turntable and tone arm base, so that operation of controls does not impart any movement to the turntable tone arm thus providing excellent protection against damage to the record stylus.

The controls are unusual, have an impressive appearance, and consist of three slide bars 2" long by 1" wide by ¼" high, which move parallel to the front panel. Each slide bar is moulded from black plastic with a brushed aluminium top. Speed selection is performed by moving the extreme left hand slide bar to one of three positions:– 16-2/3 rpm on the left, 33-1/3 rpm in the centre, or 45 rpm on the right. The next slide bar, which is located to the right of the strobe light and speed control potentiometer, is the power on-off switch. The third slide bar operates the arm lift, and is mounted to the left of the name plate at the right hand end of the panel.

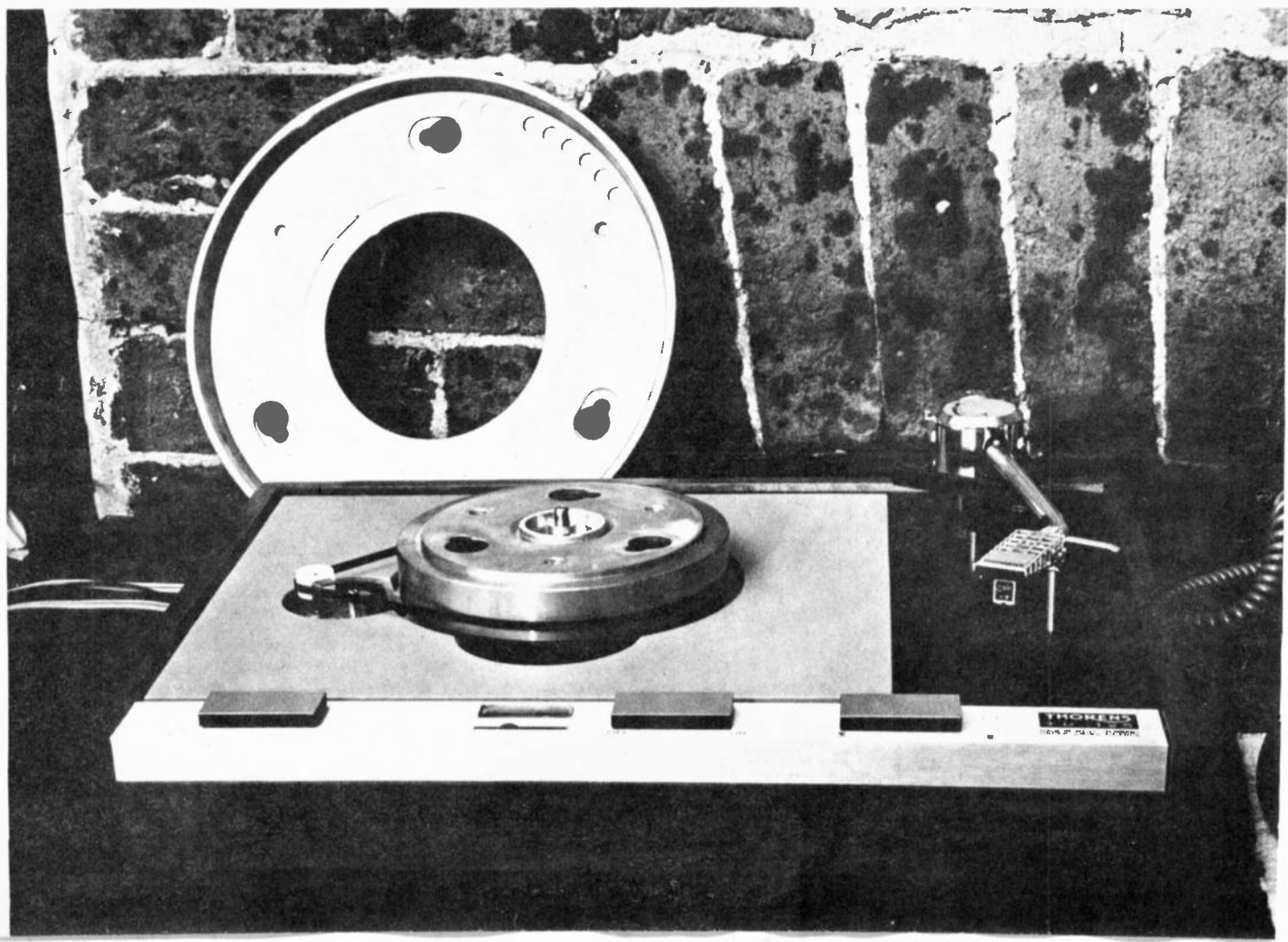
A potentiometer driven by a knurled wheel located on the front panel adjusts turntable speed. This adjustment is performed whilst viewing a stroboscope through a front panel window and prism lens assembly.

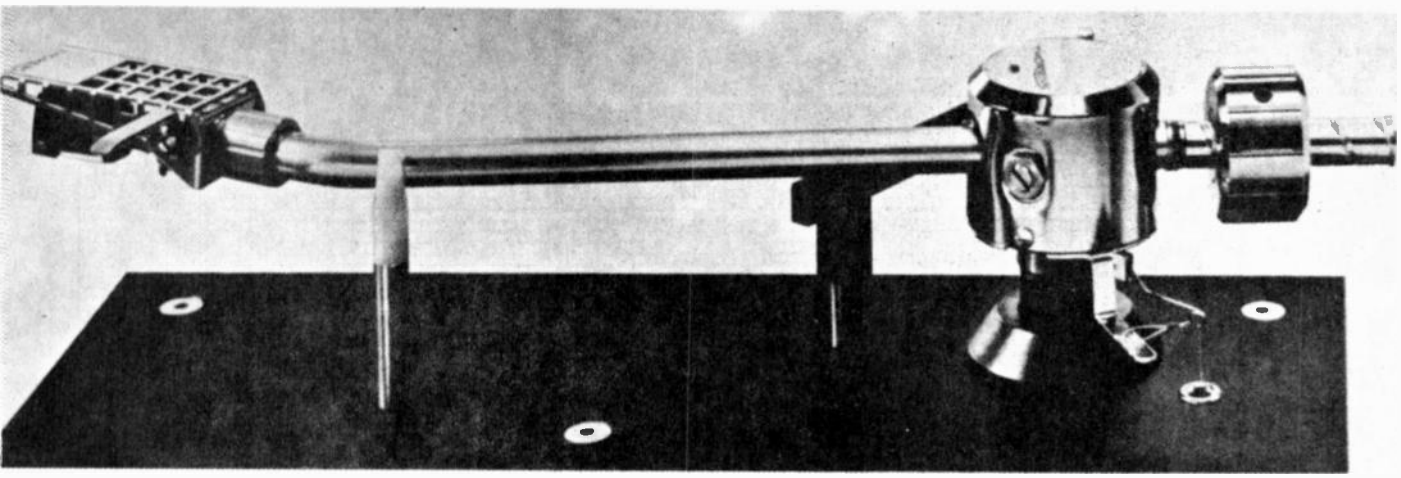
The stroboscope has four sets of markings: two for 50Hz operation and two for 60Hz operation. One pair of markings is for the 45 rpm speed, the other pair for both 16-2/3 rpm and 33-1/3 rpm operating speeds. Speed changes are effected by changing the frequency of a Wien bridge oscillator which drives the sixteen pole synchronous motor. The nominal motor drive frequencies are 50Hz, 37Hz and 18.5Hz with resultant motor speeds of 370 rpm, 274 rpm and 137 rpm respectively. Once a speed has been selected, and correctly adjusted by the potentiometer, further adjustments for any other speed are unnecessary due to the accurate switched frequency ratios of the oscillator. In fact, having initially adjusted the speed in the laboratory, it was not found necessary to make further corrections even though the unit was used at various speeds every day for over four weeks.

Adequate power for the motor is provided by a push-pull power amplification stage included between the oscillator and the motor. Another interesting feature is the use of switched phase shift capacitors, which are changed by the speed selector to obtain maximum motor torque at each speed setting.

The drive from the motor is taken via a Delrin pulley and a damped rubber belt to the diecast inner turntable support ring which is spigotted to take the diecast turntable. Both the inner support plate and the turntable are balanced and machined on both the top faces and edges. The turntable and tone arm are mounted on a diecast base supported by three high deflection spring mounts, providing extremely good isolation. Maximum isolation is obtained at the expense of isolator damping and this is most noticeable with this base arrangement. The base can be readily set into oscillation by removing the tone arm from its rest clamp or by any severe movement of the timber base. Once this happens it is necessary to wait till the oscillations die down before a record can be played with safety.

The three isolation springs are housed in knurled plastic retainers, which can be screwed in or out so that the turntable base may be levelled. Thorens recognise the problems which can occur in an environment where





usage is "rough" and offer an alternative rubber grommet isolator, which, whilst not providing good isolation, does allow heavy handed operation of the unit.

The cast base is finished in light grey under the turntable and has a matt black panel under the tone arm.

The printed circuit boards, 16 pole synchronous motor, power transformer, power transistors and fuse boards are all mounted on a heavy 10 gauge chemically treated steel panel mounted below the cast turntable base. This panel also contains the three spring mounts supporting the turntable base and a terminal strip for the tone arm leads.

The printed circuit board, which measures approximately 10" x 5", has been etched with the following information:—

a) reference voltages at selected points in the circuit
b) base, collector, and emitter points
c) output terminals and colour codes
d) positive connections for all electrolytic capacitors.

All switching contacts on the boards are gold plated to provide low noise and trouble free operation. The board contains seven tab potentiometers for frequency and voltage adjustment, five low-power transistors, an encapsulated full-wave bridge rectifier, resistors, two air wound inductors, and numerous electrolytic and polyester capacitors. The two large pnp germanium power transistors, type AD 149, are mounted on the 10 gauge steel panel, which provides more than adequate heat dissipation. Mains voltage selection is effected by changing fuses and is very simple, yet foolproof, due to the different fuse lengths used for 117V and 240V volt supplies.

The tone arm used on the turntable supplied to us was a Thorens TP.25. This is very similar in design to the Thorens tone arms used over the past few years. We, therefore, were interested to find out how good it was by modern standards. Performance was good in terms of anti-skating and transverse friction characteristics even though the anti-skate device is an updated version of the fishing line and sinker principle.

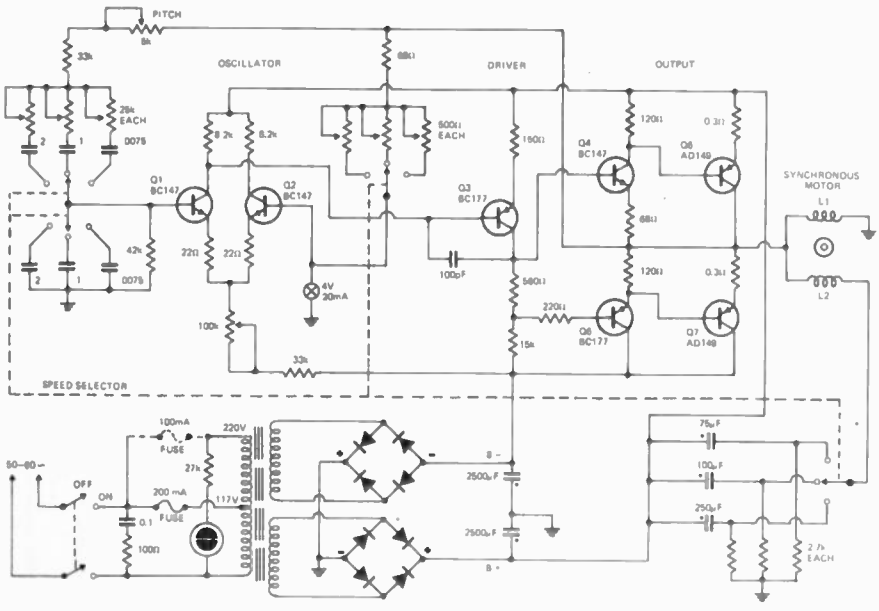
We decided, as a final check, to find out what effect arm resonance had upon performance. To do this we mounted a miniature accelerometer on the arm itself. To excite the arm into resonance a 45 rpm test record was used at 16-2/3 rpm giving a frequency range of 5.3Hz to 5.3kHz (20Hz to 20kHz at normal speed).

The output from the accelerometer and the output from both channels were then monitored to determine performance. The first, and only significant resonance, occurred at 9Hz (as measured by the accelerometer), but its effect was barely noticeable on the output from the cartridge. In all respects the Thorens tone arm was equal to the task and consistent in quality with the system as a whole.

The design of the tone arm is fairly conventional, being a balanced arm with a screw type counter weight, and an anti-skate weight fixed via a nylon thread to a small arm on the side of the tone arm support gimbal. The arm is designed to accept heavy cartridges and therefore may require an additional weight installed in the head shell when using a light cartridge such as the Ortafon MI5E.

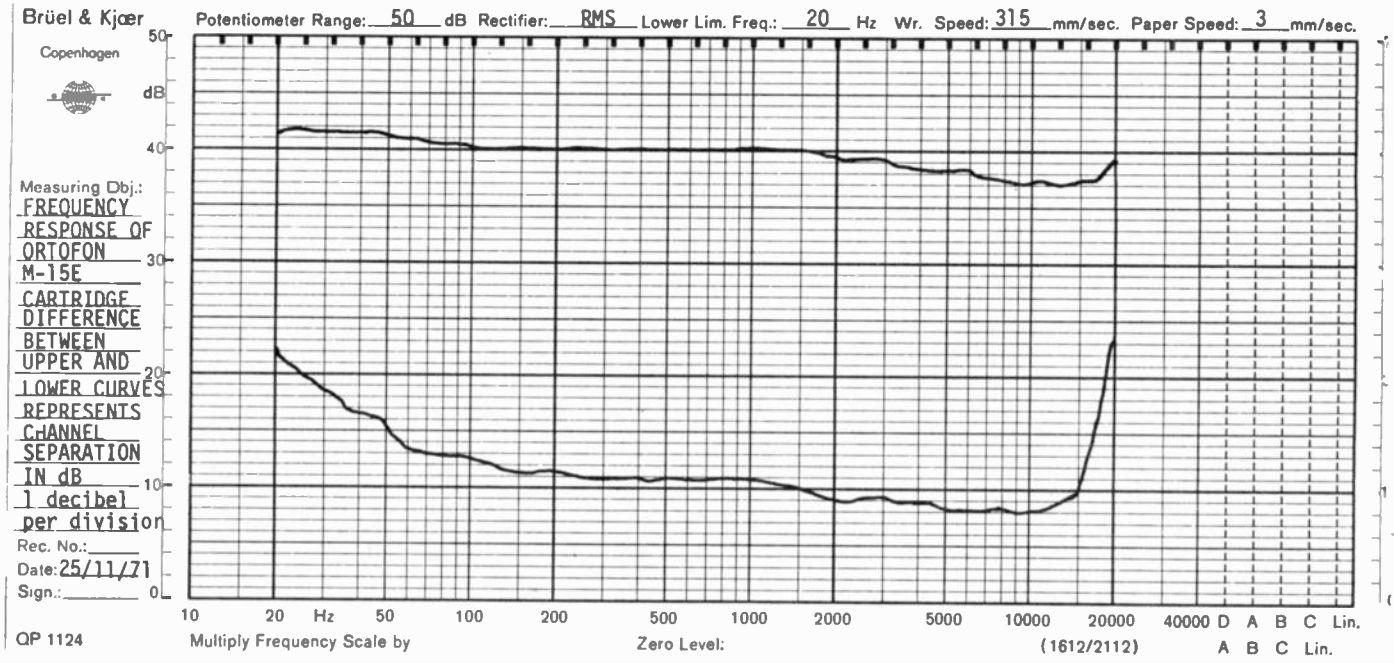
Once the arm has been balanced the desired tracking weight can be selected by moving a small lever on the left hand side of the support head. The lever is calibrated at ½ gram increments and applies the load by tensioning a spring. The arm itself is constructed from a polished aluminium tube, and is fitted with a plug in head shell designed to take most cartridges with standard ½" mounting centre.

Stylus, overhang, and tracking angle



This is the circuit of the Thorens 125 constant speed motor drive.

THORENS MODEL TD 125 TURNTABLE



can be readily adjusted by screws on the head shell which allow the mounting plate to move in or out and to tilt up or down; a necessary feature that is not found on many tone arms.

Another feature is the tone arm lift which not only has a smooth, well damped movement, but is also fitted with a rubber pad on the top edge so that the tone arm will not readily slide across it.

One problem we found was that there is no automatic cut-off and, because the unit is so silent, we usually did not notice for some time that the stylus was in the run-out groove, and with clean records a few hours could pass with the noise undiscerned.

A further, minor criticism, is that heavy handed people may find the unit too delicate because of the resiliency of the mountings.

The turntable was supplied for testing complete with the latest Ortofon M 15E cartridge, which features low compliance and an elliptical stylus. This stylus is well matched to the turntable due to its very good tracking characteristics, although some sibilance was just noticeable on certain records due to slight mistracking. Frequency response is very smooth from 20 to 20 kHz and is only bettered by a few other brands of cartridge.

A 19 page instruction manual gives accurate data for setting up and operating the turntable and includes specific details on cartridge alignment. The unit has a one year warranty against defective parts.

The Thorens Turntable Model TD 125 has a very pleasing and uncluttered external appearance, which is matched by an equally exceptional mechanical performance. The incorporation of an electronic speed control system is a worthwhile addition resulting in a turntable with well balanced performance characteristics. By and large we found this unit was a delight to use and its technical performance was exemplary in every respect.

We consider that this turntable is equal to the best that we have ever seen and should maintain Thorens untarnished reputation for many years to come. ●

MEASURED PERFORMANCE OF THORENS MODEL TD 125 TURNTABLE

Turntable			
Wow and Flutter	—	45 rpm	0.15% rms
	—	33-1/3 rpm	0.15% rms
Hum and Rumble Equalised (unweighted re 1kHz at 5 cm/sec)			−47dB
Speed Adjustment		+2%	−2.5%
Turntable Weight		7.2 lbs	
Pick Up Arm			
Transverse Friction		less than 0.1 gram	
Arm Resonance Frequency			9Hz
Cartridge			
(Ortofon M15E) Frequency Response		20Hz to 20kHz $^{+2}_{-3}$ db	
Channel Separation at 1kHz			29dB
Channel Difference at 1kHz			0.4dB
Output re 1kHz at 5 cm/sec			4mV
Cartridge Impedance			1.1kΩ
Signal-to-Noise Ratio of complete system (re 1kHz 5cm/sec)			39dB

Dimensions, 18-3/8" long x 14-1/4" deep x 5-1/2" high over tone arm.

Price, TD 125A/B $381 excluding cover and cartridge.

YESTERDAY STEREOPHONIC
TODAY QUADRAPHONIC

AKAI AA6100 4 CHANNEL AMPLIFIER FOR ONLY $235*

- 80 watt music power into 4 loudspeaker units.
- 4 independent channels provide true SURROUND STEREO.
- Or synthesised surround sound from all your present stereo records, tapes or any stereo source.
- Separate bass and treble controls; front and rear balance.
- Fully transistorized; universal AC voltage selector.
- Latest technical developments combined with clean, modern styling.

IT'S VIRTUALLY 2 AMPLIFIERS FOR THE PRICE OF ONE!

Another Akai Exclusive....

OMNIDIRECTIONAL SPEAKERS NDS70...ONLY $128* A PAIR

- Six 3" high compliance speakers in each unit provide 30 watt power handling.
- Wide angle dispersion eliminates critical room positioning.
- Lightweight silk speaker edge reduces distortion and increases frequency response.
- Specially developed cone optimises performance.

Akai's NDS70's Bring You a Whole New World of Sound

ALL AKAI EQUIPMENT IS BACKED BY A 6 MONTHS GUARANTEE

**suggested retail price*

AKAI

THE VERY REAL SOUND EXPERIENCE

Manufactured by Akai Electric Co. Ltd. and distributed in Australia by Akai Australia Pty. Ltd., 276 Castlereagh Street, Sydney 2000 Telephone: 61 9881

AK5

SONY PS 552

This new Sony turntable is good value for money - Louis Challis reports...

electronics TODAY INTERNATIONAL
product test

THE model 5520 is the latest in Sony's range of turntables. It was supplied for testing with the Sony VM-22GA induced-magnet cartridge. The unit is belt-driven with selective automatic or manual tone arm control.

The external appearance is similar to many other turntables currently available. The bottom edge of the polished timber plinth is recessed and painted black. This reduces its apparent height.

The smoked perspex dust cover is fitted with "clip on" type hinges. These hinges are fitted with nylon bushes and spring assemblies, which effectively control the closing of the lid, thereby eliminating possible jarring of the turntable.

The turntable base is finished matt black and has two chrome plated switches at the left hand end for 45 rpm or 331/3 rpm speed selection.

The manual/automatic control lever and record diameter select lever are positioned around a circular raised section at the right-hand front corner of the turntable base. The manual/automatic control lever has five positions. These are a central position to the lever returns at the end of each record, and two further positions on each side of this central position.

The two positions on the left are marked 'manual' and 'repeat' and are for manual operation only. In the manual position the arm is placed manually on the record and automatically returns to the arm rest at the end of the record, before turning off the power. In the repeat position the arm automatically returns to the beginning of the record and keeps replaying the record until the manual position is selected.

The two positions on the right hand side are marked 'reject' and 'start'. The 'start' position must be selected to initiate operation of the turntable, and once selected, the arm is automatically lifted and placed on the record. Once the start sequence has finished, the reject position may be selected and the arm will return to the rest and stop the turntable.

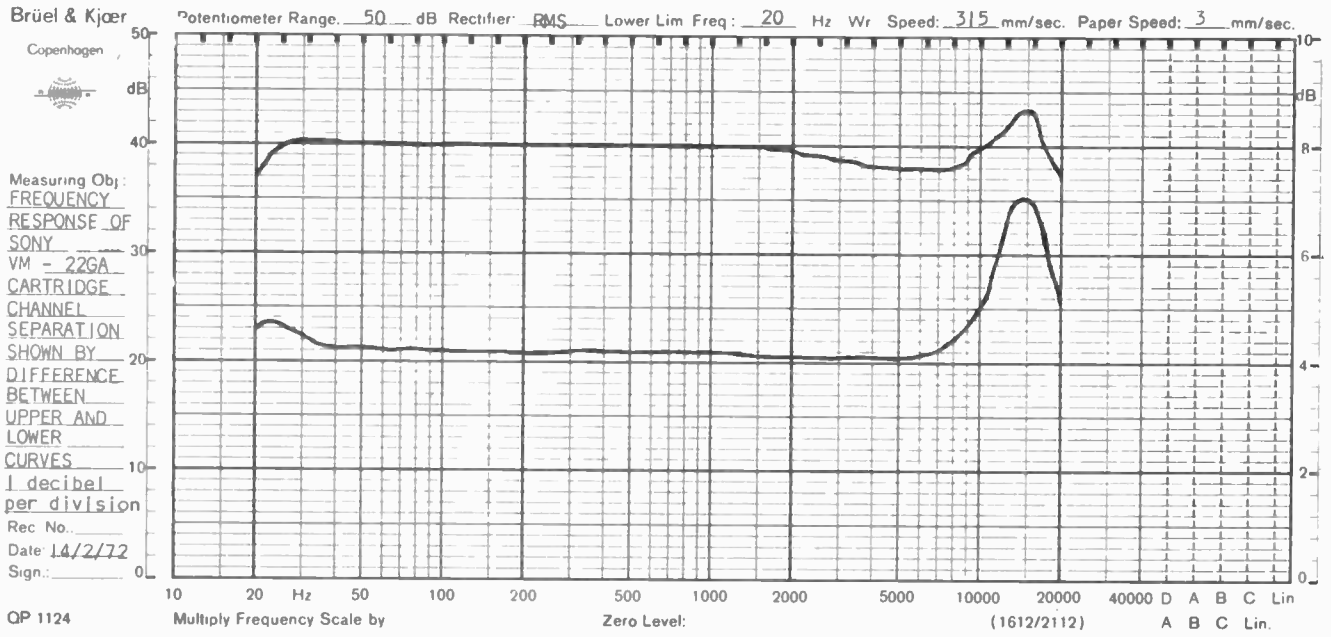
The record diameter select level has three positions for 17cm, 25cm and 30cm diameter records. The cueing lever is adequately damped in the lowering mode and undamped in the lifting mode. The tone arm is constructed from chrome plated tubing and is fitted with a plug in a headshell designed to accept cartridges with ½" mounting centres. Balancing is obtained by rotating a cylindrical counterweight on the end of the arm and then setting the tracking force by moving the balance weight a calibrated distance.

Antiskating is provided by a small weight on a line. This is connected onto one of three positions on a small arm projecting out at right-angles to the main arm. The inner position is for tracking weights behind ½ gram and 1.5 grams, the middle position for 1.5 to 2.5 grams and the outer position for 2.5 to 3.0 grams. The arm rest is fitted with a stop on the right hand side so that it is impossible for the arm to overshoot the rest when returning. Similarly an automatically controlled stop prevents the tone arm from falling off the cueing arm as it approaches the centre of the turntable.

One feature which we feel is essential but has not been included on this turntable, is the ability to clamp the tone arm to the rest. The lack of this feature can be a nuisance, particularly when changing cartridges, apart from the increased probability of knocking the arm off the rest and damaging the stylus.

The cast aluminium alloy turntable is

O TURNTABLE



MEASURED PERFORMANCE OF SONY AUTOMATIC TURNTABLE MODEL PS5520 SERIAL NO. 10084.

TURNTABLE	45 rpm	33-1/3 rpm
Wow and Flutter	0.1%	0.1%
Hum & Rumble re 1kHz at 5cm/sec (unweighted)	−44dB	−44dB
Speed Error	−0.3%	-0.3%
TURNTABLE WEIGHT = 2lbs 3ozs.		
PICK UP ARM		
Transverse friction	70mg	
Vertical friction	50mg	
Arm resonance	7Hz	
TRACKING FORCE CALIBRATION		
	Setting	Measured Tracking Force
	1.0 grams	1.0 grams
	2.0 grams	2.0 grams
CARTRIDGE TYPE VM-22GA		
Frequency Response	20 to 20kHz	±3dB
Cartridge weight	= 6.9 grams	
Channel separation at 1kHz	= 19dB	
Channel difference at 1kHz	= ½dB	
Output at 1kHz 5cm/sec	= 5.5mV	
Cartridge impedance	= 47KΩ	
Price - recommended retail price $221.		

Monarch Amplification

You've probably saved enough money already.

Just when you thought you were still saving up for it, you find out that **Monarch** Amplification can be yours from as little as $107 (or up to $100 less than other amplifiers with the same performance).

Even so, the saving is just beginning—because when you get a really great amplifier at this price, you can spend more on those better speakers you've had your ear on.

Compare one of these **second generation** Monarchs with another, more expensive amplifier. Check the power, the frequency response and the distortion. Have a look at the features listed below, from slide controls and filters, to the satin walnut veneer cabinet.

How much? You've probably saved enough already.

Monarch SA-600
Recommended Retail Price $139.

The professional amplifier for perfectionists with a limited budget. 22 Watts per channel of clean, undistorted power, enough power for any speaker system. All silicon transistor circuitry means low noise. Harmonic distortion of 0.8% for transparent sound. Four slide controls for bass, treble, balance and volume. Main and remote speaker connections. High and low filter.

For your dollar the most flexible comprehensive amplifier on the market.

Monarch SA-450
Recommended Retail Price $107.

A feature-packed amplifier of very low cost to introduce the beginner to hi-fi performance.

Magnetic and crystal (for your old turntable) inputs. Tape monitor. Loudness and high filter control. Electronic fusing protects transistors. 8 watts per channel RMS. 3 slide controls. A "best buy" for the beginner.

Australian Distributors

W. C. Wedderspoon Pty. Ltd.

Showroom: 193 Clarence Street, Sydney. 29-6681

WD18/FP

ACT. Homecrafts, Petrie Street, Canberra. 2600

VIC. Douglas Trading, 191 Bourke Street, Melbourne. 3000

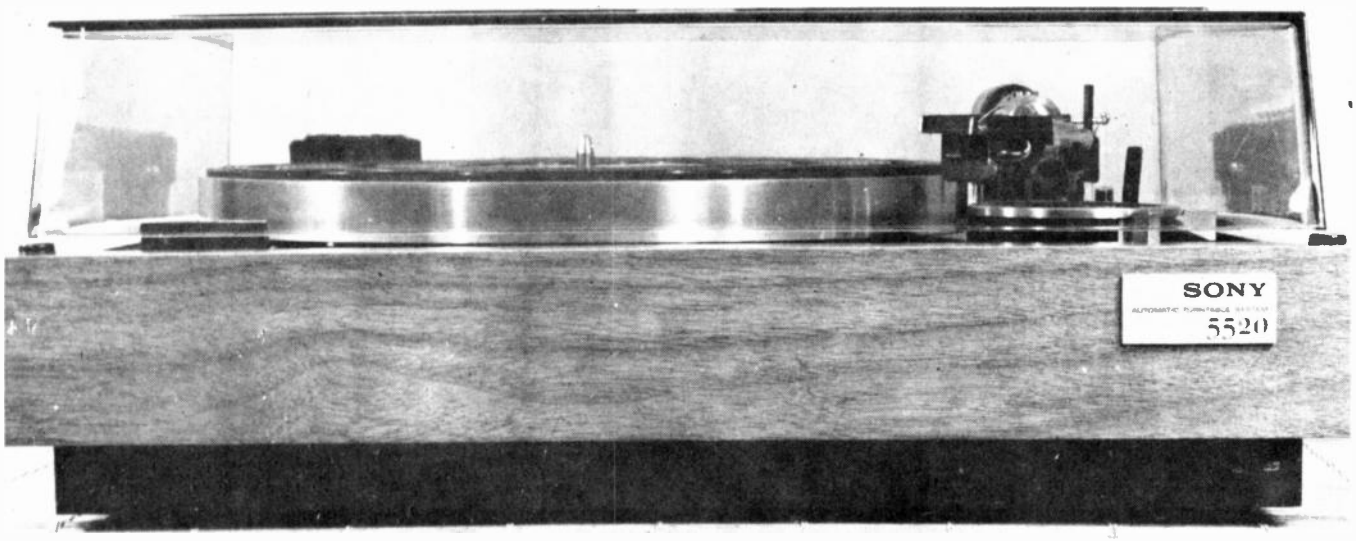
QLD. Tel-Air Electronics, 187 George Street, Brisbane. 4000.

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

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

S.A. Sound Spectrum, 33 Regents Arcade, Adelaide. 5000

SONY PS 5520 TURNTABLE



finished with a brushed rim and fitted with a ribbed rubber mat. The turntable is driven by a four pole condenser-hysteresis motor, via a synthetic rubber belt, to an inner rim on the turntable.

SUBJECTIVE EVALUATION

Subjective evaluation of the cartridge and turntable was performed with the Nana Mouskouri record "Over and Over" and the J.B.L. demonstration record PRO 496. Some sibilance was noticeable on the Nana Mouskouri record but no mistracking was audible on the J.B.L. demonstration record.

In fact the clarity of reproduction from this cartridge was much better than we expected and was a delight to listen to.

(It should be noted that most cartridges, with the exception of one or two that we have heard, mistrack slightly at the higher frequencies resulting in sibilance).

MEASURED PERFORMANCE

The measured performance of the turntable and cartridge was equal to, or better than the manufacturer's specifications in all respects excepting channel separation which was typically 19dB. Some mistracking occurred at the higher frequencies with moderate to high velocities (about 8 cm/sec at 10 kHz). This did not result in audible distortion even on our very demanding test records. The cartridge output is also higher than most induced magnet type cartridges.

With the low transverse and vertical frictions measured on the tone arm this unit would be suitable for cartridges capable of tracking as low as ½ gram.

The turntable was supplied with a multi-language instruction manual printed on 27 pages of high gloss paper. The instruction manual was arranged in a logical sequence with each section graphically depicting the various operations. The table of contents detailed below clearly shows the extent of the information given in the manual.

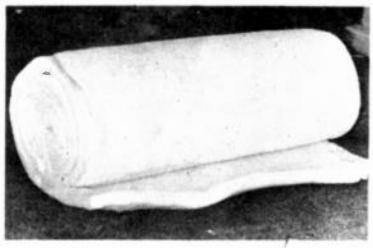
Preparing for Use
Unpacking
Assembly
Adaption to local power line
Tone arm adjustments
System connections

Operating instructions
Preparation
Automatic operation
Manual operation

Care of your PS 5520
Cleaning and removing the dust cover
Stylus replacement
Using another cartridge
Repacking for shipment

For a recommended selling price of $221, complete with cartridge the Sony PS 5520 turntable represents good value for money. For the audiophile who wants more exacting reproduction this turntable, will compliment a more expensive cartridge with higher performance. ●

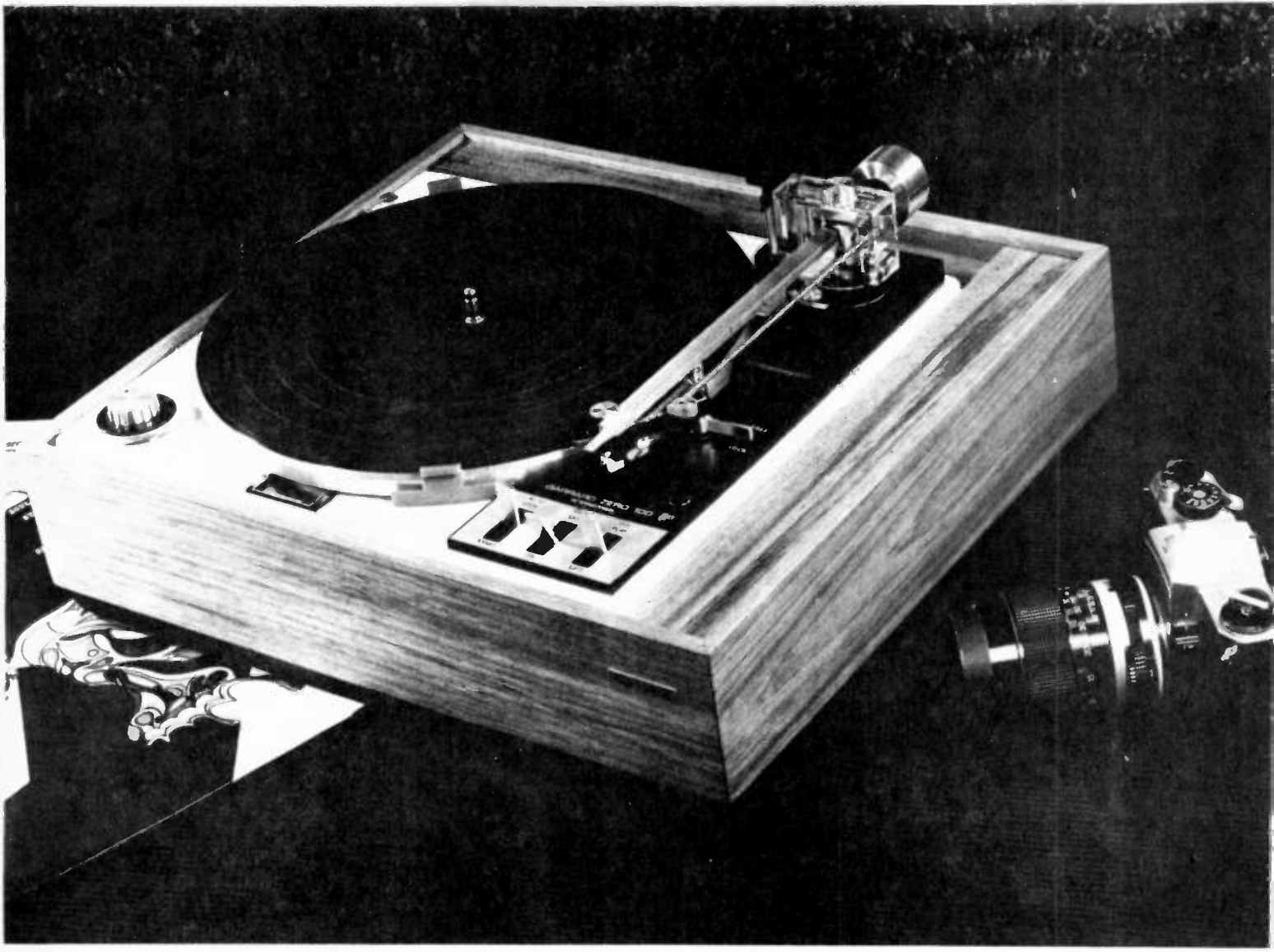
"INNERBOND"®
BONDED ACETATE FIBRES



FOR PACKING IN SPEAKER ENCLOSURES

AVAILABLE AT ALL LEADING ELECTRONIC DEALERS

WONDER WOOL PTY. LTD.
87 James Street, Leichhardt N.S.W., 2040.
Box 548 G.P.O., Sydney 2001.
Phone: 56 2780.



ZERO TRACKING ERROR

First genuine Australian test of the Garrard Zero-100 Automatic Turntable.

electronics TODAY INTERNATIONAL
product test

THE CONCEPT of a pick-up that will track a record in a linear fashion is as old as disc reproduction. The reason for wanting it is to enable the playback system exactly to reproduce the mechanical characteristics of the record cutting system.

Ideally, the pickup arm should track the record on a radial line. The stylus should be wedge shaped and be connected to the cartridge by a bar at 15° to the plane of of the record. If this can be arranged, the playback system will exactly match the characteristics of the recording system.

The wedged stylus shape has been approximated by the elliptical stylus to a satisfactory degree, and most cartridges professing high fidelity have the 15° rake angle.

The one remaining weakness is non-linear tracking.

From time to time linear tracking arrangements have been designed, but mostly they suffer from one serious weakness. This is friction caused by complex bearing arrangements.

There are two basic ways of obtaining linear tracking. The first is to have an arm which slides horizontally across a bar located at the rear of the turntable. This system, whilst provided perfect tracking, has bearings that introduce a lot of friction. The second system is that used in the Garrard Zero – 100. This consists of two parallel arms connected to the headshell, each fixed at two pivot points. With correct geometry this system provides almost totally accurate tracking. However, this requires four bearings instead of one and hence approximately four times as much friction.

Errors in tracking angle introduce second-harmonic distortion, and since the best that one can hope for with a conventional pickup arm is perfect tracking only on two positions on the record, it automatically follows that at every other point on the record, distortion will be introduced by the tracking error. This distortion is given by the equation.

$$THD(2nd) = k\,\phi\frac{V}{v}$$

where V is the velocity of the groove modulation
v is the groove velocity
and ϕ is the tracking error in degrees.

It will be seen, therefore, that the possible methods of decreasing the distortion are either:–

(i) to increase the grove velocity, (ie, use 45 rpm or 78 rpm instead of 33-1/3 rpm),

(ii) decrease the groove modulation,

(iii) reduce the tracking error

The first method has the obvious disadvantage that there will be less recording time per record. Some special records are made like this, such as our 12" diameter, 45 rpm Bruel and Kjaer test records. The second method would result in a degraded signal-to-noise ratio, and this would therefore be just as unacceptable as the generation of second harmonic distortion. The only remaining method is the use of linear tracking arms.

Before considering in detail the raison d'etre of the Garrard Zero-100 design, it is necessary to consider the subjective effect of distortion. Generally it can be said that the higher the order of the harmonic the more sensitive the ear is to it. If it is supposed to be there – then it will be pleasing, and will add colour. If harmonics are there unintentionally, such as from an overworked pocket transistor radio they are very unpleasant indeed. Thus even a fairly critical ear will happily tolerate some 3% harmonic distortion, but only about 1% third harmonic distortion. Another important subjective effect is that the average adult can hear little above 16kHz, and since modulation velocity is proportional to frequency as well as amplitude, the most severe distortion for given amplitude will occur at high frequencies. However, harmonic distortion at frequencies above 8kHz will not be audible as even the *second* harmonic will be 16kHz.

MEASURED PERFORMANCE OF GARRARD ZERO-100
SERIAL NO. 75100/004

Turntable	
Wow and Flutter	= 0.15% rms
Hum & Rumble Equalized But Unweighted re 1kHz at 5cm/sec	= –44dB
Speed Variation	= ± 3%
Turntable Weight	= 3½ lbs
Pick Up Arm – Friction Measured at the Head.	
Transverse Friction	= 200 mgs
Vertical Friction	= 30 mgs.
Cartridge Supplied – Shure type M71-6	
Tracking Force	= 2 grams
Frequency Response	= 20 to 20kHz ± 1 –2dB
Channel Separation at 1kHz	= 27dB
Channel difference at 1kHz	= 1dB
Output re 1kHz 5 cm/sec	= 4.4mV
Cartridge Impedance	= 47 k Ω
Cartridge Weight	= 6 grams.
Price – less base and cartridge	$268

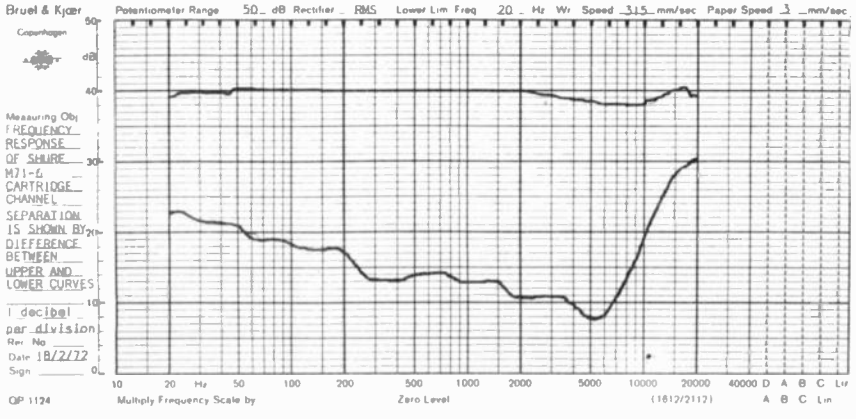
MECHANICAL CONSTRUCTION

The Garrard Zero-100 player has an appearance that could be described as "professional". The base plate is white enamelled pressed steel and has a raised section on the righthand side containing the pick-up arm and its controls. In the centre is an escutcheon for viewing an illuminated stroboscope image. On the left hand side of the deck are a pair of concentric aluminium knobs. The inner knob provides speeds of either 45 rpm or 33-1/3 rpm, and, for automatic operation, sets the changer mechanism for the correct record size. The outer knob provides a variation of ±3% of the nominal operating speed. The pick-up control levers on the righthand side of the deck provide for automatic operation, manual on/off and pick-up cueing, respectively.

These gold-anodized vertical control levers are well spaced to allow easy operation.

The cueing lever provides a very fast lift, but is nevertheless positive and free of lost motion to ensure that the stylus can be lowered back into the same groove. The lowering action is slow and extremely smooth in both the manual and automatic modes.

The main feature of the Zero-100, is of course, the tone arm.



ZERO TRACKING ERROR

The Garrard Zero- 100S is the non-automatic version of the unit tested.

The rather large main gymbal bearing of this arm is enclosed in a clear rectangular perspex frame.

The 'universal' bearing of the secondary arm consists of a spherical head resting in an indentation. This is located in the perspex frame, approximately one inch from the centre line of the main bearing. It is constrained against rough handling or shipping, by a cage. This gives the impression of looseness when the head shell is moved. Nevertheless the bearing is very positively located while playing records.

On the top of the main gymbal is a small ceramic magnet; this is directly beneath a similar magnet attached to the perspex frame. These magnets provide the anti-skating force. The strength of this force is adjusted by sliding a piece of steel between the two magnets, thereby decreasing their mutual repulsion. The position of the steel shield is visible through the perspex frame and this has calibration marks (in grams) corresponding to the tracking weight of both conical and elliptical stylii.

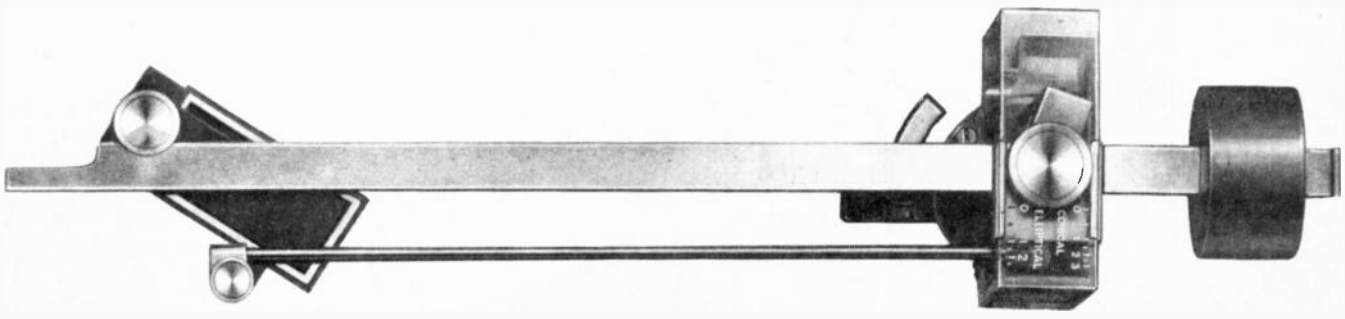
The counter weight is made of lacquered brass. It screws onto the arm by means of a central plastic spider and is locked by a nylon ratchet under the main arm. This is designed vibrationally to isolate the mass of the counterweight from the tone arm, in an attempt to reduce low frequency excitation of the system consisting of the tone arm mass and stylus compliance. The tracking force is provided by a small brass weight under the tone arm. This will provide tracking weights of up to 3 grams.

It is at the head shell that one appreciates the complexity of the parallel tracking arrangement. The head shell is pivoted to the main tone arm and the secondary arm via ball bearings. The main arm bearing is designed to be loaded in either direction, while the one on the secondary arm is preloaded to remove play.

These bearings are a very important part of the Zero-100 unit, and to a large extent determine its performance. We found that there was no measurable play in either bearing, but we felt there was probably more stiction than was desirable. Measurements showed that whilst the vertical stiction was a very respectable 30 mg, the horizontal stiction was 200 mg. These figures clearly show the increased stiction caused by using four bearings for horizontal movement as against two for vertical movement.

To find out the actual effect of this sideways friction we set up the arm using an Ortofon MI5E cartridge tracking at 1 gram. We found that the tracking over some of our audio obstacle course test records was exemplary on the outer channel, but slight mistracking occurred on the inner channel and this was largely due to the arm's friction. Using the Shure M71-6 cartridge supplied to us with the unit, we obtained excellent performance at a tracking weight of 2 grams. This is the maximum recommended for this particular cartridge.

While Garrard claim that much lower tracking weights are possible, we do not see any point in reducing second harmonic distortion by reducing



the error in the tracking angle, and then replacing it by far more annoying and objectionable third and higher harmonics on high level transients. We would therefore recommend that a heavier tracking cartridge such as the Shure M71-6 or Ortofon MF15 be used.

While the arm is possibly "state of the art", the turntable drive system is far from it, and is similar to that used on some of the earliest turntables. It consists of a pulley driving onto a pressed steel rim. We found that although the turntable rumble figures are quite low, subjectively, they seem to be higher, due to the higher frequency components that are caused by the ringing of the steel rim.

Although the turntable weighs 3½lb, the drive rim is very light. A far better performance would most probably be obtained by eliminating the steel drive rim and incorporating it in the main aluminium diecasting.

The drive motor is a combination induction and synchronous motor providing an operating speed as accurate as the mains frequency, and independent of voltage fluctuations.

Fine speed adjustment is obtained by varying the height of an idler wheel on a conical stepped pulley. The provision of speed adjustment brings with it the need for some form of speed measurement. This is provided in the form of a stroboscope on the underside of the turntable. The stroboscope is illuminated by a neon-light mirror, enabling it to be viewed from above.

A simple but well designed feature is the spring loaded pick-up arm. This enables the pick-up to rise against a spring without straining the actuating mechanism should the unit be inadvertently started with the arm in the locked position.

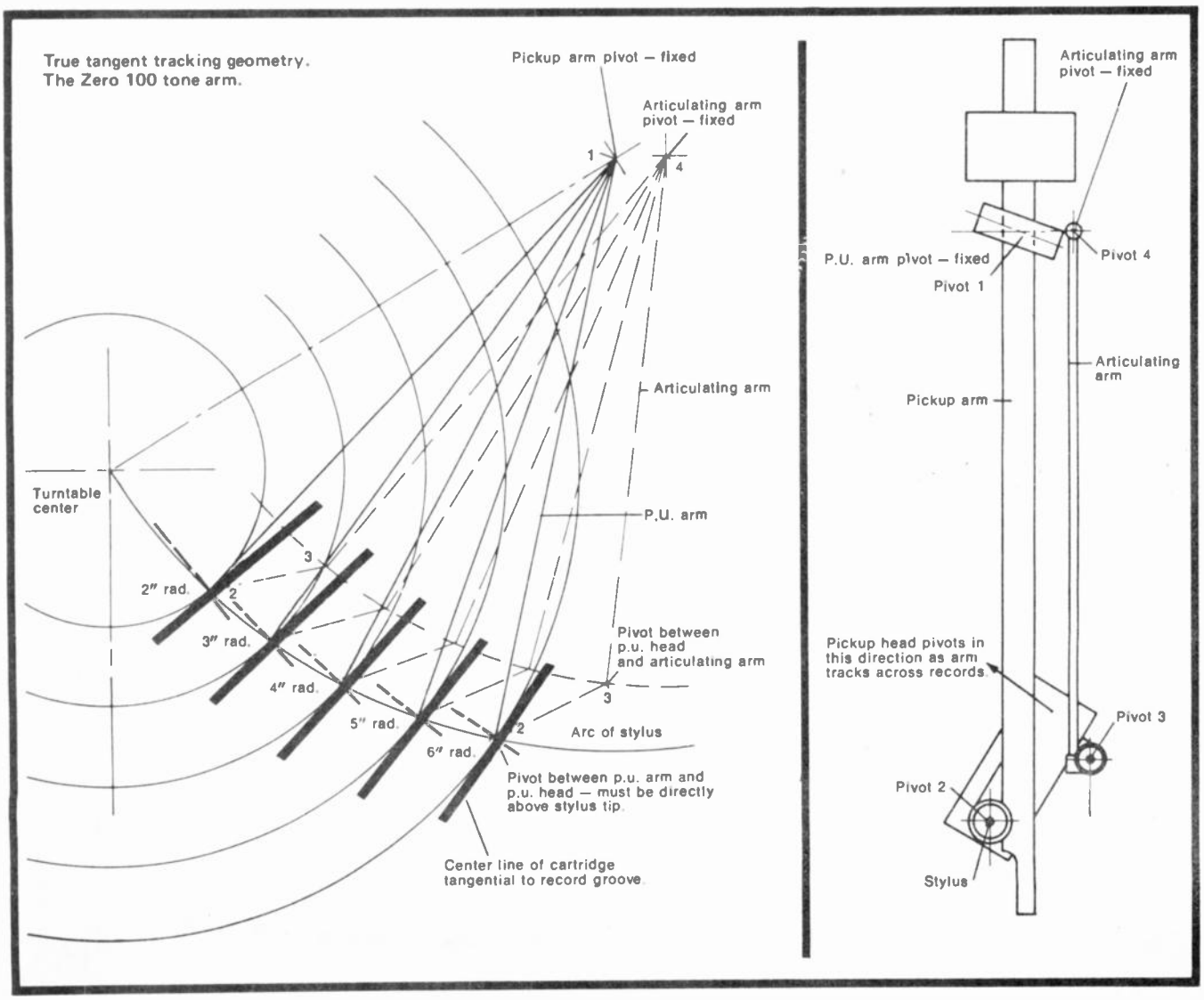
One point which arose during the testing is the need for a good earth between the turntable deck and the amplifier. If this is not provided or inadequate, the signal-to-noise ratio may not exceed 20 dB.

The handbooks supplied with the Garrard Zero-100 provide detailed information on the turntable's operating principles, construction, installation and use.

The Zero-100 arm is extremely well designed, but the same degree of refinement has not been extended to the rest of the turntable.

With a suitable cartridge, the Zero-100 performs well. However, despite the complexity of the arm mechanism there is no measurable difference in performance between the Zero-100 arm and other *top quality* conventional arms. Nor could we detect any subjective improvement on most programme material.

The Zero-100 unit is well constructed, and while it does not achieve all the aims it strives for, it is the best unit that we have seen that will provide linear tracking without severely compromising the other requirements of a good pick-up arm. ●



SWIMMING POOL

OBJECT of our first design competition — details of which were published in our July and August (1971) issues — was to design 'an effective and reliable system which will provide audible warning if a child falls, or is about to fall, into a swimming pool.'

The response was surprising — for not only were there far more entries than we had expected, but the general standard of design and presentation was of a remarkably high standard. So much so, that final judging has become extraordinarily difficult.

However by a process of selective elimination we have now arrived at ten finalists, all of whom have now been asked to submit working prototypes.

The problem of designing an effective and reliable warning system is far more difficult than it may at first appear, for the device must be capable of distinguishing between wind-caused ripples, thunderstorms, and debris, yet be capable of providing warning when a small child — or crawling baby — enters or is about to enter the pool.

The device must also be capable of being fitted to pools of any shape or (domestic) size.

As is typical of many problems such as this, successful solutions may be relatively complex. And whilst a number of readers submitted devices of elegant simplicity, the vast majority of simple devices had severe operational limitations.

Broadly speaking, reader's entries can be divided into three distinct design categories, depending on the basic operating principle.

These categories are:—

(1) Floating devices that sense water movement.
(2) Hydrophonic devices — with or without frequency selective filtering — that detect the sound component of the splash.
(3) Light beams around the perimeter of the pool.

FLOATING DEVICES

Most entrants in this category appreciated that changes in water level could be compensated by a system using two floats of different buoyancies, a heavier semi-submerged float being used as a positional reference, whilst a second float senses ripple level.

Many of these entrants used reed switch and magnet mechanisms to detect relative float movement.

Unfortunately, quite a few entries had to be rejected because the devices had no method of differentiating between ripples caused by a child entering the pool, and those caused by wind. Several other quite ingenious entries failed to include any way of switching the unit off once triggered — and as some of these were self-contained units floating in mid-pool it was not apparent how one could disable them when the pool was used normally.

Of the ten finalists, five use this basic principle.

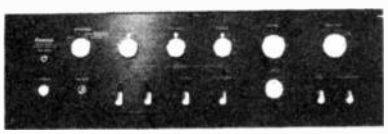
HYDROPHONIC SYSTEMS

About a quarter of the entries specified submerged geophones that detected the splash (or subsequent shock-wave) when a child fell into the pool. The majority of these entries

FIRST PRIZE
$1000
WORTH OF HI-FI EQUIPMENT
FROM
SIMON GRAY
Pty. Ltd.

Sansui turntable — two speeds, four pole synchronous motor. Magnetic cartridge with 0.5 mil. diamond stylus.

EXAMPLES OF HI—FI EQUIPMENT AVAILABLE FOR THE WINNER'S CHOICE AS PART OF $1000 FIRST PRIZE PRESENTED BY SIMON GRAY PTY. LTD.



Model AU-666 stereo amplifier — 10Hz — 40kHz — 35 watts per channel rms.

SAFETY CONTEST

suggested that a ceramic microphone be modified for the purpose.

One of our finalists, Mr. M. J. Standbridge, actually used hydrophonic spectrum analysing equipment to determine the frequency content of the splash. He found that there are major components between 1.3 and 2.7kHz, and these can readily be distinguished from the much higher average frequency range of water lapping against the side of the pool.

For this type of sensing to be reasonably immune to extraneous noise some form of frequency selection is essential – three of the finalists in this category feature this in their designs.

The fourth finalist in this category uses a very ingenious technique in which three widely spaced geophones respond only to alarm signals that arrive out of phase – thus in-phase sounds such as those caused by thunder – do not actuate the alarm.

LIGHT BEAMS

The third main category postulates the use of light beams around the outside of the pool. Only one of the contestants suggesting this system has made the finals, but he has presented a system that whilst more expensive than most has the capability of differentiating between adults and small children, yet is not triggered by birds, or flying papers etc.

SPECIAL COMMENDATION

Apart from the ten finalists, we have received quite a substantial number of entries that almost, but didn't quite make it. Alas we can offer no prizes but the top twelve of these entrants were:–

C. C. Mills, Williamstown, NSW
P. Doolan, Croydon, Vic
A. S. Lenon, Punchbowl, NSW
B. G. Wriede, Gladstone, Qld
M. Glynn, Sydney, NSW
M. W. Atcheson, Freemans Reach, NSW
R. C. Bosler, Maroubra, NSW
S. Hoy, Noble Park, Vic
R. Boyle, North Rockhampton, Qld
K. Noonan, Paddington, NSW
Ms Jameson & Dufton, Hawthorne, Vic
P. Resmer, Dandenong, Vic

Also deserving special mention is an entry from 11-year-old Kelvin Davis of Wynnum West, Qld.

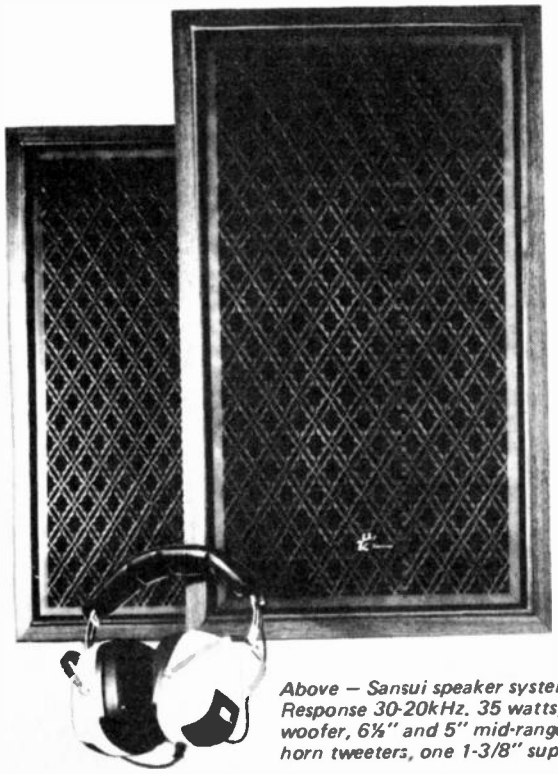
Kelvin's entry shows an extraordinary understanding of the problems involved. His solution is to use an underwater geophone, audio amplifier and triggering system, all of which he has devised from commercial instructional kits. Congratulations Kelvin! We are arranging for you to receive a year's free subscription.

Finally we commend A. M. Adams of Rose Bay for his mathematical approach to wave analysis.

We will publish final results, together with details of the winning entries, as soon as possible. ●

FINALISTS

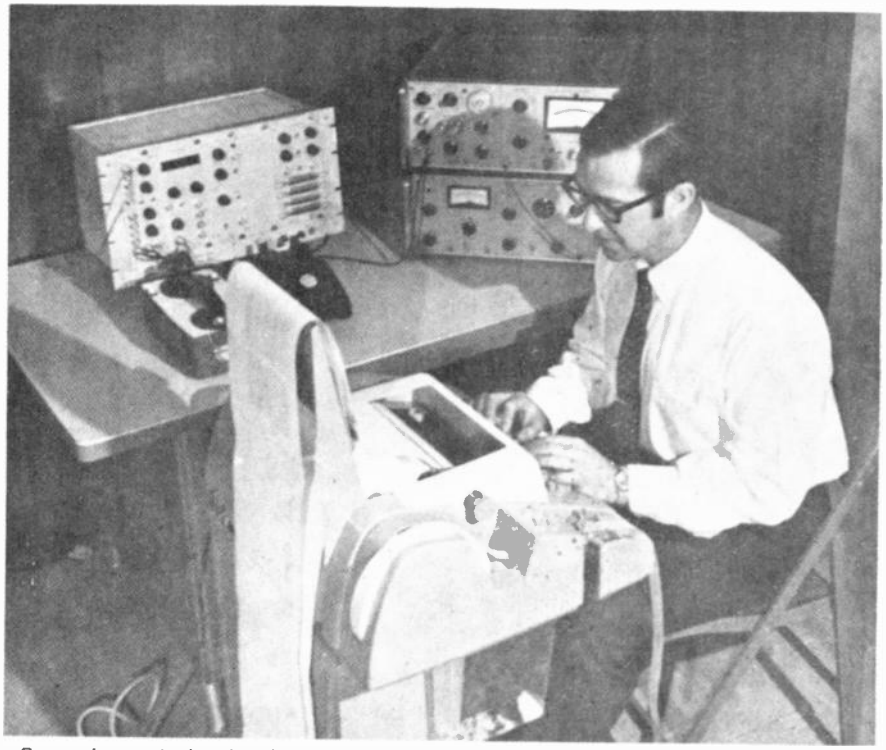
G. Collins, N.Z.
G. Goodwin, NSW
J. Olsonn, NSW
S. Tusak, Vic
J. F. Brandwyk, SA
J. Scott, Qld
D. Knox, Vic
Fairey Australasia Pty Ltd
J. Downing – SA
J. Stanbridge, W.A.



Above – Sansui speaker system. Response 30-20kHz. 35 watts, 12" woofer, 6¾" and 5" mid-range, two 2" horn tweeters, one 1-3/8" super tweeter.

Computer-Interfaced Instrumentation in the Development Laboratory

BY GEORGE KEATS, DIGITAL DATA INSTRUMENTATION PRODUCT GROUP MANAGER, PRINCETON APPLIED RESEARCH CORPORATION.



• *Researcher analyzing data from an in-process experiment employing computer-aided instrumentation.*

Although it generally agreed that a small, "dedicated" computer is usually best suited to production/quality control/quality analysis applications, the requirements of computer-interfaced instrumentation in the measurement and development laboratory differ significantly from those of computer-interfaced production-test instrumentation. Practical, standard equipment by means of which laboratory instruments may be interfaced with a time-shared, general-purpose digital computer is described, and several examples of computer-aided laboratory measurement systems are presented.

THE benefits of computer-interfaced instrumentation for production-test and quality control/quality analysis applications have been recognized for many years, and are almost universally acknowledged. Similarly, computer-interfaced instrumentation can be equally beneficial in the development laboratory.

However, the requirements for the two applications differ significantly.

Currently, there is considerable difference of opinion concerning the appropriate computer system to be used with instrumentation in the experimental and development laboratory. The spectrum of learned opinion ranges from the "mini-computer concept" to the "maxi-computer complex." In applying the "mini-computer concept", a small, "dedicated" computer is programmed to fulfill the requirements of one specific measurement (or, at most, a few measurements), and to provide the necessary data reduction according to a fixed programme. A system of this type is well suited to typical production-test requirements.

LABORATORY MEASUREMENTS

The requirements of typical laboratory measurements differ from those of production-line and quality control/quality analysis applications in many ways. Among the principal differences are:

- The need to evaluate and analyze – not just to measure and record.
- The greater range of mathematical operations that are typically interposed between the observations (readings) and the results.
- The greater diversity of measurement modes, ranges, and formats (configurations) encountered during the course of a single problem – hence, the frequent need for operator intervention in the original setup, to override the original pattern of tests . . . and also the greater need for "midstream" interpolation,

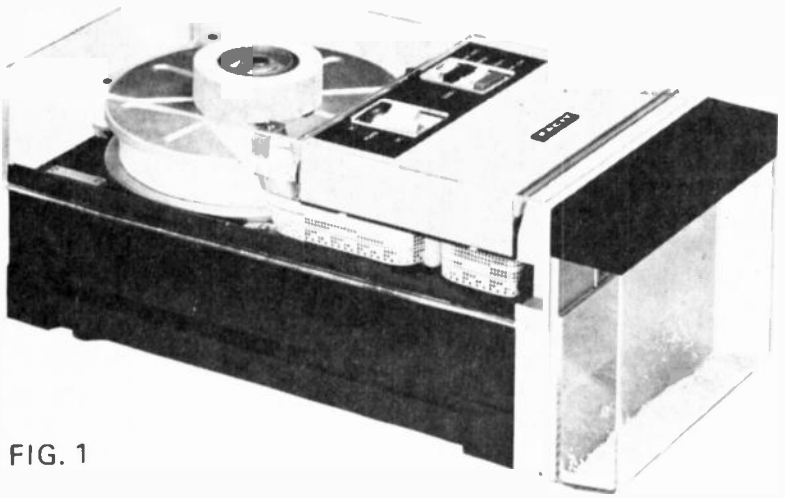
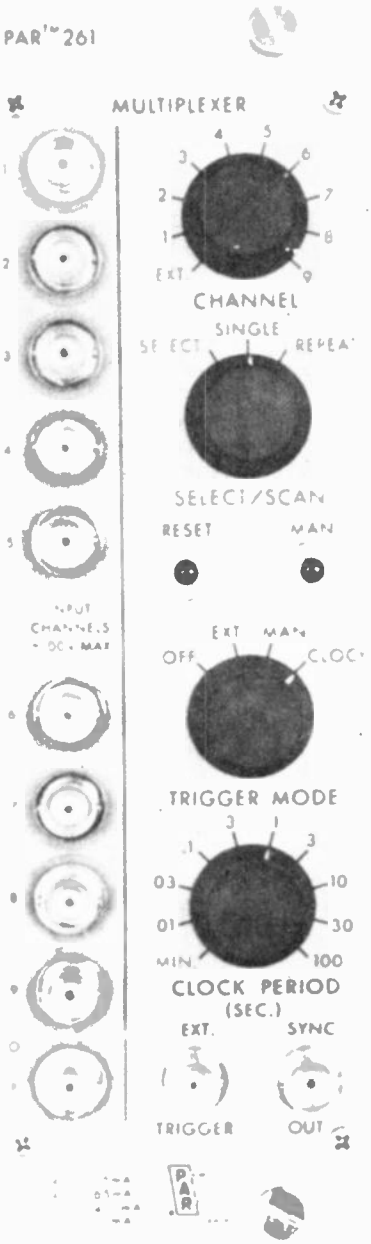


FIG. 1

This FACIT tape punch is used extensively in ELECTRONIC TODAY INTERNATIONAL'S own laboratories as an interface between our laboratory instrumentation and Honeywell time-sharing computer terminal.

Princeton Research's analogue multiplexer samples one to nine analogue channels sequentially, and/or repetitively and provides the resulting signal at an output connector. It also provides a two digit BCD output identifying the channel under observation.

This PAR Model 260 A/D convertor is specifically designed to operate as part of an instrument/computer interface system.



modification, and interpretation.

- The greater need to transfer the burden of computation to the computer — but (generally), with much shorter runs, fewer readings, and more data manipulation per reading.
- The less-restrictive time-vs-accuracy tradeoffs (eg, less need for fast settling time) — hence, more emphasis on the ability to accommodate more signal conditioning and greater range, and less emphasis on data rate.

By providing access to powerful numerical techniques for the solution of empirical and analytical problems, the high-speed, general-purpose digital computer has wrought far-reaching changes in both the scope and intensity of "experimental attack" that is used in laboratories throughout the scientific and engineering communities. Until quite recently, such computers were within the reach of only those few laboratories that enjoyed generous budgets. Only the largest and most complex problems could justify the expense associated with their use.

However, once a large general-purpose computer became available to a laboratory, it was discovered that its speed was so great that it became difficult to keep it busy. To make better use of the capacity and capability of such computers, time-sharing systems, in which many (often, one hundred or more) subscribers can use the computer on a virtually "simultaneous" basis have been developed to the point where they can make available the computational power of a large computer system to the requirements of the average laboratory engineer at relatively low cost. Indeed, the individual scientist or engineer can now enjoy liaison with a million dollar computer for an average charge of the order of $12.00 per hour.

A major obstacle that has hampered the more extensive application of time-shared computer systems in the development laboratory has been the

Computer-Interfaced Instrumentation in the Development Laboratory

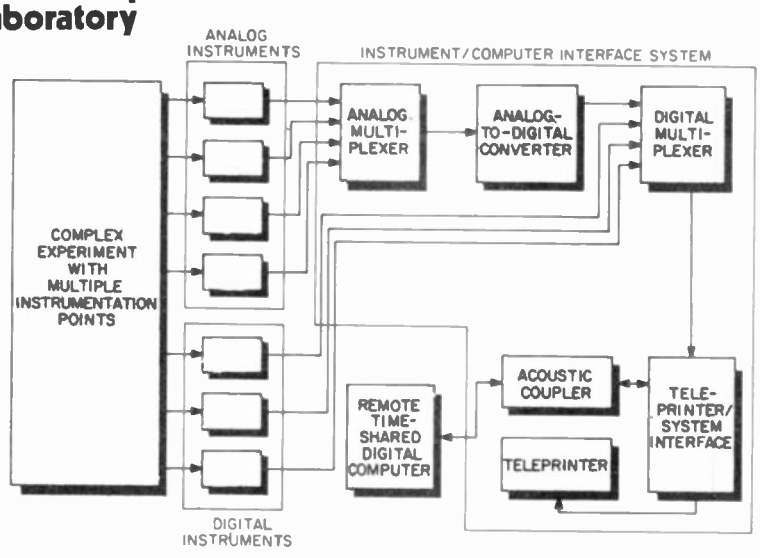


FIG. 2

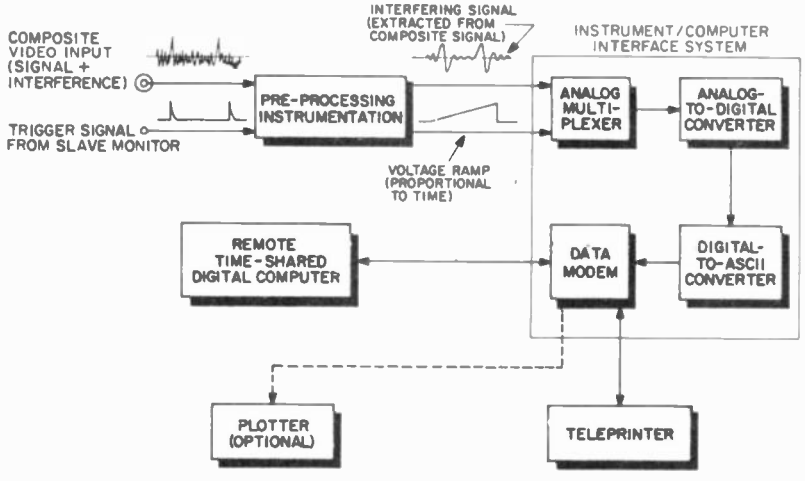


FIG. 3

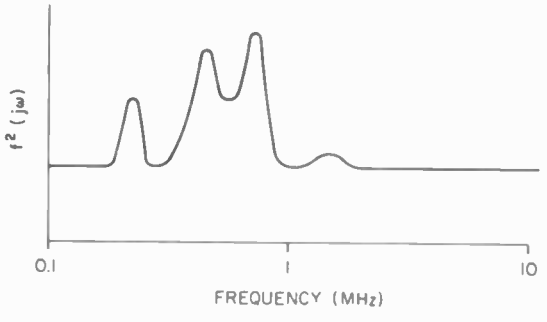


FIG. 4

Fig. 2. Simplified block diagram of a computer interface system. Fig. 3. Computer-aided instrumentation system that pre-processes information prior to its introduction into the computer. The particular setup shown is intended to determine the spectral characteristics of interference in the output of a video amplifier. Fig. 4. Typical Fourier transform of the interfering waveform, produced from data provided by the test setup of Fig. 3.

problem of transferring data between laboratory instrumentation and the computer. For this purpose, if the maximum benefits of the computer-laboratory liaison are to be realized, it is essential to avoid the slow and tedious task of measuring, recording, and entering data by means of which the effectiveness of ordinary laboratory instruments may be enhanced by literally "hanging a computer" on their inputs and outputs.

INSTRUMENT/COMPUTER INTERFACE

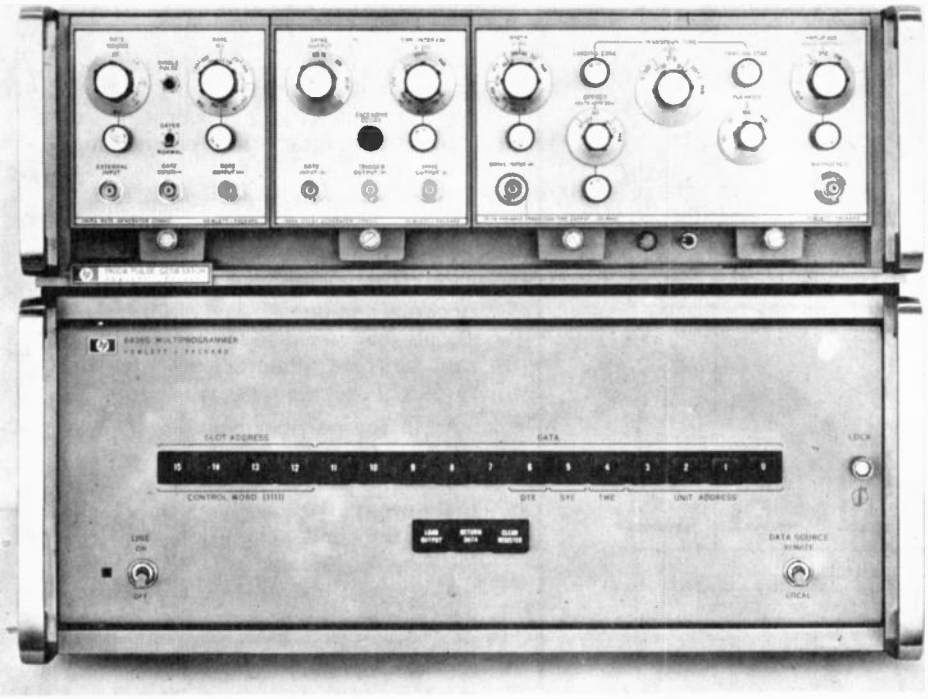
Instrument/computer interface systems, that are intended specifically to facilitate the efficient transfer of data between laboratory measurement instruments and a remote, time-shared computer, are now available commercially. A group of instruments, that comprise a typical instrument/computer interface system, intended specifically to accommodate the special requirements of the development laboratory, are shown in Fig. 1. This system facilitates the conversion of analogue and digital data into the now almost universal ASCII code. It also provides for the automatic sequencing and/or external addressing of each signal which may be in either analogue or digital form.

Figure 2 shows how the instruments are organized into the computer interface system. Analogue data are sampled by the analogue multiplexer, which employs nine double-switched reed-relay channels that are expandable in increments of nine. This module accepts as many as nine analogue inputs, samples each channel sequentially or selectively, and provides channel-number identification. Several modules may be connected in parallel to accommodate as many analogue channels as are required.

The analogue multiplexer output proceeds to an analogue-to-digital converter, that employs the dual-slope technique to produce a four-digit BCD output. The operator can select either 200-ms sampling with 0.01% accuracy, or 20-ms sampling with 0.1% accuracy.

The digital multiplexer accepts up to eight digital inputs, each of which may provide 5-digit BCD data. Several digital multiplexer modules may be operated in series to accommodate an unlimited number of digital inputs.

Either the digital multiplexer or the A-to-D converter may serve as inputs to the teleprinter/system interface. This module converts parallel input words (comprised of 5 BCD digits, exponent, polarity sign, and 2-digit channel-identification number) into serial form that may be fed to either a teleprinter, or to an acoustic coupler



Hewlett-Packard Model 1900A/6936S Programmable Pulse Generator interfaces easily to computer.

or data set for interconnection to a remote computer.

To illustrate how computer-aided measurements can be employed in the development laboratory, three examples of typical applications are described, and three additional applications are suggested.

ANALYSIS OF AN ARBITRARY WAVEFORM

Assume, for example, that in testing a video amplifier, which drives a display system under development, a "glitch" is observed in the amplifier's output waveform, and it is determined that the glitch is somehow correlated with the raster generator of a nearby TV monitor. The glitch is found to produce a characteristic series of "picket-fence" images on the screen of the primary monitor. Clearly, the interference is caused by the second slave monitor. However, before a good engineering solution can be devised to eliminate the interference, it is necessary to know the spectral characteristics of the interfering waveform.

The instrumentation to provide this information is shown in Fig. 3. The basic scheme consists of averaging the video signal over many repetitions, using the classic box-car-integration or gated-integrator technique. In this manner, a particular signal may be extracted from a composite waveform, since all non-coherent signals (i.e., not correlated with the interfering waveform) will average to zero. To recover the entire waveform, the observation point (aperture) is moved in time with respect to an arbitrary – but consistent – synchronizing trigger. This is the essential operating principle of many signal averagers and sampling oscilloscopes.

Note that the use of an instrument such as the boxcar integrator, which is the "pre-processing instrumentation" in Fig. 3, performs a great amount of pre-processing of the signal prior to its introduction into the computer system, thus obviating the requirement for ultra-high-speed multiplexers and A-to-D converters.

The "philosophy" involved in obtaining the desired spectral characteristics of the interfering waveform is simple. Two outputs are available from the pre-processing instrumentation: a voltage proportional to time, and a voltage proportional to the amplitude of the interfering signal. These voltages are sampled alternately (multiplexed), encoded into BCD, re-encoded into ASCII, and transmitted to the remote time-shared computer by means of a conventional teleprinter, modem, or terminal. The data are stored automatically in a file, and later recalled (in this example) by a Fortran programme which computes and plots the Fourier transform (power spectral density) of the interfering waveform, as shown in Fig. 4.

Once the spectral characteristics of the offending waveform have been defined, the solution to the problem in terms of the provision of effective shielding, circuit redesign, etc., may be approached in a rational manner.

TRANSISTOR PARAMETER MEASUREMENTS

It is sometimes necessary to characterize, in some detail, the behaviour of semiconductor devices under actual operating conditions. Frequently, however, the circuit designer must abandon the manufacturer's typical specifications, and determine his own design parameters, based upon a measurement scheme that approximates these conditions. Figure 5 illustrates a method whereby the testing of RF transistors may be

FIG. 5

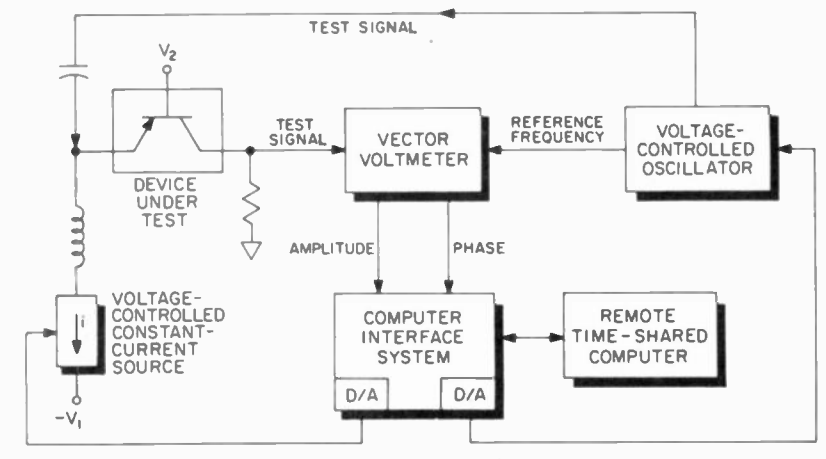


Fig. 5. Block diagram of a computer-aided system for the determination of transistor characteristics under actual operating conditions.

Computer-Interfaced Instrumentation in the Development Laboratory

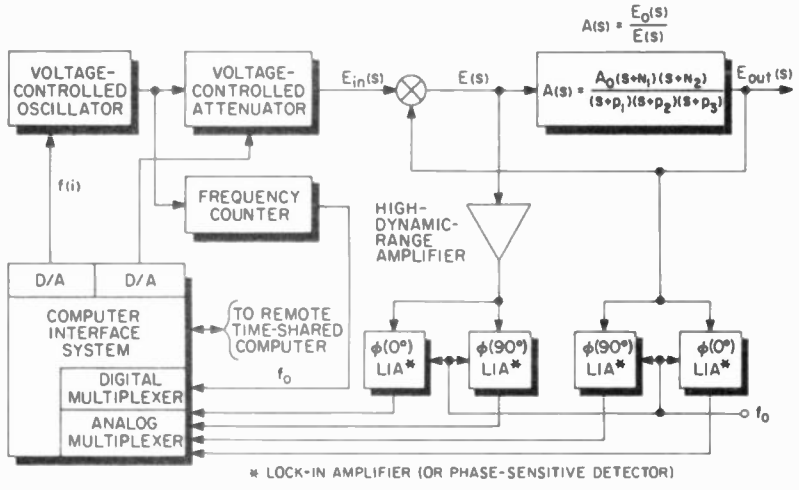


FIG. 6

Fig. 6. Block diagram of a system for the computer-aided determination of a linear circuit's transfer function.

automated by means of a time-shared computer to control the test frequency, temperature, bias levels, etc. The experimental requirements call for the measurement of gain, phase shift, and spot noise as functions of frequency, temperature and collector current. From these measurements, the device can be characterized in terms of the usual hybrid or scattering-matrix parameters, for use in a software programme involving computer-aided design.

A CW test signal is supplied to the transistor under test by a voltage-controlled oscillator, while collector current is controlled by means of a voltage-controlled current generator. Both test conditions are responsive to the analogue outputs of two D-to-A converters, located in the computer interface system. The D-to-A converters are special hardware-software-orientated subsystems that decode the serial information from the remote computer into digital data words. The software that controls these words is relatively simple, resembling those driver routines that are employed with conventional peripheral plotters.

The example presented here is simple, and may assume a variety of physical configurations. It should be noted, however, that the control is essentially open-loop. Although it is easy to construct a system in which the output of each controlled instrument is measured and verified, it is far simpler and faster to control instrumentation that provides the necessary inherent accuracy, thus obviating the need for careful feedback verification. Philosophically, this concept is somewhat analogous to the argument for pre-processing of measured data.

TRANSFER-FUNCTION APPROXIMATION

A classic circuit and systems problem is the characterization of a linear circuit or system in terms of its transfer function. The approach is usually semi-analytical, and the engineer is often forced to employ a graphical technique in which straight-line asymptotes are drawn, revised, etc. It is not unreasonable, therefore, to employ a remote, time-shared computer as the modern "graph paper."

Consider, for example, the problem of determining the open-loop transfer function of an amplifier or servo system that must operate in a closed-loop mode. For this purpose, one might devise a programme to perform a "survey" of amplitude and phase as functions of frequency, and then return to search for intermediate points, based on the strategy of finding those critical phase-shift changes that signal entry into a higher-frequency time constant, or into more interesting phase-change phenomena.

In the computer-aided system shown in Fig. 6, several lock-in amplifiers (phase-sensitive detectors) serve as excellent data pre-processors to produce in-phase and quadrature signals (converted to DC voltages) that can be read directly into the file system of the remote computer.

As in the previous example, D-to-A converters (alternatively, digital-to-digital converters) provide the means for varying the input frequency and amplitude to the instrument system. However, unlike the previous example, the reference frequency is monitored (by the frequency counter), and is therefore verified in order to close the loop completely.

OTHER APPLICATIONS

The significant applications of the time-shared computer in the R & D or measurement laboratory are virtually unlimited. Additional examples of such applications include:

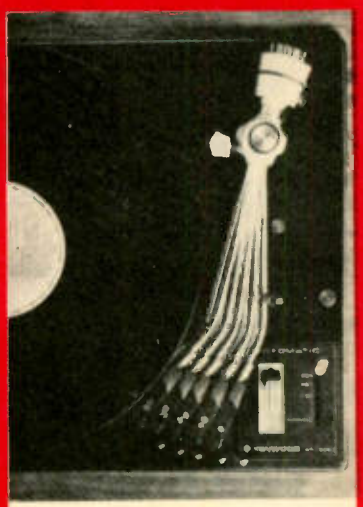
- *Multiple Decay Products.* A multi-exponential decay phenomenon is associated with the various lifetimes and relaxation effects of fluorescent systems. Assuming that each relaxation effect is a true exponential, one can calculate the logarithm of each time-correlated data point, and then let the computer find the resulting straightline asymptotes.

- *Low-Frequency Correlation Studies.* Many electromechanical devices, such as gyros and accelerometers, suffer not only from long-term drift, but also from internal noise arising in bearings, etc. One can record (off line) long-term stability measurements, and then calculate, by means of simple programmes, the statistical fluctuations and spectral characteristics of the recorded data.

- *Extended Measurements.* One can use the counters, scalers, sampling oscilloscopes, lock-in amplifiers, boxcar integrators, etc., that are available in his own or his neighbour's laboratory to increase the precision and accuracy of other basic instruments by determining their inherent errors, and storing the data. The time-shared computer can then take these systematic errors into account when performing calculations based upon data derived from these instruments. ●

You can tell the quality by the SOUND . . .
with fine crystal or with

KENWOOD
Stereo turntables



ALL AUTOMATIC OPERATION
— all you do with KP-3021 is switch on and press a button ... your records stay scratch-free and play better longer.

KP-3021 Automatic Stereo Turntable. All you do is switch on, with this 24-pole synchronous motor turntable. Everything is automatic! AUTO-PLAY . . . the arm leaves the rest and goes gently onto the disc. AUTO-RETURN . . . arm returns to rest and turntable stops. AUTO-REPEAT . . . arm returns to start and plays disc again. AUTO-CUT . . . if you want to stop playing arm rises and returns to rest. Two speeds — 33.1/3 and 45 r.p.m. wow and flutter less than 0.08%. Super sound in the Kenwood manner.

Also available — KP-4021 belt-idler double drive stereo turntable with 16-pole synchronous motor. High quality MM type cartridge with wide 20-20,000 Hz. KP-2021 belt drive stereo turntable with durable outer-rotor synchronous motor for vibration-free operations. Lateral balancer for best tone arm balance.

the sound approach to quality

KENWOOD

SYDNEY: 630 7400
ADELAIDE: 93 6117
PERTH: 28 5725
CANBERRA: 47 9010

JACOBY MITCHELL

MELBOURNE: 30 2491
BRISBANE: 44 4674
LAUNCESTON: 2-5322
NEWCASTLE: 61 4991

PORT KEMBLA: 4 2071

To: Jacoby, Mitchell & Co. Pty. Ltd.
P.O. Box 2009, North Parramatta, N.S.W. 2151
Please send me full details on Kenwood Stereo Turntables
☐ KP-3021 ☐ KP-4021 ☐ KP-2021
(tick models required) and location of nearest Kenwood Sound Centre.

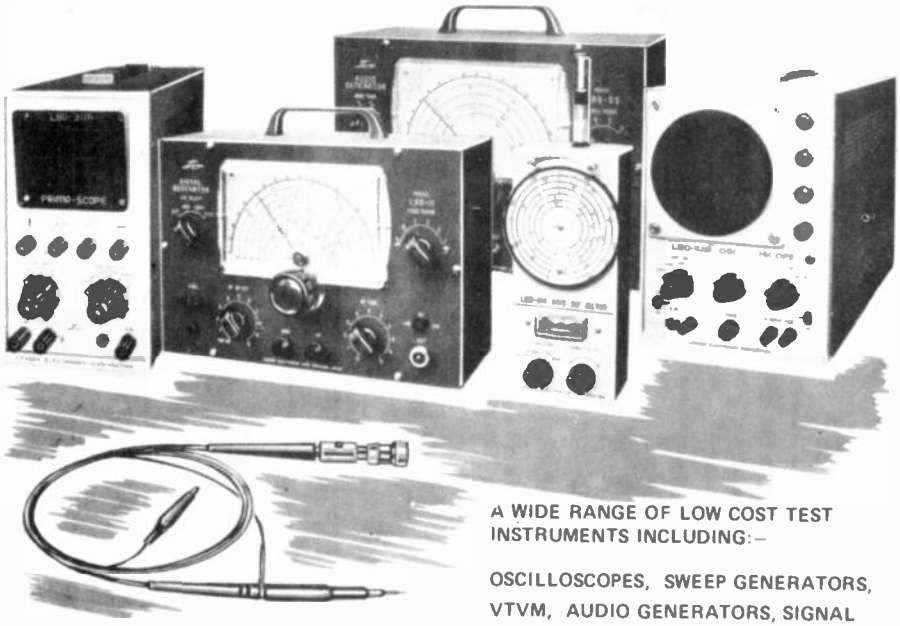
Name .....

Address .....

..... Postcode .....

JM/K — 7ET472

LEADER TEST INSTRUMENTS



A WIDE RANGE OF LOW COST TEST INSTRUMENTS INCLUDING:–

OSCILLOSCOPES, SWEEP GENERATORS, VTVM, AUDIO GENERATORS, SIGNAL GENERATORS, TRANSISTOR CHECKERS, ATTENUATORS, PROBES.

LSG-11 WIDE BAND SIGNAL GENERATOR

Probably the most popular low cost Signal Generator in the world. This signal generator has a useful frequency range from 120 kHz to 130 mHz and using an optional crystal, can be crystal controlled. Adjustable output modulation frequencies of 400 and 1000 kz can also be used for testing audio amplifiers.

* $45.00 + S. TAX

LAG-55 AUDIO GENERATOR

The LAG-55 is an indispensable instrument for audio work. Three different waveforms, (sine, square and complex) are available for a variety of tests. The wide frequency range from 20Hz to 2MHz and constant output levels are most desirable features of the LAG-55. Sine waves are generated with a Wien-bridge configuration and square waves by a Schmitt trigger circuit.

* $85.00 + S. TAX

LDM-810 GRID DIP METER

The well known Leader LDM-810 Grid Dip Meter is one of the more useful instruments for checking receivers, oscillators, transmitters and circuit components.
A frequency range from 2 to 250 MHz (in 6 bands) is available with an internal modulation frequency of 1 kHz.

* $45.00 + S. TAX

LBO-52B 5" OSCILLOSCOPE

The LBO-52B Oscilloscope has been designed for high performance operation wideband, DC to 10 MHz with a high sensitivity of 10 mV p to p makes it an invaluable tool in the development and testing of electronic circuits. It is especially useful in the examination of low level equipment such as tuners, IF amplifiers etc.

* $295.00 + S. TAX

LBO-31M 3" OSCILLOSCOPE

The LBO-31M is a compact oscilloscope designed for all round service. Its small and handy size will appeal to experimentors, servicemen and plant technicians who demand maximum performance with minimum space requirements. Responses from 3 Hz to 1 MHz and sensitivity is 80 mV/cm.

* $137.50 + S. TAX

LPB-10Z LOW CAPACITANCE PROBES

The LPB-10Z is a high impedance probe specially designed for Leader LBO-52B, LBO-55B, LBO-32B, LBO-33B Oscilloscopes. Its use prevents any disturbance to the circuit under test. Input impedance is 10 MΩ shunted by 18 pF and attenuation is 20 dB.

* $16.50 + S. TAX

CATALOGUES AVAILABLE ON REQUEST.

Distributed by:

WARBURTON FRANKI

* NOTE THAT THESE ARE SUGGESTED LIST PRICES ONLY AND MAY VARY SLIGHTLY IN SOME AREAS

AVAILABLE FROM LEADING ELECTRICAL SUPPLY HOUSES.

WF5101

THREE IN HAND

Keithley's new digital multimeter has the readout in unit with the probe.

In practically every branch of electronics or electrical engineering, there is a need to make quick, accurate measurements of voltage, resistance and current.

But as circuit assemblies become ever smaller, the need to locate a test probe onto a component, (or a thin track on a printed circuit board) whilst one looks at a meter some distance away — becomes increasingly tedious.

Keithley's new digital multimeter — designated type 167 Digital Multimeter — has resolved this problem by building a solid-state readout right into the unit's hand-held probe.

The unit measures dc voltage from 1mV to 1000V and ac voltage from 1mV to 500 volts. As an ohmeter the unit measures 1 ohm to 20 Megohms. Current measurements can be made with optional shunts.

To obtain a three digit readout small enough to be built into a hand-held probe, a custom designed, solid-state, gallium arsenide phosphide display module 0.4" x 0.2" x 0.75" long was fabricated. Apart from three full, seven segment digits it contains decimal points, overrange "1", minus sign, and function indicators.

Multiplexing the display has reduced the number of wires in the cable between the probe and battery pack. To display all the digital information would normally require 23 lines for the three digits plus over-range "1", with an additional four lines for decimal point, one line for polarity, four lines for function, and one common return line, making a total of 33. Multiplexing reduces the number of lines required to 12.

The multiplexing drives eight lines, containing the data for a single 7-segment digit, plus the decimal point associated with that digit. The overrange "1" in the display as well as the minus sign and four function indicators form another "7-segment" digit — although the digit is dismembered. The cathode for this dismembered digit, as well as those for the other three whole digits, is also controlled by the multiplexing circuitry. Thus, the cathode lines determine which digit will display the information contained on the data lines at any given instant.

The 167 has automatic ranging and polarity sensing. The ranging circuit is located on the LSI module (along with the digital circuitry) except for five discrete diodes which decode the ranging signals from the module. The use of FET type range switches simplified the circuitry since the gates of the FET's can be turned on directly by low-level signals from the LSI module.

An absolute-value amplifier on the input determines polarity and also reduces the number of components in the A-D converter. The absolute-value amplifier is an arrangement of op-amps that provides a positive voltage output — no matter what the polarity of the input. Polarity sensing is obtained by monitoring direction of conduction in one of the op-amp feedback loops. The amplifier also rectifies incoming ac signals to provide the 167 with its ac ranges.

Since the A-D converter only has to handle a single polarity, the number of components and the converter's complexity are reduced. The A-D converter consists of only one LSI module and two IC's and thus contributes to long battery life.

BATTERY OPERATION

By incorporating a highly efficient power regulator, the total power dissipated by the unit was kept small enough for battery operation to be used. Additionally, the unique power regulator of the unit required no warmup — merely turn-on. Thus, a "Push-to-Read" switch could be built into the probe and a user could obtain a meaningful measurement from a cold start in less than two seconds (that includes turn-on, ranging time, and settling time to rated accuracy on the final range).

The power from the batteries is transformed to +12, –5 volts by a highly efficient switching regulator.

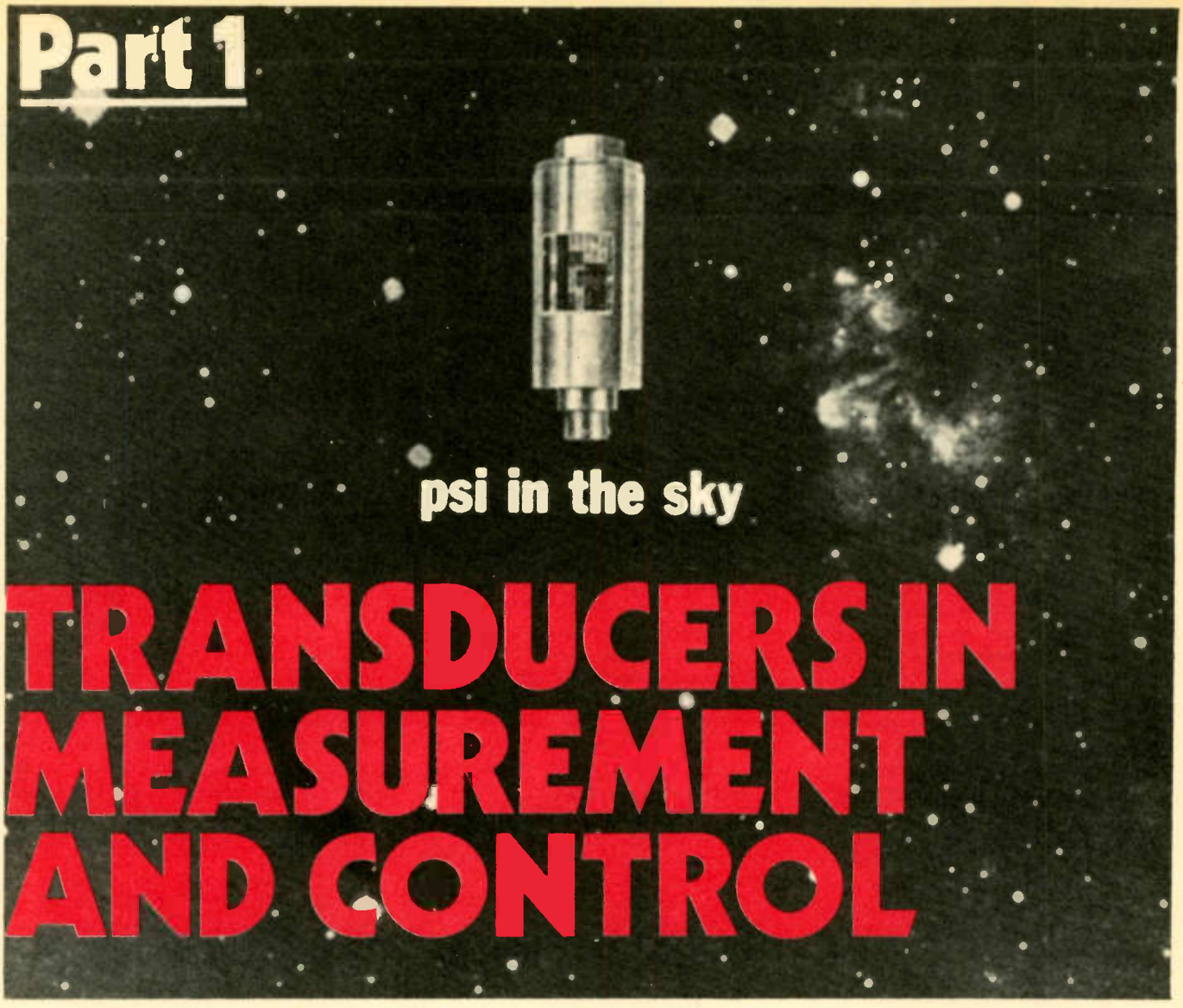
The output of the regulator is monitored to assure that sufficient energy to run the unit is available. When it is not — either because the batteries are too weak or the supply somehow gets shorted out — the regulator (and thus the instrument) turns off. Thus, excessive discharge of batteries is prevented. This extends the life of rechargeable batteries and prevents potentially destructive battery leakage.

LARGE SCALE INTEGRATION

Large scale integration is employed to minimize the number of discrete components and their required connections. A single LSI chip contains the digital section of the A-D converter, BCD counters, latches for the display, multiplexing circuitry, BCD to 7-segment converter, range counter, function decoder, overrange circuitry and timing circuitry. This one package contains the complete digital section of the instrument and replaces 55 TTL packages of MSI and SSI complexity.

The number of discrete components was minimized by use of thick film resistor networks which had the added advantage of providing excellent stability over wide temperature ranges. ●

Part 1



psi in the sky

TRANSDUCERS IN MEASUREMENT AND CONTROL

A series of articles by Peter Sydenham M.E., Ph.D., M. Inst. MC. Lecturer and consultant in instrumentation at the University of New England, Armidale.

A TRANSDUCER, is a device that converts (transduces) one physical variable into another. Transducers are not restricted to electrical signal conversion techniques, but in the main these predominate as electrical methods are universal, and provide a common interconnecting method for an engineering system or a scientific experiment.

This series will describe the proven practical methods (and this includes economic sense, as cost is important) now used to produce, in the main, electrical signals from the original physical effect to be measured.

Transducers provide convenient signals for measuring a process, for automatically recording these measurements when needed and, finally, for providing a signal that can be used to control. It is not possible to control without measuring and so the fundamental basis of automation is the transducer. The transducer is also able to provide gain by amplifying weak original signals before they are used. Application factors of a million are commonplace.

Often, more than one basic transducer principle is used to produce the required output. Units are cascaded. Consider the fuel gauge of a motor car, shown diagrammatically in Fig. 1. The first stage is known as the primary or input transducer, following are the secondary or intermediate stages and, finally, there is an output transducer.

In the fuel tank a float transduces the fuel level to an equivalent rotary motion. This drives a rotary potentiometer which provides a voltage proportional to the angle of rotation. Sometimes there is a calibration or adjustment stage in the chain. At the dashboard the voltage is turned back to a rotary displacement in the fuel gauge meter movement. The advantage of the electrical signal is that it avoids the need for a complicated mechanical linkage between the fuel level and the gauge. In a control application an electrical measurement output signal also enables in-line correction, compensation and computation to be made before the signal is used. Recording is also made most easily with electrical plotters.

In principle, a transducer is a simple device. In practice, however, simple schemes invariably suffer from defects that limit the ability of the device to provide repeatible and accurate values.

They may suffer from wear as time proceeds: environmental factors such as temperature, pressure, humidity and shock for instance, may be a significant problem. Consequently, at first sight, the developed transducer system usually appears quite complicated. But if treated systematically, it can be broken up into separate sub-systems that perform distinctly different tasks, each being joined to produce a satisfactorily reliable and accurate device.

A list of all the different transducers yet devised would be never ending, for the basic physical effects that could be used is beyond complete classification. Each may be used for many different purposes. For example, a light spot moving across a photo-cell can be used to measure position, alternatively, the movement might be used to change the sound level of a radio receiver by varying the voltage applied to the receiver output stage.

Nevertheless some transducers have emerged that are well developed for specific tasks. Thus a brief list can be made of primary devices, and those quantities measureable by the use of intermediate stages.

Linear Movement: From this are also derived thickness, velocity, acceleration, force, wear, vibration, hardness, stress, strain, pressure, gravity, magnetic field, level and position, by the use of secondary devices.

Angular Movement: Angular vibration, tilt, torque, position are obtained with angular transducers.

Temperature: Flow, turbulence, heat conductivity, remote sensing and displacement can be obtained by use of this basic measurement.

Illumination: Length, force, strain, torque, frequency, and light distribution have been measured using illumination.

Time: Speed, counting, frequency and position rely on time measurement.

Force: Weight, density, stress, torque and viscosity use force indirectly.

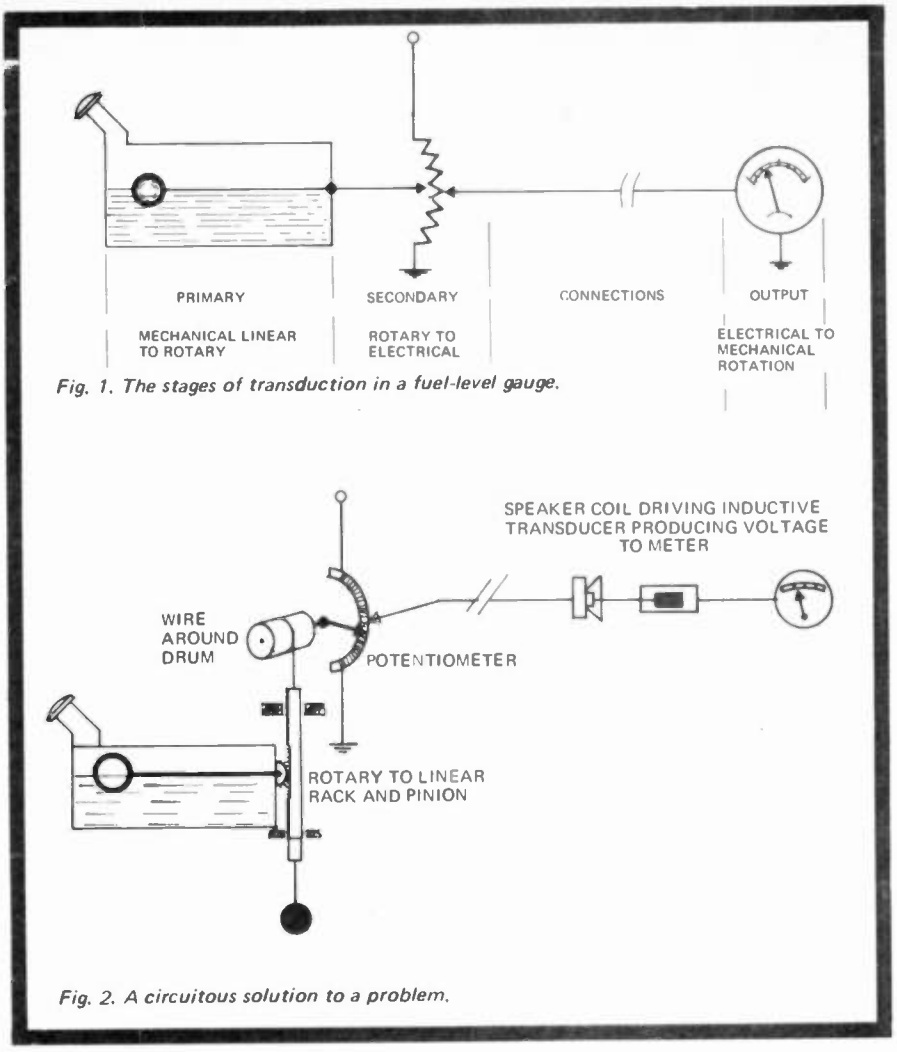


Fig. 1. The stages of transduction in a fuel-level gauge.

Fig. 2. A circuitous solution to a problem.

It is many years since James Watt thought of using the speed indicator of an early steam engine automatically to control its speed, and so producing what was probably the world's first industrial feedback control system.

In that case, a centrifugal governor was used to change the difficult-to-detect shaft speed into an equivalent mechanical displacement. It was, in fact, what is now called a transducer.

Since the time of the industrial revolution, machines and processes have developed at an ever quickening rate and the need to convert difficult-to-use effects into alternative physical forms has grown rapidly.

Late in the 19th. century, electricity became available to industry and science. Then the electronic discipline emerged. Electronic techniques, allied with those of mechanical, optical, thermal and acoustic origin — the list is never-ending — enabled a vast array of transducers to be developed to fulfil the needs of sophisticated measurement and control.

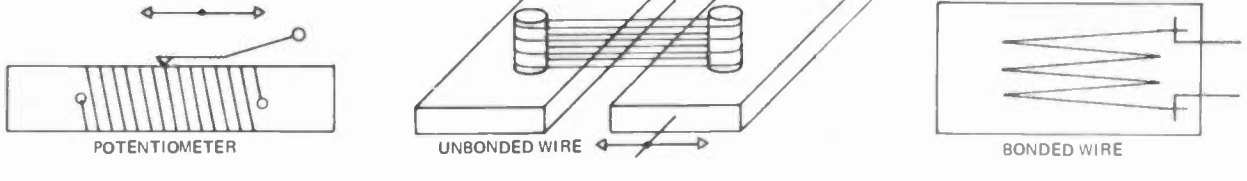


Fig. 3. Resistive displacement principles

Fig. 4. A linear wire wound displacement transducer having 25μm resolution.

This list is not complete but it does illustrate the variety of possibilities open to the designer. A problem can be solved by circuitous means (Figure 2 is a fuel gauge arrangement with redundant use of transducers) but economic and reliability factors decide which way is acceptable in reality.

Transducers may provide the transduction in one of two basic ways. It may, firstly, control the available source of energy as a tap lets water through or a variable resistance controls the current flow from the power source in a circuit. Secondly, the transducer may actually convert the original energy form into another more appropriate form. An example is the use of a photo-voltaic cell in which light radiation energy generates electrical energy. Transducers may also provide mechanical energy from the available electrical source as happens in the moving coil loudspeaker.

An interesting fact is that the dynamic and static behaviour of mechanical, acoustic and electrical systems are each described by similar mathematical equations. This analogy, as it is called, enables the behaviour of large machines to be simulated by inexpensive electrical networks. For example, the internal-combustion engine can be simply represented by a resistor and a capacitor at speeds above idling. So for research purposes, once the value of R and C are determined, it is possible to study the performance of that engine in a computer.

Some transducer applications need only a slow speed static response but often the need is for rapid conversion. The frequency response is, therefore, of interest. Mechanical systems are generally incapable of the same high speeds obtainable in electrical devices. For this reason there is a trend toward total electronic technique if possible. This is not always a prudent way to solve the problem as many mechanical devices have been extensively developed to provide reliabilities of years (or millions of operations). A simple example is the choice made when several independent circuits have to be switched together. A bank of reed-relays is inexpensive, simple to design and capable of excessive overloads. A solid-state equivalent circuit is more expensive to develop and more prone to overloads. Each case should be considered on its merits.

Several terms, commonly used in measurement are often misunderstood and misused. The first is the **repeatibility** of measurement. If repeated measurements are made of a static process by an instrument with sufficient sensitivity there will be a **scatter** of the values around some mean value. This scatter represents the uncertainty of the measuring process used. The most commonly used method of expressing this scatter is by what is known as the standard deviation (σ). This is found by a simple statistical mathematical formula. The important thing to realise is that there is a 68% chance of the true value lying between plus and minus 1 σ. For example, if a voltage is measured 100 times and its mean value found to be 100V with a standard deviation of 2 volts this means that 68 times it will lie between 98 and 102 volts and 32 times it will be outside these limits. In practice, one-σ limits are not tight enough. For $\pm 2\sigma$ limits it is 95 times out of 100 and for $\pm 3\sigma$ limits 99.7 out of 100 times within. Repeatibility is the first requirement of a transducer for without it accuracy has no meaning. (The standard deviation of any transducer or precision measuring instrument is almost always quoted by the manufacturer.)

The **resolution** of a measuring instrument is the smallest quantity that it can detect. But to have extreme resolution does not imply that it will repeat each time nor be accurate. A screw-thread micrometer could have a drum of enormous diameter enabling extremely small distances to be gauged, but the screw friction and error would produce scatter and inaccuracy.

Precision is the term used to describe how well the instrument measures and gives a reliable value. The smallness of the standard deviation, therefore, is a measure of precision.

Accuracy is the most difficult factor to obtain. An instrument may be precise, always giving the same value, but to be accurate, that value must be true to the established standards. For example, a voltmeter may indicate

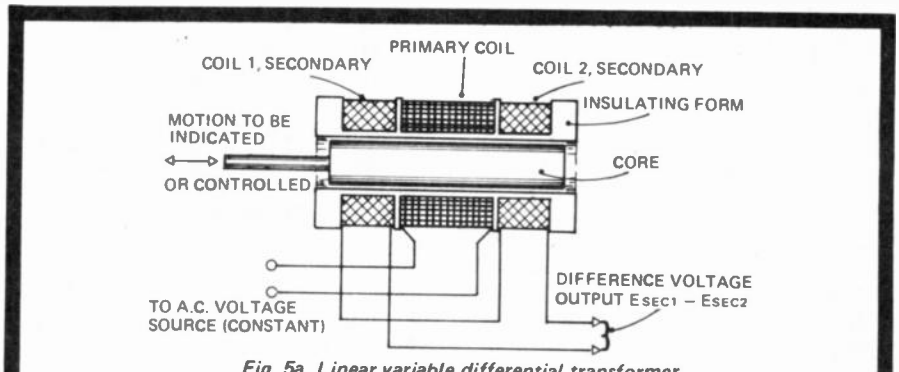


Fig. 5a. Linear variable differential transformer.

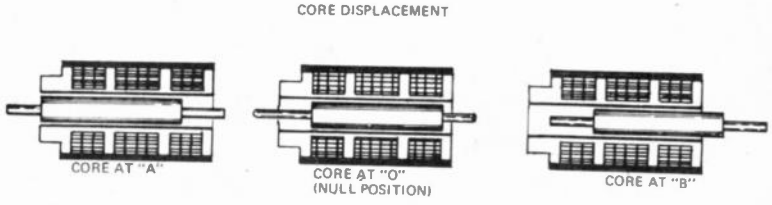


Fig. 5b. This shows the core of the l.v.d.t. in three different positions.

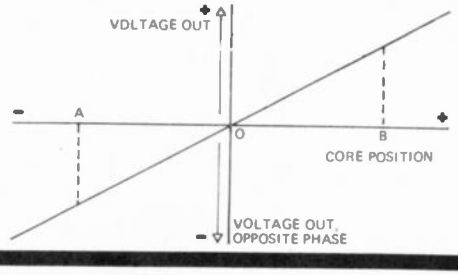


Fig. 5c. Output voltage of l.v.d.t. with core in positions shown in Fig. 5b. above.

There's stereo and stereo.

Once upon a time there was only one way to hear stereo.

One forward facing speaker poured sound into one ear. And one forward facing speaker poured sound into the other ear.

To hear anything resembling balanced stereo, you had to sit at the apex of the critical sound paths. And you had to sit still. All of which struck Stig Carlsson of Stockholm University as decidedly unsatisfactory.

So after years of research he created the Carlsson omnidirectional speaker.

It works like this.

The sound is projected out of the top of the speakers.

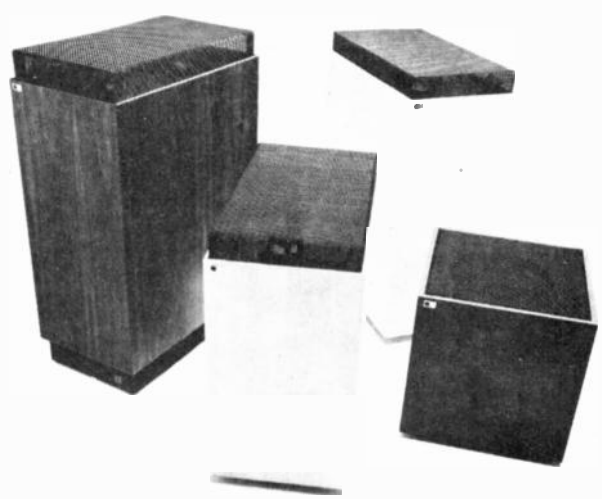
And then moves outwards in all directions —it bounces round the room like a ball in a squash court.

Until it reaches your ears. Just like in real life. The effect is quite staggeringly different.

Just how different we want you to judge for yourself.

By going to your nearest Sonab dealer.

Phone or write to us—and we'll give you his address. And send you some free literature, too.



Sonab

Sonab of Sweden Pty. Ltd., 114 Walker Street, North Sydney, N.S.W. 2060
Telephone: 929 4288/4554

TRANSDUCERS IN MEASUREMENT AND CONTROL

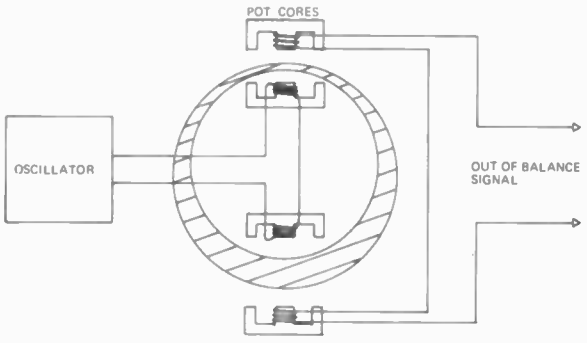


Fig. 6. A differential arrangement using two variable reluctance transducers for monitoring tube eccentricity.

10.1 volts repeatedly but if the pointer is bent or the multiplier resistor incorrect, the actual voltage may be only 9.5. There is no way of establishing accuracy without resorting to another measurement device. Often, accuracy is added to a precision instrument by resorting to calibration. In transducer application, this must usually be automatic, or built in to the device, as a human link is undesirable.

So much for a general basis of transducer technology. The series now continues by discussing various measurements in turn. We start with the methods used to transduce displacements.

This initial article deals with small displacement transducers ranging in capability from a few millimetres down to hundredths of the diameter of atoms. These devices are particularly useful in obtaining derived quantities as well as direct measurements (as will be seen later). The second article in the series discusses the industrial displacement range, that is, from millimetres to several metres, and then the surveying range from hundreds of metres to the size of the Earth and larger.

MICRODISPLACEMENT TRANSDUCERS

Displacement is measured directly with resistive, inductive and capactive methods and, indirectly, by optical means.

Resistive: The simplest way to transduce movement into electrical signals is mechanically to vary the properties of a resistance. This can be realised by direct mechanical movement of the tapping point, as in a potentiometer, or by straining the resistance element, as in a strain gauge, (Fig. 3).

Potentiometers, whether linear or rotary, consist of a resistance track upon which slides a contact wiper. The earliest precision potentiometers used fine resistance-wire wound around a toroidal former. As the wiper moved over the turns, the output changed abruptly and this limited the resolution. A modern type linear potentiometer is shown in Fig. 4, infinite resolution has been obtained by using a continuous slider running longitudinally along the wire (it may also be obtained by the use of composite-material track). Repeatibility is limited by the precision of the wiper contact position and slight variations in electrical contact. Due to relatively poor repeatibility and reliability, and because of the high operating force, it is unusual for a resistance potentiometer of this type to be used for applications where high resolution is required.

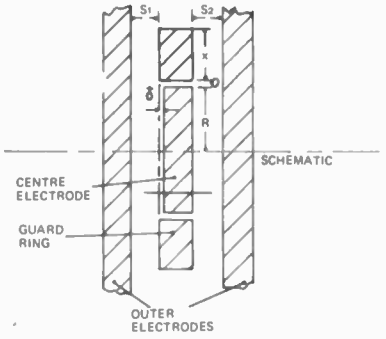
An unusual type of resistance potentiometer is that whereby a tightly coiled tension spring is stretched to open the coils and increase the resistance. The required displacement-output signal characteristic is determined by the method of hard-coiling the spring.

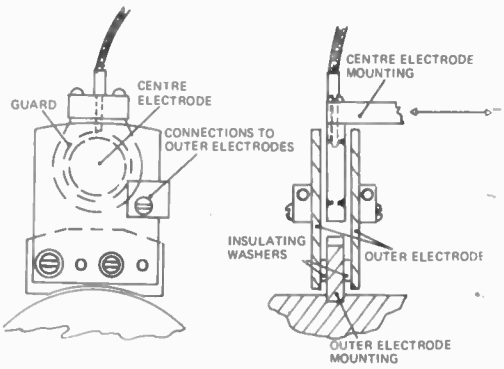
The sensitivity of resistive methods is limited by the allowable self-heating of the element, for temperature changes alter the resistance value.

Strain gauges are resistances that are strained bodily so as to alter their physical cross-section and length. Resistive types are made as wire, or stamped foils of thickness around 20μm, and are arranged to obtain multiple elongations connected in series. Adhesives are used to attach the gauge to the member to be measured. This ensures faithful movement with the parent. Typical resistance values range from 10 to 10,000 ohms. Self heating and temperature effects limit the sensitivity of these devices but absence of mechanical moving contacts enables resolutions of better than 1 microstrain to be obtained.

The ratio of strain to proportionate resistance change is termed the gauge factor. This is usually quoted by the manufacturer. For linear resistance gauges it is close to 2.0. Calibration is necessary for precision work.

Wheatstone bridges, of simple and advanced form, are used to measure the resistance changes of both potentiometers and strain gauges. To compensate for temperature, a dummy resistance is used in one arm of the bridge.





Differential parallel plate capacitance transducer developed at the National Standards Laboratory, Sydney.

The main advantage of resistive strain gauges is their extremely small size, ranging from 2mm upwards. Frequency response exceeds 50MHz for special, surface deposited types.

Solid-state strain gauges are also available. If a semiconductor element such as silicon is strained, it also shows a change in resistance. Their gauge factor is not constant but depends upon instantaneous strain magnitude and temperature. Gauge factors of 100 are typical.

The main disadvantage of resistive strain gauges is their fragility, and this requires them to be mounted on a more substantial element. For fixed applications, it is practicable to mount the gauge between the two moving members in what is known as an unbonded arrangement.

Strain gauges are used extensively in civil and mechanical engineering testing. Gauges are glued to the structure in many places. A data-logger reads each in turn recording the strain at that time. This data is then processed to produce the required information.

Inductive: Electromagnetic and electrostatic fields can be utilised for

displacement sensing, each having practical advantages. Alternating current excitation can be employed and dissipative circuit elements are kept to a minimum (factors which enhance sensitivity and reduce drift). Inductive methods use, in the main, either the linear variable differential transformer (l.d.v.t.) principle, or operate on a reluctance variation concept.

The l.v.d.t. consists of a spatially centre-tapped solenoid in which moves a magnetically-hard steel core, (Fig. 5). The coil is energised either by a separate primary coil or by direct connection across the winding. As the core moves relative to the winding the flux-linkages cutting each half of the winding vary, resulting in amplitude unbalance between the halves. The degree of unbalance is linearly related to the core's displacement from the coil centre.

One method of sensing the unbalance is to connect the sensing coils in opposition and measure the output voltage. It is necessary, however, in this simple method, to determine the phase relationship between the excitation and output in order to decide the sign of the displacement. A superior technique uses a phase-sensitive detector, the output then being a bi-polar dc voltage which is linear with displacement.

Linear variable differential transformers are used extensively in industry in weighing machines, pressure transducers and load cells; and in science in earth strain-meters, tilt meters and seismometers. A major manufacturer offers over 2000 different models. In these applications resolution required is rarely less than 5μm.

The principle is also used in some industrial dimensional metrology gauging heads where 100nm is the best resolution needed.

The core and winding are mounted to avoid mechanical contact, but perpendicular movement to the core's axis is not possible. Axial core travel can be over very large distances and the zero position can be set electronically at any point along the length of the winding. Humidity, even liquids, do not affect the operation. Magnetic shielding is used to isolate the winding from external fields.

The other main inductance technique employed is known as the reluctance transducer. If the air-gap of a magnetic circuit is varied, the magnetic circuit reluctance changes. As the majority of the circuit reluctance is produced across the air-gap the response is reasonably linear. In practice the iron circuit can be made from a pot-core as shown in the tube gauge (Fig. 6). This contains the sensing coil and a freely moving limb which completes the circuit. The device is directly energised and may be sensed by similar methods to l.d.v.t.'s. A differential arrangement is often used to balance the effects of temperature and stray fields.

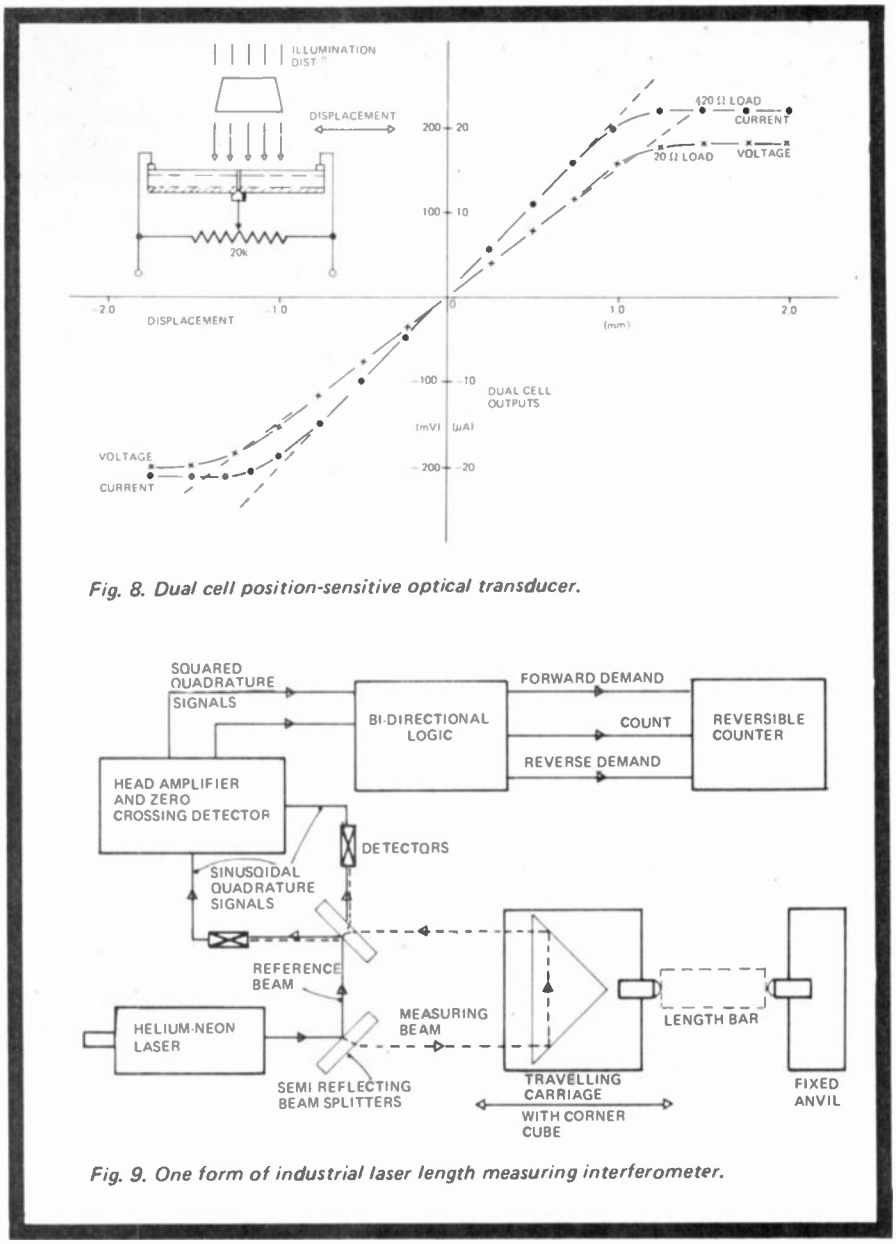


Fig. 8. Dual cell position-sensitive optical transducer.

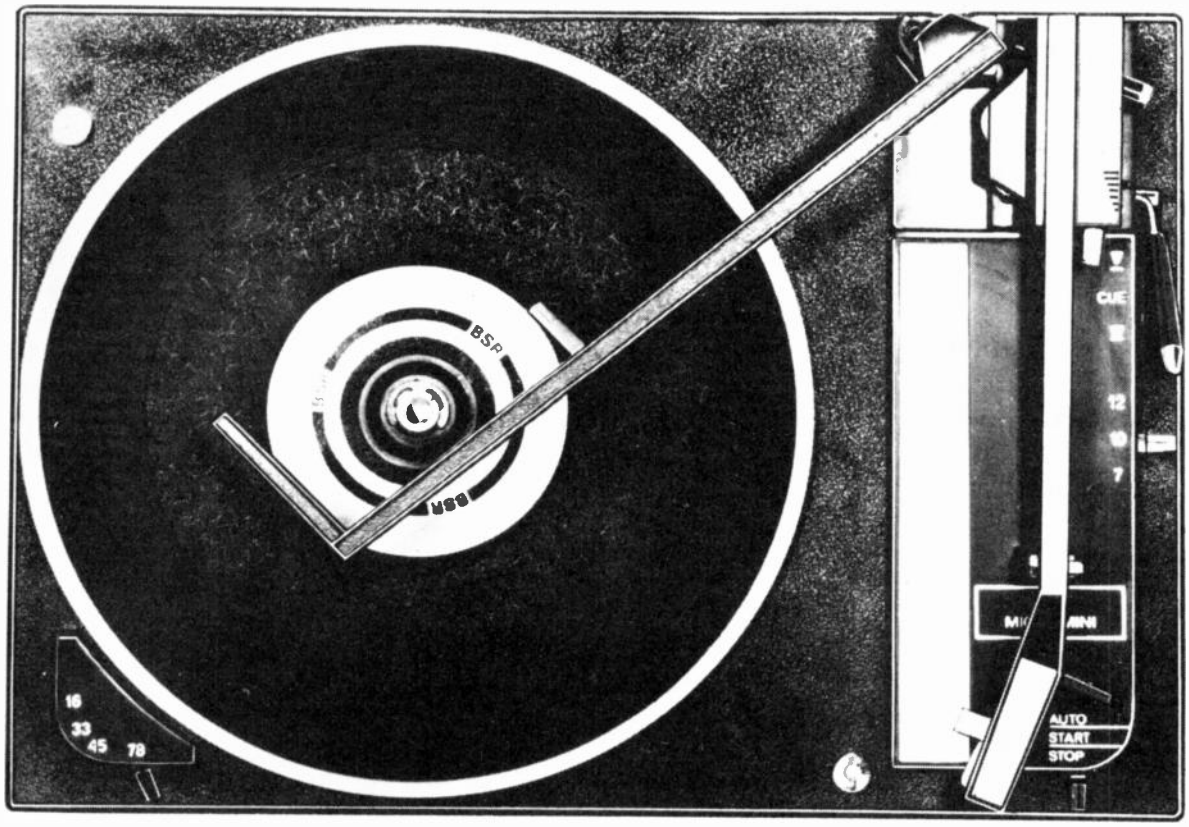
Fig. 9. One form of industrial laser length measuring interferometer.

Reluctance transducers have been employed for measuring tube eccentricity, as shown for measuring dynamic lubricant film thicknesses, and in pressure gauges. Current research on a borehole tilt meter at the Australian National University uses a reluctance technique to sense the pendulum movements. Sensitivities of these small range inductive methods can be as high as 200mV/μm. Frequency response is limited by the excitation frequency used (10-10kHz) and mechanical factors.

Capacitive: The most favoured extreme precision sensing method is known as capacitance micrometry. In its simplest form it consists of measuring the capacitance changes resulting as the separation between two plates of a capacitor is varied. As capacitance is inversely proportional to gap distance, the displacement/output characteristic is a non-linear hyperbolic. A guardring is used to control fringing of the electrostatic field existing between the plates and to reduce the effect of lead strays which shunt the small variable-capacitance limiting the attainable sensitivity. Linearization has been achieved in one manufactured gauge by placing the sensing capacitance in the feedback of an operational amplifier.

The magnitude of the sensing capacitance is only a few picofarads. Reactive bridges can sense to 10^{5} pF, or a little better, using tap changing inductive transformers. As the capacitance value is proportional to plate area and inversely to separation,

maxi-featured micro-mini changer BSR-C124



It's just 11 7/8" x 8 3/8" — just twice as big as this illustration.

Technical data:

capacity	*six 7", 10" or 12" records.*
speeds	*78, 45, 33 and 16 rpm.*
power	*standard unit suitable for 240v, 50 cycle mains supply.*
wow	*below 0.35% rms.*
flutter	*below 0.08% rms (Gaumont — Kalee meter).*
finish	*satin black mainplate with black turntable mat and brushed aluminium centre disc. Combination of black and silver on pick-up arm and control panel.*

This is a little beauty. The smallest record changer ever produced by BSR. The C124. It's small in size and small in price. Weighs only 3 3/4 lbs. It's 11 7/8" long, 8 3/8" wide and 4 11/16" deep. It has maxi features normally found only on larger decks, including a cueing device, fixed balance weight and an automatic arm lock. A visual indicator shows stylus pressure at a glance. Elegant and slim, the C124 pick-up arm incorporates the new exclusive SC7M cartridge, ceramic stereo cartridge which tracks at 2 grammes minimum. Single play is facilitated by the diecast control arm which swings to the back of the deck.

The BSR C124 small, light, portable, inexpensive, precision crafted — maxi featured.

BSR

BSR A'asia Pty Ltd Southern Section Industrial Estate
St Marys New South Wales Telephones 623 0375 and 623 0376

Wholesale Distributors **Goldring Engineering (A'asia) Pty Ltd**

- ☐ **New South Wales** 26 Ricketty Street Mascot 2020 Telephone 67 6088
- ☐ **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
- ☐ **New Zealand** G P O Box 2630 Auckland

BSR:P113©

TRANSDUCERS IN MEASUREMENT AND CONTROL

Fig. 10. Testing the corrosion thickness of a pipe with an ultrasonic gauge.

highest sensitivities result for largest plate sizes and smallest gaps.

Practical considerations of plate flatness and degree of parallelity limit the gap size to around 100nm or more. Plate diameters in use range from millimetres to centimetres. In most applications the sensitivity of the method to stray capacitance is reduced by using a differential capacitance mechanical layout. A central plate moves between two fixed sensing electrodes, the plate being earthed. Any temperature effects and air dielectric changes occur equally in each arm of the arrangement. If sensed by a bridge circuit, these effects are largely cancelled. A unit developed at the National Standards Laboratory in Sydney is shown in Figure 7.

Capacitance gauges have been used in geophysical instruments such as gravimeters, tilt meters and strain meters. They are also used in industrial gauging and machine tool control.

Optical: Mechanical displacements of interest can be converted into movements of a light beam which can then be sensed with a position-sensitive optical detector. Rotations can be magnified using an optical-lever if space permits.

In simple arrangement, the radiation beam is either split into halves, each half feeding a separate photocell or alternatively, the beam may impinge directly onto a photo-device with position-sensitive characteristics. In each case a differential bridge arrangement is usually incorporated giving zero output if the beam is truly centred. This null position can be conveniently displaced by electrical means.

In brief, static arrangements use position-sensitive photo cells or passive optico-mechanical arrangements (beam splitting mirrors, prisms) and dynamic methods use optico-mechanical devices (rotating prisms and wedges, vibrating apertures) or electrodynamic devices (image dissector tubes, magneto-optical and wavefront shearing).

Numerous possibilities exist, but for simplicity and cheapness, solid-state position-sensitive photo-cells will usually be the first choice considered. The simplest method uses two (or four for 2 axis measurement) silicon solar cells, about 10mm square, which are mounted adjacent to each other. This is illustrated in Figure 8. A rectangular light spot is traversed across the junction. If central, each produces an equal signal which cancel if they are differentially-connected; this is the null position. Displacement from the null gives a proportional output until the spot moves entirely onto a single cell where a saturated displacement characteristic occurs.

In 1957 a lateral-effect position-sensitive photocell was reported in which the output is logarithmically related to the spot displacement as it moves between two ohmic contacts made on the junction surface. Extensive research was concentrated on these cells for tracking of military targets such as the plume of a missile.

A third form of position sensitive cell uses the light-spot as a contact 'wiper'. Its effectivity shorts a low-impedance, via a photo conductive strip, to a position along a high-impedance potentiometer track.

In most of these optical position-sensing methods it is paramount that the beam intensity remains constant as output away from the null (at the null point intensity is less important) is proportional to the luminous flux falling on the cells. This in turn, is decided by the total beam flux and its distribution.

Another way to detect position is to have an array of photo-diodes, interrogating them to find the position of a spot or a pattern illuminating them. Arrays containing 2500 diodes have been made.

These optical methods can detect movements perpendicular to the beam's axis. Interferometry can detect movements along the axis to extreme precision.

If a coherent radiation source is split into two paths, each being optically mixed upon return from reflectors, the position of the interference fringes resulting is a direct measure of length differences between the two arms. If one arm is fixed as a reference length, displacements in the other arm can be measured by monitoring the fringe movements. A unit developed in Britain is shown in Figure 9. Suitable radiation wavelengths range from millimetres to micrometres, so in most cases the monitoring task involves whole fringe counting and then fringe width subdivision or interpolation. The shortest practical wavelength is around 500nm, which in the simplest interferometer accounts for 250nm displacement of the measuring arm.

One well-used method of interpolation is to produce two signals from the fringes which are 90° spatially separated. Digital operation on these dc coupled signals will yield a divide by 4 factor. This technique was developed simultaneously in 1953 for interpolation in an interferometer and in Moire grating use for industrial control by Ferranti. A number of totally electric methods have been devised to obtain improved resolution from dc quadrature-phase signals. These include mechanically activated sine and cosine potentiometers driven to balance, use of resistance networks to produce a set of different phase triangular signals which can be divided by trigger levels and super-position of the signals on to an ac carrier which then enable phase-sensitive detection to be used. At the best, however, only 1% precision can be retained.

Another way to interpolate the fringes is to drive the return mirror so as to maintain the fringe in a constant position. This method has been used in the University of Cambridge laser earth strain meter. In all cases of fringe monitoring, however, it is possible for optical and electronic noise to displace the fringe too rapidly for the system to record, thus losing or gaining an integral number of error counts.

Laser interferometers are used in industry for the exacting calibration of jig boring mills and the like. With the industrial units, the effects of the air (that is the change in temperature, humidity and pressure) limit the precision to around 1 part in a million. This is improved by feeding back data on the conditions using appropriate transducers. In some applications, notably earth strain interferometers, the complete system is contained in an evacuated tube to avoid these errors. In such cases, precision of around 1 part in 10,000 million are realised if the wavelength of the laser is stabilised.

Miscellaneous:

The above are the most popular methods for sensing small displacements. There are many other

ways to solve the problem and each has its particular attributes which make them suited to special applications. Here are just a few.

Radiation Gauging – Here a source of short wavelength radiation (α, β and γ) is located on one side of the (thin) material to be measured. The degree of absorption, measured by a radiation counting detector on the other side, is a measure of thickness. A number of variations exist on this, for example, shuttered absorbers are used to measure axial displacement in turbines and one-side gauges have application in continuous thin plastic-film measurement. The measurement precision depends upon radiation count integration so accuracy is increased by averaging the count over a longer period.

Ultrasonic Gauging – If the velocity of propagation is known, the transit time of an acoustic wave within a material is a measure of thickness. Sound waves travel at about 300m/sec in air, 1500 m/sec in water and 5000m/sec in metals. This principle has been used for small distance gauging. The slower velocity of acoustic waves, compared with electro-magnetic radiation, enables finer resolution to be obtained for a given technological limit on transit time measurement. An extensive study of an ultrasonic micrometer has been made at the Atomic Energy Research Establishment in Britain where they have developed units that resolve to 2μm. Ultrasonics have been successfully employed for engineering component thickness measurement, corrosion thickness measurement in pipes, (see Fig. 10), and for medical applications in which foreign objects are located, growths discovered and probes guided.

Laser Beam Diffraction – Coherent radiation diffracts around a small object to produce an interference pattern beyond it. This has been used to gauge wire size diameters down to 10 m. The position of the chosen diffraction fringe, (best produced by a laser source) can be monitored by a position sensitive photocell to enhance the resolution. This method is capable of size measurement at very high speed.

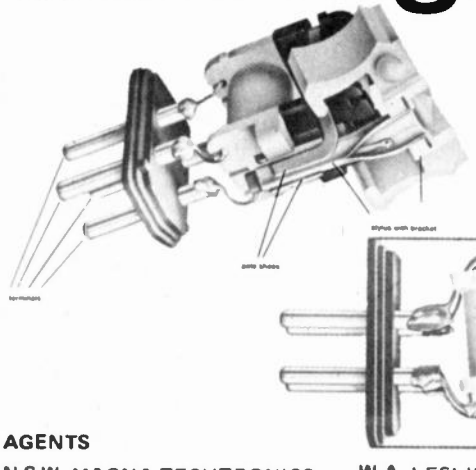
Sub-millimetre Waves – In many applications of interferometry the wavelength of the source is too short compared with the surface finish to be gauged against, and a mirror must be added. The National Physical Laboratory in England have developed an interferometer using submillimetre waves of wavelength 50-1000μm. Their device has been called the Teramet. It can measure to normal tight engineering tolerances (2μm) but needs no specially-provided reflector as in laser interferometry.

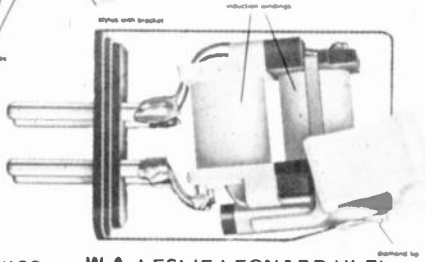
Other lesser known techniques include vibrating-wire strain gauges in which the tension of a continuously vibrated wire is varied. (The resonance frequency is then a measure of length change causing the tension change); piezo-electric crystals in which a force (accompanied by very small proportionate compression or extension) produces an electric charge flow which can be calibrated as displacement; pressure sensitive paints and semiconductors that exhibit resistance changes as they are deformed mechanically; and the use of a television pick up tube (usually the vidicon) to produce serial electrical signals of an optical shape enabling amplification to be achieved and an electrical output to be obtained.

In the next article we shall deal with methods for converting lengths from several millimetres to celestial distances into electrical signals for use in applications ranging from control in the workshop to guidance in space. ●

Hi-Fi Stereo Magnetic Pickup Cartridges

ELAC high fidelity





Hi-Fi Stereo Magnetic Pickup Cartridge ELAC STS 444-12
Frequence range 10 . . . 24000 Hz
Stylus tip radius 12 um (.0005")
Stylus force 0.75 . . . 1.5g
Static force 0
Static compliance 33 . 10^{-6} cm/dyne

Hi-Fi Stereo Magnetic Pickup Cartridge ELAC STS 444-E
with elliptically ground diamond stylus. This prevents end-of-side distortion of the upper range of frequencies caused by pinch effect.

Hi-Fi Stereo Magnetic Pickup Cartridge ELAC STS 244-17
Frequency range 20 . . . 20000 Hz
Stylus tip radius 17 um (.0007")
Stylus force 1.5 . . . 3g
Static compliance 18 . 10^{-6} cm/dyne

Hi-Fi Stereo Magnetic Pickup Cartridge ELAC STS 344-17
Frequency range 20 . . . 22000 Hz
Stylus tip radius 17 um (.0007")
Stylus force 1 . . . 2g
Static compliance 25 . 10^{-6} cm/dyne

Hi-Fi Stereo Magnetic Pickup Cartridge ELAC STS 344-E
with elliptically ground diamond stylus. This prevents end-of-side distortion of the upper range of frequencies caused by pinch effect.

AGENTS

N.S.W. MAGNA TECHTRONICS AUST P/L., 49 Whiting St., Artarmon.

A.C.T. HOMECRAFTS P/L., Petrie Street, Civic — A.C.T.

VIC MUSIC MAKER P/L., 394 Victoria St., North Richmon Richmond, Vic.

W.A. LESLIE LEONARD HI FI P/L., London Court — Perth.

QLD BRISBANE AGENCIES, 73 Wickham St., Fortitude Valley, Brisbane.

S.A. NEWTON MCLAREN LTD., 82 Gilbert St., Adelaide.

ATTENTION
ALARM INSTALLERS

SIMPLIFY YOUR INTRUDER ALARM PROJECTS

Allow us to supply professional equipment at reasonable prices.

Due to mass production we can offer quality equipment freeing you to devote your time to the heart of your intruder system i.e. the application and installation.

Contact us for information on Pressure Mats, Bells, Magnetic Reed Switches. Control Systems, Timers, Photo-Electric Beams, etc.

SECURITY ENGINEERING PTY. LTD.

SUPPLIERS TO THE SECURITY INDUSTRY

182 GEORGE ST., PARRAMATTA, NSW. 2150. PH: 635 6550 -- 635 6468.

REALISTIC DX 150A
COMMUNICATIONS RECEIVER

SW/CW/SSB/AM

Transistorised. All solid state	4 Bands .535 to 30 MHz (includes Broadcast)	240V AC or 12V DC operation

This is the BIG performance set that obsoletes tube receivers . . . a professional-looking set that appeals to amateurs and short wave listeners alike. The DX150A gives long-range, world-wide realistic reception on 4 bands, including Broadcast. Fully transistorised—all solid state—no warm-up delays; the DX 150 will run on dry cells if current fails or is not available; will operate from a car's cigarette lighter or any 12V DC service. A 240V AC power supply is also built in. Over 30 semi-conductors—product detector for SSB/CW, plus fast and slow AVC—variable pitch BFO—illuminated electrical bandspread, fully calibrated for amateur bands—cascade RF stage—ANL for RF and AF—zener stabilised—OTL audio—illuminated "S" meter—built-in monitor speaker plus front panel jack for external (optional) matching speaker.

Realistic Performance

Suggested Retail Price **$234.20**

Weston electronics PTY LTD

(A unit of Jacoby Mitchell Holdings Ltd)
376 EASTERN VALLEY WAY, ROSEVILLE, 2069.
Cables and Telegraphic Address: 'WESTELEC,' Sydney. Phone: 40 1212

Please forward free illustrated literature and specifications on Realistic.

Name.

Address

ET

UNITED TRADE SALES P/L
280 LONSDALE STREET, MELBOURNE, 3000
PHONE 663-3815 (Opposite Myers)

COMPUTER RACKS – 28½" x 28½" x 71". Square Tube 1¼" Cad. Steel. All members are bolted together and can be made to various size racks. Double B/Bearing slide rails. Price $30 ea. Racks are dis-assembled for transport. Freight Forward.

POWER TRANSFORMERS – BRAND NEW, Primary 230 Volt AC-Sec. 26-0-26 volts 280 ma-Sec No.2 90 volts. Size 2¼" x 2" x 7/8". Only 1-50 ea. P/P 50 cents.

SPECIAL – CURLY CORDS, 25 cents ea. P/P 15 cents.

MULTIMETERS –

	Sensivity DC	Sensivity AC	PRICE
C-1000	1,000 o/v	1,000 o/v	$6.75
CT500/P	20,000 o/v	10,000 o/v	$18.15
AS 100D/P	100,000 o/v	10,000 o/v	$34.50

Add 60 cents for pack/post.

POWER SUPPLIES, 35 volt, 5 amp, C Core Transformer and Filter Choke 5-10,000 uF 50 volt electrolytics Transistor Regulator voltage adjustable. Size 21" x 7½" x 7½". Weight approx. 25 lbs. Price $35.00. Freight forward.

3 GANG CAPACITORS – approx 415PF per section ceramic insulation. Ideal for aerial tuning units. Only $2.00 each.

RESISTORS. Poly bags of 100 mixed. $2.00. P/post 30c.

SPECIAL. 400uF. 25v. Electrolytics. 30 cents ea. P/post 10c.

3,000 TYPE RELAYS. No specific coil resistance supplied. 50 cents ea. P/P 30 cents.

PIANO KEY SWITCHES. 6 keys, 4 sections with 6 changeovers. $1.00 ea. P/P 40 cents.

SILICON DIODES. 100 P.I.V.-145 amps. $4.50 ea. P/P 40 cents.

CAPACITORS. Mixed values Mica and Ceramic. Poly bags, $2 per 100 P/P 30 cents.

TRANSFORMERS.230 volt Primary 2 Secondary windings of 70 volts 20 amps. Weight approx 30 lbs. Freight forward $25.00.

VALVES – 6J6 30c ea – ATS25 = 807 50c ea – 6K7 60c ea – 6SJ7 60c ea – 6AC7 20c ea. 12 for $2.00. Postage on valves 10c ea.

CAPACITORS – .33μF 400 volt DC working – 10c ea. P/P 7c.

TWIN PATCH PLUGS – ring tip & sleeve – 60c ea.

VHF Converters, Aircraft Band 108 Mhz-136 Mhz. Just place alongside your Broadcast Radio and set dial in a clear spot between 600 Khz and 1000 Khz, then do tuning on converter dial. No connecting wires are needed. Converter operates from 9 volt transistor battery. Price $14.65. P/P 45 cents.

DENSHI CONSTRUCTION KITS, no soldering required. There are 16 Projects, including Transistor Radio, Morse Code Oscillator, Continuity Tester, Signal Injector, Transistor Wireless Microphone, Transistor Reflex Radio and numerous others. These kits are priced at only $11.50. P/P 80 cents.

TAPE RECORDER BOARDS. Less valves (uses 6GW8 and 12AX7) 6GW8 output and bias Oscillator. Only $3.00 ea. P/post 30 cents.

PHONE JACKS. 3.5 and 2.5 mm. 10 cents ea. P/post 6 cents.

COMPUTER BOARDS. Size 1. Contains 4-0c45, glass encapsulated. 2 min. toroids. 10 diodes $1.00 ea. P/P 20 cents. Size 2. Average 10 Transistors, 30 diodes, resistors and capacitors. All components have long leads. $2.50 ea. P/P 40 cents.

ALL PRICES SUBJECT TO ALTERATION WITHOUT NOTICE

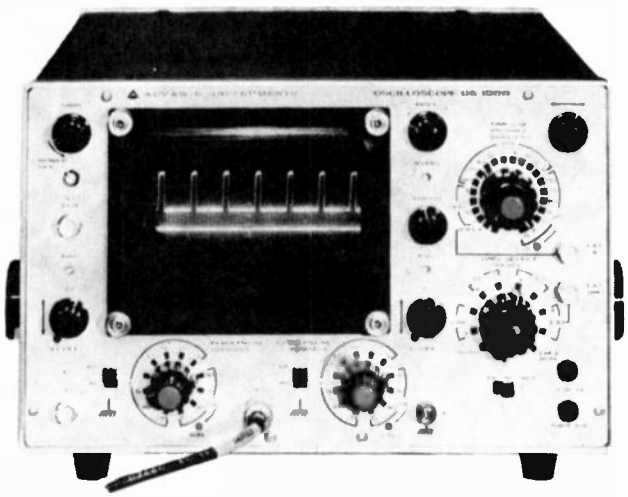
Wanted to buy — Test Equipment Transmitters, Receivers, etc.

Two new instruments from ADVANCE

which offer

UP-to-the-minute performance and latest 'state of the art' technology

DOWN-to-earth prices



OS1000 oscilloscope

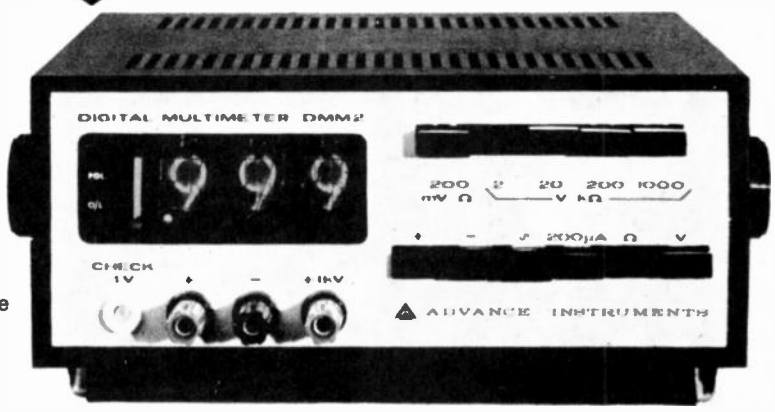
OUTSTANDING FEATURES • DC to 15 MHz bandwidth • 5mV/cm dual trace • Signal delay • Comprehensive trigger facilities, incl. TV sync. • Bright line auto free-run • Switched X-Y operation

The ADVANCE OS1000 is a portable, dual trace oscilloscope, combining small size and light weight with a specification providing the ability to make precise waveform measurements. Wide time base ranges and comprehensive trigger control combined with broad bandwidth and calibrated deflection factor make this instrument suitable for many general purpose and laboratory and TV applications. Use of solid state circuitry throughout makes the OS1000 particularly suitable for servicing or laboratory use.
Full specifications available on request.

DMM2 digital m/meter

OUTSTANDING FEATURES • 17 ranges for measurement of AC or DC voltage, current and resistance • Maximum stability • LSI reliability

The DMM2 Digital Multimeter provides in 17 ranges a clear digital reading of AC or DC voltage, AC and DC current and resistance. Push button selection of functions and ranges. The display has a max. reading of 1999 with automatically positioned decimal point. Overrange and reverse polarity indications are provided. The DMM2 weighs only 3½ lb and can be operated from AC supply, external 12V DC, or an optional rechargeable battery pack. Design ensures maximum stability for all measurements, ease of operation allowing use by non-technical operators and high reliability with all counting and storage functions performed by an LSI package (Large Scale Integrated Circuit). Full specifications available on request.



Distributed by:

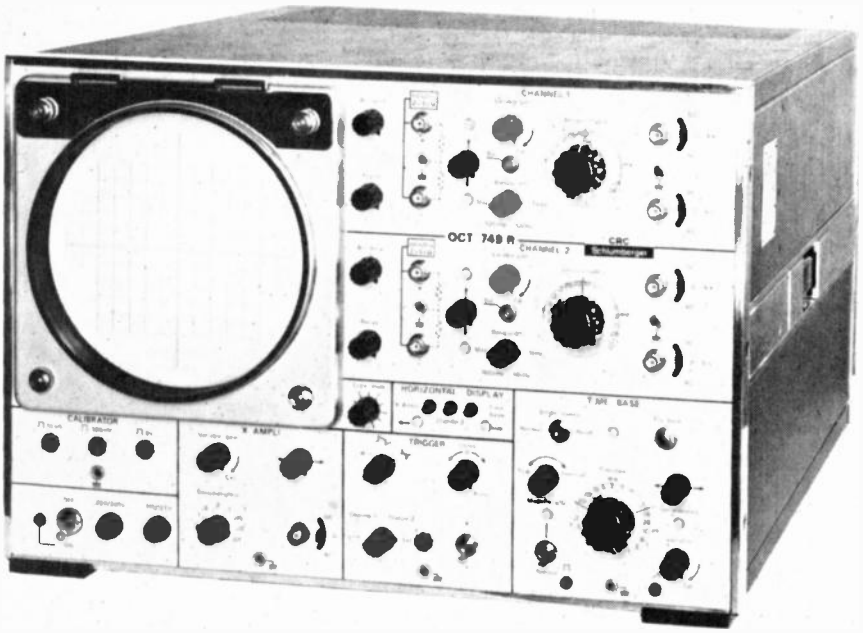
JACOBY MITCHELL

SYDNEY	630 7400	BRISBANE	44 4674
MELBOURNE	30 2491	PERTH	28 5725
ADELAIDE	93 6117	LAUNCESTON	2 5322

JM/57/70

EQUIPMENT NEWS

SENSITIVE DUAL-BEAM OSCILLOSCOPE



The Schlumberger OCT749R is a high gain double beam oscilloscope designed specifically for the measurement and display of low level signals encountered in biological and mechanical engineering. Differential or single ended inputs can be applied to give dual beam time based displays or alternatively an external signal may be applied to the X amplifier. Facilities are included for switching one Y channel into the X amplifier to give equal gain low phase shift X-Y displays. Y amplifier outputs are provided for X-Y plotting or recording on a UV or magnetic tape recorder.

The OCT749R has a large display, multiple trace location and 'un-calibrated' lights. Selection of noise limiting bandwidths and compensated FET inputs is said to give exceptionally low drift for an instrument of this sensitivity.

The vertical amplifier outputs permit the use of cascaded operation when a single beam sensitivity of up to 2uV/cm may usefully be used, due to the exceptionally low noise levels inherent in the amplifier. The vertical amplifiers are claimed to have a bandwidth of dc to 1MHz over all sensitivity settings with switchable low pass filtering to restrict this down to 1kHz for low noise, high sensitivity displays.

The manufacturer states that the slow sweep speed and long persistance P7 tube phosphor, coupled with the ability to monitor transducer outputs directly, make the OCT749R eminently suited to all forms of servo system performance testing. The use of the X-Y display mode for phase measurement (with less than 1^{o} phase shift to 100kHz) and the recording capabilities also enhance the use of OCT749R in this area.

Further details:– Schlumberger Instrumentation Australia Pty Ltd, PO Box 138, Kew, Vic. 3101.

DIGITAL MULTIMETER

A new Fluke multimeter is now marketed in Australia by Elmeasco Pty. Ltd.

The Fluke Model 8120A is a complete 25 range digital multimeter that can be used to measure ac and dc voltages, ac and dc currents, plus resistance. Each function has five ranges all of which it is claimed, provide 0.01% of range resolution and 20% overranging. Maximum voltage sensitivity is 10uV on the 100 mV ac or dc ranges while maximum current sensitivity is 10nA. The 8120A's in-line, non-blinking readout displays polarity information, an overrange "1" and four full decades of digits.

Custom packaging of the 8120A combines an attractive appearance with rugged but light-weight construction. Tough, scuff resistant covers provide exterior protection and a locking tilt-up bail can be rotated for use as a convenient carrying handle.

The manufacture states that severe overloads can be continuously applied to all of the 8120A's voltage and resistance ranges without damage while current ranges are protected with fusing.

Large, clearly legible, two colour lettering is used to identify each of the interlocked pushbutton selector switches and the decimal point is automatically positioned in the readout. These features reduce the liklihood of an overload being applied through operator error.

The manufacturers claim that long-term reliability is enhanced by the use of recirculating-remainder analogue-to-digital conversion. This technique utilizes a simple resistive feedback network, serially to determine and display all digits.

Operating power from sources available virtually everywhere in the world, including shipboard and aircraft power, will energize the 8120A. A slide switch is provided for efficient 115/230Vac changeover while the internal regulating circuits of the 8120A operate equally well at power line frequencies of 50-500 Hz.

Battery operation for eight hours of multimeter use, at sites remote from line power, is optionally available. The internally mounted, rechargeable battery option can be ordered installed, or easily added by the user in the field. Battery charge is restored by operating the 8120A from line power and disconnecting the line cord provides instantaneous changeover to battery power.

Assured accuracy is maintained in the presence of normal mode noise because a low-pass filter at the input provides positive, broadband rejection. A guard shield prevents common mode errors when the 8120A is line operated. Optional battery operation ensures complete freedom from error-causing "ground loops" even when the measurement is referenced to a potential elevated more than a thousand volts above power line ground.

Further details from: Elmeasco Instruments Pty. Ltd., P.O. Box 334, Brookvale, N.S.W. 2100.

Another great idea from INTERDYN

do it yourself and save!

SEAS

HI - FIDELITY SPEAKER KITS

This famous Scandinavian manufacturer has come up with an appeal to all budget-minded hi-fi fans – acoustic suspension, neoprene surround speaker kits which you can fit into your own readily made enclosures!

Ranging from the two-way Type 10 with peak power rating 40W to the Type 60 with 4 drive units and peak power rating 120W, these speakers have the world-famous smooth response, superb transient performance, long throw woofers and matched disperion characteristics for which Seas are justly renowned.

Kits are complete with wiring diagrams and fully detailed drawings. If you want to match speakers with your furniture, if you have enclosures all ready for speakers, if you want to save money, get the facts on the Seas kits! Cabinet sizes 10 litres (1/3 cubic ft.) to 60 litres (2 c.ft).

TYPE 10
Two drive units, 6½" woofer, 1½" dome tweeter. Frequency range in 10 litre cabinet, 45-20,000 Hz. Peak power rating 40W.

TYPE 18
Two drive units 8½" woofer, 1½" dome tweeter, Frequency range in 20 litre cabinet, 35–20,000 Hz. Peak power rating 60W.

TYPE 30
Three drive units 10" woofer, 1½" dome tweeter. Frequency range in 30 litre enclosure, 30 – 20,000 Hz. Peak power rating 70W.

TYPE 35
Three drive units 2 x 8½" woofers, 1½" dome tweeter. Frequency range in 40 litre enclosure, 30 – 20,000 Hz. Peak power rating 120W.

TYPE 60 (Kit illustrated)
4 drive units. 2 x 10" woofers, 1 x 6" mid-range, 1½" dome tweeter. Frequency range in 60 litre cabinet, 25 – 20,000 Hz. Peak power rating 120W, crossover frequency 600 Hz and 3,000 Hz.

Available at: Interdyn Agents

VIC: Encel Electronics, P/L 431 Bridge Rd, Richmond, 3121. Tel 42 3762.
NSW: Encel Electronics Pty. Ltd
QLD: Stereo Supplies, 100 Turbot St., Brisbane, 4000
S.A.: Challenge Hi-Fi Stereo, 6 Gays Arcade, Adelaide, 5000.
TAS: Audio Services, 72 Wilson St., Burnie, 7320.

Send coupon for literature:

INTERDYN

To: International Dynamics (Agencies) Pty. Ltd.
P.O. Box 205 Cheltenham, Vic. 3192.

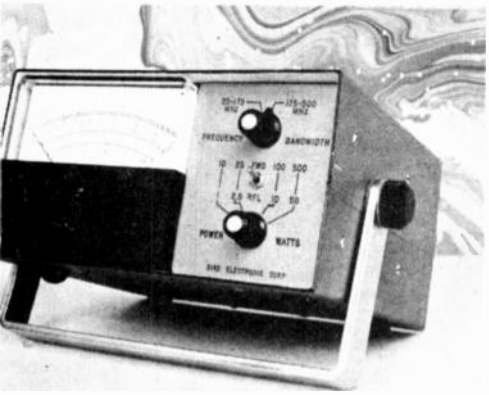
Please send information on Seas Speaker kits.

NAME .....

ADDRESS .....8564 ET

EQUIPMENT NEWS

WIDE-BAND RF WATTMETER



The new model 4370 is the first Thruline directional high-power wattmeter to cover 25 to 500 MHz from 1 watt full scale to 500 watts full scale without changing plug-in elements. This flexibility is accomplished by eight switched ranges: four forward power levels (10-500 watts) and four reflected power values (1-50 watts). The lower reflected power ranges are also available for forward readings by reversing RF connections.

In operation, a precision machined 50-ohm reference line-section is inserted between the signal source and the antenna, load or other component under power test. Directional power sensors incorporated in this line-section produce dc signals proportional to both incident and reflected RF main-line power, for readout on scales calibrated in watts as well as dB. All variable measurement parameters – frequency range, forward/reflected power and full scale values – are switched on the front panel. The readout unit and the line-section, it is claimed, may be separated by as much as 3 feet for operational convenience.

Bird Quick-Change QC Connectors, which mate with male or female N, BNC, TNC, UHF, C, SC, HN, GR Type 874 and 7/8" EIA lines without the need for performance-degrading adapters, add to the flexibility and aid the low insertion VSWR (less than 1.1) of the new RF Wattmeter. Measurement accuracy, is claimed to be ±5% on all ranges, from 0-1 watt to 0-500 watts at 25-500 MHz. Finished in rich leather grain, model 4370 Thruline measures 4¼" x 8" x 7½" and weighs 5½ lbs.

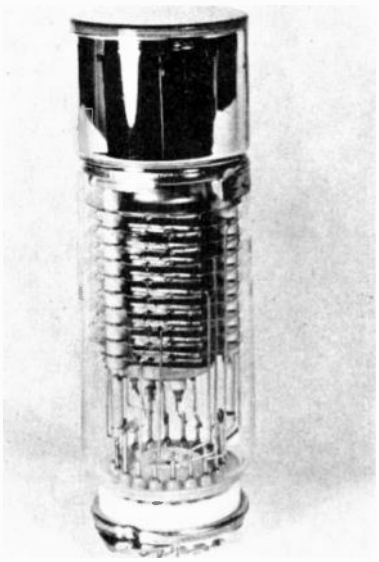
Further details from Warburton Franki Pty Ltd, Box 182, Chatswood, NSW. 2067.

EQUIPMENT AND COMPONENT NEWS

These are editorial sections and as such, all insertions – including photographs – are totally free of charge. Nor is there any obligation to take corresponding advertising space.

To assist Australian companies seeking export markets in Europe, we can also arrange for the insertion to appear in the European edition of ELECTRONICS TODAY INTERNATIONAL.

As this is a news, rather than advertising section, equipment submitted for insertion must be of recent development. Copy, where applicable, should describe the item in terms of its applications as well as its specifications.

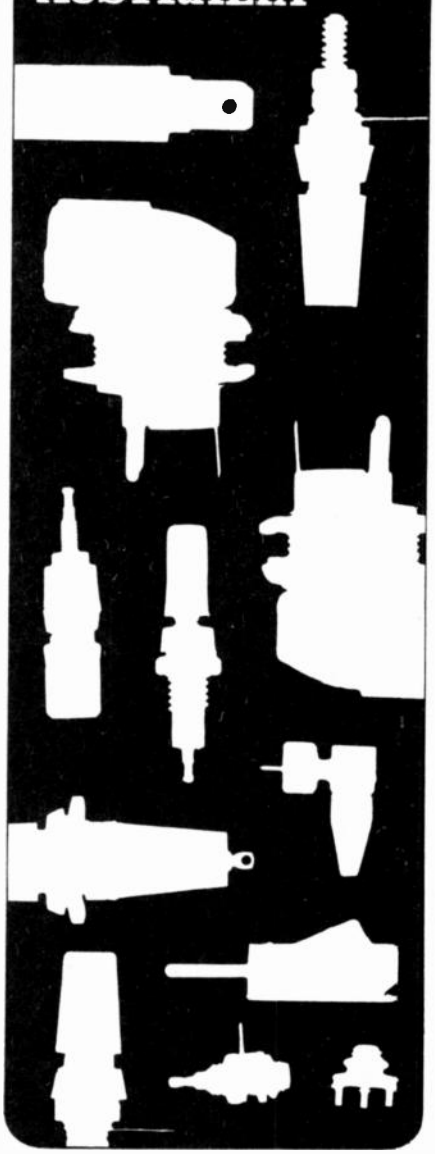


PHOTOMULTIPLIER TUBE FOR FLYING SPOT FILM SCANNING

A new photomultiplier tube, the type 9558F, has been introduced by the Electron Tube Division of EMI Electronics Ltd, Hayes, Middlesex, for use in colour flying spot film scanning applications where relatively high light levels are involved. A major influencing factor has been the new EMI MX69 flying spot cathode ray tube which, together with changing film techniques and machine standards, has imposed a greater demand on the photomultiplier tubes to maintain their performance at high brightness levels.

Intended for use in the blue and green channels, the 9558F is an extension of the range of EMI tubes with S20 photocathodes and will gradually supersede the S11 photocathode 9656 types.

BELLING & LEE QUALITY COMPONENTS FROM LEADING WHOLESALERS THROUGHOUT AUSTRALIA



BELLING & LEE

(AUSTRALIA) PTY. LTD.

Canterbury Rd.,
Kilsyth, Vic., 3138.
P.O. Box 20,
Australia.
Tel. 729 0621

Sales Offices
in all States

PRE-PAK ELECTRONICS

DISPOSALS DIVISION

95-97 REGENT ST., REDFERN, N.S.W., 2016. PH: 69 5922—

BRISBANE & QLD.—RADIO COMPONENTS, 67 SANDGATE RD., ALBION, 4010

HOURS OF BUSINESS:
MON., WED., FRI.—8.20 a.m. to 5.30 p.m.
THURS. 8.30 a.m.-8 p.m. SAT 8.30-1 p.m.

EXCLUSIVE BARGAINS

Mullard Cold Cathode Indicating Tubes. Type ZM1020. Numbers 0-9, in-line, end-viewing indication incorporates a red filter. Min. supply voltage 170v. Cathode current 2mA. Base B13B. $2.75 each plus 15c post.

Mullard Cold Cathode Counting Tubes. Type Z505S. Decade tube with cathodes 0-9 brought out separately, for use as a counter or selector. Max. stepping speed 50kHz. Supply voltage 475v Output current 800uA. Base B13B. $2.75 plus 15c post.

Mullard Photoemissive Tube. Type 92AV. Vacuum. Surface—Caesium antimony. Sensitivity—45uA/1m at 85v. Anode supply voltage 100v. Max. dark current .05 uA Base—B7G. $2.75 plus 15c post.

Digivac Tungsol Readout Tubes. Vacuum fluorescent Low power, operates on 1.6v. or D.C. at 45mA. Single Plane character formation. Types DT1705 reads 1-0 with decimal point. $3.00 each plus 15c post. Types DT1707 displays + or —1 with decimal point. $2.50 each plus 15c post. Suitable Counter and Driver by G.I. Dual 25 pin in-Line M.S.I. contains Up-Down Counter, Latch, Decoder and Driver. Normal trade price $24.00. Our price $10.00 plus 15c post.

Outstanding value in recording Tape. All new and packed. Made by O.C.L. Polyester Grade—3" x 150' 45c, 3" x 300' 65c, 3" x 600' $1.10, 3" x 900' $1.90. All plus 20c post.

Valve Sockets. 7 & 9 pin base, 12 assorted types for 60c plus 15c post.

Westinghouse Full-wave selenium rectifier. Type LT91. 20v. at 2 amp. 75c plus 10c post.

Valves. Brand new and packed. 12AT7 50c ea. OA2 75c ea. Both plus 15c post.

New Oucon Electrolytic Capacitor. Insulated Can type, complete with mounting clip. 100 mfd. 200VDCW. 65c plus 15c post.

New and Packed NKK Toggle Switches. DPDT with centre-off position. Ratings 5A. 125Vac. or 3A 250Vac. Superbly made. Beautifully chromed. 60c ea. plus 10c post.

Miniature Transistor Jack Sockets. 3.5mm. 10 for $1.00 plus 15c post.

Hamlin Reed Switches. Type ORG2. Single pole. 250V. 1A. 80c each or 10 for $7.00.

Tuchel 8 pole Male and Female Connectors. Polarized. Complete with Top-entry Cover and Clamp. $1.00 each plus 15c post.

WHAT IS SURPLUS?

What is Surplus? Many people are still under the impression that 'Surplus' or 'Disposals' components and equipment are War-time and Government surplus material. We want to put your minds at rest. WE DO NOT SELL GOVERNMENT SURPLUS MATERIAL. Our surplus are end of runs and over-bought manufacturers' stock. In most cases the goods we offer are in fact of high-grade specification and worth a lot more than standard and commercial components, but because we purchase in bulk we are able to bring these to you at 'anti-inflationary' prices. This way you save a lot of hard-earned cash and still purchase high grade components that are trouble free.

FANTASTIPAK . . .

For One Month only. A Fantastic 5lb. Bargain Parcel of guaranteed NEW Electronic components. Included are Transistors, Electrolytic Capacitors, Resistors, Potentiometers, Rotary Switches, Magnetic Counter, Computer Boards, P.C. Boards, Transformers, Tag Strips, Lamp Holders, etc. We guarantee the value of this parcel to exceed $30.00. FIRST COME, FIRST SERVED, AS WE HAVE ONLY LIMITED QUANTITIES AVAILABLE. Don't be astonished but we are only asking $18.00. Post Free.

'SUPERPAK' SPECIALS

PAK. 1. 10 assorted BC177 & BC178 PNP Transistors. TO18 Case. New but Unmarked Guaranteed quality. 10 for $1.50 plus 15c post.

PAK. 2. 10 Fairchild PNP Planar Epitaxial transistors. TO18 moulded case. 10 for $1.50 plus 15c. post.

PAK 3. 100 assorted resistors. ½ & ¾ watt. Top quality. 100 for $1.50 plus 20c post.

PAK. 4. 30 Ex-Computer Transistors. NPN & PNP Germanium Silicon in TO5 & TO18 cases. 30 for $2.00 plus 15c post.

PAK. 5. EM404 Silicon rectifiers. 400P.I.V. 1 amp. 8 for $2.00.

PAK. 6. TEXAS Power Transistors. TIP29A NPN 60V 1A. TIP30A PNP 60V 1A. TIP31A NPN 60V 3A. One of each type. 3 for $4.25 plus 25c post.

PAK. 7. Sub-miniature Electrolytic capacitors. P.C. Leads, top quality. 5 each of the following types: 1mfd 3v, 2mfd 3v, 5mfd 6v, 5mfd 50v, 10mfd 6v, 30mfd 10v & 50 mfd 10v. 35 for $3.55 plus 15c post.

PAK. 8. 10 NPN Silicon Transistors. TO5 Case. Suitable for Audio or Drivers. New and Unmarked. Guaranteed quality. 10 for $2.00 + 15c post.

PAK. 9. P.C. Board. Single-sided Copper laminate in fibreglass. 2½ lbs. of assorted and useful sizes. None less than 3" sq. $2.00 plus 40c post.

PAK. 10. 10 high-grade metal tubular paper capacitors. 2mfd - .1mfd 200v. Suitable for cross-over networks and time delays. 10 for $1.00 plus 40c post. 50 for $4.00 plus $1.25 post or 100 for $7.50 plus $2.00 post.

PAK. 11. Lever Key Switches. Ex-G.P.O. equipment. 10 assorted types for $3.00 plus 40c post.

PAK. 12. I.B.M. Computer Boards. Size 4" x 2½". Packed with semi-conductors, PNP & NPN types. diodes, resistors and capacitors. 4 boards with a minimum of 16 transistors $1.75 plus 20c post. Quotations for larger quantities.

PAK. 13. 100 Assorted Polyester, Ceramic & Mica Capacitors. $2.00 plus 20c post.

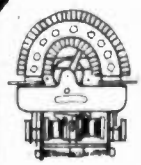
MERCURY WETTED CONTACT RELAY

Made by Clare, U.S.A. Operating Voltage 12v. Coil resistance 500 ohms. Current 50 m/a. High speed type. Single pole Change-over. Complete with 8 pin Base. Part No. HGS 1059. **$1.50 ea.** plus 15c post.

HIGH SPEED MAGNETIC COUNTER.

4 digit 0-9999. (4" x 1" x 1") 500 ohm coil 18-24v operation or 36v type. 2300 ohm. coil. For batch counting or lap timing, also dozens of other uses. **95c ea.** post free.

UNISELECTORS



Made to stringent P.O. specifications. Suitable for Digit counting and Storage, Numicator selection, Batch counting and controlling, Switching and Phasing and many other uses. Type A (illustrated), 4 Level 25 wiper wwith Forward and Reverse Coils each of 120 ohms. Can operate on 18 volts. **$5.50** each, post 50c. Type B. As Type A but single coil and only forward switching. 75 Ohms Coil. 24 volt operation. **$3.50** each plus 50c post. Type C. 8 Level 25 Full Double wiper 75 ohms Coil. 48 volt operation. **$8.00** each, plus $1.00 post.

TWIN TRANSFORMER UNITS

Matched Pairs of 600 ohm Balanced Line 1 to 1 Isolating Transformers, both mounted in sturdy metal case. **$1.00.** Complete as specified plus 30c post.

HAND GENERATORS
Magneto type producing 15 volts D.C. **$1.10 ea.** plus 20c post.

20V. BUZZERS in moulded bakelite case—wall or bench mounting—adjustable armature. **75c** plus 15c post.

POTENTIOMETERS

Brand New High Grade Commercial Type. Linear: 500K Standard Shaft 25c, 100K + 100K Ganged Standard Shaft 75c, Log: 25K ½" Shaft 25c, 100K 1" Shaft 25c, 1meg 1" Shaft 25c, 2meg ½" Shaft 25c, 250K + 250K Ganged ½" Shaft 75c, 2meg & 2meg Ganged 1" Shaft 75c, 10K with DPDT Switch ½" Shaft 30c, 1meg with DPDT Switch ½" Shaft 30c, 500K + 500K with DPDT Switch ½" Shaft 85c, 1meg + 1meg with DPDT Switch and Concentric standard shaft 70c, 2meg + 2meg with DPDT Switch and Concentric Standard Shaft 70c. All 10c post. TAB Mounting Preset types: Linear—5k, 15k, 20k, 25k, 500k, 1meg. Log: 500k. All 15c each plus 10c post.

DO YOU NEED LOTS OF MICROFARADS? Then take your pick from these precision made Computer grade electrolytics. Made by very famous manufacturers. All plus 25c post.

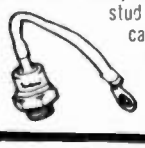
200mfd	200V	$2.00	8000mfd	13V	$2.25
250mfd	110V	$2.25	8000mfd	55V	$4.00
2500mfd	45V	$2.00	10000mfd	25V	$4.00
3500mfd	75V	$2.50	10000mfd	33V	$4.50
4000mfd	50V	$2.50	11000mfd	19V	$3.50
4000mfd	60V	$2.75	14000mfd	13V	$3.00
4000mfd	75V	$3.00	15000mfd	10V	$3.25
5500mfd	45V	$2.00	16000mfd	12V	$3.50
6600mfd	45V	$2.50	25000mfd	6V	$3.00
7000mfd	13V	$2.00	74000mfd	10V	$5.00

TYPE 203 POWER TRANSISTOR IN TO3 CASE

Mounted on large finned Heat-sink. Transistor is G.E. (PNP) similar to ADZ11. Max. 1c-15 amp. Nominal 10 amp. Vceo 37v Vcbo 40v Vebo 20v. Frequency 90 Khz. **2.50 each** post free.

S.T.C. RS8 Series HIGH POWER SILICON RECTIFIERS

Suitable for outputs of 100 amperes (Direct forward current) at crest working voltages of between 50 & 700v. These rectifiers incorporate an alloyed silicon junction in a stud ended hermetically sealed case. Type RS801 80 PIV 120 amps. $6.00 plus 75c post. RS812 120 PIV 120 amps. **$8.00** plus 75c post.



1972 CATALOGUE . . . Owing to circumstances beyond our control delivery of our catalogues have been delayed due to a printers' dispute. We trust that this will shortly be finalised and we can assure all our readers who have sent for this that these will be despatched with the utmost haste as soon as possible. Please accept our sincerest apologies.

MANUFACTURERS . . . We will purchase all your surplus, redundant and end-of-run Electronic components and equipment at the best prices. Cash paid. Please send lists or phone details to Mr. M. Sheridan.

EQUIPMENT NEWS

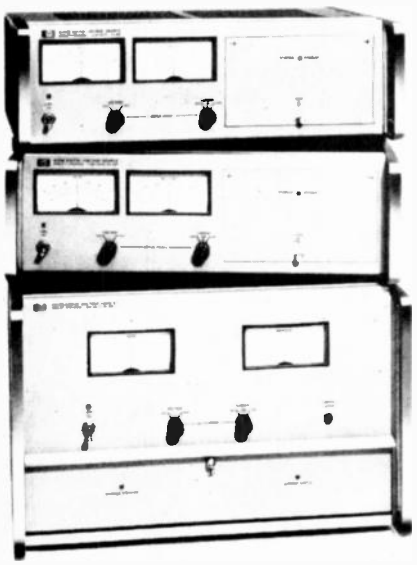
The S20 photocathode has intrinsic properties, it is claimed, which help reduce picture shading by improving linearity and pulse shape over a wide range of light levels. This will result in better picture quality and easier setting up. The specification of the 9558F also ensures that the overall signal-to-noise ratio is not lower than that achieved by tubes with S11 photocathodes.

The 9558F is physically interchangeable with other tubes in the EMI S20 series including the red channel types, 9658R and 9658A. Circuit changes are said therefore to be minimal and when carried out will facilitate complete interchangeability of tubes between all three channels.

Flexibility of machine designs will not, however, be sacrificed by the introduction of this new tube as the existing 9656 types will still find considerable application in monochrome instruments and in colour equipment where standards permit.

Further details from EMI Electronics and Industrial Operations, Blyth Rd, Hayes, Middlesex, England.

250W DIGITALLY CONTROLLED VOLTAGE SOURCE



A new digitally programmable voltage source, the Hewlett-Packard Model 6129B, supplies 250 watts of dc or low frequency ac power. This new digital supply can swing its output voltage over the full range of -50 volts to +50 volts or vice versa in less than 300 microseconds, the manufacturer claims, while supplying any current between 0 and 5 amperes.

The Model 6129B is the latest addition to a family of digitally programmable voltage sources. Other models available include the Model 6130B (±5OV at 1A) and the Model 6131B (±100V at 0.5A).

All three supplies are designed to be controlled by computers, couplers, or other digital sources. They function as high-power digital-to-analogue converters, digitally controlled power sources, or digitally controlled waveform synthesizers and are claimed to meet all requirements for systems.

All three supplies are dual-range; all have -9.999 to +9.999V (BCD) or -16.3840 to +16.3835 (binary) ranges in addition to their higher-voltage ranges. Their outputs are said to be accurate within 1.5 millivolts on their low ranges and within 15.0 millivolts on their high ranges. Resolution is 0.5 millivolts (binary) and 1 millivolt (BCD) on the low range, and 5 millivolts (binary) and 10 millivolts (BCD) on the high range. Load regulation is 150 microvolts on the low range and 500 microvolts on the high range, the manufacturer claims, for a load-current change equal to the rated output current – ripple and noise (dc to 50 MHz) are less than 12 millivolts peak-to-peak and 3 millivolts rms.

Programming inputs to all three supplies include voltage magnitude, voltage polarity, voltage range, current latch level, and gate (encode) signals. Coding for voltage magnitude can be either four-digit (16 bit) 8421 BCD or 15-bit straight binary. Current latch coding is three-bit binary. All other data inputs are one-bit binary lines.

Kits are available for interfacing the supplies with Hewlett-Packard computers; each kit consists of a plug-in computer input/output card, interconnecting cables, and complete software.

Further details from Hewlett Packard Australia Pty Ltd, 22-26 Weir Street, Glen Iris, Vic. 3147.

600 MHz FREQUENCY METER

Designed primarily for use as a precision communications test instrument in the uhf communication and TV bands, Racal Instruments Ltd's new Model 9024 Frequency-Period Meter has a direct reading frequency range from 10 Hz to over 600 MHz. Sensitivity is claimed to be better than 10 millivolts up to 500 MHz.

The instrument has an eight digit, latched, in-line display plus flow indication, and its single and multiple period measurement facilities from 10 Hz to 3 MHz enable low and medium frequencies to be measured with optimum accuracy. Frequency ratio measurements are said to have upper limits of 600 MHz and 15 MHz respectively.

The two noise-tolerant input channels are claimed to operate correctly with high amounts of distortion, sub-harmonic content and even amplitude modulation. Channel A has 50 ohm input impedance and operates to 600 MHz whilst Channel B has high input impedance and with a frequency range to 60 MHz.

The fast-warm up characteristics of the precision oscillator ensures that the counter's full resolving power may be quickly utilized. Another in-built oscillator feature is an initial ageing rate stated as better than 1 in 10^8, with better than 1 in 10^9 after some months.

Fully screened, including the readout window, to keep radiated rf interference to

SPECIAL

● **R.F. POWER TRANSISTORS**
BLY89 25 watts out at 175 MHz with 13.6 volt supply. Balanced emitter **$9.00 each.**
2N3927 15 watts out at 175 MHz with 13.6 volt supply. **$4.00 each.**

● **ELECTROLYTICS**
40,000 µF. 10 Volt **$2.00**
35,000 µF. 15 Volt **$2.00**
25,000 µF. 25 Volt **$3.00**
1,000 µF. 100 Volt **$1.00**
100 µF. 500 Volt **$1.50**

● **TRANSISTOR DC/DC CONVERTER TRANSFORMERS**
12 volt input, 220 volts output at 150 mA. With circuit and connections. **$3.00 each.**

● **TRANSISTOR DC/DC CONVERTER TRANSFORMERS**
12 volt input, 400 volts output at 150 mA. With circuit and connections. **$5.00 each.**

● **TRANSFORMERS**
230v. primary, 25 volts centre tapped at 1 amp. sec. **$2.50 each.**

● **INTEGRATED CIRCUITS**
SN7400N **85c**
SN7410N **85c**
SN7441AN **$2.85**
SN7490N **$2.60**
SN7472N **$1.45**
SN7473N **$2.20**
SN7475N **$2.45**
Light Emitting Diodes each **$1.20**

● **RESISTORS**
2 watt Carbon. Bag of 250 mixed. **$1.50 per bag.**

● **VALVES**
6SJ7 ..... **50c ea.**
6ES8 ..... **75c ea or 3 for $2.00**
2D21 Thyratron **50c**
58CV Photo-Cells ..... **75c ea.**
6AL5 ..... **50c ea or 5 for $2.00**

WAYNE COMMUNICATION ELECTRONICS

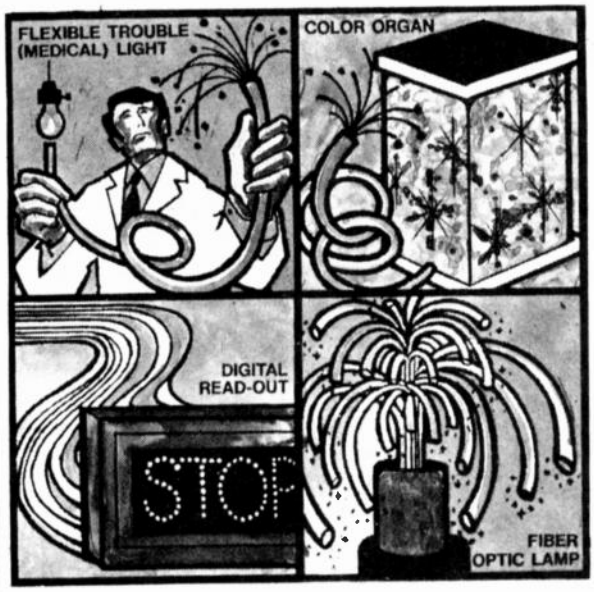
757 GLENFERRIE RD.
HAWTHORN. 3122
TELEPHONE: 81-2818

STA

ELECTRONICS PTY. LTD.

Manufacture — Sales — Service
392 Centre Road, Bentleigh, Vic., 3204
Telephone 97 4832.A.H. 97 5539

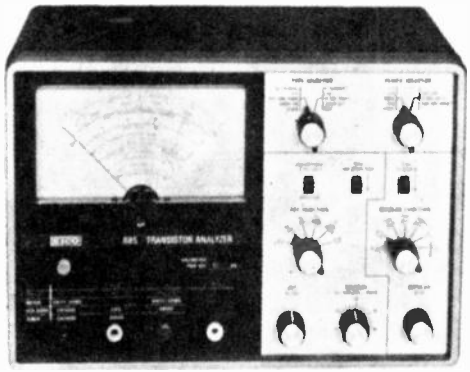
fiber Optics



OP1060-C	360ft. 10 mil plastic fibre 6ft lengths	$5.37
OP2016-C	96ft. 20mil plastic fibre 6ft lengths	$5.37
OP3006-C	36ft. 30mil plastic fibre 6ft lengths	$5.75
OP4506-C	36ft. 45mil plastic fibre 6ft lengths	$8.27
OP7196-C	6ft. jacketed fibre 19 x 17mil fibres	$4.67
OP7376-C	6ft. jacketed fibre 37 x 17mil fibres	$5.87
OP8000-C	4 channel light head 6-12v AC/DC	$3.35
OP8020-C	2 bulbs 3 watts (low heat)	.71c
OP8030-C	Eyelet assortment for fibre endings	.95c
OP8050-C	Adhesive end-treat compound	$2.99
OP8060-C	Fibre Optic Manual	.83c
OP7073-C	3ft. jacketed fibre 7 x 17mil fibres	$1.67
OP8070-C	This is a special introductory Fibre Optic Kit offer normal value $14.52 Super Special at only	$10.63

NEW EICO 685 TRANSISTOR ANALYZER

IN AND OUT OF CIRCUIT DYNAMIC SEMICONDUCTOR AND CIRCUIT AC ANALYZER



- Performs the 4 basic tests on all types of FETs including pinch-off.
- Performs the 3 basic tests on all types of bipolar transistors.
- Tests for true transconductance and AC Beta, in and out of circuit.
- Tests all types of diodes and measures zener voltage.
- Tests SCRs, TRIACs, and UJTs.
- Incorporates easy-to-use DC Voltmeter and Ohmmeter.
- 50 uA taut band meter movement.

EICO 443 TRANSISTOR-DIODE CURVE TRACER

- Makes it possible for any general purpose oscilloscope to display direct readouts of the most meaningful data.

Diodes, rectifiers, signal and power transistor characteristics can be tested by the versatile Model 443 curve tracer. Circuit designers and service technicians will find it invaluable for determining the DC characteristics of a wide variety of silicon and germanium semi-conductors. The output of the 443 can be displayed on any general-purpose oscilloscope. Diode and rectifier characteristics that can be tested include Forward voltage (V), Forward current (I), Reverse current (Ir), and Peak Inverse Voltage (PIV). The PIV test voltage is variable from 0 to 1400 V. Transistor tests include those for h_{FE}, h_{OE}, I_{CEO}, V_{CE} (sat), and BV_{CEO}

Other significant features of the Model 443 are:

- All silicon solid state printed-circuit construction
- Dual transformers for isolation and safety
- Flashing light indicates high voltage at diode test terminals
- Matching switch for comparing and matching transistors
- Direct-reading beta controls on front panel
- Built-in oscilloscope voltage calibrators
- Terminals for connecting external test sockets

ELMEASCO INSTRUMENTS PTY. LTD.

P.O. Box 334, Brookvale, NSW and P.O. Box 14, St. Kilda South, Victoria. Tel.: Sydney 93 7944 — Melbourne 26 1552. ADELAIDE — Phone 64 3296 BRISBANE — Phone 71 3366

EQUIPMENT NEWS

an extremely low level and with spillback virtually non-existant together with the capability of being remotely programmed, the 9024 is ideal, the manufacturer claims, for use in advanced automatic test equipment systems and/or in radio communications installations.

Further details from Racal Electronics Pty Ltd, 47 Talavera Road, North Ryde, NSW. 2113.

18 GHz MICROWAVE COUNTER WITH -35 dBm SENSITIVITY

Hewlett-Packard's new Model 5340A measures frequencies from dc to 18 GHz using only a single 50Ω input connector. Operation is entirely automatic: there's no changing of plug-ins, inputs, or ranges, no manual tuning, and no mental arithmetic. The new counter is claimed to be the first to be able to trigger on signals as small as -35 dBm to 12.4 GHz and -25 dBm to 18 GHz.

Model 5340A displays eight digits with automatically positioned decimal point and correct units of kHz, MHz, or GHz. A front-panel switch selects the resolution of the display, from 1 Hz to 1 MHz. Finer resolution at the higher frequencies is obtained by overflowing the most significant digit of the display.

The manufacturer claims that the dynamic range of the new counter is from -35 dBm to +7 dBm. Damage level is typically +30 dBm ± 7 Vdc. VSWR at the type N input connector is less than 2:1 from dc to 12.4 GHz and less than 3:1 from 12.4 to 18 GHz.

Standard time base is a 10 MHz crystal oscillator with an aging rate stated at less than 3 parts in 10^7 per month. Optional is a high-stability time base which has an aging rate less than 5 parts in 10^{10} per day.

For applications which require high input impedance (some IF circuits, for example) the counter has a second input which can be used from 10 Hz to 250 MHz. Its input impedance is 1 MΩ and its sensitivity is 50 mV rms sine wave. A front-panel switch selects either the dc-to-18-GHz 50Ω input or the 10-Hz-to-250-MHz 1 MΩ input.

Digit-serial, bit-parallel, ASCII-format digital output is standard on all 5340A counters. An option, useful in automatic systems, makes all front-panel controls and the display remotely programmable. Rear panel inputs, replacing those on the front, are also available.

Further details from Hewlett-Packard Australia Pty Ltd, 22-26 Weir St, Glen Iris, Vic. 3146.

NANOVOLT AMPLIFIER

Keithley's new Model 103A Nanovolt Amplifier is claimed to have low-noise performance (4.2 nanovolts per root Hz), wide bandwidth (0.1 Hz to 300 kHz), and calibrated gain (up to 60 dB).

The 103A is designed for amplification of low-level signals. The user is provided with a choice of differential or single-ended input configurations to simplify connecting the amplifier to the source. Noise figure contours in both configurations are available on request. Input impedance is claimed to be 1000 MΩ shunted by 20 pF in the differential mode.

Bandwidth of the Model 103A can be reduced to limit interfering noise through the use of front-panel selected upper and lower cutoffs.

Common-mode voltages up to 1 volt peak-to-peak can be handled by the 103A and overloads of up to 20 volts will not harm the instrument.

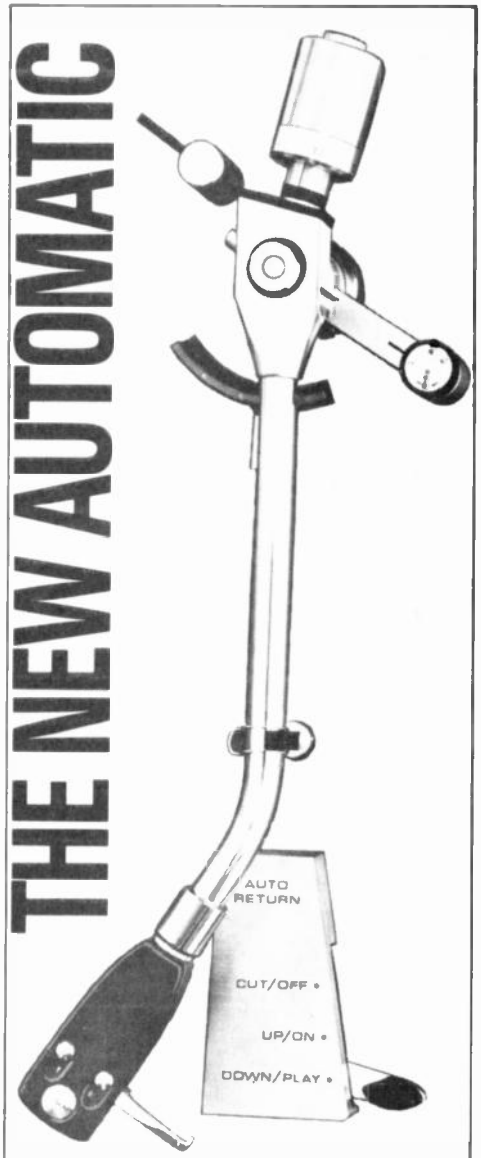
Output from the 103A is 10 volts peak-to-peak and thus sufficient for most readouts.

The 103A can be powered from any ±18 volt, 50mA regulated source. An accessory power supply, the Model 1031A, is available and powers up to 3 Model 103A Nanovolt Amplifiers.

Another accessory, the Model 1037 Transformer, is said to provide increased sensitivity (input noise less than 0.4 nanovolt per root Hz) from low-resistance sources.

Further details from Warburton Franki Pty Ltd, Box 182, Chatswood, NSW 2067.

THE NEW AUTOMATIC



The new PL–50 is the new automatic. A professional belt-drive stereo turntable with automatic precision return mechanism. A totally new feature that doesn't detract in the slightest from our traditional record of quality. Its special features and its automatic return make it the cream of the Pioneer range. See it at your Pioneer dealer.

Specifications

1. Static balanced low mass tubular arm with anti-skate and lateral balance.
2. Tracking force range as low as 0.8 g.
3. PC–35 induced magnet cartridge. 10 to 25,000 Hz.
4. Wow & flutter less than 0.08%.

PIONEER

high fidelity stereo. That's how perfection sounds.

AS-127-Y

PA & PB BRIDGE RECTIFIERS – EX STOCK

8 AMPERE AND 25 AMPERE AVERAGE CURRENT

FEATURES

400 VOLTS TO 1000 VOLTS PIV

UNIVERSAL, 3-WAY TERMINALS – SNAP ON, WRAP AROUND, OR SOLDER

INSULATED METALLIC CASE FOR MAXIMUM THERMAL CONDUCTIVITY

DIFFUSED SILICON JUNCTIONS WITH AVALANCHE CHARACTERISTICS

SMALL SIZE – SIMPLE INSTALLATION

The MINIBRIDGE was designed to replace larger bridges or four studs in power supplies, converters, inverters, motor control circuits and DC motor starters. The unique beam lead sandwich construction is used instead of discrete axial lead plastic encapsulated rectifiers allowing better heat transfer from junction to case and lower operating junction temperatures.

TYPE	PA40	PA60	PA80	PA100
	PB40	PB60	PB80	PB100
PIV/leg	400V	600V	800V	1000V

Matching AMP "250" Series FASTON connector available.

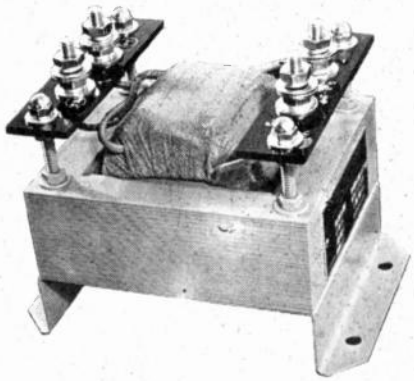
AUSTRALIAN GENERAL ELECTRIC LIMITED

86-90 BAY STREET, ULTIMO. 2007
TELEPHONE: 212-3711

DISTRIBUTORS: Watkin Wynne Pty. Ltd., 32 Falcon St., Crows Nest. Tel: 43-2107.
PB Components, Melbourne, Tel: 53-2766.
GEC-Elliott Automation, Sydney, Tel: 439-1922.
GEC-Elliott Automation, Melbourne, Tel: 387-2811.
GEC-Bliott Automation, Adelaide, Tel: 71-7971.
GEC-Elliott Automation, Brisbane, Tel: 32-0441.
H. Rowe & Co. Pty. Ltd., Perth, Tel: 28-5444.
Fairchild Australia Pty. Ltd., Melbourne, Tel: 723-4131; Sydney Tel: 439 Sydney, Tel: 439-4355.

WHENEVER QUALITY TRANSFORMERS ARE NEEDED

LOOK TO RADAMETA



WE SPECIALISE IN ALL TYPES OF TRANSFORMERS INCLUDING LIGHTING, INDUSTRIAL, POTENTIAL AND SPECIAL TRANSFORMERS

SUPPLIERS TO GOVERNMENT FOR 23 YEARS — EST. 1928

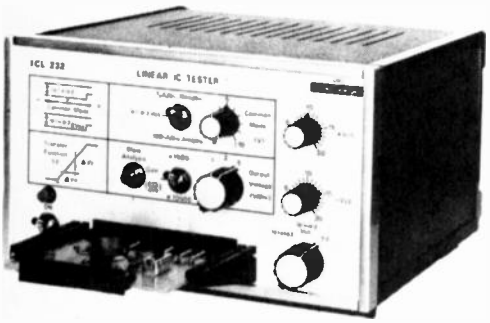
DIRECT OR ALL LEADING WHOLESALERS

RADAMETA

655 KING GEORGES ROAD PENSHURST, N.S.W., 2222. PHONE 57 3937

EQUIPMENT NEWS

LINEAR IC TESTER



Recently released by Schlumberger's CRC division is the low cost TCL 232 linear IC tester which is designed to assist in characterisation and fault finding.

Used in conjunction with any standard oscilloscope the unit will display the important parameters of linear integrated circuits. Input bias current, offset current, and offset voltage are measured as a function of the common mode voltage and the transfer characteristics may also be displayed.

To accommodate flat pack, dual in line, and eight pin to S package various plug in adaptors are provided which include correction networks for the more commonly used linear IC's.

Further details from Schlumberger Instrumentation Australia Pty Ltd, PO Box 138, Kew, Vic. 3101.

NEW STORE

A new dual-density disk drive, the RP03, for use with the Digital Equipment Australia DEC system-10 family of large computer systems, has a storage capacity of 62,361,600 characters, an average access time of 29 milliseconds, and a data transfer rate of 400,000 characters per second. It is used with a new controller that can operate up to eight disk drives. The RP03 system of 250 million characters is priced at $150,000, including the controller, four drives, and a data channel, and $25,000 for each additional drive.

Full details from Digital Equipment Aust. Pty. Ltd., 75 Alexander St., Crows Nest, NSW. 2060.

SCOPE

SOLDERING IRONS

Buy a SCOPE and join the club of satisfied USERS—you need not keep it a secret, others don't. That's why SCOPE IS KNOWN AT ALL THE BEST PLACES—in the tool kit, on the bench, in the boot, on the kitchen table, in the garage, on the service truck, in the engine room, even on the roof. . . . Wherever SCOPE goes it gives you the best service—and a host of satisfied users will agree it is the QUICKEST, the EASIEST, the SAFEST . . . THE BEST OF ALL SOLDERING IRONS.

ECONOMY
Consumes current only whilst in use. Scope 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.

SAFETY
Low voltage operation.

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.

SPEED
ONLY 5 to 6 seconds' initial heating up time from cold, then practically instantaneous.

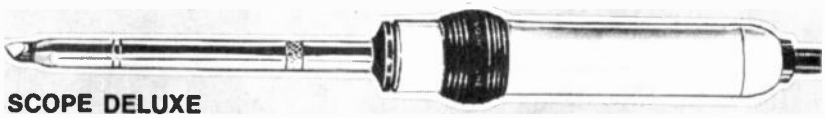
MINI WEIGHT
Scope De Luxe weighs only 3½ ozs. complete. Miniscope 1¾.

All irons are supplied complete with a spare tip and two elements and suitably packed for presentation as a gift.

POWER SOURCE
Scope Irons will operate from 2.5V to 6V. For convenience, Safety and complete satisfaction use only the *Approved Scope Transformer—look for the name Scope.

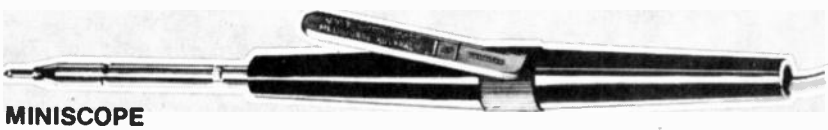
*Approved by electricity authorities APP. No. N/360/6894—5

Fully guaranteed when used with the approved "Scope" Transformer—
available from Electrical Wholesalers and Hardware stores



SCOPE DELUXE

SCOPE STANDARD



MINISCOPE

Trade sale enquiries to sole Aust & NZ agent:—

IRH Components Pty. Limited
The Crescent, Kingsgrove, N.S.W. 2208. Phone: 50-0111
74 Raglan St., Preston, Vic. 3072. Phone: 44-5021

INTERSTATE	TELEPHONES
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 MEANS A LIFETIME OF SATISFACTION

Please post free SCOPE literature.

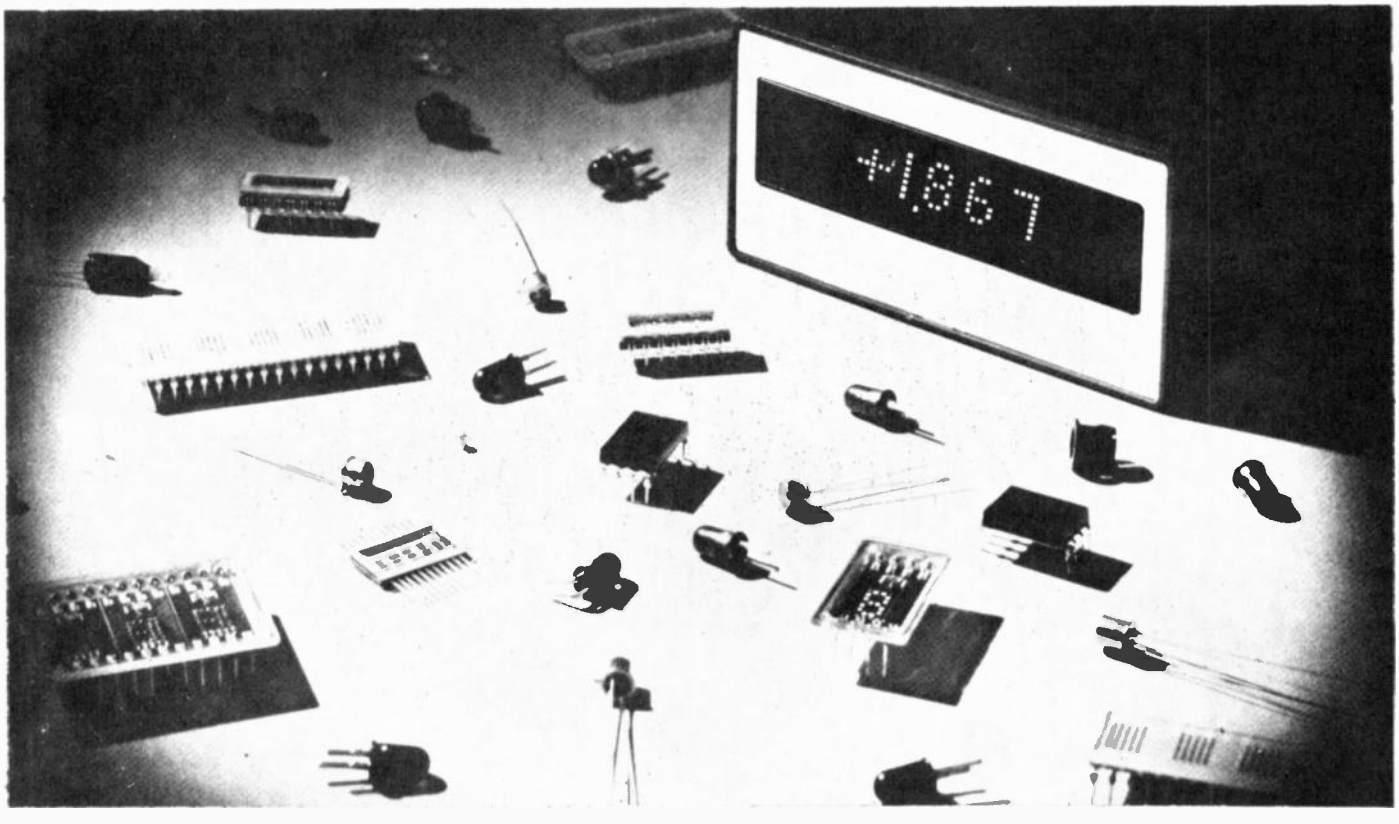
NAME .....

ADDRESS .....

.....

CITY ..... Postcode .....

57 cents!



The Hewlett-Packard 5082-4440 costs just that! 57 cents in quantities of 100 and only 81 cents for single units. This is the cheapest, most reliable solid state lamp available today.

The 5082-4440 is only one of the remarkably large range of optoelectronic devices available from Hewlett-Packard.

Others are:
Solid State Displays, ranging from single numerics to clusters of alphanumerics, many with decoding ICs built into the display package.

Infra-Red Emitters and Photodiodes, available in a variety of package styles to suit your particular purpose. Also Photon Coupled Isolators.

Digital Panel Meters, with low power requirement and high reliability.

Solid State Lamps, like the 5082-4440 – with a range of luminous intensities and packaging arrangements to cover most requirments.

This is only part of the Hewlett-Packard optoelectronic story. Let us tell you the rest – write for further information to Hewlett-Packard Australia Pty. Ltd. 22-26 Weir Street, Glen Iris, Victoria 3146. Tel: 20 1371.

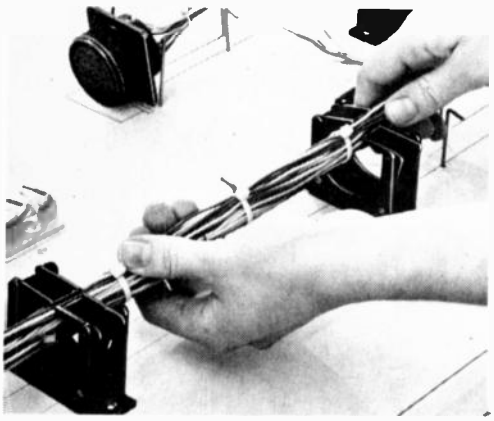
Branches also in Adelaide, Brisbane, Canberra, Perth and Sydney. Also in Auckland and Wellington, N.Z.

HEWLETT hp PACKARD

90221

COMPONENT NEWS

NEW WIRING HARNESS SYSTEM



A new Wiring Harness Jig Board system has been introduced by Panduit Corp., Tinley Park, Illinois. The new system is claimed to be a proven concept for faster wiring harness assembly, and offers the advantage of re-use of the board and accessories instead of requiring extensive storage space.

The new PAN-BOARD Jig Board comes in a standard 2ft. by 3ft. size. Larger harnesses are fabricated by joining two or more boards side-by-side or end-to-end, by means of a special lip incorporated into the PAN-BOARD design.

The PAN-BOARD Jig Board consists of layers of stainless steel screen separated by layers of honeycomb material. In use, an engineering drawing or blueprint of the harness to be built is taped on the board, and various wire holding accessories are attached to the board according to the layout. Using the accessories to define the wiring path, wires are installed in the normal manner.

The available accessories include a versatile "snap-in, snap-out" elastic retainer which automatically forms round bundles as the wires are inserted. Uniform, tight harnesses are thus insured when cable ties are installed.

Other accessories include the fanning strip assembly to isolate conductors at the proper place; straight and bent harness pins to define the wiring paths and hold down the harness; and coated harness springs to secure wire ends.

PAN-BOARD accessories conveniently elevate the harness above the board surface, making it easier and faster to install cable ties, and aiding in dressing and forming the harness.

One of the main advantages of the PAN-BOARD system is the fact that it is immediately reuseable by simply removing the accessories and the drawing, and laying a new drawing on the board. This eliminates the need for extensive storage space to keep harness boards, and a large number of duplicate accessories. Only the drawing has to be stored for each type of harness.

Full details from Astronics Pty. Ltd., 121 Crown St., East Sydney, NSW.

NEW SEALING COMPOUND

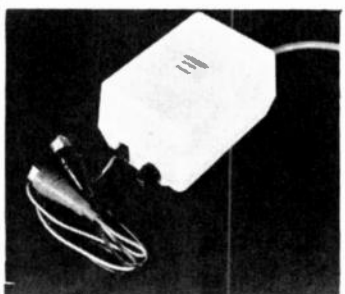
A sealing compound for strain gauges, has been incorporated in the Philips product range under type number PR 9258/00.

Strain gauges very often require protection in conditions of fluctuating relative humidity in order to ensure absolutely accurate measurement. According to the

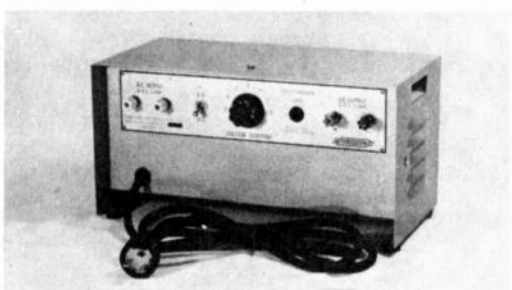
FERGUSON Transformers Pty Ltd

MANUFACTURERS OF:– *TRANSFORMERS *FLUORESCENT LIGHTING BALLASTS *MERCURY VAPOUR CONTROL EQUIPMENT *SODIUM VAPOUR CONTROL EQUIPMENT *NEON TRANSFORMERS *OUTPUT TRANSFORMERS *TRANSISTOR OUTPUT *TRANSISTOR DRIVER *MATCHING TRANSFORMERS *GENERAL PURPOSE *FILAMENT TRANSFORMERS *LOW VOLTAGE TRANSFORMERS *SPECIAL PURPOSE *FILTER CHOKES *STEP-DOWN TRANSFORMERS

Step-down transformer



12V, 1½ AMP battery charger



A.C./D.C. variable power supply used by N.S.W. Dept of Education in school science laboratories

Ferguson products are available from electrical and radio wholesalers and HEAD OFFICE – 331 High St., Chatswood. Phone: 40 0261

AGENTS

TAS. Associated Agencies Pty Ltd, 25 Barrack St, Hobart, 7000. Phone: 2 1843

A.C.T. Errol Nazer Pty Ltd, 84 Barrier St, Fyshwick, 2600. Phone: 9 0325

QLD. Keith Perty & Co Pty Ltd, Waterloo St, Newstead, 4006. Phone: 51 5461

W.A. H.J. McQuillan Pty Ltd, 107 Wellington St, West Perth, 6005. Phone: 21 4821

S.A. K. Farmer Sales Pty Ltd, 49a Whitmore Sq, Adelaide, 5000. Phone 51 4488-9

VIC. Ferguson Transformers Pty Ltd, 181-183 Hawke St, West Melbourne

manufacturer, this new sealing compound affords perfect protection. It is said to be resistant to sea and other water up to a pressure of approximately 400 kg/cm^2. The compound can be stored at room temperature and, supplied in effectively pre-dried; 4 x 50 mm strip form, is simple to use. Fused on with a soldering bolt, the material provides complete sealing of the area embracing the leads connected to the strain gauges.

This sealing compound protects a measuring installation for years against the effects of moisture and is claimed to allow absolutely accurate measurement even under water, for example: in shipbuilding.

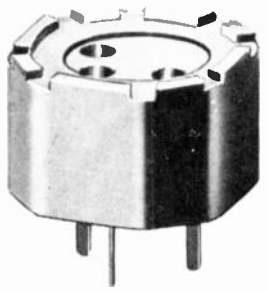
Further details from Philips Electrical Industries, 95-99 York Street, Sydney, Scientific and Industrial Equipment Division.

LIGHT REFLECTION TRANSDUCER

The FPLA850 consists of a gallium arsenide infrared emitting diode and a silicon NPN phototransistor. The on-axis radiation vector of the diode and the on-axis response vector of the phototransistor are both perpendicular to the face of the FPLA850. The phototransistor thus responds to radiation emitted from the diode only when a reflective object or surface is in the field of view of the phototransistor. The diode used in the FPLA850 is similar to Fairchild's FLD 1000 gallium arsenide infrared emitting diode. It emits an intense, narrow band of radiation, peaking at approximately 9000 A (non visible) when forward biased.

Further details from Fairchild Australia Pty. Ltd., 420 Mt. Dandenong Rd., Croydon, Vic. 3136.

TO-5 3-LEAD SOCKET



McMurdo (Australia) Pty. Ltd., announces the Jermyn A23-2045 TO-5 3-lead socket which is of octagonal shape and allows close packing on 0.40 in. pitch without danger of adjacent devices shorting.

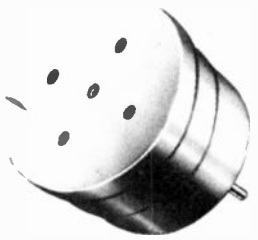
The overall height of 0.3 in. enables devices with leads up to 0.25 in. long to be fully inserted.

The socket is moulded in glass loaded nylon and is fitted with gold plated phosphor bronze contacts. Contact resistance is claimed to be typically 11 milli-ohms and capacitance between contacts is 0.7 pF. Insulation resistance between the contacts is said to be over 10^4 megohms.

The solder tails are suitable for P.C. boards up to 0.125 in. thick and are arranged on a 0.20 in. P.C.D.

Further details from McMurdo (Australia) Pty. Ltd., 17-21 Carinish Road, Clayton, Vic. 3168.

P.T.F.E. SOCKETS



A range of Jermyn sockets, with precision machined bodies in P.T.F.E. is now available to accept the majority of transistors and I.C.'s in TO-18 and TO-5 size packages.

Suitable for breadboarding, production and burn-in purposes the sockets are suitable, it is claimed for the temperature range -70°C to +200°C.

Rapid installation and firm fixing is achieved by press fitting into a round hole in the chassis or P.C. Board.

Types available are:–

TO-18 – 3 and 4 lead (0.1" P.C.D.)

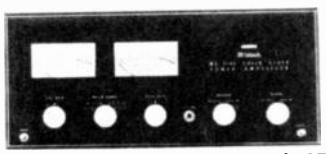
TO-5 – 3, 4, 5, 6, 8 and 10 lead (0.2" P.C.D.)

TO-5 – 10 lead (0.23" P.C.D.)

TO-5 – 12 lead (0.25" P.C.D.)

Further details from McMurdo (Australia) Pty. Ltd., 17-21 Carinish Road, Clayton, Vic. 3168.

McIntosh
AMPLIFIERS.
Closer to Perfection



MC2105 2 x 105 watts RMS – $1076

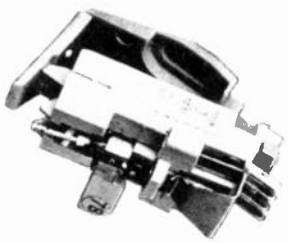
Available from Selected Dealers in Brisbane, Sydney, Melbourne, Adelaide, Canberra and Perth.

SOLE AUSTRALIAN DISTRIBUTORS
Leroys Industries PTY. LTD. 266 Hay St., Subiaco. W.A. 6008

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	$6.95
GP91-2 HIGH OUTPUT MONO CRYSTAL Stereo Compatible	$6.95
GP92 MONO CERAMIC Stereo Compatible	$7.55
GP93 STEREO CRYSTAL	$8.55
GP94-1 STEREO CERAMIC	$8.95
GP94-5 STEREO CERAMIC FOR TRANSISTOR AMPLIFIERS	$9.95



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.S.W. Phone: 73 1227

WE HAVE AUSTRALIA'S LARGEST RANGE OF —
ACOUSTIC SPEAKER GRILLE CLOTH

Call and see the wide range of colours and weaves. (Country and interstate residents—for just 25 cents we will send you a sample swatch with prices).

NAME

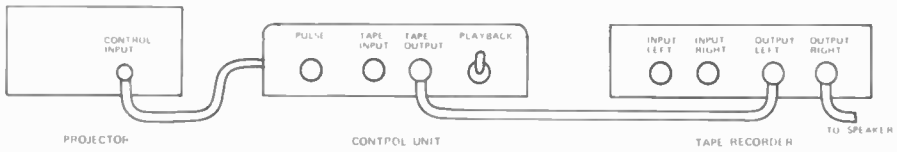
ADDRESS

Manufacturer & Wholesaler Enquiries Welcomed.
TRUSCOTT ELECTRONICS PTY. LTD.
the sound house
62-64 HINDMARSH SQUARE, ADELAIDE
SOUTH AUSTRALIA 5000

TAPE/SLIDE SYNCHRONIZER

(Continued from page 48)

Fig. 7. Interconnections — replay.



PARTS LIST ET 513

R1	— resistor	10k	½ Watt	5%
R2	— resistor	100ohm	½ Watt	5%
R3	— resistor	680k	½ Watt	5%
R4	— resistor	1k	½ Watt	5%
R5	— resistor	100k	½ Watt	5%
R6	— resistor	10k	½ Watt	5%
R7	— resistor	1k	½ Watt	5%
R8-R12	— resistor	10k	½ Watt	5%
R13	— resistor	2.7k	½ Watt	5%
C1	— capacitor	330µF	25V electrolytic	
C2	— capacitor	10µF	25V electrolytic	
C3	— capacitor	100µF	25V electrolytic	
C4	— capacitor	10µF	25V electrolytic	
C5	— capacitor	10µF	25V electrolytic	
Q1-Q4	— transistors	BC108		
D1-D5	— silicon diodes	EM401	or equivalent	
D6-D8	— silicon diodes	IN914	or equivalent	
RLA	— miniature relay type VP2, 430 ohm coil (or equivalent)			
T1	— mains transformer — AR type 6474 — 12.6V, 150 mA or equivalent			
PC board	— ET 026			
SW1	— double pole on/off switch MSP 625 or similar			
SW2	— single pole on/off switch			
PB1	— push button switch — press to make RCA sockets, metal case (available from Warburton Franki Pty. Ltd. in all States — type number is 200D), three-core flex, cable clamp, plug to suit projector, hoop-up wire etc.			

Flick the replay switch SW2 to the off position and move the first slide into position. Now start the tape recorder and switch the replay switch into the on position as soon as the commentary starts. The slides will now be changed automatically at the prerecorded times.

The 'pulse' button on the control unit may still be used to override the control unit at any time.

The replay switch must be in the off position when stopping, starting or rewinding the tape as any signal from the tape recorder will initiate a slide change.

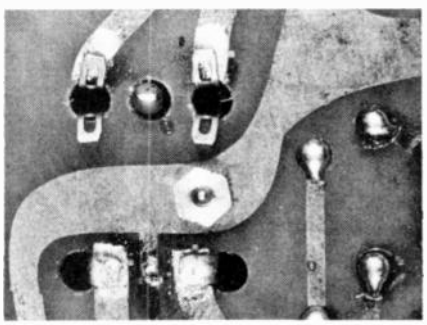
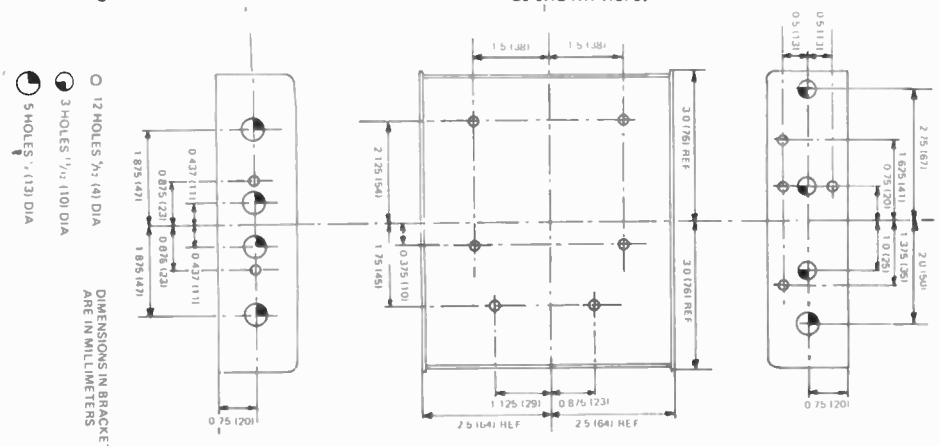


Fig. 8. The relay is soldered directly onto the printed circuit board. The two centre pins of the change-over contacts are commoned — as shown here.



Metalwork details — this case can also be obtained, ready made but undrilled, from Warburton Franki Pty. Ltd. The type number is 200D.

PLAN YOUR FUTURE IN ELECTRONICS

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.

RADIO SERVICING

Comprehensive training in the maintenance and repair of radio and TV receivers, providing a solid basis for colour TV servicing courses for which will commence in the near future.

BROADCASTING

A thorough grounding in all theoretical and practical application of broadcasting equipment as required by P.M.G.'s broadcast operator's examination.

SHIPS RADIO OFFICERS

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.

Classes are conducted at 21 Pier Street, Sydney (at the foot of Goulburn Street).

Daily: 9.30 a.m. to 4.30 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.

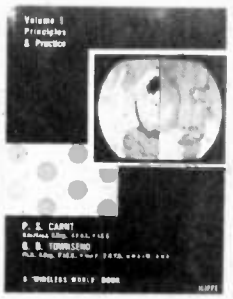
COLOUR TV

COLOUR TELEVISION SERVICING – By: Gordon J. King.

CONTENTS: Science of colours, the colour camera signals and displays, shadow mask colour tube, overall view of colour system, purity and convergence, time-bases E.H.T. and power supplies, luminance and colour difference amplifiers and Grey-scale tracking, vision chroma reference generator and sound stages, encoding and decoding, test instruments and signals, locating fault area, servicing procedure, servicing in field, tuned circuit alignment, faulty picture tube systems. PRICE: $14.85.

COLOUR TELEVISION – VOL I: Principles and Practice – By: Carnt and Townsend – 487 pp. illustrations. 16pp. plates.

CONTENTS: Colour Measurements. Colour Picture Tubes. Cameras and Film Scanners. Transmitter Coding. Specification in N.T.S.C. Systems. Transmitter Coding Circuits. Introduction to Colour Receiver Design. Colour Receiver Amplifiers. Colour Receiver Decoding Circuits. Colour Receiver Reference Frequency Generators. Operation of the Shadow Mask Tube. Colour Receiver Test Equipment and Performance Measurements. Receiver Installation. Colour Receiver Fault finding. Monochrome Reception of N.T.S.C. Signals. Shortcomings of N.T.S.C. Systems. Appendices. PRICE: $13.50.



COLOUR TELEVISION THEORY – By Geoffrey H. Hutson – PAL-System Principles and Receiver Circuitry.

CONTENTS: Light, Colour Television Signals, Colour-bar Signals (NTSC and PAL), Basic PAL Coder, Transmitter, and Receiver Arrangements, Receiver Display Devices, Convergence: General Principles, Convergence and Raster-shape Correction Circuitry, Chrominance Signals; General Principles of Quadrature Amplitude Modulation and Demodulation, Principles of PAL Quadrature Modulation and PAL-S Demodulation, Basic Principles of PAL-D Demodulation, Synchronous Demodulators, PAL-D Decoder Techniques, Delay-lines and Associated Circuitry, PAL-D Decoder Techniques: V-Channel Switching Circuitry, Chrominance Amplifiers and Associated Circuitry, Colour-difference and Luminance Amplifiers, E.H.T. Systems and Receiver Design and Development. PRICE: $10.80.

BEGINNER'S GUIDE TO COLOUR TELEVISION – By: T.L. Squires A.M.I.E.R.E. – 124 Pages.

CONTENTS: Historical Outline, Colour Signal, Creating a Colour Signal, Complete Signals, Colour transmission, Receiving the Colour Signal, Domestic Aerial Systems, Receiver Block Diagram, The SECAM Receiver, Revision, Controls on a Colour Television Receiver, Index. PRICE: $2.55.

IS COMING!

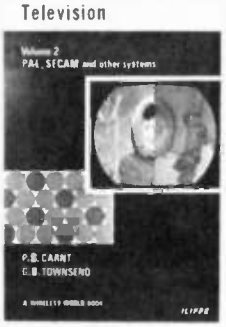
PREPARE YOURSELF NOW WITH TECHNICAL HELP FROM THE EXPERTS...

COLOUR T.V. SERVICING GUIDE — By: Robert Middleton — 112 pages arranged in Trouble Symptoms.

Includes general trouble shooting procedures, trouble with black and white sections, colour-killing and automatic-chroma-control, colour sync, chroma-matrix, Convergence, high-voltage and focus-circuit and Colour-Signal Generator troubles. PRICE: $4.75.

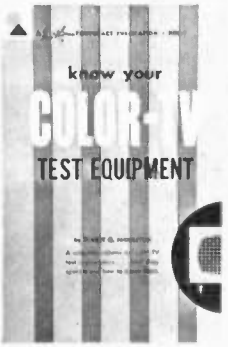
101 WAYS TO USE YOUR COLOUR-T.V. TEST EQUIPMENT — By: Robert Middleton.

CONTENTS: Equipment Checks, Chroma Signal Tracing. TESTS: Colour Sync, Chroma Demodulation, Matrix, Bandpass Section Regeneration, Sequential Chroma, Convergence, and Miscellaneous Tests. PRICE: $4.05.



COLOUR TELEVISION — Vol II Pal, Secam and Others — By Carnt and Townsend — 276 Pages — $16.10.

CONTENTS: N.T.S.C. system — revised, PAL System and Equipment, Comb filter, Secam Equipment, ART, NIR and other Systems, Dot Structure and Cross Colour.



KNOW YOUR COLOUR T.V. TEST EQUIPMENT — By: Robert Middleton.

CONTENTS: General Instrumentation; White-Dot and Crosshatch Generators; Understanding Colour-Pattern and Bar Generators; Principles of Video-Frequency Sweep Generators; Miscellaneous Colour Test Equipment; Maintenance of Colour-T.V. Test Equipment. PRICE: $5.50.

PRINCIPLES OF PAL COLOUR TELEVISION AND RELATED SYSTEMS — By: H.V. Sims, C. Eng., M.I.E.E., R.I.E.R.E.

CONTENTS: Development of Colour Television; The NTSC System; Phase Distortion; The PAL System; Some Inherent Deficiencies; PAL Decoders; The SECAM System; Comparison of the Systems; Bibliography. PLUS: A Flying spot colour television transparency scanner and examples of the effects of phase distortion in the PAL system. PRICE: $6.30.

MODERN BOOKS & PLANS,
21-23 Bathurst Street, Sydney 2000.

Please send me the following book(s) . . . . . .

. . . . . .

. . . . . .

Add postage — N.S.W. 60c, other States 80c.

I enclose $ . . . . . .

Name . . . . . .

. . . . . .

. . . . . State . . . . . P. Code . . . . . .

ET42

Prices current at time of publishing but are subject to change.

AUDIO NEWS

Latest cassette recorder to have the Dolby system of noise reduction inbuilt is this new SC700 from Sansui. Apart from the Dolby system, the unit features a wide-band 'contourless' record-replay head, a preamplifier with low-noise silicon transistors, and a tape selector switch to permit the choice of chromium dioxide or standard ferrous oxide tapes.

AUSTRALIAN HIGH FIDELITY ASSOCIATION

At a well attended meeting on February 28, delegates from the hi-fi industry voted to form an association to oversee development and promotion of hi-fi in this country.

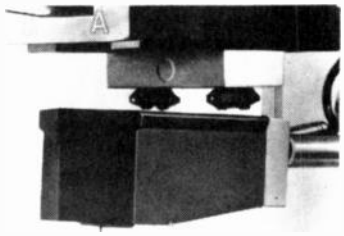
The new body – designated the Australian High Fidelity Association – aims to promote high quality standards in this fast growing entertainment medium. The organisation will also act as a reference centre for public enquiries.

Electronics Today International welcomes this new body and wishes them every success in their future operations.

Secretary of the new association is:–

Mr. J.W. Martin,
P.O. Box 2009,
North Parramatta,
N.S.W.

CRYOGENIC CARTRIOGE



Decca have produced what they claim to be a virtually hum-free cartridge incorporating the unique "positive scanning" technique used in their range of ffss pick-up heads.

Decca have named this new cartridge *'The London'*.

It has always been thought an inherent feature of the ffss design that, because the signal is generated at the stylus itself, any hum present in the vicinity of the pick-up (i.e. from turntable motors, mains leads, switches, transformers etc) would be 'read' as a genuine signal. The revolutionary new magnetic material incorporated in the London magnetic circuit design has overcome this problem and the result is not only a significant reduction in hum but also a drastic reduction in the mass of the cartridge (from about 14 grams to less than 4 grams) and the nuisance of external magnetic fields has been virtually eliminated.

The new product also features an increase in output: giving 1½ mVs/cm/sec – an increase of about 50% on the output of the average top quality magnetic cartridges now available.

The unprecedented technique of super-cooling the armature in liquid nitrogen at *minus 196°C* has helped give this cartridge an eminently flat response and stable performance.

The manufacturer's claim:–

(a) reduction of hum by as much as 15 dB
(b) increase in output (7½ mVs for 5 cms)
(c) reduction of stray magnetic field enabling steel turntable to be used
(d) reduction of physical mass – down from about 14 grams to 4 grams.

"this must be one of the best, possibly even *the* best professional-quality tape recorder yet made"
— Electronics Today, Feb. 1972.

FERROGRAPH
SERIES SEVEN D
with
DOLBY B NOISE REDUCTION SYSTEM
DOLBY SYSTEM

Sole Australian Distributors
Leroya Industries PTY. LTD.
266 Hay Street, Subiaco. 6008. W.A.

These new Bowers and Wilkins type DM2 speakers – which are to be marketed complete with metal stand – will be shown at Britain's Sonex '72 exhibition at the end of March. Like all speakers in the B&W range, these new DM2's are supplied complete with chart recording of frequency response.

Also to be shown at the Sonex exhibition are a range of American Poly Planar speakers, that are suitable, if the advance publicity is anything to go by, even for hanging from trees in the garden.

PHILIPS LOUDSPEAKERS

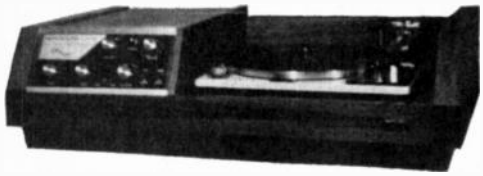
The Elcoma Division of Philips have produced their 1972 edition of their High Fidelity Loudspeaker and Enclosure Design catalogue.

The new catalogue contains details of the company's range of driver units from 1" dome tweeters to their 12" high power woofers.

Also included are constructional details of enclosures for various loudspeaker combinations.

The catalogue is available – free of charge – from the Elcoma Division of Philips in each State.

STOP PRESS



New Australian manufactured unit-audio systems from AUDIOSOUND combine a choice of Garrard or Dual record players with AUDIOSOUND'S existing range of 30 Watt/channel amplifiers. Options include an AM tuner, simulated quadrisonic output and a choice of AUDIOSOUND loudspeakers.

Any combination of equipment may be supplied housed in either of two cabinet styles. One is a four-piece system with record player on a wooden base – and fitted with a plexiglass lid.

The second combines amplifier and player in a compact cabinet (illustrated). Prices of complete systems start at $449.

Full details from AUDIOSOUND, 35 Heather Street, Collaroy Plateau, NSW, 2098.

TDK~SD*

THE ONLY SUPER-TAPE THAT WORKS PERFECTLY ON EVERY TAPE RECORDER OR CASSETTE PLAYER.

No problems in erasure • no squeaky highs.

*(*SUPER DYNAMIC – EXCLUSIVE GAMMA-FERRIC)*

**Professional quality recording tape praised the world over.
Tape recorders are . . . "dramatically improved"
says Consumer Guide, U.S.A.
"Significantly different performance from other tapes that we have tested" says Electronics Today, Sydney.**

THE TDK STORY In 1932, TDK's founders invented a new class of materials, ferrites, that became the basis of the entire magnetic recording industry. Today TDK is an International Company with more than 5,000 employees in Japan, U.S.A., West Germany and Taiwan, maintaining TDK's leadership in audio, video and computor grade tapes.

'SD' SUPER DYNAMIC CASSETTE TAPE The tape that turned the Cassette into a High Fidelity Medium.
Gamma Ferric Oxide, an exclusive TDK high resolution, high efficiency magnetic formulation, has made it possible to achieve fidelity in the cassette medium that could previously be obtained only with reel to reel decks.
The surface of SD tapes is almost mirror smooth, which combined with special binders and lubricants has all but elliminated head wear.
The tape offers the following features:
Frequency response from 20–30,000 HZ • Increased output level • Minimum distortion • Expanded dynamic range • Lowest noise, best signal-to-noise ratio • High reliability jam proof cassette construction • Polyester Base.

'SD' SUPER DYNAMIC REEL TAPE Engineered for the next generation of tape recorders, TDK Super Dynamic tape on open reels is capable of dramatically improving the performance of old recorders of modest quality. With reasonably good home equipment, it can produce professional, studio quality results 20–30,000 HZ.

(left) Ordinary magnetic particles, magnified (right) SD–tape microfine particles of Gamma Ferric Oxide exclusive to TDK, also magnified.

Size available:
7" 1200' & 1800'
10" NAB 3600'
C60, C90, C120, C180.

AVAILABLE FROM QUALITY HI-FIDELITY STORES.

OTHER TDK TAPES AVAILABLE FROM DISTRIBUTORS

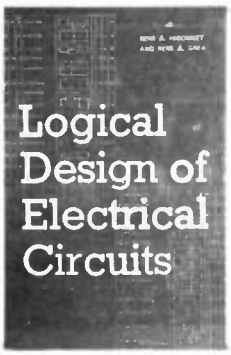
DIGI–Pack Computor Cassettes • Endless tape cassettes (3 mins, 6 mins, 30 sec. and 90 sec.) • Video and Computor tapes • Bulk packs. All tapes are Polyester based.

SOLE AUSTRALIAN AGENTS
CONVOY IMPORTS, 1 Maclean St., Woolloomooloo, Sydney, 2011. Phone 357-2444.

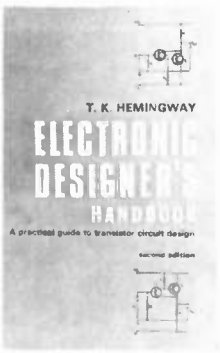
STATE DISTRIBUTORS:

NSW – Convoy Imports, (as above)
VIC – AMI, 155 Gladstone St., Sth Melbourne – 69 7281
QLD – Brisbane Agencies, 72 Wickham St., Valley – 21 9139
SA – Truscott Electronics, 64 Hindmarsh Square, Adelaide – 23 3024, 23 3278
WA – Arena Distributors (Aust) P/L, 196 Adelaide Terrace – 25 9993, 25 9098

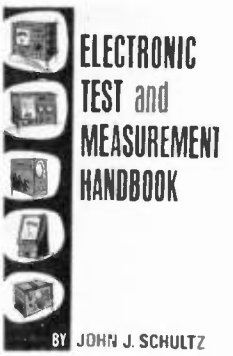
MAIL ORDER BOOKS



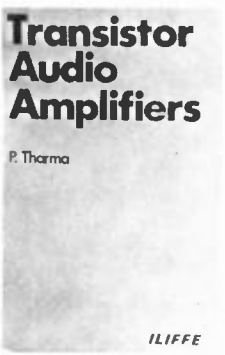
E48. LOGICAL DESIGN OF ELECTRICAL CIRCUITS — R.A. HIGONNET & R.A. GREA — 8 ¾.. x 5½" 220 pp. $8.30.
Virtually all the fields used by the present day circuit designs are covered in the book including combinational circuits (steady state), sequential circuits, which are treated by a modern, simpler method; and shunt-down circuits (inhibitors) described by Boolean algebra. Many worked examples plus more than 300 illustrations are provided.



E16. ELECTRONIC DESIGNER'S HANDBOOK. 2nd EDITION — T.K. HEMINGWAY — 296 pp. 8½.. x 5½" $10.85.
This book provides an up-to-date introduction to transistor circuit design. The basic techniques of design are emphasised and the circuits analysed are done so in such detail that the underlying techniques can be applied to any circuit of a known mode of operation. Contents (in brief) basic circuits; special circuits; useful techniques and troubleshooting.



E50. ELECTRONIC TEST AND MEASUREMENT HANDBOOK — J.J. SCHULTZ — 8½" x 5½" 220 pp. P/B $6.15.
Whether electronic equipment is commercially built or "home constructed" or a combination of the two, eventually there is a need to test it. It may be concerned with verifying or establishing proper operation, checking performance or repairing a defective circuit. This manual is designed to facilitate such testing regardless of its purpose.



E45. TRANSISTOR AUDIO AMPLIFIERS — P. THARNA — 8¼" x 5½" 352 pp. $19.00 pub 1971.
This book presents the various aspects of design of transistor audio amplifiers and is based on the work done by the audio application group of the Mullard Central Application Laboratory. The contents (in brief) cover transistor characteristics, circuit design and measurements, considers various applications and describes circuits.

E10 BREAKTHROUGH — DR. KONSTANTIN RAUDIVE. BOOK & L.P. RECORD. 391 pp. 8½" x 5½" $13.90. Dr. Raudive's research points to the fact that seemingly there is life after death and with the aid of tape recorder, radio and microphone a "breakthrough" has been achieved. This book and the recording of the voices from the dead has been the subject of world wide discussion.

E12 PULSE DIGITAL & SWITCHING WAVEFORMS — JACOB MILLMAN Ph.D. 958 pp. 8½" x 6". Soft Cover $10.25. Hard Cover $18.40. There are many ways of implementing a pulse or digital system designed to perform a particular function. It is hoped that through a study of this text and the experience gained for solving problems the reader will develop facility with these circuits and sharpen his creativity and ingenuity.

E14 DIGITAL PRINCIPLES & APPLICATIONS — A. P. MALVINO — D. P. LEACH. 433 pp. 9¼" x 6¼" $10.45. This book introduces the exciting field of digital electronics. It covers all the necessary fundamental concepts offered in a first course in digital systems. Glossaries, review questions and problems with solutions appear at the end of each chapter as study aids.

E15 DESIGNING WITH LINEAR INTEGRATED CIRCUITS. ED. BY JERRY EIMBINDER. 300 pp. 9½" x 6" $11.50. In the past few years integrated circuits have rapidly come into use and have also undergone many changes and found new applications. The authors of these articles, application engineers at integrated circuit manufacturers, provide the latest information on the subject.

E21 THE WORLD OF TOMORROW — K. GOLDSTEIN. 10" x 7½", 128 pp. Well illustrated in colour $3.95. Board a Time Machine and travel a century into the future. Explore the oceans and outer space. Imagine creating and living in tomorrow's world! An excellent gift book for budding young scientists and engineers.

E28 TAPE RECORDING FOR THE HOBBYIST — A. ZUCKERMANN. 9" x 5½", $4.40. This book suggests not only WHAT you can do with a recorder, but HOW. Apart from the hobbyist there are many ideas on what a recorder can do for anybody's home and business life.

E34 BEGINNERS GUIDE TO TRANSISTORS — J. A. REDDIHOUGH. 7¼" x 5", 160 pp. $3.55. Describes what transistors are, how they work, the many types available and their many applications. This will be useful to the layman wishing to understand the fundamentals or the apprentice technician.

E35 DICTIONARY OF ELECTRONICS — H. CARTER. 7¼" x 5", 416 pp. $5.95. The concise but explanatory definitions from many branches of electronics, including radio, television, communications, radar, electronic instrumentation and industrial electronics should prove useful to all those interested in modern electronic terminology.

E36 DICTIONARY OF TELECOMMUNICATIONS — R.A. BONES. 7½" x 5", 208 pp. $7.50. The wide range of definitions, including many reproduced from, or based on, British Standards recommendations, is supplemented by appendices including units and abbreviations, wavelengths and frequency bands and signal reporting codes.

E38 ELECTRONIC'S DATA HANDBOOK — M. CLIFFORD. 8¾" x 5½", 158 pp. $3.55. This is an incredible reference work for both students and technicians as it provides in one volume the formulae and tables most frequently required.

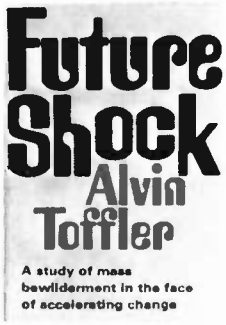
E39 ELEMENTS OF TRANSISTOR PULSE CIRCUITS — T. D. TOWERS. 8¾" x 5½", 168 pp. $6.30. Provides the busy engineers with a review of the transistor version of the building bricks commonly used in pulsed circuits; descriptive and practical detailed analyses and maths have been kept to a minimum.

E44 20 SOLID STATE PROJECTS FOR THE CAR & GARAGE — R. M. MARSTON. 8¾" x 5½", 116 pp. Hard Back $6.10. P/B $4.25. Eighteen projects for the car range from those that warn of danger to easing the driver's task — Two for the garage — a self-regulating battery charger and a speed controller for an electric drill.

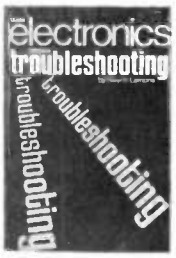
E45 TRANSISTOR AUDIO AMPLIFIERS — P. THARNA. 8¼" x 5½", 352 pp. $19.00. The background information which has helped in the design of several original circuits is presented. The classical method of design and evaluation are adopted and simplified to suit transistor audio amplifier circuits.

E46 SIX-LANGUAGE DICTIONARY OF AUTOMATION, ELECTRONICS & SCIENTIFIC INSTRUMENTS — A. F. DORIAN. 10" x 8", 732 pp. $12.80. Orders taken, delivery 12 weeks. This book enables the engineer and physicist to understand the technical publications of another language. Contains over 5,500 terms in English, French, German, Italian, Spanish and Russian.

E47 PRINCIPLES OF ELECTRONICS IN MEDICAL RESEARCH — D. W. HILL. 8¾" x 5½", 302 pp. $12.00. Orders taken, delivery 12 weeks. Written specifically for doctors and others responsible for electronics staff and apparatus it describes the more commonly used terms, components and circuit techniques with references to further reading.



E11. FUTURE SHOCK — ALVIN TOFFLER — 8½" x 5½" $6.90.
Future Shock is the most startling survey on the present weakness of our society and its future yet written. It is about change and how we adapt to it. It is about the future and the shocks that its arrival brings.



E29. LEARN ELECTRONICS THROUGH TROUBLESHOOTING — WAYNE LEMONS — 3½" x 5½" 576 pp. $12.75.
In this excellent book, illustrated by many photographs and drawings, the subject matter is presented in terms of practical troubleshooting situations and simple, reproducible examples. These facts will be indispensable to the technician entering the electronics field.

Prices are current at time of publishing but are subject to change.

MODERN BOOKS & PLANS, 472
21-23 Bathurst Street, Sydney 2000.

Please state code number when ordering

Please send me the following book(s) .....

.....

.....

Add postage—N.S.W. 60c, other States 80c.

I enclose $ .....

Name .....

.....

..... State..... P. Code.....

RECORDINGS... CLASSICAL

REVIEWERS: John Clare, John Araneta

ELGAR – Sea Pictures, MAHLER – 5 Ruckert Lieder. Janet Baker (mezzo soprano) London Symphony Orchestra (in the Elgar) New Philharmonia (in the Mahler) Sir John Barbirolli (conductor) HMV OASD-2721.

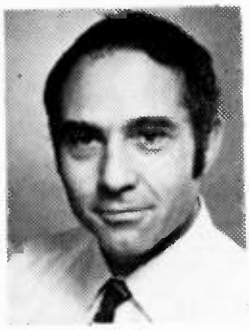
Nothing of course newly recorded on this record. The Elgar cycle has been available with the du Pre recording of the same composer's Cello Concerto, while the Ruckert Lieder can still be had with Barbirolli's rendition of the Fifth Symphony. For those who feel as I do that there are better performances of either the Cello Concerto or the Symphony, here is a chance to get to know these seldom heard works in very fine performances. Not being particularly fond of Elgar, I do enjoy this quite Victorian cycle, full as it is of the typically grand tunes Elgar could so often write. The performance here is the only readily available one, but it can hardly be bettered. But enjoyable the Elgar may be, Mahler's Ruckert Lieder are a different matter altogether. These five songs are among the finest in the literature, and certainly rank with Mahler's best work. Mahler's writing for both voice and orchestra is very subtle indeed and moving, and perhaps nowhere else in music can one find more perfect pictures of loneliness as in these songs, except in Mahler's own later music. Composed in 1902, orchestration of these songs was only completed by 1904, so that these songs are contemporaneous with sketches of the Seventh Symphony, and it is quite possible to hear in the sensitive orchestral writing of these songs the nocturnal touches of that larger work.

In these songs, Janet Baker must naturally bear comparison with Ferrier, Forrester, and Fischer-Dieskau. But she holds her own with these songs and in many cases, surpasses the above singers. There are times when I feel she does not bring out the implied foreboding in say, "Ich atmet' einen linden Duft" as only a man, I think, can do (Fischer-Dieskau, Charles Kullman). These songs are, after all, not strictly a cycle, and I feel a performance divided between male and female singers would be more ideal. But this is an expensive proposition for five short songs and it is easier to buy Fischer-Dieskau's recording of four of the lieder as a supplement to this performance. Elsewhere, I feel that Baker's performance is far superior to even the classic Ferrier performances, memorable though these may be. Ferrier's rather emotional approach to these songs somewhat overpower these actually delicate lyrics. Compare, for instance, the simple, direct faith with which Janet Baker sings the end of both "Um Mitternacht" and "Ich bin der Welt". Both Ferrier and Fischer-Dieskau are too loud, and assured. And surely, here is great singing the way Janet Baker delicately phrases "in meinem Lieben, in meinem Lied." Beautiful. The late Sir John Barbirolli delivers fine, almost affectionate orchestral performances in both cycles, but I do wish greater control was evident in "Um Mitternacht." I know the wind and brass writing here is very difficult, but surely it can be done? In the same song, I feel the harp at "du halst die Wacht" is rather sloppy and in any case, it is also rather vulgarly prominent. Sound is generally good, and notes and texts are included. – **J.A.A.**

MUSSORGSKY-RIMSKY KORSAKOV Boris Godunov Soloists, Vienna Boys Choir, Sofia Radio Choir, Vienna State Opera Chorus, Vienna Philharmonic, Herbert von Karajan (cond.) DECCA SET 514-7.

My initial reaction on receiving this set was one of irritation at yet another Rimsky-Korsakov version of Boris Godunov. This was no doubt heightened when upon opening the libretto I found a photograph of Rimsky. In actual fact, this set is perhaps the most honest I have come across with regard to the textual problem of Boris. On the rather dazzling box, we find both Mussorgsky *and* Rimsky-Korsakov. The credits in the libretto explicitly state this is the Rimsky version and Act 4 (1) edited by Ippolitov-Ivanov. The notes on the production do not lamely defend the use of the Rimsky edition with the usual fiddle: ie. it is more brilliant, Rimsky was after all more expert, etc. The notes state that Karajan studied both original and Shostakovich versions before deciding on the Rimsky, especially since the singers objected to relearning their parts, an understandable problem since relearning the original manuscript is nothing short of learning another opera. Rimsky almost transforms Boris into one of the many fantasy operas he wrote – little starkness but always polish couched in splendid if at times banal orchestration, the sharpness gone. There can be no doubt about Rimsky's expertise; he did invest just about every scene with great, if obvious splendour and colour. But the original has its own dark, often crude splendour. As Stravinsky put it, where, for instance, "Mussorgsky accompanied Pimen, as he wrote, by a single bassoon," Rimsky, "to make certain everyone saw the point, added other instruments, with the result that an original idea is reduced to commonplace."

I must admit to having played this set six times now and after the fifth time I was still wondering what could possibly be wrong either with me or this production. At this point I decided to go back to the Cluytens-directed set on ANGEL and could after that better understand why I could never play through that set as well. Trying the Bolshoi recording on MELODIYA merely served to confirm my suspicions. The Bolshoi performance, generally wretchedly sung and conducted, and featuring a not particularly profound Boris in Ivan Petrov, nevertheless excites me enough to play through it, precisely because it is crude, it is more idomatic, and is done with almost patriotic fervour. Both ANGEL and the present DECCA sets are hardly crude, and especially in the case of the latter I felt at times as if I were appreciating Rimsky's editing for the first time all too clearly. But going back a sixth time to this recording I felt I could well admit its undoubted qualities. Let me say that this Boris is in a technical sense the best available. As far as sound goes, everything is excellently managed. Trust DECCA to bring in really impressive bells for the Coronation Scene and for once they do not seem to come from a completely separate track. Sound and separation are always clear no matter what forces are involved and just about down to the last orchestral detail. As for the performance, it is, I feel, the best played and conducted Boris, and certainly the most finely sung. I am still surprised to find, even the bit roles well sung, which is not unremarkable in the history of performances of this opera. If only there had been more snap, and drive to this performance, I would have no hesitations whatsoever about recommending this set in lieu of any recording of the original Boris. If there is any one act in this performance that



ALEX ENCEL SAYS:

There's a tremendous amount of interest in the QL11 4-channel matrix adaptor for quadraphonic sound. Unlike some of the units currently on offer, this is not a cheap passive unit, but is complete with pre-amplification. Ask us to explain the difference, and you'll understand why it's such excellent value at $69.50.

* *

We've now obtained a supply of the new ROTEL 630 stereo headphones, and like all Rotel products, these are excellent performers and extremely good value for the money. Come on in and try a pair. You'll be delighted that they're only $14.50.

* *

On the tape recorder scene, our Tandberg prices are the best in Australia. Take for instance, the 3041 stereo tape deck, which is designed for a hi-fi system, has 4 sound heads, offers sound on sound, echo, mono mixing, separate recording and playback heads. Suggested retail price, $463 Our price $298 and similar savings are available on the other units in the Tandberg range.

* *

When an authoritative magazine says "We performed tests between our monitor speakers and STAX headphones, and decided that our monitors will have to go!", this is indicative of the superb quality that Stax offers, and the amazing purity of sound. The magazine was Australian Hi-Fi, which further stated, "the nearest thing to perfection that we have experienced in speakers or headphones". Any wonder that Stax are acclaimed the world's best? Supplied with matching power unit, driving up to 6 sets of headphones, Stax are priced at $78.50 and enthusiasts say they're worth every cent. We'll demonstrate with pleasure, or send the complete review for your perusal.

* *

Our current trade-in scale is creating a tremendous amount of interest among stereophiles. There was never a better time than right now to step up to a more modern system, replace components, go four-channel, or in any other way develop or improve your stereo enjoyment. We supply Australia's best value in stereo systems from $149 to $3,900, and with over $250,000 worth of world-famous components to choose from at any time, you can be certain that you're getting the best. And because of our sales volume, you can also be certain that it will be at the best price. Re trade-ins — Let's know the make, model, age and condition of your current system, so we can give you an accurate assessment of its worth.

* *

Re our Sydney address. At the time of going to press, we intend to move from 257 Clarence St., Sydney. However, at this stage we haven't finalised exactly where we'll be located by the time this advertisement appears in April. We suggest that you either call at our current address, where there'll be a re-direction to our new address, or by phoning new and altered phone numbers, you can get our new address in that way.

ENCEL STEREO

Australia's foremost hi-fi authorities

431 Bridge Rd., Richmond, Vic. 3121.
Tel: 42-3762
Mail orders, P.O. Box 286, Post Office, Richmond, 3121.
AND IN SYDNEY:

CLEARANCE SALE

ELECTRONIC EQUIPMENT AND COMPONENTS

Receivers, transceivers ex-Army & Citizens Band transmitters, test equipment, oscilliscopes, sig. generators, multimeters, chassis racks, panels, computer parts & boards, power transformers up to 6.6KV, valves, transistors, potentiometers, etc., speakers, amplifiers, cables — hook/up & coaxial 50 & 70 ohm, multicore up to 50 core. Panel meters, AVO meters, valve testers and all types of electronic components.

7,000 sq. ft. of electronic gear, plenty of parking come and inspect. Open 10-5 p.m. weekdays, 9.30-12 Saturday

Wanted to buy receivers, tranceivers, electronic equipment & components. Top prices paid.

SPECIAL THIS MONTH

No. 62 tranceivers Army type 1.6 to 10M/C 12 Volt operation price **$39.50.**

50 ohm coaxial cable ½" diam. new price 45c yd.

HAM RADIO (DISPOSAL BRANCH)

104 Highett Street, Richmond, Vic. 3121. PHONE: 42-8136.

ALL BOOKS

REVIEWED IN THESE PAGES

(AND HUNDREDS OF OTHERS)

AVAILABLE FROM

TECHNICAL BOOK CO.

289-299 SWANSTON STREET, MELB. 3000. Ph. 663-3951

EDGE ELECTRIX

SPECIALISTS IN ELECTRONIC PARTS AND EQUIPMENT

OPEN 8.30 AM TO 5.30 PM
MONDAY TO FRIDAY —
8.00 AM TO 12 PM
SATURDAY & SUNDAY

25A BURWOOD ROAD
BURWOOD, 2134 N.S.W.
PHONE: 747-2931

FULL RANGE OF:

Capacitors — Resistors — Potentiometers — Semiconductors — Tuning Condensers — Transformers — Speakers — Valves — Switches (Rotary, Slider, Toggle, etc.) — Bezels — Batteries — Stylii — Tape (B.A.S.F.) — Cassettes — Flex — Soldering Irons — Relays — Plugs — Sockets — Terminals — Tag Strips — Tagboard — Matrix Board — Copper Clad Board — Etching Material — Rectifiers — Cases — Chassis — T.V. Aerials — Cable — Fuses — Jacks and Jack Plugs and Kitsets.

COMPLETE MAIL ORDER SERVICE

All goods available at competitive prices. Please write or ring for a quote . . .

CLASSICAL

I thoroughly enjoyed and played through, it is, strangely enough, the Polish Third Act. The Polish Scene has always been for me that portion of Boris I would willingly omit, and I have never heard any performance, be it in the original manuscript or Rimsky versions, that could make me want to come back to it. But even at this writing, the music of the Polish Scene in this performance always comes to mind as the outstanding moment of this set. Karajan evidently enjoys this moment and plays it for all it is worth. It is hard to forget the way Karajan brings out the rhythms of the Polonaise, and the cries of "Vivat!" from the guests shortly before the concluding duet is simply thrilling. But Karajan's singers are also no less remarkable. Galina Vishnevskaya (Princess Marina) may no longer sound as vocally secure as she used to but she is the Princess Marina. She is never just temperamentally crude or vain as Irina Archipova is in the MELODIYA nor just well sung as Evelyn Lear is on the ANGEL. There is always dignity, reserve, and yet fire to her performance. For once too, Rangoni is not the tiresome dullard one expects from portrayals of this role. Zoltan Kelemen coaxes, insinuates, never just threatens. One is quite prepared to believe Rangoni is a Jesuit. Ludovico Spiess (Grigori, later Prince Dimitri) has an almost Italianate break in his voice, but this I feel only helps to portray a not particularly subtle and romantic Pretender. The choruses in this act are very well differentiated and sing well.

The Vienna Philharmonic here plays with the appropriate grace and refinement. Unfortunately, I feel, as I have said, that Karajan lets too much refinement take over the Russian scenes so that while one is always aware that first rate forces are at hand, power is often sadly lacking. The all-important choruses are hardly differentiated between peasants, monks, urchins, boyars, and in any case, they are all too well-mannered. To take certain scenes: the Prologue, for one, lacks that feeling of restlessness that Mussorgsky has evoked so well from Russia's "Time of Troubles". The urchins in the St. Basic Cathedral Scene (Act IV, 1) are pleasant sounding enough to make it hard to believe even a simpleton could be perturbed. Incidentally, tame sounding as this scene is, surely Karajan could have gotten Shuisky to sound a bit more outraged when the simpleton confronts the Tsar with Dimitri's murder. It hardly matters that simpleton and Shuisky are sung by the same person (Aleksei Maslennikov). The editors could have also helped by reducing the pause before Shuisky's words of outrage. The final Revolutionary Scene, which Karajan wisely includes, is, once again, well sung but hardly a revolution. Listen to the incredibly revolutionary sounding MELODIYA performance, and this scene becomes not just an epilogue, as in Karajan's performance, but the true finale of the opera, an enigmatically moving ending with its strange unresolved chords. But I must again emphasize the fact that Varlaam, Missail, Shuisky, everyone sings well. But where is the evil, or coarseness? Which brings me finally to Nicolai Ghiaurov's Boris. If there is a more beautifully sung Boris to be heard I have not found it. Ghiaurov only mars his otherwise musical performance by shouts in the Clock Scene. Still, I felt Ghiaurov sounds too youthful for Boris, not Batyushka enough. His death scene is nevertheless natural and moving. Bearing in mind, therefore, the reservations I have stated above, I would still finally recommend this set very highly. This recording is the only complete recording to be had; all other available sets have seen fit to omit various numbers and scenes. – J.A.A.

DEBUSSY: Nocturnes (Nuages, Fetes, Sirenes).
RAVEL: Daphnis and Chloe II, Pavane.
Boston Symphony Orchestra and New England Conservatory Chorus conducted by Claudio Abbado. DGG 2561 012.

If a more stunning performance of Daphnis and Chloe exists on record then I have not heard it.

The voluptuous surges of sound are absolutely intoxicating, particularly when the wordless chorus emerges, and the spectacular whipcracks are more than that: they are more exciting than a roller-coaster! It is in fact so much a tour de force that one almost hesitates to take it seriously, if you see what I mean. At this time I do not feel inclined to argue with myself about that. The phenomenally brilliant orchestral playing, enhanced by the best reproduction I have heard in ages, is something to be experienced.

Debussy's Nocturnes have not fared quite so well, though they receive performances which are never less than excellent. The subleties of Debussy invite more argument over interpretation than does Ravel's forthrightness. Abbado has avoided limp bonelessness, the greatest pitfall in performing Nuages, but sometimes only just. Lacking is some of the rhythmic tension which should sustain even the most delicate drops of sound, the most breathless lulls. The oboe entry lacks just that hint of drama, and the tiny ripples with which Debussy often follows the incursion of a heavy sonorous figure are perhaps lacking in the precise animation with which Boulez, for instance invests all the fascinating minutiae. Debussy's most transparent and vaporous music is always pinned with springy contrasts. Abbado seems more completely at home with the even flow, the charming wistfulness of Ravel's Pavane for a Dead Princess.

Fetes is another tour de force. The brilliant splashes of colour, the terrific momentum and the fantastically mounting forms are wonderfully satisfying. The rhythm is perhaps too 'straight ahead' in places, not sufficiently spiced with giddy displacements.

Sirenes is almost as impressively played and sung as Daphnis and Chloe, yet again some of Debussy's intricate rhythm patterns tend to be flattened by the largeness of Abbado's conception.

The elaborate packaging suggests that this is intended as a special showcase for the Boston Symphony Orchestra. The overall brilliance of the playing reinforces that impression. Few recordings have this impact. – J.C.

700 WATTS R.M.S.

THE
PHASE LINEAR
AMPLIFIER

BRIEF DESCRIPTION: Fully direct coupled dual channel amplifier. Input selection provision, either d.c. which gives flat response down to 0 Hz, or a.c. which provides a subsonic filter and 100 K ohm input impedance for hi-fi applications. The a.c. input stage is designed so that it will never overload, thus retaining the perfect transfer function and overload characteristics possible only with a totally direct coupled design.
The output stages employ high current, high voltage, triple diffused silicon transistors arranged in a quasi-complimentary format and biased for the true class B operation. The required bias current is carried by the driver transistors only, resulting in circuit efficiency which approaches the theoretical maximum.
Electronic energy limiters, together with supply fuses, prevent excursions into the unsafe operating region, regardless of load conditions.

SOME SPECIFICATIONS
POWER: Greater than 350W RMS each channel, both driven into 8 ohms, 0—20 kHz
FREQUENCY RESPONSE: 0—250 kHz at 1 volt
DISTORTION: Less than .25% typically less than .01%
HUM & NOISE: Better than 100 dB below 350 W
DAMPING RATIO: Greater than 1000:1 at 20 Hz
WARRANTY: 3 years parts and labour
PRICE: $1185 suggested retail.

PERFORMANCE: Pure clean power, effortless precise response without overloading clipping distortion. Absolutely stable with all speaker loads, including electrostatic. Test reports state (in part): "ELECTRONICS TODAY" Magazine (Aust.) "The Phase Linear meets the most exacting specifications that could be realistically required for precision audio frequency equipment in scientific or industrial applications. It is in fact a precise instrument — and really too good for hi-fi applications".
"AUDIO" Magazine (U.S.A.) "We made the specified IHF tests for stability . . . and in no case was there any spurious oscillation . . . the frequency response curve is perfectly flat from d.c. to 100 kHz, the limit of our audio generator. 350 watts per channel was obtained easily with a distortion of less than .04%, which is as low as we can go with present equipment . . . at a ¼ watt level (distortion) measurements were well below our measuring capabilities. Hum and noise . . . better than 100 dB below the 350 watt/channel rated output. Reproduction was all anyone could possibly want as far as quality was concerned, and we wouldn't hesitate to recommend the Phase Linear . . ."

Further information and complete test reports available from the Sole Aust. Agents:

WILFRED H. JONES & CO. (AUST.) PTY. LTD.
190 Willoughby Road, Crows Nest, NSW 2065 • Phone 43 3228

"THE POWER AND THE GLORY – MAC"

McINTOSH AMPS. NOW AT CONVOY TECHNOCENTRE

(New Shipment from U.S.A. – 240-250 50 cycle models)

MODEL C26 PRE-AMP MODEL MC2105 POWER AMP

In January, ELECTRONICS TODAY reviewed the "Mac" pair, C26 Preamplifier and McIntosh 2105 Power Amplifier (210 watts RMS. Total.) Here are highlights from the review. *"At rated output of 105 watts per channel the frequency response was flat from 20Hz to 20kHz ± 0.1dB. With such a high output rating we were surprised when after two hours operation with one channel operating at 105 (RMS) Watts and one at 250 watts (that's right – 250 watts), the temperature rise did not exceed 80°F above a 70°F room temperature on the overloaded channel heatsinks . . . The total harmonic distortion was particularly low . . . The McIntosh is the best amplifier we have ever tested."*

The C26 will control any good amplifier, $550.80. The MC2105 Power Amp can be driven by any good amplifier modified by Convoy, $1076.

The Model MC5100 90 watts RMS is a combined Control and Power Amplifier unit with all the features and quality of McIntosh for the remarkable price of $787.00 complete. Now a new shipment at Convoy Technocentre, the direct importers.

There's a B & W Monitor Speaker for every purpose and pocket at Convoy Technocentre.

What the Critics say about B & W MONITOR Speakers

MODEL 70 ELECTROSTATIC *"approaching the ideal everyone is seeking – perfection."* Mr. John Gilbert in the Gramophone London. – *"I was astounded . . . they sound like the real thing!"* John Freestone, distinguished music critic England. MODEL DM3 Monitor Speakers 2 cu. Ft., *"The DM3 is a loudspeaker design worthy of the name MONITOR. We heartily commend it,"* Audio Record Review. MODEL DM1-72, New Monitor Speakers, 0.65 cu.Ft., *". . . the very best we have heard within its size and price range,"* Tape Recording Magazine . . . *with my colleague audio consultant David Phillips we like them sonically better than any other system."*

β & W Speakers start at $139.00

J.B.L., U.S.A. Hear the L.100 Century speakers. See the Aquarius range of omni-directional speakers – surround yourself with superlative sound.

PEERLESS OF DENMARK. A superb 12" 3 way in Teak or Walnut only $220. pr. astounding value. Cameo 2 way $100. pr. best value.

PIONEER, Japan. Best value for money in Amplifiers, Turntables, Speakers, 15 months Guranatee.

SONY, Japan. Full range of Cassette Recorders, Amps, Turntables, Speakers.

PHILIPS INTERNATIONAL HI–FI, HOLLAND. Europe's top Hi-Fi Equipment manufactured to din standards. A full range of this equipment on demonstration.

TEAC CENTRE FOR AUSTRALIA. A complete range of new TEAC semi-professional equipment on demonstration, fabulous AS100 Amplifier, reminiscent of valves. The Model 1230 Deck and the fully professional 7010 and 3300. Also professional quality TEAC Hi-Fi Cassette Deck from $183. The superb model A350 with Dolby and bias switch only $318.

TECHNOCENTRE SERVICE DIVISION. We Set up your tape recorder or deck for the correct bias to give you optimum from the tape you use. It will be like a new machine when set up for TDK–SD Tape. All repairs and service for Hi-Fi equipment.

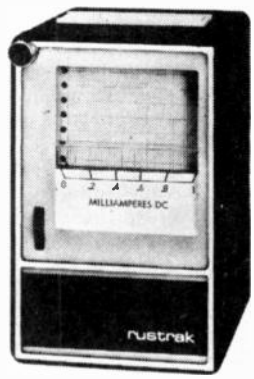
Where you hear and buy the world's top equipment!
Free Customer Parking!

Convoy Technocentre
For Sound Satisfaction
A Division of Convoy International Pty Ltd

Now at corner of Plunkett & Maclean Sts., Woolloomooloo, Sydney, 357-2444 (past Astor Model).

THE rustrak PRIVATE EYE

Rustrak Miniature Recorders chart voltage, current, power, temperature, pressure, strain, events; or virtually any parameter that can be converted into an electrical signal.
Inkless, drywriting, rectilinear recording with wide range of sensitivities, writing and chart speeds.
Quick, easy chart review and re-wind. Sliding access window.
Rugged die-cast aluminium case in epoxy suede-like charcoal gray finish.
63' chart roll – one month's supply at 1" per hour.
Portable or for panel mounting as a system component.
Accuracy ±2% of full scale.
Only 5⅝" high, 3⅜" wide, 4⅛" deep. Weighs 3½ lbs.
Combine any two functions on one chart in our new Dual 300 Series.



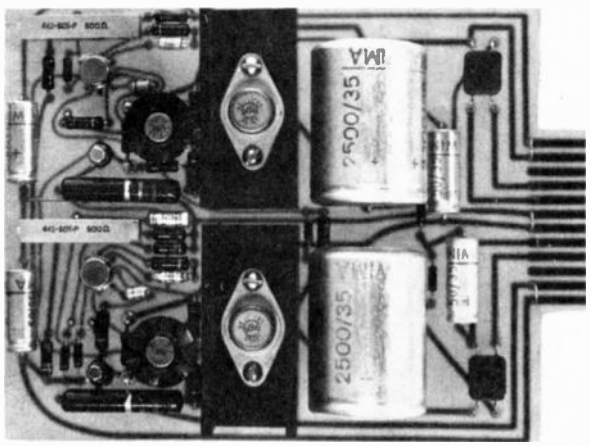
Model 288

TECNICO ELECTRONICS

53 Carrington Road, Marrickville, N.S.W. 2204. Tel. 55 0411
2 High Street, Northcote, Vic. 3070. Tel. 489 9322
211 Flinders Street, S.A. 5000. Tel. 23 3979
97 Merivale Street, South Brisbane, Qld. 4101. Tel. 4 1571

TE5932

POWER MODULES



- Single and Dual Outputs
- Output Voltages to 50 Volts
- Output Current to 2.0 Amps
- Line and Load Regulation – Less than 0.01%
- Short Circuit proof

SCIENTIFIC ELECTRONICS PTY. LIMITED

42 Barry Street, Bayswater
Vic. 3153. Phone –
Melbourne 729 3170; Brisbane 47 4311
Adelaide 77 1325; Perth 21 6146

RECORDINGS... JAZZ

REVIEWER: John Clare.

CHARLIE MINGUS. Blues And Roots Atlantic Stereo SD-1305. Wednesday Night Prayer Meeting. Cryin' Blues, Moanin', Tensions, My Jelly Roll Soul, E's Flat Ah's Flat Too. Jackie McLean and John Handy altos, Booker Ervin, tenor; Pepper Adams, baritone; Jimmy Knepper and Willie Dennis, trombones; Horace Parlan or Mal Waldron, piano; Dannie Richmond, drums.

This is an extremely important reissue, particularly for those who have just started to collect jazz: this is what it's all about! Although all of these pieces are based on modified blues forms, there is not one which does not sound entirely contemporary. That is because the very best of contemporary jazz – Shepp, Cecil Taylor, Joseph Jarman – belongs to the same tradition of emotional, high energy, inventive music as Johnny Dodds, Red Allen, Coleman Hawkins, Roy Eldridge, Bird and Diz, James Moody, Mingus, Ellington, Monk and so on. Though I've often defended the validity of the best West Coast jazz, of the equally four-square but honest and invigorating Chicago jazz, of beautiful melodic players like Paul Desmond, Bobby Hackett and Jimmy Hamilton – these forms, these players are to me but minor planets lit by the fiery core of great wild innovators, some of whom I've listed above.

This music must seem to the newcomer as loose and sprawling as a Faulkner novel, but it is unified by the same underlying strength of form, the same pervading richness of tone. Tough, jabbing solos emerge from turbulent ensembles, which themselves sound as though they were improvised on the spot. Mingus urges his men on with hoarse cries which become part of the music. In solo and support his bass, with its agility, clubbing percussiveness and odd short resonance creates an unmatched sense of urgency.

Wednesday Night Prayer Meeting sounds as the title would indicate like a wild church service in Harlem with the congregation spontaneously erupting in shouts of jubilation. Note the powerful solos of Willie Dennis and Booker Ervin over frantic triple metre. But all this excitement is channeled through compositions and arrangements of great ingenuity. Fine use has been made of the reeds and trombone instrumentation. If one can describe sound in visual terms, I would say that the predominant tones are sepia, yellow, cocoa and mohogany.

This record was made originally in both stereo and mono. The stereo gives the music an appropriate spread, but my old mono copy sounds a little clearer. – J.C.

ARCHIE SHEPP. Pitchin' Can. America. Stereo 30 AM 6106. Uhuru, Pitchin' Can. Bobby Frew, piano; Bob Reid, bass; Clifford Thornton, valve trombone; Mohamed Ali, drums; Al Shorter, flugel horn; Lester Bowie, trumpet; plus various percussionists. Personnel on Pitchin' Can includes Leroy Jenkins, viola; Sonny Murray, drums; Julio Finn, harmonica; Chicago Beau, vocal.

The title track takes up about a third of this recording. Uhuru occupies the rest of the playing time, and though it is basically just another Archie Shepp bash it is essential listening if you want to have a comprehensive picture of what Shepp does. This, like almost every other Shepp recording, is markedly different to every other Shepp recording. It's not that Shepp's own playing changes radically from session to session (though his soprano is quite different to his tenor), but that he creates new musical settings almost every time he records.

Sometimes he carefully organises a new musical environment, writing some passages, having other passages improvised by unusual combinations of instruments; sometimes he just gathers a new set of musicians together and they all have a long jam, which seems to be what he has done here.

Newcomers will find Uhuru one of Shepp's more difficult things to get into. The percussion section plays rhythmically throughout. It sounds rather like furniture falling over at high speed. The piano can be heard chiming, and splintering like chips of ice, almost without let. If you concentrate on this it becomes rather hypnotic, sometimes filling your head with leafcutter ants, suggesting at whiles a mad proliferation of architectural fragments up through the floor, as though a bewildering city were being constantly rebuilt. On its own it is on the level of mere psychedelic effect, but it is meant to serve, and it does serve as a mosaic backdrop for the soloists.

Shepp, on tenor, is by far the strongest. Clifford Thornton is the least interesting. Bowie is not at his best, but he is always good to hear. There are some dull spots, and it all goes on a little too long, but there is a lot of exciting stuff. Take note of Shepp's African influenced singing near the end of side one. His voice is just as rich and compelling as his saxophone, and I think that he does this sort of thing much better than Leon Thomas.

Pitchin' Can is totally different – an open, rolling riff in waltz time, repeated over and over and broken by a really fine Shepp solo on soprano. This sounds like something recorded at the same time as the Black Gypsy session. The first time I heard this I thought that the riff was repeated for longer than it was worth, but after a couple of hearings it got into my system, and I felt that it could go on forever. This is music which anyone can enjoy.

I thought that the soloists apart from Shepp could have been further forward on Uhuru, but Pitchin' Can is quite well recorded. Nothing you could quarrel with on a budget price recording such as this. – J.C.

THELONIUS MONK. Art Blakey's Jazz Messengers With Thelonius Monk. Atlantic Stereo 1278. Evidence, In Walked Bud, Blue Monk, I Mean You, Rhythm-A-Ning, Purple Shades. Art Blakey, drums; Thelonius Monk, piano; Johnny Griffin, tenor sax; Bill Hardman, trumpet; Spanky DeBrest, bass.

I don't think that we can complain about a shortage of jazz recordings at the present time. Indeed, your tastes would have to be very specialised indeed not to have found several things to interest you over the past few months. Not all of the recordings have been released by the larger companies of course but some very good ones have. This reissue is one of the very best. Still viewed by many at the time of its first release as experimental, this music, it must be clear to everyone now but Stanley Dance, is classic jazz.

This has always been one of my favourite Thelonius Monk recordings, and I think it is one of the best that Blakey has made. The two are perfectly suited – perhaps Blakey was the only drummer at the time who fully understood Monk's approach. Not usually reticent (you may have noticed) to expand on such matters, I hesitate to try to add anything to the excellent cover notes by Martin Williams, who was, and maybe still is editor of Down Beat magazine.

Williams has not, however, offered any assessment of the other musicians. I don't think that they constitute the best of the Jazz Messenger groups, but they all get into the tough, exciting feel of the proceedings. Griffin is one of the more remarkable virtuosi on tenor sax, and he is able both to fly at high speed and to employ stark, often sarcastic declamatory figures to great effect. I was fortunate enough to hear him play in London, and he is quite overwhelming.

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 output 40 watts R.M.S.
FREQUENCY RESPONSE:
From 20 cycles to 20,000±1db.
HARMONIC DISTORTION:
Less than 1 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.

$134.00 Plus Freight (cabinet extra)

Model C300/20/T (with Tuner)

$108.00
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.

Model C400/20

Cabinets for above in teak or walnut with metal trim, $10 extra.

THE NEW MAGNAVOX 8-30 SPEAKER SYSTEM
COMPLETE SYSTEM: (1.6 cubic ft.) IN WALNUT OR TEAK VENEER, OILED FINISH. (Regret no mail orders for complete system.) — $60.00.
SPEAKER KIT: (Less cabinet.) COMPRISING 1 8/30 SPEAKER, 2 3TC TWEETERS, 1 3" TUBE, 1-4 or 2 mfd. CONDENSER, INNERBOND AND SPEAKER SILK. AVAILABLE IN 8 OR 15 OHMS. $29.50 Postage $1.50 extra.

CLASSIC RADIO 245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE 798 7145

MAGRATH'S

VEROBOARD PLAIN

Part No.	No. of Strips	Size	Size Pin	Price
402/7022	16 way	17.9" x 3.4"	.052"	$1.23 each
403/4001	21 way	18.0" x 4.8"	.052"	$1.41 each
441/4501	16 way	17" x 2.5"	.052"	$0.84 each
442/4505	24 way	17" x 3.75"	.052"	$1.10 each
522	34 way	17.9" x 3.75"	.040"	$1.23 each

VEROBOARD PLUG-IN copper clad

Part No.	No. of Strips	Size	Size Pin	Price
202/7011	16 way	5.1" x 3.4"	.052"	$1.14 each
241/2502	16 way	5" x 2.55"	.052"	$1.01 each
243/2504	24 way	8" x 3.75"	.052"	$1.45 each
245/2506	24 way	3.75" x 3.75"	.052"	$1.23 each
281/271	23 way	3.7" x 3.591"	.052"	$1.23 each
303	22 way	3.7" x 2.5"	.040"	$1.14 each

VEROBOARD FULLY PIERCED copper clad

Part No.	No. of Strips	Size	Size Pin	Price
2/7003	16 way	17.9" x 3.4"	.052"	$1.76 each
4/1001	21 way	18" x 4.8"	.052"	$2.11 each
6/7006	24 way	17.9" x 5"	.052"	$2.42 each
41/1501	16 way	17" x 2.55"	.052"	$1.23 each
44/1505	24 way	17" x 3.75"	.052"	$1.77 each
101/231	27 way	17" x 4.371"	.052"	$2.11 each
122	34 way	17.9" x 3.75"	.040"	$1.98 each

VEROBOARD Copper clad each side

Part No.	No. of Strips	Size	Size Pin	Price
1311	39 way	8.1" x 8.4"	.052"	$3.51 each

'VOLTAC' (formerly SLIDUP) Variable Autotransformers

TYPE	In V	Out V	Current	CAP. VA	Price Sales Tax Extra
P1 Panel Mounting	230	0.260	0.5 amps	100	$11.77
BP3 ,,	230	0.260	1.5 amps	300	$18.15
BP5 ,,	230	0.260	2.5 amps	500	$20.46
BP10S ,,	230	0.260	5.0 amps	1000	$28.38
SB5 Bench Mounting	230	0.260	5.0 amps	1000	$28.38
B15 ,,	230	0.260	15.0 amps	3000	$70.40
B25 ,,	230	0.260	25.0 amps	5000	$123.20

15% SALES TAX WHERE APPLICABLE. FREIGHT EXTRA.

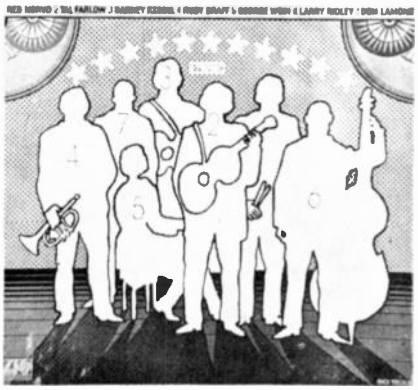
J. H. MAGRATH & CO. PTY. LTD.
208 Lt. Lonsdale St., Melbourne, Vic. 3000. Tel. 663 3731

recordings... JAZZ

Hardman is not the most original or brilliant trumpeters around, but his brittle sound, and his hardbitten but passionate feelings are most appropriate. Strongly influenced by Clifford Brown, he has one phrase that is all his own – though even that is close to a phrase I have heard Brown play – and he uses it in every single solo, to great effect particularly in Blue Monk, where he repeats it almost obsessively through several transpositions. Blue Monk is, of course, one of the most powerful and complete jazz performances on record.

The bass is unfortunately barely audible, which is a great pity, because I am sure the straight ahead bass line would have made the music more accessible to those who find it difficult to feel a beat that is not always explicitly stated. Use of the loudness contour on your amplifier is quite legitimate in these circumstances.

The recording was always strangely balanced. While the piano is playing – and Monk often lays out behind solos – that is all that can be heard through that particular channel. Great music like this will always triumph over less than ideal reproduction. – J.C.



GEORGE WEIN. George Wein's Newport All Stars. Atlantic Stereo SD 1533. Blue Boy, These Foolish Things, In a Little Spanish Town, Am I Blue, Ja Da, Topsy, My Melancholy Baby, Sunny, Nobody Knows You When You're Down And Out, Exactly Like You. Red Norvo, Tal Farlow, Barney Kessel, Ruby Braff, George Wein, Larry Ridley, Don Lamond.

There's not a great deal that I can say about this, beyond the fact that it's a pleasant, rather homely session by a group not exactly exploding with talent. Tal Farlow seems to me to be the most interesting of them, but he's not given enough space to do much. In any case, it would be hard to sound all that great over the rhythm section, which is – I hate to say it, it's a bit corny.

Many Australian musicians I know are enthusiastic about Ruby Braff. I have never heard him play an original, nor even a particularly authoritative phrase, but perhaps they like him because he is several trumpeters in one. There's a lot of Buck Clayton in his playing on Spanish Town and the beginning of a Dizzy Gillespie phrase (Diz usually repeats it several times and then flies off at an alarming tangent; Ruby comes out of it in very pedestrian fashion), while Roy Eldridge creeps into the introduction to Melancholy Baby.

Miles Davis recently championed George Wein's piano playing, but there's nothing here to convince me that he wasn't joking. He's obviously listened to Ray Charles's organ work, but he plays it in a pretty four square fashion.

I was happy to hear the fellows having such a good time, but I can't see myself listening to it much in the near future. – J.C.

FREDDIE HUBBARD. Straight Life CTI Stereo 6489 007. Straight Life, Here's That Rainy Day, Mr Clean. Hubbard, trumpet and flugelhorn Joe Henderson, tenor; Herbie Hancock, electric piano Ron Carter, bass; George Benson, guitar; Jack De Johnette, drums; Richie Landrum, percussion.

A while back I said that Miles had picked up the odd phrase from Freddie Hubbard and extended it in his work from Nefertiti, Miles In The Sky, Bitches Brew and so on. On this album Hubbard plays it all back to the point of straight imitation in places. In fact most of the album is a simplified version of what Miles has done. It's very exciting, it couldn't help but be so, but just a little disappointing for those who remember Hubbard's much more complex and original work with Eric Dolphy.

Because it is much more straight ahead, many will find it easier and more satisfying than either Miles' recent work or Hubbard's earlier stuff. Hubbard is one of those players, like Clark Terry, who can be at home with the most difficult or the most relaxed music. Here he's just having a good blow. His bright clean sound, fluency and precision are delightful.

On Mr Clean and Straight Life the rhythm section creates a marvellous Latin rock feeling, somewhere between Miles' thing and the Dizzy Gillespie group which had James Moody and Llalo Schiffrin. Henderson is a bit cliched on Straight Life, more inventive on Mr Clean, but hard and exciting in both cases. His sound is the closest I've heard to the late Keith Barr's.

Backing Hubbard on Straight Life, Herbie Hancock does one of his chromatically ascending whirling mazes of sound. Hubbard strikes hard to get out, does not lose his footing, and the result is the most dazzling moment on the album. George Benson's solos are the dullest. He sounds old fashioned and out of his element.

Rainy Day is played very slowly and expressively by Hubbard on flugelhorn. He sounds like Miles via Art Farmer, and there are a few indications that he has heard Chet Baker's performance of Autumn In New York.

Recorded sound is brilliant, except for the bass, which could have been up a shade. A good, if somewhat derivative workout. – J.C.

varian
electron tube and device group

Stay on the air longer with our power grid tubes.

varian PTY LTD
82 christie street
st. leonards 2065

ETD 471

INTRUDER ALARMS

FOR HOMES, OFFICE, WEEKENDERS, CARS ETC.

If you can install a doorbell then you can install these.

- Home Alarms (6-12 Volt Trans.) $12.15–$37.50
- Sirens 12 Volt. ½ to 2 mile range) $10.00–$34.50
- Pressure Mats $9.50–$11.50
- Car Alarms (Protects car & contents) $25.00
- Reed contacts & Magnet $1.50
- Reed contacts (Screw-on type) $2.50
- Key switch $4.50
- Aluminium circuit tape $2.20
- Adhesive contacts for tape $0.20
- Mini shock recorders $2.50
- Heat sensors (N.O. – Close at 135°F) $4.00
- Light sensitive relay (switches on at sunset, off at dawn) $8.50

MANY MORE – Send S.A.E. FOR Catalogue

R. C. Protector Alarm Systems
Box 226, Brookvale, N.S.W. 2100
or call at . . .

10 Crinan St., Hurlstone Park, N.S.W.
Phone 55 7151

9 Chard Rd., Brookvale, N.S.W.
Phone 93 7292

OPEN SATURDAY MORNINGS

RECORDINGS... POP TRENDS

REVIEWER:
Michael Delaney, John Clare.

EVOLUTION – The Best Of Iron Butterfly – Iron Butterfly. Kinney. Stereo SD.33-369.

Iron Butterfly Theme – Possession – Unconscious Power – Flowers & Beads – Termination – In-A-Gadda-Da-Wida – Soul Experience – Stone Deliver – Belda Beast – Easy Rider – Slower Than Guns.

Iron Butterfly had the barest necessities. They were one of the few successful exponents of West Coast psychedelia. The concept was totally amorphous – Californian rock vintage 1967 post Byrds. Los Angeles still reigned supreme and nobody knew what was happening least of all the groups involved. It didn't matter in any case. This was something new. There really was a high degree of method in the musical madness that ensued despite the stylistic mayhem. The general approach was restricted to voltage and feedback with lots of sinister lyrics – very flash. Atmosphere was almost always foreboding. Iron Butterfly was much more a catalyst than an innovator as they were remote – vaguely talented. It was a mood thing that crept up on you when you were most vulnerable. The band worked extra hard on image and soon became the highlight of drug culture cool. The hypsters pulled out all the stops. "In-A-Gadda-Da-Vida" remains their one noteworthy achievement as it sold well in excess of three million copies. This one track captures complete the stone terrific attitude adopted by mid-sixties' American rock. Iron Butterfly never had the time to find out what'd hit them. "In-A-Gadda-Da-Vida" sealed their fate as it was eventually to become the major reason behind the not so recent split. It was one of the only tracks that didn't come across as either affected or pretentious. "Evolution – The Best Of Iron Butterfly" presents an insight into a band unable to move with the times. "Slower Than Guns" and "Stone Believer" – two fine cuts from the "Metamorphosis" album – are the only songs that can boast definite impact. "Flowers & Beads" is simply trite. It's an uninspired attempt at the full love scene – weekend hippie muzak. "Unconscious Power" must have the worst set of seemingly portentous lyrics yet recorded. Iron Butterfly offer nothing that hasn't been done better by someone else. The group was loaded with latent potential – each melody is distinct; the instrumentation above average. It just fails to lead anywhere. The album doesn't really serve much of a purpose as most of their fans have moved to other things. Production is discerning. – M.D.

"THE ALLMAN BROTHERS BAND AT FILLMORE EAST" – Stereo. SD.802. Double-Set.

This New York sextet maintains an outstanding level with regard to the individual musicianship and overall flexibility. Each member relates with both direction and dynamics. It's therefore unfortunate that the sum is slightly less interesting than the parts. The Allman Brothers are far from what you'd call unique. Although their approach seems quite valid, the band suffers a noticeable lack of personal identity. They've refined electric-blues to a point verging on technique. They're just so smooth – so calculated and cool.

In their desire to continue the works of the original Butterfield/Bloomfield coupling The Allmans have lost the essence of the White Chicago sound. Their music simply fails to excite beyond virtuoso performance. They've forfeited gut appeal. There's nothing that'll make you sweat like the good blues should. Nevertheless, this deluxe 'live' package does manage to hold its own without too much fuss. Duane Allman & Dicky Betts come across with some of the finest double lead guitar this side of the old Buffalo Springfield. They extend in and about their composite range with energy and colour. "Whipping Post", "You Don't Love Me" and "Hot 'lanta" stand as the highlights. Both guitarists exercise immense control without that subsequent loss in variety and drive. It's such a pity that they can't provide a bit more flair with the arrangements. "Statesboro Blues" tends to be anaemic whilst "Stormy Monday" is far too timid for its own good. This group strives to be cerebral in an area where white musicians are at an instant disadvantage with regard to authenticity. There's much more to the blues than subtlety and phrasing. The Allman Brothers should get themselves back into the physical thing before attempting further 'live' sessions. If they could only work away from the jazz rhythms and the definitive atmospheres. They lack 'oomph'.

Production is exceptional. The mix and balance attain a standard well above the usual 'live' recording. It should be heard for this alone. – M.D.

"THE FOUR OF US" Reprise Stereo. MS.2041.

John Sebastian documents life-style. Each song is a whimsical commentary based on the one recurrent theme. Good because his saccharine optimism is good. Appropriate because his sense of nostalgia is sorely needed. It just seems to set everything within ultimate proportion. Tight little sounds; songs as songs can only be – exact and open. Music that buzzes with wide-eyed innocence and intimacy. Music that tugs at the heart strings.

Sebastian spins these generous images – precious objects; all flotsam and jetsam. Words so fine that they'd leap to your shoulder and tease your ears. Something that'd be there to comfort. The odd phrase meant to remind you 'bout new mown lawns and rain on the roof. John Sebastian is the minstrel. His lyrical personality is so much his own – so possessed with a unique and joyous outlook on the world. You can't remain objective.

"Black Snake Blues" and "Well, Well, Well" are examples of basic roots replanted. He sings 'de blooz' with as much grit as marked his earliest credits with the Lovin' Spoonful. Sebastian hasn't changed. He's still the king of good-time washboard. "I Don't Want Nobody Else" is another of his love yarns. It unfolds with a vulnerable charm, sassy, yet gentle and melodic past the bounds of time. "Apple Hill" is one of his drifting tunes very much the predominant mood throughout the album. "Black Satin Kid" is the old loon back at work: 'You know you talk about your East Coast/West Coast jazz and your Nashville country-soul. They're gonna talk about a kid from San Antone. He wrote the history book of rock'n'roll . . . ' Sebastian keeps the backing well below the vocal. He maintains command of tone and texture with an ease characteristic of his position.

"The Four Of Us" – the musical autobiography of the Lovin' Spoonful – rates as his most distinctive soloist attempt to date. The entire project is fashioned around the one acoustic guitar. All subsequent motions are derived from this combination lead/rhythm. This assures both unity and balance. John Sebastian is one of America's most prolific songwriters. He has a way of making things worthwhile. Production is adequately together – smooth and discerning. – M.D.

"FROM THE INSIDE" – Epic Stereo. ELPS. 3613.

Poco needs no introduction. They're just about the slap-happiest sound to have come along since laughter. It's music with an inbred smile – kinda bashful and coy; always sincere. This Californian quintet draws immediate strength from the sentiment and nostalgia surrounding mainstream country. They recognize the myth and tradition. Poco possesses that austere charm otherwise enlisted by the rural purists. Their approach is warm and uncomplicated – glowing with surprise. This band has little time for effect. It's hard to believe that they were once dismissed as the least fashionable progeny of the late Buffalo Springfield. The group has magic. There's no denying it. "Bright-eyed, high-bouncing Poco – creating images of green hills, amber fields, rolling white clouds and a balanced planet. With an aura of optimism that almost seems naive . . . " They're charmers

POP TRENDS

poised to spin you a whole bunch of foxy tales about the simple joy of living.

"Just For Me & You" reflects with a coquettish wisdom that damn near defies you not to feel good. "What If I Should Say I Love You" and "From The Inside" provide the fetching informality that lets you know just how tender this here band can be. Each song is a pleasure. They seem to revel in the unorthodox – mixing a variety of counter rhythms and contrapuntal melodies. "Do You Feel It Too" and "You Are The One" are the most complex whilst "Hoe Down" consists of the archetypal acoustic guitar and percussion.

Poco plays with easy-lilting spirit and taste. There's a total order and unity that often proves disconcerting. Rusty Young's superb pedal steel adds the instrumental spice to the rather unobtrusive acoustic work. This is shown to greatest advantage in "Ol' Forgiving" and "You Are The One".

Poco sounds less exuberant on this their fourth Epic release. They seem to be much more concerned with inner balance and the control of both harmonies and tone. They're getting to sound right mellow. It had to be the next step.

Recorded in Memphis under the guidance of Steve Cropper – "From The Inside" continues the standard first set by their debut album entitled "Pickin' Up The Pieces". Poco is an extra-special band. Don't let them pass by unnoticed. Production has an unusual sheen. Cropper has maintained maximum clarity and depth without skimping on the individual quality of presentation. The arrangements are excellent. M.D.

JADE WARRIOR: Vertigo Stereo 6360033. The Traveller, A Prenormal Day at Brighton, Masai Morning, Windweaver, Dragonfly Day, Petunia, Telephone Girl, Psychiatric Sergeant, Slow Riad, Sundial Song.

This group has imagination, ability and some lovely sounds at its disposal. As with Pink Floyd (whom they resemble in only a few places) one wonders what they could produce with more extensive musical knowledge. Perhaps that would spoil it altogether, but I feel that they would avoid some of the cliches which seem to check them here and there in full flight.

The Oriental effects on a Prenormal Day at Brighton disappointingly resolve themselves into a sort of tin pan alley Japanese motif. You know the sort of thing: "Sayonara, pretty orange blossom" or however it goes. Still, the track is genuinely exotic and pleasing. If they really knew something about Eastern music – who knows what they might have done.

The Traveller begins with brooding flamenco chords on the guitar and then moves into an ethereal feeling, with superficial resemblances to Debussy. This is interesting. One could launch into a discussion of the range of expressive possibilities of the Phrygian cadence which occurs in Spanish music, in Bach and in the modal forms of Debussy etc. That feeling of something left unsaid, umemphatic resolution, mystery. It can release a continuous unwinding passion, or a play of sensuous atmospherics, or a feeling of religious awe. Jade Warrior have created a very enjoyable atmospheric piece.

One thing which makes the group sound distinctive is the absence of a conventional drum kit. Even the heavy rock riffs they use from time to time are backed by congas and maraccas. Thus the usual rock drum cliches are avoided. Flute and congas are used effectively, and when the electric guitar suddenly cuts loose with heavy fuzz tone and that tearing, unravelling sound they get, the effect is truly electrifying.

The lyrics of Masai Morning and Psychiatric Sergeant are well worth listening for. Elsewhere hoary old poetic cliches obscure some good ideas. The vocalist is disturbingly like Cliff Richard at times.

Sound is clear and very vivid, with a bit of unwanted distortion in three or four places. A very interesting and often pleasing album. I wonder about their next one, because I have the feeling they do not know enough to do much more. Now somebody is going to tell me they've all studied music for about ten years! –J.C.

"OTHER VOICES" – The Doors. Kinney. Stereo.EKS.75017.
In The Eye Of The Sun – Variety Is The Spice of Life – Ships With Sails – Tightrope Ride – Down On The Farm – I'm Horney, I'm Stoned – Wandering Musiciian – Hang On To Your Life.

The lizard king is dead so don't expect his former colleagues to keep on with all that fevered mysticism. That'd serve no purpose other than to hasten an early defeat. The Doors have redefined their approach, reallocating some aspects of the old with a more pronounced jazz influence. Their instrumental character remains essentially unchanged although the standard has lost a deal in transit. The group has failed to support their previous momentum both in quality and imagination. They just seem to be marking time with no set concern for the future. "In The Eye Of The Sun" and "Hang On To Your Life" are the only cuts that permit the group to exceed their Morrison heritage. They've tried to make an album that would reconcile the move as a trio without understanding the implications. The result is bland. "Other Voices" is pleasantly ambitious pop that somehow sounds incomplete. The talent and experience is still there. It's just a little harder to find beneath all the cool restraint.

"Down On The Farm" is a dry song simply conceived without thrust. "Wandering Musician" squanders a fine melody on a quite unremarkable arrangement – thin and flaccid. The Doors don't appear to utilize their technical abilities. They inhibit each movement by sticking firmly to the basic rhythm. "Tightrope Ride" flogs a monotonous up-tempo riff. There's only an occasional glimpse of the group that once carried Jim Morrison through so many warlock raves. "Other Voices" has been assembled with a minimum of feeling. The Doors sound mechanical – as if every step had been computerised. "Variety Is The Spice Of Life" is the one track that could stand a chance as a single. The group needs a front man to balance and co-ordinate the overall production. Morrison was indeed the major strength behind their music. – M.D.

PRE-RECORDED CASSETTE/CARTRIDGE
TAPE EXCHANGE CLUB
EXCHANGE TAPES FOR ONLY $1 PER TAPE
JOIN NOW AND "CHANGE YOUR TUNE"

Drive up and exchange your tape at selected Golden Fleece Service Stations in N.S.W., Q'land, and Victoria. Choose from a comprehensive range of 1,000's of superb pre-recorded tapes.

For application details, ring or write now to:–

SOUND HOUSE
14 BEATTY AVE., TOORAK, VIC., 3143.
TELEPHONE: 20 5089

L.G. WALKER & CO PTY LTD.,
1 Sluman Street, Denistone, N.S.W. 2114
Telephone: 85 0576

G.E. REVELEIGH & CO
64 Burbong Street, Indooroopilly,
Brisbane, Q'LD. 4068.
Telephone: 78 1908

"You can't fix it if you can't see it"

The Ellispection Kit lets you see deep down in the midst of complex machinery or wiring. Complete with a full range of adaptors and accessories to suit every possible task on electronic equipment, the Ellispection Kit satisfies *every* inspection need. Battery operated and housed in a durable wooden case, the light and easy to use Ellispection Kit is just as much at home on house-calls as it is on the sophisticated final inspection station in a factory.

When components are crowded, tolerances small and tempers short, reach for the Ellispection Kit.

For illustrated brochure and prices, phone Sydney 632-3211, Melbourne 329-9222, Brisbane 443020, Adelaide 62-2248, Perth 61-9082 or write to:

ACI Metlabs Pty. Limited
3 The Promenade,
Guildford 2161

THE SHADOWMASK PICTURE TUBE

In a colour picture tube of the shadowmask type, the screen is made up of a repeated pattern of three juxtaposed phosphor dots. These dots emit their respective light colours when excited by three separate electron beams.

OVER the years many different methods have been devised for producing colour television images and a variety of picture tubes have been invented. Of all these, the one which has proven the most practical and effective to date, is the three gun, tricolour, shadowmask picture tube developed in the USA by RCA.

The tube relies for its operation on the ability of the human eye to integrate light of different colours into one colour-mix impression. The phosphor coating of the tube consists of 440,000 groups of three phosphor dots (25" tube). Each group of three has one dot of each of the primary colours. Thus there are over 1,100,000 phosphor dots on the screen.

Behind the screen, spaced approximately ¾" away, is a steel shadow mask with 440,000 holes, one for each tricolour dot group.

Three electron guns, one for each primary colour, are orientated such that the beams converge at the shadowmask, and then after passing through one of the holes, diverge to illuminate their respective phosphor dots. (See Figure 1).

The eye cannot discern the separate dots, and so, if for instance only the blue and green electron guns are emitting, then the colour, as seen by the eye, will be cyan. If on the other hand, only the red electron gun is emitting and both blue and green guns are off – then the eye will see only red.

In actual fact the electron beams are not fine enough to pass through one hole but actually cover several. This means that as the beam is swept across the tube it is never completely cut off by the shadowmask.

The shadowmask naturally reduces the efficiency of the electron guns. Each gun has much higher power than that used in a monochrome receiver and some 80% of the power from the three guns is lost on the shadowmask. In fact some 20 watts of heat are dissipated in the shadowmask and the resultant thermal expansion of the mask creates an additional problem. The mountings are specially designed to distort the mask as the temperature increases and thus maintain hole-phosphor dot alignment.

Although this scheme at first sight seems elegantly simple, there are many problems firstly in manufacture and secondly in controlling beam alignment and convergence.

The shadowmask itself is first produced by etching holes in a steel plate by photo-engraving techniques. The tri-colour phosphor dot screen is produced by using the shadowmask, ultimately to be used in that particular tube, as the screen for printing the phosphor dots.

The mask is assembled in its correct position over the screen which is coated with a light-sensitive emulsion containing for example, the red phosphor in suspension. A point source ultra-violet light is then positioned in the same place as the red gun would be and used to illuminate the phosphor through the mask. The unexposed phosphor emulsion is then washed away leaving a matrix of red phosphor dots. The process is then repeated for the green and blue phosphors.

The light must of course be accurately positioned in the same place that the respective colour gun will occupy. The mechanical alignment problems for the shadowmask screen and for the electron guns are therefore quite severe.

Inevitably some errors will exist when the tube is completely assembled and this will result in some dots of incorrect colour being illuminated. This effect when it occurs is known as 'Impurity' and must be corrected for, otherwise, there would be yellow in some areas where there should be red etc.

Correction is made by two circular magnets surrounding the neck of the tube. These magnets are magnetised across the diameter and when rotated together the direction of the resultant magnetic field changes. When moved with respect to one another the strength of the magnetic field is altered. The magnets operate equally on all three guns and may correct them by an adjustable amount in any radial direction. Operation of these magnets is therefore very similar to the operation of the shift magnets in black and white television sets.

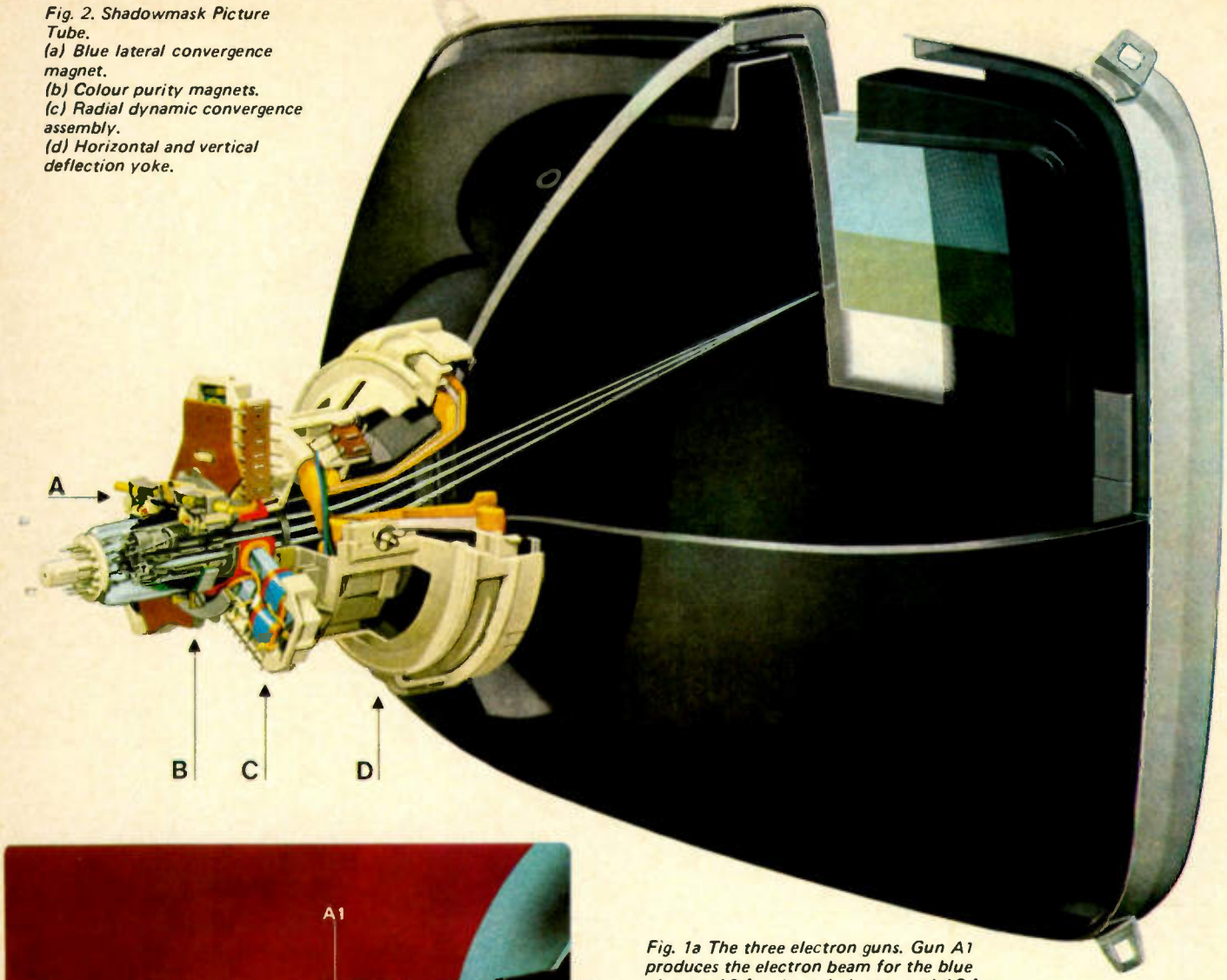
Any stray magnetic field can upset the purity of a picture tube. It is therefore essential to ensure that devices such as electric clocks are not placed on the set, or vacuum cleaners etc. are not started up in close proximity to the set. Even the earth's magnetic field can induce secondary fields in the metal parts and the screen surrounding the tube. Once purity has been adjusted therefore moving or re-orientating the set would result in altered magnetic fields and hence colour impurity. If a set has to be moved then the metal components must be demagnetized by a de-gaussing coil.

In the early days de-gaussing involved using an 18inch diameter coil energized with 50 Hz ac. The coil was moved round the picture tube and metal components and then slowly taken away as far as possible before switching off. Modern receivers have automatic de-gaussing coils built-in. These operate momentarily when the set is switched on.

Purity adjustments maintain the alignment of the tricolour beam over the entire tube but do not adjust the alignment of the beams with respect to each other either at the centre of the picture, or when deflected.

The process of aligning the beams with respect to each other at the

Fig. 2. Shadowmask Picture Tube.
(a) Blue lateral convergence magnet.
(b) Colour purity magnets.
(c) Radial dynamic convergence assembly.
(d) Horizontal and vertical deflection yoke.



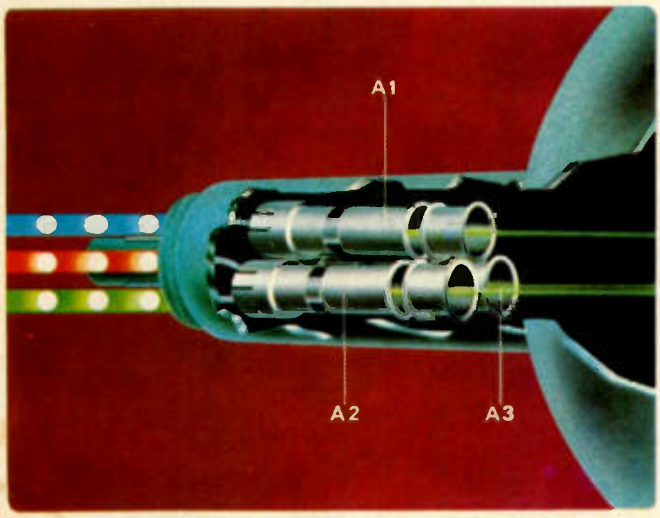


Fig. 1a The three electron guns. Gun A1 produces the electron beam for the blue picture. A2 for the red picture, and A3 for the green. The guns are slightly tilted towards the axis of the tube so that the beams cross at the shadowmask.

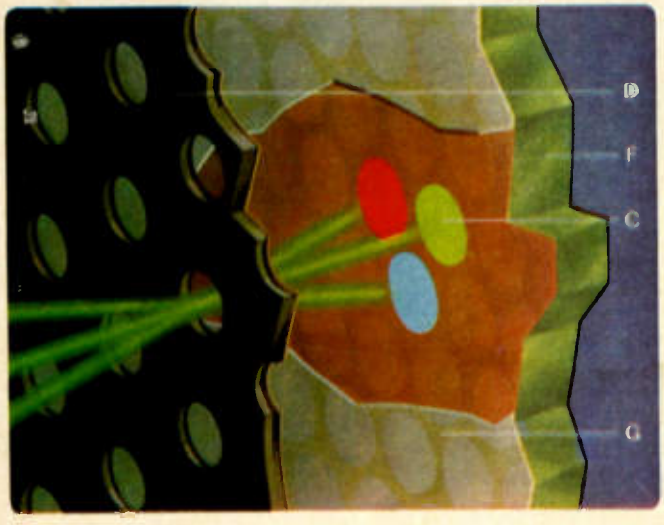


Fig. 1b. Detail of the screen. Each electron beam is directed by means of the colour purity adjustment so that it strikes only the associated phosphor dots, that, is, the 'red' beam strikes only the red phosphor dots, and so on. In practice. the electron beams are wider than shown, and pass through more than one hole in the shadowmask to land on dots in adjacent groups. C=phosphor dots, D = shadowmask, F = glass faceplate, G = aluminium backing to screen.

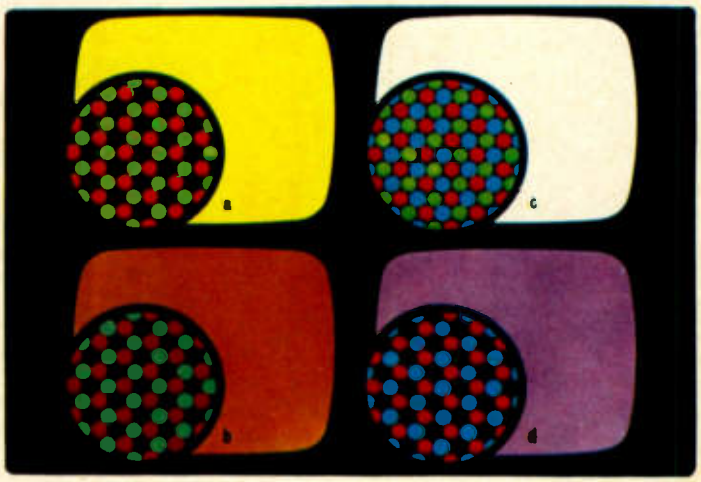


Fig. 1(c) Colour Production.
(a) Yellow is a mixture of red and green light
(b) With less brightness, yellow changes to brown.
(c) White and grey are a mixture of the three primary colours
(d) Violet is a mixture of red and blue light

THE SHADOWMASK PICTURE TUBE

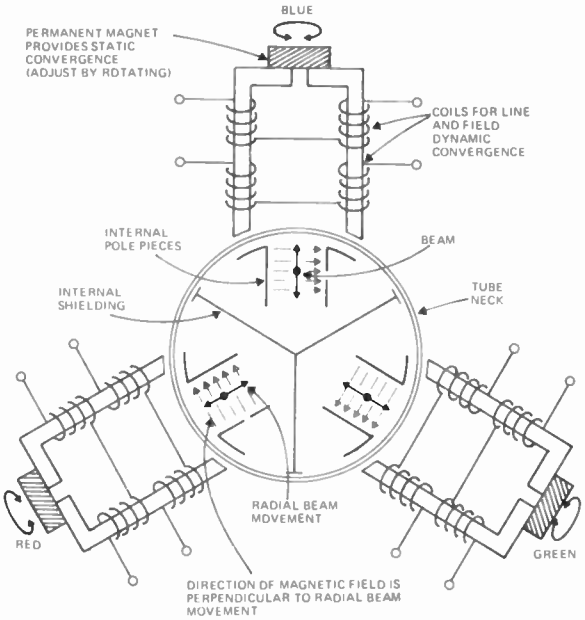


Fig. 3. Radial dynamic convergence assembly.

centre of the picture is called STATIC CONVERGENCE, and when deflected DYNAMIC CONVERGENCE.

A full discussion of the factors affecting convergence is beyond the scope of this article, but basically static convergence errors are due to gun misalignment and are usually corrected by permanent magents. As the beam is deflected it comes out of convergence due to the different orientation of the electron guns combined with errors introduced by screen curvature. The errors for each colour are different and may not necessarily be the same for both horizontal and vertical deflections. A common dynamic convergence assembly is as shown in Figure 3.

Immediately after the gun assembly a magnetic shield separates the three beams, in each 120° section iron pole pieces are inserted so that the electron beam passes through them. Externally a 'U' shaped magnet is associated with each pair of pole pieces. Two sets of coils are wound on each magnet which are fed with currents proportional to the horizontal and vertical deflection respectively. These currents are generated within the deflection drive circuits and require to be parabolic in shape to achieve correct convergence.

It must be remembered that these dynamic convergence adjustments are strictly only correct on horizontal and vertical axis through the centre of the tube and there may still be errors in the corners which it is not possible to eradicate.

Additional circuitry is also required to compensate for pin cushion distortion and for grey scale accuracy on monochrome transmissions. The picture tube therefore, together with its deflection, purity, convergence etc. components comprises the major cost of a colour television set.

Although the shadowmask tube has been the most successful commercially until fairly recently it has certain serious disadvantages. These are:–

(a) Convergence is extremely difficult and calls for complex dynamic magnetic correction with its associated circuitry.

(b) Setting up the tube in service is difficult, lengthy and as far as the customer is concerned – costly.

(c) Over 80% of the total electron beam energy is intercepted by the shadowmask which limits picture brightness and introduces heat problems.

(d) Using a neck diameter small enough for magnetic deflection efficiency, limits the size of electron gun and hence available beam density and picture brightness.

(e) With beams emanating from electron guns spaced at 120°, focus and convergence planes are not coincident over the whole screen and defocusing occurs in outer areas. ●

THE TRINITRON PICTURE TUBE

THE Sony corporation of Japan has developed a colour picture tube which overcomes many of the disadvantages of the shadowmask tube. The new tube is called the Trinitron. In place of the three colour guns at 120° to each other, one single gun with a three beam cathode is used. (see Figure 4.)

The three colour phosphors are applied to the screen in parallel vertical stripes, several hundred three colour groups across the width of the screen. A vertical grid is used in place of the shadowmask with one slot per tri-colour stripe. This arrangement is as shown in figure 5.

A weak electron lens system converges the beams a short distance from the gun. They then diverge and pass through four parallel deflector plates (3 electron paths). The inner two plates are held at the same potential so that the green central beam is undeflected. Convergence is effected by applying parabolic waveforms generated by the line time-base to the two outer pairs of plates. As the three beams are already in line horizontally, vertical convergence is not required. The convergence adjustments are therefore, obviously much simpler. The external magnetic components and convergence circuitry are reduced considerably compared to the shadowmask tube.

For example with the Tinitron tube static convergence is adjusted by four magnets and dynamic convergence by two controls only. This contrasts with four magnets plus *thirteen* controls to converge shadowmask tubes. Additonal advantages of the Trinitron tube are:–

(a) As the shadow mask is replaced by a vertical grid with much higher electron transmission (30%) heat losses are less and picture brightness is higher.

(b) Since only one gun assembly is used it may be physically larger with consequent increased beam density.

Factors (a) and (b) above when taken together give the Trinitron tube twice the brightness capability of a shadowmask tube. Some shadowmask tubes have been built with in-line guns but have not been successfull as brightness efficiency drops off even further.

It must be obvious therefore that the Trinitron is a most significant advance in colour television, bringing cheaper receivers one step closer. ●

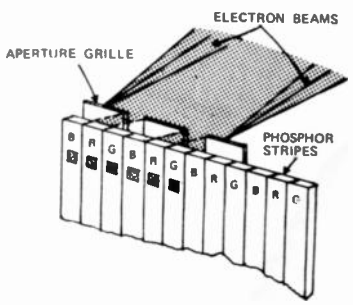
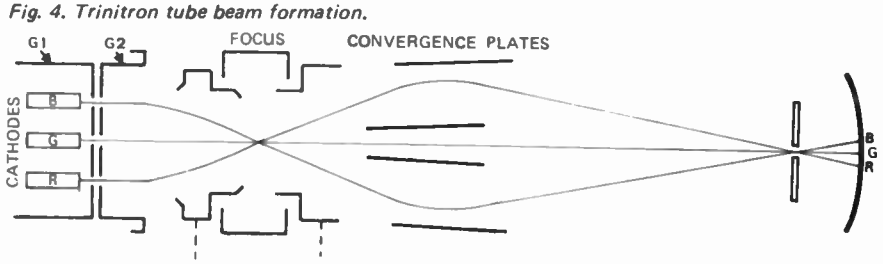


Fig. 5. Trinitron tube aperture grill.

Fig. 4. Trinitron tube beam formation.



BOOK REVIEWS

REVIEWER: Brian Chapman

BEGINNER'S GUIDE TO COLOUR TELEVISION – by T.L. Squires. Published 1964 by Newnes, London. 124 pages 5" x 7". Hard covers. Review copy supplied by Technical Book and Magazine Co. Pty. Ltd., Melbourne. Australian Price $2.55.

The obvious aim of this little book is to provide an introduction to colour television at a level that is adequate for technicians who merely want to know the bare bones of the subject.

There is no mathematical content and no circuitry, merely block diagrams and basic functional descriptions. The book would be quite understandable by those people who have no electronics background, people such as producers, directors, salesmen etc. who need a technical insight into the medium in which they are employed.

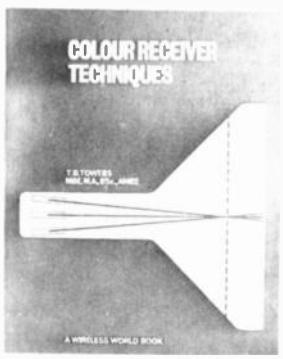
The treatment is fairly complete. opening with an historical outline and progressing through the principles of colour, image orthicons, and the synthesis of the complete signal and transmission systems. It goes on to describe receiver systems, aerials, the SECAM system and the normal controls associated with a receiver.

Unfortunately the book was written prior to the widespread acceptance of the PAL system. It was written at a time when the United Kingdom still had not decided on the system to be adopted for that country.

The author obviously considered that the NTSC system would be adopted, with SECAM also being a strong possibility. How wrong he was. Consequently the PAL system receives only passing mention – and incorrectly at that.

To quote "Basically the PAL system uses the suppressed amplitude modulated carrier like the NTSC system, but sends the I and Q signals sequentially as the SECAM system." End of quote. This is precisely what the PAL system does not do.

Neglecting this factor however, the rest of the material is well and simply presented and must be considered as good introduction. – B.C.



COLOUR RECEIVER TECHNIQUES by T.D. Towers. Published 1968 by Iliffe Books Ltd. London. Hard covers, 88 pages 10½" x 8". Review copy supplied by Butterworths Pty. Ltd., Sydney. Australian Price $6.50.

This book is based on a series of twelve articles originally published in Wireless World (January to December 1967) and was one of the first books on colour television to be published in the United Kingdom subsequent to the introduction of colour transmissions there.

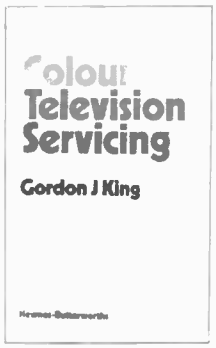
After a brief exposition on the constitution of the colour television signal the book embarks on its main purpose – the description of PAL colour television receivers. This opens with a block diagram description of the entire receiver followed by the colour picture tube, colour decoding circuits, subcarrier regeneration, power supplies and aerials. Following this there is a section on various circuitry such as IF strips, luminance (video) amplifiers, AGC and sync separation stages which were common at the time.

The second last chapter contains a description of common test equipment and this is followed finally by the complete setting-up instructions for a colour receiver.

It is obvious that the book was written over a period of time when circuitry was changing rapidly. The earlier chapters invariably show valve circuitry, while the later chapters give transistor circuitry almost exclusively. Also continuity of the book although good, is affected by the "monthly instalment" treatment.

The style and presentation is excellent and Mr Towers manages to pass on a lot of detailed information without deleteriously affecting the lucidity of the book. A common sense practical outlook shines through a text which is technician orientated.

As a description of receiver circuits it is excellent although by now the circuitry will be well out of date, particularly with the introduction of every increasing numbers of IC's into colour sets. – B.C.



COLOUR TELEVISION SERVICING by Gordon J. King. Published by Newnes-Butterworths 1971. Hard covers, 320 pages 9¾" x 6". Review copy supplied by Butterworth & Co. (Australia) Ltd., Sydney. Australian Price $14.85.

Colour Television servicing is the latest book by Gordon King to join his popular 'servicing handbook' series of which there are seven.

Understanding colour television servicing is unequivocably based on understanding colour television theory. There just is no other way – most other books on colour television either concentrate on theory only, or on servicing, this book combines the two treatments and is therfore more widely useful than most.

The text is specifically based on the PAL system and deals with current (1971) British practice. It must therefore be much closer in its theory treatment to future Australian receivers than any of the American books.

The theory treatment is well written in simple terms and will be readily understood by those having previous monochrome receiver experience. The text is well illustrated by drawings, circuits and photographs. One small criticism – I personally thought that more use could be made of colour in the illustrations and photographs.

Approximately two thirds of the text is theory and the remainder is servicing. The subject treatment is therefore quite well balanced.

For technicians requiring a conversion course from monochrome to colour, this would be one of the best single volume purchases available at present in Australia. Even though its price may be considered, by comparison, a little high. – B.C.

PAL COLOUR TV. The PAL system and Mullard circuits described. Published 1967 by Mullard Pty. Ltd., London Approximately 100 pages, 10" x 8", soft covers. Review copy supplied by Collins Books Pty. Ltd., Melbourne. Australian Price $2.50.

This book describes in detail a dual-standard (405/625 line) colour television receiver, designed in the Mullard Applications Laboratory in Surrey, England. It summarises the work done by the company over many years to develop active and passive components for colour television. The circuits described in this book were Mullard's recommendations to UK receiver manufacturers when colour was first introduced in the UK.

The book is in two parts. Part 1 describes the principles of the PAL system very well, if all too briefly. Part 2 consists of nine chapters describing in detail each sub section of the receiver. The theory of operation is given together with design requirement and performance details. In addition, wherever coils or coupling transformers are used, winding details are given. In fact if you wanted to build yourself a receiver, you could almost do so from this book.

Extremely well written, in a very clear style, this book is excellent value at the more than reasonable price. Beginners however should back this book up by a standard text which amplifies general colour theory to a much greater extent. Remember, the purpose of this book is to describe a Mullard receiver designed in 1967 and nothing else. – B.C.

The World's Most Versatile Circuit Building System!

SIZES: 1/8" and 1/16" WIDTHS

Length: 100 ft. roll, 5 ft. card

IDEAL FOR PROTOTYPE AND PRODUCTION CONSTRUCTION.

USEFUL FOR WIRING REPAIRS

* NO DRILLING * FAST * NO MESS

Available from all leading Radio Houses

Marketed by:—

ZEPHYR PRODUCTS PTY. LTD.

70 BATESFORD RD., CHADSTONE, VIC. 3148

Telephone 56-7231.

MANUFACTURERS OF RADIO AND ELECTRICAL EQUIPMENT AND COMPONENTS

NEW IMPORTED STEREO TURNTABLE AND PICK-UP

240V. AC Operation

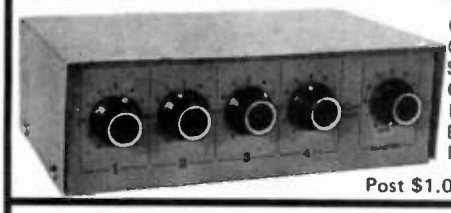
3 speed turntable with ceramic stereo pickup counter-balanced tubular arm, $7.90. Base in teak or walnut, $5.50 extra. De Luxe Base . . . $8.50. Post 50c, or $1.00 with Base.

Turntable and motor separate $4.50

Pickup arm and cartridge $3.50

FET FOUR INPUT MIXER

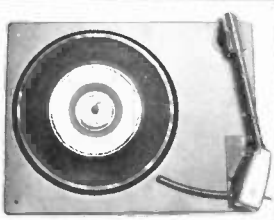
AS FEATURED IN SEPTEMBER "ELECTRONICS TODAY"



COMPLETE KIT OF PARTS AS SPECIFIED CASE & COVER IN BAKED ENAMEL FINISH $24.75

Post $1.00

NEW GARRARD RECORD PLAYER



Three speed turntable with "Sonatone" ceramic pick-up mounted on grey metal base plate with automatic stop.

$15.50. Post and packing NSW — $1.00; Interstate — $1.50.

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 $39.95 PER UNIT, FULLY GUARANTEED

Postage extra.

NEW RANGE OF RESISTORS CONDENSERS & 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 ½, 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 pacge 60c extra.

MAGNAVOX WIDE RANGE TWIN CONE SPEAKERS

8 or 16 ohms V.C. Post & Packing 65c.

6 WR MK V 12 Watts rms $9.90
8 WR MK V 16 Watts rms $10.75
10 WR MK V 16 Watts rms $11.50
12 WR MK V 16 Watts rms $12.50

SPEAKER SPECIAL
Imported Tesla 8" Speakers. 8 ohm imp. $4.75. Post & Packing 65c.

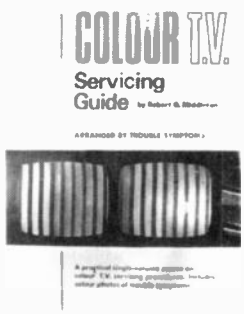
POLYESTER CAPACITOR PACK

Contains 100 polyester condensers from .001 to .1 in 150, 250 & 400 volt working. $3.50 — Post 40c extra.

NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE 56-7398

BOOK REVIEWS



COLOUR TV SERVICING GUIDE by Robert G. Middleton. Published 1965 by Foulsham Sams and Coy. Ltd., England. Hard covers, 112 pages 11½" x 8½". Review copy supplied by Collins Book Depot Pty. Ltd., Melbourne. Australian Price $4.75.

The screen of the colour picture tube itself is the most important servicing aid to the technician, naturally enough because most faults are evidenced by some failure in picture performance.

Hence by carefully evaluating the picture itself into what is present and what is not present, together with testing the operating range and effect of the various controls, an indication of the problem area is obtained.

This book, therefore, gives copious colour illustrations of the various fault symptoms on the picture tube screen itself. Where colour pictures of the screen do not convey the full story, oscilloscope waveforms are given together with full descriptions of the prominent fault characteristics.

Almost without exception the effect of the fault is shown as a variation to a standard colour bar pattern which of course is usually only available from a fairly expensive piece of test equipment. The pictures would however give an appreciation of the likely appearance of the screen when displaying normal programme material. How much better it would have been if colour photos of programme material under fault conditions had also been included.

A further point which must be kept in mind is that the book is specifically for NTSC, not PAL receivers and therefore some minor differences to the servicing techniques will exist, particularly in relation to the colour difference circuitry.

Most of the circuitry shown is for valve type equipment and it must be borne in mind that Australian sets will not only be transistorised but will most likely make heavy use of integrated circuits.

Nevertheless the book does give a valuable insight into the type of faults to be found on colour receivers and is after all quite inexpensive. – B.C.

KNOW YOUR COLOUR-TV TEST EQUIPMENT by Robert G. Middleton. Published by Howard W. Sams and Co., Inc., New York 1964. Soft Covers, 160 pages 8½" x 5½". Review copy supplied by Grenville Publishing Co., Pty. Ltd., Sydney. Australian Price $5.50.

There is an old song which goes something like this – 'What happens to the break-down van when the break-down van breaks down?' The same thing can be said about test equipment. It is very nice to own a choice selection of sophisticated test gear, but what do you do when it fails. Obviously some sort of insurance is required and the best kind I know is the ability to fix it yourself.

In this book, that most prolific writer Robert G. Middleton, has provided an excellent run-down on the principles of operation, and most common faults, in modern colour television servicing equipment. Basic instruments – white-dot and crosshatch generators, colour pattern and colour bar generators, colour television analysers, and colour picture tube testers are all described in a clear, easily understood manner. In addition, as a wide-band oscilloscope is also an essential tool in colour servicing, this too is given detailed treatment.

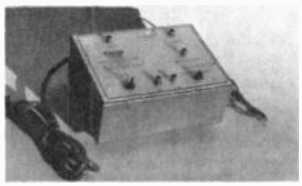
As with all American colour television books, it must be remembered that the system in use there is NTSC. It would be wise therefore to bear in mind the basic differences between PAL and NTSC when studying the book. For example the colour burst has a frequency of 3.58 MHz in NTSC and 4.43 MHz in PAL. Therefore American colour test equipment may not be compatible with Australian PAL receivers.

However the theory and practice remains the same and at the price the book is worth while having. – B.C.

World's Top A.V. at Convoy

EDUCATIONAL & PROFESSIONAL AUSIO VISUAL

The Contutor Division at Convoy International has the world's leading Audio Visual equipment for teaching in Universities, Schools, Industries and Government Bodies – also Electrosonic Multi Screen shows.



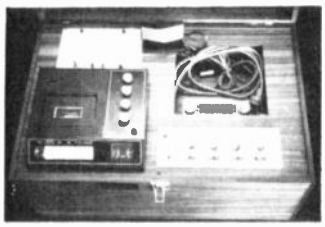
THE PULSYNC

A universal Audio Visual Synchroniser for use with any tape recorder or Cassette recorder with two tracks and a projector with remote control, $84.32, make perfect sound and slide synchronised shows.

THE CONTUTOR

An individual Audio Visual teaching unit for automated, person-to-person teaching, in sound. Synchronised with brilliant colour slides, in full room lighting, (Convoy's exclusive Conscreen is hard but light absorbent – no reflections). Your teaching program is absorbed at the student's own learning rate. Repeat any part as often as you wish. Make your own programmes; listen with headset or speaker. Prices to teaching bodies about $600 per Carrel complete with projector.

THE CASSAMP



A "teacher's bulldozer". Record a lecture once and couple it with synchronised slides. You can let this unit do your lectures for you. Also records questions and answers, acts as Public address system, Stereo Music, Radio and Records. Price of Basic Units to teaching bodies $411.00. Portable, locks-up – no tapes – simple cassettes.

ELECTROSONIC PROJECTOR CONTROL UNIT ES6

Makes your Audio Visual shows professional. Each slide dissolves into the next. No breaks or movement to lose attention. Dissolve rate is variable or a set time change is available. Just press a button or couple to the Pulsync and have an automatic show. Ideal for window displays as unit automatically resets at zero. $313.80 inc. tax.

ELECTROSONIC MULTI SCREEN AV SYSTEM

There are a complete range of Audio Visual Encoder-Decoder units available from Electrosonic through Convoy Contutor Division (sole Australian Agents). The system will control up to 900 functions from a single tape recorder, cartridge or cassette, track with absolute reliability. 100 screens possible (200 projectors) or a Son-et-Lumiere are ideal uses for the Electrosonic Encoder-Decoder system. Each Multi Screen show can be made to operate and reset from a single push button. No operators are required. Also random-access projectors-computor coupled.

Call at Convoy for a demonstration – write – phone. You may hire or lease this equipment.

Convoy Contutor Division
A Division of Convoy International Pty Ltd

CNR. PLUNKET AND MACLEAN STREET, WOOLLOOMOOLOO, 2011 • PHONE (02) 357-2444

electronics TODAY

THE COMPANIES LISTED ON THIS PAGE STOCK KITS AND/OR PARTS FOR "ELECTRONICS TODAY" PROJECTS. THEY DO THEIR BEST TO HAVE ALL PARTS AVAILABLE AS SOON AS POSSIBLE AFTER PUBLICATION.

HOWEVER IT MUST BE APPRECIATED THAT DUE TO THE VAGARIES IN SUPPLY AND DEMAND THERE MAY BE OCCASIONS WHEN A PARTICULAR PART OR KIT CANNOT BE SUPPLIED DIRECTLY FROM STOCK.

WE WILL EXTEND THIS SERVICE TO COVER ALL STATES AND NEW ZEALAND AS SOON AS POSSIBLE.

NEW SOUTH WALES

A.C.E. RADIO: 136 Victoria Road, Marrickville, 2204. Telephone 51-7008

EDGE ELECTRIX: 25a Burwood Road, Burwood, 2134. Telephone 747-2931

INSTROL: 91a York Street, Sydney 2000. Telephone 29-4258

KITSETS AUSTRALIA: Suite 2, 21 Oakes Avenue, Dee Why, 2099. Telephone 982-5571

NATIONAL RADIO SUPPLIES: 332 Parramatta Road, Stanmore, 2048. Telephone 56-7398

RADIO DESPATCH SERVICE: 869 George Street, Sydney, 2000. Telephone 211-0191

VICTORIA

E.D. & E: 232 Flinders Lane, Melbourne, 3000. Telephone 63-3596

J.H. MAGRATH & CO: 208 Little Lonsdale Street, Melbourne, 3000. Telephone 663-3731

S.T.A. ELECTRONICS: 392 Centre Road, Bentleigh, 3204. Telephone 97-4832

QUEENSLAND

KITSETS AUSTRALIA: 2/673 Ann Street, Fortitude Valley, 4006. 52-8391

SOUTH AUSTRALIA

GERARD & GOODMAN: 192-196 Rundle Street, Adelaide, 5000. Telephone 23-2222

BOOK REVIEWS

101 WAYS TO USE YOUR COLOUR-TV TEST EQUIPMENT by Robert G. Middleton. Published by W. Foulsham and Co. Ltd., England 1963. Hard covers, 144 pages 8½" x 5½". Review copy supplied by Grenville Publishing Co. Pty. Ltd., Sydney. Australian Price $4.05.

The purpose of this book is to provide data on the systematic use of test equipment to analyse colour television receiver faults.

As the title suggests, there are literally 101 separate test set-ups described. These are broadly grouped into categories as follows:– Checks on test equipment performance, Chroma signal tracing, Colour sync tests, Chroma demodulation tests, Matrix tests, Bandpass tests, Regeneration tests, Sequential Chroma tests, convergence tests and finally about 25 miscellaneous tests.

The entire book is written in the vein of the methods of setting up equipment and interpreting results. The book does not attempt to relate these tests to specific receiver troubles, except in passing. It provides details of typical circuits, typical waveforms and photographs of actual oscilloscope waveform displays.

All circuit illustrations are from valve receivers which would be entirely out of date as far as Australian receivers are concerned which undoubtedly will be hybrid IC and transistor designs. As with all American books, it speaks of NTSC rather than PAL, our designate system. Nethertheless the techniques are still applicable and are very exhaustively covered.

Good background if you already know your colour theory. – B.C.

COLOUR TELEVISION with particular reference to the PAL system. By G.N. Patchett. Published 1967 by Norman Price (Publishers) Ltd., London. Soft covers, 257 pages 8½" x 5½". Review copy supplied by Technical Book and Magazine Co., Melbourne. Australian Price $7.50.

This book deals with the basic theory of colour and colour television systems, with particular emphasis on the PAL system. Other modern systems such as NTSC and SECAM are described briefly.

Instead of dealing with the NTSC system in detail and then considering the PAL system as a modification to it. The fundamental principles of all modern systems are considered in detail followed by a section on the principles common to NTSC and PAL. The NTSC and PAL systems are then separately described.

It is assumed that the reader has a sound understanding of monochrome television techniques and although it could be understood by anyone with no prior television knowledge the going would be tough as, in common with other colour texts, only the colour signal processing circuitry is described in detail. Such things as deflection circuitry and line, frame time bases are only discussed to the extent of explaining any differences between monochrome and colour.

The book is particularly notable for the numerous three colour diagrams throughout which greatly add to the presentation of the theory.

In particular the section on convergence is extremely good. Three-colour diagrams dramatically portray the way in which convergence errors come about, and numerous colour photographs of cross-hatch generator patterns illustrate the various convergence errors caused by different maladjustments. It would be the best treatment of convergence that I have seen.

The opening sections on 'colour mixing and photography' and colour theory are also well done and well illustrated.

By far the best value for money book at present available on colour television principles. – B.C.

COLOUR TELEVISION THEORY by Geoffrey H. Hutson. Published by McGraw Hill Coy. Ltd., 1971. Hard covers, 375 pages 10" x 7½". Review copy supplied by McGraw Hill Coy. Ltd. Australian Price $10.80.

This book is primarily written for technicians and engineers who already have a working knowledge of monochrome television principles and wish to now extend their knowledge to modern colour television systems. Although the book is primarily concerned with the PAL system, adequate cross reference is given to NTSC and SECAM to understand the principle differences between the systems.

The introductory chapters are excellent giving a clear and detailed treatment of light and colour and the basic principles of colour television.

(Continued on page 124)

ZERO-100

the most sophisticated turntable in the world.

Garrard

Plessey Ducon Pty. Limited
Villawood. N.S.W. 2163 **Phone** 720133

National Distributors/Audioson International Pty. Ltd./Western Australia: 196 Adelaide Terrace, Perth. **Queensland:** 72 Wickham Street, Valley, Brisbane. **South Australia:** 9 Osmond Terrace, Norwood, Adelaide. **Victoria:** 49 Westbank Terrace, Richmond, Melbourne. **New South Wales**/British Merchandising Pty. Ltd., 49 York Street, Sydney. Available at all leading Hi Fi Stores and Sound Centres.

AD43

INPUT GATE

LETTERS FROM OUR READERS

HI-FI IN THE HOME

Electronics Today is an excellent magazine; though it could do with a few more hi-fi articles. A small suggestion: how about a home survey on hi-fis? — ie. pay 'friendly neighbourhood calls' on homes of hi-fi enthusiasts to evaluate the quality of equipment combinations.

N.C. Kensington. NSW.

• What do our readers think?

BATTERY SAVERS

In the Feb issue of your magazine, I was interested to see the 511 project on battery savers. Having built up a number of these units in the past, to run 6v cassettes from 12v car supplies, I felt the following comments may be of interest to your readers, these are the pitfalls involved with some brands of such appliances, and which I might add are not confined to the cheaper types.

It relates to the lack of heat sinks and thermal stabilization on a number of such machines.

When working on their own batteries, no troubles are apparent, but when used from 12v car supplies or AC power units where the output run at 6 volts or more, (and this is the case when using a 6.8v Zener, and even a 6.2v high tolerance Zener will give an output above 6v), thermal runaway may start after a time depending on the ambient temperature. This may be cured by fitting heat sinks.

A suggestion I would like to make which would overcome the problem of fitting heatsinks, is to use a lower value Zener and so keep the output at 5.8v for the 6v units, and about 8.5v on the 9v unit.

Trusting these few comments will save some of your readers from an embarrassing scene with their local dealer or serviceman.

H.J.S. Numarkah. Vic.

BERNARDS FAMOUS RADIO AND TELEVISION BOOKS

HI-FI, TUBES, RADIO VALVES, TRANSISTORS, ELECTRONICS

No.	TITLE	PRICE
56	Radio Aerial Handbook	.45
57	Ultra-Shortwave Handbook	.45
58	Radio Hints Manual	.45
64	Sound Equipment Manual	.45
68	Freq Modulation Receivers Manual	.45
96	Crystal Set Construction	.20
100	Comprehensive Radio Valve No. 1	.85
104	Three Valve Receivers	.25
121	Comprehensive Radio Valve No. 2	.85
129	Universal Gram-motor Speed Indicator	.20
135	All Dry Battery Portable Constn.	.45
138	How to Make Aerials for TV & V.H.F./F.M. Transmissions	.50
141	Radio Servicing for Amateurs	.60
143	Comprehensive Radio Valve No. 3	.85
146	HI-FI Loud Speaker Enclosures	.85
147	Practical Tape-Recording H'book	.85
149	Practical Stereo Handbook	.60
150	Practical Radio Inside Out	.80
153	Miniature Portable Oscilloscope	.45
156	Transistor Circuits Manual No. 1	.45
157	Comprehensive Radio Valve No. 4	.85
160	Coil Design and Constn. Manual	.85
161	Radio, TV and Electronics Data Book	.60
163	Transistor Circuits Manual No. 2	.45
165	Radio Tuners — Hartley on Hi-Fi	.85
168	Transistor Circuits Manual No. 4	.45
170	Transistor Circuits for Radio-Controlled Models	1.30
171	Super-Sensitive Transistor Pocket Radio	.60
173	Practical Transistor Audio Amplifiers for the Home Constructor	.60
174	Transistor Subminiature Receivers Handbook	.85
175	Transistor Test Equipment and Servicing Manual	.80
176	Manual of Transistor Audio Amplifiers	1.00
177	Modern Transistor Circuits for Beginners	1.30
178	Comprehensive Radio Valve No. 5	1.00
181	22 Tested Circuits Using MAT's	.85
183	How to Receive Foreign TV Programmes by Simple Modifications	.85
184	Tested Transistor Circuits Handbook Using Professional Printed Circuit Modules	.60
185	Tested Shortwave Receiver Circuits Using Micro Alloy Transistors	.85
186	Tested Superhet Circuits for Shortwave & Communication Receivers using MAT's	1.00
187	The TSL Mark-4 Valved F.M. Tuner and its Construction	.60
188	Construction of the B.H. Hi-Fi 14-watt Audio Amplifier	.25
191	Practical Car Radio Handbook	1.00
192	How to Build the Sinclair X-10 Amplifier	.25
193	"At a Glance" Radio Valve and TV Tube Equivalents and Substitution Manual	.60
501	ABC's of Magnetism	.85
502	ABC's of Missile Guidance	.85
	Resistor Colour Code Calculator	.25
	Engineer's Reference Tables	.25

NEW PUBLICATIONS

BP4	International Handbook of the World's Short Wave Med & Long Wave Radio Stations & FM & TV Listings	1.00
BP7	Radio & Electronic Colour Codes & Data Chart	.45
BP1	Handbook of Transistor Equiv. & Substitutes	1.30
BP2	Handbook of Radio, TV & Ind. Tube & Valve Equiv.	1.30
BP3	Handbook of Tested Transistor Circuits	1.30

Others to be added shortly.

POSTAGE TO BE ADDED TO ABOVE PRICES, SPECIAL DISCOUNTS TO BOOKSELLERS ANO SCHOOLS. DESCRIPTIVE CATALOGUE AVAILABLE UPON REQUEST.

Sole Australian Distributors

BERNARDS RADIO BOOKS AND SUPPLIES

4 Vera Street, Eastwood, N.S.W. 2122. Telephone 88-3360

TELEPHONE TAPPING

I refer to your article on 'bugging' in the March (1972) issue of Electronics Today.

Perhaps the most fascinating aspect of 'bugging' is that carried out by the Commonwealth Government by authority of the Telephone Communications (Interception) Act of 1960. No information is available to indicate the extent of 'phone tapping at this level as it is known only to the Federal Attorney-General and the Director-General of Security. Should the Attorney-General not respond to a request from A.S.I.O. for a warrant under the Act, the Director-General himself may issue the authorising warrant.

Senator Greenwood of the Federal Parliament has indicated that his department is "examining" the possibility of extending powers under the Act to the Police on the warrant of a magistrate. If implemented this would surely constitute one of the most dramatic invasions of privacy of this generation.

Council for Civil Liberties
T. Lynam, Hon. Secretary.

READERS' LETTERS

It is our policy to reply to all readers' letters — but not necessarily via these columns. Please ensure that you write your full name and address on your letter. We have a number of letters — mostly from our younger readers in which not even the writer's initials are included.

We try to reply to letters as quickly as possible — however on occasions there may be some delay. But please don't think that your letter has been ignored.

TRUE VOCATION

Before Electronics Today came onto the market I used to dispose of out-of-date telephone directories by hanging them in the outhouse.

Now I have found a new source — seems like you and your editorial staff have found your true vocation in life.

G.J. Bankstown.

• And you yours, G.J!

SPECIAL OFFER!

We must quit surplus stocks in some sizes new shipments are arriving!

UP TO 50% OFF PROFESSIONAL QUALITY

NEW FORMULA

TAPE FROM U.S.A.

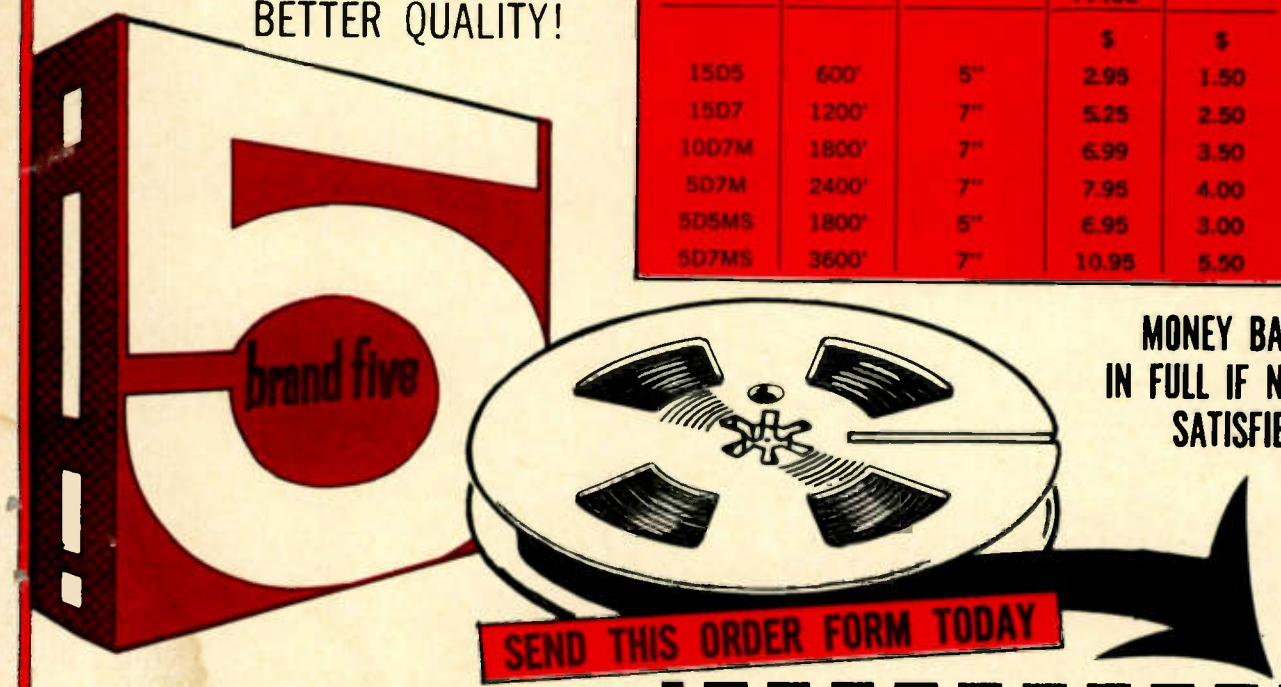
WHEN YOU BUY SIX REELS OF THE ONE SIZE TAPE!

Special offer open for 1 month only from date of this issue.

- A BRILLIANT PRODUCT OF ROBINS INDUSTRIES OF NEW YORK U.S.A.
- FEATURES NEW FORMULA LOW NOISE-HIGH OUTPUT COATING..YOU CAN'T BUY BETTER QUALITY!

Fully manufactured and packed in the U.S.A., these high quality tapes enable you to have perfect, professional quality sound. The secret is the new low noise-high output formula coating. Brand 5 gives a greater degree of excellence than ever before. Simply buy six reels of the one size of tape in any of the sizes shown and you get up to 50% discount. All reels guaranteed factory fresh, and in factory sealed cartons. Now's the time to stock up as this offer is for a limited period only.

TAPE No.	LENGTH	REEL SIZE	LIST PRICE	NOW
			$	$
15D5	600'	5"	2.95	1.50
15D7	1200'	7"	5.25	2.50
10D7M	1800'	7"	6.99	3.50
5D7M	2400'	7"	7.95	4.00
5D5MS	1800'	5"	6.95	3.00
5D7MS	3600'	7"	10.95	5.50



MONEY BACK IN FULL IF NOT SATISFIED!

SEND THIS ORDER FORM TODAY

DIRECT TAPE DISTRIBUTORS

BOX 3040 G.P.O. SYDNEY 2001

Please send me 6 reels of tape No.:..... @

$..... ea. I enclose a cheque for $.....

NAME:.....

ADDRESS:.....

.....

purer sound
than a $4,000
speaker system!

STAX SR3 ELECTROSTATIC HEADSET

"the sound experience of a lifetime"

A big claim? Yes but with the full, natural, luxurious, distortion-free reproduction which Stax affords, it's safe to say that a speaker system of comparable sound purity has not yet been developed.

Stax sound beggars description.
You must indulge in the "sound experience of a lifetime" at your earliest opportunity, and try to write your own words of praise. And you'll be delighted with the moderate price too! Electrostatic drive adaptor reduces headphone weight, and will handle up to 6 sets of phones. Hear Stax at any of our agents, or write to us for the comprehensive reviews from Australia and overseas.

Sole Australian distributors:

INTERDYN

Available at: Interdyn Agents
Vic.: Encel Electronics Pty. Ltd., 431 Bridge Rd., Richmond, 3121. Tel: 42-3762
N.S.W.: Encel Electronics Pty. Ltd.
QLD: Stereo Supplies, 100 Turbot St, Brisbane, 4000.
S.A.: Challenge Hi-Fi Stereo, 6 Gays Arcade, Adelaide, 5000.
TAS.: Audio Services, 72 Wilson St., Burnie, 7320.

To: International Dynamics, PO Box 205 Cheltenham, Vic., 3192. Please send reviews and information on Stax headphones.

NAME .....

ADDRESS .....

..... 8573ET

INPUT GATE

EXTENDED AMPLIFIER RESPONSE

A growing number of amplifier manufacturers claim that their products have a response extending well beyond 20kHz. As I always understood that the ear cannot hear anything above 16 or 17kHz anyway, is there any point in such an extended response?

J.S.M., Singapore.

• We very much doubt it. Certainly very few valve amplifiers had any appreciable output above 20kHz, but as far as treble was concerned, subjectively their response was quite indistinguishable from top quality solid-state units with response extending beyond 100kHz.

The most commonly used argument is that an extended frequency response ensures true reproduction of transients – yet ignores the fact that cartridges and tape decks are incapable of handling transients of such nature anyway.

It is probably that as the elimination of the output transformer from today's amplifiers has removed the previous limitation on frequency response, the inherently extended frequency range is now being claimed as a positive benefit.

The point is easy enough to prove – one way or the other – and we have asked our acoustical consultants to undertake some practical experiments. Thank you for raising this interesting question.

ERRATA

Wide-range Voltmeter – February 1972.

There is an error in the main circuit diagram on page 50. Pin numbers 2 and 3 on IC1 (only) should be transposed. The assembly drawing – Fig. 2, and the pc pattern – Fig. 1 are correct, therefore the drawing error will only affect those who have assembled the unit without using the suggested printed circuit board.

High-fidelity TV sound – March 1971.

A few readers have found that the degree of attenuation introduced by the circuit shown in Fig. 3 is excessive, and that sufficient volume cannot be obtained. This is due to the wide variation in signal level – between one set and another – at the take-off point.

In such cases, the 22k resistor shown in Fig. 3 should be replaced by one of a higher value – 47k or 68k should be satisfactory.

electronics TODAY MICRO·ADS

ELECTRONICS TODAY MICRO ADS RATE IS ONLY $7.50 PER SINGLE COLUMN INCH OR 76c PER LINE. TO PLACE YOUR MICRO AD, MERELY FILL IN THE FORM BELOW AND SEND TO ELECTRONICS TODAY, MICRO ADS, 21-23 BATHURST STREET, SYDNEY, 2000.

FREE CATALOGUE of Electronic components. Send 9 x 4 S.A.E. to Micronics, P.O. Box 175A, Randwick. 2031.

WE ARE SMALL, but we aim to please Please write for our prices. CHI Electronics, P.O. Box 17, Walkerville. S.A. 5081.

HOBIPAK – Box 224, Carlton South. 3053 RESISTORS Carbon film 5% 1/8, ½ 1W 5c, Metal film MR 30, 2% 18c; Tantalum capacitors tags 38c. Dispatch 10c order Catalogues SAE please

---

MARINE radio telephone from manufacturer PMG approved 45 watts 3 channel 31-3272 Sydney.

EICO signal generator 75Khz – 150 Mhz $82.00. 31-3273 Sydney.

ELECTRONIC Organ. Do not build yourself an organ without first finding out about the superb Schober (USA) Assemble-It-Yourself Kits. Inquiries to Schober Organ (Australia), 124 Livingstone Av., Pymble, NSW. 2073. (Mail only, please.)

CRYSTALS . . for CB 27, 240 and 26, 785 MHz, ¼in. pin, miniature, $6 pr. Post Free Shalley 127 York Street, Sydney.

REPAIRS to receivers, transmitters construction testing: TV alignment, Xal conv., specialised electronics equip. Eccleston Electronics, 146a Cotham Road, Kew, Vic. 80-3777.

AUSTRALIAN Tape Record Society offers tape library, "The Microphone" Journal, audio visuals, round robins, tapesondence, sales. Inquiries, P.O. Box 130, Hornsby, NSW, 2077. Please enclose large stamped envelope.

TAPE to disc service. Take advantagy of W. and G. Records professional experience when next needing a tape to disc service. W. and G. Record Processing Co., 185 A'Beckett St., Melbourne. Tel 329-7255.

Electronics Today Micro Ads
Please Print Clearly
Electronics Today, 21-23 Bathurst St., Sydney, 2000

Name . . . . . .
Address . . . . . .
State . . . . . Post Code . . . . .

Electronics Today Micro Ads
Please Print Clearly
Electronics Today, 21-23 Bathurst St., Sydney, 2000

Name . . . . . .
Address . . . . . .
State . . . . . Post Code . . . . .

WOULD YOU LIKE TO BE A RADIO AMATEUR?

The Wireless Institute of Australia, established in 1910 to further the interest of Amateur Radio, can help you to attain the knowledge necessary for the P.M.G. Amateur Operators' Certificate of Proficiency examination.

Correspondence Courses may be commenced at any time. Personal Classes commence in February each year.

For further information write to:

THE COURSE SUPERVISOR, W.I.A.
14 Atchison Street, Crows Nest, 2065. N.S.W.

B & W D.M.1. LOUD SPEAKERS $95.00 each "Jet Audio"

G.P.O. Box F336, Perth, Western Australia 6001.

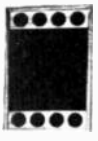
REVOLUTIONARY BULK BUY AT CUSTOM ELECTRONICS

304 NEW SOUTH HEAD ROAD, DOUBLE BAY, N.S.W. PH: 36 2560

36 watt PACKAGE – $160 –
CUSTOM Amp. w/Mag. Cart. Garrard w/lowering dev. Two-8" 2-way spkrs.

New "Upright" Base

50 watt PACKAGE – $221 –
CUSTOM Amp. w/filters Garrard w/hyd. low. mag. cart. Two-8" 3-way spkrs. ("MIDI").



75 watt PACKAGE – $377 –
AWA Orthofidelity Amp. Garrard w/hyd. low. mag. cart. Two-12" 3-way spkrs. ("2001").

"2002" 12" 3-way 25W RMS

80 watt PACKAGE – $431 –
PIONEER SA600 Amp. Garrard New SL72B syncrolab Giro arm & Pickering Cart. Two-12" 3-way spkrs. ("2001").

15" Ultimate 5 element 50W RMS

CAREER OPPORTUNITIES

EMPLOYERS — Seeking Staff? Electronics Today is read by the very people you seek! (and our copy deadline is only 10 days). Managers, Engineers, Technicians, Draughtsmen, Salesmen, etc. • You already have a good job but seek a better one. Here they are.

TECHNICAL SALES ENGINEER

We are seeking a capable Sales Engineer, to join our Sydney office Sales Staff. The group manufactures and markets a wide range of electrical and electronic equipment, transformers and small passive components. The successful applicant will be required to liase with existing clients and make new contacts to promote our diversification program.
QUALIFICATIONS: Previous sales experience in the industry together with the ability to confer with high level engineering and sales personnel in Government Departments and Industry.
Tertiary training such as would fulfil part requirements of an Electronic or Electrical Engineering Diploma desirable.
AGE: 25-45 years.
An attractive commencing salary will be negotiated plus vehicle allowance.
Fringe benefits include incentive payments and superannuation.
For further details of this position, telephone Mrs Millar, at 78-0281 or submit a written application to the State Engineer.

A. & R. SOANAR ELECTRONICS GROUP
4 Close Street, Canterbury N.S.W. 2193.

DRAUGHTSMAN

A vacancy exists in the Engineering Drawing Office of our Port Kembla Works for an EXPERIENCED DRAUGHTSMAN to assist in the mechanical work in developing and maintaining plant associated with the smelting, refining and casting of copper.
Qualifications should include the mechanical certificate and practical experience in heavy industry.
Conditions include a subsidised superannuation scheme and, at the discretion of the company, overtime and annual bonus.
Salary by negotiation.
Apply in the first instance, in writing to

The Manager.
THE ELECTROLYTIC REFINING AND SMELTING COMPANY OF AUSTRALIA LIMITED,
BOX 42, POST OFFICE,
Port Kembla, N.S.W. 2505.

TECHNICIAN
(Data Electronics)

Our Field Engineering Department requires a Technician who will ideally have certificate level qualifications in electronics and who has had considerable practical experience in data techniques. Excellent conditions.

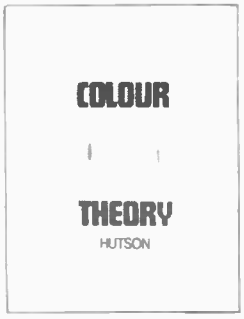
Apply Staff Office,
AMALGAMATED WIRELESS (Australasia) LIMITED
422 Lane Cove Road, NORTH RYDE.

COPYRIGHT — ALL RIGHTS RESERVED

Devices or circuits illustrated or described in ELECTRONICS TODAY may be the subject of patent protection. Information is given without prejudice to patent rights and without responsibility for any circumstances arising from its application.

ELECTRONICS TODAY'S product tests are—unless otherwise stated—performed by our independent testing consultants, whose name will be supplied on request. No product test, or part thereof, may be reproduced for any purpose without the written authorisation of the Editor.

BOOK REVIEWS



(Continued from page 118)

Chapter 3 describes in detail colour bar signals for the NTSC and PAL systems. I am somewhat puzzled as to why this treatment is placed where it is. I would think that continuity would have been better had this section been included at a late stage. Chapter 4 deals with the Basic PAL Coder, Transmitter and Receiver Arrangements, followed by a description of picture tube and convergence principles.

Chapters 8, 9 and 10, deal with chrominance signals and quadrature amplitude modulation, whilst chapters 11 to 17 inclusive discuss receiver circuitry. Many circuit diagrams are given and some typical fault symptoms are described.

Appendix A describes more particularly the NTSC system and appendix B describes the use of the BBC test card F in evaluating receiver adjustment and performance.

The quality of printing is excellent and the text is profusely and entirely adequately illustrated with photographs and drawings. An excellent feature of the book is the fact that particular attention has been given to stating all units in the SI system.

This text would undoubtedly be the best introductory material available. but at the same time the depth of treatment would be entirely adequate for engineering maintenance personnel. Accent of course is mainly on the receiver and only sufficient detail of transmitters is given to provide a system understanding. Excellent reference material. – B.C.

COLOUR TELEVISION VOL 1 PRINCIPLES AND PRACTICE by P.S. Carnt and G.B. Townsend. Published in 1961 by Iliffe Books Ltd. Hard covers, 487 pages 9" x 5½". Review copy supplied by Butterworths Pty. Ltd. Sydney. Australian Price $13.50.

This book explains the basic principles of colour television which are common to the three world systems of NTSC, SECAM and PAL. As the NTSC system is basic to all three, it is treated in great detail in this book.

A working knowledge of black and white television is assumed, as it is with most books specifically devoted to colour systems. Mathematical content in the text is kept to a minimum although all algebraic derivations of colour signal equations are naturally provided, together with vector diagrams without which it is really impossible to gain an adequate understanding of the colour modulation processes. Where mathematical proofs are considered necessary, these are included in the appendices.

Chapters on fault finding have been included and although these are by no means exhaustive they do give a basic grounding in the common faults which occur.

All circuitry in the book is based on valve techniques, due of course to the publishing date (1961). However as the book is really concerned with systems theory, and the principles are the same whether it be valve or transistor, this is no great hardship.

The greater portion of the book is devoted to NTSC receivers, transmitters being discussed on a system basis only. There would be few if any books current, however, that give such a thorough exposition of colour techniques – even though specifically NTSC. – B.C.

COLOUR TELEVISION VOL 2 PAL, SECAM AND OTHER SYSTEMS by P.S. Carnt and G.B. Townsend. Published by Iliffe Books 1969. Hard covers, 276 pages 9" x 5½". Review copy supplied by Modern Books and Plans Pty. Ltd., Australian Price $16.10.

Volume 1 of this book provided a thorough detailed explanation of NTSC system principles. Volume 2 takes over from Volume 1 and extends the coverage to the PAL, SECAM systems and to the lesser known ART and NIR systems. As PAL is the system in use in

READER INFORMATION SERVICE
AND ADVERTISERS' INDEX

For further information on Advertisers listed below complete the coupon/s stating information required including company and position held (if relevant). Cut out the coupon and post to:—

ELECTRONICS TODAY, 21-23 Bathurst St., Sydney. 2000.

ADVERTISERS

Four reply coupons are provided here for your convenience. Please list only ONE advertiser and ONE product on each coupon. If you require information on more than four individual products, make as many copies of the coupons as you like (preferably typed)—again using one coupon form for each product.

Send to ELECTRONICS TODAY, 21-23 Bathurst St., Sydney. 2000.

ADVERTISER ....
PRODUCT ....
NAME ....
ADDRESS ....
.... POSTCODE ....
COMPANY ....
POSITION ....

4:72

Send to ELECTRONICS TODAY, 21-23 Bathurst St., Sydney. 2000.

ADVERTISER ....
PRODUCT ....
NAME ....
ADDRESS ....
.... POSTCODE ....
COMPANY ....
POSITION ....

4:72

Send to ELECTRONICS TODAY, 21-23 Bathurst St., Sydney. 2000.

ADVERTISER ....
PRODUCT ....
NAME ....
ADDRESS ....
.... POSTCODE ....
COMPANY ....
POSITION ....

4:72

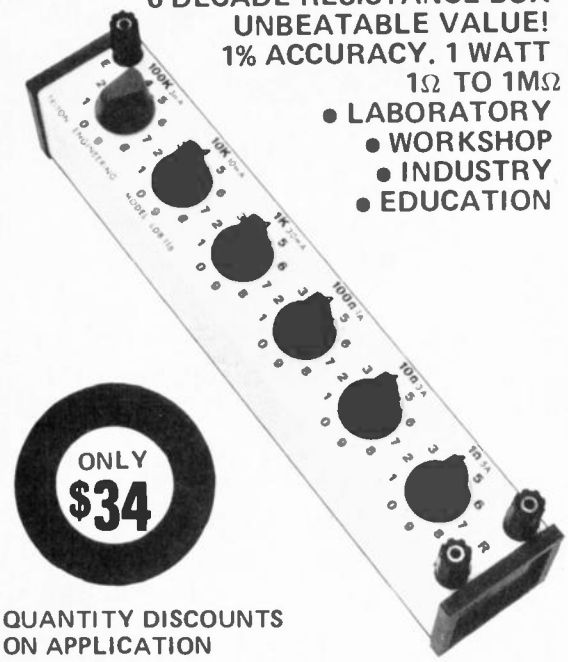
Send to ELECTRONICS TODAY, 21-23 Bathurst St., Sydney. 2000.

ADVERTISER ....
PRODUCT ....
NAME ....
ADDRESS ....
.... POSTCODE ....
COMPANY ....
POSITION ....

4:72

TRITON ENGINEERING PTY LTD

6 DECADE RESISTANCE BOX
UNBEATABLE VALUE!
1% ACCURACY. 1 WATT
1Ω TO 1MΩ
• LABORATORY
• WORKSHOP
• INDUSTRY
• EDUCATION



ONLY $34

QUANTITY DISCOUNTS ON APPLICATION

P.O. BOX 20, GREEN VALLEY
NSW. 2168 – PHONE 607 7435

HAM RADIO SUPPLIERS
MAIL ORDER SPECIALISTS

323 Elizabeth St. (2 doors from Little Lonsdale St.)
Melbourne, Vic. 3000. 'Phones: 67 7329, 67 4286.

MODEL C-1000 POCKET MULTIMETER, 1000 ohms/per Volt, AC Volts: 0-10/50/250/1000 (1000 opv). DC Volts: 0-10/50/250/1000 (1000 opv), DC Current: 0-100mA Resistance: 0-150K ohms (3K centre). 2 colour scale. Range Selector Switch. Dimens.: 3½ x 2¼ x 1 in. **$6.75** Post Free.

MODEL 200H MULTIMETER, 20,000 opv, DC Volts: 0·5/25/50/250/500/2500V (20,000 opv). AC Volts: 0.15/50/100/500/1000V (10,000 opv) DC/Amps: 50uA/2.5mA/250mA. Resistance: 0·60K/6M ohm (scale centre 300 ohm—30K ohm. Capacitance: 10uuf to .001uF/.001uF—.1uF, D3 scale 20 db to plus 22db, Size 4½ x 3¼ x 11-8. **$11.75** P.P. 40c.

MODEL CT 330 MULTIMETER, 20,000/OPV, DC Volts. 0-6/6/30/120/600/1.2K/3K/6K Volts, AC Volts: 0·6/30/120/600/1.2K Volts (10K/DPV), DC/amps: (0·0.06mA/60mA/600mA). RESISTANCE: 0-6K/600K/6M/60M/600Megohm. (30/3K/30K/300Kohms) centre scale: Capacitance: 50 uf to .01 uf .001 to 0.2 uf. Decibels:—20 to plus 63db size approx. 5½ x 35/8 x 1¾. **$18.75** P.P. 40c.

MODEL DL-640 MULTIMETER, 20,000/OPV, DC Volts: 0-0.25/1/10/50/250/500/1000V at 20K/OPV, 5000 volts at 10K/OPV, AC Volts: 0-10/50/250/1000V at 8K/OPV, DC/A: 50uA/1mA/50mA/500mA/10 amps. RESISTANCE: 0-4K/400K/4M/40Megohm. DB Scale:—20 to plus 36db. Capacitance: 250pF to .02uF, Induct, 0-5000H, size 5¾ x 41/8 x 1¾in. **$19.75** P.P. 40c.

NEW MODEL US-100. Overload protection. Shockproof Movement, polity switch, DC volts: 0.25/1/25/10/50/250/1000V (20K/OPV) AC Volts: 0-25, 10/50/250/1000V (5K/OPV), DC/Amps: 1mA/25mA/500mA/and 10A. AC/Amps 10A. RESISTANCE: 0-50M/ohms (centre scale 50) R X 1/10/1000/1K/10K, db scale—20 to plus 10 plus 22/plus 35/plus 50 db. **$29.90** P.P. 40c.

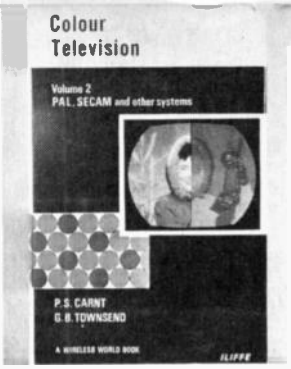
US106 as above but 50,000/o.p.v. $34.00 P.P. 40c.

MODEL AS100/DP HIGH SENSITIVITY
100,000/ohms/volt DC, Mirror Scale, PROTECTED MOVEMENT, SPECIFICATIONS: 6/20/120/300/600/1200 Volts A.C., (10K/OPV), Volts D.C.: 3/12/60/120/300/600/1200 (100K/OPV) D.C. Amps: 12uA/6mA/60mA/300mA/12 Amps. RESISTANCE: 2K/200K/20Mg/200Meg, Decibels:—20 to plus 63dB. AUDIO OUTPUT: 6 Volts/30/120/300/600/1200V A.C., SIZE: 7½in. x 5½in. x 2¾ in. **$34.50** P.P. 40c.

GENERAL COVERAGE COMMUNICATION RECEIVERS

"REALISTIC" DX150. Solid state (as reviewed in Electronics Today product test page 61, June '71 issue) 4 bands covering 535 kcs to 30 mcs fully transistorised SW/CW/SSB/AM broadcast 240V A.C. or 12V D.C. operation. Product detector for SSB/CW plus fast and slow AVC—variable pitch BFO—illuminated electrical bandspread, fully calibrated for amateur bands, Cascode R.F. stage—ANL for R.F. and A.F.—Zener stabilised—OTL audio—illuminated "S" meter—built-in monitor speaker. Price **$234.20.**
Matching speaker 8 OHM for use with "Realistic" DX150. Price **$13.60.**
"TRIO" 9R59DS. (General coverage.) 4 bands covering 540 kcs, valve type, to 30 mcs. Two mechanical filters ensure maximum selectivity. Product detector for SSB reception. Large tuning and bandspread dials for accurate tuning. Automatic noise limiter. Calibrated electrical bandspread. "S" meter and B.F.O. 2 microvolts sensitivity for 10 db S/N ratio. Price **$178.50.**

BOOK REVIEWS



the United Kingdom, this is the system to which fullest treatment is given.

To make the book reasonably self contained a short section at the beginning of the book revises the NTSC system. The PAL system and PAL equipment are then described in full detail with particular emphasis on PAL waveforms, frequency spectra and complementary errors. In the PAL equipment section block diagrams and circuitry are provided for selected transmitter sections before passing on to a much more thorough treatment of PAL receiver circuitry. Many circuit diagrams are provided from a variety of commercial receivers, mostly transistorised, and in some cases even coil winding data is given.

A generous section is devoted to the characteristics of comb filters as used for the separation of interleaved frequency spectra, that is for separating luminance and chrominance signals.

Following this, the SECAM system is studied over about 40 pages and the ART and NIR etc. systems over about 20 pages. A final section on dot structure and cross colour completes the book.

The book is particularly noteworthy for the clear treatment of advantages and disadvantages of the various systems and of various circuit arrangements. The book is extremely up to the minute and would be excellent value for engineer or technician alike. – B.C.

PRINCIPLES OF PAL COLOUR TELEVISION by H.V. Sims. Published 1969 by Iliffe Books Ltd., London. Hard covers, 154 pages 9" x 5½". Review copy supplied by Butterworths Sydney Ltd. Australian Price $6.30.

Mr Sims is Head of Engineering Maintenance Section of the Training Department BBC. As such he has been associated with colout television since 1953 and has given many lectures to the I.E.E. and the I.E.R.E.

As can be expected with such a background the treatment of the subject is very good and very detailed.

After a brief section on the development of colour television, the basic NTSC system is discussed followed by a detailed treatment of the effects of phase distortion (the major weakness of the NTSC system).

The book then moves on to the PAL system in general and a treatment of PAL deficiencies before discussing PAL decoders.

Brief details of the SECAM system are then given and this is followed by a brief comparison of the three systems both before and after optimisation.

Two appendices complete the book, the first of which discusses a flying spot colour television transparency scanner. The second appendice gives examples of the effects of phase distortion on the PAL system.

Although the treatment, as said before, of individual subjects is excellent, I cannot say that I was happy with the continuity of the book. Unless one was already familiar with colour television one would, I feel, lose his way and wonder just what part the author was talking about.

The introduction to colour television systems is too brief for anyone who has no previous knowledge of colour systems and no block diagrams of the complete transmitter or the complete receiver are given.

Good as a second reference, specifically on PAL, if another more general text has already been studied. Not recommended for beginners. – B.C.

PRICES AND DELIVERIES

Prices of books quoted in these reviews were correct at the time of publishing this issue. However it is expected that existing stocks will be exhausted very quickly and suppliers advise that future prices may not necessarily be as quoted.

Again, because of the expected demand, there may be a waiting time of 12 to 14 weeks between placing an order and receiving the books – Ed.

The new TEAC A-350 reaches a new low in background noise. Because the Dolby Noise Reduction System** is incorporated into it. Signal-to-noise ratio is improved by as much as 5dB at 1kHz, 10dB at 4kHz and above. Eliminating coloration and audible noise and hiss inherent in the tape or induced by the recorder.

Even mike pre-amp noise is eliminated by means of the Input Selector Switch.

The TEAC A-350 reproduces low frequencies never heard on a cassette before. As well as high. Multiple functions tape selector switch sets the exact bias and equalization for maximum frequency range from any tape—regular or high energy and the new chromium dioxide tapes.

There's a new low in distortion. Peak Level Indicator warns you of overload *before* VU meters peak out. Especially critical with the new low-noise tapes which require a higher recording level. Expanded VU meters, too, for further accuracy. Up to +6dB vs. +3dB.

There's a new low in tape head wear and maintenance. High density ferrite heads are standard on the A-350, the same ones used on expensive open-reel machines. So durable and precisely milled, TEAC guarantees them for the life of the machine.

Not an improved model, the TEAC A-350 is an all-new tape deck designed especially for the expanded frequency range and low-noise characteristics of new chromium dioxide and high energy tapes. Which is why it delivers a new high in cassette stereo sound reproduction.

**Dolby is a trademark of Dolby Laboratories, Inc.

Cassette tape decks have reached a new low.

TEAC
A Sound Idea

Australian Distributors:
Australian Musical Industries Pty. Ltd.,
155 Gladstone St., Sth. Melbourne, Vic., 3205.
Phone 69 7281

NSW: Convoy International Pty. Ltd., 357 2444; Magnetic Sound, 29 3371; W. C. Wedderspoon, 29 6681; Autel Systems Pty. Ltd., 89 0663. **TAS:** Wills & Co., Launceston 2 4641; Audio Services, Burnie 31 1960. **NT:** P. J. Leunig Pty. Ltd., Alice Springs. **SA:** Truscott Electronics, 23 3024. **QLD:** Brisbane Agencies Audio Centre, 26 931; Stereo Supplies, 21 3623. **WA:** Arena Distributors Pty. Ltd., 21 9993. **ACT:** Homecrafts Hi-Fi Centre, 47 9624. **VIC:** Douglas Trading, 63 9321; Brashs Pty. Ltd., 63 6701; Suttons Pty Ltd., 60 1201.

ENROL NOW AND RECEIVE THE BENEFIT OF COLOR TV TUITION

AUSTRALIA'S

ESTABLISHED ELECTRONICS COLLEGE

THE AUSTRALIAN RADIO & TELEVISION COLLEGE PTY. LTD.

- ESTABLISHED OVER 40 YEARS
- OVER 15 FULL TIME STAFF TO ASSIST YOU
- FULL NIGHT-CLASS PRACTICAL LESSONS
  OR
- EXTENSIVE CORRESPONDENCE TRAINING WITH SPECIAL PRACTICAL HOME-TRAINING KITS

Mail Coupon NOW

- You are invited to mail the coupon below which can be your first step towards securing a job or business of your own with good prospects, security and big money. A.R.T.C. will mail to you by return, at no obligation to you the big free booklet: "Careers in Radio and Television". This booklet will show you definite steps you can take for a better job, how you can succeed in life. Post the coupon, phone or call NOW.

AUSTRALIAN RADIO AND TELEVISION COLLEGE PTY. LTD.

E.S.&A. BANK BUILDING

Cnr. Broadway and City Road, Sydney.
(Dpp. 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.....

.....T204