

AUSTRALIA'S DYNAMIC MONTHLY

AUGUST 1972 50c

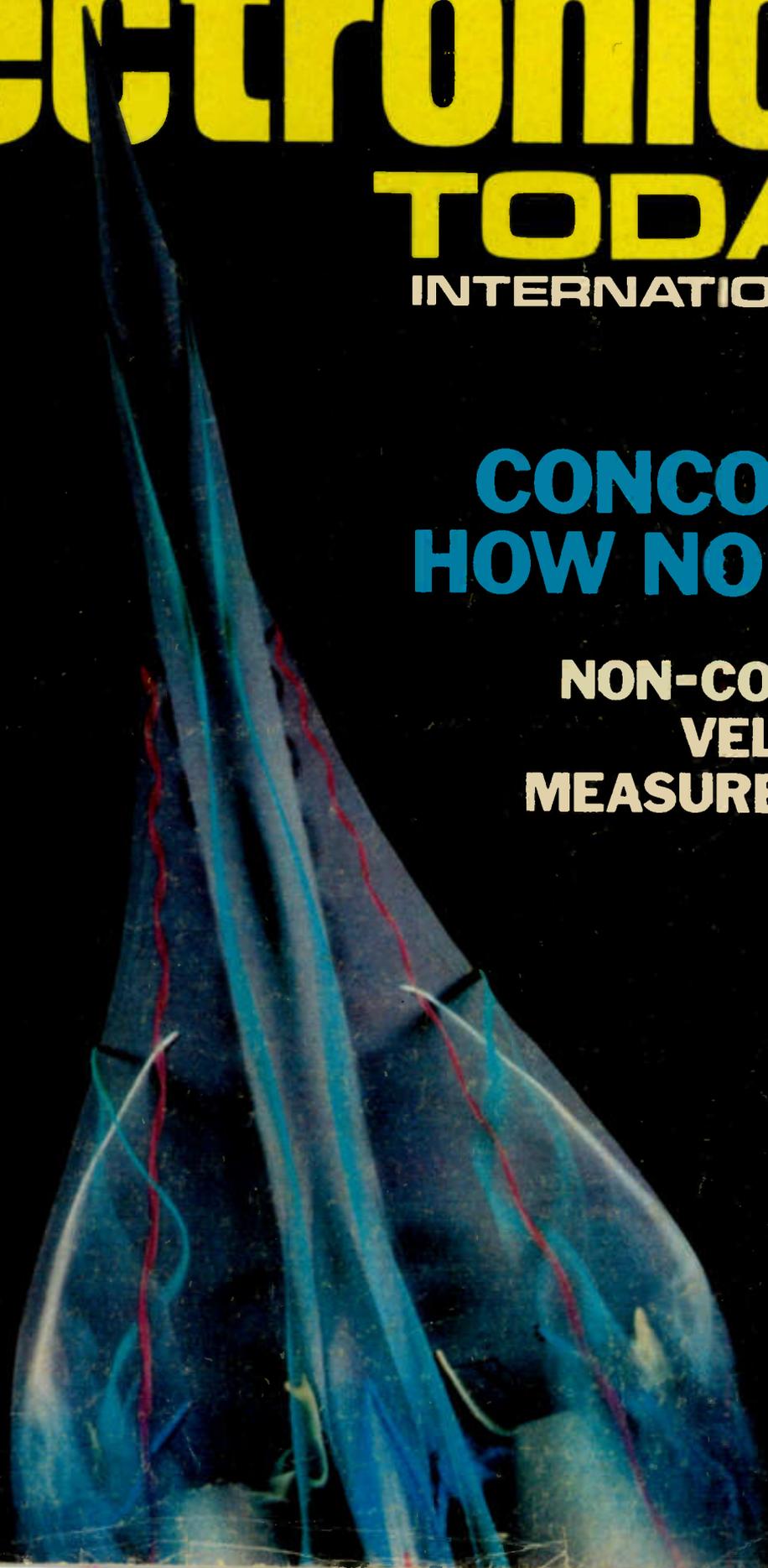
electronics

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COLIN RYRIE



With deep sadness, we report the passing of our Managing Director, Colin Stirling Ryrie.

Colin was only 42, and the boating accident that cut short his life on Friday, July 7, robbed his family, his co-workers, and countless friends around the world, of a remarkable man.

His drive and vitality led him into many fields of endeavour, but his two outstanding interests were magazine publishing and sailing.

Sailing came earliest. State and National 12-foot skiff champion while still in his teens, he later moved to the Finn monotype class and twice represented Australia in the Olympic Games — at Melbourne and Tokyo. And it is a tribute to the wide sweep of Colin's imagination that it was he who first suggested, and helped initiate, Australia's most spectacular yachting venture — the challenge for the America's Cup.

Colin's entry into publishing came almost as early in life. He became editor of a yachting magazine at 19, then moved to the advertising side and in five years gained enough all-round experience in publishing to move out on his own.

In fact, Colin and I moved out together — to start Modern Magazines, whose first publication was Modern Motor. This was in 1954; other titles followed, and today Modern Magazines (Holdings) Ltd. produces a dozen periodicals, each a leader in its field.

Electronics Today International is one of our newest ventures — and the "International" part of its name is again a tribute to Colin Ryrie's pioneering spirit. He conducted the negotiations that made ETI the nucleus of an international network — the first such venture by an Australian magazine publisher. As our readers know, the British edition of ETI is already on the streets; another overseas edition is due out later this year, and others still will follow.

Our sympathy goes out to Colin's widow, Anthea, and his two children by a previous marriage, Kim and Caroline; and with it our pledge, that the publishing house Colin built shall endure. We say this in the knowledge that Colin built well, making the task easier for us who follow.

One member of the staff with a special interest in this pledge is young Kim Ryrie who, like his father, entered publishing while still in his teens. You first saw his name in ETI as Projects Adviser; now his interest has turned to photography. So we still have a Ryrie working with us — and that's good.

Jules Feldman
Editor-in-Chief

Who stands to gain?

IT is both right and proper that the implications of technological development should be closely scrutinized by those in any way affected by the consequences of resultant change.

And in many areas, subjective observations from lay people have as much validity as similar observations from those expert in any particular field. Equally there are occasions when valid criticism can only be based on objective measurement and expert opinion, factually presented by non-interested parties.

The extraordinary brouhaha surrounding the Far Eastern tour of the Anglo-French Concorde supersonic airliner is in this category.

Here the extraordinary statements of those anxious to flog the thing are exceeded only by those with a vested interest in otherwise competitive non-supersonic aircraft. Such statements range from BAC's "Concorde will be one of the greatest steps forward in world transportation since the invention of the wheel", to the opposition's claim that "Ozone poisoning will kill all the Concorde's passengers".

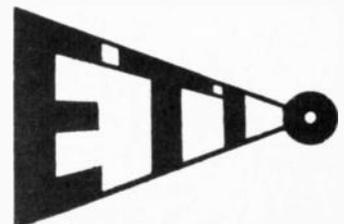
But in the assessment of the two major criticisms of the aircraft — firstly that it will upset the atmospheric balance of the stratosphere, and secondly that its noise level will be excessive — the layman is clearly out of his depth, for neither parameter can be evaluated subjectively. They are both matters for measurement and calculation.

In these areas the layman can only attempt to assess data that are available to him, and which are within his understanding.

Even then caution is necessary. For example few of those groups concerned with the preservation of the environment have realized the extent to which their 'facts' have been supplied by those whose interests have little to do with ecology.

When such data is presented all one can do is to ask — as did Socrates — "Who stands to gain?"

If historians are correct in their belief that travel is the catalyst of civilization, then an aircraft that is capable of reaching practically any part of the world within twelve hours must be judged rationally and dispassionately, using evidence not obfuscated by issues vital only to those with rival commercial or political interests.



U.S. Summary, Electronic End Equipment Consumption (Million \$)

	1970	1975	1980	1985
Total	28,273.9	41,514.2	56,954.8	80,922.6
Consumer	4,495.0	6,520.0	8,800.0	12,900.0
Entertainment	4,350.0	6,000.0	7,800.0	10,900.0
Automotive	65.0	300.0	700.0	1,600.0
Other Consumer	80.0	220.0	300.0	400.0
Industrial	11,178.9	19,994.2	29,354.8	45,522.6
Data Processing	5,849.0	10,801.0	14,702.0	22,306.0
Other Office & Store	361.0	1,345.0	2,135.0	3,300.0
Telep. & Teleg.	813.2	1,440.6	2,135.0	4,787.2
Other Comm.	2,247.0	3,086.0	4,557.5	6,954.4
Test & Measurement	554.4	843.8	1,261.6	1,967.7
Lab & Medical Inst.	613.1	1,122.6	1,899.7	2,854.5
Process Control	741.2	1,355.2	2,177.1	3,352.8
Government	12,600.0	15,000.0	18,800.0	22,500.0
Military	10,800.0	12,500.0	15,800.0	18,500.0
Civil Agencies	600.0	1,200.0	1,500.0	2,000.0
NASA	1,200.0	1,300.0	1,500.0	2,000.0

United States Electronic Components Consumption (Million \$)

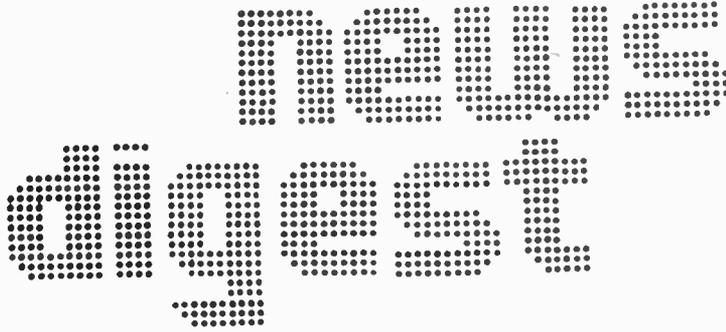
	1970	1975	1980	1985
Total Components	6,195	7,646	10,472	14,195
Electron Tubes	1,057	1,008	994	826
Receiving Tubes	242	180	126	70
TV Picture Tubes	451	499	505	393
Power and Spec. Purpose	364	329	363	363
Discrete Semiconductors	754	715	1,210	1,402
Integrated Circuits	792	1,175	2,276	4,278
Monolithic	402	715	1,540	3,100
Hybrid	390	460	736	1,178
Capacitors	475	585	720	840
Resistors	350	424	454	463
Transformers & Reactors	375	425	468	515
Connectors	400	585	708	1,050
Relays	295	325	332	351
Switches for Electronics	160	245	360	488
Speakers	273	397	556	804
Electronic Parts, NEC	1,251	1,764	2,322	3,158
Microwave Components	116	233	401	646
Printed Circuit Boards	103	159	214	274
Magnetic Tape	300	501	671	859
All Other NEC	732	871	1,036	1,379

© May 1972, Electronics Industries Association

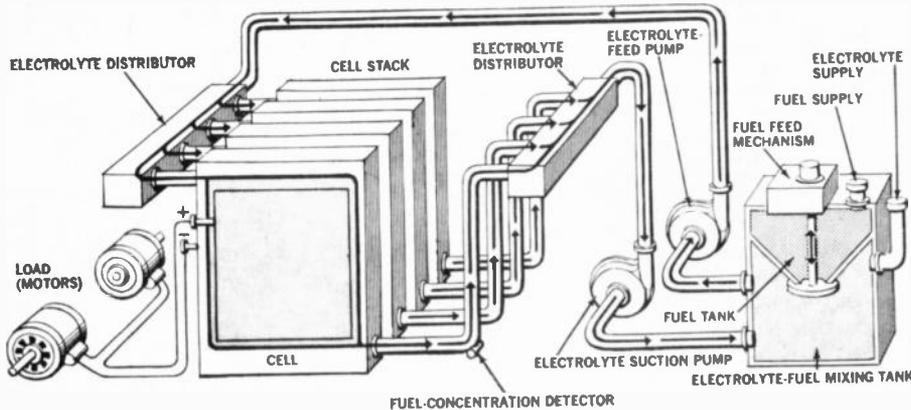
Predictions of US electronic component and equipment consumption for the next fifteen years were made recently at a seminar entitled 'Electronics 1985' held by the EIA.

Extracts from two of the published tables are reproduced above. (It should be appreciated that these tables are merely projections based on collected data - Ed.)

(Turn to page 12)



ELECTRIC CAR - LATEST



In Japan, the Sony Corporation recently demonstrated a prototype electric car claimed to be capable of speeds up to 56 mph.

The power source is a 're-fuelable' zinc-air 6 kW battery consisting of 256 individual cells each measuring 6" by 8".

Each cell has two positive porous-carbon electrodes with a negative electrode sandwiched between them. Separators prevent the electrodes touching.

An external tank contains the fuel which consists of powdered zinc suspended in an electrolyte. This fuel is pumped into the spaces between the positive and negative electrodes for an eight second period every 52 seconds.

The powdered zinc suspended in the electrolyte becomes trapped on the negative electrodes. Air entering the cells (which are vented to atmosphere) permeates through the porous-carbon positive electrodes thus oxidising the zinc and liberating electrons. The expended zinc particles are then flushed from the cells at the end of the 52 second period.

As some zinc is dissolved in the electrolyte during the 52 second power cycle its concentration is measured during the flushing cycle. A concentration detector linked to the fuel supply system then maintains the zinc at the correct level.

The finally-used-up zinc is recycled by an external electrolytic process, power for which is taken from the

240V mains. The recycling process is reasonably efficient and Sony claim that just under 4 kWh are required to process the quantity of zinc required to produce one kWh of energy in the battery.

The prototype vehicle also carries a 10 kW nickel-cadmium booster which is switched into circuit for starting, accelerating and hill climbing. This battery also provides power during the eight second cell re-fueling period. It is charged from the main zinc-air battery when the car is running at steady speeds.

According to Sony, the cost of the battery will be approximately \$600.

CASSETTES REPLACE PUNCHED CARDS

A new low-cost data handling system from Computer Electronics of Shire Hill Industrial Estate, Saffron Walden, Essex (UK), uses standard tape cassettes. The cassettes are claimed to be more convenient and more speedily handled than punched card, paper tape and 'naked' magnetic tape currently used. The cassette is claimed to be capable of handling the same amount of data as 2000 punched cards. Information can be retrieved and edited by using a standard electric typewriter keyboard.



- ATTRACTIVE • POWERFUL • COMPACT
- FULLY COMPATIBLE • SUPERB VALUE

THAT'S THE NEW GRAYSON "OXFORD" STEREO SYSTEM!

AND IT COSTS A MAXIMUM OF ONLY \$349!

Each component of the new Grayson Oxford stereo system has been selected by electronics engineers to blend perfectly — just as the hand finished oiled teak cabinets will harmonize with your lounge room decor.

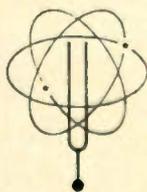
**LISTEN
NOW AT
YOUR
SIMON GRAY
DEALER!**



Power output is a massive 36 watts R.M.S. sufficient to fill a medium size theatre, if necessary. Frequency response of the cartridge is 20-20,000 Hz. and the amplifier is better than 20-60,000 Hz. ± 2 dB. which covers every audible sound and many beyond actual hearing!

For \$349 or less you get:—

- * The Sansui Model AU-101 solid state stereo amplifier.
- * The Silcron Mk. III belt driven turntable.
- * The Sansui Model TA-1050 precision tone arm. * A magnetic stereo cartridge with a diamond stylus.
- * Hand finished "works" cabinet, fitted with a dustproof perspex cover. * A matching pair of teak speaker systems fitted with 8" twin cone wide range Wharfedale speakers.



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Adelaide Office: 301 South Terrace, Adelaide S.A. Tel. 23 621E

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looking for a medium the only question is . . .

Selecting a stereo amplifier in the medium price range poses only one major question . . . not which brand . . . but which model Sansui?

There's absolutely no doubt that dollar for dollar Sansui solid state stereo amplifiers offer more performance, more real power and greater reliability. So down to the nitty-gritty. *Which model Sansui?*

THE ALL-NEW SANSUI MODEL AU-505.

We confidently predict that the all-new Sansui AU-505 is destined to become one of the most popular stereo amplifiers ever available in Australia.

With almost double the power of the AU-101, the AU-505 represents terrific value at only \$199 . . . and that's the *most* you will pay, for trading in your old equipment can reduce the price *considerably*.

Facilities on the new AU-505 offer great flexibility in tone control . . . provision is made for A-B speaker switching . . . a new flip-switch instantly provides tuner input . . . and both headphone and microphone jacks are situated on the front panel, together with a DIN tape recorder socket. Ask for complete specifications when you visit your franchised Simon Gray dealer!

Now examine these abridged AU-505 specifications:

Power output: *Music power* — 90 watts at 4 ohms
70 watts at 8 ohms
R.M.S. power — 70 watts at 4 ohms
50 watts at 8 ohms

Frequency response: 20-60,000 Hz. \pm 2 dB.
T.H.D.: Less than 0.5% at full rated output.

Channel separation: Better than 50 dB.

Input sensitivity: 3 mV. (magnetic pickups), 4 mV. (microphone), 200 mV. (tuner, tape recorder, auxiliary).

Dimensions: 16" x 11" x 4 $\frac{1}{8}$ "
Price: \$199* (recommended price).

- *All Sansui models feature all-silicon transistor design
- *All output stages are semi-complementary Darlington SEPP-ITL OTL designs — no input or output transformers — consequently less distortion.



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FULL DETAILS.
SEND THE COUPON
RIGHT AWAY AND
WE'LL SEND YOU
ALL THE FACTS.**

Simon Gray Pty. Ltd.
28 Elizabeth Street, Melbourne, 3000
Telex: 31904
Please send me all the facts about the Sansui Model AU-101, AU-505, AU-555A* in detail and the name of my nearest Simon Gray dealer.

NAME

ADDRESS

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*Delete items not required



SANSUI — COMBINING TONAL QUALITY AND POWER.

priced amplifier? which

Sansui?

THE PROVEN AND POPULAR SANSUI MODEL AU-101.

When reviewing the all low-noise silicon transistor AU-101 "Electronics Australia" said . . . "the best comment we can make about the AU-101 is that few amplifiers, regardless of price, give an overall test result as good as this." "Electronics Today" said . . . "Performance of the Sansui AU-101 belies its low price" . . . "The hum and noise performance are both very good and better than most other amplifiers at twice the price" . . .

Look at these abridged AU-101 specifications:

Power output: Music power — 50 watts at 4 ohms
44 watts at 8 ohms
R.M.S. power — 36 watts at 4 ohms
30 watts at 8 ohms

Frequency response: 20-60,000 Hz. \pm 2 dB.
T.H.D.: Less than 0.8% at full rated output.

Channel separation: Better than 45 dB.

Input sensitivity: 3 mV. (magnetic cartridge), 4 mV. (microphone), 200 mV. (auxiliary and tape recorder).

Dimensions: 16" x 11" x 4 $\frac{5}{8}$ "
Price: \$149* (recommended price)

THE CHOICE OF THE ENTHUSIAST — THE SANSUI MODEL AU-555A.

Few amplifiers have received the acclaim afforded the Sansui AU-555A by the dedicated high fidelity enthusiast. All over Australia (and the rest of the world) the AU-555A has been selling in ever increasing volume. What's the secret?

Basically, **tonal quality**. Similarly priced competitors are left a long way behind . . . and some avid music lovers claim there's very little perceptible difference between the AU-555A and the top-of-the-line Sansui AU-999 in terms of tonal quality. Of course, the AU-999 is a simply superb amplifier . . .

Let's look at the abridged AU-555A specifications:

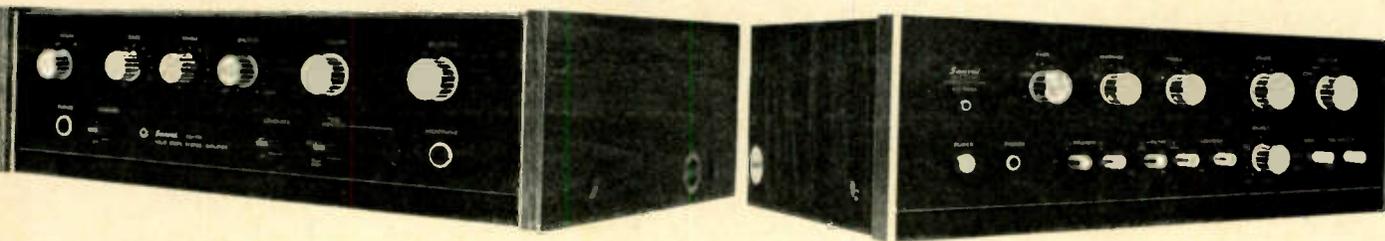
Power output: Music power — 85 watts at 4 ohms
R.M.S. power — 66 watts at 4 ohms
50 watts at 8 ohms
60 watts at 8 ohms

Frequency response: 20-40,000 Hz. \pm 1 dB.
T.H.D.: Less than 0.5% at full rated output.

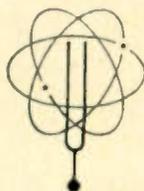
Channel separation: Better than 60 dB.

Input sensitivity: 2 mV. (magnetic pickups), 180 mV. (tuner, tape recorder, auxiliary)

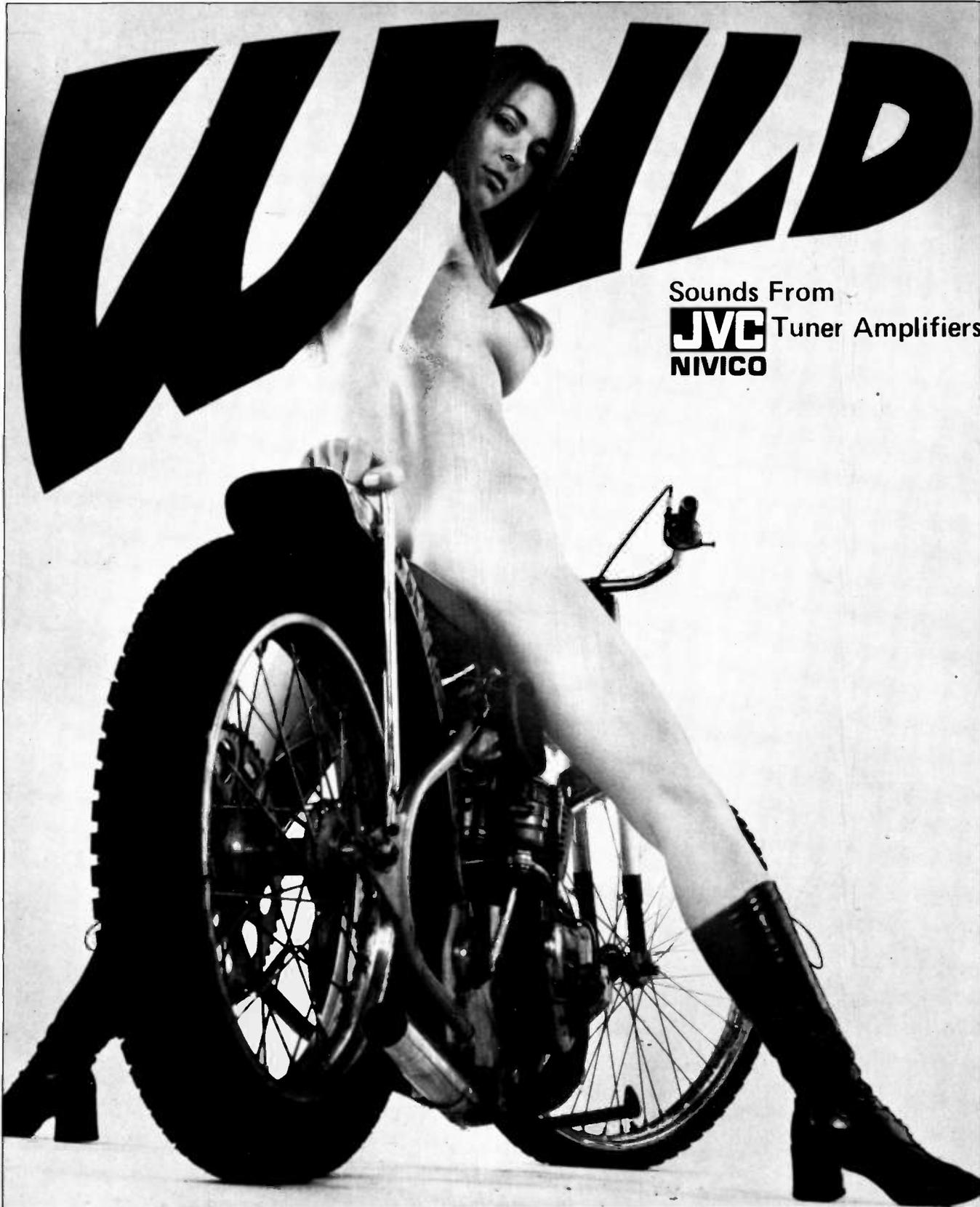
Dimensions: 15 $\frac{1}{8}$ " x 11 x 5 $\frac{3}{8}$ "
Price: \$237* (recommended price)



***PRICES.** Prices quoted are recommended prices only . . . the actual cost can well be less. Trade-in valuations can make a world of difference! See your Simon Gray franchised dealer!



Sansui Distributors: Australia, excluding 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.:** Pflitzer'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:** Atkins 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, Sugunami-ku, Tokyo, Japan.



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NIVICO

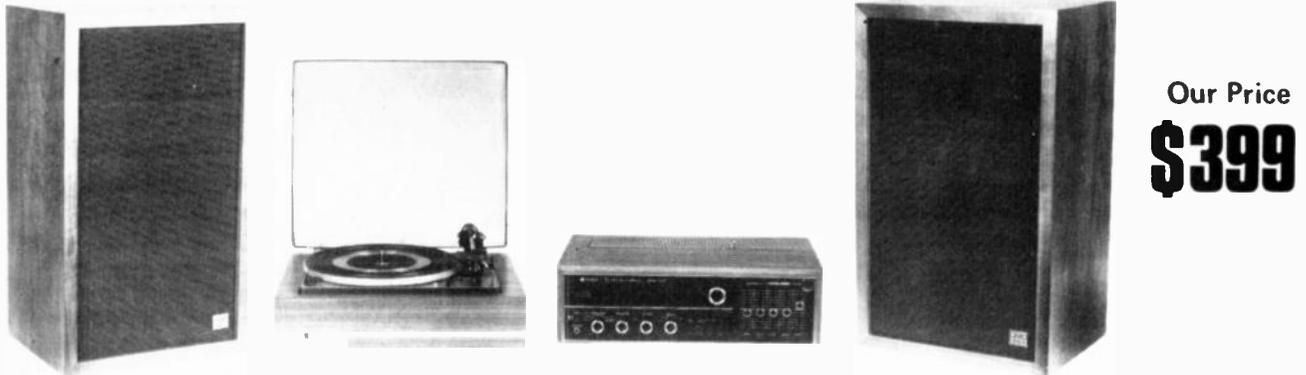
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Sydney's Leading **JVC** Specialist
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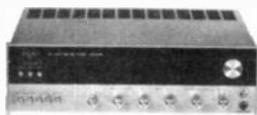
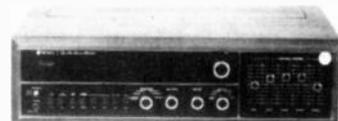
PRESENTS THE WORLD'S TOP EQUIPMENT AT SYDNEY'S BEST PRICE



Our Price
\$399

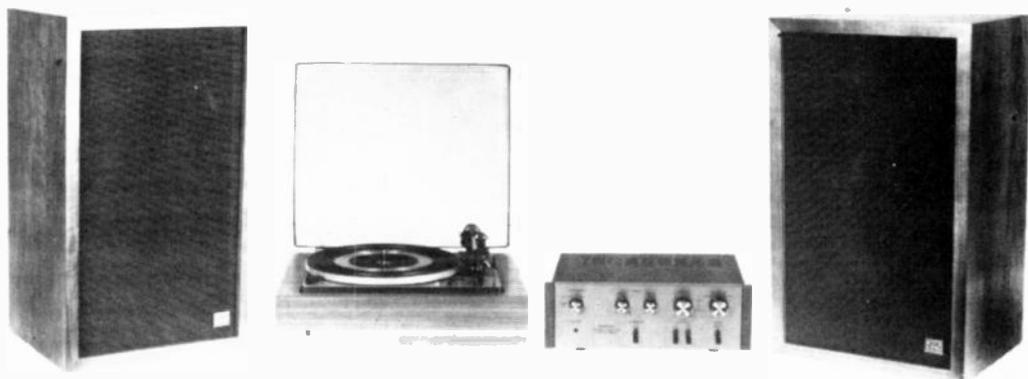
** Above system includes Dual 1214 Turntable, JVC Nivico 5010 40 watt Tuner Amplifier complete with SEA tone control system and BLA 500 speakers.*

** JVC Nivico also has a full range of Tuner Amplifiers 40 watt/watt/75 watt/140 watt/200 watt. Ask our price and be amazed.*



For those that require clean control of power without the additional SEA feature of above, TEAC Tuner Amps are the answer at prices equal to straight amplifiers.

Our Price
\$299

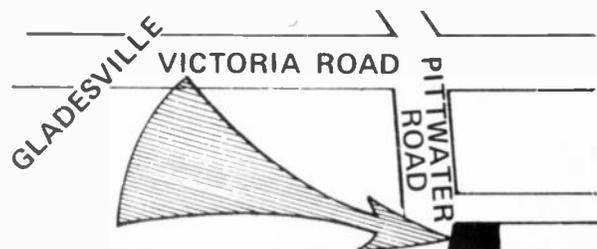


** For those who do not require a tuner (we cannot see why at above price) we have our Dual 1214. Complete choice of Pioneer SA500A, Sansui 101, Kenwood KA2002 and the JVC Nivico BLA500 speakers. It sounds unbelievable for the price.*

All above can be bought Mail Order plus freight.

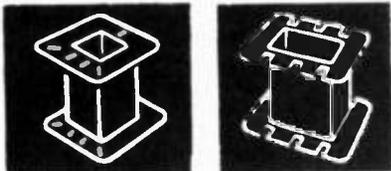
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Transformer bobbins made from acetal resin. Excellent electrical insulation, low moisture absorption, intermittent service temperatures up to 250°F., with the ability to withstand solvents and impregnation temperatures up to 315°F. Designed for use with standard wasteless "E.I." Lamps.

DIMENSIONS			Price Cents ea.
Window Width	Stack	Description	
1/4"	1/4"	Slotted Holes	12
3/8"	3/8"	Open Slots	13
1/2"	1/2"	Open Slots	14
9/16"	9/16"	Open Slots	15
9/16"	9/16"	Centre Divide	16
9/16"	9/16"	Off Centre Divide	16
9/16"	11/16"	Open Slots	16
9/16"	7/8"	Slotted Holes	16
11/16"	13/16"	Open Slots	22
3/4"	3/4"	Open Slots	24
3/4"	3/4"	Centre Divided	25
3/4"	1"	Open Slots	25
7/8"	7/8"	Open Slots	26
7/8"	1"	Open Slots	29
1"	1"	Open Slots	30
1"	1 1/4"	Glass Filled Nylon	52
3/4" x 15/16" x 2 1/4"			50
Slotted Holes			

MANUFACTURERS' PLEASE NOTE

Huge discounts available on quantities in excess of 100. Other sizes available on request and in certain instances glass-filled nylon A198 can be made available for temperatures in excess of 315°F.

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FUZZ FINDER

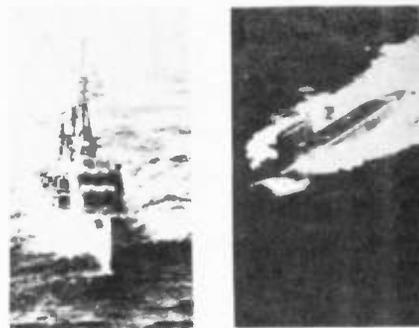
The Nuremberg Police Force (Germany) has been testing a system developed by Siemens for locating patrol cars by computer. From radio signals transmitted at regular intervals by the vehicles they can be monitored on a TV screen by the dispatcher.

Although computer-controlled location is not new in principle, until recently it was thought to be impracticable for urban areas because buildings impede the straight line propagation of radio waves. Siemens has now demonstrated that urban application is feasible. The computer was programmed to evaluate the signals resulting from radio waves rebounding from buildings. As this is carried out in fractions of a second, the position of each car at any given moment is established by the "differences in propagation time" of the individual signals and the results are flashed on to a data display unit.

This new system eliminates delays inherent in radio communication

where headquarters contact cars individually one after the other and the dispatcher gradually charts a unified view of their positions, resulting in loss of valuable time before they are directed to the scene of action. It has similar application for fire departments, emergency repair and maintenance services and ambulances.

NO COMMENT



USE IN SURFACE AND SUBSURFACE NAVIGATION

Omega is the only navigation method that is as well-suited for submarines as for aircraft or surface vessels. Its low frequencies penetrate seawater to appreciable depths. They also travel through sea ice. Thus a completely submerged submarine can be guided by Omega through any seas, including those that lie beneath the frozen polar regions. Only reception is required, so the submarine user does not reveal his position.

These illustrations are from the brochure distributed by the US Navy OMEGA Project Office. The brochure is titled "OMEGA" — a Worldwide General Purpose Navigational System for Air, Surface and Subsurface.

A WORLDWIDE GENERAL-PURPOSE NAVIGATION SYSTEM FOR AIR, SURFACE AND SUBSURFACE

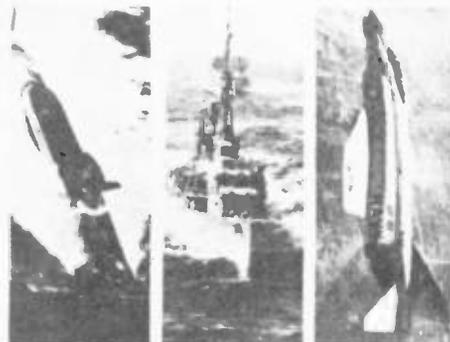


Prepared by the Naval Electronics Laboratory Center
San Diego, California 92152.

REVIEWED AND APPROVED 8-11-67

M. J. ...

Naval Staff Officer



UNDERWATER DATA



This underwater data centre — produced by GEC-Marconi — accepts inputs from almost any oceanographic instruments and records time-correlated data in computer retrieval form on magnetic tape.

The unit can for example take readings from up to ten current sensor units and will operate for over 1,000 hours from its self-contained batteries. Six hundred feet of seven track tape may be loaded into the unit, and sampling and integration periods are available from fractions of seconds to over two hours.

Usually located on the sea bed to avoid surface weather conditions, the unit with its associated electronics and battery power source can be readily housed in a standard oceanographic sphere, 24 inches in diameter.

SONY IN CHINA

The Communist Chinese Government has invited engineers from Japan's Sony Corporation to visit China to discuss the Trinitron Colour TV system.

CAR DISTANCE WARNING

In the USA, the Radio Corporation of America have demonstrated a radar system that tells a driver if he is too close to the car ahead.

Unlike most previous designs of this sort the RCA device uses a passive reflector on the rear of the preceding vehicle. The reflector contains two arrays each of 128 dipoles. The car behind transmits a vertically polarized 9GHz signal and this is received by the array and — after passing through a passive non-linear device — is frequency doubled and retransmitted back to the

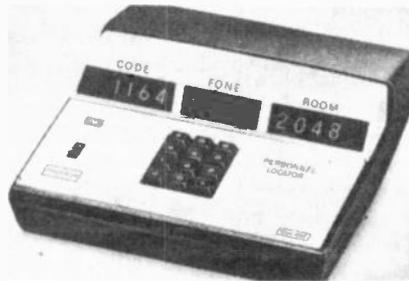
car behind (this time horizontally polarized).

A small computer in the transmitter/receiver then measures the distance to the car ahead, relates this to vehicle speed, and if the distance is too close for safety at that speed, sounds a warning. (presumably the system is disabled when overtaking).

Selling cost is said to be about \$10 for the reflectors and \$80 to \$100 for the transmitter/receiver.

The manufacturers do of course appreciate that as reflectors would have to be fitted to all vehicles the system is not really viable unless it is made obligatory by legal sanction.

BIG BROTHER'S LOCATOR



A new personnel location system known as "Trakatron" model 2002 (not 1984) has been released by Recognition Devices Inc of New York.

The system enables individuals to be located anywhere throughout a building instantly, without requiring their consciousness or involvement. The locating device uses ultrasonics to track the whereabouts of any person, indicating within one second the telephone extension and room number where he can be reached. The system can cope with up to 4096 individuals.

The Trakatron operator console is normally located on the telephonist or receptionist's desk. Each room to be monitored is fitted with a room sensor and each person is provided with a pen sized transponder.

In use, the operator selects the code number assigned to each person by means of a touchtone keyboard, thereby transmitting a coded ultra-sonic tone by means of every room sensor in the premises. If the individual being sought is anywhere within the building, his pen transponder will receive the coded signal and respond with an ultra-sonic signal back to the room sensor.

Since the signal code is selective, no other person's transponder will be triggered. The control console therefore displays the number of the room where the response was generated, together with the nearest telephone extension number.

A second control system known as "Penlock" may be used with the pen



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news digest

transponder system for 'high security' operations such as electronic door access.

Presumably the next stage will be surgically to implant the transponders in one's head.

IRH/THORN AGREEMENT

IRH Industries Limited has concluded an agreement to take over the operations of Thorn M.I. Australia Pty. Limited with respect to variable speed motor drives and related control equipment.

The newly acquired Thorn M.I. activities will be integrated into the operation of the Equipment Division of IRH Industries, which already manufactures a wide range of equipment and control systems for industry, complementary to that now being introduced.

In addition to the Thorn M.I. arrangement, IRH Industries Limited has reached agreement with Thorn Automation Limited of the U.K. to represent and manufacture under licence in Australasia the entire range of products and systems which Thorn Automation offers for industrial equipment and process control requirements.

NORTHERN AUSTRALIA SURVEY

The first commercial SLAR survey of Australia has been completed by a high-flying Caravelle jet airliner.

Owned by Litton Industries, the twin-engine Caravelle performed the assignment this week on behalf of the Department of National Development in remote territory between Mt. Isa and Cloncurry.

Carrying advanced electronic mapping equipment, the aircraft silently chartered 2,000 sq. miles of N-W Queensland by the Side-Looking-Airborne-Radar method - otherwise known as "SLAR"

SLAR is an extremely accurate method of mapping the earth in which the photo image is produced through high frequency radar waves rather than conventional camerawork.

The SLAR equipment mapped the Queensland outback in a 22-mile wide path on either side of the plane, at speeds of up to 500 m.p.h.

In this way, a huge amount of territory that would take weeks to record by normal aerial camera methods, was covered in a couple of days.

Originally developed in the U.S. for

military applications in the late 1950's, the SLAR system is able to function regardless of whether the earth is hidden from the air by clouds, storms or darkness. Further, from an altitude of 40,000 feet, the SLAR signals are able to pick up details of objects on the ground a few feet in size and discriminate between features less than 50ft. apart.

A spokesman for Litton's Aero Service Company said that the results of the SLAR survey would enable the Department of National Development to evaluate the new method of high speed mapping. It was possible that the SLAR technique had particular application to New Guinea and other jungle covered areas of the South Pacific, the spokesman added. It was also equally applicable to vast ice covered areas of Antarctica.

Resembling a flying computer station, the Caravelle cabin is packed with electronic recorders, monitors and meters together with a doppler radar profiler and aerial cameras. Extremely accurate automatic navigation is achieved by using a Litton LTN-51 inertial navigation system - the same equipment as employed by the Concorde SST.

DRAFT STANDARD FOR LOUDSPEAKERS

The Standards Association is seeking comment on a draft Australian standard for sound system loudspeakers, issued for public review as DR 72079.

The draft prescribes and defines the characteristics of loudspeakers, drivers and systems which must be specified in order to adequately describe electro-acoustic performance and specifies relevant measuring methods.

This draft is technically compatible with the recommendations of Publication 268-5 issued by the International Electrotechnical Commission (IEC). Grateful acknowledgement is given for the assistance received from this source.

The draft forms Part 5 of a comprehensive set of proposed standards on sound system equipment.

Copies of DR 72079 may be obtained, without charge, from the various offices of the Standards Association of Australia in all capital cities and Newcastle.

Comment on the provisions of the draft is invited from persons or organizations experienced in the manufacturing, use and testing of sound system equipment, and should reach the head office of the Association, 80 Arthur Street, North Sydney, N.S.W., 2060, or any branch office, not later than 31 August 1972.

Sizzling!

the only word
to describe
the extraordinary
performance of
the new Wharfedale
"Denton" and
"Linton" compact
speaker
systems.

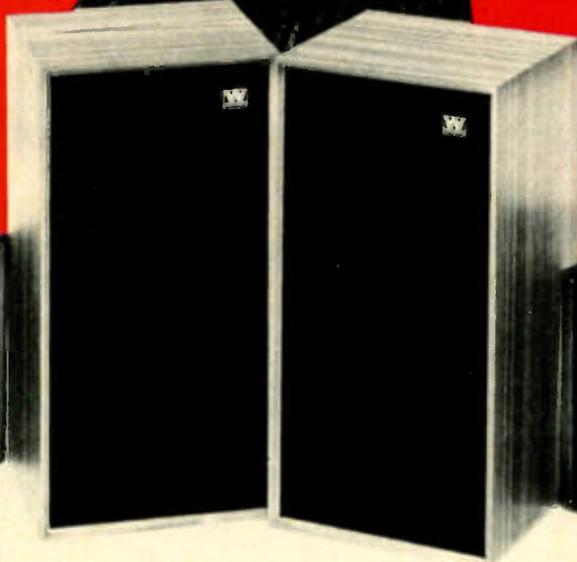
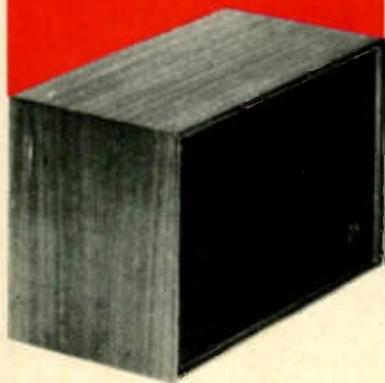


Building effective compact speaker systems requires technical "know-how" and experience — and that's where Wharfedale really shines. For over forty years Wharfedale has been Britain's leading manufacturer of high quality wide range loudspeakers; Wharfedale advances in technology are very obvious in the all-new "Denton" and "Linton".

Two models of each unit are available . . . a two way system with an entirely new 8" bass reproducer and a 2" tweeter, and a three way system which specifies a 4" mid-range speaker in addition, to add further reinforcement in the "presence" frequencies.

A long throw voice coil is used in the bass speaker to provide restraint-free lower registers and the new 2" tweeter is the result of intensive Wharfedale research — high frequencies are smooth and satisfying. Large magnet structures offer greater sensitivity.

Now examine closely these brief specifications:



DENTON 2.

Size: 14" x 9 1/4" x 8 3/4" / Frequency response: 60-16,000 Hz. \pm 3 dB. / Power rating: 20 watts DIN. / Speaker complement: 8" bass speaker, 2" tweeter. / Crossover frequency: 1,400 Hz. / Finish: Oiled teak or polished walnut.

LINTON 2.

Size: 19" x 10" x 9 1/2" / Frequency response: 55-17,000 Hz. \pm 3 dB. / Power rating: 20 watts DIN. / Speaker complement: 8" bass, 2" tweeter. / Crossover frequency: 1,200 Hz. / Finish: Oiled teak or polished walnut.

LINTON 3.

Size: 19" x 10" x 9 1/2" / Frequency response: 55-17,000 Hz. \pm 3 dB. / Power rating: 25 watts DIN. / Speaker complement: 8" bass, 4" mid-range, 2" tweeter. / Crossover frequencies: 1,100 and 4,000 Hz. / Finish: Oiled teak or polished walnut.

DENTON 3.

Size: 14" x 9 1/4" x 8 3/4" / Frequency response: 65-17,000 Hz. \pm 3 dB. / Power rating: 25 watts DIN. / Speaker complement: 8" bass, 4" mid-range, 2" tweeter. / Crossover frequencies: 1,100 and 4,000 Hz. / Finish: Oiled teak or polished walnut.

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BREAKTHROUGH



IN BRAIN X-RAY

Computerized brain X-ray machine is major advance in diagnostic radiography.

A CONVENTIONAL radiograph shows the varying densities of body tissues interposed between the X-ray source and a sensitized photographic plate. Dense areas then absorb the most radiation – and vice versa. A major limitation of this technique is that a feature has to be comparatively thick or dense to register on a photograph at all.

A chart of the absorption coefficients of the body's constituents is shown in Fig. 1. Taking the absorption coefficient of water as the base (zero) between fat (-10%), and tissue (+8%), it can be seen that there is only 18% variation in absorption. It will also be seen that all tissue (muscle etc.) falls within the narrow band of only 4% or so overall variation.

This narrow separation of absorption coefficients is the major stumbling block in the use of conventional radiographic techniques.

A further difficulty is the confusion of information caused by the superimposition of three-dimensional information on a two-dimensional photograph. In fact studies of conventional X-ray techniques have shown that only one-hundredth part of the information potentially available from the radiation of X-rays is actually realised on the photographic record.

These problems are compounded in brain examinations for the brain's constituents are composed of soft tissue which is effectively masked by the shield of bone from which the skull is formed. Variations in bone thickness – and the consequent effect on X-ray absorption – completely obliterate tissue details.

COMPUTER TECHNIQUES

In 1969, the Central Research Laboratories of EMI (UK) supported



ABOVE: Mr Godfrey Hounsfield of EMI's Central Research Laboratories developed the original technique and led the team that developed the final machine.



BREAKTHROUGH IN BRAIN X-RAY

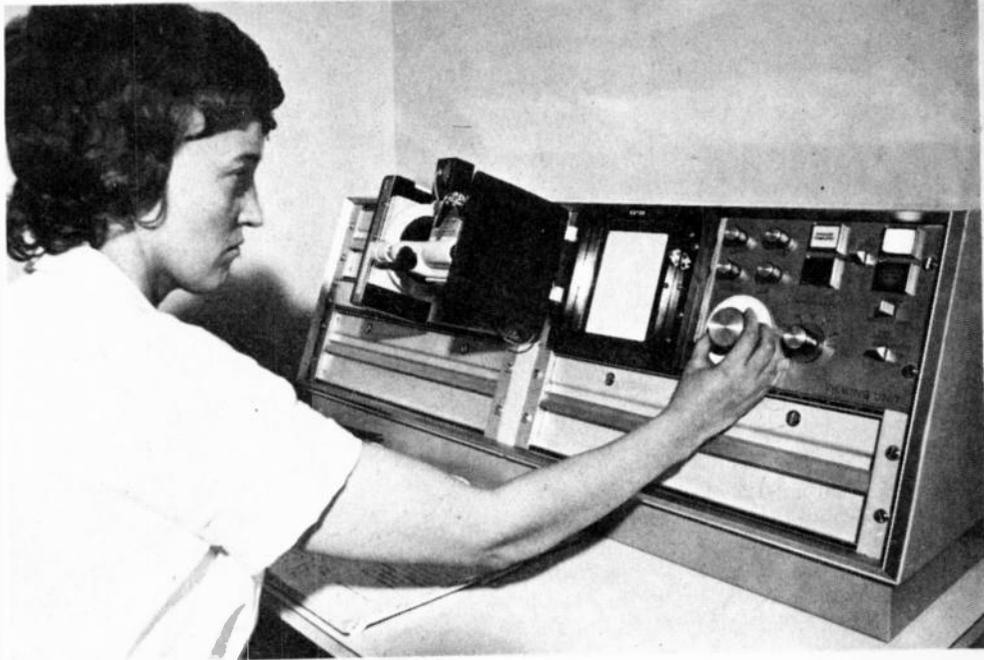
by the British Department of Health and Social Security (based at St. George's Hospital, Wimbledon) began investigations into the use of computers in an attempt to overcome the inefficiency of conventional X-ray techniques.

It was soon realised that the technique was capable of recovering large amounts of data that would have otherwise been discarded. Following satisfactory initial valuation, a clinical version of a computer X-ray machine was developed for diagnosing, investigating and precisely locating the presence of cerebral disorders and diseases such as tumours, cysts, haemorrhages, lesions, atrophy etc.

The equipment takes X-ray pictures of a three-dimensional body as a series of slices. The X-ray scanning unit — rotates around the patients head, taking 56,000 readings from a narrow beam of X-rays passing through the head and examining two adjacent tomographic slices of the brain, each approximately 1 cm thick, in one four minute scan.

These readings are then digitized and fed to a computer which, by solving 28,000 simultaneous equations on the readings for each slice, calculates the absorption coefficients of the material in the slice to a very high order of accuracy. A picture is then built up as a 25,600 point (160 x 160) matrix in which each point represents a 1½mm square area in the slice.

For general clinical work, where less comprehensive data has proven to be adequate, a resolution of 6,400 points (80 x 80 picture matrix) is used. In this lower resolution picture each



Viewing unit. Results may be examined directly or photographed using the inbuilt Polaroid Land camera.

point covers a 3mm square area.

A viewing unit allows the operator to vary the black and white levels to cover a small range anywhere in the picture and to expand the range of numbers between 'black and white' to cover the full range of tones seen on the display. This 'window width' control indicates the numbers obtained on the final print-out and allows specific levels of absorption coefficients to be emphasized selectively so that minute variations in absorption may be studied in detail.

Normal visual display of results is by pictures on a cathode ray tube for direct examination and for recording on Polaroid film. Computer print-outs of absorption coefficients are also available. These provide detailed information on the atomic number and tissue density at each matrix point

thus providing an additional aid to diagnosis.

Variations in absorption coefficients of soft tissue, too small to be detected precisely until now, are easily indicated and quantified. From the patient's point of view the new technique has a lot to offer for the existing alternatives — such as angiography, ventriculography, or radio-active isotope scanning require the patient to be anaesthetised or to have an injection of radio-active material.

FAST AND ACCURATE

The new technique is both fast and accurate. It gives the diagnostician accurate information on the nature and location of diseased or damaged tissue, revealing features quite impossible to discriminate by conventional X-ray techniques. Patients can be screened at the rate of four an hour and do not require any of the medical preparations demanded by other methods. The system is ideal for use with out-patients and as a first-line diagnostic tool on suspect cases without making demands on hospital beds or skilled medical staff. It requires only a single operator with little or no medical knowledge.

The technique also eliminates the major physical and psychological discomforts which have been unavoidable with most other methods. The radiation dose received by the patient is no greater than that for a conventional X-ray picture.

The price of the present units will range from \$100,000 to \$200,000 — depending on the degree of sophistication required. Ten units are currently being assembled at EMI's

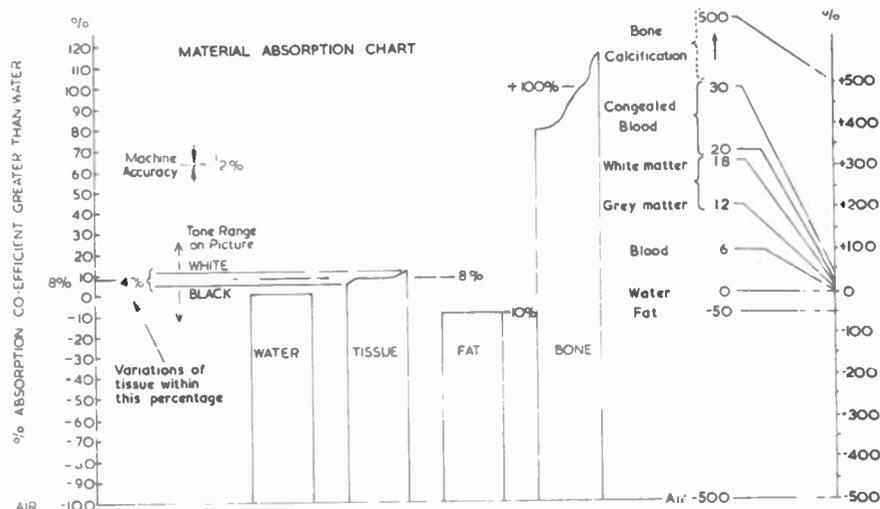
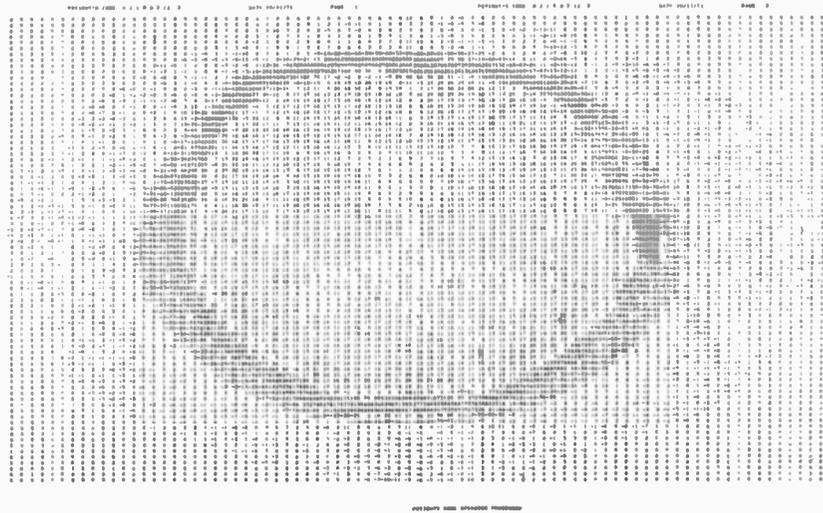


Fig. 1. Absorption coefficients of the body's constituents.

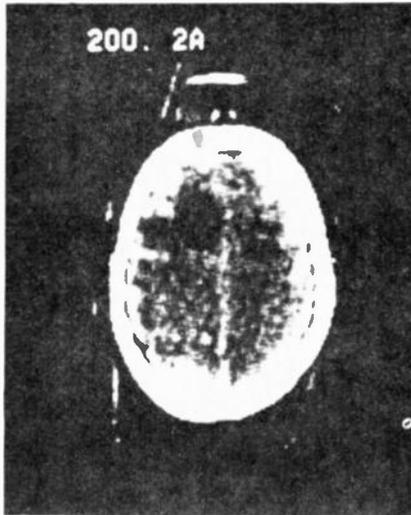
laboratories and firm orders have been received for at least two of these. A world market of two or three hundred machines is forecast.

The computer used in the prototype was EMI's own model ICL 1905. However the intention is to sell the unit complete with its own mini-computer — possibly a PDP 12 or equivalent 24k store machine.

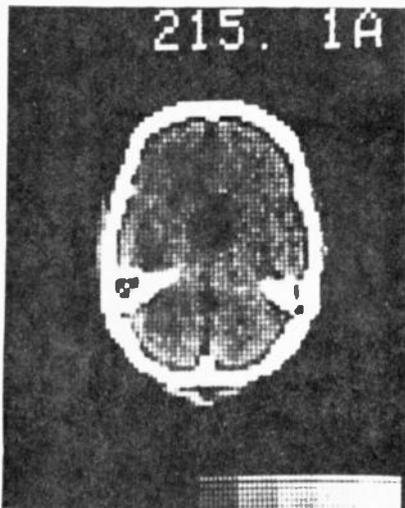
With growing experience in this new technique, a marked reduction is forecast in the need to resort to the more expensive, unwieldy and complex methods which also involve far greater discomfort to patients. In the short evaluation period in direct clinical use, it has already opened up vital new possibilities in medical research — and without doubt the experience gained with this new technique will be utilised in many other applications in science and medicine. ●



In addition to the pictures produced on the cathode ray tube viewing unit, the results of the X-ray scans may be printed out by computer. This numerical print-out shows the absorption coefficients of the material at each point, providing detailed information on the atomic number and density of the tissue at each picture matrix point.



Here are two pictures showing disorders revealed in detail by the new technique. Above. Astrocytoma III cystic left front lobe. Below. Cranio pharyngioma.



EXISTING METHODS

ANGIOGRAPHY

Requires patient to be anaesthetised, contrast-media injected into the arteries of the neck, and X-ray photos taken of the head. Abnormalities in vascular pattern are interpreted for causative lesions. Attendance of highly skilled staff needed. Process most uncomfortable to patient; hospitalization required before and after; accompanied by a certain morbidity.

VENTRICULOGRAPHY (Pneumography of "Air-Study")

Requires patient to be anaesthetised, air (or gas) injected into the central ventricular system by lumbar puncture or via burr-hole in skull-bone, and positioning the head to make the injected air occupy various parts of the vascular system to study contour anatomy or structure displacement. Lengthy procedure with risk of serious complications, always accompanied by some morbidity. Demands skilled medical attendance.

RADIO-ACTIVE ISOTOPE BRAIN-SCAN

Requires injection of patient with a small amount of

radio-active material which will accumulate in abnormal tissue areas (tumour, abscess, haematoma, etc.) or certain chemicals for selective absorption by certain types of tumours.

Mechanical scanning with a collimated detecting device takes 25 minutes, the result plotted on a photographic plate; alternatively a gamma camera can be used. Limited to (though very good for) areas served by blood. Little discomfort to patient but process is slow and risks due to radio-active accumulation in the body not fully determined.

CONVENTIONAL X-RAYS

Insufficient sensitivity to discriminate between tissues of slightly differing densities. (As shown in the chart the absorption coefficient range between fat and tissue is only 18% wide, and the range for all types of soft tissues is a mere 4% wide.) Also confusion caused by presenting three-dimensional information on a two-dimensional photo, the dense bone-tissues and variations in skull-bone thickness obliterating soft-tissue details. Hence the realisation of only about 1% of data potentially available from the photo record.



HOW NOISY IS THE CONCORDE?

In this article, Louis Challis describes the latest methods of evaluating aircraft noise and details the results of his noise survey undertaken on the recent Concorde's Far Eastern tour.

If our present experience is any to go by, the more prosperous that a country becomes, the greater the incidence of noise producing devices and the greater the stress for that minority of the population most adversely affected by these devices.

Of the noise producers, possibly the most objectionable is the modern jet aircraft, and the people who suffer the greatest annoyance are those living adjacent to airports.

The problem of airport noise presents aviation authorities with one of the greatest technical headaches of this decade, for whilst it is possible to produce quieter subsonic jets, the rate at which aircraft movements are growing, together with the probable introduction of supersonic transports, creates an almost insurmountable problem.

Complaints of annoyance from aircraft are dependent on two factors; these are:-

- a. the peak level of aircraft noise
- b. the number of aircraft movements taking place on a short term or long term basis.

These two factors are particularly interesting as, apart from aircraft such as the Concorde, the noise power per pound of thrust for most newly developed jet engines is being reduced at a very satisfactory rate. Thus, the first of the factors is being tackled on a rational and scientific basis.

The number of aircraft using most modern large airports is increasing at a rate that (typically) doubles the number of movements every seven years. Surprisingly, this is about the same rate of increase as motor vehicles registered in this country and the result is the same in both cases; saturation limiting the capacity of both forms of transport. Whilst the road authorities may find this problem a limitation, the airport authorities have to some extent been presented with a solution — in the form of larger aircraft carrying more and more people. Thus, whilst the total number of aircraft movements double every seven years, the number of passengers carried doubles in a far shorter period of time, typically four years.

Until 1970 it was a safe bet that each

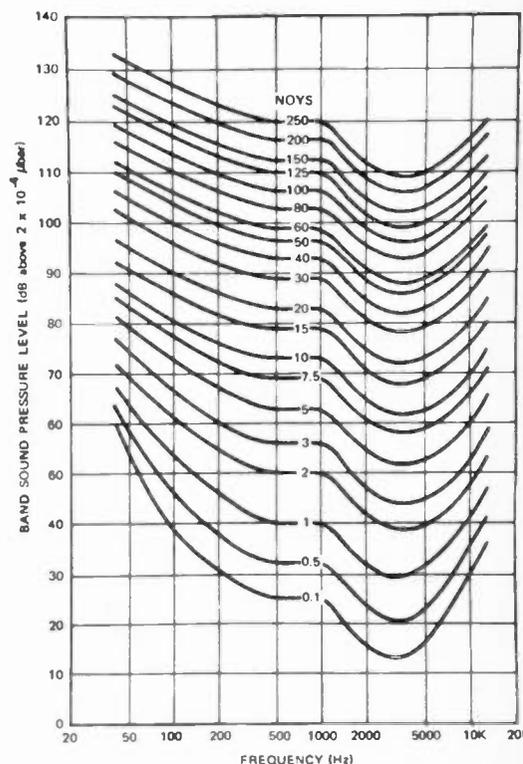
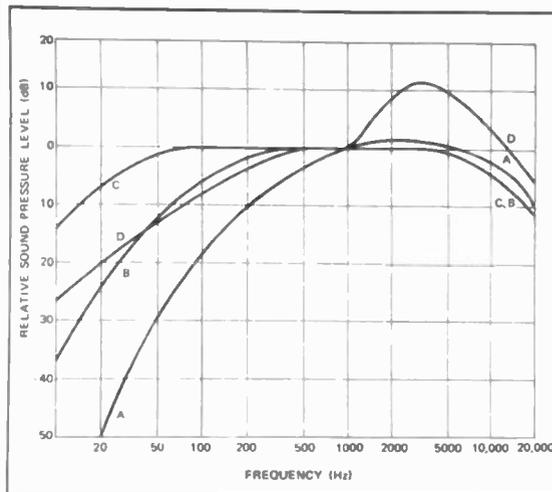


Fig. 1. Curves for determining noisiness of bands of sound used in Kryter's method of calculating perceived loudness.



Fig. 2. International standard A, B, and C weighting curves for sound level meters. Also shown is the recently accepted D weighting curve for monitoring jet aircraft noise.



STATISTICAL ANALYSIS SYSTEM FOR MEASUREMENT OF AIRCRAFT PERCEIVED NOISE LEVEL

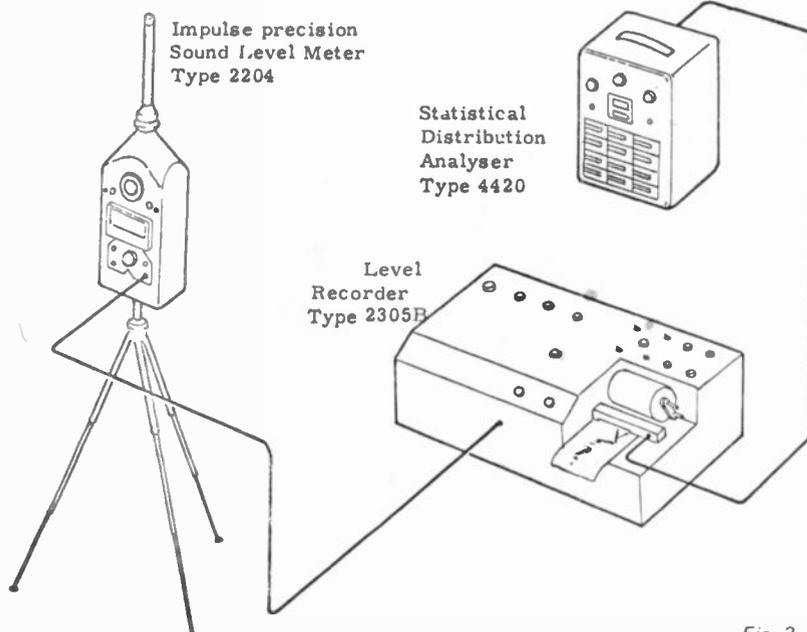


Fig. 3.

new aircraft was noisier than the last and that each new aircraft introduced resulted in the replacement of an aircraft which was generally smaller, and invariably much quieter. The Boeing 747 B was the first aircraft to reverse the trend and, although its noise level is far from satisfactory it does represent a turning point in the technological quest for quieter aircraft.

THE MEASUREMENT OF NOISE

Because the human ear responds to noise in a non-linear manner, the units used for measuring noise are also non-linear. Thus, the unit of the decibel is used for sound measurement and it is defined as -

$$\text{Sound Pressure Level in decibels} = 20 \log_{10} \left(\frac{P}{P_0} \right)$$

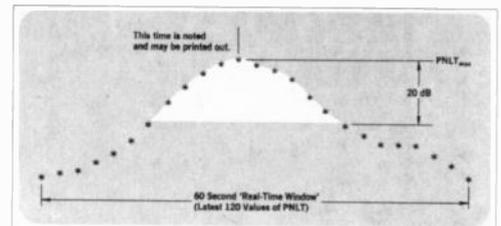
where P is the root-mean-squared pressure, and P₀ is the reference

pressure of 0.0002 microbars (or dynes) per square centimeter.

This is a physical measure of sound intensity. It follows the ear response (roughly) in being logarithmic, but fails to allow for variation in response with pitch.

There have been many systems proposed for the measurement of noise, including the simple A, B, and C Scale weightings, and the more complex Phons and Sones. Most of these systems are intended to correct for the subjective human response to pitch. But, because of the unusual characteristics of aircraft noise, only one has gained a reasonable degree of acceptance for the measurement of aircraft noise, and that is the "Perceived Noise Level".

Within the last decade the perceived noise level abbreviated to NBdB has largely replaced the physical decibel as



THIS PROGRAM PERFORMS A COMPUTATION ON READINGS OBTAINED FROM THE HP 8054A REAL TIME AUDIO SPECTRUM ANALYZER. THE PROCEDURE ADOPTED CONFORMS TO THE ICAO RECOMMENDATIONS SET FOR DESCRIBING AIRCRAFT NOISE AROUND AN AIRPORT.

CORRECTION FACTOR ? (* DR -) KK.K DB
 1.5
 INTERVAL BETWEEN MEASUREMENTS ? K.K SECONDS
 0.5
 TO START MEASUREMENTS HIT RUN
 PAUSE

MAXIMUM PNL T OCCURED AFTER 10.5 SEC.
 MAXIMUM TONE CORRECTED PERCEIVED NOISE LEVEL= 123.2 DB
 EFFECTIVE TONE CORRECTED PERCEIVED NOISE LEVEL=121.4 DB

HISTOGRAM OF PNL T VALUES**

05.5	111.2
06.0	111.8
06.5	114.2
07.0	116.3
07.5	116.5
08.0	116.9
08.5	117.1
09.0	118.2
09.5	119.9
10.0	120.0
10.5	123.2
11.0	121.2
11.5	121.2
12.0	122.7
12.5	122.1
13.0	123.1
13.5	122.8
14.0	122.5
14.5	122.3
15.0	122.2
15.5	120.6
16.0	119.0
16.5	117.4
17.0	116.1
17.5	114.9
18.0	111.5
18.5	109.7
19.0	108.4
19.5	108.0
20.0	105.4
20.5	104.5
21.0	103.6

Fig. 4 Aircraft certification requires computation of effective perceived noise level (ENPL). Computation of tone-corrected noise levels (PNLT) every 0.5 second is part of this procedure. A Hewlett Packard audio data processor computes PNL T and stores the latest 120 values until the maximum PNL T occurs as the aircraft flies over the test point. The system then computes the ENPL using the PNL T values inside the white area.

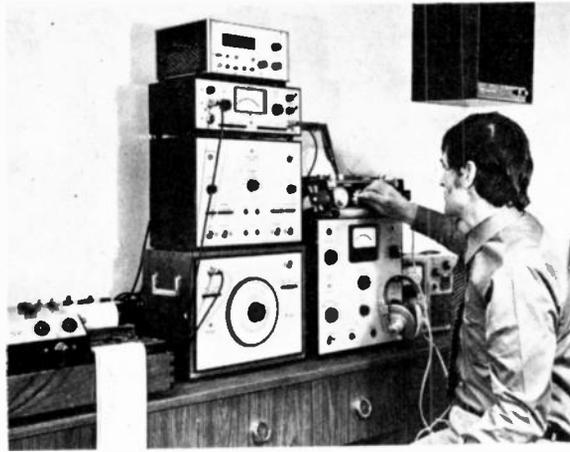
After computing the ENPL is printed out and also PNL T values or a PNL T histogram like the one shown here.

a measure of the subjective "noisiness" of aircraft and certain other noises. It has arisen as the outgrowth of a large number of listening tests, especially fly-over tests, conducted in the United States of America.

The research which led to the development of the Perceived Noise Level scale was initiated by the Port of New York Authority. The Authority concluded that jet aircraft could operate at Kennedy Airport and they set a limit of 112 PNdB for take-off noise at communities under the take-off path. (Heathrow Airport has set a limit of 110 PNdB).

Stevens and Rosenplinth, the two acousticians primarily involved in this work, developed a set of curves called "NOY Curves" (Fig.1) which presented intensity against frequency used to determine the annoyance of the noise rather than its loudness. This

HOW NOISY IS THE CONCORDE?



is particularly important as annoyance and loudness are not synonymous.

The specification has been defined and redefined as more data has accumulated. The result is a weighted average over a spectrum such that the PNdB rating of a complex sound should approximate the decibel rating of a 1000Hz (1000 cycles/second) octave band of noise that sounds equally noisy.

The simplest method available for the measurement of Perceived Noise decibels is to use a sound level meter fitted with a "D" weighting network. (See Fig. 2). This "D" network has been specifically designated as the curve to be used for the measurement of aircraft noise and is the inverse of the "40 - Noy contour". To obtain the approximate noise level in Perceived Noise Decibels the D scale reading is increased by 7 decibels, i.e.

$$L_{PN} \approx L_{D \max} + 7$$

The advantage of this form of measurement is that a rapid determination of the *approximate* Perceived Noise Level can be made with relatively simple instrumentation without recourse to the complex calculations which have been a feature of such measurements in the past.

More important, the approximately perceived noise level can be continually monitored and recorded by existing equipment for more detailed analysis.

Whilst this form of measurement is not as accurate nor as desirable as the

more complex automatic perceived noise analysers which have recently been developed in Germany, this approach provides a practical method of evaluating the long term statistical perceived noise level.

EFFECTIVE PERCEIVED NOISE LEVEL

The first problem with a measurement of the type performed by the above technique — or any other which only takes into account the peak level of noise — is that it ignores the vital factor of the *time duration* of the noise exposure. (More specifically, the instantaneous sound pressure level in each of 24 one-third octave bands of the noise is required for each one half second increment of time during the aircraft fly over). Hence the Effective Perceived Noise Level scale which takes noise duration into account.

The calculation procedure which utilizes physical measurements of noise to derive the EPNL evaluation measure of subjective response consists of the following five steps:

a. The 24 one-third octave bands of sound pressure level are converted to perceived noisiness by means of a noy table. The noy values are combined and then converted to instantaneous perceived noise levels, PNL(k).

b. A tone correction factor, C(k), is calculated for each spectrum to account for the subjective response to the presence of spectral irregularities.

c. The Tone correction factor is added to the perceived noise level to obtain tone corrected perceived noise levels, PNLTK(k), at each one-half second increment of time,

$$PNLTK(k) = PNL(k) + C(k)$$

The instantaneous values of tone corrected perceived noise level are derived and the maximum value, PNLTM, is determined.

d. A duration correction factor, D, is computed by integration under the curve of tone corrected perceived noise level versus time.

e. Effective perceived noise level, EPNL, is determined by the algebraic sum of the maximum tone corrected perceived noise level and the duration correction factor,

$$EPNL = PNLTM + D$$

The subsequent data required for this is even more complex than indicated here and even the NOY curves are relatively complex. Whilst some excellent work has been carried out all over the world using equipment systems similar to that shown in Fig. 3 and derivations based on the same approach, it has been clear that systems of the type installed originally in Stuttgart by Hewlett Packard GMBH (and recently in Sydney), offer much more flexibility and instantaneous processing directly into Effective Perceived Noise Decibels.

The Hewlett Packard System uses a series of terminals at remote locations which are connected back to a central computer controlled processing unit by means of data lines or, alternatively, from mobile units using tape recorders. (Each land line is frequency equalized over the range 50 Hz to 12 kHz)

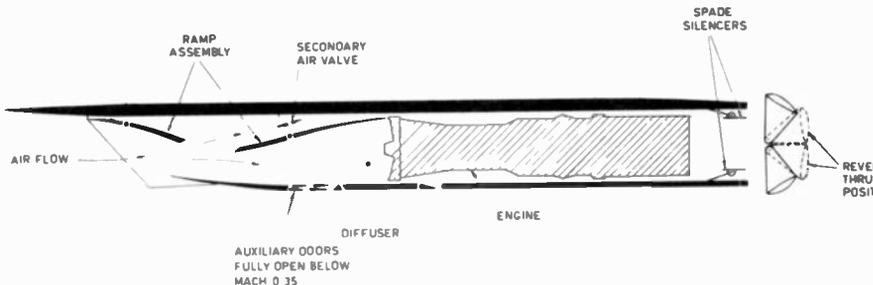
The heart of the system is the Hewlett Packard Model 2114A digital computer together with the Model 8054A Real Time spectrum analyser, which provides the 24 one-third octave band filters between 50 Hz and 10 kHz.

The computer is capable of being programmed to provide a read out (Fig. 4), or of converting the data into other internationally accepted Aircraft Noise Rating systems.

ASSESSMENT OF AIRCRAFT NOISE DISTURBANCE

In order to give a numerical value to the degree of annoyance caused to the community by aircraft, many researchers have put forward equations for determining the degree of annoyance. An equation which gives an annoyance index for aircraft noise will include terms involving some or all of the following quantities:-

a. The relative effect of a loud noise occasionally compared with a quieter noise over a long period.



A cross section of engine nacelle of Concorde.

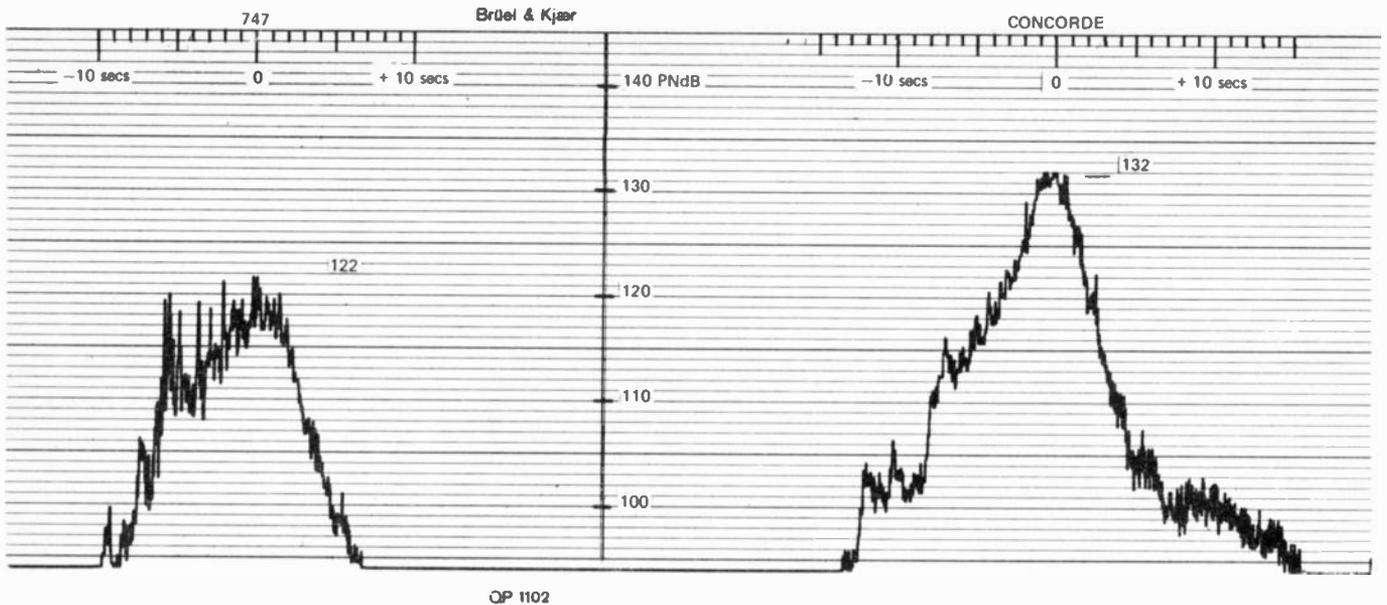


Fig. 6. PNdB curves for 747 and Concorde fly-overs. Chart speed 3mm/sec. Maximum levels 747 122PNdB Concorde 132 PNdB.

b. The number of aircraft movements in a given period.

c. A lower tolerance to noise occurring during the night, compared with during the day.

NOISE AND NUMBER INDEX

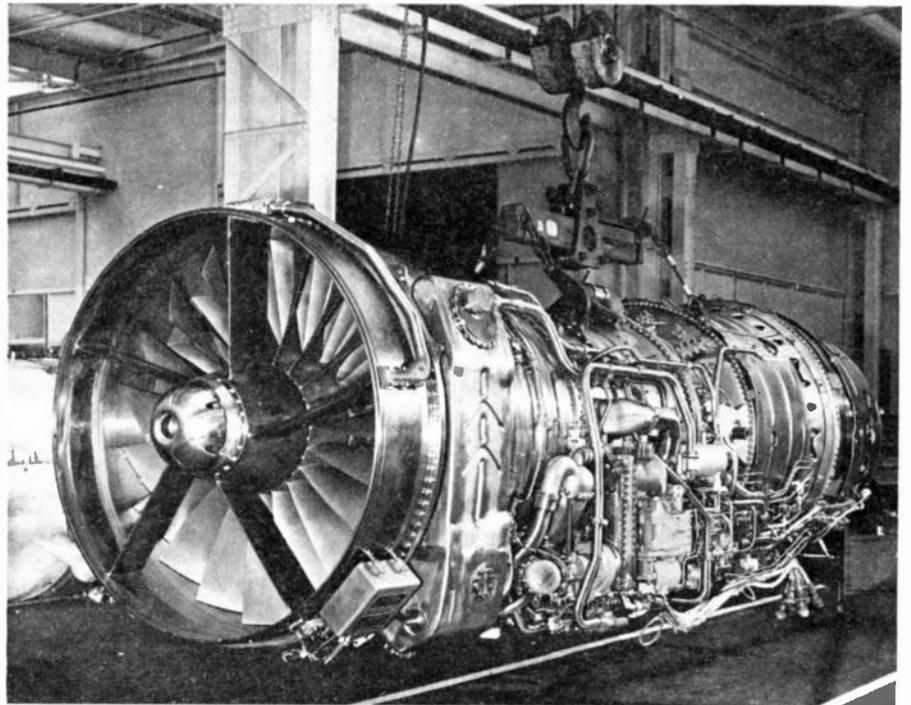
This index is historically important since it is one of the earliest attempts to derive an annoyance index for aircraft noise and has subsequently gained wide acceptance. The concept of a Noise and Number Index, N.N.I., resulted from the work carried out by the famous Wilson Committee in England which correlated measurements at Heathrow Airport with a social survey on the reactions of the population to noise. Two of the several conclusions that were drawn are as follows:-

Firstly, the survey gave a scale by which the degree of annoyance caused by aircraft noise could be assessed. This was of fundamental importance because it meant that numerical investigations could be made of the relationships between annoyance and other measurable factors, notably the physical characteristics of the noise. Second, the survey provided a tentative basis for establishing a combined "noise and number index" defining the total noise exposure which caused annoyance. The Wilson Committee concluded from the data that, in causing annoyance, a four fold increase in the number of aircraft heard was very approximately equivalent to a rise in average peak noise level of 9 PNdB.

The resulting equation is:-

$$N.N.I = L_e + 15 \log_{10} N - 80$$

where L_e is obtained from equation 3 with q equal to 6, L equal to the peak noise level in PNdB, and N , the total number of aircraft movements in the given period.



The Concorde engine.

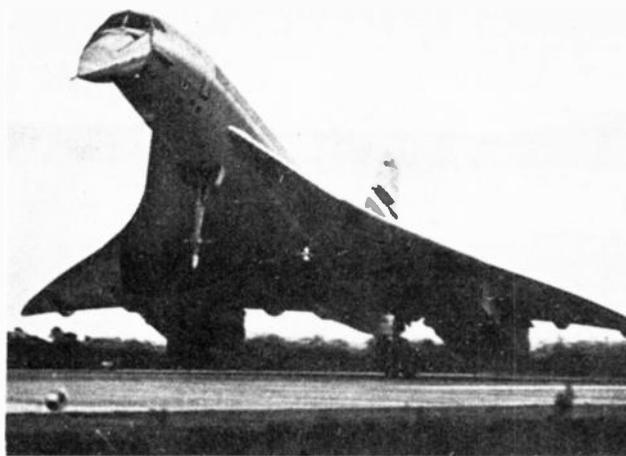
NOISE EXPOSURE FORECAST

The U.S. Federal Aviation Administration recently proposed the use of Noise exposure Forecasts (N.E.F.) as a method of rating aircraft annoyance. This system is similar in many ways to the Noise and Number Index. The major difference is that the N.E.F. is based upon the use of Effective Perceived Noise Level rather than Perceived Noise Level. The Effective Perceived Noise Level takes into account the duration of the noise and represents the most accurate method of determining the subjective effect of aircraft noise currently available, and the Noise Exposure Forecast appears

to give the most accurate assessment of the annoyance caused to individuals by aircraft fly-overs. Whilst such assessments are of untold value for planning of new airports, the primary problems facing the airlines and civil aviation authorities of the world are those at existing airports, and this is where the Concorde's problem arises; for here is the first large aircraft which may change the current trend to bigger and quieter aircraft.

You might well ask at this juncture why should some aircraft be very much noisier or quieter than other aircraft. The reasons are associated with the main noise sources of an aircraft. See summary next page.

HOW NOISY IS THE CONCORDE?



Source of Noise

1. Jet Noise The turbulence aft of the jet nozzle Interaction of turbulence and shocks in jet.
2. Axial-flow compressor Turbulence or unsteady flow passing over blades Boundary-layer pressure Fluctuations on blades. Wake of compressor blades.
3. Turbine Noise Turbulence and fluctuating flow over turbine blades. Turbulence separated flows, and unsteady flow over vanes.
4. Propellers Rotation effect of blades (thickness of blades). Rotation effect of blades passing with lift and torque forces.

The initial problem is associated with the velocity of the jet exhaust for, as has been shown by Lighthill in 1952, the acoustic power P varies as

$$P \propto \rho^2 D^2 V^n$$

where ρ is the jet density
 D is the exhaust diameter
 V is the exhaust velocity
 n is a factor varying between 5 and 9

Whilst the noise increases by a power of velocity raised to the 5th power or greater, thrust is directly proportional to the velocity raised to the 2nd power.

The earliest jet engines also produced very high levels of inlet compressor noise, particularly during landing, but this could be adequately controlled by simple redesign of the compressor stages.

Now the jet engines proposed for the seventies produce larger jet exhaust areas, together with lower exhaust velocities and very high levels of by-pass flow which effectively shield the high velocity mixing region around the jet exhaust. As will be readily realised, techniques such as these are not technically capable of being utilized in an aircraft which is intended to travel at Mach 2.2. The manufacturers have, therefore, developed a whole new range of engine silencing techniques that are intended to reduce the noise level of supersonic aircraft to that produced by normal aircraft.

THE CONCORDE

Visually the Concorde is a beautiful combination of grace and symmetry. However this does not impress conservationists, who dislike it because it brings problems of sonic boom and higher noise levels into the residential domain. When the Concorde prototype 002 came to Sydney in mid-June we took the opportunity, which was relatively unique and unlikely to be repeated for some years, of measuring its noise.

These measurements, unlike the previous surveys which we have conducted, were aimed at determining the Effective Perceived Noise level, rather than PNdB alone. Our original surveys used the system shown in Fig. 3, whilst this survey used a large

number of precision sound level meters, Kudelski Nagra tape recorders and acoustical calibrators for accurately recording the calibration level on the tape.

The technique utilized was, firstly to record the calibration level from a 'pistonphone' which produces a precise acoustical level corresponding to 124 decibels on the tape recorder, with the sound level meter set to 124 decibels and the level control of the tape recorder locked, so as to produce a modulation level corresponding to -10VU. Then, if the sound to be measured is substantially louder or quieter, the attenuation of the sound level meter can be adjusted up or down by the desired number of steps of 10 decibels and the equivalent level of the calibration signal is similarly (automatically) adjusted up or down with reference to the recorded noise signal.

The equipment that we used to analyse the noise of the Concorde is shown in Fig. 5. It consisted of a Measuring Amplifier, (Bruel and Kjaer type 2607) a one-third Octave Band Filter set (Bruel and Kjaer type 1614) and a High Speed Level Recorder (Bruel and Kjaer type 23058).

Each fly over was analysed into a series of sequential one-third octave band components on the level recorder, between 50 Hz and 12 kHz. These were then digitized and fed into a computer, which was pre-programmed to compute out the value of the EPNdB.

The measurements were taken at the internationally accepted positions - of 1 mile and 2 miles from the point of touch down under the glide path - at 0.35 nautical miles on both sides of the centre line of the runway for side line noise, and (in our case unsuccessfully) 3½ miles from start of roll on the extended centre line of the runway.

Some of the results do not agree with the previously published data which has been disseminated in the press.

(Continued on page 94)



Fig. 7. Concorde 002: Approach Noise at 2 miles.

PRESENTING...



A TRUE QUADRIPHONIC SYSTEM COMPLETE IN MAGNIFICENT MATCHED TEAK OR WALNUT CABINETS COMPRISING OF DUAL GERMAN TURNTABLE, SHURE MAGNETIC CARTRIDGE ONKYO Y3A AMP (REVIEWED JUNE EA) COMPLETE WITH SOUND FIELD COMPOSER PLUS DANISH PEERLESS 12" 3-WAY SPEAKER SYSTEM.

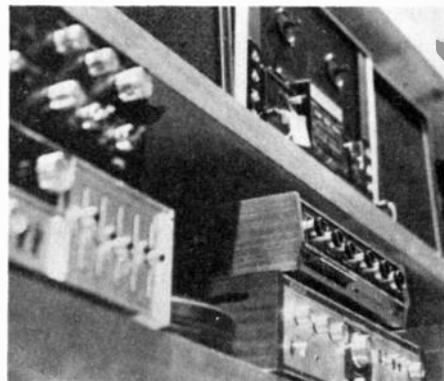


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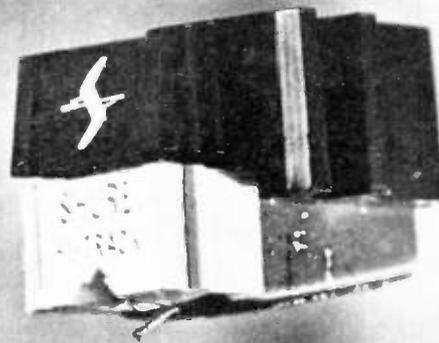


SHURE M91ED CARTRIDGE

Detail changes improve the performance of this excellent high-trackability cartridge.

electronics
TODAY
INTERNATIONAL

product test



SHURE M91ED CARTRIDGE

measuring trackability to fine degrees of accuracy we decided that the best way to appraise the new Shure

cartridge was to listen to a number of recorded passages known to be 'difficult'.

The range of recording covered bass drums, pianos, Moog synthesizers, female vocalists (where the 'sibilance' is so difficult to reproduce without distortion), and many more.

In all cases the performance was excellent, and no mistracking could be detected. Irrespective of the material that we tried, the cartridge appeared to perform faultlessly.

The measured performance of the cartridge was equally as good. Using our latest automated Bruel and Kjaer measuring equipment we found the frequency response to be within +0 and -2 dB from 20Hz to 20kHz. The channel separation was also very good being better than -25 dB between 50Hz and 8kHz.

Of the trackability tests that we conducted, the most pleasing result was the ability of the cartridge to faithfully track modulation levels in excess of 10 cm per second (at frequencies above 15kHz) at one gram tracking weight. This performance is nearly as good as the Shure V-15 Mark II improved cartridge and is indicative of what the M91ED cartridge has to offer.

The Shure M91ED is an excellent cartridge, well worth the consideration of those who are looking for a cartridge in the \$50.00 price bracket. It exceeds the manufacturer's specifications and outperforms other cartridges which we have tested in the same price range.

MEASURED PERFORMANCE OF SHURE M91ED CARTRIDGE

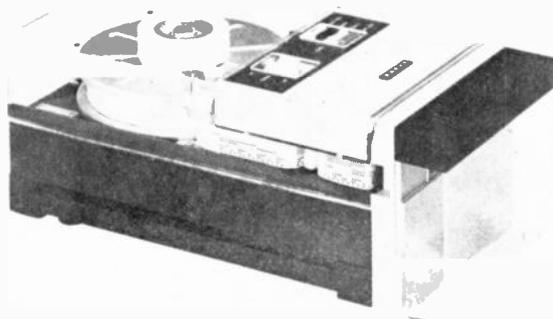
Frequency Response	20Hz to 20kHz \pm 1dB
Channel Separation at 1kHz	27dB
Channel Difference at 1kHz	Less than 1/2dB
Output Sensitivity (at 1kHz - re 5cm/sec)	4.6mV
Cartridge Impedance	47k Ω
Cartridge Weight	5.8 grams
Price	\$50

Tape punch check list

If you are thinking about buying a tape punch, then ask yourself these ten questions . . . then compare!

	FACIT 4070	BRAND X
1. Does it operate at all speeds up to 75 characters per second asynchronously?	YES	
2. Does it have built-in supply and take-up facilities of compact design?	YES	
3. Does it have a low noise level? 0 dB when idling?	YES	
4. Does it feature integral control circuitry, which guarantees troublefree connections to different systems?	YES	
5. Do plug-in components facilitate service and maintenance?	YES	

	FACIT 4070	BRAND X
6. Does it automatically indicate tape supply and tape running low?	YES	
7. Are versions available for TTS tape?	YES	
8. Is a 24 volt version of low power consumption obtainable?	YES	
9. Does it feature automatic dc checking?	YES	
10. Is a choice offered between stand mounting and desk top versions?	YES	



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How to see with your ears



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The entire orchestra. Every instrument just where it should be. Spread in front of you in an arc.

Then try the same experiment with a pair of front facing speakers.

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Instead of an orchestra you'll see two front speakers aiming solid wedges of sound at you.

And that's all.

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The Sonab omnidirectional system reproduces sound exactly as it was originally produced.

Using the acoustics of the room. Using the walls, ceiling, floor as reflecting surfaces.

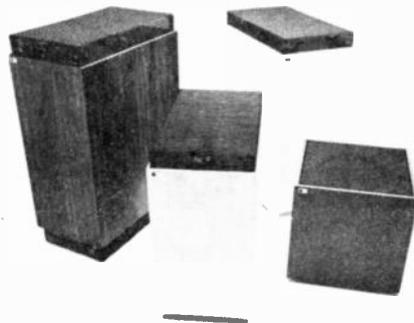
It seems so simple. But it took twelve years of university research and several world patents to get the Sonab system right.

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And see with your ears for yourself.

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Sonab

Sonab of Sweden Pty. Ltd., 114 Walker Street, North Sydney, N.S.W. 2060. Telephone: 929 4288/4554.

non-contact velocity measurement

Sophisticated laser technique is used to solve difficult measurement problems.

DESPITE dramatic advances in measurement techniques in the past decade, it is only quite recently that a method has been devised for non-contact velocity measurement of gas flow, and other 'non-cooperative materials.

This problem has been overcome by a sophisticated laser doppler technique developed in the UK by Dr Bohdan Watrasiewicz and Dr Michael Rudd.

Dr Watrasiewicz graduated in physics, obtained his M.Sc. on semiconductor technology and his Ph.D. at the Applied Optics Section of Imperial College. During his subsequent time at the British Aircraft Corporation, in Bristol, he became involved in optical and acoustic holography, laser interferometry, infrared, albedo and solar sensors, and imaging in partially coherent illumination.

In 1967 Dr Michael Rudd, then a Ph.D. research student from the Cavendish Laboratories at Cambridge, joined the team headed by Bohdan to develop a non-contacting measurement technique for studying flow velocities in fluid dynamics research. Within 18 months a laboratory prototype had been developed and Michael Rudd returned to Cambridge to continue his main research interest.

The potential of the method[®] was realised at the time for many other uses could be made of the same basic instrument. However, BAC could not see a way to finance the market development and Dr Watrasiewicz joined Cambridge Consultants Ltd (a year ago) to nurse the prototype through its development stage.

The move was a logical one for Cambridge Consultants have been developing skills and experience in sophisticated electronic techniques for several years.

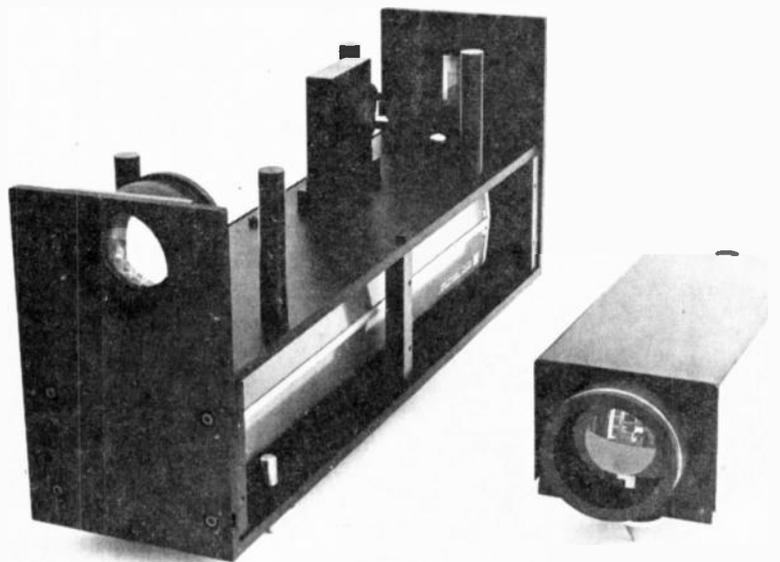


Fig. 1.

BLACK BOXES

To the user, the laser doppler velocimeter consists of two black boxes (in both senses of the word) each having a lens as the only external feature. Coupled to both is an electronic unit displaying velocity in a digital readout form.

From the larger optical unit, (Fig. 1) radiates two pencil-size laser beams that cross in front of the unit. In use the second, smaller unit is placed to see the intersection spot either as a reflection from a surface or as transmission through a fluid or transparent solid.

Setting up time is therefore minimal and special skills are not required. Once installed the instrument will

measure over a dynamic velocity range from $100\mu\text{m}/\text{sec}$ to $100\text{m}/\text{sec}$ using several preselected settings. The near-future aim is to be able to handle Mach 1 velocities (about $300\text{m}/\text{sec}$). For the instrument to operate, the surface or fluid needs some scattering particles — but not many. The natural flaws in ordinary glass, or the dust specks on a mirror create enough signal for the system to measure velocity. It is this aspect that requires a complex electronic system, for the signal to noise ratio is extremely low.

Another feature of the system is its pinpoint resolution. It measures the average velocity of only 10^{-3}mm^3 of volume. For this reason alone it is of great value in fluid velocity profile and turbulence measurements.

The apparent simplicity is just a feature of good ergonomic design, for the inside operation is, in fact, a battle to extract high quality data from a rarely existing and noisy signal.

HOW IT WORKS

To explain the operation let us first consider the optical principles involved. The optical layout is shown in Fig. 2.; some sections have been exaggerated in size for the sake of clarity.

A medium price, unstabilised, laser acts as a high brightness source of light. (The technique will work in principle, with any intense light source). The output beam is folded to pass through the special dual-prism. This acts as a beam splitter providing two parallel, spatially coherent beams. These two beams are focussed to cross at the point of interest. As the two optical path lengths are identical and the beams coherent, an interference pattern is produced in the spot — as a series of light-dark rings similar to those produced by a pinhole which is illuminated by light. As the circle of intersection is fractional millimetres in diameter, only a few fringes are produced.

The photo detector picks up the scattered and unscattered light from direct transmission or reflection. If the surface or fluid is moving the total light received by the detector, due to the doppler effect, has a frequency component dependent upon a magnitude of the velocity. When measuring by reflection from an opaque surface the angle of incidence of the detector is unimportant. For transmission use the reading is in fact the sine of the velocity so correction is needed unless the detector views at close to 90°.

THE ELECTRONIC CIRCUITRY

The signal from the photo-detector is now electronically processed to provide a measurement of velocity.

The received signal consists of short bursts, or wave pockets (as shown in Fig. 3). Each burst contains the doppler frequency of interest. They occur randomly with time and their length may vary from one to fifty cycles. These factors are determined by the scattering properties of the surface or fluid.

The task of the electronic unit is to measure the frequency of the cycles to a precision of better than 0.1%. To obtain such precision it is necessary to measure and average the period times for those cycles (many are not complete or sufficiently noise-free to be used) over a period of time.

A schematic diagram of the system electronics is shown in Fig. 4. The

basic essentials are cross-hatched and will be described first.

The first process — after initial preamplification at the photo-detector — is an automatic gain control bandpass filter and amplifier. Their function to reject the lower frequencies provided by the envelope of the bursts. Due to limitations elsewhere in the system this unit is mode-switchable to cover a series of 20:1 velocity ranges that cope with all speeds of interest.

The phase splitter provides a second signal which is 90° phase shifted from that of interest. This is a requirement of the heterodyne filter following.

In order to improve the signal noise ratio it is necessary to restrict the

band-width of the signal used for counting. However the frequency can range widely due to variation in velocity. A band pass filter with a fixed centre-frequency would thus have to be quite broad and therefore ineffective. For this reason the system has an automatic process that tracks a narrow bandwidth filter over the range selected. This concept is shown in Fig. 5.

The heterodyne box provides a dc tracking signal that controls the frequency output of the voltage controlled oscillator (VCO). It is unusual in that it provides only the wanted signal, there being no extraneous frequency sum-component that needs filtering, as is usual in most

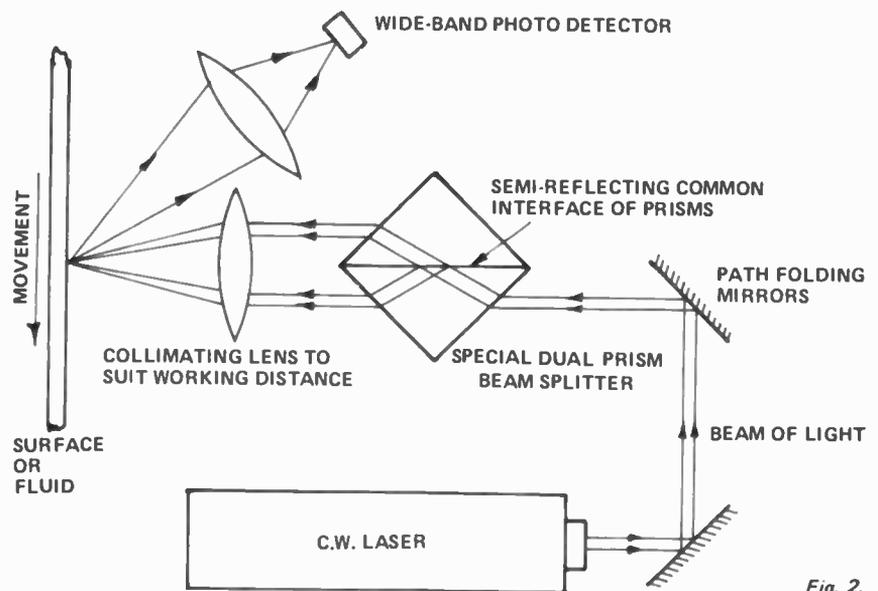


Fig. 2.

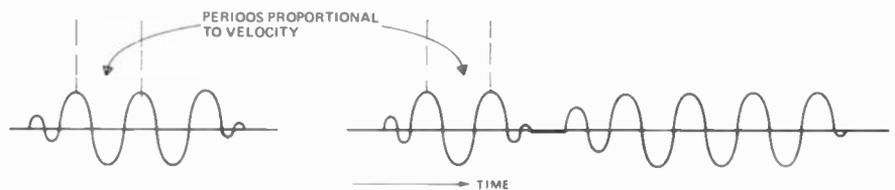


Fig. 3.

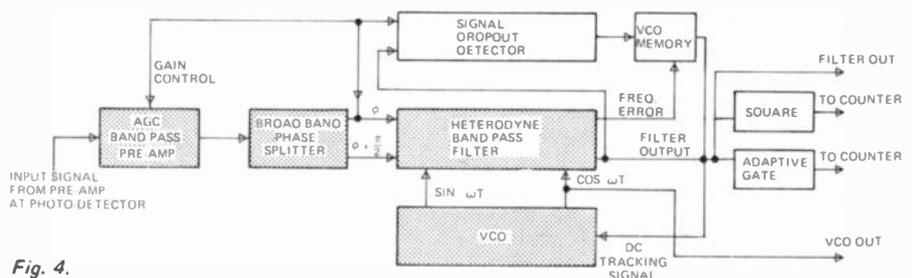


Fig. 4.

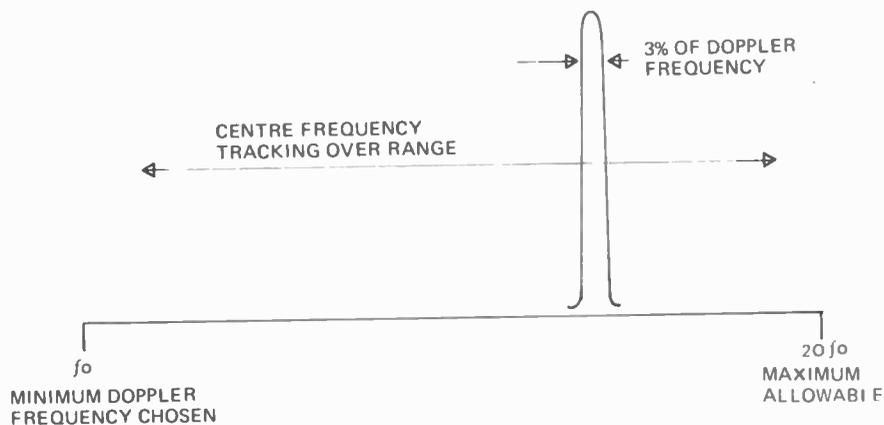


Fig. 5.

tracking filters. By this approach the quality of the doppler frequency bursts are improved enormously.

The next stage is to square up the bursts and count the periods. However, as the bursts are short and may have incomplete start and finishes of cycles it is easy to see that a timer-counter will read falsely so the end effects are liable to provide errors of one part in 25. For this reason Cambridge Consultants have devised an adaptive gate unit which applies a test to see if a complete cycle has occurred. If it has the value is used. As some bursts may be only 3-4 cycles in duration a criteria of calculation for greater than 2 is used.

Figure 6 shows a burst. At (a) the up-crossing of the trigger, the level is tested. If it occurs the next zero crossing is recorded. The time is stored and if another half-cycle occurs at the end of the burst the two are utilized. This technique uses as much of the inherent signal information as is possible to enhance the precision period measurement of short bursts.

The counter also, is a little different from normal practice. If the gate of a frequency counter were actuated for a given interval in this system it would

only indicate the total number of burst cycles in that line, not the period of the cycles. For this reason a pseudo-time scale is used in which the counter is controlled so as to be gated open for a given total period, (operated by the squared cycles) rather than a continuously opened gate. Once the time period has expired, the count is displayed - giving the integrated period or average frequency which is a measure of velocity. Up to 90% of bursts may be rejected as unsatisfactory in which case the actual duration to make, say, a one second integration will be approximately 10 seconds.

The VCO output is made available. This is a reasonable, but not highly accurate, measure of average velocity for the oscillator tracks the doppler frequency. Also available in the commercial unit is an analogue velocity output for chart reading. The one common feature in all velocity measurement applications for the unit is the doppler frequency. Different cases however, need velocity shown various units, so plug in boards are used to set up the output display as needed.

Although involved, the actual

circuitry uses only a few printed-circuit boards and the entire electronics are housed in a standard 19 inch instrument case. Once designed and proven, the cost could reduce as demand grows for much of this unit is common to many other areas of measurement, for example in doppler sonar and structural resonance testing.

So far, orders include a unit for the British Iron and Steel Research Association (BISRA) who assisted financially in the development of the electronics. They are to use the unit to measure the air-flow in the exhaust of a steel furnace in order to be able to compute the mass flow rate of waste products as a continuous process.

Another unit is to be used to measure the velocity of fine nylon fibre as it is drawn. This method lends itself because of the high accuracy and the small non-contact probing volume. The work will assist a better understanding of the drawing process.

Salford University have a unit for research into fluid dynamics of the air velocity around nozzles.

Other potential uses are to monitor water-flow over a range from a drop to thousands of gallons per minute, to measure velocity of "uncooperative" surfaces such as hot steel and plastics. It has also been suggested that this may be the answer to berthing supertankers and as a speedometer in high-speed marine work. At a cost of £4760 this is value for money if non-contact, high precision, pinpoint velocity measurements are needed. ●

TRANSDUCERS IN MEASUREMENT AND CONTROL

Part 5 of this continuing series will be published in our September issue.

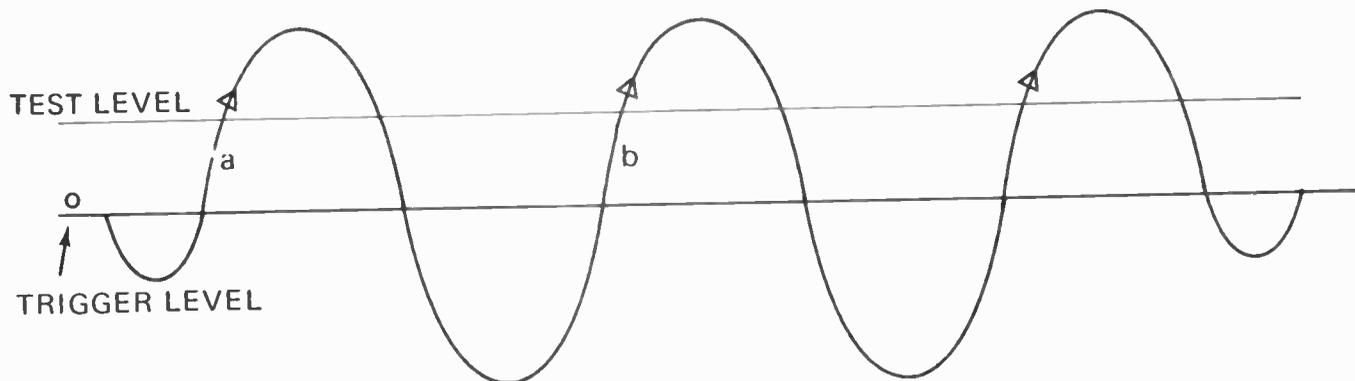


Fig. 6

forget our rave reviews and our research and sit in judgement on two fascinating experiments....

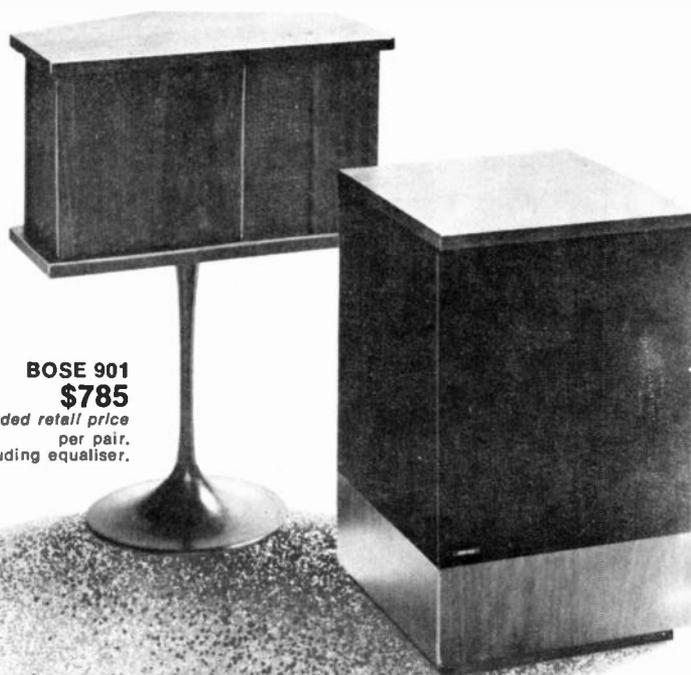
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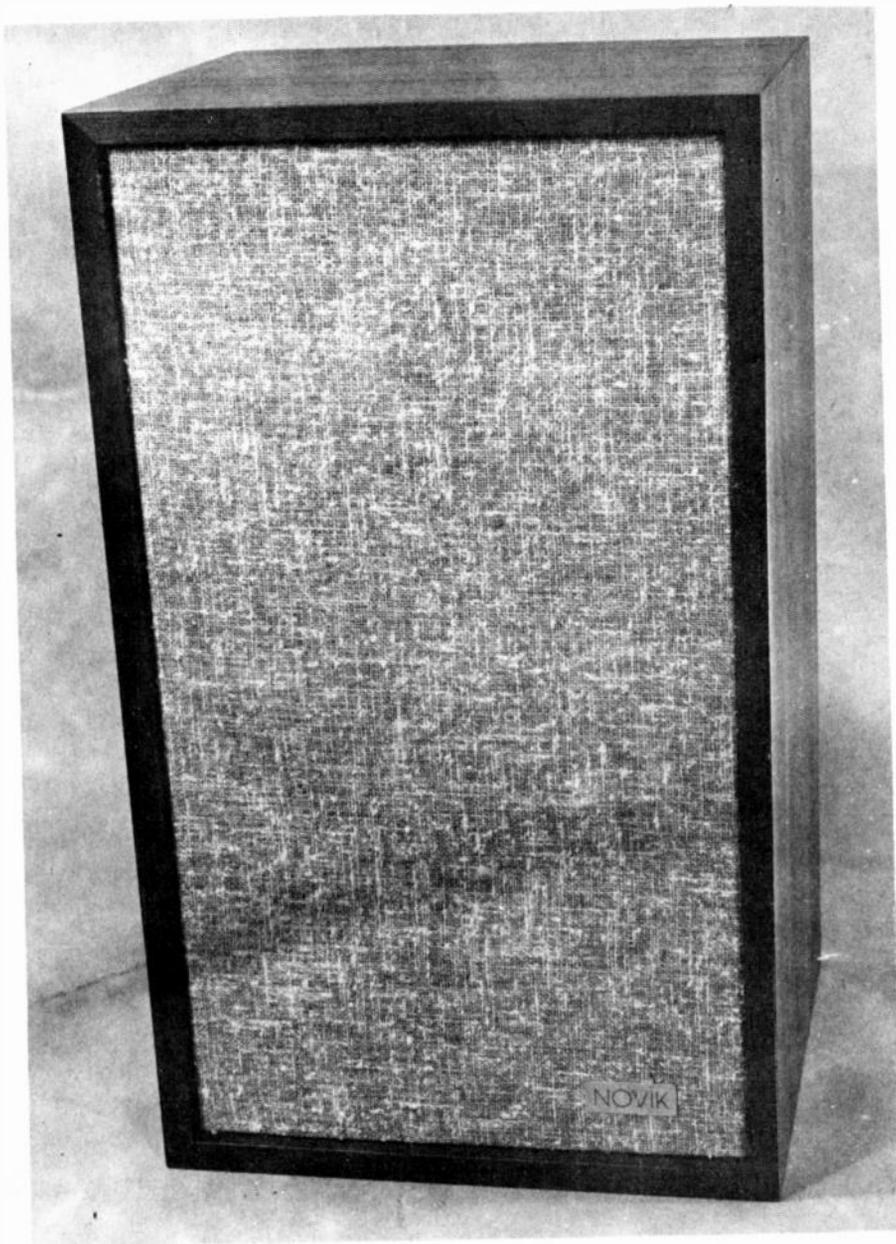
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THE NOVIK LOUDSPEAKER

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product test

Australian-made speaker enclosure uses South American drive units.



In many Latin American countries, secondary industries are making significant contributions to increasing gross national products. In fact many have great difficulty in keeping pace with the demand.

Hence it did not come as a very big surprise to discover that a factory in San Paulo in Brazil is currently manufacturing a range of high-fidelity speaker drive units.

These drive units are used in the new range of Novik speakers currently being manufactured in Australia.

The Novik enclosures are extremely well made and bear a strong physical resemblance to the AR4X enclosure — but that is where the resemblance ends.

Our customary practice is to look at the construction of equipment before we start to take any electrical measurements. In this instance it was not easy, for the grille was more solidly attached than any previous grille that we have encountered. A further complication was that the grille is recessed.

Having finally removed the grille we were surprised to find three little aluminium angle brackets lying at the bottom of the enclosure, together with the sheared off heads of three screws. Apparently these brackets were meant to be holding the woofer in place.

However despite the failure of the screws — probably caused by initial overtightening — the woofer was more than adequately retained by a sealant used on the rear face of the speaker mounting frame. (The manufacturers tell us that they have recently modified the mounting arrangements.)

DRIVE UNITS

The drive units consist of a 10" diameter woofer, a 5" mid-range unit and a 2" cone tweeter.

The woofer has a flexible cloth surround, locating the flimsiest speaker diaphragm that we can ever recall seeing. This diaphragm is not very effective and has a tendency to 'break-up' on high level signals — as shown in the distortion tests. The five

MEASURED PERFORMANCE OF THE NOVIK LOUDSPEAKER – SERIAL NO. 100006.

Frequency Response
50Hz to 15kHz ± 6 dB

Total Harmonic Distortion

	100Hz	1kHz	6.3kHz
1 watt input	4%	0.5%	0.5%
5 watts input	6%	1%	1%

Electro-Acoustic Efficiency
0.4%

Cross-over Frequencies
900Hz
8kHz (refer graph)

Woofer Resonance

In Free Air	43Hz
In Enclosure	68Hz

Measured Impedance

100Hz	1kHz
9 Ω	11 Ω

Enclosure Volume
1.5 cubic feet

Dimensions
14" wide x 12" deep x 23½" high

Weight
29.5 lb.

Price
Suggested retail price \$129 each



inch mid-range unit is quite conventional and provides good mid-range presence.

The two inch cone tweeter is of a type that is prone to high directionality at frequencies above 8 kHz. It is not typical of the current state of the art.

During our preliminary evaluation, the amplifier that we were using became unstable, and at one stage appeared to burst into oscillation. The reason was not at first apparent until we measured the speaker's impedance characteristics – and found that the

5" mid-range unit was open circuit. The second speaker enclosure that we tested was satisfactory in this respect.

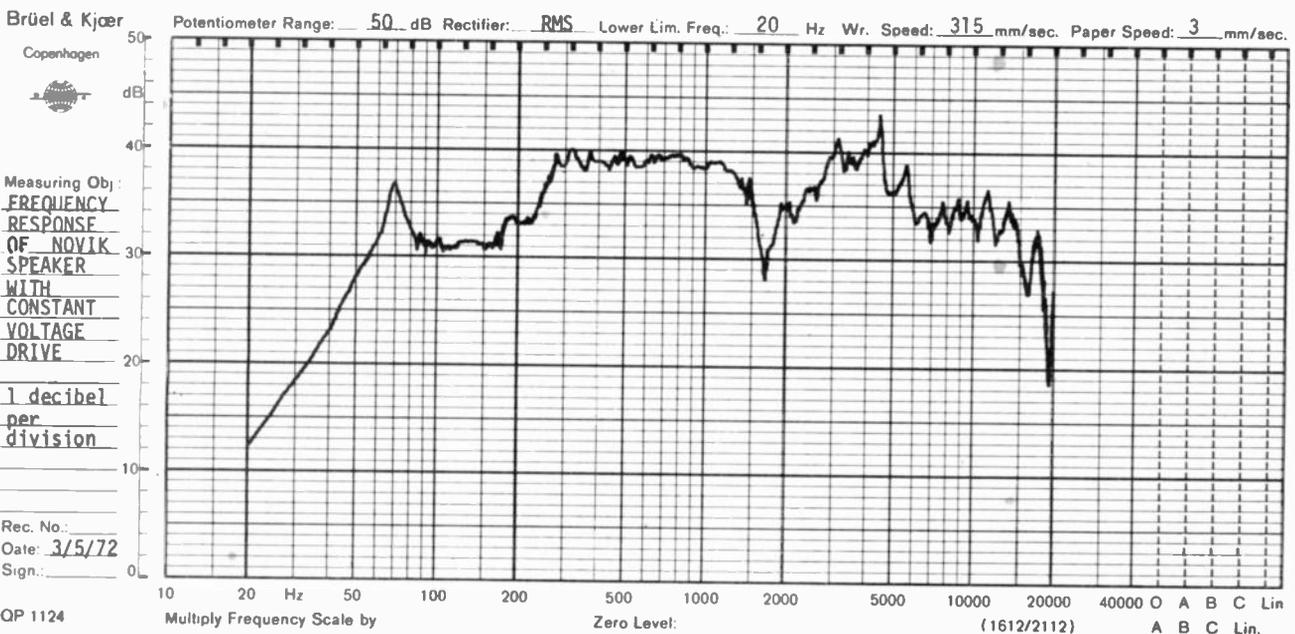
Having sorted out this problem we then measured the frequency response of the Novik speaker – with rather surprising results.

Firstly the change in output level at 250 Hz is unusual, and secondly, the high frequency directivity was more pronounced than in any other enclosure that we have seen for many years. Overall, the frequency response is reasonable but a little boomy

because of a resonant peak at 70 Hz and a drop off in response between 80 Hz and 200 Hz. Impedance characteristics were generally quite good.

The distortion tests were very interesting. There was a high level of distortion from the woofer, yet a low level of distortion from the mid-range and tweeter units.

The cross-over network consists of a large air-cored inductor and a series of 1 μ F block encapsulated foil capacitors glued together to provide the 6 μ F



THE NOVIK LOUDSPEAKER

capacitor connects the mid-range speaker to the tweeter. The tweeter output is adjustable by a four-position switch located on a terminal panel at the rear of the enclosure. The four positions are marked 'out', -3, 0 and +3 and switch a number of resistors in parallel or series with the tweeter to provide boost or cut. In the 'out' position the tweeter is switched out of circuit.

Cross-over frequencies are nominally stated to be at 1300Hz and 8kHz. However the the first crossover actually occurs at 900Hz. An interference notch at 1600Hz is not audible on programme material. It is caused by the 5" mid-range speaker being out of phase with the woofer at that frequency.

The enclosure is constructed from

3/4" veneered particle board. The internal base is solidly glued into the box and internal damping is provided by a number of 6" by 4" blocks of low density fibreglass. A pair of banana plug sockets are located on a recessed panel at the rear of the enclosure.

As with the cross-over network, the enclosure has been designed in Australia and both are extremely well made.

SUBJECTIVE IMPRESSIONS

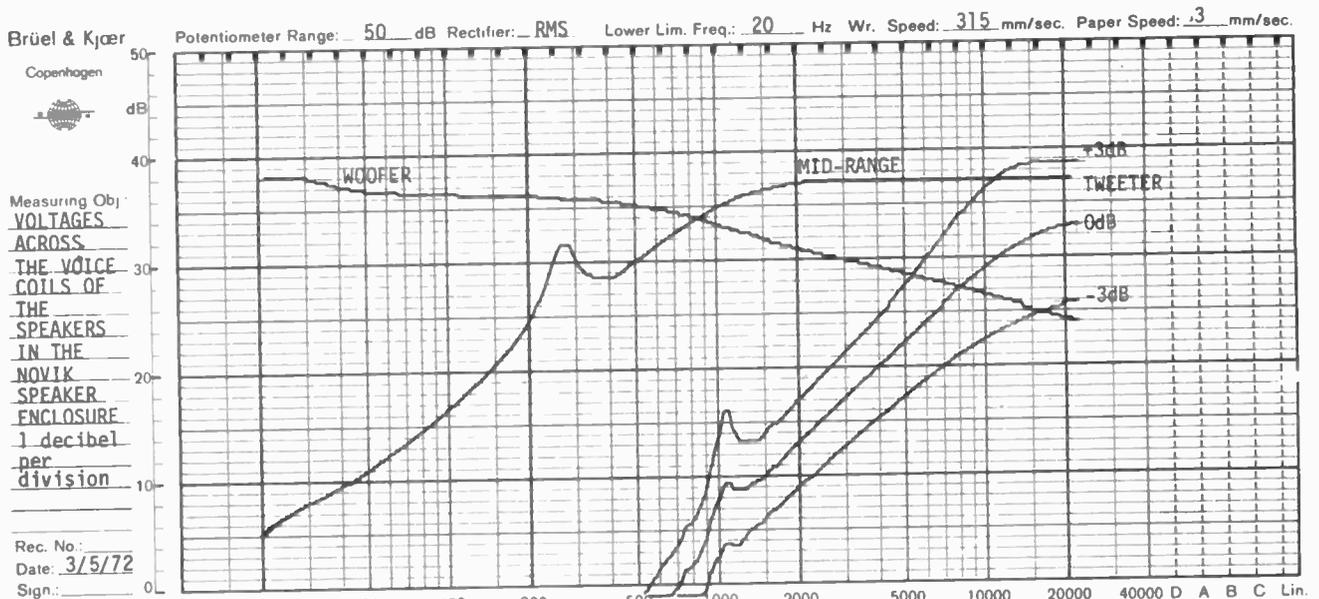
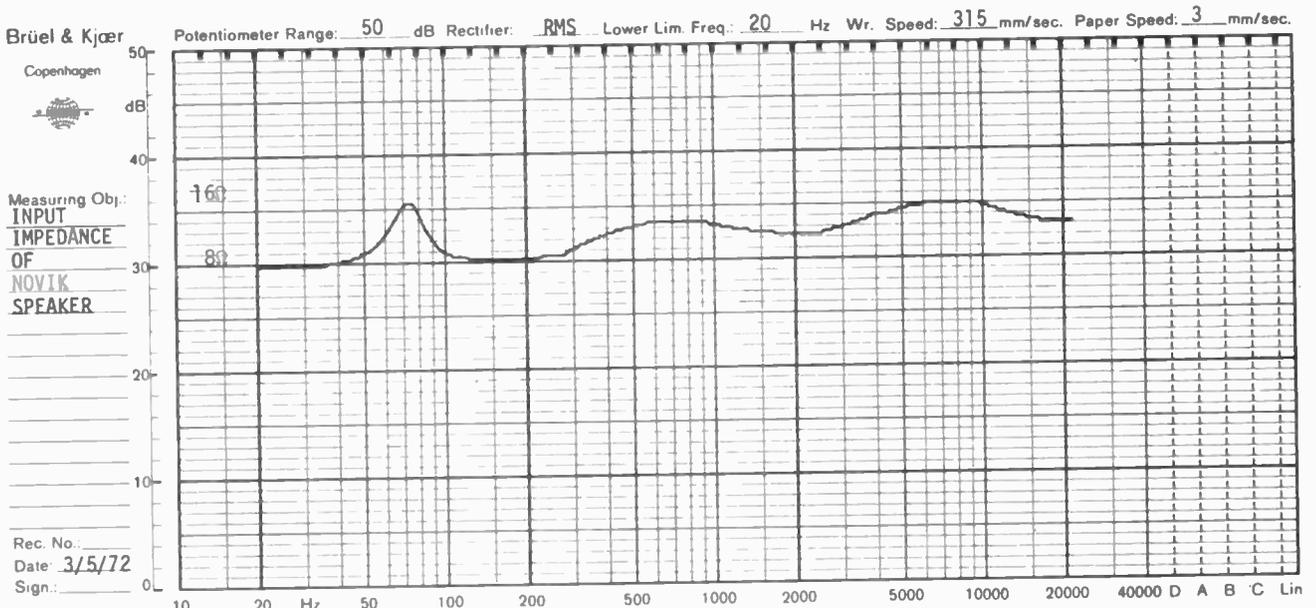
On actual listening tests the Novik was rather disappointing, as the colouration at the low frequency end of the audio spectrum was audible; in fact on some programme material it was quite pronounced.

The mid-range performance was good and the tweeter was quite acceptable provided that one was directly facing the enclosure. But if one moved to one side of the median plane the loss of

high frequency content was very noticeable in an acoustically dead room. In a live room the performance was more acceptable but not totally satisfactory.

Novik speakers are guaranteed for five years against faulty workmanship and components. However the unit must be returned - at the purchaser's expense - to the manufacturers, for their assessment and repairs at their discretion. The unit will be repaired and returned free of charge if they validate the claim.

Basically it must be said that the performance of the woofer fitted to these enclosures is not comparable with that provided by the mid-range and tweeter units, and in an era when most manufacturers are able to offer excellent performance at the lower frequencies it is apparent that Novik will have to put a lot more effort into the design of the woofer before Henry Kloss loses any sleep.



PRACTICAL GUIDE TO TEMPERATURE CONTROL

Accurate, repeatable temperature measurement and control is an essential requirement in many aspects of science and industry.

Many scientific experiments depend upon the maintenance of a stable temperature — often, as with pathological specimens, over long periods of time.

Even the cheapest usable laboratory ovens and water baths must therefore be capable of maintaining temperatures that are constant to within at least 1°C — in fact many will better this by a factor of at least two.

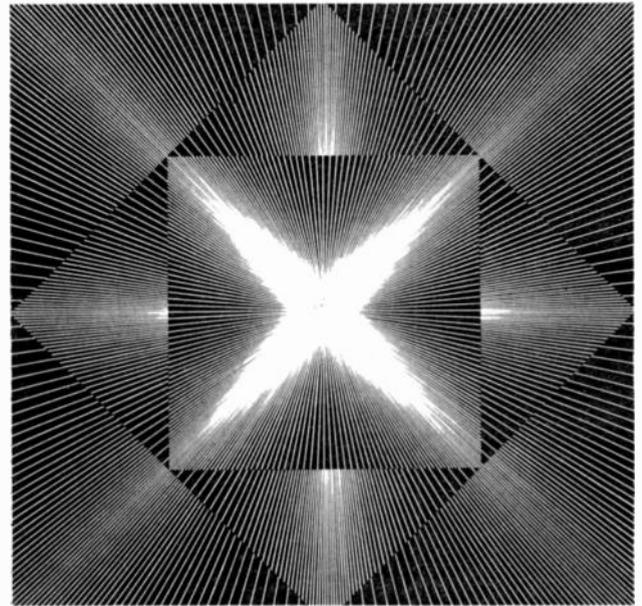
In the development of colour films on an industrial scale, large quantities of water must be held to close temperature limits, even in industries such as chicken hatching, large volumes of air must be maintained to astonishingly tight specifications.

THERMOSTATIC CONTROL

To various extents, all solids expand when heat is applied to them. Thus, when a metal rod is heated along its length, each unit of its length will become longer. This increase in length (per degree of temperature rise) is called the coefficient of linear expansion and has different values for different materials.

Table II shows the coefficient of expansion for various materials. The Table also shows the coefficient of

Temperature controlled systems are used throughout science and industry — in this series of articles Collyn Rivers explains how they work.



volumetric expansion — which is roughly equivalent to three times the coefficient of linear expansion.

From Table II it can readily be seen that the volumetric expansion of mercury is over six times that of glass, and that the linear expansion of copper is considerably greater than that of say, invar, (invar is an alloy containing 36 percent nickel and 64 percent steel).

It is this difference between expansion rates that is exploited in devices such as thermometers and thermostats.

The simplest form of thermostat consists of a bimetal strip — usually

invar and brass. As temperature rises, the brass expands more than the invar thus causing the strip to bend. This movement is used to open and close a pair of electrical contacts which in turn make and break the electrical energy supplied to the heating (or cooling load). (Fig. 1).

The thermostat is located within the area to be controlled — for example, in a laboratory water bath the thermostat will be immersed in the bottom of the bath.

A thermostat of any type is simply an 'on/off' device: it is either open or closed. This effect is shown diagrammatically in Fig. 2. Here the upper line represents the thermostat movement whilst the lower line shows the current flow through the heating element which is controlled by the thermostat. At the lowest temperature the bimetal strip is straight and the contacts are closed — hence current flows through the heating element and temperature begins to rise (T1). For a time, temperature rises and as it does so the bimetal strip begins to bend. At a certain temperature — determined by the characteristics of the bimetal strip

TABLE I

SCALE	MELTING POINT	BOILING POINT	SYMBOL
Celsius (Centigrade)	0	100	C
Fahrenheit	32	212	F
Reaumur	0	80	R
Absolute Celsius	273	373	K
Absolute Fahrenheit	492	672	—

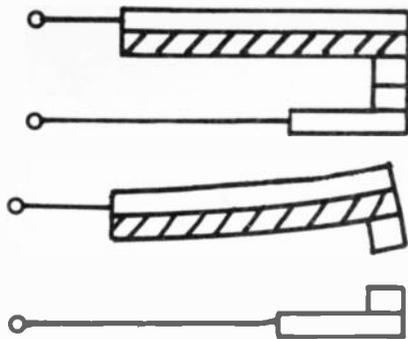


Fig. 1. Basic thermostat: when heated, brass (shaded) portion expands more than invar thus causing strip to bend and contact to open.

and the spacing of the electrical contacts — the bimetal strip bends sufficiently to open the contacts (T2) and the heating stops.

Thus the thermostat oscillates between maximum temperature (contacts open) and minimum temperature (contacts closed). This variation is known as the 'differential' of the thermostat, and in top quality units may be as little as $\frac{1}{2}^{\circ}\text{C}$.

It should however be clearly understood that the temperature differential described above is that achieved once the heated system has reached a state of equilibrium. During the initial process of coming up to the desired temperature, the system may well 'overshoot' by quite a substantial amount. This action may then be followed by several swings of temperature — diminishing in amplitude — above and below the required set point.

The amount of initial overshoot is a function of the design of the complete heating system — including the electrical size of heating elements, time taken for the thermostat to respond to temperature change etc. It may be reduced by careful design but can rarely be eliminated completely. Hence on/off control systems must only be used where these initial characteristics can be tolerated.

A further article in this series will describe various types of proportional controllers — which do not exhibit this overshoot characteristic.

Precision thermostats, such as those used for laboratory applications, whilst still exploiting the basic principle of different coefficients of linear expansion — do not use bending bimetal strips. Generally they use long rods of brass or copper located within an invar framework. One end of the rod is rigidly clamped to the invar frame and the other end is linked to electrical contacts via a lever mechanism that magnifies the relative movement between the two brass rod and the invar framework.

This type of precision thermostat is necessarily large and is therefore only

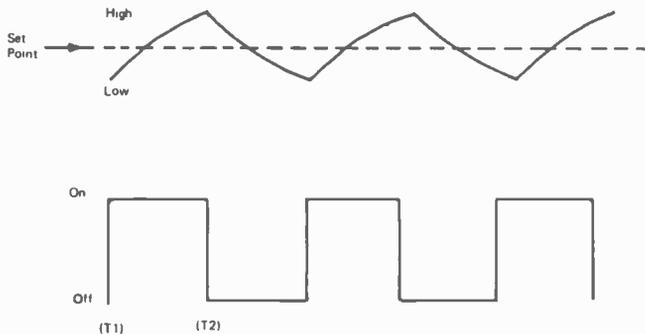


Fig. 2. Operation of thermostat above and below set point, upper curve shows temperature of load, lower curve shows heater being turned on and off.

suitable for large ovens and water baths — or other applications where space is not at a premium. Nevertheless they can be very effective devices indeed and differentials of 0.1% have been achieved.

A major disadvantage of nearly all electric thermostats is that the contacts are used to interrupt the heating load current, which, in large ovens or water baths may be at least ten to fifteen amps.

This results in two problems — with a common cause.

Thermostat contact points open and close fairly slowly, and because of this a certain amount of arcing takes place. Unless the thermostat is very conservatively rated, the contact points become burnt and pitted and

must be replaced at frequent intervals. Failure to do so may well result in the points welding together and thus supplying power continuously to the heating element. If the element is used to heat a pathological oven, months of research can literally be burnt up in less than half an hour. Many a thankful of tropical fish has perished for the same reason.

The second effect of point arcing is that the heat generated in the arc disorients or expands some parts of the thermostat, thus affecting its operating accuracy.

To overcome these problems, a few top quality ovens use the thermostat merely as a switching device to control a main power contactor.

Practically throughout science and industry, and shortly to become common usage elsewhere, temperature measurements are quoted in degrees Celsius.

Earlier, a centigrade scale was proposed by Celsius, a Swedish astronomer. This term was used extensively until 1948 when, at an international conference, the word 'Celsius' was adopted in place of 'centigrade' — a term which is also used to define one hundredth part of a grade (part of a European scale in which a circle is divided into 400 grades).

The Celsius scale has now been adopted by Standards Institutes worldwide for use in scientific work. Units are expressed in degrees Celsius — often abbreviated to $^{\circ}\text{C}$.

An absolute Celsius scale (Kelvin scale) is also used in scientific calculations. In this system, zero degrees represents the total absence of heat. Units are expressed as degrees Kelvin — or $^{\circ}\text{K}$.

The Fahrenheit scale is still used in some parts of the world

in medicine, engineering, meteorology, and for domestic purposes.

All conventional temperature measurements are based on two fixed reference points which are both stable and easily reproducible.

The lower of these two points, 0°C (273°K) is defined by the temperature of melting ice. This is measured at an external pressure of 760mm of mercury at sea level on latitude 45° .

The second point defines 100°C (373°K) and is based on the boiling point of water — measured under the same conditions.

Two further reference points are sometimes used. These are the boiling point of sulphur (444.6°C), and the melting point of gold (1063°C).

Relationships between these three scales are shown in Table I — which also includes the Reaumur scale. This latter scale is still used in parts of Europe for domestic temperature measurement.

PRACTICAL GUIDE TO TEMPERATURE CONTROL

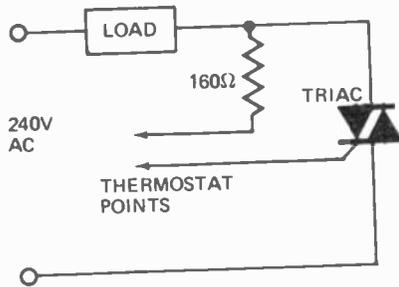


Fig. 3

This method is effective, but expensive and clumsy.

A far simpler method of overcoming the problem is to use the thermostat contacts in the gate circuit of a suitably rated Triac which in turn switches the heating load. This overcomes all the problems in one go and is both cheap and effective.

The writer of this article has modified several hundred laboratory heating systems in this way over the past eight years — and without exception none has since required any further attention to contact points. A further bonus is that the temperature regulation of the device is frequently improved — by as much as 50 to 75 percent.

Figure 3 shows how the modification is made. If installing this modification, bear in mind that the Triac assembly must be mounted in the coolest possible location and not within the heated part of the oven!

CONTACT THERMOMETERS

The construction and use of the mercury-in-glass thermometer is familiar to us all. The contact thermometer is in essence a standard thermometer of this type but modified to incorporate electrical contacts.

In its simplest form the contact thermometer is made to switch at a specified temperature. A typical example of this type of thermometer is shown in Fig. 4. Here, one wire is in permanent contact with the mercury pool in the thermometer bulb — a second wire is attached to the inner face of the tube and this is contacted by the mercury at the predetermined temperature.

An adjustable form of contact thermometer is shown in Fig. 5. In this device the leads enter the glass tube via a plastic cap. A magnet mounted on this cap is used to rotate an internal armature; this is attached to a fine threaded spindle terminating in a platinum contact, the operating

TABLE II
Coefficients of expansion (per °C x 10⁻⁶)

SUBSTANCE	LINEAR	VOLUMETRIC
Aluminium	23	69
Brass	18.9	56.7
Copper	16.8	50.4
Glass	8.6	26.4
Pyrex glass	3.2	9.6
Invar	0.9	2.7
Quartz	9.4	1.2
Steel	10.7	32.1
Tungsten	4.5	13.5

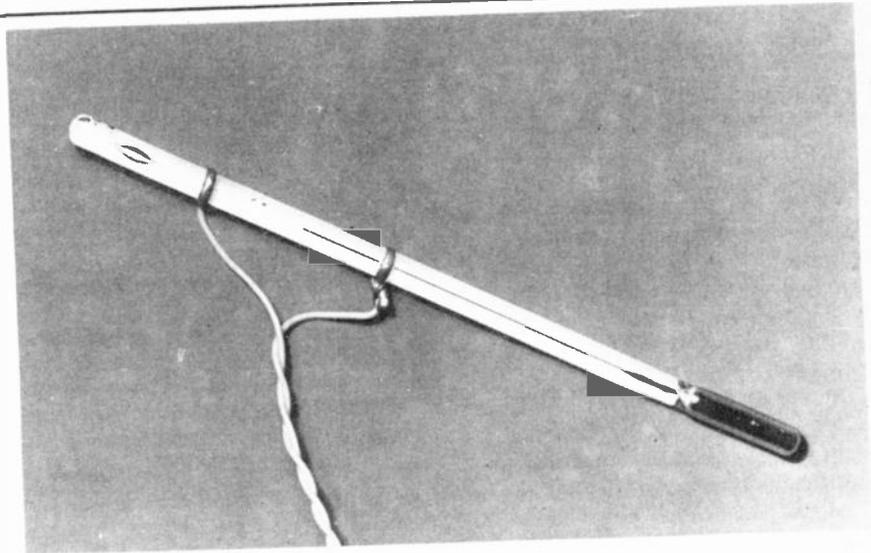


Fig. 4. Basic contact thermometer — designed to switch at 40°C. At that temperature, the expanding mercury touches the second contact point.

temperature of which is read from a calibrated scale.

Although far more fragile than electro-mechanical thermostats, contact thermometers are simple devices capable of accurate, repeatable switching for millions of operations. The switching differential is largely a function of the range that must be covered — but accuracies of 0.1% and better are quite common; and thermometers with a differential of as low as 0.001% (over limited ranges) can be obtained.

Contact thermometers are less commonly used than they deserve to be — probably because they were developed many years before the introduction and commercial acceptance of cheap simple circuitry that was capable of exploiting their switching capabilities: for contact thermometers have what was at one time a major drawback — that is that they can only switch very low currents and voltages. This switching capability is limited to preferably less than five to ten volts — the lower the better within reason — and the current flow should be less than a few milliamps. If these limits are exceeded, changes within the mercury will shorten the unit's life quite drastically — and apart from this the heating effect of the

current (which must inevitably pass through the mercury column) will grossly affect the switching accuracy.

Originally, complex valve amplifiers were used to magnify the low acceptable switching currents to a level which could be used to drive a load contactor — these were clumsy and expensive — although incredibly enough, several companies still have such anachronisms in series production.

Unlike thermostats in which the contact points close as the temperature falls — and thus reapply power to the heating load — contact thermometers switch 'on' as the set point is reached. This is of course an ideal characteristic for refrigeration loads but is the opposite to that normally required for heating loads.

Nevertheless a Triac switching circuit may be used — switching the Triac 'off' as the desired temperature is achieved. One method of achieving this is shown in Fig. 6.

In operation, when the contact thermometer is 'open', the capacitor is charged via the 150k resistor until the breakover voltage of the trigger diode is reached — usually around 30 volts — the diode then breaks down triggering the triac into conduction.

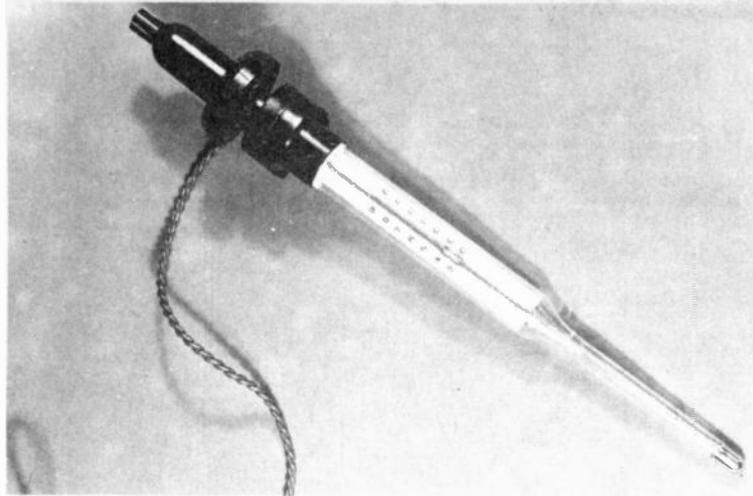


Fig. 5. Adjustable contact thermometer. Rotating upper magnet assembly (in top hat fitting) is used to adjust switching temperature — here set at 35°C.

The power loss caused by the minor phase shift is negligible).

Subsequently, when the contact thermometer 'closes', the capacitor is prevented from reaching the trigger diode breakover voltage and the triac is prevented from conducting.

In practice this circuit works very well indeed, although it may occasionally be necessary to select triacs capable of switching reliably at low trigger energy levels. The voltage applied across the contact thermometer is higher than desirable but in practice problems are rarely experienced.

A more elegant (but also more costly) version of this circuit is shown in Fig. 7. This latter circuit should preferably be used in critical applications. Both switching voltage and current is much lower than in the version shown in Fig. 6. In this circuit the contact thermometer is wired across the capacitor in a UJT firing circuit. When the contact thermometer is 'closed', the capacitor is prevented from reaching the UJT valley point (or 'firing') voltage and thus the triac is not triggered.

This is an excellent circuit for controlling laboratory water baths and ovens for applications where the characteristics inherent in 'on/off' control systems are acceptable.

Yet another method — originally developed by General Electric in the USA — uses an SCR connected within a full-wave bridge. (Fig. 8).

With the contact thermometer 'open', the SCR will trigger on each half cycle and deliver power to the heater load. When the contact thermometer 'closes', the gate of the SCR is effectively held at SCR cathode potential and is therefore prevented from triggering. Thus power is removed from the heating load. In this circuit the maximum current through the contact thermometer is about 250 μ A.

This circuit (Fig. 8), whilst limited to switching loads of less than 150 watts or so, is reliable, cheap and simple. It is an excellent temperature control system for small fish tanks, or other similar applications where only low energy heating elements are used.

As with electro-mechanical thermostats, contact thermometers are strictly 'on/off' devices, and because of this the heating element that they control (and hence the controlled volume) will continuously cycle above and below the 'set point'.

This characteristic is inherent in this — and other — types of control systems, but in a well designed system the variations may be well within the permissible limits. In fact using these techniques the writer has successfully

designed laboratory water baths and ovens with an overall temperature differential of less than 0.1%. One small water bath was produced with a differential of less than 0.05%.

The following points should be noted by experimenters seeking to obtain optimum accuracy and long term stability when using contact thermometers.

a) The exposed glass column may be at a different temperature from the bulb. This may cause non-uniformity in the temperature of the mercury column. Where possible ensure that the whole thermometer is at the same temperature. If the thermometer is immersed in liquid, ensure that as much as the cc column as possible is immersed. If an immersion level is specified, ensure that it is maintained.

b) Glass is slightly plastic, and if the contact thermometer is changed from a high temperature to a low temperature there may be errors of up to 0.5°C until the glass returns to its original dimensions. This may take several weeks.

c) As the glass ages, there will be a slight decrease in the volume of the bulb. This may cause an error of up to 0.2% over a period of five to ten years.

The next article in this series will describe the operation of thermistors — and includes a number of practical circuits.

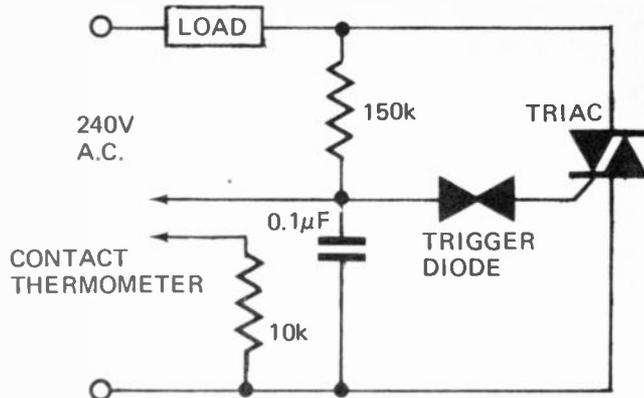


Fig. 6

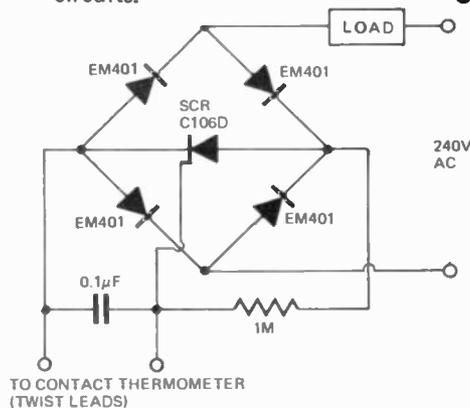
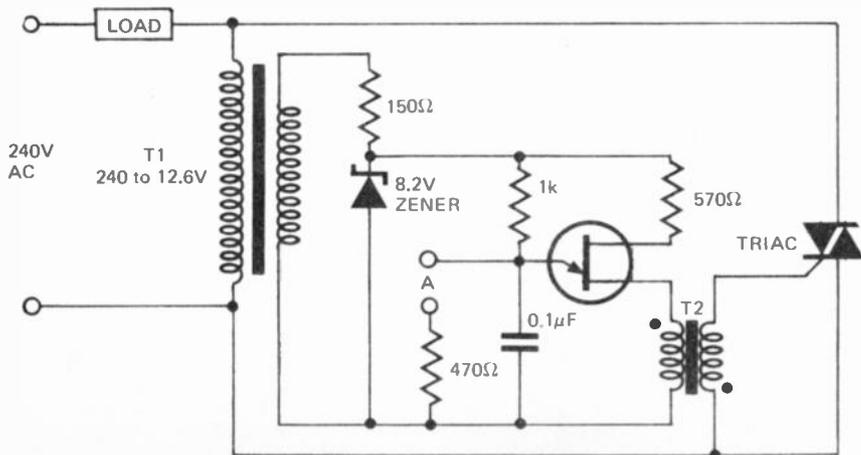


Fig. 8

INTEGRATED AUDIO

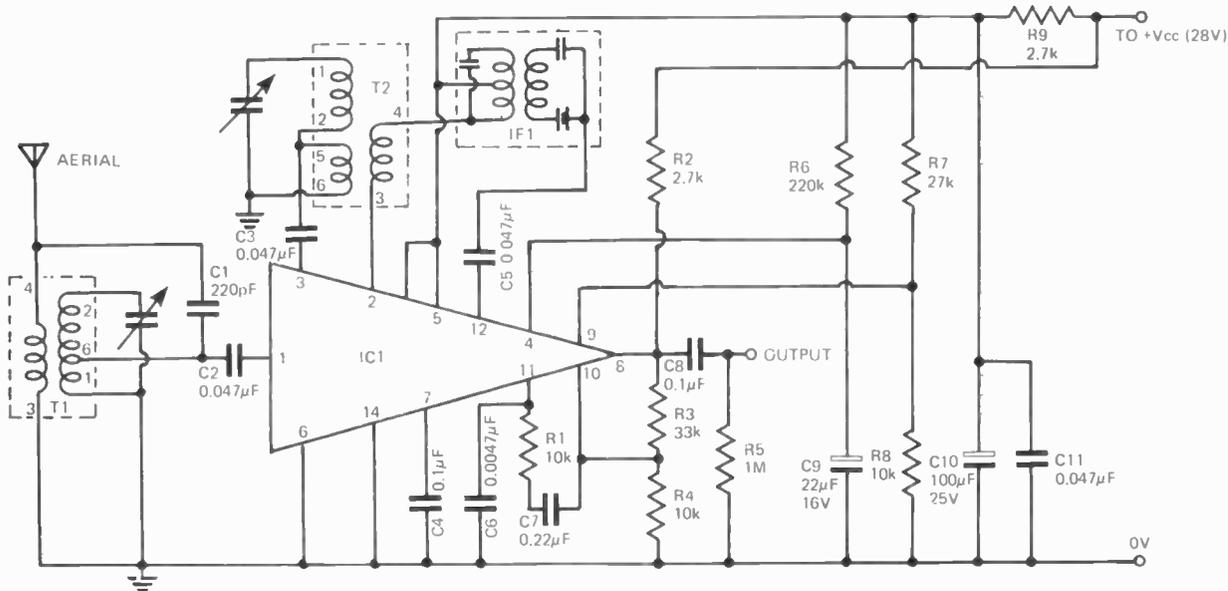


Fig. 1. Circuit diagram of the radio tuner.

ETD PROJECT 425

In this third installment of the series, we describe construction of the radio tuner and give details of the cabinet woodwork.

THE radio tuner is built around the Philips integrated circuit type TAA840. This IC incorporates an RF amplifier, mixer-oscillator, AGC, detector and audio pre-amplifier. External components are limited to the aerial coil, oscillator coil, IF filter, tuning gang, nine resistors and eleven capacitors.

The circuit, Fig. 1, is simple to align and may be used as a separate tuner, if required, and may operate on a variety of supply voltages by simply changing a few resistor values. The gain of the tuner may also be altered if required to match the sensitivity of other amplifiers. The output voltage may be increased to a maximum of two volts, or reduced if required, again by changing a few resistors.

Resistor changes necessary for a variety of supply voltages are given in table 1. Ensure that the voltage on pins 5 and 13 (controlled by resistor R9) is within the range of 5 to 7 volts. In addition the voltage at pin 8 should be within the same limits except for



SYSTEM-ETI 425

INTEGRATED
AUDIO SYSTEM

supply voltages of 6 volts (3.5V at pin 8) and 9 volts (4.5V at pin 8). The voltage at pin 8 is determined by the ratio of R3/R4 as follows:—

$$V_{\text{pin 8}} \approx 1.4 \times \frac{(R3 + R4)}{R4}$$

The gain of the tuner may be changed by altering the values of R3 and R4 by equal amounts. For example if twice the output is required the values of R3 and R4 must both be doubled. The gain may be increased by up to five times (normally set to provide 400 mV RMS) providing that a supply voltage of at least 12 volts is available.

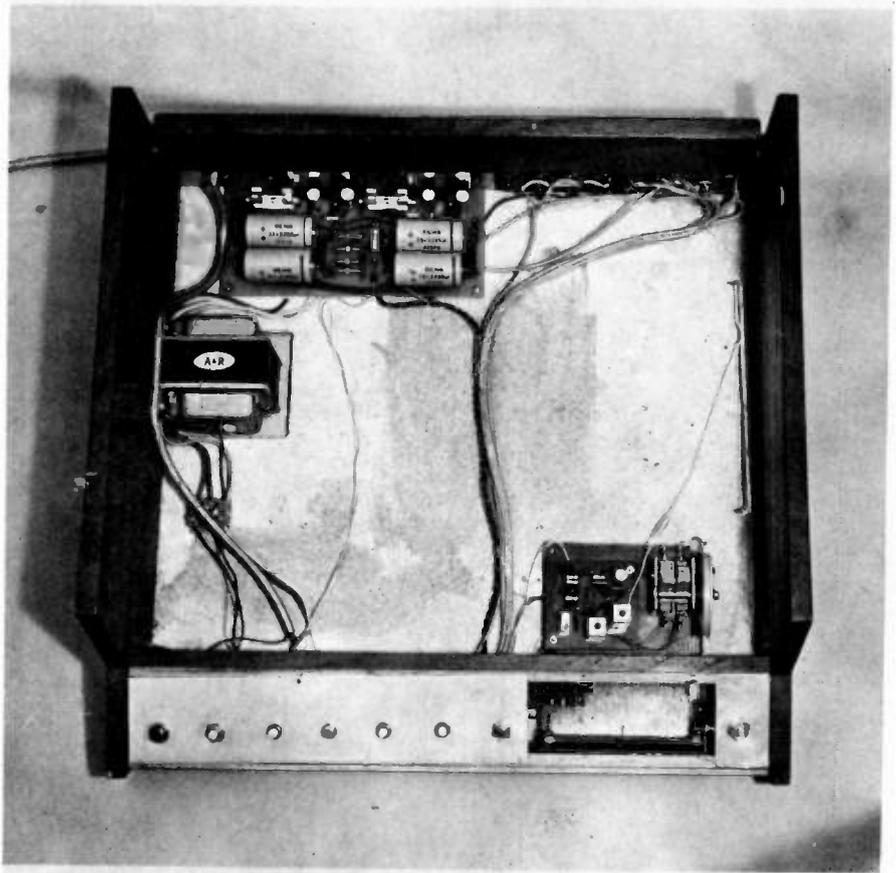
TUNER CONSTRUCTION

Assemble the components to the PC board as shown in the component overlay diagram Fig. 3. Pay particular attention to the orientation of the IC and to the polarity of the capacitors.

The shield of the output screened cable is used as the 0V return line for the tuner, and should be returned to the preamplifier 0V.

TEST AND ALIGNMENT OF THE TUNER

Connect the tuner to a power amplifier and switch on. Check that 5.7 volts with respect to the zero volt line is present at pins 5 and 8 of the IC. Stations should be obtainable, but



The completed cabinet with all electronics in position.

TO TUNING GANG

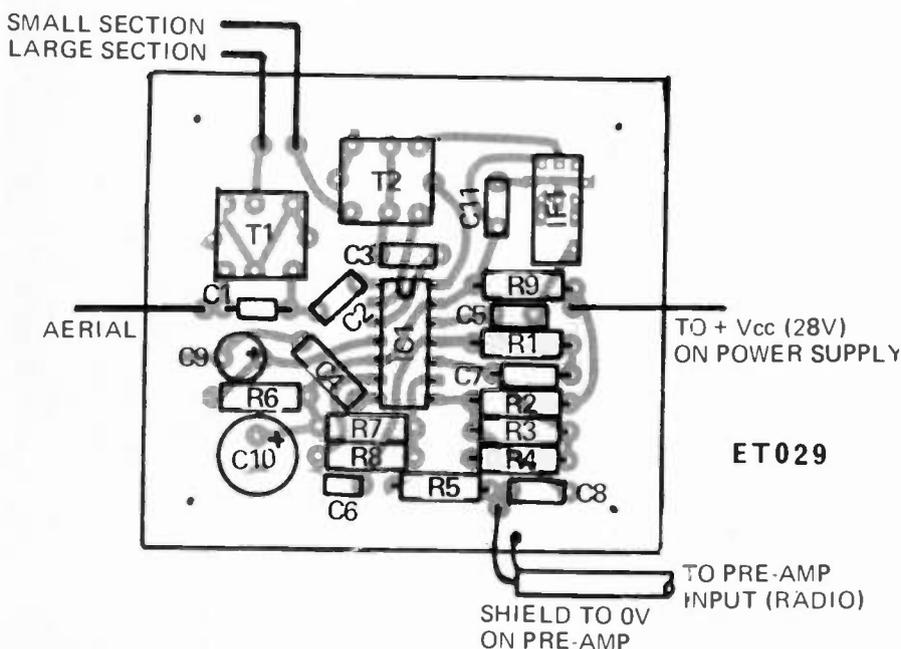


Fig. 2. Tuner component overlay.

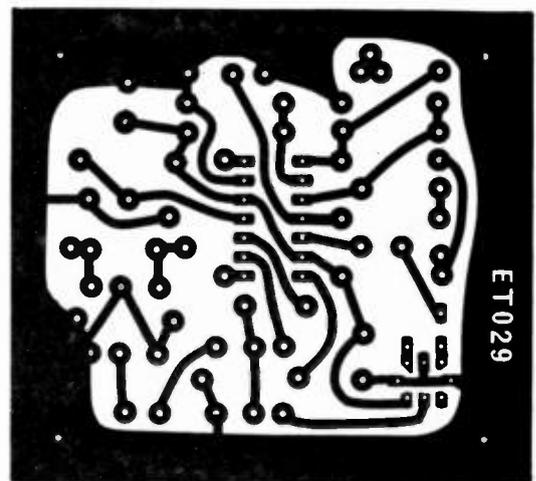


Fig. 3. PC board layout for the tuner (full size)

INTEGRATED AUDIO SYSTEM-ETI 425

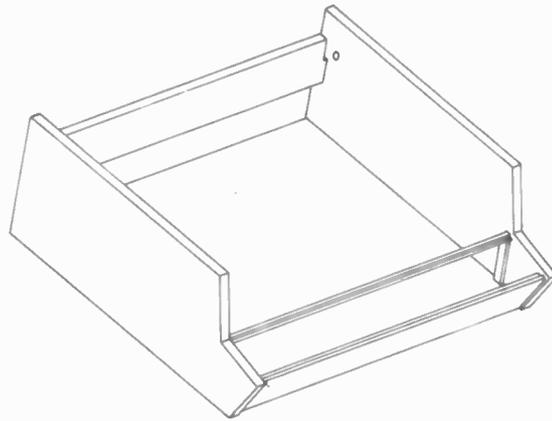


Fig. 4. The fully assembled cabinet.

PARTS LIST

IC1	integrated circuit type TA840		
T1	aerial coil (Aegis type S201 or similar)		
T2	oscillator coil (Aegis type S203 or similar)		
IF1	IF filter (Murata type YFL455A)		
Tuning gang	MSP type K2Xt/39260 or similar		
R1	resistor	10kohm 5% ½ watt	
R2	"	2.7kohm " "	
R3	"	33kohm " "	
R4	"	10kohm " "	
R5	"	1Mohm " "	
R6	"	220kohm " "	
R7	"	27kohm " "	
R8	"	10kohm " "	
R9	"	2.7kohm " "	
C1	capacitor	220pF	NPO disc
C2	"	0.047µF	disc
C3	"	0.047µF	"
C4	"	0.01µF	100V greencap
C5	"	0.047	disc
C6	"	0.0047	disc
C7	"	0.22µF	100V greencap
C8	"	0.1µF	100V greencap
C9	"	25µF	6.4V electro
C10	"	100µF	16V electro
C11	"	0.047	disc
PC board	type ET029		

TABLE 1

	6V	9V	12V	15V	18V	24V	30V	40V	60V
R2	390	820	1.2k	1.8k	2.2k	2.7k	2.7k	*3.9k	*5.6k
R4	22k	15k	10k	10k	10k	10k	10k	10k	10k
R9	56	330	680	1k	1.2k	2k	2.7k	*3.9k	*5.6k

* 1 watt resistors

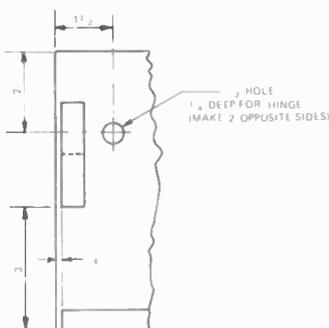


Fig. 5a. The side panel.

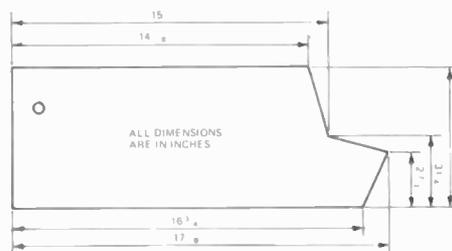


Fig. 5b. Dimensions for fixing the hinge and rear panel to the side panel.

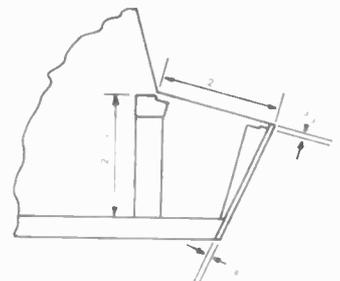


Fig. 5c. Details of front panel and control panel support strut positioning.

may be very weak and out of alignment with the dial.

A high-impedance voltmeter and a signal generator will make alignment considerably easier, but are not strictly essential. To align the coils with the above instruments, connect the voltmeter so that the voltage on pin 4 is monitored (this is the AGC voltage) and connect the signal generator to the aerial input through a small capacitor (200pF). Set the signal generator to 455kHz and using as low a signal level as will give a useful reading, adjust the IF slug for maximum reading on the voltmeter. Set 600kHz on the signal generator and adjust the tuner-dial to the 600kHz position as indicated by the pointer. Adjust the oscillator coil slug until a maximum on the voltmeter is obtained. Now peak the aerial coil slug for maximum reading.

Now set both signal generator and the dial to 1500 kHz and adjust the oscillator trimmer capacitor (on the smaller section of the tuning gang) and the aerial coil trimmer capacitor for maximum reading on the meter.

If a voltmeter is not available then the audio output may be used as a level detector. A lower signal level will be required then when using the voltmeter, otherwise the AGC will prevent accurate tuning.

If a signal generator is not available, radio stations at the low and high ends may be used as signal sources. If no voltmeter is available then weak stations or a short antenna must be used or again the AGC will prevent accurate tuning.

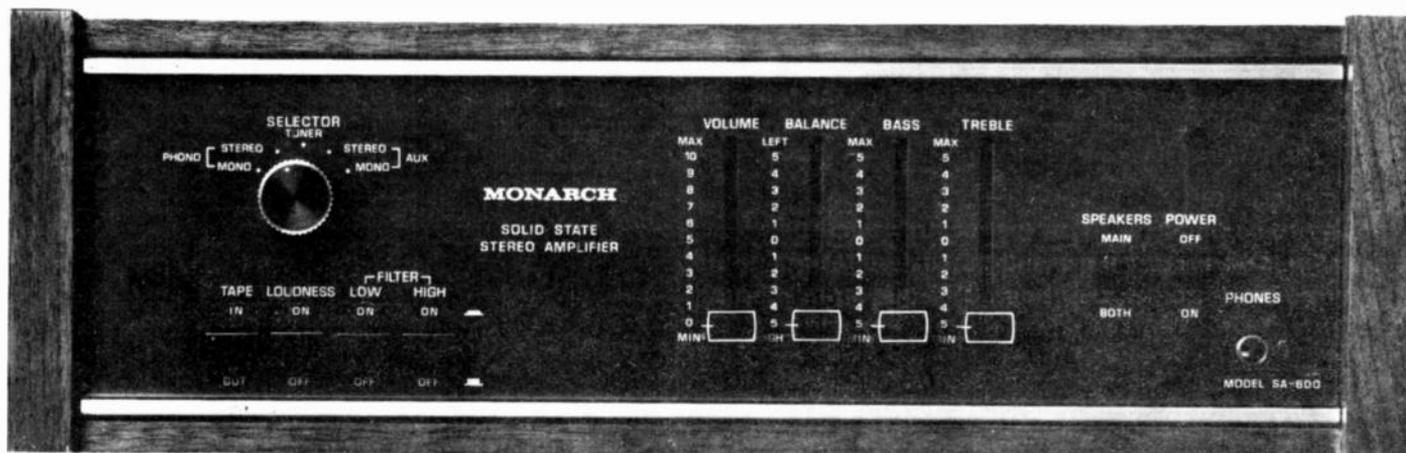
Use a station at the low end of the band to adjust the aerial coil, oscillator coil and IF coil, and use a station at the high end of the band to adjust the trimmer capacitors. As there may be interaction between adjustments repeat the procedure several times.

CONSTRUCTING THE CABINET.

The fully assembled cabinet woodwork is shown in Fig. 4. The component parts of the cabinet are as shown in Figs. 5 to 9. It is recommended that particle board be used for the sides, back and base. The

(continued on page 47)

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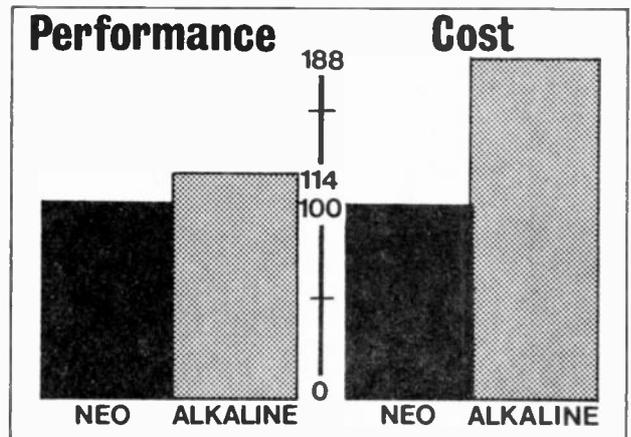
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(continued from page 44)

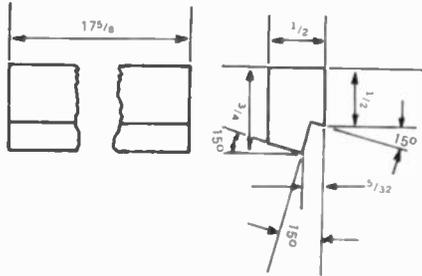
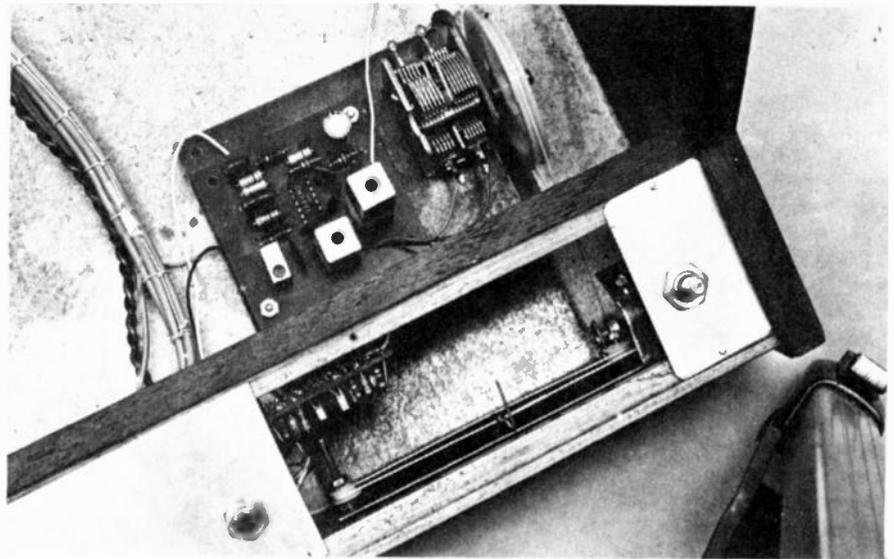


Fig. 6. Control panel support strut.



The tuner mounted in position.

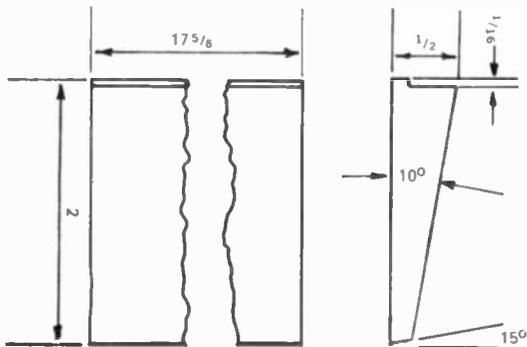


Fig. 7. Front panel.

front, panel support and the two braces should be of oregon or similar timber.

All visible parts of the cabinet should be veneered with iron-on-veneer. Inside surfaces should be veneered before assembly.

Butt-joints, glued and nailed are suitable for all joints except for the rear panel which should be dowelled for extra strength.

The motor board, Fig. 10, is also made of 1/2 inch particle board, which we suggest should be surfaced with black laminex or similar. Note that the cutouts for the tuner and power transformer do not extend through the laminex. The cutout details shown are for the Silcron MK3 turntable only, and will have to be changed if another turntable is used.

The motor board is supported on springs to prevent acoustic and mechanical feedback. To retain the motor board during transport, wood screws are inserted through the base into the legs as shown in Fig. 11. These screws should be adjusted so that about 1/8 inch upward movement is possible.

The method suggested for aligning the legs and retaining screws is as follows: Before the laminex is fitted, nail and glue the legs to the motor

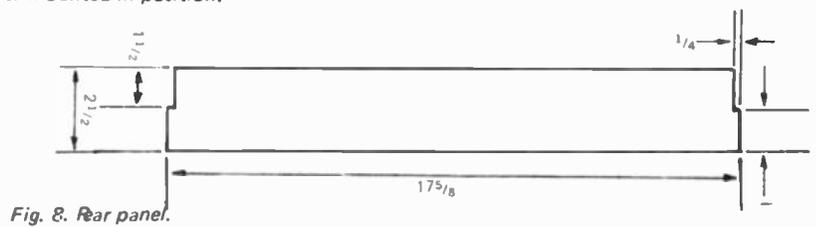


Fig. 8. Rear panel.

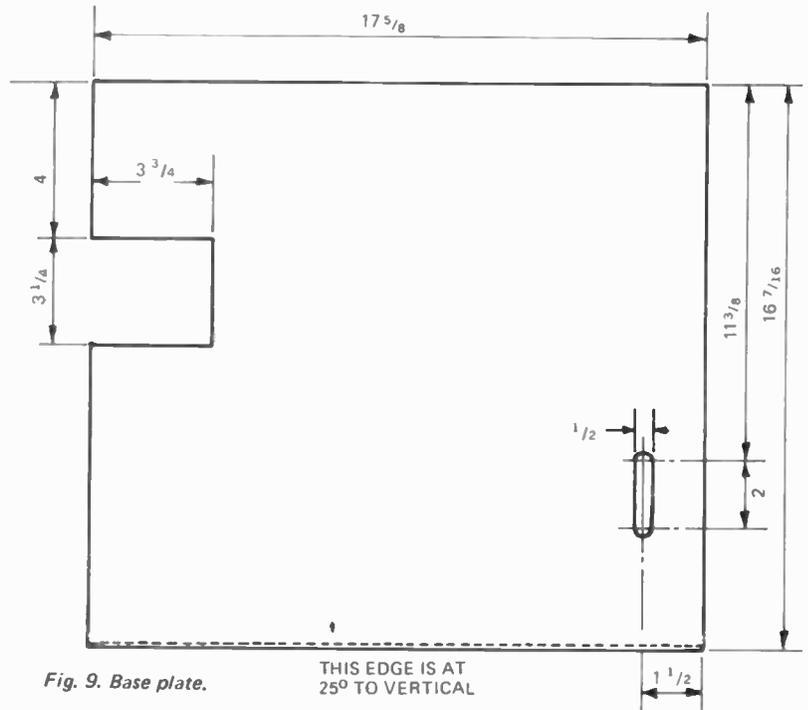


Fig. 9. Base plate.

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FOR studying the VHF/UHF portion of the radio spectrum, a VHF/UHF converter must be very sensitive, have a low noise figure and be very stable. Any tendency towards instability or regeneration in the RF stages will degrade the performance of the system.

To be able to detect noise radiated by cosmic sources, the noise figure of the front end of the receiving system must be 3dB at worst — preferably better. System gain should be sufficient to provide a readily measurable output at the detector when the antenna is connected to the receiver and aimed at a weak noise source. An overall receiver gain of at least 60dB should be adequate.

But choosing a low noise valve or transistor amplifier for the receiver's first stage is not necessarily sufficient to ensure a good noise figure. The front end noise figure can almost invariably be improved by adjusting the tuning and matching of the first stage.

NOISE GENERATORS

Basically a noise generator is a device for creating a controllable amount of RF noise over a wide range of frequencies. This is generally referred to as 'white noise'.

The simplest type of noise generator (Fig. 1) consists of a diode (either vacuum or solid-state) in series with a resistor having a resistance equal to the characteristic impedance of the transmission line that will be connected to the radiometer input

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terminals. This resistor in effect is substituted for the line, and the noise voltage generated by current flowing through the diode is thus fed to the receiver input. The level of current flowing through the diode determines the amount of noise that is generated.

The circuit shown in Fig. 1 is very simple and is adequate for making front end adjustments or comparisons. If constructed more or less as shown in Fig. 1 (b) it will operate satisfactorily up to a couple of hundred megahertz.

To use the generator, plug the chassis-mounted male

coaxial-connector into the receiver's input socket, and with the battery switched off, measure the noise output of the receiver using a VTVM, high impedance voltmeter, or pen recorder. Make sure that any gain controls (i.e. RF or AF) are set well within the range over which the receiver response is linear. If you are using a receiver having AGC, make sure that it is switched off or otherwise disabled. Fig. 5 shows a block diagram of the arrangement.

Turn the noise generator on and set the potentiometer for a large receiver

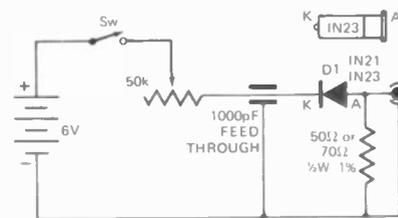
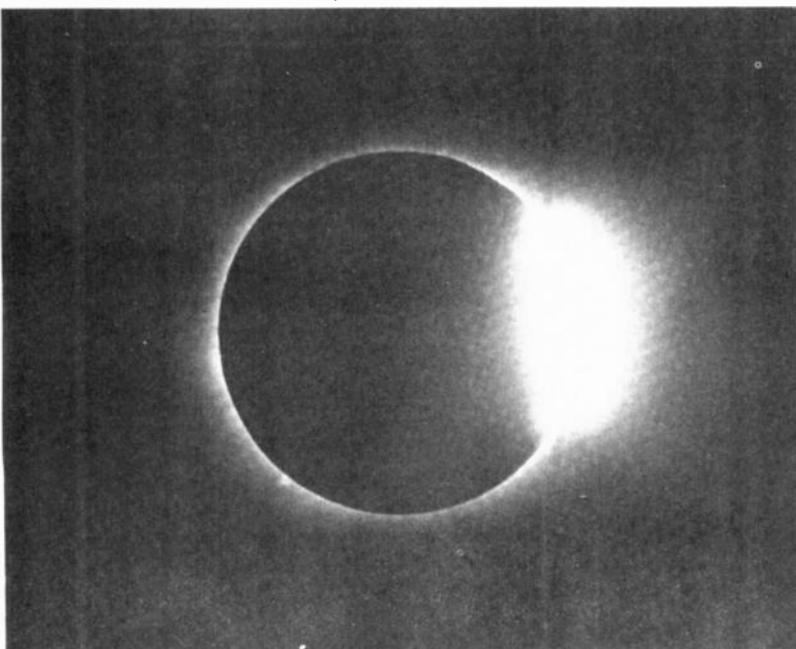
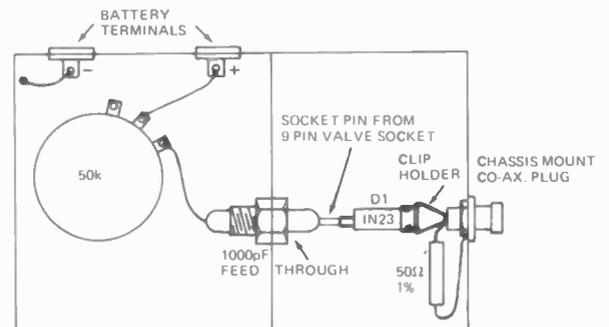


Fig. 1. Diode noise generator (solid state)



RADIO ASTRONOMY FOR AMATEURS

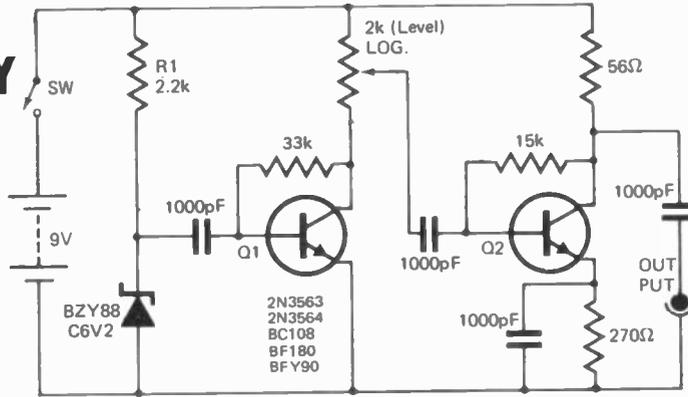


Fig. 2. Zener Diode Noise Generator.

Q1 and Q2 are same type. All capacitors are disc ceramic.

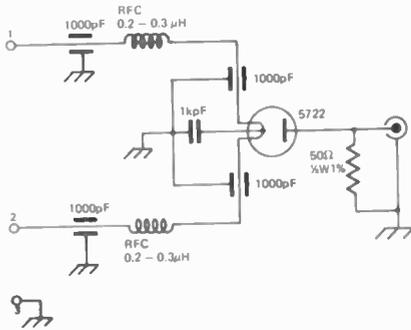


Fig. 3. Valve diode noise generator.

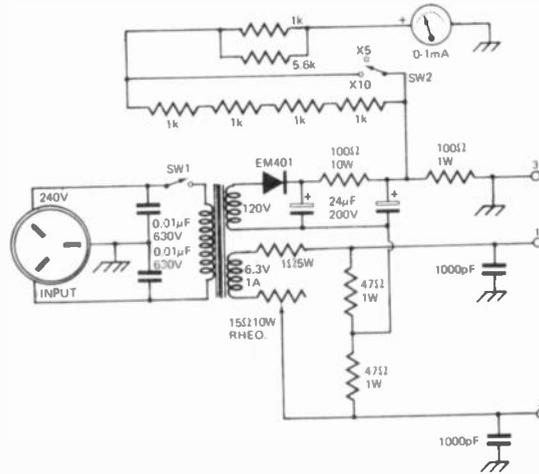
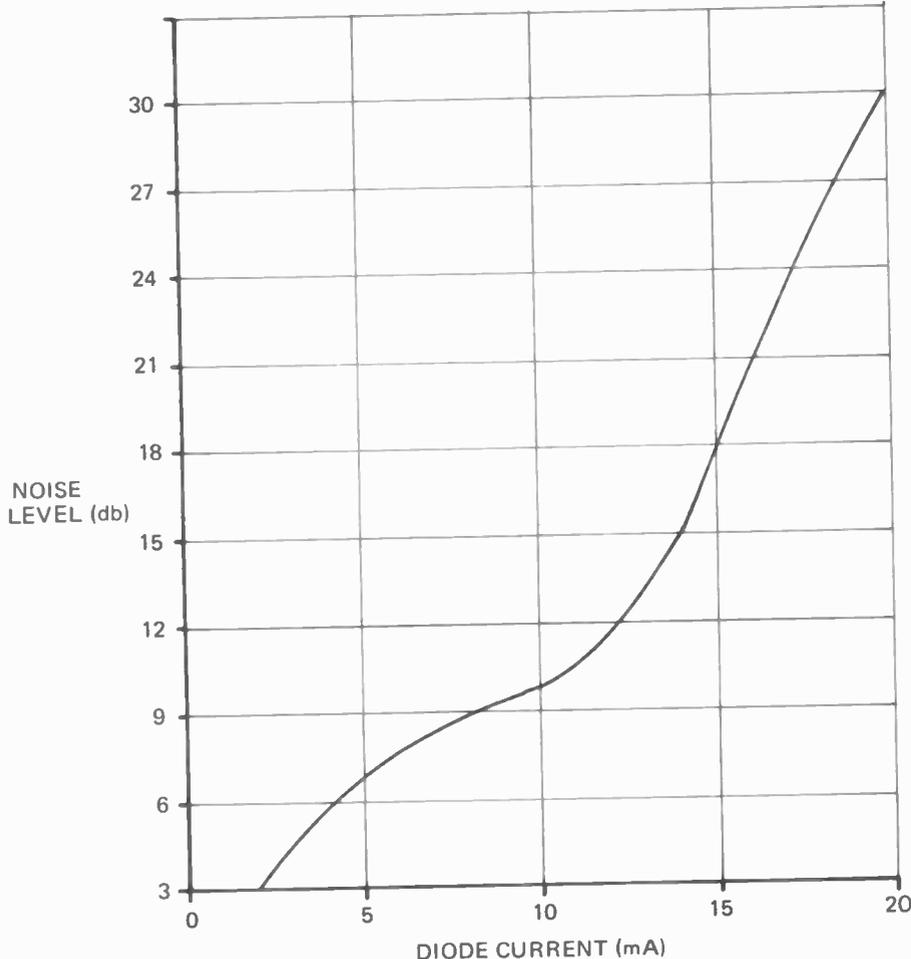


Fig. 4. Vacuum diode current versus noise level

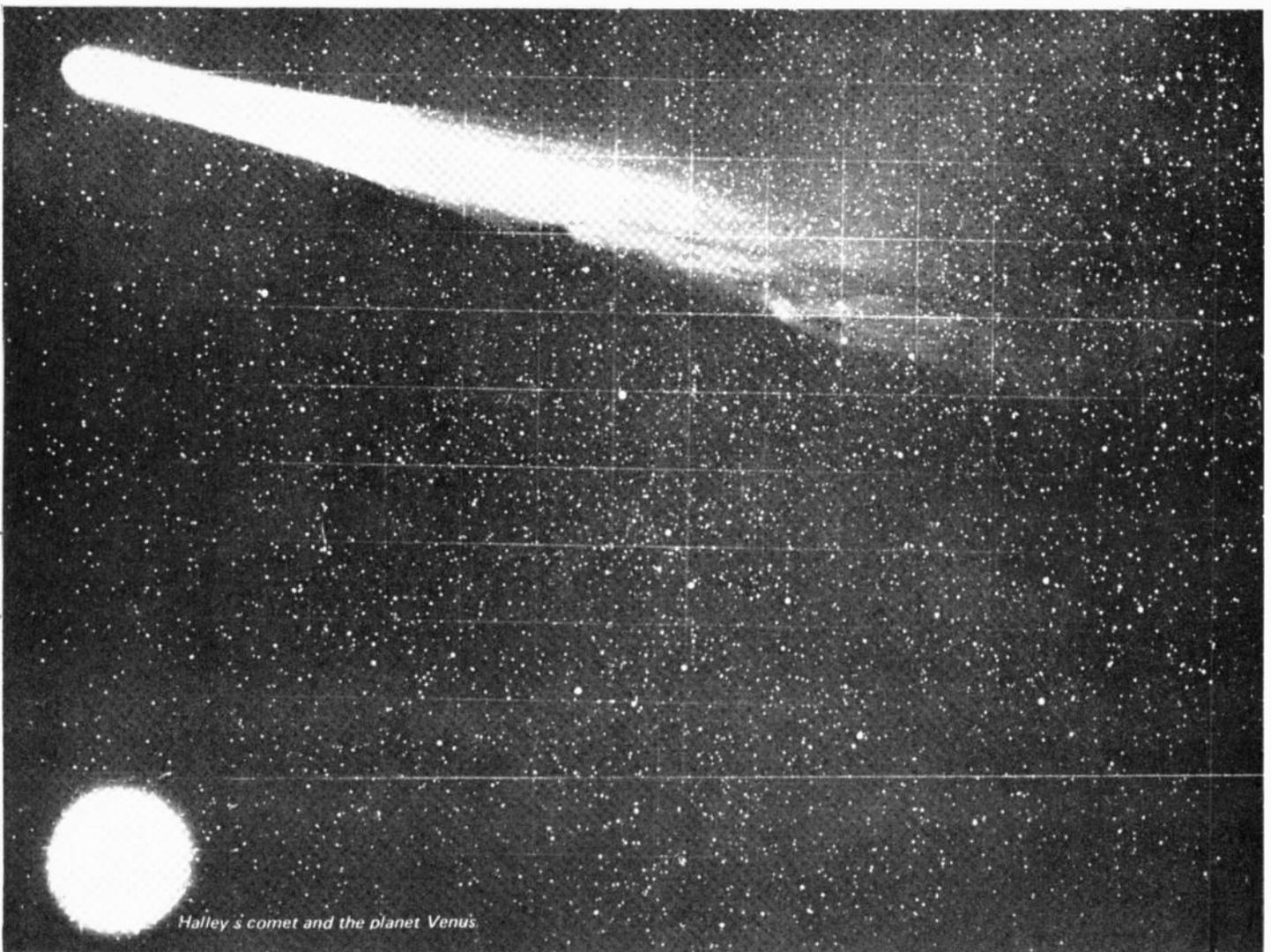


noise output, say twice the value just measured, and note the potentiometer dial setting. The front-end of the radiometer, particularly the input tuning and matching, is then adjusted such that the same noise increase is attained with successively lower amounts of current flowing through the diode after each adjustment to the receiver's circuitry is made. Never make more than one change at a time.

The noise generator shown in Fig. 2 has the same operational limitations as for the circuit shown in Fig. 1. It will operate quite well up to 80MHz as shown. The upper frequency limit may be increased to at least 150MHz by decreasing R1 to 1.8k, using BF180 or BFY90 transistors and following good VHF constructional practices. This generator is used in the same manner as that described for the circuit of Fig. 1 above.

Uses of the two noise generators just described are limited to making receiver adjustments and for short term gain calibrations. They cannot be used for noise figure measurements. This is a fairly serious limitation as noise measurements are invaluable for determining that the receiver is operating correctly, and for making direct comparisons between different pieces of equipment.

The circuit shown in Fig. 3 has none of these limitations. It operates by



Halley's comet and the planet Venus

utilizing the 'shot effect' caused by random emission of electrons from the cathode of a vacuum tube diode. This electron emission is of course the anode current which flows through the load resistance. The random component of this current is the noise output.

The emission of electrons from the cathode is temperature dependant and because of this can be readily controlled by varying the filament current. (fig. 4). (Note that the filament itself is the cathode in noise diodes of this type).

Vacuum tubes employing pure tungsten or thoriated-tungsten filaments should be used in this application. For example the transmitting tube type 24G is very suitable. This tube is occasionally available from surplus stores.

CONSTRUCTION

The noise generator should be well shielded and decoupled from the power supply. Separating the noise

diode (etc) from the power supply is good practice. Good VHF construction practices should be followed to ensure correct operation. A variable dc source may be used for the filament supply if one is available.

The coaxial output connector should match that used on the input of the receiving system — alternatively the receiver and noise generator may be coupled together by a very short length of coaxial cable.

ADJUSTMENTS AND NOISE MEASUREMENT

To measure the noise figure of the receiver, connect the equipment as

shown in Fig. 5 and allow it to warm up for 20 minutes or so.

With the noise generator switched off, adjust the gain of the receiving system or attenuators so that a suitable indication is obtained on the chart recorder, (or other level monitoring equipment). this value should be noted and regarded as the reference level.

Now turn on the noise generator, wait until it warms up, and then adjust the filament current until the output power level has doubled. This is an increase of 41% on an ac voltmeter or 3db on an audio level meter. The value of diode anode current at this point is

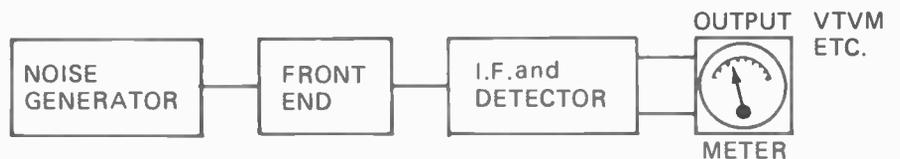


Fig. 5. Basic adjustment or calibration setup.

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directly related to the noise figure of the receiver.

Adjustments should be made to the receiver input matching, tuning and coupling, interstage coupling etc., so that the same percentage increase in the output level is obtained with lower and lower values of noise diode current.

Generally, the best noise figure will be obtained when the input circuit is slightly overcoupled. The final value of noise diode current, after all the adjustments have been made and no further improvement can be obtained, can be substituted in the following formula to obtain the true noise figure of the receiver.

Noise Figure (in db)
= $10 \log_{10} 20 \times IR$
where I

= diode current in *amperes*
and R

= terminating resistance in *ohms*

For example: if I is found to be 2mA
and as R is 50 ohms.

N.F. (db)
= $10 \log_{10} 20 \times 0.002 \times 50$
= $10 \log 2$
= $10 \times .3010$
= 3 db

The noise generator can be used to calibrate the radiometer by feeding in noise at predetermined levels (set by the anode current). This should be done at regular intervals if the system is used for long sessions, or before and after each observation if short sessions only are undertaken.

Direct comparisons between one system and another can be made — providing they both have the same input impedance. The measurement is

independent of bandwidth thus allowing such comparisons to be made.

VHF/UHF SYSTEMS

A converter/IF amplifier combination is not necessarily the only system that can be successfully used for operation at the high end of the frequency spectrum.

VHF/IF amplifiers from microwave radar units may be used directly (as described in an earlier article in this series).

Frequencies used in these IF strips vary from 30MHz to 400MHz or 500MHz. They generally have a low noise first stage and combine high gain with a low input impedance. Strips such as these may be found in surplus stores from time to time.

Figure 6 shows a typical VHF/UHF system. The attenuators are those described in the July issue. At this stage the antenna does not have to be a large high gain array but should be a beam array having reasonable gain and directivity. If the IF is a communications receiver, the AGC must be disabled and the RF gain turned to maximum sensitivity. Initially, the attenuators should be switched out of circuit.

ESTABLISHING INTERNAL NOISE

With the antenna disconnected, and the receiver selectivity control set to the broadest position switch on the receiving equipment and allow it to warm up.

With the chart recorder zeroed and the receiver at operating temperature, connect a resistor across the preamplifier or converter input terminals. This resistor should have the same resistance as the receiver input impedance (probably 50 ohms).

Then, using a short time constant on the detector output, record the noise level, whether on the chart or by noting down the reading. If the reading is quite high (i.e. more than ¼ scale), increase the attenuation

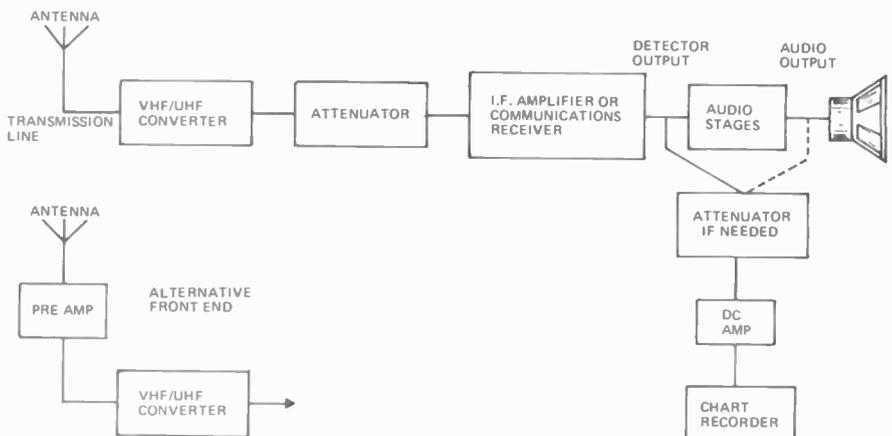
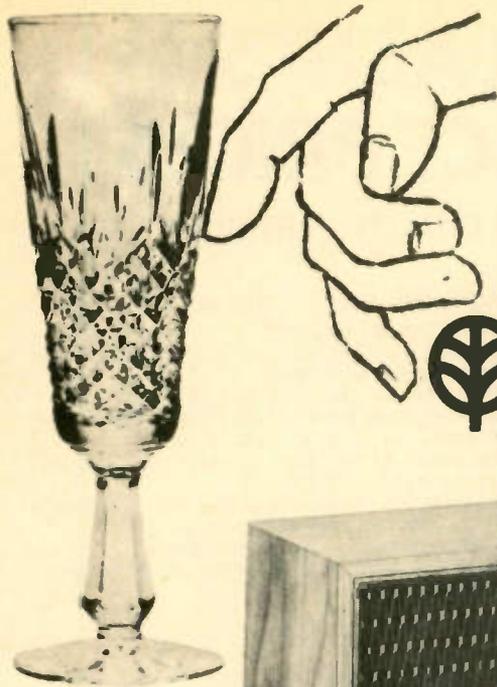


Fig. 6. Basic VHF radiometer.

(Continued on page 123)



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Tracking Force: .7 gram
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WEIGHING MOVING TRAINS

Fully automatic system weighs coupled trains of mixed stock at speeds up to 5 mph.

VICTORIAN Railways has installed an Avery electronic weighing-in-motion system at its South Dynon Goods yard in Melbourne. By weighing coupled wagons on the move, it eliminates the necessity to uncouple a train, marshal wagons individually over static weighbridges and then recouple.

The system is fully automatic and records individual gross wagon weights in trains of mixed stock travelling at speeds up to five miles an hour. It is designed to weigh both 100 ton bogie wagons and four-wheel wagons, hauled in either direction, and can accommodate vehicles of either broad (5ft 3in) or standard gauge (4ft 8½in).

It consists of a load-cell rail axle weigher connected to static instrumentation, which controls the weighing cycle, computes axle and wagon weights, and operates a digital indicator and an electric tabulating machine. Axle weights and total wagon weights are printed by the tabulator on continuous paper tape.

The operator initiates weighing by pushbutton after the locomotive and tender have passed over the weighbridge. Proximity switches alongside the tracks identify the wagon type as each approaches the axle weigher and set the weighing instrumentation accordingly. Special circuitry zeroes the system before each weighing to allow for spillage, rain, etc. on the platform of the axle weigher. The system, which was commissioned in September 1971, can also be used for purely static weighing when necessary.

Operation in detail

A large percentage of the traffic from South Dynon Yard is handled by transport agencies which have the exclusive use of one or more wagons. The agents load the wagons themselves and advise the Railways of the gross weight of each. The Avery system is used to confirm these figures.

The wagons, all of which are numbered, are marshalled and coupled into a train behind a main-line locomotive. On receipt of a proceed signal from a weigh office sited adjacent to the axle weigher the train is hauled forward at a steady speed of five miles an hour.

As the train approaches the weigh



A Weighing station.

station, the wagons are stabilized by 66ft-long guide rails to reduce the amount of side loading due to yawing. For the same reason, the lead-on rails to the axle weigher are jointless and level to within 1/16" in 25ft.

The axle weigher has a platform 5ft 3in long by 7ft 3in wide and is fitted with two rail tracks, one for broad-gauge and the other for standard-gauge traffic. It is of extremely rigid construction to inhibit the generation of low-frequency vibrations, which may affect weighing accuracy. Gap-bridge rails and end curbs are installed to reduce shock and vibration as the wheels pass over the nominal ¼ inch gap between the dead track and the weigh rails.

A process of axle counting identifies the type of wagon approaching the weigher and the instrumentation is set automatically for either a bogie or four-wheel wagon. The axles of bogie wagons are between 5ft 9in and 6ft centres and those of four-wheel wagons are at 10ft 6in centres. There will, therefore, be either two axles (bogie wagon) or one axle (four-wheel wagon) between the switches, which are 8ft apart. If the first switch operates twice before the second operates, a bogie wagon is about to cross the weigher.

Each axle is weighed individually. The analogue weight signals produced by the 50,000lb-capacity load cells are transmitted to the transistorized digital instrumentation, which amplifies and converts them into digital signals suitable for the weight display and tabulating machine. Free-motion devices are fitted to all

load cells to minimize the effects of non-vertical or shear forces.

The secret of successful weighing-in-motion lies in the suppression of both high- and low-frequency vibrations. The first mode arises mainly from the impact of the vehicle on the weigh platform. It is attenuated by the rigid structure and an integral filter network. Low-frequency vibrations are inherent in the wagon and are more difficult to counter. The Avery system owes its high accuracy (¼% of dynamic weighing capacity) to a digital filter, which averages a large number of separate weight signals taken at varying intervals during the weighing period.

The axle weight is indicated on a neon-type digital display reading from 0 to 100 tons in 14lb increments. Simultaneously, the tabulating machine prints out the weight on a 6in-wide paper tape. The second axle is then weighed and recorded, and the two weights are summed by the instrumentation to give total wagon weight. The consecutive number of the wagon in the train is printed alongside the total wagon weight thereby identifying the wagon weight.

When the wagon leaves the weigher, the 'downstream' proximity switches notify the instrumentation that the system is clear. All the following wagons in the train are weighed in the same manner. If a wagon passes over at too high a speed, the letter 'E' is printed instead of a weight. In the static weighing role, the system indicates and prints weights in the range 0 to 25 tons by 14lb increments.

MINI-MAGNAVOX

8-30

ENCLOSURE

The combination of Philips tweeter and Magnavox bass driver provide superb sound from this compact new design.

ETI PROJECT 425S

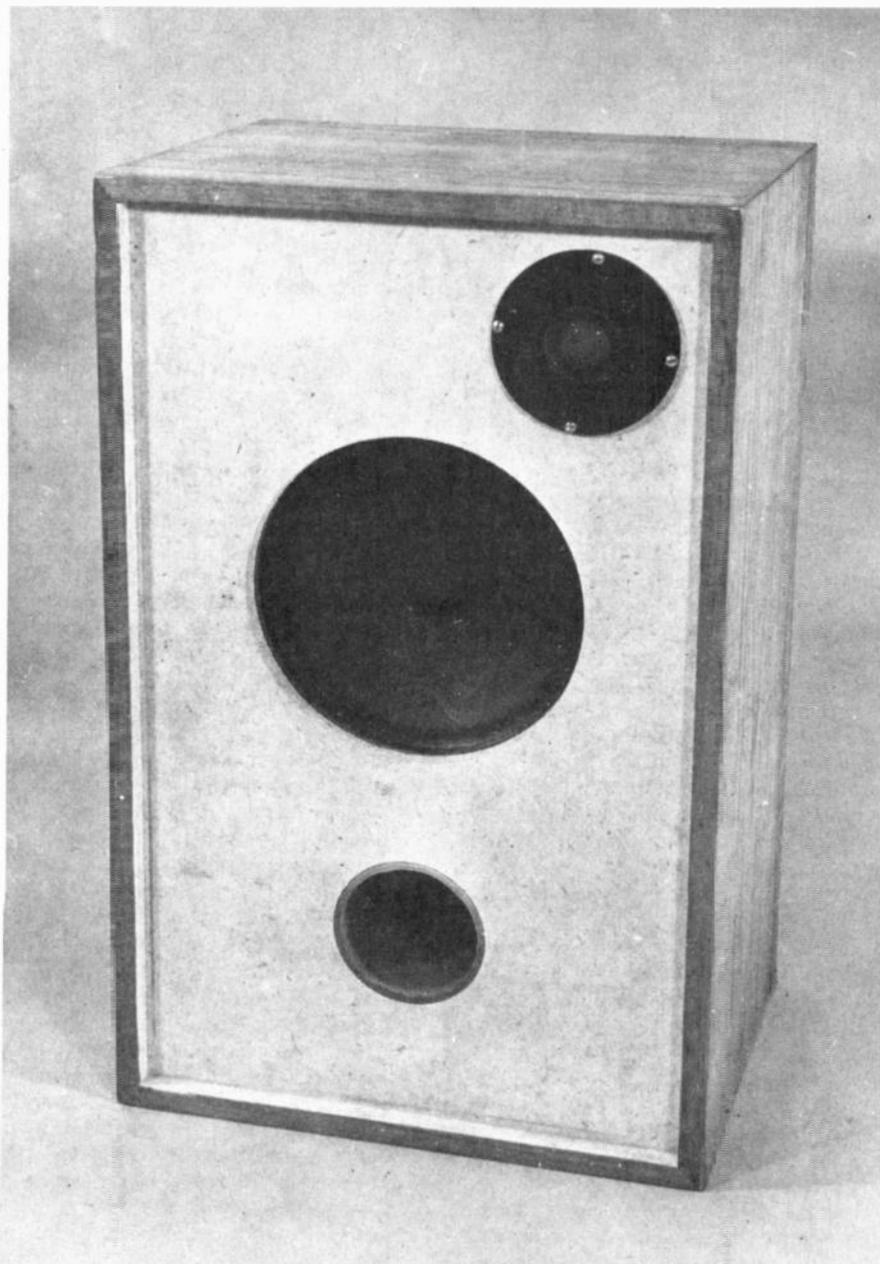
DURING initial development of our DETI 425 Integrated Audio System it became clearly apparent that whilst the modified version of the Magnavox 8-30 speaker enclosure (described in Electronics Today International — July issue) provides what must be the best value for money on the speaker market today, there was a very definite need for a smaller version of this enclosure.

It was also clear that whilst many people sought a smaller enclosure — they were not prepared to sacrifice any of the superb performance that the larger units are unquestionably capable of providing.

Nevertheless in reducing the size of a speaker enclosure *something* has to be sacrificed. Were this not so, few manufacturers would build cabinets larger than necessary. Except for the newly rich.

Generally the sacrifice that has to be made is that of efficiency — that is the ratio of acoustic power out for electrical power in, and thus, everything else being equal, small enclosures produce less sound than larger ones for any given input level.

Equally however, smaller speakers are generally used in small rooms where there is less need for high acoustic outputs — for the power required to produce any particular sound level is directly related to the size (and furnishing) of the room in which the equipment is installed. The efficiency of a speaker is also very much a function of its design. A typical small infinite baffle speaker enclosure may have an efficiency of 0.1% whereas a bass reflex enclosure of the same size may be well over 1%, or even 2%. This does not mean to say that the infinite baffle enclosure will only sound 1/10 (or 1/20) as loud as the bass reflex design — for the ear has a logarithmic response to sound levels — but there will still be a substantial



The completed speaker without the front grille fitted.

NOTES.
ALL OUTSIDE WOODWORK IS 1/2" PARTICLEBOARD COVERED WHERE VISIBLE WITH THE DESIRED VENEER

1" x 1" D.O.R. CLEATS AROUND ALL EDGES + 2 ACROSS EACH SIDE, ONE ACROSS TOP AND BOTTOM AND 2 ACROSS BACK (SEE EXPLODED VIEW.)

LINE ALL INSIDE SURFACE WITH 2" SOFT FIBREGLASS (EXCEPT FRONT)

FRONT GRILL NOT SHOWN

ALL DIMENSIONS ARE IN INCHES

SPEAKERS SHOULD BE MADE AS PAIRS, ONE WITH THE TWEETER ON THE LEFT AS SHOWN AND ONE WITH IT ON THE RIGHT

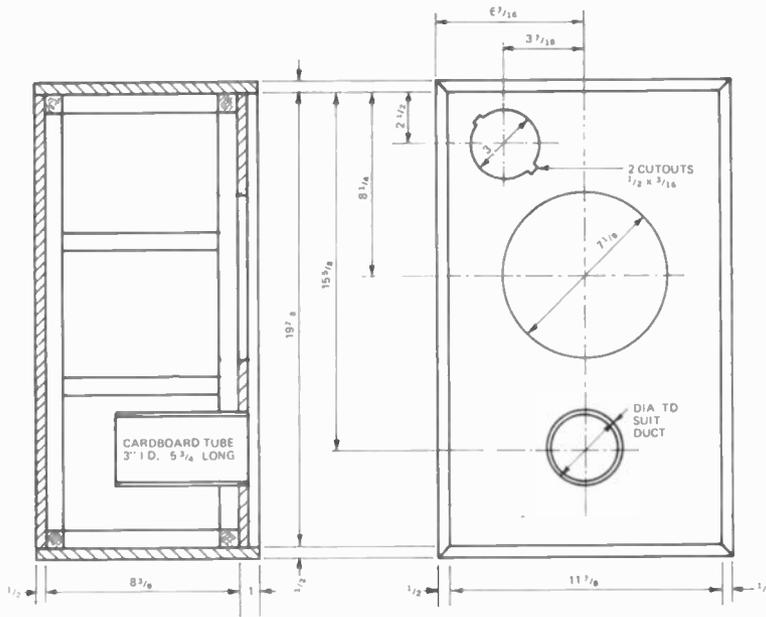


Fig. 1. Cabinet dimensions.

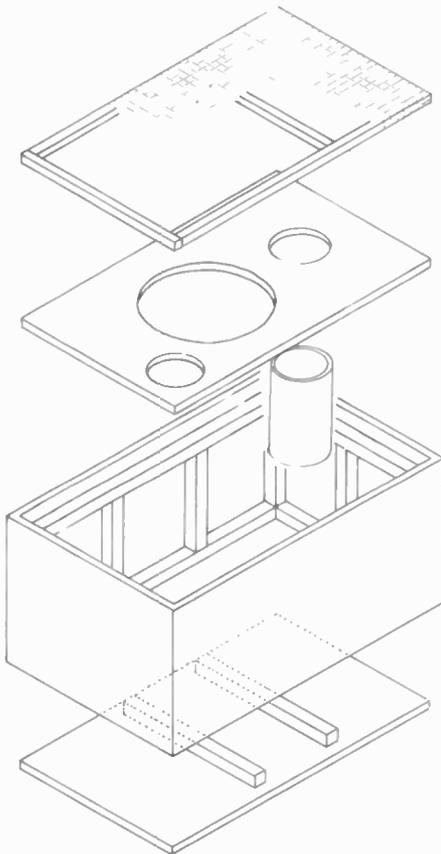


Fig. 2. Cabinet assembly.

Fig. 3. Crossover network.

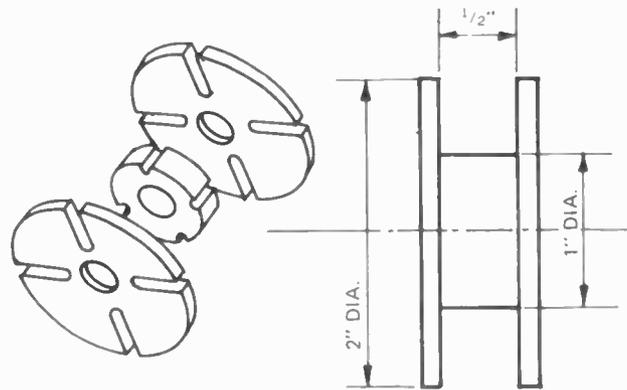
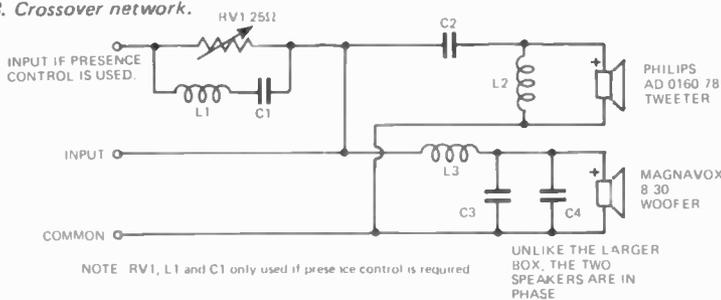


Fig. 4. Suggested construction of former for winding coils L1, L2 and L3. Wooden former is held together by centre bolt — here removed. Any suitable construction may however be used providing dimensions follow drawing on right.



The Philips type AD 0160/T8 tweeter.

acoustical consultants overcame this problem very ingeniously by including a 'presence' control which in effect 'lifts' the midrange frequencies by slightly attenuating the lower bass and upper treble.

This midrange attenuation is not quite as pronounced with the smaller enclosure, and whilst in our opinion the presence control is a very worthwhile addition — especially when used with an amplifier of the performance capability that we have built into the overall system — it may be omitted by those seeking reasonable performance at minimum cost.

CONSTRUCTION

In keeping with our overall concept of portability, the smaller enclosure is constructed from thinner material than the larger unit. Half inch particle board is used and the essential rigidity maintained by internal bracing.

Construction is quite simple and simple butt joints are used throughout. The dimensions given must be followed closely. All joints must be both glued and screwed — the final enclosure must be airtight.

The back panel must be a good fit and should be held in place by at least 12 screws. A rubber gasket should be fitted between the back panel and the

difference between them.

The larger 8-30 enclosure was built as a bass reflex unit because that is the optimum design for the Magnavox bass driver.

The technique has also been adopted for the smaller unit — and so whilst the efficiency of this new unit is slightly lower than that of its bigger brother it is still a lot more efficient than most other units of similar size. Apart from the difference in absolute sound levels the performance of the two enclosures is virtually identical.

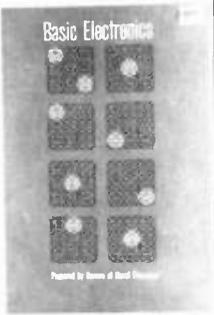
PRESENCE CONTROL

As described last month, one problem that arose during development was that the output of the Magnavox 8-30 bass driver at low frequencies — and of the AD 0160/T8 Philips tweeter at high frequencies — was greater than the midrange output of either. This resulted in a slight dip in the midrange — but not one of such magnitude that a separate midrange driver was really justified. Our

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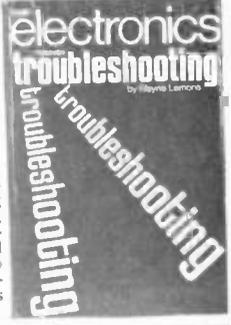
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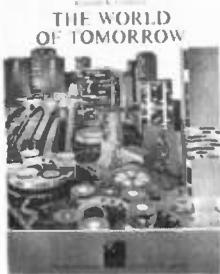


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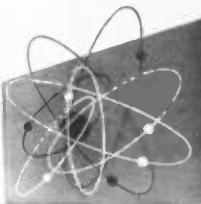
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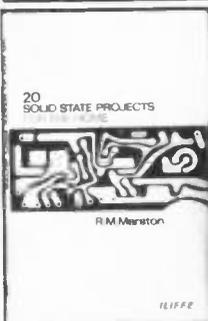
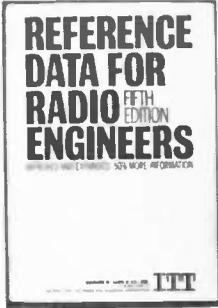


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MINI-MAGNAVOX 8-30 ENCLOSURE

main body of the enclosure if there is any doubt about airtightness.

The presence control (if fitted), and the input terminals should be located on a suitable rectangular aluminium strip recessed into the back panel. Again this must be airtight.

All inside surfaces except the front panel should be lined with a two inch thickness of soft fibreglass.

The Magnavox 8-30 bass drive unit should be mounted from the rear of the front panel using four suitable nuts and bolts. The Philips tweeter on the other hand *must* be mounted from the front of the front panel. A gasket or some form of sealing compound should be used between the tweeter mounting frame and the front face of the enclosure to ensure an airtight seal.

The presence control and crossover network are identical to those used in the larger enclosure. Figure 2 shows the circuit diagram. The three coils, L1, L2 and L3 are identical. Each consists of 109 turns of 20 gauge B&S enameled copper wire. These coils are shown in Fig 3. Once wound, the coils should be tied in several places, removed from the former, and then dipped in clear varnish or laquer and left to dry. (Each coil will require approximately 4 ozs of wire). Remember that you need six coils for two enclosures.

Capacitors C1, C2, C3 and C4 are Philips type 344 25685, 6.8uF, 100V.

When connecting the crossover and presence network ensure that the speakers are connected with the polarity shown. (NOTE — the correct polarity for the smaller enclosure is not the same as that for the larger unit). The positive terminal on the Philips tweeter is identified by a red spot. The equivalent terminal on the Magnavox driver has a red insulating bush.

The crossover and presence control components should be wired onto a suitable piece of Veroboard and located within the enclosure in any convenient place.

Connections within the speaker enclosures, and from the enclosure to the amplifier, should be made using twin flex not lighter than 14/0076.

The Magnavox driver and the Philips tweeter can be obtained from the majority of kit parts suppliers — many of whom can also supply all woodwork for the enclosures.

Build these speakers carefully and you can be confident that the results will be at least as good as many professionally built enclosures costing many times the price.

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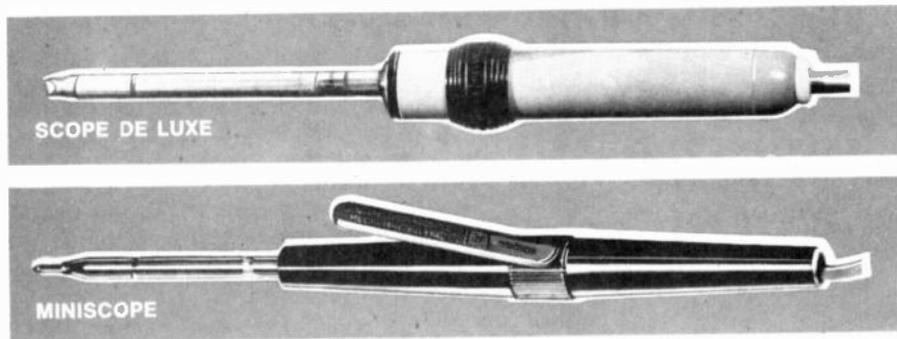
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CROWN IC150 PREAMPLIFIER

UNLIKE a number of present day audio equipment manufacturers, Crown put performance before price. They appear to build to a specification rather than a marketing formula.

The Crown Preamplifier, type IC-150 is built as a self-contained unit and may be used in conjunction with any suitable power amplifier, although it is of course primarily intended for use

with the Crown DC150 or DC300. It contains all tone controls and selection facilities normally to be found on most combined amplifiers.

The front panel is constructed with a polished aluminium section consisting of three horizontal raised ribs; one at the top, one approximately two thirds down and one at the bottom. The top section contains all the control knobs

We test the
Crown IC-150
preamplifier
and DC 300
main amplifier.

IMPERIAL

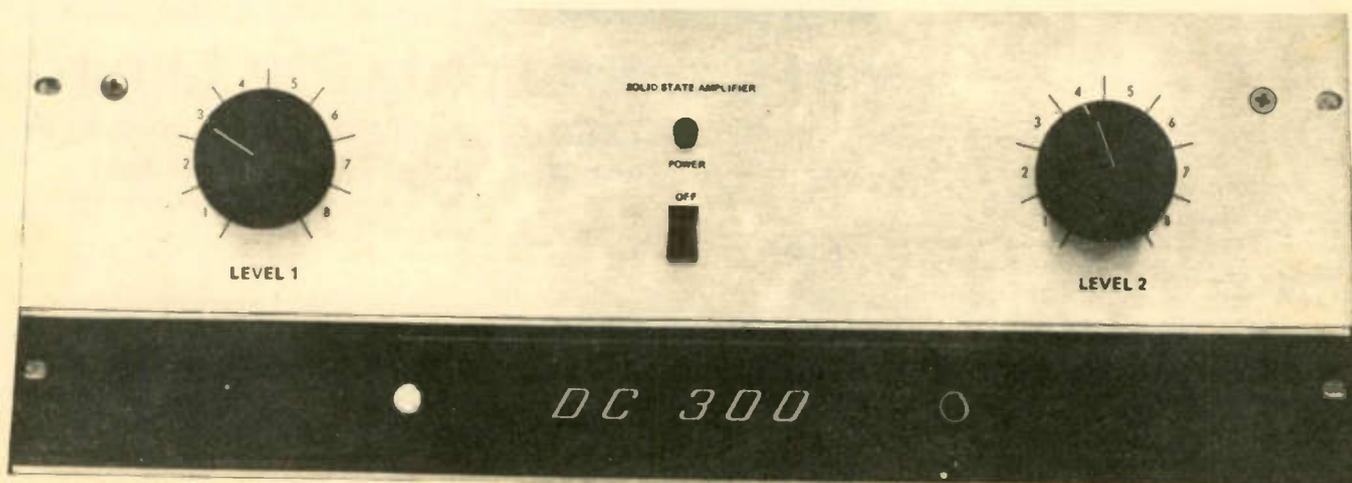
CROWN DC300 MAIN AMPLIFIER

The Crown DC 300 is a true laboratory power amplifier. Even its external appearance, with two large volume control knobs and rack mounting facilities, has a truly professional appearance.

In some respects the Crown DC 300 matches the IC-150 preamplifier, the front panel having a black trim across

the bottom part of the panel and a brushed aluminium top section.

The level control knobs are located at either end of the brushed aluminium section with a power switch located in the centre of the panel and a small neon indicator above the switch. The lower black section contains a removable centre panel retained by two, chromed



which are backed by a brushed aluminium escutcheon plate. The bottom section contains five push buttons and is finished with an imitation black leather facing. The fluted black plastic control knobs are fitted with brushed aluminium caps and, from left to right, provide the following facilities:—

- a) input selector with positions for phono 1, phono 2, tuner, auxiliary 1, auxiliary 2, tape 1 and tape 2.
- b) volume control
- c) balance control
- d) panorama control with three positions; namely, normal stereo, mono, reverse stereo.
- e) dual concentric bass controls with boost, cut and flat positions.
- f) dual concentric treble controls with boost, cut and flat positions.

A small "push on" "push off" button located between the selector switch and volume control, switches the loudness circuit in and out. A similar push button located between the bass and treble control switches the bass and treble controls out of



circuit to give a flat frequency response.

Five rectangular push buttons centrally located in the bottom part of the front panel provide monitoring of tape 1 or tape 2, selection of high or low filters, and mains on.

All input and output sockets are

located at the rear, on a recessed horizontal panel, (as opposed to the more common location on the vertical back panel). The left hand end of this panel contains five 2-pin power outlets, four switched and one unswitched.

Adjacent to these sockets on the

POWER

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knurled-head screws. Removing this panel exposes five fuses and four dc balance adjusting potentiometers. This panel also has four replacement fuses clipped to the back of it.

All input and output terminals are located on the rear panel between the power transformer, which is located in the centre of the panel, and the respective channel heat sinks, located one at each end of the rear panel. The inputs are standard ¼" tip and sleeve sockets. The outputs connections for each channel are located behind removable metal boxes and consists of a ¼" tip and sleeve socket and two banana plug sockets, one coloured red and the other black. Presumably the covers are fitted to minimize accidental removal of the output leads.

Behind each end panel a slide switch is located for selection of the desired VA overload characteristics. This switch has two positions marked Hysteresis and Normal.

The Hysteresis position will tolerate much greater reactive VA phase relationships at a given power output and is therefore recommended for

inductive loads — such as loudspeakers. The Normal position, with its closer tolerances, is mainly for laboratory applications and, in most instances, will limit the power output so that the fuses will not blow, even when the output terminals are shorted.

The amplifier circuit consists of a transistor preamplifier stage driving a single ended push-pull stage with four

Westinghouse 2N 3773 transistors as the final power stage. The overload circuit consists of two transistors in a feedback loop which varies the base bias of the first transistors in the main amplifier.

MEASURED PERFORMANCE

The measured performance was very good and in most respects was equal to



MEASURED PERFORMANCE OF CROWN PREAMPLIFIER, MODEL IC-150 SERIAL NO. 1471.

Frequency Response	20 to 20kHz $\pm\frac{1}{2}$ dB	
Channel Separation	100Hz	44dB
	1kHz	44dB
Signal to Noise Ratio		
Phono Input	52dB	
Auxiliary Input — Stereo Mode	88dB	
	— Mono Mode 78dB	
Intermodulation Distortion	960Hz and 1kHz	0.01%
Input Sensitivity for Rated Output of 2.5V		
Input	mV	Input Impedance
Tuner	225	100k Ω
Auxiliary 1 & 2	225	100k Ω
Tape 1 & 2	225	100k Ω
Phono	0.75	47k Ω
Harmonic Distortion	Less than 0.001%	
Tone Controls		
Bass	14dB Boost	at 50Hz
	15dB Cut	at 50Hz
Treble	14dB Boost	at 10kHz
	15dB Cut	at 10kHz
Loudness Control	17dB Boost	at 50Hz
	3dB Boost	at 10kHz
Low Filter	4dB Cut	at 50Hz
High Filter	11dB Cut	at 10kHz
Price —	\$554	

IC-150

right hand side are two screw terminals. These have a jumper wire installed at the factory. Open-circuiting these terminals de-energises a muting relay which shorts the preamplifier outputs to earth. A remote switch may be connected between these terminals to provide remote silencing of the output as required. The left hand end of the panel contains eleven pairs of R.C.A. sockets — four pairs for outputs and seven pairs for inputs. Two pairs of output sockets are for tape 1 and tape 2 recorder inputs, the other two pairs are for connecting to power amplifier inputs. One somewhat surprising omission was a headphone socket for monitoring with the speakers isolated.

ELECTRONIC CIRCUITRY

The circuitry is very simple and is all contained on two printed circuit boards, with the exception of the power transformer, the wafer type selector switch and the five push buttons. The smaller of the two boards measuring 2" x 3½", contains the two phono input preamplifiers and is mounted internally on the back panel in close proximity to the phono input

DC300

the manufacturer's specifications. Very low hum and noise figures and a typical noise spectrum are detailed in the instruction manual and we checked these by examining a detailed 3.16Hz bandwidth spectrum analysis of the noise. It is interesting to see the extent of the harmonic content due to the mains frequency — in particular the third and fifth harmonics.

The intermodulation distortion and harmonic distortion at the rated output was much lower than we have measured on any previous power

amplifier, being less than 0.1% at the rated output of 150 watts (both channels driven to full power.) However, for any audio application, harmonic or intermodulation distortion below 0.1% in an amplifier is of no real advantage because of three significant factors:—

- source distortion
- speaker distortion
- the masking characteristics of the human ear.

Source distortion, be it from a record or a tape lies typically between 1% and 10% and can be as high as 20% on peaks or transients. (These figures, of

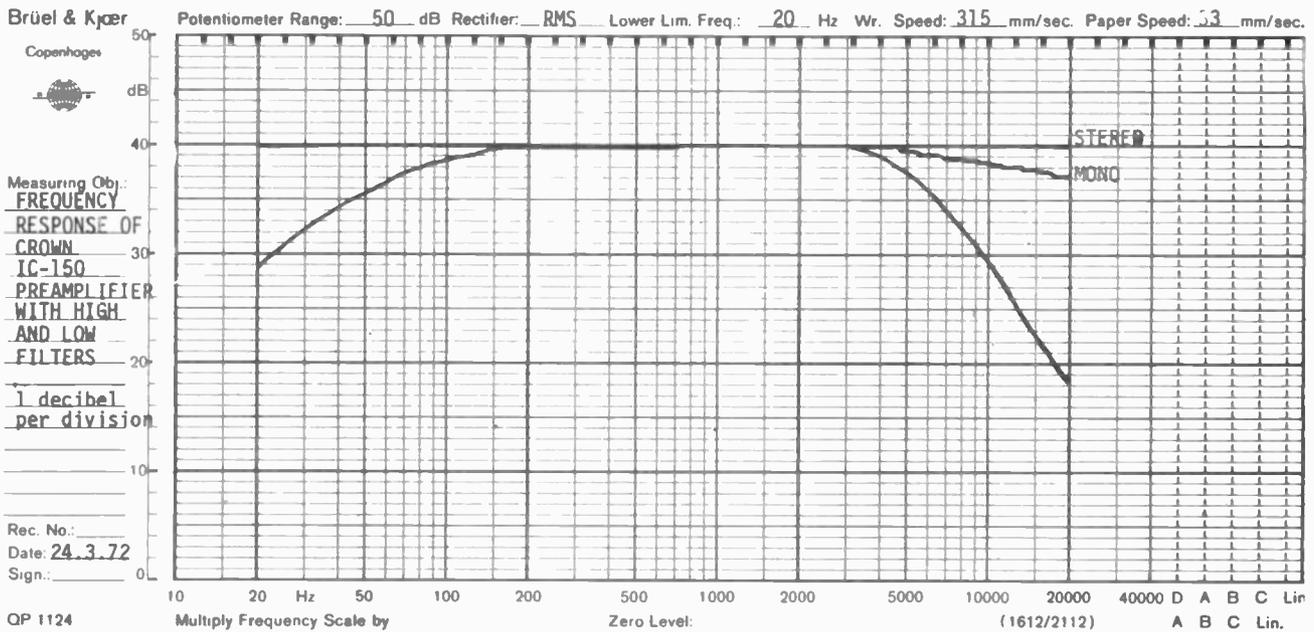
course, are the sum of the distortion on the record or tape and the distortion generated in the pick-up or tape deck.) Speaker distortion is dependant mainly on the power input, and for normal listening levels lies typically between 0.5% and 10%.

One of the curious effects of the human ear which makes correlation of instrument analysis to subjective assessment very difficult and complex, is the phenomena known as masking. Considerable research has been conducted by numerous organizations into this effect and has resulted in the publication of the International Organization for Standardization. Recommendation No R532 "Procedure for Calculating Loudness Level."

If a fundamental exists together with its second and higher order harmonics then it is possible for the harmonics to be audibly masked by the fundamental. Assuming the fundamental is 500Hz at a sound pressure level of 90 dB then, if the second harmonic is below 65 dB, it will be inaudible. Similarly, if the third harmonic is below 30 decibels it will also be inaudible. These levels correspond to distortion levels of 5.5% and 0.1% respectively for the second and third harmonics. However, not only would a level of 30dB be lost in

MEASURED PERFORMANCE OF CROWN DC300 POWER AMPLIFIER, SERIAL NO A-1859

Frequency Response:	20Hz to 20kHz $\pm\frac{1}{2}$ dB
Power Output (8 Ω load-rated input 1.75V)	145W both channels driven 155W one channel driven
Channel Separation (at rated output)	100Hz—84dB 1kHz—84dB
Signal to Noise Ratio (at rated output)	110dB
Total Harmonic Distortion	Less than 0.02% 20Hz-20kHz
Intermodulation Distortion (1kHz and 960Hz)	0.02%
Dimensions (rack mounting)	19" wide x 7" high x 9¾" deep
Weight	40lbs
Price —	\$1075



sockets. Each channel has gain adjusting potentiometers with adjusting screws protruding through the rear panel.

The second printed circuit board, measuring 13" x 3", contains all the control potentiometers, the muting relay, and the two integrated circuits preamplifier output stages. The IC's

are fitted into solderless receptacles to facilitate easy replacement and to eliminate possible thermal damage during the soldering process. The power transformer is fully encapsulated and located in the far right hand corner when viewed from the front. The most interesting feature of the circuit is the "Panorama"

control which consists of two potentiometers and one three position rotary switch ganged together and wired to provide variable stereo spread from full normal stereo through mono to reverse stereo.

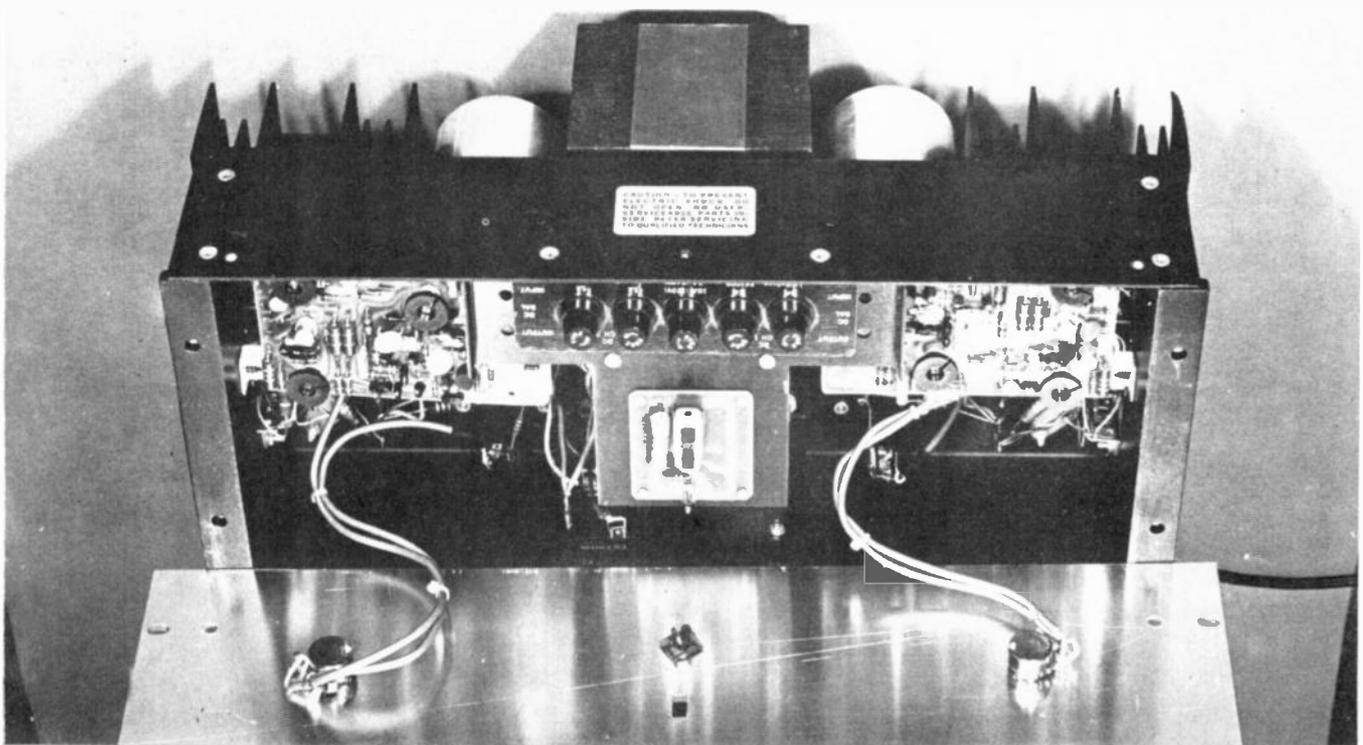
The IC's used are Motorola, type 3490 operational amplifiers with the

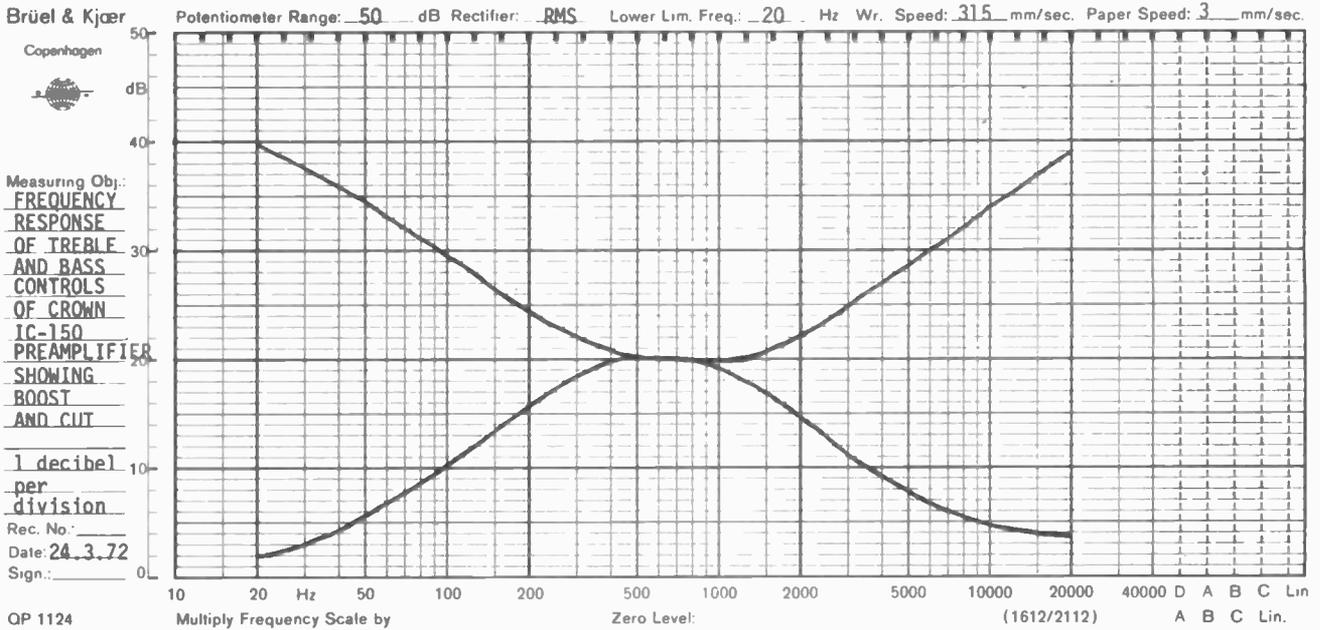
background noise under most listening conditions but a level of 90 dB is approximately 20 to 30dB higher than normal listening levels.

Because of all these factors it is impossible under most listening conditions to detect distortion less than 1% (ie 40dB below the level of the fundamental). On a theoretical

basis the sum of the individual distortion components is additive on an RMS basis. Therefore if we assume a speaker distortion of 0.5%, an amplifier distortion of 0.1% and a source distortion of 1% the resultant distortion is only 1.122%. Even if we ignore the amplifier distortion the resultant level is still 1.118%, a

difference of 0.004% which cannot be detected by most instruments or the human ear. Going a step further, most sources, be they tape recorders, record players, or even a live performance, rarely have a signal to noise ratio exceeding 50dB, which is equal to a distortion level of 0.3%. Even if the signal to noise ratio was 60dB, which





IC 150

bass and treble controls in the feedback circuitry.

The measured performance was very good with most parameters being equal to or better than the manufacturer's specification.

Harmonic distortion was exceptionally low — it was literally unmeasurable being below our source harmonic distortion of 0.012%!

INSTRUCTION MANUAL

The 27 page instruction manual is a loose leaf volume with a plastic multi-ring spline. It is divided into two

sections: No 1, General Operation, and No. 2, Technical Description. The page labelled "From Box-to-Bach in 7 minutes 30 seconds" adequately describes the connections necessary for immediate operation but shows the cable between the preamplifier and amplifier incorrectly connected to the "tape one" record output which in

DC 300

most professional equipment does not exceed, the equivalent distortion level is still only 0.1%.

The intermodulation characteristics of the Crown DC 300 were measured at 0.2% at rated power and this is

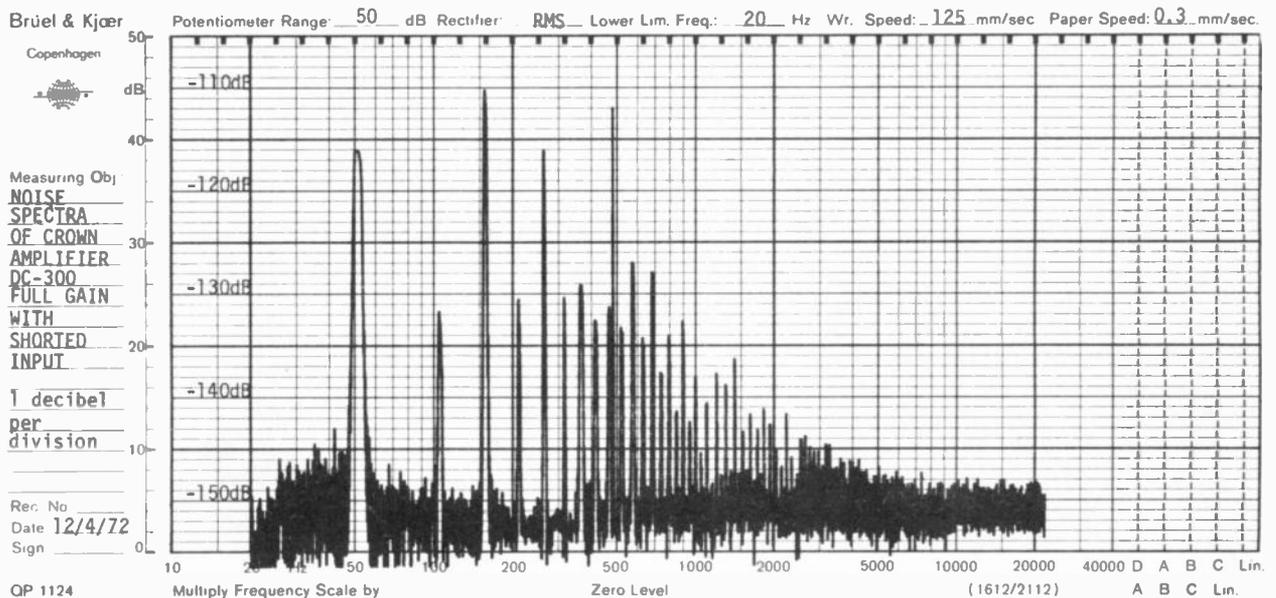
particularly good by any standard. Such a performance is exemplary, it is in fact better than one would normally require for even the most exacting application.

SUBJECTIVE TESTING

Subjective tests were performed with good quality speakers and different

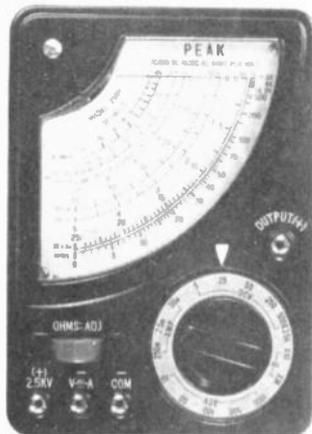
high quality audio amplifiers to assess whether any audible difference could be detected between the Crown DC 300 amplifier with its known exceptionally low distortion characteristic and other amplifiers with distortion characteristics varying between 0.05% and 0.01%. However in every case it was impossible to detect

(Continued on page 71)



PEAK QUALITY MULTIMETERS

VALUE PACKED



200-H. 90 quadrant meter. Pocket size.
AC/V : 10V 50V 100V 500V 1,000V
 (10,000Ω/V)
DC/V : 5V 25V 50V 250V 500V 2,500V
 (20,000Ω/V)
DC/A : 50μA 2.5mA 250mA
OHM : 6kΩ 6MΩ
Capacitance : 100pF to .01μF. 0.01μF to 0.1μF
db : -20db to +22db
Audio Output : 10V 50V 100V 500V 1,000V AC
Approx. size : 4½" x 3¾" x 1-1/8"

\$15.50



A-10/P. Giant 6½" Meter. Inbuilt signal injector. Overload-Protected.
AC/V : 2.5V 10V 50V 250V 500V 1,000V
 (10,000Ω/V)
DC/V : 0.5V 2.5V 10V 50V 250V 500V 1,000V
 at 30,000Ω/V 5,000V (10,000Ω/V)
DC/A : 50μA 1mA 50mA 250mA 1A 10A
AC/A : 1A 10A
OHMS : 10kΩ 100kΩ 1MΩ 100MΩ
db : -20 to +62db
Signal Injector : Blocking oscillator circuit with a 2SA102 transistor
Approx. size : 6-2/5" x 7-1/5" x 3-3/5"

\$60.00



CT-500/P. Popular, medium-size, mirror scale. Overload-Protected.
AC/V : 10V 50V 250V 500V 1,000V
 (10,000Ω/V)
DC/V : 2.5V 10V 50V 250V 500V 5,000V
 (20,000Ω/V)
DC/A : 0.05mA 5mA 50mA 500mA
OHM : 12kΩ 120kΩ 1.2MΩ 12MΩ
db : -20db to +62db
Approx. size : 5½" x 3-5/8" x 1¾"

\$19.25



M-650/P. Plastic dial cover. Mirror scale. Overload-Protected.
AC/V : 6V 30V 120V 300V 1,200V
 (15,000Ω/V)
DC/V : 3V 12V 60V 300V 600V 1,200V
 (50,000Ω/V)
DC/A : 30μA 6mA 60mA 600mA
OHM : 16kΩ 160kΩ 1.6MΩ 16MΩ
db : -20 to +63db
Approx. size : 5½" x 3¾" x 1¾"

\$24.95



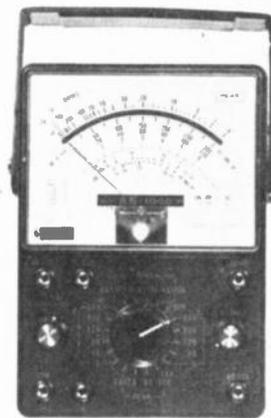
370W/P. Bench model. Overload-Protected.
AC/V : 2.5V 10V 50V 250V 500V 1,000V (4,000Ω/V)
DC/V : 0.5V 2.5V 10V 50V 250V 500V 1,000V (20,000Ω/V)
DC/A : 50μA 1mA 10mA 100mA 1A 10A
AC/A : 100mA 1A 10A
OHM : 5kΩ 50kΩ 500kΩ 5MΩ 50MΩ
db : -20db to +62db
Approx. size : 7" x 5¼" x 3-1/8"

\$57.50



OL-64D/P. Popularly priced model, rugged construction. Overload-Protected.
AC/V : 10V 50V 250V 1000V
DC/V : 0.3V 1V 10V 50V 250V 500V 1000V 5000V
DC/A : 50μA 1mA 50mA 500mA 10A
OHM : 4kΩ 400kΩ 4MΩ 40MΩ
db : -20 to +62db
Approx. size : 6" x 4-1/5" x 2"

\$21.55



AS-100D/P. High 100,000 Ω/Volt sensitivity on DC. Mirror scale. Protected-movement.
AC/V : 6V 30V 120V 300V 600V 1200V (10,000Ω/V)
DC/V : 3V 12V 60V 120V 300V 600V 1,200V (100,000Ω/V)
DC/A : 10μA 6mA 60mA 300mA 12A
OHM : 2kΩ 200kΩ 20MΩ 200MΩ
db : -20 to +57db
Audio Output : 6V 30V 120V 300V 600V 1,200V AC
Approx. size : 7½" x 5½" x 2¾"

\$37.95

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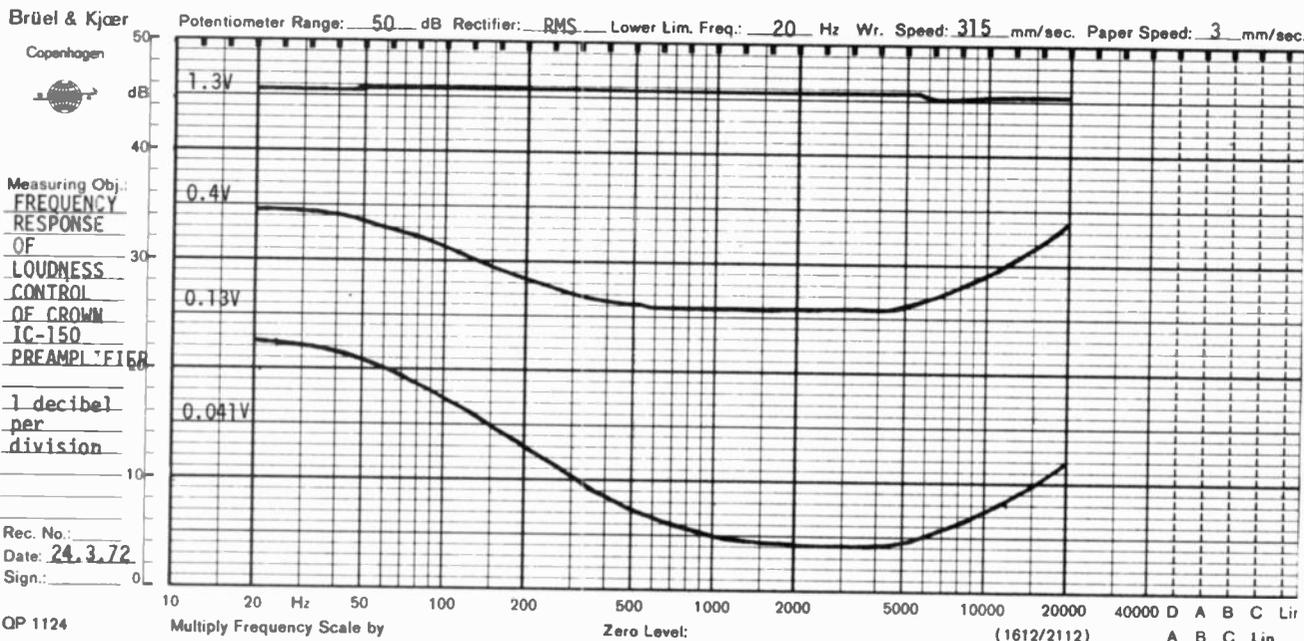
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Trim moustaches, beards, sideburns as you shave with the barber style trimmer.



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**THE NEW SUNBEAM
SUPER SHAVEMASTER SHAVER**
The most advanced shaver for all men of all ages.

LB3.3319



IC 150

fact comes out before the tone and volume controls of the preamplifier approximately 20dB below the normal output level. The technical section discusses all performance parameters in considerable detail together with graphic illustrations. It includes the

characteristics of the tone controls, loudness control, high and low filters, intermodulation distortion and harmonic distortion, etc. The manual also includes a reply paid application card for a three year warranty title, but does not describe what is covered. Presumably this three year warranty title extends the normal 90 days cover

to three years with certain conditions.

At a recommended selling price of \$554.00 the Crown preamplifier is certainly not the cheapest on the market, but it is the only preamplifier that we have seen whose harmonic distortion and intermodulation distortion was equal to or better than our measuring system.

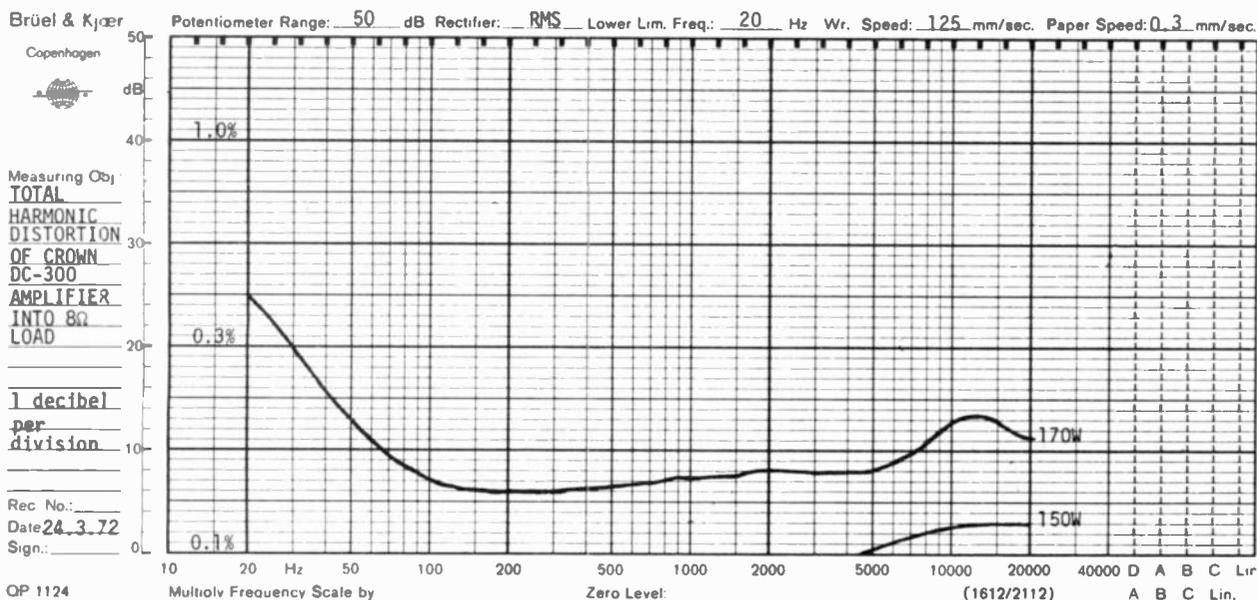
DC 300

any difference between the Crown amplifier and the other good quality amplifiers. The tests were conducted with the same programme source and

the same speakers so that the only change in the system chain was the amplifier. With a power frequency response from dc to 35kHz, this amplifier is basically designed for laboratory and control system operation and, in fact, does not

include speaker selection facilities.

More exacting requirements are necessary in certain industrial applications and, in this respect, the Crown amplifier is most certainly the best we have seen. ●



COLOUR TV

Latest colour TV camera uses advanced techniques.

THE third generation of colour TV cameras has arrived! This claim was made by Thomson CSF of France when introducing their new TTV1515 colour camera to Australian television engineers during a demonstration in the studios of TCN 9 Sydney.

What is meant by the term "Third Generation"? One may arbitrarily divide colour cameras into three groups, each having certain discrete characteristics.

The first generation may be said to consist of those colour cameras, introduced about 1958, which weighed in the vicinity of 330 lbs, were equipped with three or four orthicon or vidicon scanning tubes, electron valve circuitry and fixed focal length objective lenses. Many hours of tedious adjustments were required to produce pictures which were generally of low quality and had poor stability.

The second generation cameras made their advent about 1965 and were fitted with the more stable lead-oxide vidicon tubes and utilized transistor circuitry. These cameras had markedly better stability and performance but still weighed a cumbersome 220 lbs. Both first and second generation systems required heavy and bulky cables from camera to camera-control unit (CCU). These cables had a diameter of the order of 1¼ inches, weighed about 1lb per foot, and were limited to a maximum length of the order of 300 metres. Colour registration was difficult to obtain and required frequent adjustment. All these factors tended to limit the use of colour cameras to the studio, their use in outside broadcasts (OB vans) was an



Fig. 1. Thomson TTV 1515 Colour Camera.

extremely difficult and muscle stretching exercise.

The third generation cameras, as exemplified by the Thomson CSF TTV 1515, have the following features:

1) Reduced weight and bulk, of the order of 110 lbs and 1.8 cubic feet, making the camera easily transportable.

2) The camera cable is reduced to a single coax with small cross section

(0.4 inch) and a maximum permissible length of 2000 metres.

3) Simplified operation by the use of automatic control for colour registration, synchronization and setting etc.

4) Reduced power consumption, 250VA for the complete camera channel and 130VA for the camera alone.

5) A notable increase in performance

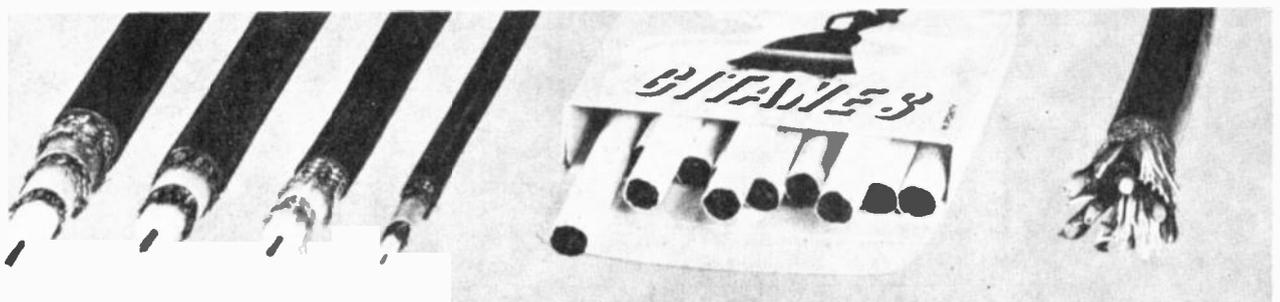


Fig. 2. On the left are the single coaxial cables used with the new camera (the larger diameter cables are for lengths exceeding 500m), On the right is seen a typical multi-core camera cable used with earlier generation cameras.

CAMERA

—*THIRD GENERATION*

as regards sensitivity, resolution and colour reproduction.

6) Interchangeable, servo controlled, zoom lenses.

7) The extensive use of hybrid thick-film integrated circuits to provide the equivalent of 3000 discrete transistor functions.

THE SINGLE COAXIAL CABLE

One of the most interesting features of the system is the method used to reduce the connecting cable complexity. Earlier cameras, as stated earlier, required a bulky cable which typically contained seven coaxial lines and 85 single conductors. These cables were useable in 50 metre lengths up to a maximum of 300 metres and were in fact, one of the main sources of failure in the system.

The TTV1515 overcomes these requirements by the use of multiplexing, thus allowing all data and power to be transmitted via a single coax, sometimes called a triax because of an extra external sheath.

The information transmitted by this single coax cable is as follows:—

1) The camera power, -130 volts at 1 amp.

2) Forty six engineering channels from the CCU to the camera are pulse width modulation, multiplexed within the lower 3MHz of the control cable frequency spectrum.

3) CCU to camera viewfinder video data is transmitted as an AM modulated 58MHz carrier with a bandwidth of 7MHz.

4) The camera to CCU B, R and ψ video signals are AM modulated onto 9MHz, 22MHz, and 36MHz sub-carriers respectively. The R and B channels have a 3MHz bandwidth, and the ψ channel, known as the pseudoluminance channel, has a 6MHz bandwidth.

5) Ten camera to CCU engineering signals are transmitted on the total three channels during the image erasure time.

The total camera to CCU frequency spectrum is as shown in Fig. 4 and extends from dc to 70 MHz. The external sheath of the cable carries only cable integrity information and ensures an equipotential earth between camera and CCU.

AUTOMATIC TIME REGISTRATION

Three-colour sampling involves breaking down the elements of a colour picture into three independent, separately processed pictures. The separation is maintained throughout

the camera sequence and the picture is then reformed by superimposition on the picture tube screen. For the reformed picture to be faithful, sharp and free from coloured fringes, the three primary video signals must be rigorously overlaid and must remain so in time.

In previous cameras, lack of accuracy in registration severely limited the resolution of detail obtainable.

This difficulty arose because of the small size of the camera tube target (10mm x 16mm) which means that vertical detail will be of the order of 10 microns, that is, one-thousandth of image height. A fourth vidicon was therefore used in the cameras, its sole purpose being to provide the detail that was lacking in the super-imposed colour image.

The least mechanical shock or electrical drift, no matter how small, impaired the overlap of the three primary images, making the picture unuseable unless the camera was readjusted, which in fact was necessary several times a day.

This was the situation until the introduction of the novel TTV 1515 system of automatic registration. This system allows the camera registration to be automatically set and maintained permanently without limitation in time, or, without the need to arrest the image, irrespective of its content.

This is accomplished by optical references which are injected into the separator at the level of the objective's image plane, and are therefore common to the red, green and blue channels. These references take the form of two light sources provided by microprisms and optical fibres, along the edge of the image's useful field, but external to the image. These are sampled during the time the image is suppressed.

These references are extracted from each of the R, G and B video data and compared with fixed electronic references for the purpose of generating error voltages. The error voltages are used to correct the twelve scan functions (amplitude, and horizontal and vertical framing of the R, G and B channels) in such a way as to ensure perfect registration.

Starting with a misalignment of 5%, the camera will automatically achieve

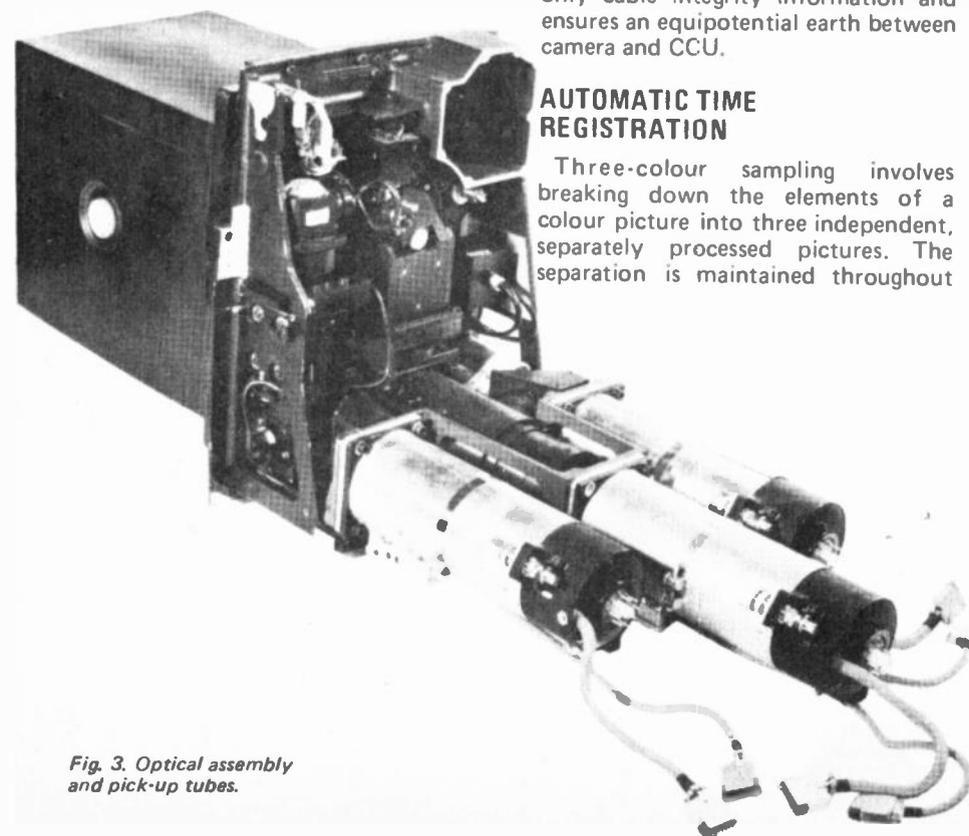


Fig. 3. Optical assembly and pick-up tubes.

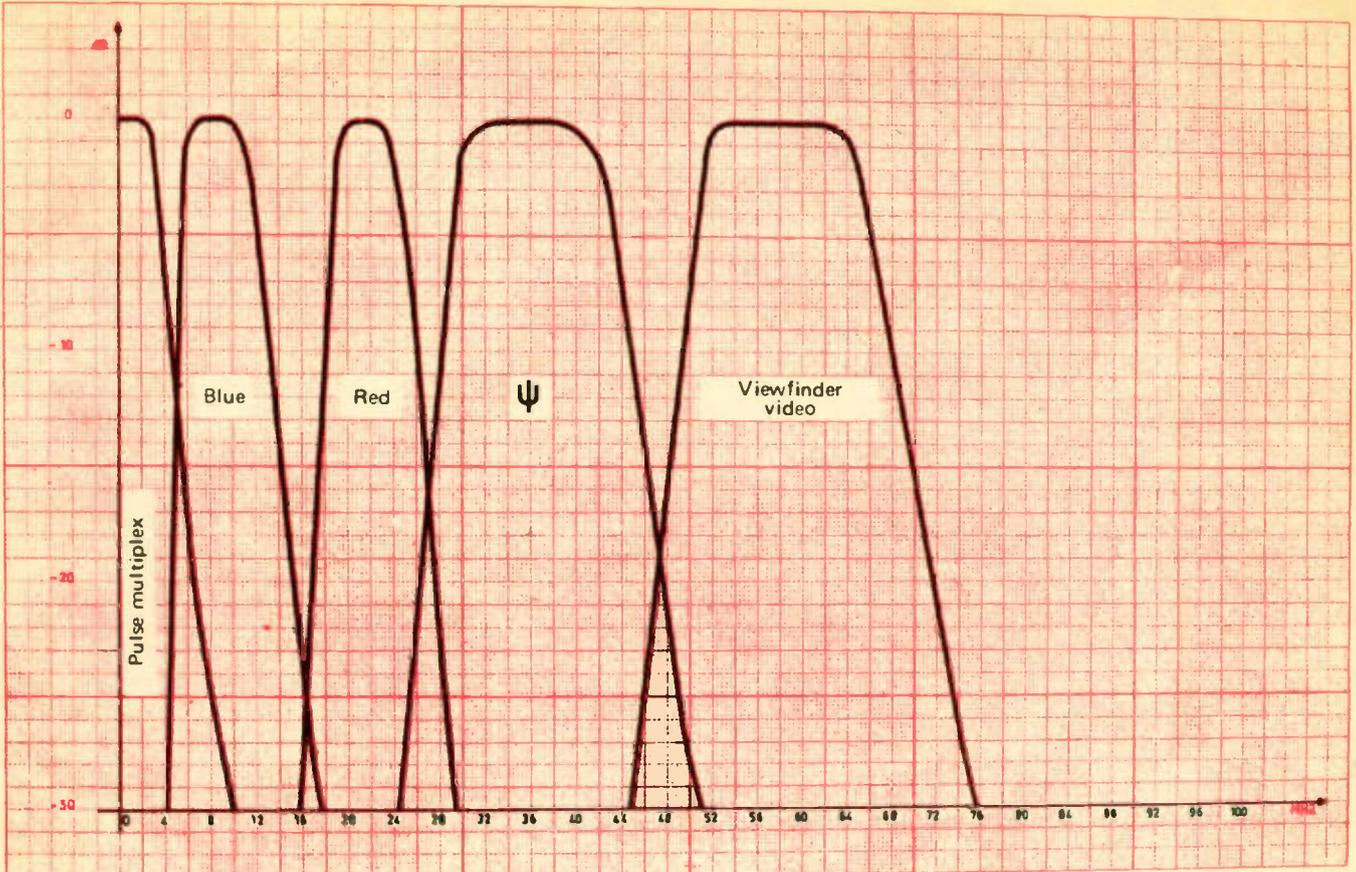


Fig. 4. Distribution of rf multiplex frequencies.

Fig. 5. Block schematic drawing of camera control unit.

registration within eight seconds and maintain it to within 0.05%.

MICROELECTRONICS

These new facilities and this kind of performance would have been impossible in the previous generation of cameras, or else would have necessitated an inordinate amount of equipment. Nor would they have been possible within the volume of the current third generation camera using transistorization alone.

Only by making full use of the possibilities offered by modern microelectronics, with monolithic circuits and thin- or thick-film hybrid circuits, has this been possible.

The TTV 1515 comprises about 540 integrated circuits, 350 discrete transistors and 500 diodes. Without microelectronic circuitry about 3000 discrete transistors would have been needed and it would have been very difficult to obtain the same performance. In any event the overall volume would have gone up two or three times, which was unthinkable.

This new colour camera offers operational simplicity, precision and portability which were sadly lacking in previous equipment. We see in this camera the blending of many advanced techniques such as thick-film hybrid circuitry, signal multiplexing, remote servo controls etc. These innovations have significantly advanced the "state of the art" in colour TV transmission. ●

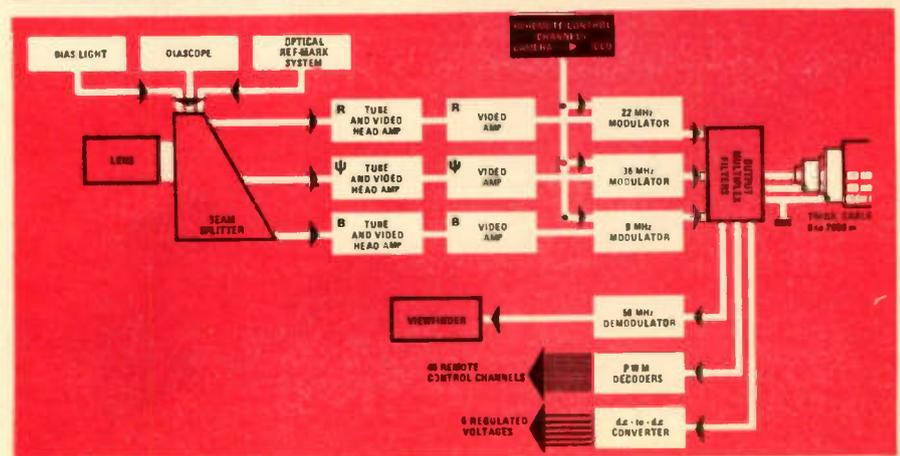
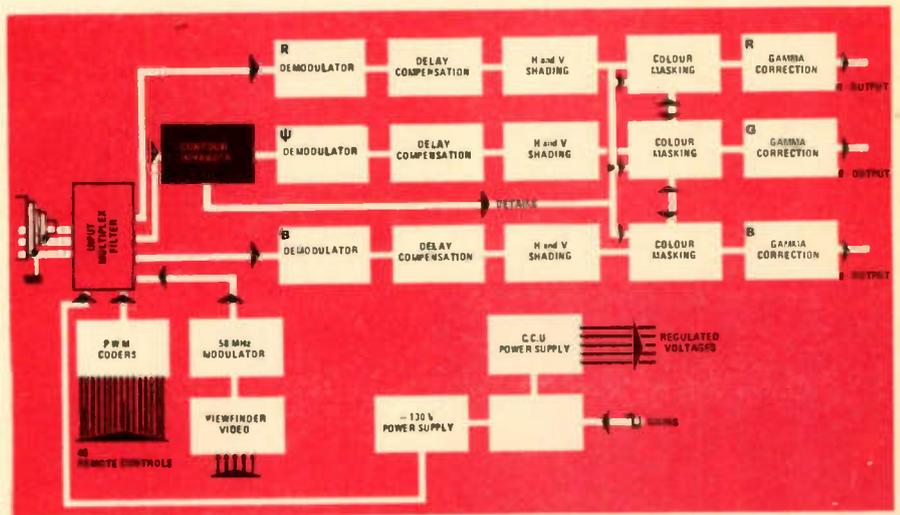


Fig. 6. Block schematic drawing of camera.

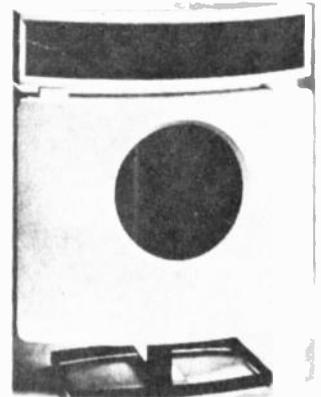
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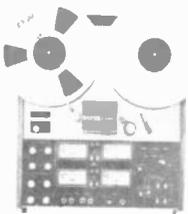
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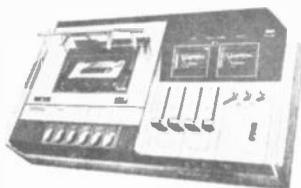
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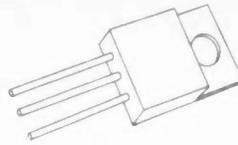
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Process Control Equipment	X	X	X	X	
Reproduction Equipment		X	X	X	
Blender, Mixers	X				
Hand Tools	X				
Machine Tools/Misc. Mfg.	X		X		
Photographic Equipment	X	X			
Vending Machines	X	X	X		
Internal Combustion					
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 - RECIRCULATING REMAINDER *A/D CONVERSION
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- *Patent Pending

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GLIDING TIME

Unique time-recording system dramatically improves employer/employee relationships — Jan Vernon reports.

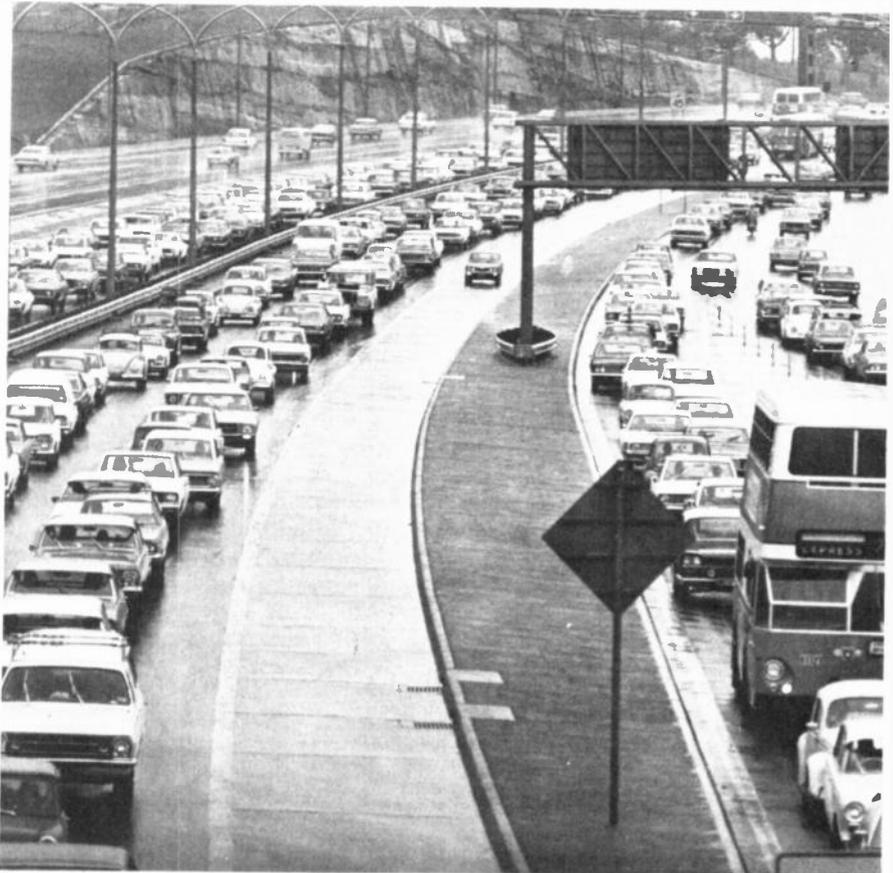
A NEW time-recording system is dramatically improving employer/employee relations in factories throughout Western Germany.

Whilst very simple, the concept, known as 'gliding time' is probably unique in the history of management and labour relations.

Basically, fixed times of arrival and departure are replaced by a working day which is split into two different types of time. The main part of the day is the 'core time'. During this period all employees must be at their jobs. The gliding time, or flexible time, is at the beginning and end of each day and during this time it is up to the individual to choose when he or she arrives and leaves.

The system can be adapted to suit the organization concerned. One company might decide on a core time of 10 a.m. to 4 p.m., with 8.30 a.m. to 10 a.m. and 4 p.m. to 5.30 p.m. as bands of flexible time. Another company might decide on the same core time with a wider spread of flexible time: say from 7 a.m. to 10 a.m. and 4 p.m. to 7 p.m. Lunch hours can either be fixed or included in the flexible time spread. The employee's only concern is to work the contracted number of hours and to be present during core time.

The new scheme has advantages for both management and employees. Management in companies where the scheme has been tried say it reduces absenteeism. Employees can attend to personal business either before or after they start work in the morning, or finish in the afternoon, instead of taking time off as in the present system. People can work to their normal rhythm, for some are 'morning people', at their best early in the day, others are 'afternoon people', and not properly awake until at least 10 a.m., and most productive later in the day. In Germany it has been found that by allowing employees to start at the time



best suited to themselves, management gets them at their brightest and most productive. And they arrive in better shape if they can plan their journey to work to miss the peak hour.

Using the gliding time system employees have the freedom to shop and to travel at off-peak times. They have the privacy of being able to attend to personal business without having to explain why they want time off. The whole concept of punctuality is abandoned and with it goes the stress caused by having to be at the office at an exact time. Indeed under the conventional system it is not uncommon for employees to take a day off rather than arrive a few minutes late.

WHERE IT STARTED

The idea of variable hours was pioneered by Mrs Christel Kammerer, a management consultant at Königswinter, near Bonn. Messerschmitt-Bolkow, a manufacturer

of equipment for aircraft and satellites, installed the system in 1968. Now approximately 3,500 German companies use the system (and that's 5% of the entire German workforce!) In England a number of major firms are at present carrying out their own evaluations.

In its simplest form the employee works an agreed number of hours, possibly arriving at 8.22 a.m. and — if he's working an eight hour day — leaving at 4.22 p.m. But this is still too rigid for the full benefits to be obtained. It works best over a longer period — say a month. The employee knows how many hours a month are expected of him and it's up to him to make sure he works that number of hours.

The system integrates work and home life in a more satisfactory way, providing employees with a considerable degree of freedom, whilst at the same time improving overall company efficiency.

(Continued overleaf)

GLIDING TIME



If flexible time is introduced some changes must be made in old routines and habits. But this may well have positive benefits. Some overseas companies using the scheme announced publicly the times when all employees would be in, and found that outside callers tended to restrict their calls to these times. This gave employees a period free of interruptions each day.

Naturally there are limits on how far flexible hours can be extended. Telephonists, receptionists, commissionaires and canteen staff need to be at their jobs at set times and there are some doubts about whether the scheme can be extended to production work. But even here the idea has not been discarded completely. Firms such as Saab and Volvo are planning to abandon assembly lines, at least partially, in favour of a team work system and flexible hours could still be possible if each team came to an agreement about hours to be worked.

THE COST OF THE SCHEME

Gliding time is being promoted very strongly at the moment by Hengstler Flextime Ltd. (Hengstler make counting machines) The managing

director of the company, Willi Haller, saw the benefits flexible hours could produce and designed a counting machine specifically to handle flexible working systems.

The Hengstler machine consists of a clock connected to panels housing individual counters. The worker is issued with a coded plastic badge. When he arrives at work he pushes it into a slot and it stays there during the time he is at work. A personal counter records the number of hours the coded badge stays in place. The machine does not record starting and stopping times. It merely adds up the hours of work and carries forward the running total so the employee can tell at a glance how his score is going. The machines are expensive, costing English firms between £10 to £12 per employee to install. It is possible to operate the flexible system without the machine and one English company does this with conventional punch clocks and manual signing in. The data are processed by computer so that people can tell how their credit or debit stands at the end of each week. But the machine system allows unique flexibility and is claimed to pay for itself in benefits gained.

Flexible time has produced some

spectacular results for employers. At Messerschmitt, it brought about a 50% reduction in the number of short term absences. Productivity increased and the amount of overtime was reduced.

How would the system go in Australia?

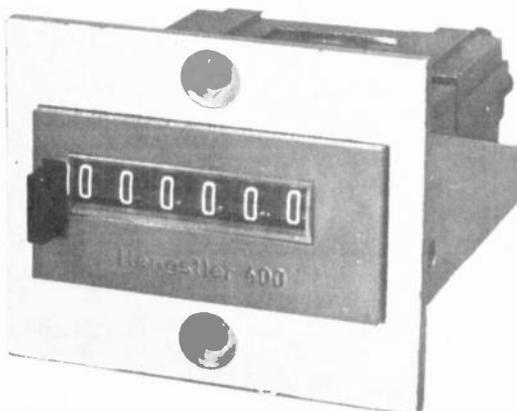
A few offices work like this already – on an informal basis – and of course people who work for themselves are free to plan their day to suit themselves. But the vast majority are involved in the 8 to 4 or 9 to 5 rat race.

There would probably be opposition to gliding time from both employers and employees, partly because some people dislike change of any kind. Valid opposition may come from unions because gliding time will cut down on overtime payments. Employees may be asked to work short hours on slack days, longer hours when the work load is heavy. Some overseas companies have handled this by raising wages to compensate for loss of extra pay, for if productivity increases then everybody gains.

Enthusiastic German employers are saying, "Why didn't we try this system before". One possible reason for the system's undoubted success is the growing realisation of the rights and needs of individual workers. People previously worked set hours because that suited the employer and no one questioned the employer's right to expect anything other than this. And of course it is only recently that we've had the sophisticated recording equipment necessary for the implementation of flexible time.

Sometime in the future we might have a system whereby we only work when we feel like it. In the meantime, flexible time seems the next best thing. ●

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Here's an outstanding new wide-range high performance loud-speaker you can't afford to miss. It has superb good looks and sounds even better. In the recommended enclosure you'll have exceptional response

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Features

Large 'O' magnet gives 20 watts RMS power handling in recommended enclosures and lower 'Q' for cleaner bass. Long throw voice coil allows extreme excursions with minimum distortion. Infinite baffle response is 35 Hz to 20 kHz.

In the recommended 1.8 cu. ft. enclosure it is 54 Hz to 20 kHz \pm 6 dB and 41 Hz to 20 kHz at \pm 10 dB. The high frequency response is a particularly outstanding feature in such a rugged speaker capable of 20 watts RMS power handling.

Specifications

Power handling capacity	20 watts RMS in recommended enclosure
Fundamental resonance	45 Hz nominal
Voice coil diameter	1"
Voice coil impedance	8 or 15 ohms
Frequency response	35 Hz to 20 kHz \pm 6 dB
Air gap flux density	1.15 tesla
Total gap flux	455 μ weber

* A woofer version, C80, is also available. Frequency response is 35 Hz to 8 kHz \pm 6 dB.

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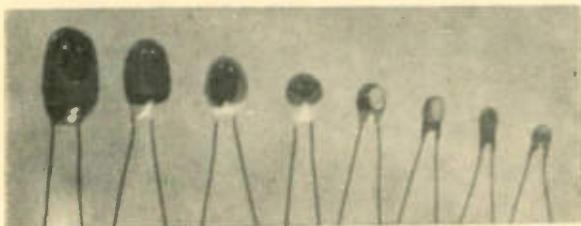
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EQUIPMENT NEWS

NEW DANA 550 MHz COUNTERS



DANA LABORATORIES have released a new range of five counters in their 8000B Series.

Each Counter provides four measurement modes: (1) Frequency (2) Period (3) Multiple Period Average (4) Totalize. Four additional modes are available on some models, providing an extended frequency range to 550 MHz, Time Interval, Time Interval Average and Frequency Ratio.

A temperature compensated crystal oscillator (TCXO) is used as the reference to eliminate long warm-up delays and to achieve optimum versatility and accuracy in a general purpose counter. A higher stability TCXO and a range of oven oscillators are available as options.

Input sensitivity is normally 50 mV to 550 MHz. However, an optional amplifier will increase this to 1mV with automatic triggering. This high sensitivity allows frequency measurements with up to 99% AM present on the signal.

Further details: Jacoby, Mitchell & Co. Pty. Ltd. P.O. Box 2009, North Parramatta, N.S.W., 2151.

POCKET DATA RECORDER

Small enough to be carried in the pocket, a miniature analogue tape recorder developed by a British firm provides four channel continuous monitoring for up to 24 hours – or, at timed intervals, for much longer periods.

Measuring only 10.3 cms by 8.6 cms by 3.6 cms, the recorder has many applications. Since it can be carried by a patient, it can be used – with suitable input transducers – to gather data on cardiac behaviour and so forth while the patient continues his normal day-to-day activities. It can be used for data logging duties in remote or hazardous areas or in aircraft, vehicles or on machines where the use of more cumbersome equipment might prove impractical.

The cassettes employed are easily changed and are widely available.

A variety of optional, plug-in amplifier, timing and other modules are available. These include carrier-modulator amplifiers for use with temperature sensors and other transducers.

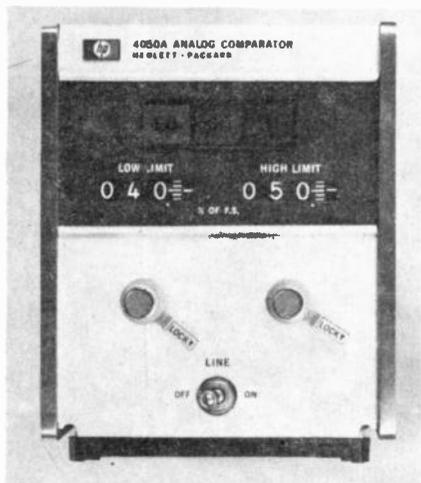
When the recorder is fitted with a timing device, information can be recorded non-continuously for up to a month without exhausting the built-in batteries.

Two versions of the recorder are available, each offering a different standard tape speed. One provides 24 hours recording time at a tape speed of 2 mm/sec and the other gives 60 minutes at 50 mm/sec. Provision is made for time markers and event recording.

A high speed playback unit, of modular construction, is used to replay tapes at 20 or 60 times the recorded speed. If required, recording can be displayed on a chart recorder or fed, on-line, to a computer for analysis.

Further details: Oxford Instruments Co. Ltd., Osney Mead, Oxford OX2 ODX, England.

HI-GO-LO TESTING



A new analogue comparator, the Hewlett-Packard Model 4050A, compares an unknown voltage with preset high and low limits. The new instrument converts any analogue instrument that has a dc output proportional to its reading into a HI-GO-LO indicator. HI-GO-LO lights are on the front

panel. A relay, operating with the lights, may be used to actuate external sorting devices. More than two Model 4050A's can be used with one analogue meter for automatic classifying.

High and low limits are set independently by digital dials. Both limits can be extended to 125% of full scale. A three position analogue voltage range switch on the rear panel sets the range to 0.1, 1.0 or 10V full scale. Polarity is selected by a switch inside the cabinet. Accuracy is $\pm 0.6\%$ of full scale with a response of 0.1 second.

The Model 4050A is packaged in a standard HP 1/3-module, 155 mm high, 130.1 mm wide and 203.2 mm deep (6-3/32 x 5-1/8 x 8 inches). It weighs 2.8 kg (6 lbs).

Further details: Hewlett-Packard Australia Pty Ltd, 22-26 Weir Street, Glen Iris, 3146, Victoria.

'VU' AND PANEL METERS

Recently announced by Ernst Turner Electrical Instruments Limited is a new range of edgewise panel meters.

One meter known as the Model 125 has a scale length of 1.25" while occupying only 0.8 sq" of panel space. This meter is available with ranges 0-100 Vdc and 50 μ A to 1A dc with internal multipliers and shunts, ranges above this can be supplied with external multipliers and shunts. By using the special Ernst Turner centre pole movement the instrument is claimed to be unaffected by external magnetic fields and nearby ferrous metals. This meter is supplied complete with internal rectifier and resistances and conforms to all conditions of the BELL LABORATORIES specification for 'VU' meters.

Another recent introduction are the '900' Series meter which are modern rectangular panel meters with moving coil, moving iron voltage and current, thermocouple, single and dual index contactless controllers and ac rectifier types for current and voltage as well as 'VU' and 'PPM'. They can all be supplied with special scales and most can be supplied with up to 50% zero suppression.

Further details: John Hadland (Aust.) Pty. Limited, 28 Chester St. Oakleigh, Victoria 3166.

GUIDE TO OSCILLOSCOPE SELECTION

A new publication is available to anyone thinking of purchasing an oscilloscope and who requires advice on various technical aspects.

Entitled "The No-nonsense Guide To Oscilloscope Selection" the publication is available free of charge. Requests should be made on company letterheads to: Literature Department, Hewlett-Packard Australia Ltd., 22-26 Weir Street, Glen Iris, Vic. 3146.

DOLBY USE WAYNE KERR TESTMATIC

Shouldn't you



The Testmatic at work at Dolby Laboratories. It can do its 58 measurements on an all-clear board in 6 seconds flat.

'If the Wayne Kerr Testmatic did not exist, it would have been necessary for us to invent it'

Dave Peacock, Head of the Test Department, Dolby Laboratories Inc.

The heart of a Dolby System noise reduction unit is a small but complex circuit board. In six-by-seven inches are assembled no fewer than 507 resistors, capacitors, diodes and transistors.

On that score alone, fault-finding is a major operation. And as Dolby's policy is to make all processors interchangeable, they have to guarantee the stability of every part of the circuit. So their electronic checkout procedure entails 58 separate DC measurements.

Said Dave Peacock, head of the Test Department: 'An interesting thing about our board is that it is specifically designed to suit the Testmatic. We began by making a thorough search of the market to see if there was a testing machine that would suit us. Had the Testmatic not

existed, we should have had to invent something very like it ourselves.

'How has it done? Well, on average we get about 2.5 faults a board. Half of these are DC faults. Thanks to Testmatic, finding and correcting them take only 10 percent of our electronic checkout effort.

'We've costed it, and we know it has saved us more than £1,000 in a year - using the TM60 for a mere 2½ hours a day. But we're stepping up output, so next year the saving should be even more impressive.

'Any teething troubles? ... I wouldn't say so. We hit a small snag about a year ago but the Wayne Kerr service was so prompt that the whole thing was really a non-problem ...'

For Demonstration or more Information contact :



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- ADELAIDE 56-7333
- MELBOURNE 69-0151
- BRISBANE 51-5121
- PERTH 25-7787
- HOBART 23-TB41
- SYDNEY 648-4711

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EQUIPMENT NEWS

EIGHT CHANNEL ANALOGUE RECORDER



An Australian designed and built eight channel analogue recording system has recently been introduced by Electrodata Associates Pty. Ltd. The model MT465 system incorporates the use of multiplex techniques to record two analogue channels on each tape track. As a consequence, the system incorporates a four track, $\frac{1}{4}$ inch tape deck thus enabling its cost to be held at less than one-half of other eight channel systems.

Bandwidth of each channel is dc – 200Hz maximum, three tape speeds are available, – 19, 9.5 and 4.8 cm/s – and separate record and playback heads facilitate immediate

monitoring of data being recorded. Each channel is equipped with its own peak reading level meter and the entire system can be readily rack mounted if desired. A voice comment can be made on track 1 of the tape when a microphone switch is pushed.

The system is seen as having many applications particularly in medicine, geophysics and vibration studies where many parameters need to be simultaneously recorded and where equipment cost considerations are important.

Further details: Electrodata Associates Pty Ltd, 8 Barry Avenue, Mortdale, NSW 2223.

SAINT LOGIC



Cimron, the instrument division of Lear Siegler Incorporated, has announced the release of a new multimeter using what they call SAINT LOGIC.

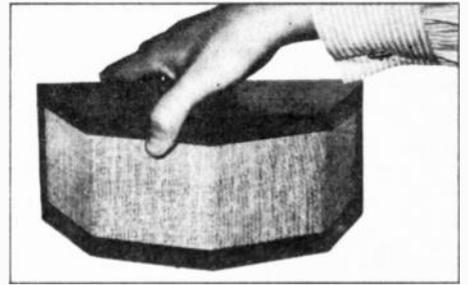
Designated the DMM 50, the new five digit multimeter offers high quality, high accuracy, high noise rejection and high speed at the same time. Saint Logic is defined by the manufacturers as a combined use of successive approximation (SA) logic

for speed, and integrating (INT) logic for its inherent noise rejection.

Multimeter capabilities include 5 ranges of dc and dc/dc ratio, 4 ranges of ac, 5 ranges of resistance, optically coupled data output and remote programming.

Further details: Warburton Franki Pty Ltd, Adelaide, Brisbane, Hobart, Melbourne, Perth and Sydney.

This is not a speaker.



it's the missing part of your speaker.

What's missing from your speaker, no matter how much you paid for it, is a high-frequency response that remains genuinely flat off axis. (The 15-kHz output of a top-rated \$450 speaker, for example, is down 12 dB at 60° off center).

The new Microstatic high-frequency speaker system is designed to give you this missing response when you connect it to any medium or low-efficiency speaker of any size or design. And we mean ± 2 dB from 3.5 kHz to 18 kHz over a 180° angle!

Microstatic won't change the sound quality of a top-rated speaker on axis, but it will make a dramatic improvement in the stereo image and overall transparency from any listening position in the room.

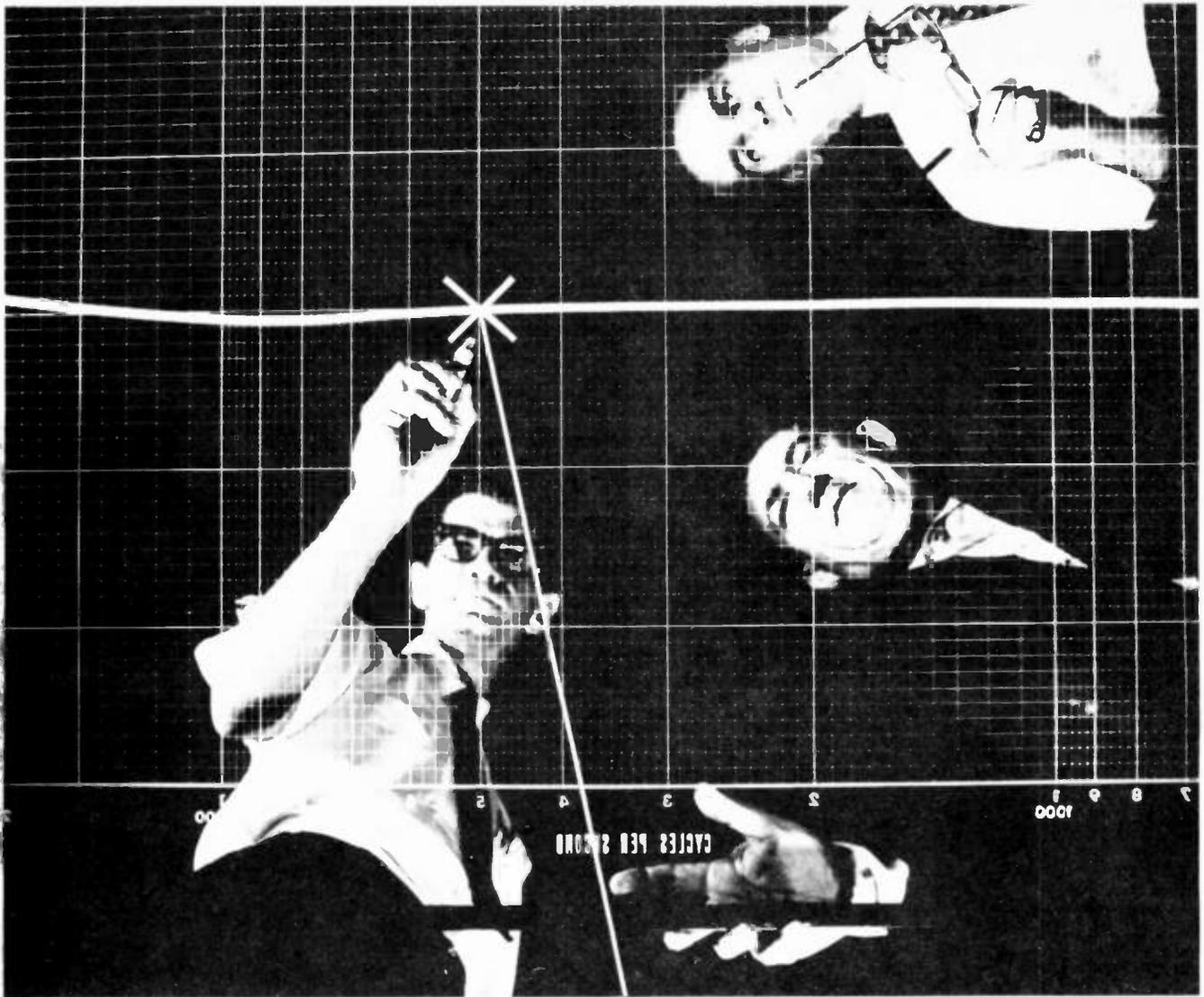
Don't just take our word for it. Read the Hirsch-Houck report in Stereo Review. Or Ivan Berger in Saturday Review. Or E. T. Canby in Audio.

For copies of these rave reviews plus detailed literature, write us directly. Microstatic is priced at about \$100 ea.

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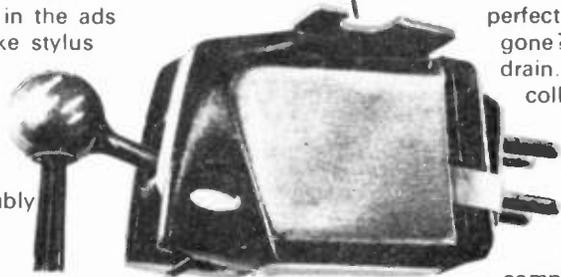


Stanton solves the X Factor

X IS THE UNKNOWN QUANTITY

It's what they don't tell you in the ads and specifications. Things like stylus life, distortion, resistance to hum, kindness to records, consistency.

Ever noticed how two identical cartridges sound completely different? Probably not, because few people have the chance to compare identical cartridges. But we do, and one thing we're proud of is a Stanton . . . is a Stanton . . . is a Stanton. Ever paid out a small fortune for a pricey cartridge and had the stylus collapse after a few months? Diamond



perfect but cantilever suspension gone? Forty odd dollars down the drain. Stanton stylii just don't collapse. If you happen to get one that does, we'll swop you a new one. So we can frame yours.

Then think how much longer your records will last with Stanton (remember static compliance doesn't mean a thing, but it's the only figure you're likely to get), think how clean your records will sound because you're not amplifying hum, and think of the distortion that's probably less than your amplifier. Think, and you'll agree—the X factor is the deciding one.

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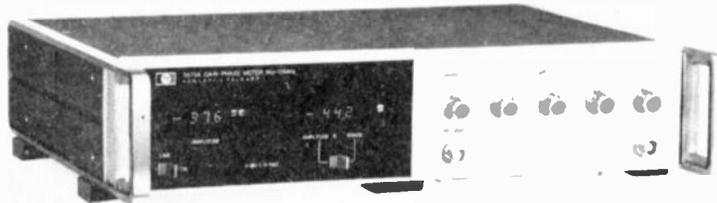
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Adelaide, S.A. 5000

EQUIPMENT NEWS

NEW VECTOR VOLTMETER



A new Hewlett-Packard instrument, the Model 357A Gain Phase Meter, can measure both amplitude and phase over a frequency range of 1 Hz to 13 MHz, with display of these parameters in digital form.

Phase and amplitude accuracies depend upon frequency and signal level. For example, at signal levels higher than about 20 millivolts at less than 10 kHz, phase measurement accuracy is said to be as good as ± 0.5 degrees. For levels above about 2 millivolts and below 1 MHz, amplitude accuracy is as good as ± 1 dB. Resolution of the digital readout is 0.1 degree for phase, and 0.1 dB for amplitude. Reading rate is 4 per second.

The instrument's dynamic range is 80 dB over the frequency range of 1 Hz to 13 MHz, with input signal levels from 0.2 millivolts to 20 volts being handled by the front-panel controls. Use of a 10:1 divider probe permits signals of up to 200 volts to be measured.

Two channels are provided for phase measurement — one for a reference signal and the other to monitor the phase-shifted signal, and both channels have identical input circuits. A notable feature is that phase difference measurements do not require sine waves; square waves and pulses being measured just as easily, since phase

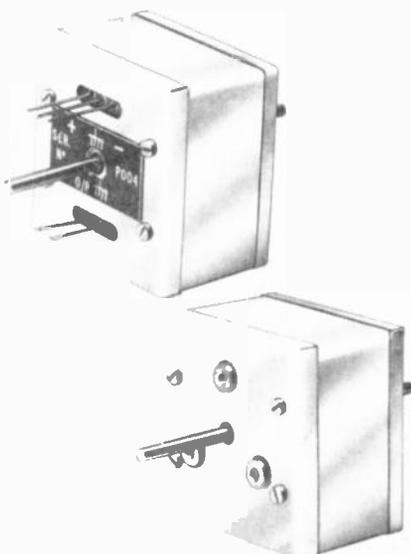
detection in this instrument is achieved by differences in zero crossings the shape of the waveform is not important.

The amplitude of either channel can be measured and, most significantly, the instrument can measure the ratio in dB of the two channels. A function switch on the front panel selects the amplitude of either channel, or the ratio of the two for display on the left hand panel meter.

The Model 3575A uses unique, HP developed logic circuitry to reduce measurement errors caused by noise, thus avoiding one of the shortcomings of broadband instruments, in which frequency tuning is not required namely, susceptibility to noise and harmonics. Noise reduction is achieved in operation by using a front panel frequency range switch to filter higher frequencies. Even harmonics are rejected by the instrument.

Frequency tuning and amplitude setting are not required. An overload indication is provided, and an option is available for programming. The basic instrument comes with the left hand panel meter only — the right hand meter is optional.

For further information, write on company letterhead to: Hewlett-Packard Australia Pty Ltd, 22-26 Weir Street, Glen Iris, Victoria 3146.



CONTACTLESS POSITIONAL TRANSDUCER

A new positional transducer from Jackson Brothers (London) Ltd is designed to convert angular or rotational displacement into proportional output.

The conversion is made by capacitance variation. There is no mechanical contact between the moving parts and hence the effective life is claimed to be superior to that of other conventional units and the resultant continuous output eliminates 'dead spot' problems.

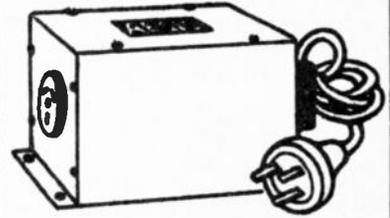
The output can be arranged to be ac or dc. The output response with input can be linear, sinusoidal logarithmic or practically any law desired. Although it has an internal 10 kHz oscillator, provision can be made for an external source.

Further details: British Merchandising (Pty) Ltd., Shaw House, 49-51 York Street, Sydney.

*AEGIS

* registered trade mark

Mains Filter



Aegis Range of mains filters consists of:

MF2A	240V	0.5 amps
LF1	240V	2.0 amps
MF5	240V	3.0 amps
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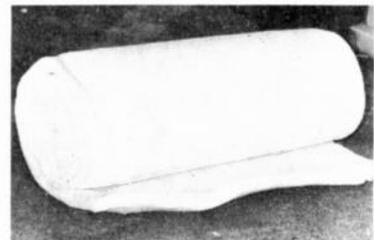
These filters are useful in reducing noise and hash carried through the mains.

Distributors in all States. Write for technical details and prices.

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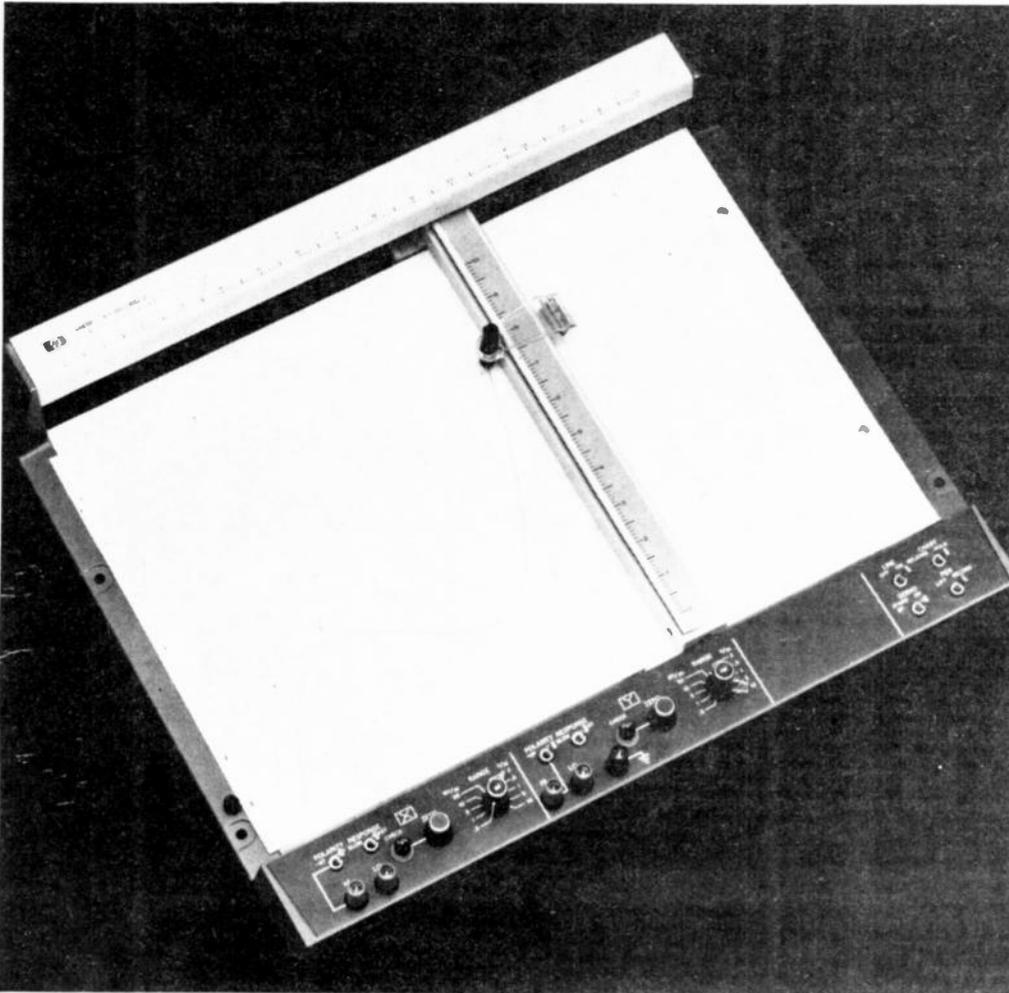
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Box 548 G.P.O., Sydney 2001.
Phone: 56 2780.

EQUIPMENT NEWS

RUGGED, GENERAL PURPOSE X-Y RECORDERS



Two new general purpose laboratory X-Y recorders are introduced by Hewlett-Packard. These new recorders, Models 7044A and 7045A, are claimed to withstand abuse and rough handling, yet perform with the speed and accuracy demanded of laboratory quality instruments. Both use a rugged aluminium mainframe which eliminates the need for critical mechanical adjustments.

The new Model 7044A is a medium speed recorder with a slewing speed of 20 inches per second. Acceleration of the Model 7045A on the Y axis is 3000 inches/sec², and on its X axis, 2000 inches/sec².

Input ranges of both instruments are from 0.5 millivolts/inch to 10 volts/inch. Metric calibration is available as a no-charge option. Input resistance on all ranges is 1 megohm. Input is via a front-panel; the guard is internally connected.

Accuracy of both instruments, comparable

to industry standards, is claimed to be $\pm 0.1\%$ of full scale and resettability is 0.1% of full scale. Overshoot is less than 2% of full scale.

Both the Model 7044A and 7045A use a servo-actuated ink pen. Its writing area is 10 by 15 inches (25 by 38 cm). Autogrip electric paper hold-down grips charts to 11 by 16.5 inches or the standard European size A3 (29.7 by 42 cm). Special paper is not required.

Other options include a time-base switchable onto either axis, an event marker, rear input connector, remote TTL control of pen lift, time-base and event marker and retransmitting potentiometers for either or both the X and Y axes may be included.

Further details: Hewlett-Packard Australia Pty Ltd, 22-26 Weir Street, Glen Iris, 3146, Victoria. Phone 201371.

AUTOMATIC 0.1% DIGITAL BRIDGE

Wayne Kerr have recently announced the release of their B 900 automatic bridge in Australia.

The B 900 is a wide range of bridge with two displays giving simultaneous automatic read out of the resistive and reactive terms of any unknown. Overall range is from 10 mohms to 10 gohms. (10^{-5} to 10^{-11} ohms.) in all four quadrants of the coupled plane. The displays each cover 0-19999 with automatic polarity, decimal and units indication. One reads C, L or $\frac{1}{C}$ and the other R, G, D or Q.

In addition to these options either or both displays can be used as a four-range digital voltmeter.

Further details from: Warburton Franki Adelaide, Brisbane, Hobart, Melbourne, Perth, Sydney.

SOLDIERING IRON WITH INSULATED BIT

A miniature and light-weight soldering iron is available with an electrically insulated bit. Leakage current is negligible, and the manufacturers claim that live transistors may be soldered without the slightest risk of damage.

The element is enclosed in a ceramic (aluminium oxide) shaft, the tip of which is graphite coated to provide good thermal contact to the bit. Routine production test is 2000V ac between element and bit.

A range of bits is available including one protected against oxidation with iron overall, followed by chromium on the body and nickel on the soldering tip.

Further details: Technical & Scientific Equipment Co. Pty. Ltd., G.P.O. Box 241E, Melbourne 3001.

NEW RANGE OF SCHLUMBERGER CORRELATORS

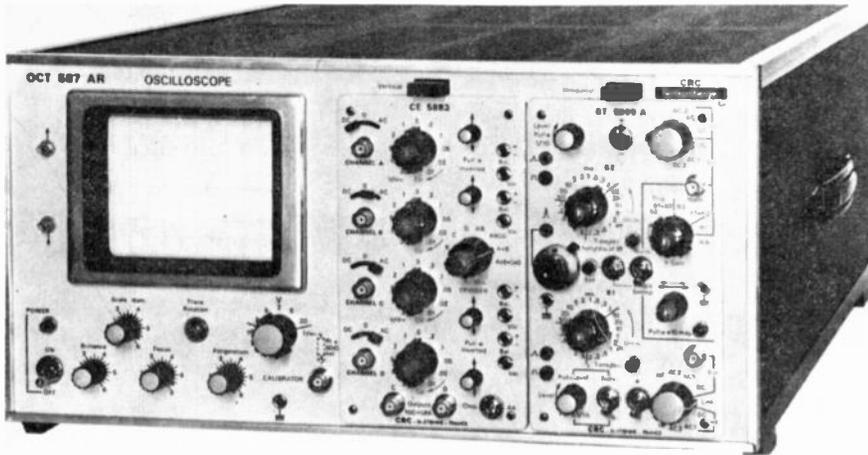
Schlumberger/Saip offer a new range of Correlators to meet the requirements of different measurement and signal analysis applications.

All models compute in real time, the correlation between two input signals – or between one input signal and itself – as a function of the time delay between the signals.

Model CNTR 1024 computes simultaneously, depending upon the option chosen either 256, 512, or 1024 points of the cross or auto-correlation curve over a frequency range from dc to 25 kHz with the incremental delay having a value variable from $10\mu\text{s}$ to 100 sec and total delay span from $2560\mu\text{s}$ to 1024,000 sec.

Model CTR 100A computes simultaneously 100 points over a frequency range from dc to 500 kHz with incremental delay variable from $.5\mu\text{s}$ to .45 sec and total

PLUGIN FOR COLOUR SERVICING CRO



To meet the need for an oscilloscope which would trigger directly from PAL colour signals Schlumberger CRC have released the BTV 5851 plug-in time base for their OCT 587 and 588 series oscilloscope main frames.

This plug-in will synchronise automatically to colour and black and white TV signals and by push button selection permits the detailed examination of important parts of the waveform including VITS lines. Superimposed examination of different test lines is possible.

A composite video output is available from the time base with the line under examination intensified when viewed on a picture monitor.

By the novel use of logic techniques in the time base delay circuitry trigger stability is said to be maintained with signal to noise ratios of worse than 20db. In addition full suppression of colour subcarrier sync sound modulation is obtained.

Apart from PAL 625 line standards, SEACAM, NTSC, 819 and 525 standards are catered for. The timebase capability is complemented by a range of Y amplifiers having real time bandwidths to 100MHz and a capacity of up to four switched channels.

Further details from:- Schlumberger Instrumentation Australia Pty. Ltd, P.O. Box 136, Kew, Victoria, 3101.

IC TEST CLIP

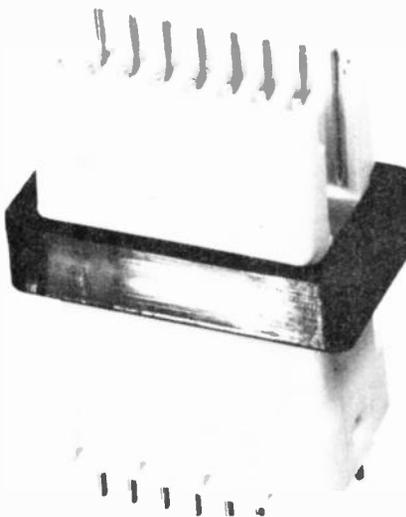
Seecom Electronic Components announce the availability of the Guest International Integrated Test Clip servicing and testing tool.

The Clip is intended for use on high density packaged 14 or 16 lead D.I.L. Integrated Circuits, as a convenient method of connecting to the contacts for test purposes. The Test Clip can also be used as an I.C. removal tool.

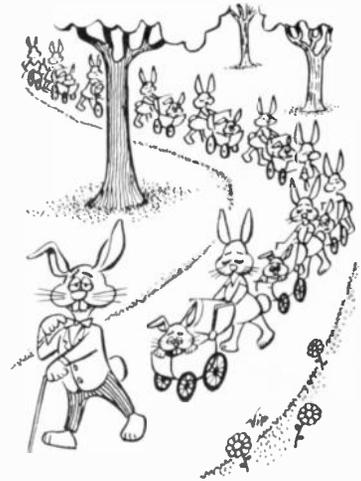
The Clip is moulded of high quality yellow Acetal Polymer, the locking band is of black nylon, these materials achieve minimum friction.

Contacts are of phosphor-bronze with 1µm hard Gold, plated on top of nickel plating. Positive contact is achieved by the Clip spring action on the I.C. Leads.

Further details from:- Seecom Electronic Components, 34 East Parade, Mount Fairley, WA 6050.



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Chassis — T.V. Aerials — Cable — Fuses
— Jacks and Jack Plugs and Kitsets.

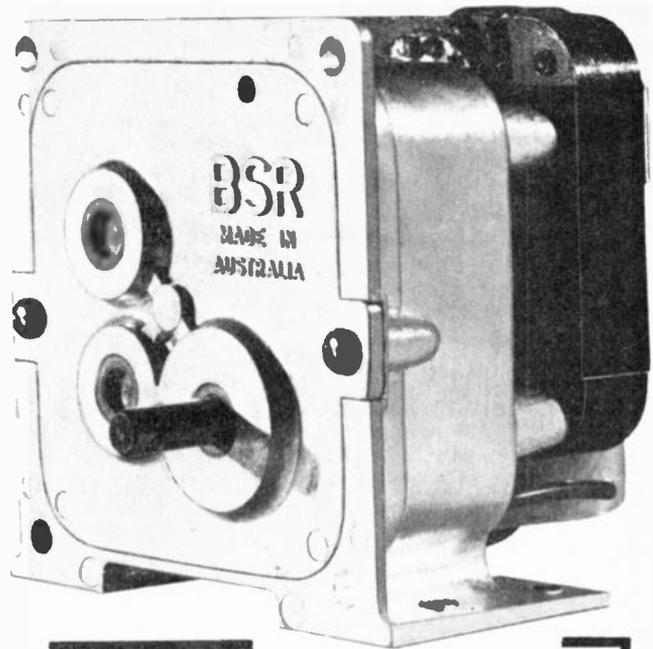
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BSR

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Geared Motors



The VPS100 gear box is designed for applications requiring a compact, powerful drive unit and features a die-cast housing, sintered bronze bearings; machine-cut steel gears and pinions plus a non-metallic gear in the first reduction to keep noise to a minimum.

These units are designed to provide greater durability and are particularly suitable where continuous duty is required. All gears are grease lubricated.

They can be adapted to horizontal or vertical mounting and overall dimensions for the VPS100 motor and gear box are 3" x 3" x 3".

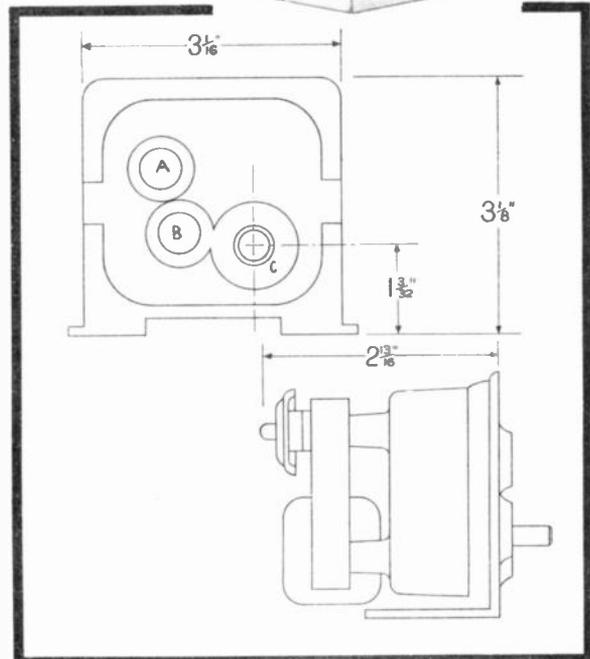
In the standard range, 38 alternative output speeds are available, from as low as 0.9 r.p.m. to 368 r.p.m. (Other speeds are also available but require special gears.)

The wide range of ratios available, together with the choice of 3 output shaft positions, A, B or C, gives great versatility in mounting and speed selection and make the VPS100 adaptable to many applications without expensive re-tooling.

For a unit of such compact dimensions, the torque output is considerable and, when powered by a 1/2" shaded pole motor, gives, e.g., 46 lb./in. at 0.9 r.p.m.

In those cases requiring still higher torque output and continuous operation a 1" shaded pole motor can be fitted. Alternatively, for intermittent use higher rated 1/2" or 1" motors are available if required.

In those applications where space is restricted an open gear box, type VPS101, can be provided, having the same general characteristics as type VPS100.



STANDARD BSR GEARED MOTOR VARIATIONS WITH 1/2" STACK SHADED POLE MOTOR.
VPS 100 A VPS 100 B

RPM No. Load	Starting Torque	Output Shaft Position Alt.	RPM No. Load	Starting Torque	Output Shaft Position Alt.
0.9	46 lb. in.	A or C	1	27 lb. in.	A or C
2.7	10.5 lb. in.	B	3	11.5 lb. in.	B
3.7		B	4.5		B
5		B	6		B
5.8	8.5 lb. in.	A or C	7	6.25 lb. in.	A or C
8	8.25 lb. in.	A or C	10	5.75 lb. in.	A or C
9.5		B	15.5	3.5 lb. in.	B
11		A or C	25		A or C
13	4.25 lb. in.	B	30	2.75 lb. in.	B
20		A or C	34.5	30 oz. in.	A or C
24	3.25 lb. in.	B	40		B
28	2.75 lb. in.	A or C	56.5		B
33		B	76	14.5 oz. in.	B
47		B	90	14 oz. in.	A or C
63	1.75 lb. in.	B	124		A or C
74	1 lb. in.	A or C	167		A or C
100		A or C	270	3.75 oz. in.	B
139		A or C	368	3.5 oz. in.	B
223	6.75 oz. in.	B			
304	4.75 oz. in.	B			

PRICE LIST VPS 100 MOTOR/GEARBOX

Quantity	1/2" Motor	1" Motor	1 1/2" Motor
Single Unit	\$10.73	\$12.30	\$14.79
2-15 Units	9.66	11.07	13.31
16-50 Units	9.12	10.46	12.57
51-100 Units	8.05	9.23	11.09
Over 100 Units	6.97	8.00	9.61

Prices for other than standard output speeds available on application.

Note: Quantity buys apply only to motors/gearboxes with the same specifications.

Prices apply in Australia only.



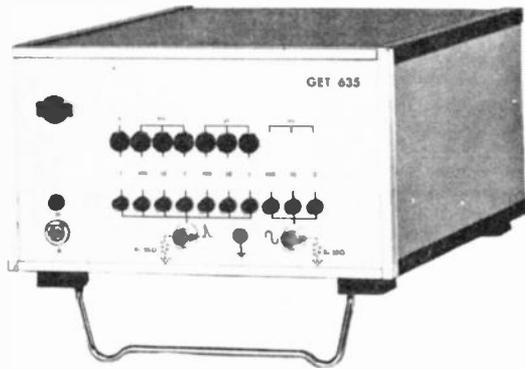
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NEW ZEALAND GPO BOX 2630 AUCKLAND

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EQUIPMENT NEWS

SCHLUMBERGER/CRC TIME MARK GENERATOR



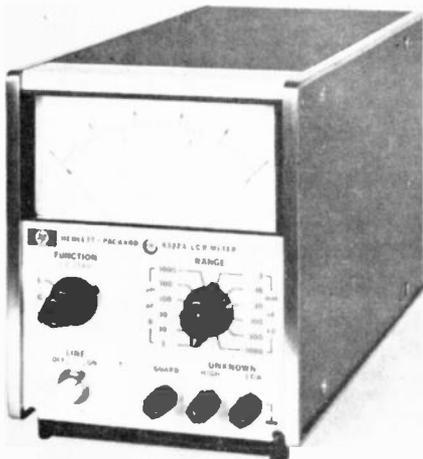
The Schlumberger/CRC Time mark generator is said to be ideal for calibrating oscilloscope timebases.

It is controlled by a 10MHz quartz crystal oscillator and generates 1Hz to 1MHz pulses plus sine wave output from 10MHz to 500MHz with peak to peak amplitudes of 1.5V.

Facilities are included for mixing frequencies and for producing trigger signals for the pulse output.

Further details from:- Schlumberger Instrumentation Australia Pty. Ltd., P.O. Box 138, Kew, Victoria. 3101.

FAST LCR METER



Inductance, capacitance and resistance are read quickly and accurately, it is claimed, with this new Hewlett-Packard Model 4332A LCR Meter. It measures inductance from 3 microhenries to 1 henry full scale, in 12 ranges. Capacitance from 3 picofarads to 1 microfarad and resistance from 3 ohms to 1 megohm full scale are also covered in 12 ranges. The measuring frequency is 1 kHz for resistance and 1 kHz or 100 kHz for inductance and capacitance, depending upon the range used.

The Model 4332A is useful for both laboratory and production testing of linear and non-linear components such as semi-conductor devices and ferrite-core coils. Because this new instrument uses a synchronous detector to discriminate the reactance component from loss in L and C measurements, the error due to the loss component is said to be negligible. For resistance measurements, the instrument uses a phase detector to eliminate the reactance component. A guard terminal is provided to minimise stray capacitance during capacitance measurements. A special test lead is furnished for guarded measurements.

Accuracy of inductance and capacitance measurements is claimed to be $\pm 1\%$ of reading + $(1.5 + 3/Q)\%$ + $0.03\mu\text{H}$, or pF]. Resistance measurements are accurate to within $\pm 1\%$ of reading + 2% of full scale.

Two analogue outputs are provided on the rear panel of the Model 4332A. One is 0.3V or 1.0V full scale depending on the range used, and is proportional to the meter deflection. This output is used with a DVM for higher accuracy. The other output is 1.0V full scale for all ranges and can be used to drive a recorder, an analogue comparator or data processing equipment.

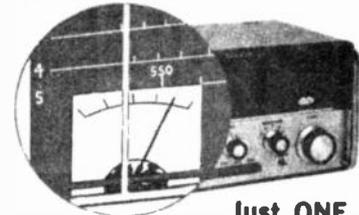
Reading response time is typically 1.0 second on the analogue meter, and 0.25 second at the analogue output.

The unit is 6-3/32 inches high, 5-1/8 inches wide and 11 inches deep (155 x 130 x 270 mm). It weighs 7.7 lb (3.5 kg).

For further information, contact Hewlett-Packard Australia Pty Ltd, 22-26 Weir Street, Glen Iris, Victoria, 3146

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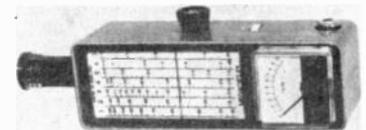
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Comprising transformer, mounting plate, silicon bridge rectifier and smoothing capacitor plus screws, nuts, etc.

PS3 6V, 7.5V, 9V, 12V, 15V, 1A \$5.95 post 50c
 PS4 18V, 20V, 25V, 27V, 30V, 1A \$7.90 post 60c
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 PS8 Electronically regulated and protected, output 20-45V DC at 2 Amp maximum. Adjustable current cut-out. \$22.50 post \$1.00.

MAGNETIC PRE-AMP KITS

Hi-Fi quality and proven performance make these Kits one of the best buys today. Input 5mV, output 1V (approx.), 3 transistors per channel, correct equalisation.

MP-1 Mono Cartridge \$3.50
 MP-2 Stereo Cartridge \$6.00
 MP-3 Mono Tape \$3.50
 MP-4 Stereo Tape \$6.00
 A.C. Power Supply, suit above \$5.00

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An amazing 12V D.C. to 240V A.C. inverter designed to operate any fluorescent tube to 13W max. rating. Foolproof circuit, compact size 4"x1 1/2"x1 1/4". Easy to install Price \$9.95. Post 35c.

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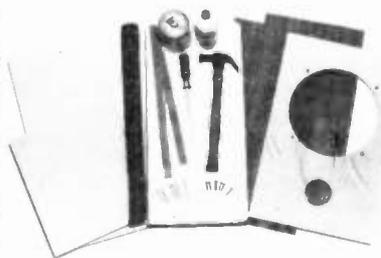
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In every order received to the value of \$5.00 or more, for each \$5.00 value we will include absolutely FREE a choice of the following:—

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1 Pr	TT800/TT801 Transistors	\$2.00
2	40408/TT801 Transistors	\$2.00
2	40409/TT798 Transistors	\$2.00
2	40410/TT797 Transistors	\$2.00
1 Pr	TIP29A/TIP30A Transistors	\$2.50
10	EM401, 100PIV, 1A Rectifiers	\$2.00
8	EM404, 400PIV, 1A Rectifiers	\$2.00
5	EM408, 800PIV, 1A Rectifiers	\$2.00
4	IN3491/R 50PIV, 18A Rectifiers	\$2.00
3	MR751, 6A, 100PIV, Rectifiers	\$2.50
1	2N4443, 400PIV, 8A, S.C.R.	\$3.00
2	C106Y1 S.C.R.'s	\$1.80
1	MB1, 100PIV, 2A, Bridge Rectifier	\$1.20
2	2N2646 U.J.T.	\$2.50
2	2N3054 Transistors	\$3.00
2	2N3055 Transistors	\$3.00
2	2N5459, F.E.T.	\$2.00
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10	OA90 Germanium Diodes	\$2.00
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MAGNAVOX 8-30 system 1 cu.ft. only \$16.00 each, plus post \$1.50.

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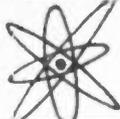
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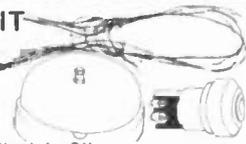


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5 T05 Silicon NPN Transistors
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MAGNETIC COUNTER



Application: The Magnetic Counter is an electromagnetic relay with 10 separate armatures and their associated contacts, one separate and one release winding. The Magnetic Counter has been designed to suit a wide range of applications, such as: Counting operations in industrial manufacture, releasing of signals when a predetermined number is reached, storing of test data for subsequent evaluation, recording of specific operations, parcelling of exact quantities for packing and forwarding, replacement, adjusting or supervision of tools used in machines at regular or irregular intervals. Comparison of input and output quantities in a manufacturing process. Pre-Pak special \$6.50 plus 25c post.

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We have a small quantity of slightly marked speaker enclosures, which will suit 6" speakers and 3" or 2" Tweeters. Both cabinets are of beautifully finished rubbed teak/walnut veneer, and feature a handsome slotted front facia. May be used vertically or horizontally.
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- PAK. 13. Polyester, Ceramic & Mica Capacitors. \$2.00 plus 20c post.
- PAK. 20. 60 Assorted Germanium Diodes, ex computer \$2.00.
- PAK. 21. 10 x 2.0mfd, 200V Paper Block Condensers, suit crossover networks and timing delay units \$2.00, plus post 25c.
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FANTASTIPAK No. 3.

New Pak for hobbyists building transistorised equipment. This Pak is loaded with useful diodes and germanium and silicon transistors and includes low voltage polyester, ceramic and electrolytic capacitors, 1/2W resistors, mini-pots, driver and output transformers, printed circuit board, rectifiers and many other items too numerous to list. We guarantee the value of this parcel to exceed \$20.00 however, for this month only, you can buy this bargain-parcel for just \$10.00, plus 25c post.

COMPONENT NEWS

PARTS CATALOGUE



A fully illustrated, comprehensive 40 page catalogue from Dick Smith Electronics Pty. Ltd., lists thousands of components for project builders and electronic experimenters.

Included in the catalogue are a number of components that many of our readers claim are not obtainable from their usual sources of supply. These include items such as Neosid formers, small trimmers, integrated circuits, Plessey E Cells, Xenon tubes, small relays etc.

Apart from the listed items – all of which are priced – the catalogue includes several pages of formulae and conversion tables, together with details of pin connections for a number of common components.

The catalogue costs 50 cents but included therein are two vouchers, each worth 25 cents, which will be credited against any order worth \$5 or more.

Dick Smith Electronics are currently establishing a comprehensive mail order service in order to supply components or kit sets to any part of Australia. Dick Smith (Wholesale) Co., 10 Atchison Street, St. Leonards, 2065.

LOW-NOISE MICROWAVE TRANSISTORS

At prices claimed to be less than half those previously common, Hewlett-Packard offers new low-noise microwave transistors. Noise figures for the HP21A's are stated to be 4.5dB at 4 GHz and 3dB at 2 GHz. These are not "typical" figures, but guaranteed data points, worst-case specifications; typicals should be somewhat better, of course.

The new low-noise HP21A's differ in only one way from HP21's, which have been in volume production for more than a year – the low-noise transistors have arsenic emitters. In all other respects they are HP21's, the 12 GHz small-signal transistor introduced in October, 1970, now in wide use in microwave amplifiers and oscillators. The 21A's have the same 2.5 micron geometry, same processing, same volume potential. For this reason they are also fully characterized. Data sheets give thorough specifications, including s-parameter information and source matching impedance at the low-noise bias levels (10V, 5 ma). The transistors come in 200-mil, 70-mil, and 130-mil four-lead common emitter strip-line packages.

Further details:— Hewlett-Packard Australia Pty Ltd 22-26 Weir St., Glen Iris, Victoria, 3146.

GUIDE TO CO-AXIAL COMPONENTS



Hundreds of valuable components and accessories for high frequency application to 9 GHz are described in a new 36 page booklet from General Radio. Included are complete and highly detailed specifications for general purpose and precision 50 ohm and 75 ohm connectors, adaptors, attenuators, terminations, 2- and 3- port coupling elements, cables, air lines and a unique broad band directional coupler.

Free copies of this publication are available from Warburton Franki, Adelaide, Brisbane, Hobart, Melbourne, Perth and Sydney.

VOLTAGE-TO-FREQUENCY CONVERTER

The new Teledyne Philbrick Model 4701 Voltage-to-Frequency Converter permits high-quality 2-wire transmission of digital data at very low cost, deriving its high performance from a unique adaptation of the "Precision Charge Dispenser" principle. This unit can be used with strain gauges, thermocouples, load cells, voltage or current sources, phase detectors, and medical instrumentation transducers, and is ideal for remote control or monitoring, 2-wire digital transmission, electronic testing, mag tape recording, telemetry, isolation, servo and phase lock loops, synchronous speed control, and arithmetic operations.

The Model 4701 features 0.01% linearity and 27ppm stability from 0°C to +70°C in converting 0V to +10V input to a corresponding 0 Hz to 10 kHz output ($f_{out} = 10 \text{ kHz} \times E_{in}/10 \text{ V}$). Output waveform is a train of DTL/T²L-compatible 30μsec pulses with repetition rate proportional to the analogue input value. Input impedance is 23 kΩ and overvoltage protection is included. Fan-out is 10 standard T²L loads, and output is short-circuit protected. Inherently low offset voltage and full scale factor are adjustable by user. Requiring only ±15 V power, the Model 4701 is complete in a 1.5" x 1.5" x 0.4" module weighing only 25 grams. Conservatively rated components, plus total encapsulation is claimed to allow MTBF of 400,000 hrs (calculated per MIL Handbook 217A).

Further details: Elmeasco Instruments Pty Ltd, P.O. Box 334, Brookvale, NSW, 2100.

CONTACTLESS KEYBOARDS

Contactless keyboards using modern solid state components to provide bounce-free long life operation are now available in Australia.

Manufactured by Rafi-Raimund Finsterholz the keyboards are claimed to provide the reliable and high speed operation required for electronic data transmission, information transmission and control systems.

Custom-designed or standard keyboard designs are available. The modular construction allows use of as many as 25 illuminated and non-illuminated keys in each row in either vertical or a horizontal direction. Encoded keyboards in mono, dual or tri-functions are available with two key roll over.

Further details: E.S. Rubin & Co. Pty. Ltd. 73 Whiting Street, Artarmon, 2064 N.S.W.

(Continued overleaf)

An instrument for TV servicing that is ...keyed to COLOUR



KYORITSU MODEL K-200 FET • METER

This meter gives you all the advantages of a VTVM in voltage, current and resistance measurement with instant warm-up . . . a feature of the field effect transistor which is even superior to a vacuum tube in loading characteristics minor scale and knife-edge pointer. 10 megohm input resistance on DC and AC means you can measure voltages accurately with minimum load. Eight AC current ranges . . . minimum circuit loading. Peak to peak scales with freq-response to 3 MHz. Fully solid state and battery operated so you can use anywhere, anytime—with built-in battery check.

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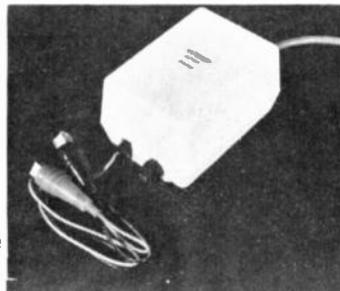
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FERGUSON Transformers Pty Ltd

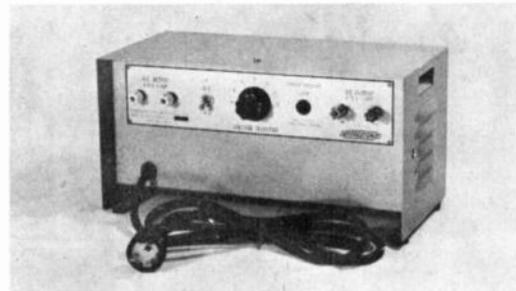
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Step-down transformer



12V, 1 1/2 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

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Waterloo St.
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H.J. McQuillan Pty Ltd
107 Wellington St.
West Perth, 6005.
Phone: 21 4821

S.A.
K. Farmer Sales Pty Ltd
49 Whitmore Sq.
Adelaide, 5000.
Phone 51 4488 9

VIC.
Ferguson Transformers Pty Ltd
181-183 Hawke St.
West Melbourne

FET-INPUT AMPLIFIER



The Zeltex ZA 910M1 module, now available through the Instrumentation Division of Racal Electronics Pty Ltd, is designed for applications such as video pulse and line driving where fast slew rate and high output current are important.

The amplifier is claimed to be extremely stable and does not require any feedback capacitance for stable operation. It can withstand a short circuit from output to the minus input - important for integrator applications. Open loop roll-off is -20dB per decade with a gain bandwidth product of 70MHz.

Fast settling makes the ZA 910M1 useful in analogue to digital and digital to analogue converters, multiplexers and other circuits needing output sampling at fast rate with consistent accuracy.

Further details: Instrumentation Division, Racal Electronics Pty Ltd, 47 Talavera Road, North Ryde, 2113.

PROCESS TIMER

New from FR Electronics (UK), the 300 Series Process Timer is an electronic unit with 2 pole or 3 pole changeover relay contacts, claimed to offer excellent reliability together with a repeatability of better than 1%.

All timers have built in protection against high voltage transients and their working temperature range is -25°C to +60°C.

Three modes of operation are available; delay on energise, interval and delay on de-energise. There are overlapping time ranges from 0.02 seconds to 30 minutes. Various input voltage units are available - both ac and dc.

Further details: N.S. Electronics Pty Ltd, Cnr Stud Road & Mountain Highway, Bayswater, Victoria, 3153.

REED SWITCH CATALOGUE

Latest issue of the FR Electronics Reed Switch Catalogue, containing details of the complete range of 37 different reed switches is now available from NS Electronics Pty. Ltd.

The catalogue includes general information on the use and application of reed switches together with a fold-out specification sheet and application list for use as a wall chart. Additional copies of the wall chart are available on request.

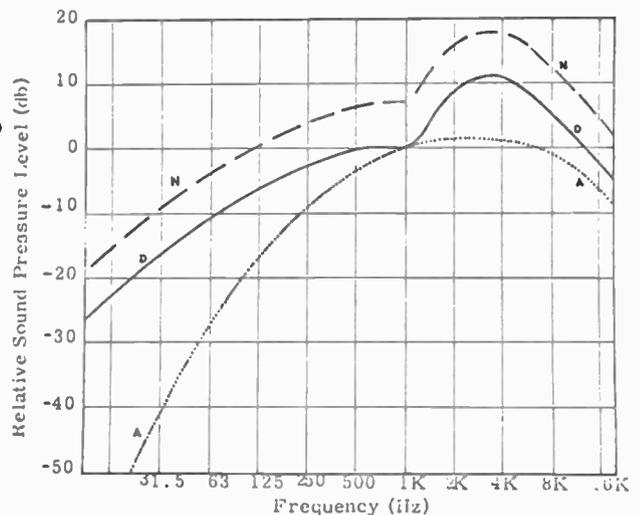
Among the specific information are details on contact suppression and the use of reed switches in coils and with permanent magnets.

Further details: N.S. Electronics Pty Ltd, Cnr Stud Road & Mountain Highway, Bayswater, Victoria 3153.

HOW NOISY IS THE CONCORDE?

(Continued from page 24)

Graph of response curve showing relationship between 'A' 'D' and 'N' weighting curves.



Thus, although we measured 125 EPNdB at 1 mile from the point of touchdown Professor Ffowcs Williams claims that this figure is 115 EPNdB for the prototype.

We measured 117 EPNdB for side line noise for the Concorde and 107 EPNdB for a Boeing 707 320c.

Whilst the side line noise figures are in general agreement with the available data, the landing noise figures measured for both one mile and two miles from the point of touch down are so far above the generally quoted figures that a number of questions need to be asked.

There are obviously two situations existing: the opponents who are quoting noise figures greater than those really existing, and the manufacturers, who are quoting few, possibly in the belief that this will quieten their opponents through lack of ammunition.

Regrettably, the data that is available

from experts such as Professor Ffowcs Williams may well have been supplied by the aircraft's manufacturers. It certainly does not agree with the results of our field measurements.

It should be noted that the figures we measured do not take into account payload (or fuel retained in the tanks). The tolerances of system measurement errors have been taken into account, so that there is a 90% confidence limit in the actual figure lying above that stated.

Generally then, the Concorde noise level is much as we had expected. It is the loudest and noisiest civil aircraft in the world today (that is if 001 is not noisier).

If the Concorde's noise is reduced by the amount that the makers claim that they can, it is still very doubtful if it will be regarded as being "quiet" and even more doubtful that it will be, as the makers claim, as quiet as the "707" class of aircraft. ●

LOUIS A. CHALLIS

Louis A. Challis B.E., M.I.E. (Aust), M.A.C.E. (Aust), is a

consulting, acoustical and vibration engineer.

Apart from his own consulting business, Mr. Challis is a lecturer in acoustics at the University of Sydney and also at the University of N.S.W.

He is a member of the Executive of Acoustics Committee of the Australian Standards Association, and a number of other committees including Hearing Conservation, Community Noise, Instrumentation, Aircraft Noise etc. Mr. Challis is also chairman of a working group currently producing Vehicle Noise Standards.

Louis A. Challis & Associates are retained by Electronics Today International as acoustical consultants.

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If you've got the electronics bug, put it to work in a challenging, worthwhile career. Become an electronics apprentice at the Army Apprentices School, Balcombe.

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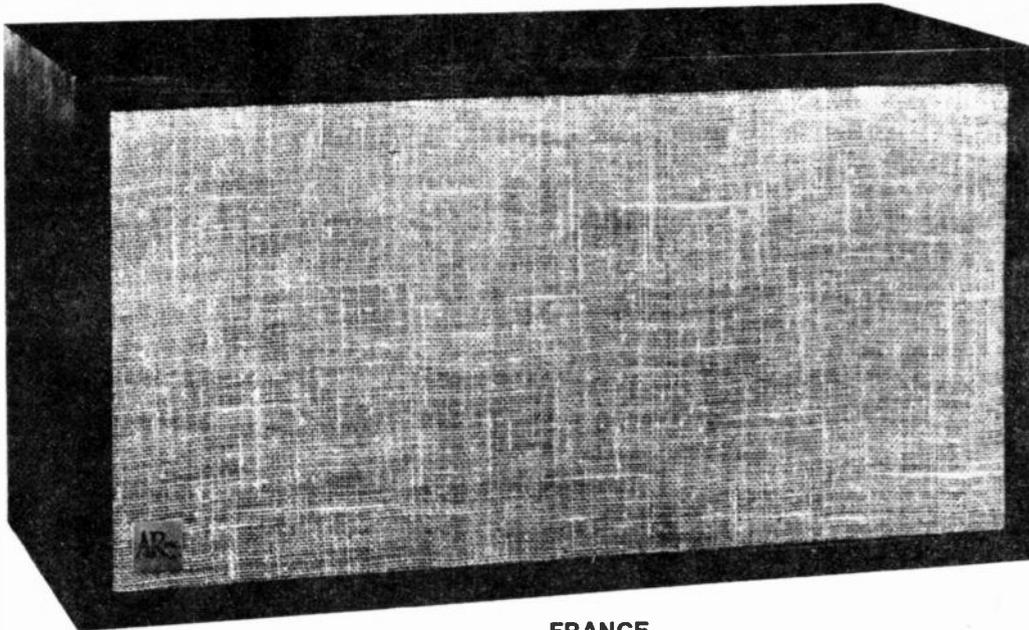
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Internationally, the Critics' Choice



U.S.A.:

"This (frequency response) would be remarkable for any speaker, and in our experience is unique for any speaker in the price class of the AR-4x. We know of no competitively priced speaker that can compare with it."

... "Hi Fi Stereo Review"

"To say that the AR-4 (forerunner of the AR-4x) is the best of this class would be to presume too much in the way of individual listener preference; it would perhaps be more to the point to say that we have heard nothing better, so far at least in this price class."

... "High Fidelity"

U.K.:

"The frequency response curves ... were better than those published by the manufacturers ... there is an audible output from 30 Hz upwards, the AR-4x reaches its full output of 50 Hz and sounds remarkably smooth through to the limit of audibility."

... "The Gramophone"

"Extreme bass down to 30 Hz at adequate levels to enjoy organ pedal tone in domestic surroundings, was obtained with quite small harmonic production. High frequency performance was good on all scores — smoothness, lack of colouration and distribution ... I like the AR-4x, and it's a good loudspeaker."

... "Hi Fi News"

HOLLAND

"For speakers this size, the bass is incredible — no resonances, but beautiful, smooth, low bass notes — we would say the 4x is ahead of all other speakers this size — the 4x presents excellent value for money — ideal in an average sized room."

... "Stereo Review"

FRANCE

"There has been nothing like it, and the least I can write is that this speaker is astonishing ... a model speaker in its class."

... "La Revue des Disques"

AUSTRALIA

"The subjective impression was of extremely clean, clear reproduction with a particularly low level of distortion, especially on transients. The frequency response is extremely good, being effectively ± 6 DB from 55 Hz — 20 KHz and for such a small speaker enclosure this is unusually good. The quality of their reproduction when received in terms of price is still particularly hard to beat."

... "Australian Hi Fi"

The workmanship and performance in normal use of AR products are guaranteed from the date of purchase: 5 years for speaker systems, 3 years for turntables, 2 years for electronics. These guarantees cover parts, repair labour and freight costs to and from the factory or nearest authorised service station. New packaging if needed is also free.

The AR catalogue and complete technical data on any AR product are available free upon request.

AR-4x recommended retail price \$119.00



Acoustic Research Inc.

Massachusetts, U.S.A.

All AR audio equipment is on demonstration at the AR Music Room in the Sydney showrooms of the Australian Distributors.

WEDDERSPOON

W. C. WEDDERSPOON PTY. LTD.

Showroom: 193 Clarence Street, Sydney. 29 6681

AR sound equipment may be purchased from the following Australian Dealers

N.S.W.: Magnetic Sound, Sydney; Photo Hi-Fi, Sydney; Sydney Hi-Fi, Sydney; Paxton Photographics, Sydney; Milversons Hi-Fi, Chatswood; Newcastle Hi-Fi, Hamilton. VIC.: Douglas Trading, Melbourne. S.A.: Sound Spectrum, Adelaide. A.C.T.: Homecrafts, Canberra. W.A.: Alberts Hi-Fi, Perth; Leslie Leonard, Perth. QLD.: Brisbane Agencies, Fortitude Valley.

AUDIO NEWS

HI-FI AUDIO SHOW

WEDNESDAY 9th August, 1972, sees the opening of the Australian Hi-Fi Audio Show. Twenty-six companies representing nearly one hundred brands and overseas manufacturers will be showing almost a million dollars worth of audio equipment from seventeen different countries.

The Show will be held at the Koala Motor Inn, Oxford Square, Sydney, from Wednesday, 9th August to Sunday, 13th August, open 10 a.m. to 10 p.m. each day. The entire ground floor area (Convention Centre entrance) is devoted to displays of the major brands.

Quite separate from the ground floor exhibition area, the 3rd and 4th floors of the hotel are taken over entirely by all the exhibiting companies for working demonstrations in individual rooms. You can listen to any or all brands in a normal room setting with drapes, carpets, and the kind of furniture usually found in most home listening rooms.

Kings Car Park is right next door to the Koala with more than ample parking, and easy street-parking in the vicinity, especially during the evenings. Signs throughout the hotel will guide you to the three display areas - approach the ground floor exhibition through the Convention Centre entrance of the main hotel lobby, then follow the signs to the express lift service to the 3rd and 4th floors where the demonstration suites are located.

Admission to the Australian Hi-Fi Audio shows is free, but a ticket is needed; tickets are available from your local N.S.W. hi-fi dealer.

EXHIBITORS

Akai Australasia Pty Ltd.

Akai CR80SS Q-8 cartridge recording system.

Akai ND S80 speaker system.

Akai GX1900 cassette/open reel transfer recorder.

Auriema (Australia) Pty Ltd.

'Superscope' range of amplifiers.

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Marantz amplifiers.

W.C. Wedderspoon Pty Ltd.

Acoustic Research Standard transducer speaker systems.

Monarch amplifiers and tuners.

Crown International Amplifiers.

Bose speaker systems.

H.J. Leak (Australia) Pty Ltd.

Leak speaker systems.

Leak Delta 30 amplifier.

Instrol Hi-Fi Centre.

Instrol audio furniture.

ADC cartridges and loud speakers

JH amplifiers and turntables.

Hagemeyer (Australia) N.V.

JVC - Nivico four channel equipment.

Haco Distributing Agencies Pty Ltd.

National modular four channel system.

Audio Engineers Pty Ltd.

Shure pick-up cartridges

SME pick-up arms

Expo International.

Expo 3 piece modular stereo cassette tape recorder.

Expo stereo amplifiers, speakers and headphones.

Atram Pty Ltd.

Uher tape recorders

PE turntables

Wega tuner amplifiers

Jacoby Mitchell Ltd.

Kenwood range of amplifiers

Kenwood KL777 loudspeaker system.

Bleakley Gray Corporation Pty Ltd.

Sansui cassette and stereo tape decks.

Jacoby Kempthorne Pty Ltd.

Sony range of transistor radios, transducers, cassette and tape recorders, amplifiers, loudspeakers and record players together with the new closed circuit television system.

Magna-Techtronics

Fischer range of Hi-Fi equipment.

Dodwell Trading Pty Ltd.

Deltek hi-fi equipment.

Onkyo amplifiers.

Goldring Engineering (Australia) Pty Ltd.

AIWA stereo tuner amplifier.

AIWA cassette tape deck.

Grundig of Germany equipment.

Goldring quadraphonic headphones.

Goodmans

The Goodman range of speaker enclosures.

Autel Systems Pty Ltd.

Phase Linear amplifier.

ESS speaker systems.

AMI - Jorgens speaker equipment.

TEAC four channel equipment.

Sonab of Sweden

Sonab amplifiers, speakers and turntables.

BASF

Chromium dioxide cassette tapes.

Audioson International Pty Ltd.

Garrard zero-100 and zero 100s turntables.

KEF range of loudspeakers.

Astronics Australasia

Pioneer amplifiers and receivers.

Pioneer stereo cassette (with Dolby)

Convoy International Pty Ltd.

TDK Extra Dynamic cassette tape.

C180 cassette tape.

TEAC Dolby cassette recorder.

TEAC four channel tape recorder.

Bower and Wilkinson DM-2 speaker systems.

Audiosound Electronic Services.

Audiosound mini-speaker system.

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Turntables and a new range of speakers.

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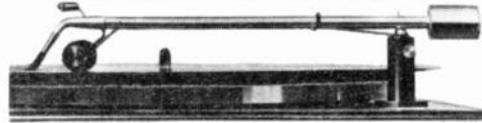


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\$160.00 - 9 seven segment display tubes, with memory, addition, subtraction, multiplication and division with 16 digit numbers and decimal point. Full construction and operating instructions.

TRIACS (400 PIV) 2A - \$2.55, 6A - \$2.70, 10A - \$3.20

WHY SETTLE FOR LESS THE BEST COSTS ONLY \$5.95



BIB-GROOV-KLEEN
Modern Automatic
Record Cleaner

•Permanent, instant, mounting. •Adjustable counterweight eliminates turntable slowdown. •Angled arm gives perfect tracking. •No need for fluids—laboratory tests prove liquid is unnecessary. •Arm rest solves "what to do with it" problem between records. •Instantly replaceable brush and roller. •Silent operation—no annoying acoustic noise. •Fits all turntables.

Local Australian Distributors for BIB AUDIO ACCESSORIES

Leroya Industries PTY. LTD.

266 Hay Street, SUBIACO, W.A. 6008



1" TWEETERS (ADO 160/T8)

A professional unit with a response to beyond 20kHz. The dome construction avoids the annoying 'Beam effect' of conventional Tweeters. Can handle 40W RMS. This Tweeter now used in the Revised MAGNAVOX 8/30 System. (Philips 6.8 uF Capacitors \$1.65)

Complete Kit: includes the 2 Tweeters crossover capacitors & instructions. Full price \$23.00. Individual Speakers \$12.00.



CHANGE OF ADDRESS

We have moved into larger premises at Brisbane. The new address is 293 St. Paul's Terrace, Fortitude Valley. Phone 52-8391. Pay us a visit.

C.D.I KIT



Well-known Mullard design. This circuit is well proven and we can guarantee results. Pre-wound Transformer Unit is housed in a strong diecast box. All top grade, NEW parts. Full instruction Booklet provided. Best value available. \$21.50. Post \$1.00.

1972 CATALOGUE

libret out.



Now Available, with over 70 Big pages of information and prices on Kits, Parts, & Hi-Fi equipment. Catalogue now comes with up-to-date amendment sheets at no charge. 50c plus 25c post.

E.T. 1425 STEREO SYSTEM

Stage 1 & Stage 2 now available. Unbeatable prices on this Kit - all New and guaranteed parts. Phone write or call for details and prices.

PRICES PLEDGE

In this day of rising overheads etc. Kit-Sets Aust. are still the cheapest parts & Kits supplied in Australia. To assure clients we make this following statement:

Should you find a better Price for ANY Part in ANY Current Australian Production Trade Catalogue we will match or better the Price. Naturally, this only applies to New parts.

REMEMBER, IT COSTS LESS TO DEAL WITH THE BIGGEST

KIT SETS AUST

Mail order Dept. P.O. Box 176 Dee Why. 2099. N.S.W.

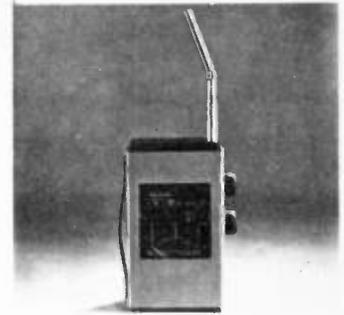
SYDNEY SALES DEPT: 230 Sussex St. Sydney.

Northside Sales Dept. 2/21 Oaks Avenue. Dee Why. Phone: 982-5571

Brisbane Sales Dept: 293 St. Paul's Terrace, Fortitude Valley. Phone: 52-8391.

Canberra Distributor Electro Pak, 5 Garema Arcade.

NEW PRECISION SOUND-LEVEL METER



General Radio has announced an important advancement in portable precision sound-level measurements and octave band analysis with the introduction of its new 1933 Precision Sound-Level Meter and Analyser.

The 1933 is lightweight and compact, combining three instruments in a single unit, a sound level meter, impulse-impact and octave band analyser. It is said to comply with the precision standards of ANSI S1.4-1971 Type I and IEC 179. The versatility of this new instrument makes it applicable for countless uses where noise levels must be measured and analysed.

The 1933 provides virtually mistake proof operations. A-, B-, and C-weighted sound level measurements are read from a linear meter scale which displays the sound level directly over a 20 dB range.

Sound-level measurements can be made from 10 to 150 dB, A-, B- or C-weighted. Frequency is 5 Hz to 100 kHz, and there are 10 octave bands with centre frequencies from 31.5 Hz to 16 kHz. A companion cassette data recorder is expected to be released later this year, providing an automatic memory for the 1933.

For further information contact Warburton Franki, Adelaide, Brisbane, Hobart, Melbourne, Perth and Sydney.

HAM

RADIO SUPPLIERS MAIL ORDER SPECIALISTS

323 Elizabeth Street (2 doors from Little Lonsdale Street)



db: -20 to +62db
Signal Injector: Blocking oscillator circuit with a 2SA102 transistor
Approx. size: 6 3/4" x 7 1/4" x 3 3/8"

db: -20db to +62db
Approx. size: 5 1/2" x 3 3/8" x 1 3/4"

MODEL C1000 \$6.95
is the ideal low cost pocket meter.

AC volts: 10V, 50V, 250V, 1000V (1000Ω/V)
DC volts: 10V, 50V, 250V, 1000V, (1000Ω/V)
DC current: 1mA, 100mA
OHMS: 150kΩ
Decibels: -10db to +22db
Dimensions: 4 3/4" x 3 3/8" x 1 1/8"

AS-100D/P. \$34.50

High 100,000 Ω/volt sensitivity on D.C.
Mirror scale. Protected movement.
AC/V: 6V, 30V, 120V, 300V, 600V, 1200V (10,000Ω/V)
DC/V: 3V, 12V, 60V, 120V, 300V, 600V, 1200V (100,000Ω/V)
DC/A: 12μA, 6mA, 60mA, 300mA, 12A
OHM: 2kΩ, 200kΩ, 20MΩ, 200MΩ
db: -20 to +63db
Audio Output: 6V, 30V, 120V, 300V, 600V, 1200V AC
Battery: Internal
Approx. size: 7 1/2" x 5 1/2" x 2 3/4"

200-H. \$12.50

90° quadrant meter.
Pocket size.
AC/V: 10V, 50V, 100V, 500V, 1000V (10,000Ω/V)
DC/V: 5V, 25V, 50V, 250V, 500V, 2500V (20,000Ω/V)
DC/A: 50μA, 2.5mA, 250mA
OHM: 60kΩ, 6MΩ
Capacitance: 100pF to .01μF, .001μF to .1μF
db: -20db to +22db
Audio Output: 10V, 50V, 120V, 1000V AC
Approx. size: 4 1/2" x 3 3/4" x 1 1/8"

A-10/P \$55.00

Giant 6 1/2" Meter.
Inbuilt signal injector. Overload Protected.
AC/V: 2.5V, 10V, 50V, 250V, 500V, 1000V, (10,000Ω/V)
DC/V: 0.5V, 2.5V, 10V, 50V, 250V, 500V, 1000V at 30,000Ω/V
5000V (10,000Ω/V)
DC/A: 50μA, 1mA, 50mA, 250mA, 1A, 10A
AC/A: 1A, 10A
OHMS: 10kΩ, 100kΩ, 1MΩ, 100MΩ



CT-500/P. \$16.75

Popular, medium-size, mirror scale. Overload-Protected.
AC/V: 10V, 50V, 250V, 500V, 1000V (10,000Ω/V)
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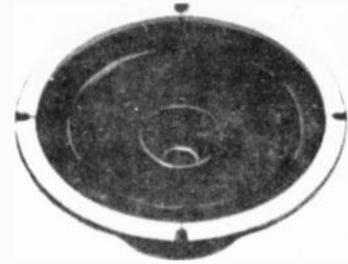
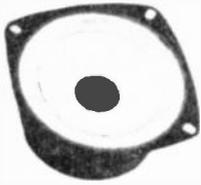
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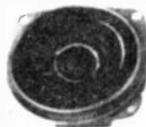
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REVIEWER: John Araneta

LISZT – Symphonic Poem No. 1 “Ce qu'on entend sur la montagne”; No. 11 “Battle of the Huns”; No. 13 “From the Cradle to the Grave” – **HAITINK**, London Philharmonic – SAL-6500 189.

Readers of these pages will recall how in reviewing the first two volumes in this series I have time and again had reservations regarding the generally “straight” approach Haitink adopts for this very Romantic and often dated music. A mazzeppa or Tasso must be played for all it is worth, and while the music can never claim to be first class, the results may be exciting at the least. Even the finer instances of Liszt's writing, such as Orpheus and Hamlet seem to suffer a little from Haitink's approach lacking as it does the fire Beecham often gave these works. But after all, a flamboyant approach need not be the best for every work in this series as this fine disc suggests. Here we are treated to two of Liszt's most banal symphonic poems, No. 1 “Ce qu'on entend sur la montagne” and No. 11 “Battle of the Huns”. The poverty of Liszt's thematic material, and even amateurish orchestration in No. 1 is embarrassing to say the least. One wishes No. 1 were considerably briefer than it is, and certainly the unity of this piece is more literary than musical.

Battle of the Huns is by comparison a tighter work but how predictable everything else is and tired. Haitink presents very straight forward readings, characteristically avoiding much rubato and exaggeration. One must admit, however, here his approach is very convincing indeed. He minimises a great deal of the banality in these scores, and while I do not think anyone can ever make No. 1 truly viable today, here one can at least listen to it with patience. The Battle of the Huns is actually thrilling and the sound Haitink and the engineers achieve at the conclusion of this piece is most impressive. Nice organ here but no indication is given on the jacket or label what instrument is used.

Liszt's symphonic poem No. 13 “From the Cradle to the Grave” was finished in 1882 and is one of the last works of the composer. Long considered highly interesting by Liszt scholars, it receives here perhaps its first hearing in living memory, and was certainly never performed in the composer's lifetime. Alas, long lost masterpiece it is not. There is, in my opinion, nothing here that possesses the peculiar brilliance which is certainly characteristic of the late piano works. With the exception of some modernistic harmonies at the conclusion of this piece, “Sleep” this section is perhaps the most beautiful section of the entire score. Part 3 “The Sweet Passion” once again brings

forward the humanity apparent in the score and first appearing in the person of the drunken poet of the previous section. Perhaps the only real flaw of the present arrangement is in the transposition of Mopsa and Coridon's duet from countertenor and bass to tenor and mezzo, thereby de-emphasizing the humour Purcell undoubtedly intended. But the humanity remains, while it seems to me a very Britten-like touch to present the supernatural mainly by implication: with the exception of Phoebus in the first section and the fairies in the second section, supernatural elements are present mainly by way of the music. Not even in the final, “Epithalamium” with its culmination in the great chaconne do supernatural elements directly enter the picture. Instead it is a grand picture of Nature and that this Fairy Queen presents. Very modern one might think, but also rather more indicative of Purcell's age than the standard edition of Fairy Queen would lead us to believe. As the first part began with Spring so in this arrangement the Fairy Queen ends with the nuptial night of the Epithalamium and at this point we notice that Pears' very symmetrical but not unobtrusive arrangement



of the numbers has been only to the good of the music as a whole.

The score has been edited by Britten and Imogen Holst. There is nothing here reminiscent of Beecham or Leppard. There are alterations certainly but never to the abuse of the music. In any case what Purcell intended is not really certain at all.

Conducting and playing is beautiful in the extreme. Singing is always on as high a level generally, although Pears is rather vocally uncertain as Phoebus in the First Part. One cannot help but say at once that perhaps the

finest singing in this set is done by James Bowman, who must surely be the finest countertenor around.

In the second part, Bowman's singing of Secrecy is simply great singing. Owen Brannigan must also be commended for a truly natural and hilarious drunken poet. All the rest of the vocal principals deliver finely wrought performances. Full marks must finally be given to the players, and especially Philip Ledger's stylishly elegant harpsichord.

In sum therefore not for the strict purist but a beautiful set nonetheless. Excellent sound. – J.A.A.

PURCELL – THE FAIRY QUEEN (A New Concert Version) – Soloists, Ambrosian Opera Chorus – English Chamber Orchestra, Benjamin Britten (cond.) – DECCA SET 499-500.

Quite a number of critics have taken this new concert version of Fairy Queen to task, particularly for its only too numerous omissions. Listening to this set, however, I rather thought how marvellous, and even thank God, it's cut. On returning to the old complete Oiseau-Lyre recording under Lewis, I was appalled how tiresome Purcell's actually marvellous score could become with the music played in its purported original sequence without the play it originally went with. I am not exactly thinking of a recording which would approximate the original 1692 production of a bowdlerized “Midsummer Night's Dream.” Certainly not. But a work like Indian Queen would surely be more enjoyable and sensible if numbers were rearranged, or perhaps even the text changed (!) to form some more wholesome structure than what sounds like bits and pieces rather arbitrarily strung together, as the Indian Queen is often performed and as it is recorded.

The Fairy Queen is, of course, a more extended work, and Purcell certainly built in some marvellous structures within the whole work, but who can see them in the older recording? The unities can be retained, surely, and the entire work made more sensible. I will concede then, that the pity of this new version is in its incompleteness. Perhaps Peter Pears or someone else can give us a new version employing all the music, but except for the sake of completeness, I would rather have this abridged version and not suffer the loss of what is wonderful in this music. Purcell's masques are not really operas, the sooner this is realized the better.

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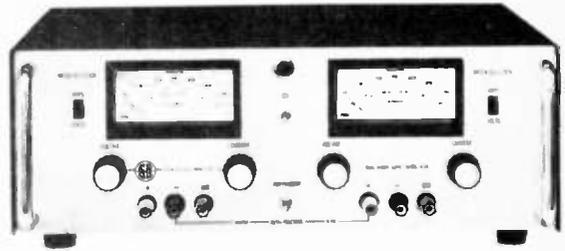
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In Peter Pears, concert version, numbers are rearranged, and almost two-thirds of the score omitted to create a grand masque in four parts. His rearrangement is intelligible, tasteful, and at all times aware of an overall structure, something one does not get in the Lewis recording. The new four-part design serves to emphasize the subtleties of each number within each of the four sections. In this present devising, we have what seems like a complex, grand Nature festival, with a unity very reminiscent of Britten's own vocal and choral cycles. The Spring Symphony and Nocturne immediately come to mind, and indeed it is obvious the nocturnal qualities of Purcell's score especially appealed to the present arrangers.

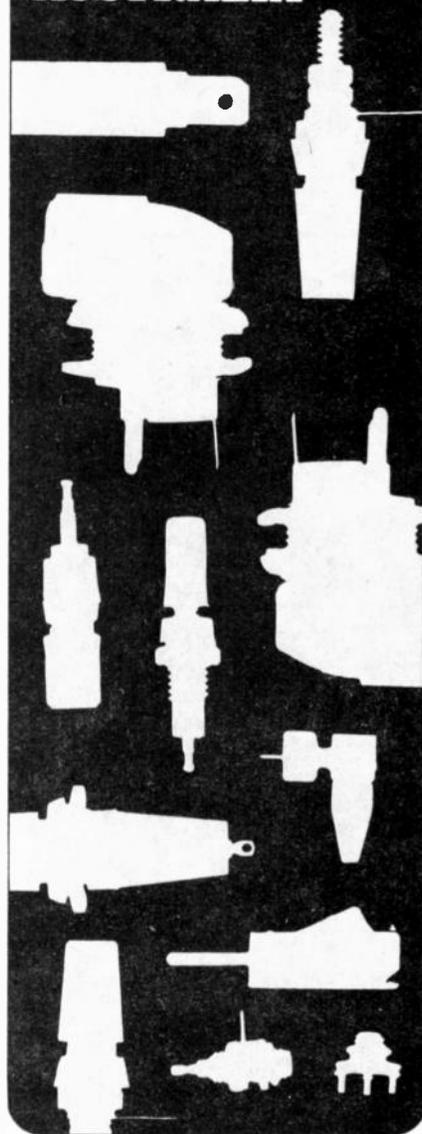
The first part, entitled "Oberon's Birthday" sets the appropriate scene for the occasion of the Fairy King's birthday: a celebration of the end of Winter and its long nocturnal rule. The various seasons pass and pay tribute to Phoebus "great parent of us all," who gives "life, warmth, and vigour to all, E'vn love . . ."

For once, as in this arrangement, the symbolic qualities of Purcell's use of the chaconne is wonderfully apparent. For once too, we see the text leads us to anticipate the ensuing sections: the calm of the midsummer night, the shepherd's passion, and the grand final Epithalamium.

The first part sets the tone for the various elements of the whole masque: in particular the pastoral and supernatural elements. In the next section "Night and Silence", the summer night's peace is for a while threatened by a poet "tripping it." Purcell's humanity and strangeness is wonderfully apparent here, but even more strange the entrance of Night, Secrecy, Mystery and there is more here that is reminiscent of Liszt's earlier masterwork, the Faust Symphony. The fine enough Cradle and Grave sections are also marred by an only too typical heroic middle section, and the heroic did tend to elicit from Liszt the empty gesture. This symphonic poem is not on par with either Orpheus or Hamlet, the latter one of those rare instances in Liszt where the heroic does not lapse into shallow rhetoric. I would have wanted more fury from Haitink in that middle heroic section but everything is otherwise well enough done, with Philharmonic playing beautifully.

Curiously, the engineers have provided a lower level of sound in this generally quiet work. Four more symphonic poems are due to be recorded by Haitink to complete this cycle, among them the rarely heard Heroide Dunebre (1849-50). None of the music in the remaining pieces are really even good but it remains to be seen whether Haitink's approach will stir them to some life, as he does Nos. 1 and 11 here. But once again one must be grateful that Haitink and PHILIPS have had the courage to let us hear this music. – J.A.A.

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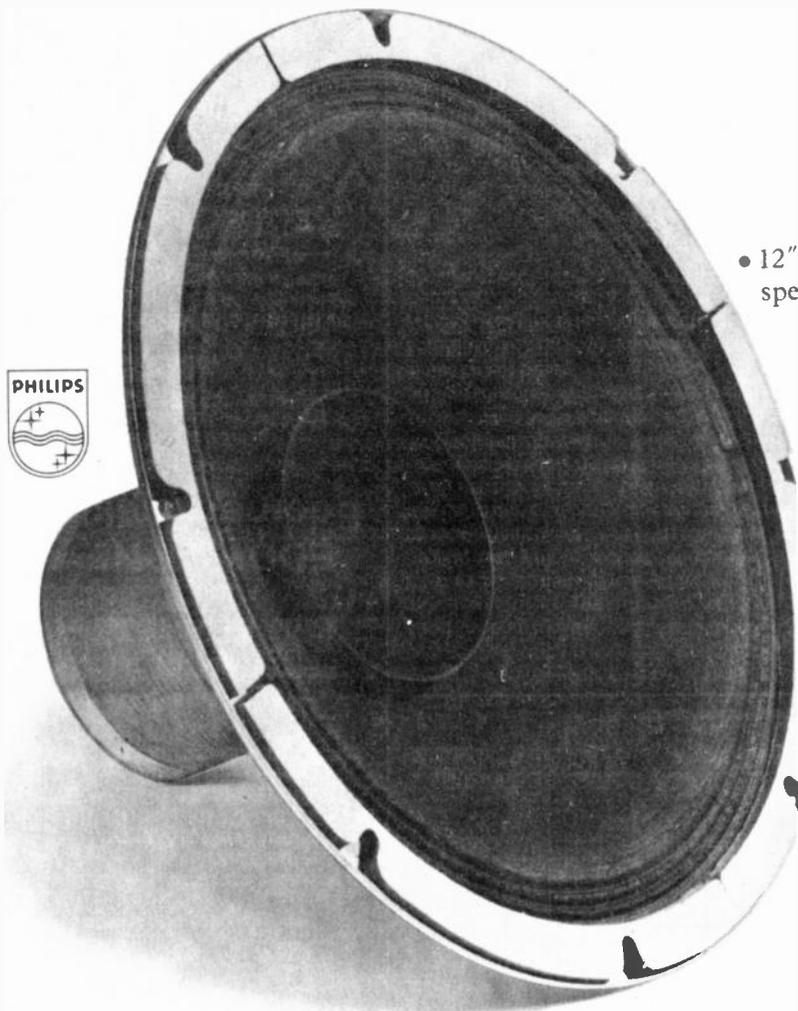
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JIMI HENDRIX – *Hendrix In The West*. Polydor Stereo 2310 161 A. Johnny B. Goode, Lover Man, Blue Suede Shoes, Voodoo Chile, The Queen, Sergeant Pepper, Little Wing, Red House. Mitch Mitchell, drums; Noel Redding or Billy Cox, bass.

Some may wonder what this review is doing in the Jazz section. It is simply my belief that near the end Hendrix was developing an approach to guitar which was more appropriate to contemporary jazz than almost any jazz guitarist other than Sonny Sharrock or John McLaughlin. Listen to what he does about twelve bars into his solo on *Lover Man*. Those running phrases would not be at all amiss in an Ornette Coleman solo. His best effort, however, is on *Red House*, where he uses a traditional blues form to show just how far outside the blues basis of almost all rock guitarists he is able to go. Towards the end his solo is straight contemporary jazz, and he is not just imitating something he has heard, but really creating in the idiom. The tonal variety and the development of complex ideas are quite comparable to what contemporary jazzmen have been doing mainly on saxophones.

For all the complexity of musical thought, Hendrix has on this album pruned away many of the superfluous notes, the redundant ornamentation which made some of his earlier work sound a little gimmicky. Many rock guitarists have diahorrea of the fingers and I think this is partly due to their efforts to inject something new and original into the same old harmonic progression. Hendrix broke through not by adding extra notes at every opportunity, but by enlarging his harmonic sense, his knowledge of what notes, not how many notes, you can play at a given time.

I read somewhere that Hendrix had wanted to form a larger band of experimental musicians, and somebody told me that he was indeed listening to people like Albert Ayler and Archie Shepp. If only he'd lived. If you find it hard to believe that he was really heading in this direction, I

suggest that you listen closely to the *Red House* solo, which is in fact divided into two distinct sections. In the first he does just about everything it's possible to do with blues conventions. There follows a reflective unaccompanied interlude, and then everything frees right up; he really breaks through into something else.

While Mitch Mitchell and Noel Redding are admirable, one wonders what Hendrix could have done with a drummer like Tony Williams or the king, Elvin Jones – the kind of drummer who could have actually fed him ideas as well as complementing everything Jimi could spring on them.

I think it will be a long time before the rock scene catches up with Jimi Hendrix, and it may be just as long before jazz guitarists wake up to what he had to offer them. In the meantime, I think that this is just about the best Hendrix I've heard. Let us not forget during these deliberations the marvellous revamps of old rockers like *Blue Suede Shoes* and *Johnny B. Goode* that are included on this album. Nor *God Save The Queen*, which is nearly as good as Jimi's version of *The Star Spangled Banner*. – J.C.

SWING AND BLUES ARTISTS – *L'Aventure Du Jazz Vol 1: Jazz Odyssey Mono 001*. Buck Clayton, Vic Dickenson, Budd Johnson, Eddie Barefield, Memphis Slim, John Lee Hooker, Sister Rosetta Tharpe Milt Buckner, Jo Jones, Willie 'The Lion' Smith, Zutty Singleton etc.

You'll have to be quite interested to go after this one. You'll probably find that one or two of the very big record stores may have it. It is worth enquiring about, though there are a couple of pretty dull tracks, and it is unlikely that many readers will get to see the French jazz documentary from which the music is taken.

Two of the very good tracks are by a band made up of some of the best swing musicians: Clayton, Dickenson, Johnson, Barefield etc. The first, *Chez Panassie*, was written by Buck Clayton, the trumpeter who first came to prominence with the Count Basie band of the late Thirties. It sounds very similar to an old Basie riff 'Ay Now!' Due in part to the recording quality, Clayton's unique trumpet sound, darkly shining with an odd brittle fragility, is not immediately recognisable. Nevertheless, he is playing beautifully, with all his lyricism and restrained emotional force. Budd Johnson on tenor and Eddie Barefield, alto, play exciting and rather 'modern' solos. Each slips in part of the Charlie Parker phrase. Dickenson is on form too, and it is all a satisfying example of the kind of jazz that was being played through the swing era by much more interesting but less famous musicians than most of those heard in the bands of Benny Goodman, Glen Miller et al.

Montauban Blues, by Budd Johnson, is a fine example of the way musicians of this era handle a slow blues: mellow, rolling, easy as easy and just a bit suave, but rising to peaks of lyrical intensity. Clayton plays a particularly beautiful solo – fanatics would buy the record on the strength of it – and Dickenson's trombone is richly eccentric. On these two tracks the bassist is Milt Hinton, the drummer Jimmy Crawford. Tomy Grimes is on guitar and Sonny White on piano.

By contrast, John Lee Hooke gives us the blues at their most primitive and eerily moving. In this slow, almost tempo-less performance of *When My First Wife Quit Me*, his guitar persists like some clanging, dissolute procession down a dusty road. The nasal voice intones laconically so frank and simple a confession of sorrow that it all sounds at first alien and strange to us. Actually, the effect is not unlike that of Australian Aborigine music. The more you listen to it, the stronger and more moving it becomes.

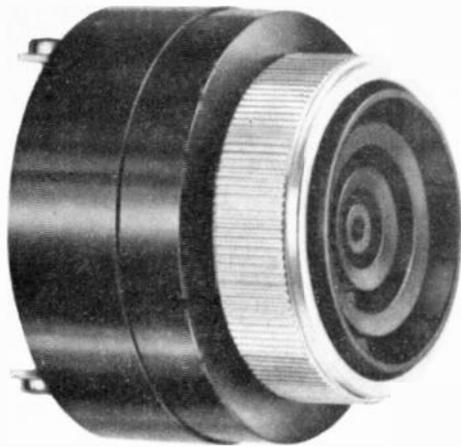
Other items include a strong vocal, and out of tune guitar by Sister Rosetta Tharpe, a brief delightful piano solo by Willie The Lion, a mad version of *Jumpin' At The Woodside* by a group led by Eddie Barefield (almost as reckless and happy this as the music Dick Hughes' group plays at French's Tavern in Sydney), a blues monologue by Memphis Slim and a not so good version of *One O'Clock Jump* by a band led by one of my favourite tenor players, Buddy Tate.

There is a Cliff Jackson, Zutty Singleton performance of *Wolverine Blues* which is not particularly memorable, but the one most forgettable thing by far is Milt Buckner's rendition of *Caravan*. I am not all that fond of jazz organ – in fact Ray Charles's approach is the only one I can get enthusiastic about – but I have yet to hear a jazz player get so objectionable a sound from the instrument as Milt, whose piano I don't really mind.

There is some good stuff on this record. Collectors will want it, as well as those whose curiosity about all the different jazz and blues styles has just been awakened. – J.C.

ROBERTA FLACK – *First Take*. Atlantic SD 8230. Compared To What, Angelitos Negros, Our Ages Or Our hearts, I Told Jesus, Hey, That's No Way To Say Goodbye, The First Time I Ever Saw Your Face, Tryin' Times, Ballad Of The Sad Young Men.

I am a bit late in reviewing this record – it's one of the recent batch of Atlantic Jazz releases which included *Blues And Roots* – and there is a particular reason. I hadn't really listened to Roberta Flack, though I'd read quite a bit about her, including



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JAZZ

comparisons with Nina Simone which should have sent me out to hear her immediately, but somehow didn't. I must admit that I was quite scornful when I first heard this recording. Nina Simone? Nina Simone it must be obvious to anyone with half an ear is one of the most amazing singers — just from a technical point of view, if you don't happen to like her — to have emerged in this country, while Roberta Flack, I exclaimed hysterically, is just a very good singer.

Taking a hold of myself, I decided not to review the record until certain facts had sunk in. One, she didn't ask for the absurd comparison, which is based solely on the occasional intonation and the fact that she plays the piano. Two, I was a fool to have taken any notice of anything I'd read (there are too many pundits already expressing the 'accepted view' in bold forthright tones and then waiting for the obligatory 'hear hears').

Miss Flack sings beautifully. She does nothing that bangs you over the head on a first hearing; she just concentrates on the sense and the melody of the songs so that there are no lapses of continuity or mood. Concentration is one of her major gifts. No matter how slowly she takes a song or how long she draws it out, you never feel that her mind has wandered elsewhere; she sings meaning into every line.

I have the feeling that this is not the best she's done — I am sure at any rate she has been recorded less shallowly than this — but at least one track — *Ballad Of The Sad Young Men* — achieves near greatness. *I Told Jesus* is also enormously impressive for the way Miss Flack calmly places one beam of sound after another into what becomes a sonorous cathedral; one of those things which keep expanding in your chest until you feel you'll blow up. Unfortunately she gives it a conventional 'big' finish. I would like to have heard her just cut right away and leave the song standing resonantly in my memory.

My advice is to find a friend who has a got a copy and hear it several times. I think you'll probably want to buy it. — J.C.

GROVER WASHINGTON JR — *Inner City Blues*. CTI Stereo 6489 013. *On My Mind*, *Mercy Mercy Me*, *Ain't No Sunshine*, *Until It's Time For You To Go*, *I Loves You Porgy*.

With a title like *Inner City Blues*, I expected a bit of hard jazz and blues, or at least a bit of soul music. In fact it's very good background music. I say good because it is very well played and recorded; these being the only criteria I can apply to background music.

Washington plays alto and tenor, quite competently but without distinction. He gets off a bit of jazz on the last two tracks. It's all very nicely arranged by Bob James who was with Sarah Vaughan some time ago. There's a restrained, rocky rhythm section, tasteful strings, tasteful brass, including those great trumpeters Snooky Young and Thad Jones, neither of whom gets to do anything very much. That's about all I can find to say about it. — J.C.

John Armstrong and the Bluebelles
Lester Young and the Bluebelles
Roy Eldridge and the Bluebelles
Bobby Hackett and the Bluebelles
Chick Webb and the Bluebelles
Woody Herman and the Bluebelles
Bunny Berigan and the Bluebelles
Louis Armstrong and the Bluebelles
Roy Eldridge and the Bluebelles
Bobby Hackett and the Bluebelles
Chick Webb and the Bluebelles
Woody Herman and the Bluebelles



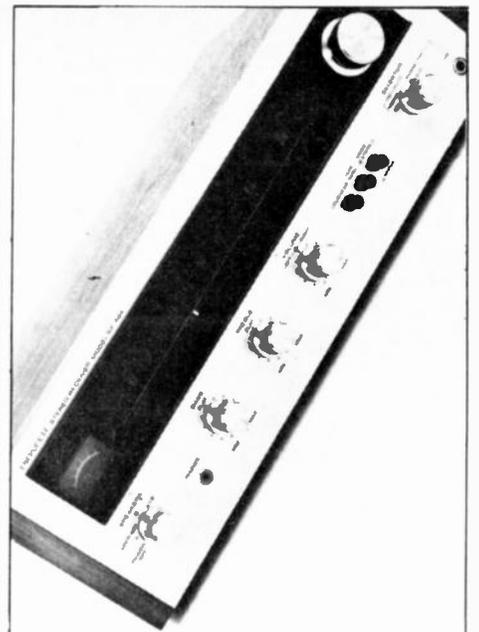
SWING BANDS — *Swing Out; Jazz From The Swinging Years*. Swaggie mono S1280
Jimmie Lunceford, **Bob Crosby**, **Bunnie Berigan**, **Louis Armstrong**, **Roy Eldridge**, **Bobby Hackett**, **Count Basie**, **The Casa Loma Orchestra**, **Andy Kirk**, **Randy Brooks**, **Eddie Condon**, **Chick Webb**, **Woody Herman**.

As Bob Barnard says in the liner notes, 1941 suits may be back in fashion, but the music on this record is not. The fact that I've had a few swing records to review lately does not mean that I am trying to bring it back into fashion. In fact I'm a bit wary of young musicians playing the music of yesterday. Revivals — and the Fifties rock and roll revival is a case in point — tend to make it even more difficult for innovative artists to get themselves heard. I prefer to hear the originals doing it on records such as this one, or if those originals are still around and still playing well, I prefer to go and hear them, not their imitators.

Most of the performances in this collection are fine timeless jazz. The rest are of little more than nostalgic value. Eight of these tracks have been previously compiled on a record called *'Man With A Horn'* and they are all trumpet solos. The solos by Randy Brooks with his own orchestra and Sonny Dunham with the Casa Loma Orchestra epitomise all that was superficial and showy in swing trumpet playing. They are full of empty dramatic flourishes and dying falls, and they are rather poorly played. For all that, they have a period charm. The two by Billy Butterfield with the Bob Crosby Orchestra, and Bobby Hackett with his own band are musical and satisfying. Bunny Berigan punches his band along solidly and Howard McGhee plays with great authority and drive over the Marvellous Andy Kirk band. Louis Armstrong is superb as always in his immaculate performance of *Sweethearts On Parade*, but the honours go to Roy Eldridge who plays the most searing, bitter chorus on the unlikely vehicle of *Stardust*.

The remaining items include brilliant Lester Young with a small Count Basie group, Ella Fitzgerald sounding nauseatingly cute but swinging like mad with Chick Webb's band, good Jess Stacey, good Woody Herman with some of Ellington's men in the band, the famous *For Dancer's Only* by Jimmie Lunceford, and more nostalgic corn from the Casa Loma Orchestra.

Odd mixture as it is, this record gives a pretty good cross section of what was being played in the late Thirties, early Forties. — J.C.



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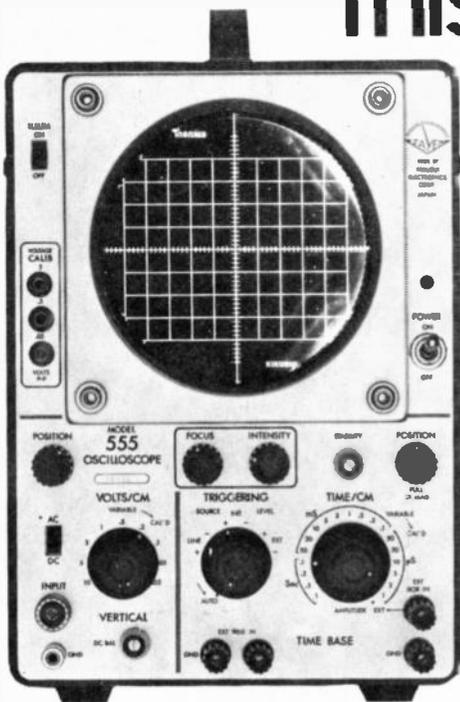
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SG-TUX2

REVIEWER:
Michael Delaney.



"LOOSE" - Crazy Horse. Kinney. Stereo MS.2095. Hit And Run - Try - One Thing I Love - Move - All Alone Now - All The Little Things - Fairweather Friend - You Won't Miss Me - Going Home - I Don't Believe It - Kind Of Woman - One Sided Love - And She Won't Even Blow Smoke In My Direction.

Balls is the thing that makes Crazy Horse so special - sheer balls. They don't play straight country as refined as The Burrito Brothers and country-folk as authentic as The Band nor country-rock as soulful as The Byrds but do they ever know how to move. Despite severe changes in line-up they've been able to continue as one of the best American road bands this side of the now defunct Buffalo Springfield. Ralph Molina and Billy Talbot are the only two remaining from the former personnel and it's probably been due to their influence that the group has retained its central character intact. The basic approach remains unaltered to the point where you'd swear blind that "Loose" was recorded by the same outfit who first gained credit for their backing on Neil Young's "Everybody Knows This Is Nowhere" - an album released more than two years ago.

If anything, Crazy Horse sound better as a revised quintet because they've found room to breath. There's still a couple of rustic ballads and one or two love songs but the emphasis no longer rests on them being poignant all the time as it did on their first album. Nils Lofgren or no Nils Lofgren - the old band could never quite get up the steam to really make their rock 'n' roll memorable. They always found it hard trying not to be sad and broken even when it came to a tune like "Dance, Dance, Dance" - a single penned by Neil Young. No matter what they did it somehow seemed like it was almost on the brink of smiling but couldn't handle that last step. And it would've made all the difference.

Since then the group has tightened itself up considerably to the point where the style

is more continuous and the rhythms more immediate. They've started to play irresistible rock with the kind of piledriving agility otherwise left to people like Moby Grape. And yet they can still sound sweet - almost saccharine. "Fairweather Friend" and "All Alone Now" are two of the cutest things you're going to find this side of Graham Nash without becoming trivial.

Sometimes they break away from pop altogether with images so vivid and romantic and painful that the songs actually appear to be significant. There's a couple like this tucked away here: "All The Little Things" and "Kind Of Woman" have that peculiar tragi-comic intensity not far removed from the Band. But Crazy Horse sting like gravel rash. They've got a sharpness without being brittle. Their up-tempo cuts ache with repetition and the ballads open skyward with a harsh beauty as tender as it is honest. "One Sided Love" chugs along so insistently that it's going to make you scream under the weight. And that's why it's so good. The pressure behind Crazy Horse rock 'n' roll is enough to stomps all over you and their restraint is such that they'd make you enjoy it. "Hit And Run" and "Move" are deliberate belters along much the same lines as "One Sided Love" - all three syphon their energy into a solid motion making bands like the La De Da's appear quite unspectacular in comparison. "Loose" is a good album. Keep on truckin'. - M.P.

"SECOND ALBUM" - Curved Air. Kinney. Stereo WS.1951. Young Mother - Back Street Luv - Jumbo - You Know - Everdance - Puppets - Bright Summer's Day '68 - Piece of Mind.

One of the major differences with pure electronic as opposed to electric sound is that its rhythms hold little in common with the standard 4/4 generally associated with good old rock 'n' roll. The former is concerned with non-repetitive frame developments dealing in modes of perception whereas the latter is still immersed in high energy volume and its direct emotional response per decibel. Each lacks the insight as to know how to both formulate and compromise priorities thus confusing the issue far more than is necessary. This failure to reach a definite integration has left such outfits as Pink Floyd and Curved Air in a state of partial identity that proves time and again to be as incongruous with its motives as it can be disjointed instrumentally.

The basic ideal behind electronic rock, disoriented as it is at the moment, has been drawn from Stockhausen. The Floyd utilize segments of his theory yet still base their immediate impact on the noise factor attached to simple rock. It doesn't really lead anywhere in the final analysis despite its technical sophistication. Curved Air and

Soft Machine tend to relate a little further in certain areas mainly due to their impeccable academic training and not - as some will think - because of their more substantial creativity. The musicianship in all three cases is fine in itself it's just that as a whole it seems to be far too ill-defined and unbalanced in the basic conception. As a result what they achieve in technique they sacrifice in feel. This doesn't detract from the musical interest so much as it succeeds in casting grave doubts on the style responsible.

Curved Air - in particular - is comprised of five people none of whom combine or relate as a unit. Sonia Kristina is well into romantic rock balladry; Darryl Way if off on a tangent with classical violin featuring him more as a scholar than a performer; Ian Eyre restrains himself as a rock bassist who should be in a progressive jazz band; Florian Milkša is into heavily syncopated percussion and Francis Monkman completely cuts himself off from the rest with his VCS3 synthesizer experiments. These ideas all work well viewed as separate entities: each is a musician and each knows his/her individual range. But the trouble is that nobody gets it on together long enough within the group to make the music soar. All their efforts seem to be directed out of the band or in competition with the other members and there's very little left to co-ordinate the sound. The moments that they do work as a cohesive unit are excellent but they're so few and far between that it never quite does anything.

Curved Air is a good group with the potential to be great. It's just that they've not organized themselves into a corporate body. They're still in the throes of deciding which path to take and how to go about getting their priorities sorted into explicit order.

"Puppets" and "Jumbo" stand as the two most accessible cuts on this their second album purely because of the relative control. The feeling is uniform - right away from the overbearing activity in "Piece Of Mind" and obsessive melodramatics that surround "Young Mother". "Back Street Luv" comes across as over-embellished rock - the merits of which are somewhat dubious once placed alongside a thing like "Bright Summer's Day '68": a tribute to Vivaldi by Francis Monkman. The latter is one of the most stimulating performances on the disc apart from the vastly inappropriate lyrics:

'On a bright summer's day
In the middle of May
with the sun shining down
my baby left town . . .'

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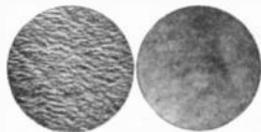
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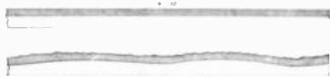
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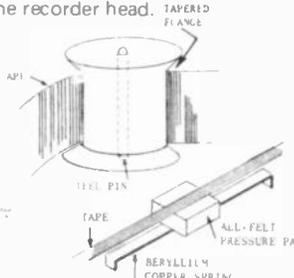
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limited use of electronics to suit almost any purpose. Until then they're going to find enormous problems trying to overcome stylistic redundancy. "Second Album" is well worth a listen. Production is superb - quite the best thing I've heard under headphones since "Tarkus". - M.P.



"YEAR OF SUNDAY" - Seals & Crofts. Kinney. Stereo BS.2568. When I Meet Them - Cause You Love - Antoinette - High On A Mountain - Year Of Sunday - Paper Airplanes - Irish Linen - Springfield Mill - Ancient Of The Old - Sudan Village.

Seals & Crofts released what must have been one of the unsung album classics of last year with "Down Home" - An E.M.I. disc that has now been due to the Bell catalogue transferring over to Phonogram. In some ways it's probably a good thing that it didn't catch on because they would've found it near impossible to match let alone better. It all goes back to the old truism that you can't improve on perfection. And "Down House" was perfect. It's the same type of thing as happened to James Taylor except that everybody discovered him at the right moment: "Sweet Baby James" was a recording that had been there from the start - his definitive statement. He'll never do anything to equal it no matter how hard he tries. The situation with Seals & Crofts is exactly the same apart from the fact that their most beautiful album remains essentially unrecognized.

"Year Of Sunday" is going to bring this duo much closer to commercial success simply because the material is less involved. The melodies are not as complicated and their treatment is much more aligned to the basic rhythm. The whole sound differs from that on the "Down Home" release due to its immediacy. Seals & Crofts don't seem to put as much depth into what they're doing these days: each song has been skimmed across with a light arrangement that makes them out to be nicely compact songwriters instead of intensely moving performers. It's not all that important because they still do it well. And that's the thing that counts.

It's unfortunate that they've confined themselves as musicians as much as they have because somewhere along the line their songs have lost the intricacy and momentum so much the force behind "Down Home". They'll never lose that feeling of insidious delicacy about their music but it's a real

shame that it's been forced back in priorities. They used to sound so emotional whereas now they just sound to be on the border of being cute. That is an overly critical statement but I think you'll know what I mean.

If you haven't heard their second album then "Year Of Sunday" is going to come as no disappointment. I'm not disappointed either, it's just that I was lucky enough to hear the full scope of their talent unrestricted by a less flattering production. "Sudan Village" and "Irish Linen" are the two best cuts because they both hold the closest affinity to the style/character first presented on "Down Home". Nevertheless, their third release is highly recommended. It's full of gentle songs thoughtfully composed and expertly played. There's not quite as much impact as on the former but this can be overlooked without a great deal of trouble. If only... - M.D.

"HARVEST" - Neil Young. Kinney. Stereo MS.2032. Out On The Weekend - Harvest - A Man Needs A Maid - Heart Of Gold - Are You Ready For The Country - Old Man - There's A World - Alabama - The Needle And The Damage Done.

Neil Young writes beautiful songs with the kind of insistently turbulent images that evoke the searcher so much a part of us all. He touches our human spirit, and leaves that touch to work and activate what it may, thus gathering the perspective needed for him to project as a poet/musician. So the thing he does best - the thing that people can't help but follow - is his ability to communicate.

There's a story in this his fifth album - a series of related emotions that can only be told aloud. He paints with his music and his music moves. Each separate song is a chapter ascending to values beyond the sound of the melody. Neil Young has as one of his greatest assets a sense of perception - an awareness and depth that passes the mere use of words; an identity of both character and form that can outrule his technical style cramp; a haunting resonance at once innovative and personable yet unscathed by his ego as a performer. Young comes mighty close to being a figure with that self-same mystique that has made Messiahs out of folk like Robert Zimmerman and David Crosby and Donovan Leitch and John Sebastian and John Lennon. The utter naturalness of his music will last simply because it's important. Lennon and Dylan are the same because they're both frank: if it's good it's because it's good. And Neil Young is both frank and good. He's a demi-god.

"This album also rebuts the argument that rock reaches a peak when it more nearly approaches a European tradition or a country/blues/folk/jazz or any other tradition that's made it. As a poem reaches its most perfect form it approaches the dance." These lines from an unbought Byrds album are universal in their meaning. They can apply to "Harvest" only because it is also a masterpiece of personal expression - free wheelin' and liberated. Young has adopted much of the same idea as the Byrds in that if it isn't felt it isn't to be explained. He writes from his heart:

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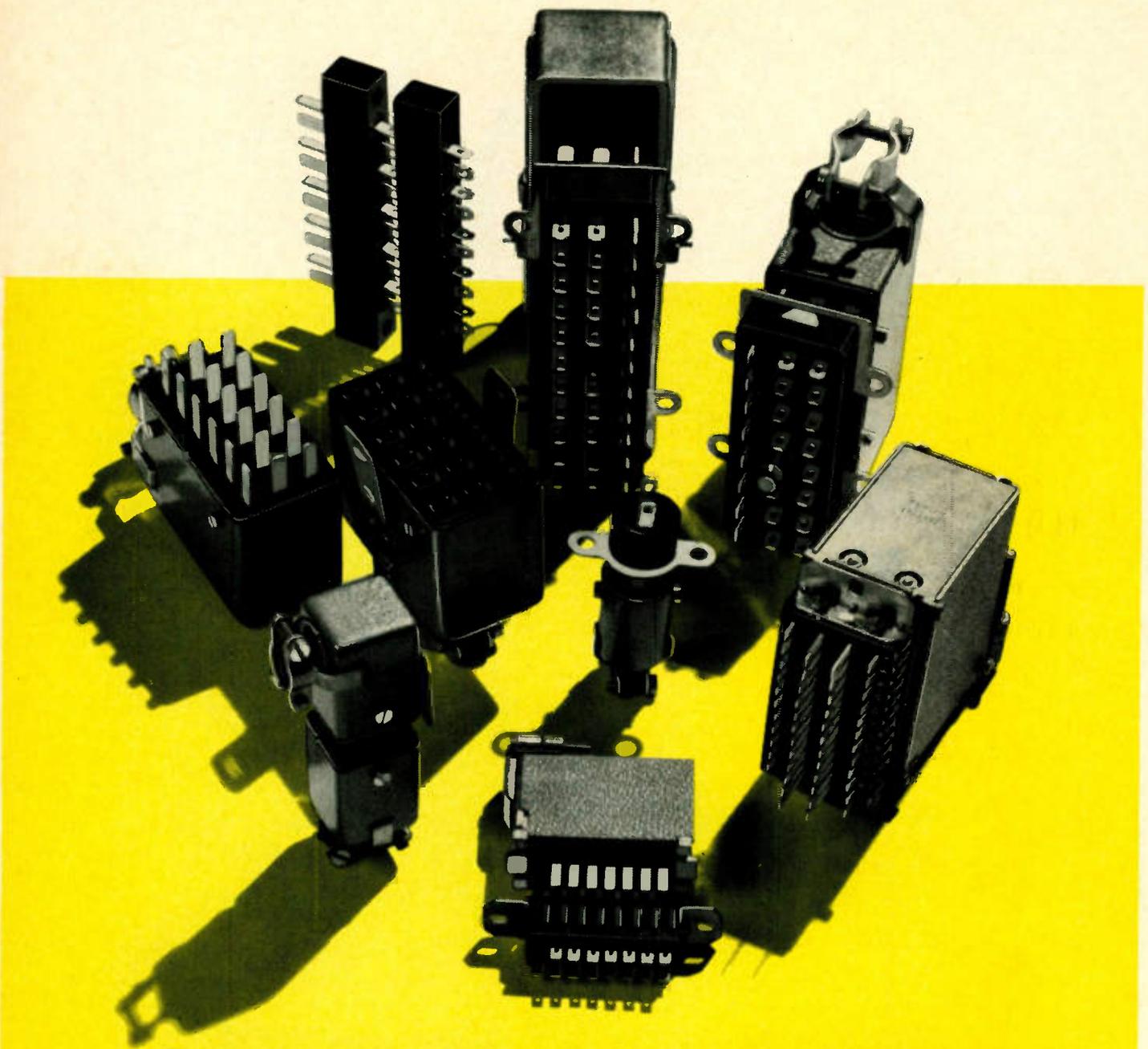
His songs hold no unforeseen loop-holes; they pull no punches once it comes down to recording experience. "Heart Of Gold", "Old Man", "Alabama" and "The Needle And The Damage Done" — an excerpt from which is printed above — are clearly defined statements. All you've got to do is listen. He's even gone so far as to use the London Symphony Orchestra to help stress his point. I don't think it's necessary to elaborate because Neil Young is a talent that you'll realize to be a genius in your own time. Production is excellent. — M.D.

"ANTICIPATION" — Carly Simon. Kinney. Stereo EKS.75016. Anticipation — Legend In Your Own Time — Our First Day Together — The Girl You Think You See — Summer's Coming Around Again — Share The End — The Garden — Three Days — Julie Through The Glass — I've Got To Have You.

Carly Simon is unique. She's one of the few ladies involved with rock 'n' roll smart enough to be a musician. Her image and feminine appeal become apparent only after you've realized what a great singer/songwriter she is. And she's sexy — like a female Mick Jagger. Considering that pop has always relegated girls to the role of 'object' it's pretty good to find somebody else apart from Aretha Franklin and Carole King getting it on as a talent who doesn't owe her success to bust measurements. That's been the fault all along: do a Joan Baez and you've become the professional virgin — so frail and humble and so terribly genuine; do a Melanie and you're just so cute it makes everybody's mind fall out smarmed over with saccharine. In essence all three have become symbols destined to be cherished but not totally respected as creative artists. And that puts the music way down.

Carly Simon is just as much a symbol except that she's more aloof. She sings icy with the bitterness of Carole King and the haunting restraint of Astrud Gilberto. She makes you itch. Her songs are gentle and romantic — lots of sentiment; tons of nostalgia. Sometimes it gets so strong that you feel like you're watching an old movie for the third or fourth time. You've seen it all before and you know the characters and the setting and even the dialogue — but it has this charm. It's almost like pure melancholy — similar in feel to Paul Simon circa "Bookends". "I've Got To Have You" and "Summer's Coming Around Again" are two of those indefinite love ballads so fragile that you begin to lose track of yourself wandering through the melody. "Our First Day Together" is a delicate song about new love — subtle and magical.

Sometimes she gets lost in her own memories. Songs like "The Garden" and "Julie Through The Glass" ring so clear that they almost stop you dead in your tracks. Always, though, her skill keeps them floating and flowing and always they're filled with that same spirit of benign intelligence that keeps them well away from the trite. Carly Simon is very clever like this: her backings are simple and the arrangements underplayed. Everything has been geared to feature her guitar/vocal as the centre-point — a position richly deserved. This is a wonderful album. Production is excellent. — M.D.



Painton have the right connections.

Painton is the keyword for maximum space saving, reliability and quality proven multi-circuit connectors. Whether male or female, covered or uncovered, side or top cable entry, with or without locks they all have the right connections... in fact a simple method of polarisation makes incorrect connection impossible.

The 159 Series is B.P.O. approved to PO203 and is available with from 7 to 71 poles. The series offers smaller physical size for any given contact combination. Contacts are of brass, gold flashed on

silver plate as standard. Connectors fitted with hard gold plated contacts to A.P.O. specification are available on request. The 159 Series offers a high standard of electrical performance with the added features of robust cable clamp design and optional retainer, providing a flat, strong and sturdily locked mating unit.

The Multicon range is quality approved to DEF-5321; is available in combinations with from 2 to 33 poles and offers many improved features compared with types of similar construction. Contacts are heavily silver plated to ensure

maximum contact efficiency. Split limb clips provide four individual areas of contact with each plug blade. Other features include moulded terminal numbering and moulded distance pips to avoid moisture build up between mated plug and socket which is instrumental in superior tropical performance.

The heavy duty Multicon range is basic to the Multicon range, and is designed to withstand extreme mechanical environmental conditions. Available in 7 contact combinations from 4 to 33 poles, the range incorporates the same

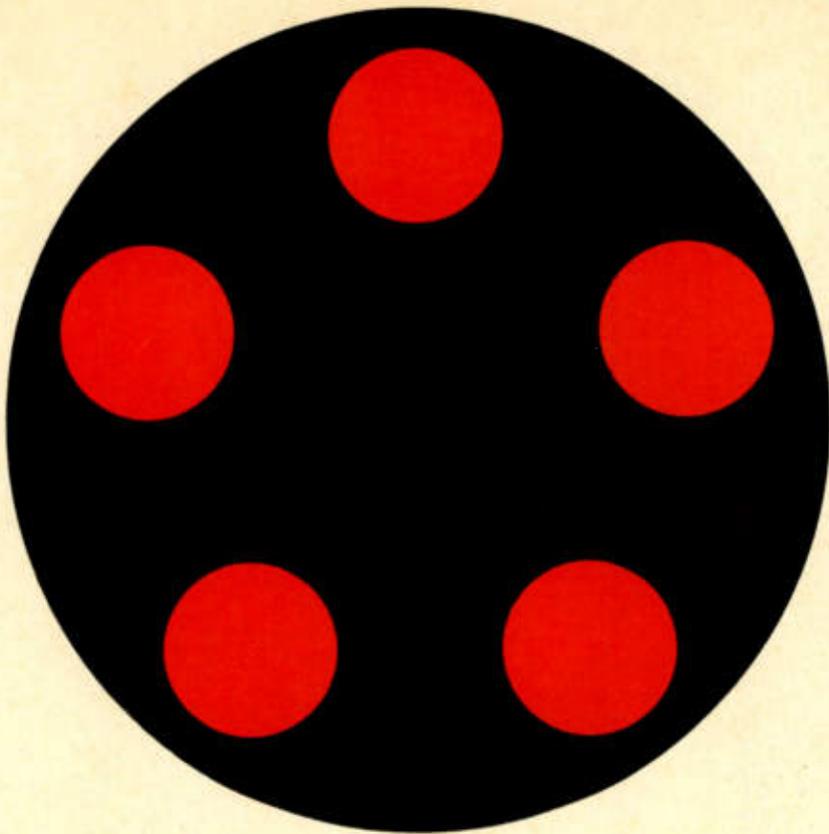
mouldings, contacts and electrical specifications as the Multicon range. A standardised range is available ex stock. Literature is available on request to the Professional Components Division.

PLESSEY
Ducon



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AD50



Ersin MULTICORE 5 CORE

The world's finest cored solder

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SPECIFICATION APPROVALS

Multicore Solder meets all appropriate national specifications and is exported to 63 countries throughout the world. Ersin Multicore is completely guaranteed.

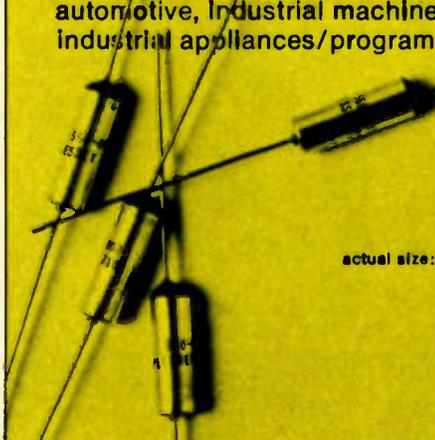
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A reversible electronic integrator with nonvolatile memory for Timing, Integrating and Counting.

The Plessey E-cell is a circuit component (sometimes called a Microcoulometer) which integrates electron flow in either direction retaining the last integral (set charge) in its memory indefinitely. Whenever the integral in the memory is made zero (cleared), the component changes state providing an electrical trigger signal.

Applications include **Timing** ordnance, safe and arm/sonobuoy scuttling/long delays (months)
Current — Time Integration environmental monitoring/data accumulation/laboratory integration — physics, chemistry, meteorology etc./proportional battery charging. **Pulse Counting and Memory** adding and subtracting pulses/counting events — traffic vending etc./confidential memory — security devices.
Use-Time Measurement end of life elapsed time and warranty indication/use accounting — office, automotive, industrial machines. **Repetitive Timing and Controls** repeat cycle timing — domestic and industrial appliances/programmed sequence timing/automatic controls.



Literature available on request.

PLESSEY
Ducon



Plessey Ducon Pty. Limited,
PO Box 2 Villawood, NSW, 2163.
Tel. 72 0133

BOOK REVIEWS

REVIEWER: Brian Chapman

110 INTEGRATED CIRCUITS PROJECTS – By R.M. Marston. Published 1971 by Iliffe Books. Limp covers, 128 pages 8½ x 5½. Review copy supplied by Butterworths (Australia) Pty Ltd. Australian price \$4.25 limp, \$6.10 cased.



With integrated circuits now readily available at reasonable prices, more and more experimenters are building projects incorporating these devices. A book containing IC projects is therefore appropriate and timely.

This book forms a companion volume to "110 Semiconductor Projects" by the same author and is of the same very high standard. There are 30 projects incorporating the RCA CA3018 IC transistor array, 30 incorporating the CA3035 ultra-high-gain wide-band amplifier array, 15 power amplifier projects using the CA3020, PA237 and PA246 IC power amplifiers and 35 digital IC projects using the popular 914, 923 series ICs.

The variety and utility of the projects are excellent, and as with those in the companion volume mentioned above, are graded in order of complexity to facilitate instruction in the theory and technique of usage.

Most project books merely give circuit and constructional details without any real attempt to instruct the reader in the finer points of the theory. This is definitely not the case with Mr Marston's books – his primary aim is obviously to instruct the reader in the design of simple circuitry so that they can get the utmost enjoyment from their hobby whilst constructing useful devices.

This approach has been so successful that many US companies (including RCA) and technical colleges have sought permission to use these projects in their training courses. The book could have no better recommendation than that.

At the modest price how can you afford to be without it. - B.C.

ELECTRONICS SELF TAUGHT – By Jim Ashe. Published 1971 by TAB Books, 285 pages 6½ by 5½, soft covers. Review copy supplied by Grenville Books Pty. Ltd. Australian price \$6.15 limp, \$9.95 cased.

The purpose of this manual is admirably summed up in the title; to provide all the necessary information to a hobbyist desiring to set up and operate his own electronic workshop.

The first three chapters introduce electronics and electronic problems, describe how to set up your workshop in the most efficient and budget conscious manner, and introduce basic electronic theory and devices.

The next four chapters deal with the theory and application of semiconductor devices, the specific chapter headings being – Diode circuits, Switching Transistors, Linear Transistors and Integrated Circuits.

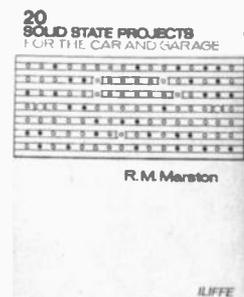
Several projects are given in chapters 8 and 9 including such things as simple amplifiers, burglar alarms and battery chargers, whilst the final chapter provides test instrument projects such as voltmeters, pulse generators and audio oscillators.

The author has crammed a lot of useful information into this book and the layout and progression are quite good. However as an introductory text, more care should have been taken with the theory explanations. In many places statements are made which

could very easily be misinterpreted by a beginner. This is due to the poor choice of analogies or to the use of ambiguous expressions. A good book on elementary theory is a very difficult thing to produce, it requires considerable re-reading and checking in order to eliminate ambiguities and errors. It is one thing to understand theory yourself, and quite another to pass it on to someone else. People who produce books which are misleading, although well intentioned, are really doing the young experimenter a disservice.

In view of the above comments, it is felt that although the book contains a lot of useful information, it is not one which we would care to recommend to beginners. - B.C.

20 SOLID STATE PROJECTS FOR THE CAR AND GARAGE – By R.M. Marston. Published 1970 by Butterworth, limp covers, 115 pages 8½x5½. Review copy supplied by Butterworths. Australian price \$4.25.



Electronic projects specifically designed for cars, such as tachometers, theft alarms, windscreen-wiper controls and battery chargers etc, are very popular indeed. This book by R.M. Marston should be scooped up by the auto-gadget hunters, for it contains just about every type of electronic auto project that has ever been thought of.

There are eighteen projects specifically designed for use in cars, and two for use in the garage. Quite a few of the designs have been previously published in the UK and the USA and have been extremely successful. In particular the first project – capacitor discharge ignition system, has been successfully built by many thousands of hobbyists. The theory of capacitor discharge ignition together with ignition theory in general is treated very completely, which gives the builder considerable insight into the reasons for the use of electronic systems.

Thus, as well as the obvious value of the projects themselves, there is the additional benefit of Mr Marston's teaching ability. In fact each project is accompanied by an excellent explanation of the theory of operation and the principles involved. In the very unlikely event that one did not want to build any of the projects, the book would still have value because of its enjoyable, commonsense treatment. - B.C.

PULSE, DIGITAL AND SWITCHING WAVEFORMS – By Millman and Taub. McGraw Hill International Student Edition, published 1965. Hard covers, 985 pages 8¼ x 5¾. Review copy supplied by Modern Books and Plans. Australian price \$10.25.

This book was planned originally as a second edition of the authors' "Pulse and Digital Circuits". However so much new material has been added and so extensive and thorough have been the additions, that the authors decided to give it a new title.

Thorough is definitely the word to use in connection with this book, which treats the subject to a degree that would be more than adequate for undergraduate electronics courses.

The opening chapter of the book reviews such things as the notational system used, networks, small signal equivalent circuits of tubes and transistors, elementary feedback amplifiers and graphical

INPUT GATE

LETTERS
FROM
OUR READERS

BOOBS AGAIN

You have an excellent technical magazine — so why do you keep on spoiling it by running advertisements such as that on page 13 of your July issue? It is irrelevant and pornographic.

—S.G. Brisbane, Qld.

* The advertisement in question seems to us to be well conceived and in good taste.

To suggest that it is pornographic is totally unrealistic — whether or not it is relevant is for the advertiser and our readers to decide.

DATA BANKS

Your editorial concerning computer data banks was well expressed and timely. There can be little doubt but that controls are required. However there is one area that you did not discuss and that is security of information. My colleagues tell me that as the data is transmitted and stored in digital form there is no possibility of accidental or deliberate intrusion, what are your views on this?

—D.J. Beacon Hill, NSW

* Your colleagues are misinformed. All that is needed to successfully wiretap is a tape recorder and a conversion table to decode the digital signals.

Intrusion can and *does* occur in any of three ways.

1. **Accidental** — as a result of user or system error. — Despite the accidental nature of the intrusion, the file is nevertheless compromised.
2. **Deliberate (passive)** done by wiretapping or electromagnetic pickup.
3. **Deliberate (active)** obtained by 'core dumping', browsing, intercepting and transmitting false data to user, masquerading as another user, between lines entry when user is inactive but still online.

One also must rely upon the integrity of the personnel operating the system — and there is no reason to believe that computer staff are any more or less honest than any other group of people, security screened or otherwise.

Readers interested in this subject are referred to the following:-

Hoffman, Lance J. Computers and Privacy: A Survey: Computing Surveys. ACM June 1969, Vol. 1, No. 1.

Lickson, Charles P. Privacy and the Computer Age. IEEE Spectrum, Vol. 5, No. 10, Oct. 1968.

Lampson, B.W. Dynamic Protection Structures, AFIPS, Fall Joint Computer Conference, Vol. 35.

Graham, R.M. Protection in an Information Processing Utility. Comm. ACM 11,5 (May 1968) p. 365-369. et al.

PIECE de RESISTANCE

If you would like to try an interesting variation on K.H.'s problem, (Input Gate — June '72), calculate the resistance of a network of one ohm resistors arranged to form the edges of a hyper-cube (or four dimensional cube) with the current entering and leaving two diagonally opposite corners. Now for the coup de grace — I know that's French for lawnmower because its always administered by the Victa — par for the course is 35 seconds. Mental arithmetic only, no pens, pencils, or time shared terminals, (or prizes! — Ed).

— A.M.F. North Balwyn, Vic.

WHAT'S IN A NAME

In your July issue you refer to the revised Magnavox loudspeaker enclosure as the 8-30 enclosure. Yet in the original constructional article the enclosure is described as the MP 31-018. Which should it be and why?

— S.J. Perth, WA.

*The enclosure, which was originally designed by Magnavox, is their type MP 31-018. However the hi-fi industry, and most readers who have built the enclosures, invariably refer to them as the 8-30 enclosures as this is Magnavox' type number of the 8" drive unit around which the enclosure was designed. To use the original number would only cause confusion.

ACOS

REPLACEMENT LONG LIFE CARTRIDGES

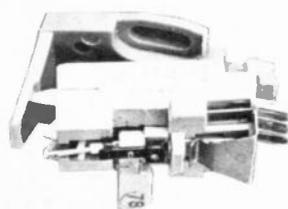
Acos 90 Series — a family of pick-up cartridges covering all the main types needed today, each fitted with Diamond Stylus at no extra cost.

GP91-1 MONO CRYSTAL Stereo Compatible	\$6.95
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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

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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 to 2 mile range) \$10.00 — \$34.50
- Pressure Mats \$9.50 — \$11.50
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- 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
- Alarm 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

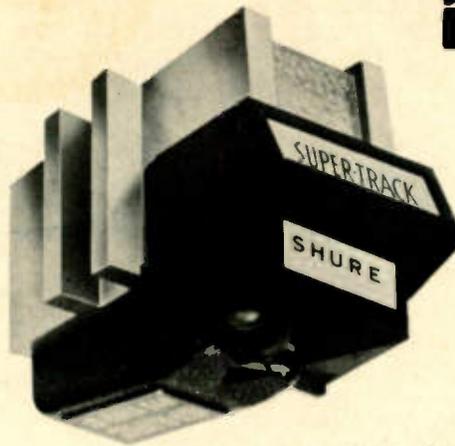
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OPEN SATURDAY MORNINGS

SUPER TRACKABILITY CARTRIDGES

For $\frac{3}{4}$ to $1\frac{1}{2}$ Grams Tracking



V-15 TYPE II (IMPROVED)

The world-famous, computer-designed Shure V-15 Type II Super Trackability phono cartridge heralded a new epoch in high performance cartridges. Now, Shure has *improved* the trackability of the bass and mid-frequency range of the V-15 Type II without affecting its redoubtable treble . . . so that even recordings with very heavily modulated low frequency passages can be tracked at super-light, record-saving forces!

WHAT TRACKABILITY MEANS TO YOU AND YOUR RECORDINGS

The "secret" of High Trackability is to enable the stylus tip to follow the hyper-complex record groove up to and beyond the theoretical cutting limits of modern records (theoretical cutting limits shown by grey area in chart at right) — not only at select and discrete frequencies, but across the entire audible spectrum — and at light tracking forces that are below both the threshold of audible record wear and excessive stylus tip wear.

THE SHURE V-15 TYPE II IMPROVED GIVES SUPERIOR TRACKABILITY AT LIGHT FORCES

No cartridge that we have tested (and we have repeatedly tested random off-the-dealer-shelf samples of all makes and many models of cartridges) can equal the Shure V-15 Type II in fulfilling all of the requirements of a High Trackability cartridge — both initially and after prolonged testing, especially at record-and-stylus saving low tracking forces. The Shure V-15 Type II Improved Super-Track Cartridge is capable of tracking the majority of records at $\frac{3}{4}$ gram!* However, state-of-the-art advances in the recording industry have brought about a growing number of records which require 1 gram tracking force in order to fully capture the expanded dynamic range of the recorded material.

THE PRACTICAL EFFECT OF IMPROVED BASS TRACKABILITY

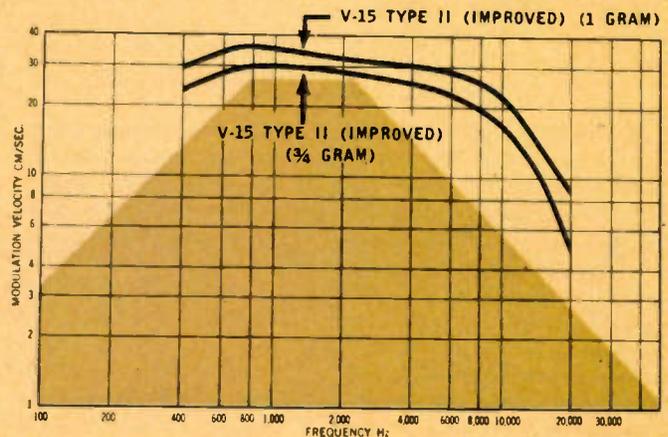
Where, in the past, you may have been required to increase tracking forces to track heavily modulated bass drum, tympani, organ pedal, bassoon, tuba, or piano passages, you can now play these passages without increasing tracking force, without bass flutter, or IM distortion. This means that you can reduce $1\frac{1}{2}$ gram tracking force to 1 gram, or 1 gram to $\frac{3}{4}$ gram for records with high velocity bass material.

UPGRADING THE ORIGINAL V-15 TYPE II

You can significantly improve the performance of your original V-15 Type II by using the VN15E IMPROVED stylus listed at right. Look for the word "Shure" in red letters on the stylus grip (the original unit used black lettering).

TRACKABILITY AS A MEANINGFUL SPECIFICATION

This chart depicts the new performance specification of trackability. Unlike the over-simplified and generally misunderstood design parameter specifications of compliance and mass, trackability is a measure of total performance. The chart shows frequency across the bottom, and modulation velocities in CM/SEC up the side. The grey area represents the maximum theoretical limits for cutting recorded velocities; however, in actual practice many records are produced which exceed these theoretical limits. The smoother the curve of the individual cartridge being studied and the greater its distance above the grey area, the better the trackability. The trackability of the Shure V-15 Type II Improved is shown by the solid black lines.



*SPECIAL NOTE:

$\frac{3}{4}$ gram tracking requires not only a cartridge capable of effectively tracking at $\frac{3}{4}$ gram, but also a high quality manual arm (such as Shure SME) or a high quality automatic turntable arm capable of tracking at $\frac{3}{4}$ gram.

SPECIFICATIONS

Trackability at 1 gram tracking force using a Shure/SME Arm:
 28 CM/SEC at 400 Hz 30 CM/SEC at 5,000 Hz
 35 CM/SEC at 1,000 Hz 22 CM/SEC at 10,000 Hz

Tracking Force: $\frac{3}{4}$ to $1\frac{1}{2}$ grams

Frequency Response: From 20 to 25,000 Hz

Optimum Load: 47,000 ohms resistance in parallel with 400 to 500 picofarads total capacitance per channel. Load resistance can be up to 70,000 ohms with almost no audible change in frequency response. Total capacitance includes both the tone arm wiring and amplifier input circuit.

Output Voltage: 3.4 mv per channel at 1,000 Hz at 5 CM/SEC peak velocity

Channel Separation:

Over 25 db at 1,000 Hz

Over 17 db at 500 to 10,000 Hz

Channel Balance: Output from each channel within 2 db

Stylus: VN15E Bi-Radial Elliptical Stylus, Diamond Tip

.0007 inch (17.8 microns) frontal radius

.0002 inch (5 microns) side contact radii

.0010 Inch (25 microns) wide between record contact points

VN7 — .0007 inch diameter, spherical stylus

Inductance: 720 millihenries

D.C. Resistance: 630 ohms

Weight: 6.8 grams

Mounting: Standard $\frac{1}{2}$ inch (12.7 mm) mounting centers

MODEL V-15 TYPE II IMPROVED Super-Track Cartridge

MODEL VN15E IMPROVED Elliptical Stylus fits V-15 Type II Improved, V-15 Type II, or V-15 II-7

MODEL V-15 II-7 Super-Track Cartridge with .0007" Spherical Stylus

MODEL VN7 Stylus — .0007" Diamond Stylus fits V-15 II-7 Cartridges

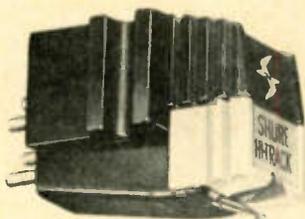
NOTE:

To play 78 RPM records with the V-15 Type II Improved or V-15 II-7 cartridge, use Model N75-3 .0025 radius spherical tip stylus.

DELUXE
SERIES
OF
HIGH
TRACKABILITY
CARTRIDGES

For ¾ to 1½ Grams Tracking

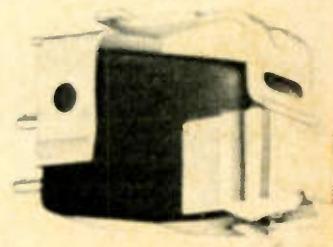
NEW!



CUSTOM
SERIES
OF HIGH
TRACKABILITY
CARTRIDGES

SHURE

M91E
Elliptical Stylus
Easy-Mount Design

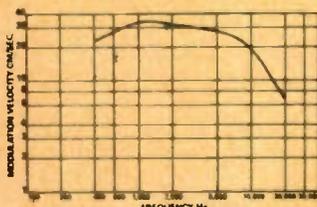


SHURE

**MODEL M91ED AND M91GD
HIGH TRACKABILITY CARTRIDGES**
¾ to 1½ grams tracking

This new series of improved M91 Hi-Track cartridges offers sound re-creation performance never before available in their price class! Optimized design parameters give superior high frequency trackability, and overall performance second only to the peerless V-15 Type II Improved. Gem-quality diamond tip is "nude-mounted" directly on the stylus bar (without a mass-increasing metal bushing) to reduce effective stylus tip mass — and improve trackability. Deluxe molded housing assembly. Available with Biradial Elliptical or Spherical Dynetic styli. Excellent cartridge choices for use in finest quality playback equipment.

TRACKABILITY CHART



SPECIFICATIONS FOR M91ED AND M91GD

Trackability at 1 gram tracking force using a Shure/SME Arm:
22 CM/SEC at 400 Hz
33 CM/SEC at 1,000 Hz
28 CM/SEC at 5,000 Hz
19 CM/SEC at 10,000 Hz
Frequency Response: From 20 to 20,000 Hz
Output Voltage: 5.0 mv per channel at 1,000 Hz at 5 CM/SEC
Channel Separation: Over 25 db at 1,000 Hz
Channel Balance: Output from each channel within 2 db
Stylus: N91ED Elliptical diamond tip
.0007 inch (17.8 microns) frontal radius
.0002 inch (5 microns) side contact radii
.0010 inch (25 microns) wide between record contact points
Stylus: N91GD Spherical diamond tip
.0006 inch (15 microns)

Tracking Force: ¾ to 1½ grams
Recommended Load
Impedance: Nominally 47,000 ohms (per channel). Can be used up to 70,000 ohms with almost inaudible change in frequency response
Input Capacitance: 400-600 Pico-Farads per channel, including arm cable
Inductance: 730 millihenries
D.C. Resistance: 630 ohms
Terminals: 4 terminals
Weight: 6 grams
Mounting: Standard ½" (12.7 mm) mounting centers
MODEL M91ED Hi-Track Cartridge with Biradial Elliptical stylus
MODEL N91ED Biradial Elliptical replacement stylus
MODEL M91GD Hi-Track Cartridge with .0006" Spherical stylus
MODEL N91GD Spherical replacement stylus

SPECIAL NOTE:

Present owners of M91 and M92 cartridges can upgrade their cartridges and obtain the superior performance of the new M91ED by using the new N91ED stylus assembly.

M91E SPECIFICATIONS

Trackability at 1 gram tracking force using a Shure/SME Arm:
20 CM/SEC at 400 Hz
25 CM/SEC at 5,000 Hz
28 CM/SEC at 1,000 Hz
18 CM/SEC at 10
Tracking Force: ¾ to 1½ grams
Frequency Response: from 20 to 20,000 Hz
Optimum Load: 47,000 ohms resistance in parallel with 400 to 500 picofarads total capacitance per channel. Load resistance can be up to 70,000 ohms with almost no audible change in frequency response. Total capacitance includes both the tone arm wiring and amplifier input circuit.
Output Voltage: 5.0 mv per channel at 1,000 Hz at 4 CM/SEC
Channel Separation: Nominally 25 db at 1,000 Hz
Channel Balance: Output from each channel within 2 db
Stylus: N91E Biradial Elliptical with diamond tip
.0007 inch (17.8 microns) frontal radius
.002 inch (5 microns) side contact radii
.0010 inch (25 microns) wide between record contact points
Inductance: 720 millihenries
D.C. Resistance: 630 ohms
Weight: 6 grams
Mounting: Standard ½ inch (12.7 mm) mounting centers
NOTE: To play 78 RPM records with any M91 Series cartridge use an N91-3 .0025 inch spherical stylus.
MODEL M91E CUSTOM Hi-Track Cartridge, Biradial Ellip stylus.
MODEL N91E Biradial Elliptical replacement stylus

SHURE

M93E Elliptical Stylus
Hi-Track Cartridge

M93E SPECIFICATIONS

Trackability using a Shure/SME Arm:
M93E at 2 grams tracking force:
18 CM/SEC at 400 Hz
24 CM/SEC at 5,000 Hz
25 CM/SEC at 1,000 Hz
13 CM/SEC at 10,000 Hz
Frequency Response: From 20 to 20,000 Hz
Output Voltage: M93E 6.2 mv per channel at 1,000 Hz at 5 CM/SEC;
Channel Separation: More than 25 db at 1,000 Hz
Channel Balance: Output from both channels within 2 db
Stylus: N93E Biradial Elliptical with diamond tip, 1½ to 3 grams tracking force
.0007 inch (17.8 microns) frontal radius
.0004 inch (10 microns) side contact radii
.0010 inch (25 microns) wide between record contact points
Optimum Load: 47,000 ohms resistance in parallel with 400 to 500 picofarads total capacitance per channel. Load resistance can be up to 70,000 ohms with almost no audible change in frequency response. Total capacitance includes both the tone arm wiring and amplifier input circuit
Inductance: 720 millihenries
D.C. Resistance: 630 ohms
Weight: 6 grams
Mounting: Snap-in type; standard ½" (12.7 mm) mounting centers on retaining clip
MODEL N93E Hi-Track Cartridge with Biradial Elliptical stylus
MODEL N93E Biradial Elliptical replacement stylus

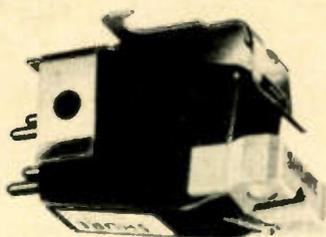
**SHURE PERFORMANCE DEPENDS
ON A GENUINE SHURE STYLUS**

The superior performance of all Shure cartridges depends upon the Shure Stereo Dynetic Stylus Assembly. An inferior stylus replacement will audibly detract from and significantly reduce the cartridge's performance and increase record wear. Obviously, if an imitation Shure Stereo Dynetic Stylus is used, we cannot guarantee that the cartridge will perform to published specifications. Accept no substitute.

**EXTRA
DURABILITY
HIGH
TRACKABILITY
CARTRIDGES**



**M75-6S and M75CS
Spherical Stylus
Hi-Track Cartridges**

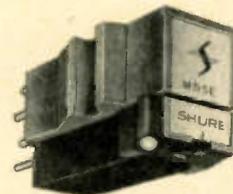


Easy-Mount Design

**STANDARD
SERIES
OF
STEREO
DYNETIC
CARTRIDGES**



**M55E
For 1/4 to 2 Grams Tracking**



CARTRIDGE MODEL	STYLUS CONFIGURATION	TRACKING FORCE	REPLACEMENT STYLUS
M75-6S	.0006" Spherical	1 1/2-3	N75-6
M75CS	.0006" Spherical	3-5	N75C

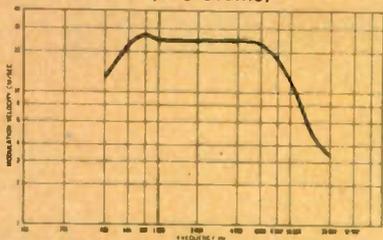
**TRACKABILITY CHART for M75-6S
(at 2 Grams)**



M75-6S and M75CS SPECIFICATIONS

Trackability using a Shure/SME Arm:
M75-6S at 2 grams tracking force:
 18 CM/SEC at 400 Hz 24 CM/SEC at 5,000 Hz
 25 CM/SEC at 1,000 Hz 13 CM/SEC at 10,000 Hz
M75CS at 3 grams tracking force:
 14.3 CM/SEC at 400 Hz 24 CM/SEC at 5,000 Hz
 24 CM/SEC at 1,000 Hz 13 CM/SEC at 10,000 Hz
 Frequency Response: From 20 to 20,000 Hz
 Output Voltage: M75-6S, 6.2 mv per channel at 1,000 Hz at 5 CM/SEC; M75CS, 9.0 mv per channel at 1,000 Hz at 5 CM/SEC
 Channel Separation: More than 25 db at 1,000 Hz

**TRACKABILITY CHART for M75CS
(at 3 Grams)**



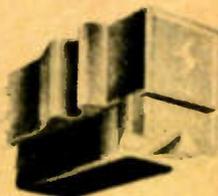
Channel Balance: Output from both channels within 2 db
 Stylus: N75-6 Spherical .0006 inch (15 microns) radius with diamond tip, 1 1/2 to 3 grams tracking force
 N75C Spherical .0006 inch (15 microns) radius with diamond tip, 3 to 5 grams tracking force
 Optimum Load: 47,000 ohms resistance in parallel with 400 to 500 picofarads total capacitance per channel. Load resistance can be up to 70,000 ohms with almost no audible change in frequency response. Total capacitance includes both the tone arm wiring and amplifier input circuit.
 Inductance: 720 millihenries
 D.C. Resistance: 630 ohms
 Weight: 6 grams
 Mounting: Snap-in type: Standard 1/2" (12.7 mm) mounting centers on retaining clip
 MODEL M75-6S Hi-Track Cartridge with Spherical stylus
 MODEL N75-6 Spherical replacement stylus
 MODEL M75CS Hi-Track Cartridge with Spherical stylus
 MODEL N75C Spherical replacement stylus
 NOTE: Use an N75-3 .0025 inch spherical stylus to play 78 RPM records with the M75-6S or M75CS.

M55E SPECIFICATIONS

A popular cartridge that gives professional performance within a moderate budget. Incorporates Bi-Radial elliptical stylus. Note the wide variety of features and impressive specifications:

SPECIFICATIONS

Tracking Force: 1/4 to 2 grams
 Frequency Response: From 20 to 20,000 Hz
 Output Voltage: 6.6 millivolts per channel at 1,000 Hz at 5 CM/SEC
 Channel Separation: Nominally over 25 db at 1,000 Hz
 Channel Balance: Output each channel within 2 db
 Compliance:
 Horizontal 15.0 x 10⁶ CM/dyne
 Vertical
 Effective Stylus Tip Mass: 1.2 milligrams
 Stylus N55E: Elliptical shaped diamond tip
 .0007 inch (17.8 microns) frontal radius
 .0002 inch (5 microns) side contact radii
 .0010 inch (25 microns) wide between record contact points
 Optimum Load: 47,000 ohms resistance in parallel with 400 to 500 picofarads total capacitance per channel. Load resistance can be up to 70,000 ohms with almost no audible change in frequency response. Total capacitance includes both the tone arm wiring and amplifier input circuit.
 Inductance: 720 millihenries
 D.C. Resistance: 630 ohms
 Weight: 7 grams
 Mounting: Standard 1/2" (12.7 mm) mounting centers
 MODEL M55E Cartridge
 MODEL N55E Stylus



**M44E
For Heavier Tracking Forces
1 1/2 to 4 Grams**

All the advantages of a Bi-Radial elliptical stylus for older turntables that track of heavier forces. Good performance at a moderate cost.

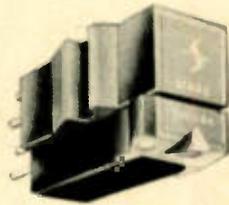
SPECIFICATIONS

Tracking Force: 1 1/2 to 4 grams
 Frequency Response: From 20 to 20,000 Hz
 Output Voltage: 9.3 millivolts per channel at 1,000 Hz at 5 CM/SEC
 Channel Separation: More than 25 db at 1,000 Hz
 Compliance:
 Horizontal 15.0 x 10⁶ CM/dyne
 Vertical
 Effective Stylus Tip Mass: 1.4 milligrams
 Stylus N44E: Elliptical shaped diamond tip
 .0007 inch (17.8 microns) frontal radius
 .0004 inch (10 microns) side contact radii
 .0010 inch (25 microns) wide between record contact points
 Optimum Load: 47,000 ohms resistance in parallel with 400 to 500 picofarads total capacitance per channel. Load resistance can be up to 70,000 ohms with almost no audible change in frequency response. Total capacitance includes both the tone arm wiring and amplifier input circuit.
 Inductance: 720 millihenries
 D.C. Resistance: 630 ohms
 Weight: 7 grams
 Mounting: Standard 1/2" (12.7 mm) mounting centers
 MODEL M44E Cartridge
 MODEL N44E Stylus

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STEREO
DYNETIC
CARTRIDGES**

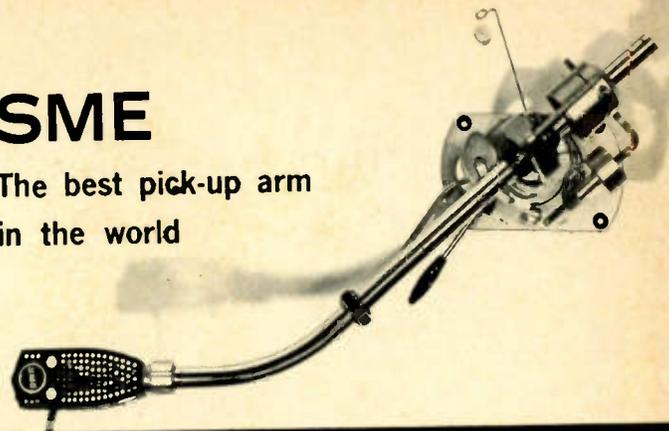


M44 Series
Combines Quality and Economy



SME

The best pick-up arm
in the world



SPHERICAL STYLUS CARTRIDGES

Three budget-priced cartridges to fill the needs of the hi-fi hobbyist who wants the most for his money in this price range. All have received ample critical acclaim as the best in their price class. Note: All M44 series styli are interchangeable.

SPECIFICATIONS

Frequency Response: From 20 to 20,000 Hz
Output Voltage: At 1,000 Hz at 5 CM/SEC
Model M44G, 7 millivolts per channel
Model M44-7, 11 millivolts per channel
Model M44C, 9.3 millivolts per channel
Channel Separation: More than 25 db at 1,000 Hz

Optimum Load: 47,000 ohms resistance in parallel with 400 to 500 picofarads total capacitance per channel. Load resistance can be up to 70,000 ohms with almost no audible change in frequency response. Total capacitance includes both the tone arm wiring and amplifier input circuit.

Inductance: 720 millihenries
D.C. Resistance: 630 ohms.
Weight: 7 grams
Mounting: Standard 1/2" (12.7 mm) mounting centers

For Light Tracking 1/4 to 1 1/2 Grams

MODEL M44G Cartridge. With .0006-inch radius spherical diamond stylus
MODEL N44G Stylus. .0006-inch radius spherical diamond

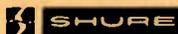
For Heavier Tracking 1 1/2 to 3 Grams

MODEL M44-7 Cartridge. With .0007-inch radius spherical diamond stylus
MODEL N44-7 Stylus .0007-inch radius spherical diamond

For Heaviest Tracking 3 to 5 Grams

MODEL M44C Cartridge. With .0007-inch radius spherical diamond stylus
MODEL N44C Stylus. .0007-inch radius spherical diamond stylus

GENUINE SHURE REPLACEMENT STYLI



CHECK YOUR SHURE STYLUS PERIODICALLY

True, it's unfortunate . . . and unfortunately, it's true: the diamond tip of ANY high fidelity stylus eventually wears out. Some sooner some later. The new ultra-lightweight tracking force cartridges (1/4 to 1 1/2 grams) extend diamond tip life many times. But even they need periodic inspection. Depending upon the degree of wear, a worn stylus will (at the very least) appreciably accelerate record wear — or it can actually damage a record beyond redemption, in a single playing!

SHURE PERFORMANCE DEPENDS ON A GENUINE SHURE STYLUS

The superior performance of all Shure cartridges depends upon the Shure Stereo Dynetic Stylus Assembly. An inferior stylus replacement will audibly detract from and significantly reduce the cartridge's performance and increase record wear. Obviously, if an

imitation Shure Stereo Dynetic Stylus is used, we cannot guarantee that the cartridge will perform to published specifications. Accept no substitute. Look for this wording: "This Stereo Dynetic Stylus is precision manufactured by Shure Brothers Inc."

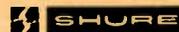
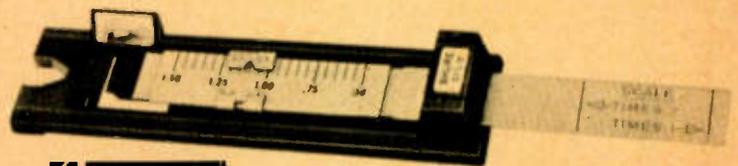
SHURE SME SERIES II "the best pick-up arm in the world"

The Shure-SME, Series II, the ultimate in independent tone arms, provides features and quality unattainable in any other tone arm. Manufactured to singularly close tolerances and standards by skilled British craftsmen. Utterly accurate adjustments are provided for every critical factor relating to perfect tracking, such as height, overhang, length, tracking force and bias (anti skating). These arms accept cartridges weighing 3 to 20 grams and allow tracking forces from 1/4 of a gram to 5 grams to be used. Because the Shure-SME tone arms realize the full potential of the cartridge and the record they are especially suited for use in combination with any Shure cartridge. Highly recommended for use in the very finest component high fidelity systems.

Some of its many features include . . .

- Virtually frictionless knife-edge bearings.
- Effective "anti-skating" bias adjuster counterweight.
- Hydraulic cueing device.
- Two models are made, 3009 and 3012, pivot to stylus distance 9 inches and 12 inches respectively.
- Distortion due to tracking error is minimised by geometry which aims at lowest distortion rather than lowest tracking error.

WEIGHT WATCHER — PAR EXCELLENCE



SFG-2 Force
Stylus Gauge

Low-cost, precision stylus force gauge is a must for the serious audiophile. Detects excessive or insufficient tracking force; allows precise resetting of stylus force to maintain optimum trackability and sharply reduce wear on records and stylus tip. Especially valuable when cartridges are switched. Accuracy to within 1/10th of a gram in 1/2 to 1 1/2 gram primary operating range; extended range to 3 grams. The SFG-2 uses friction-free, stainless steel pivot points and easy-to-read reference bars in a permanently accurate "balance" system — no springs to weaken or wear out. Special tilted mirror reflects reference bar positions for effortless, accurate reading. Greater accuracy in measurement is obtained because the SFG-2 is used with the tone arm in actual playing position.
MODEL SFG-2 Stylus Force Gauge.

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Perth 6000

RADIO ASTRONOMY FOR AMATEURS

(Continued from page 54)

between the converter and IF amplifier.

Having established this point as the internal noise level of the system, aim the antenna at the sun (a strong source of noise, especially in the VHF range). Reduce the gain of the IF or increase the detector output attenuation. Connect the antenna and slowly increase the IF gain (or reduce the detector output attenuation) until the chart recorder pen indicates about 1/3 to 1/4 full scale. This level must be above the internal noise level of the system, otherwise there is some fault or problem in the system. Overall increase from a relatively quiet sun will only be small, but much larger from an active sun.

Observations over a period of hours will indicate if the system is working correctly.

Atmospheric and man-made noise will be mixed in with cosmic noise and could mask it. Swinging the antenna beam pattern across the sun should produce a corresponding slight rise and fall in noise output. This is a good test of equipment performance.

CALIBRATION

A radiometer system should be calibrated at regular intervals using a vacuum diode noise generator (or other types of noise generator capable of producing *absolute* noise voltages.)

Starting at a low value somewhat above the receiver noise level, the output of the noise generator should be increased in predetermined steps until the receiver is nearly into its non-linear region. The overall linearity can also be checked in this fashion. Repeating the operation before and after taking observations with a radiometer provides an indication *and a measurement* of any changes in receiver gain or noise figure during the period of observation. If the radiometer is run continuously, calibrations should be carried out at least daily, or twice daily, and the values plotted to ensure accuracy and continuity in results. Convenient levels and corresponding diode currents can be obtained from Fig. 4.

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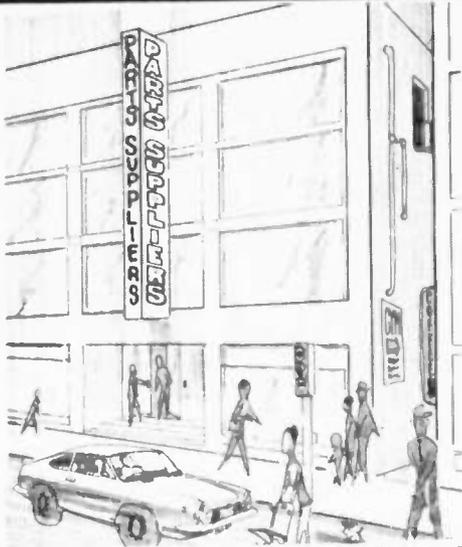
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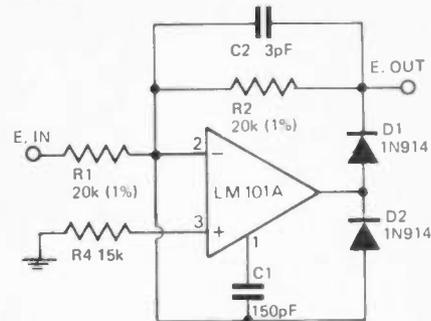
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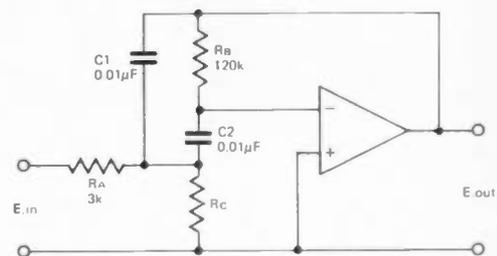
FAST HALF-WAVE RECTIFIER



A precision half wave rectifier using an operational amplifier may be constructed as shown. This will have a rectification accuracy of 1% from dc to 100 kHz.

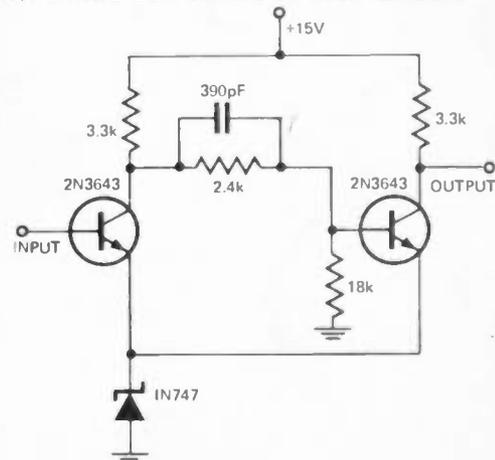
The input signal is applied through R1 to the summing node of an inverting operational amplifier. When the signal is negative, D1 is forward biased and develops an output signal across R2. As with any inverting amplifier the gain is R2/R1. When the signal goes positive, D1 is non-conducting and there is no output. The path through D2 reduces the negative output swing to $-0.7V$, and prevents the amplifier from saturating.

ACTIVE BANDPASS FILTER



A simple bandpass filter may be constructed using an op-amp and a few discrete components. The circuit shown has a constant gain and bandwidth, and the centre frequency may be adjusted from 1.6 kHz to 2.4 kHz by changing Rc from 1100 ohms to 400 ohms. Gain is 26dB at centre frequency and bandwidth is 775 Hz at 10dB down.

SCHMITT TRIGGER WITHOUT HYSTERESIS



By replacing the common-emitter resistor in a conventional Schmitt by a zener diode, the hysteresis normally associated with these circuits is eliminated.

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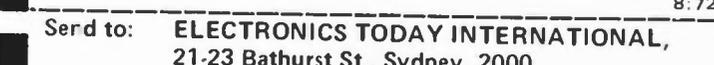
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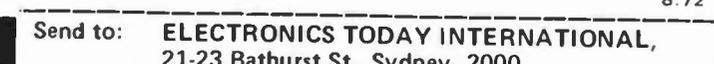
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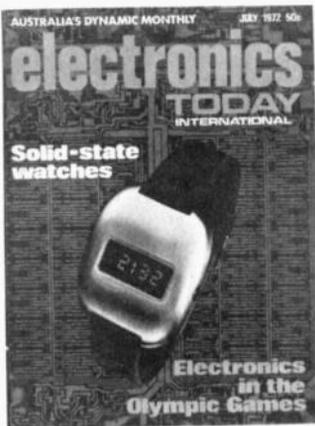


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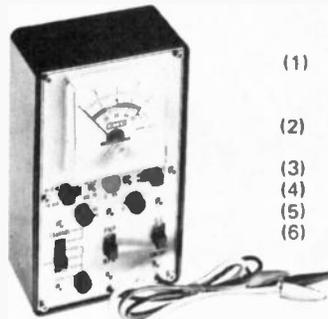
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Bi-directional record and playback tape deck Model A-4070

- 4 Ferrite heads (6 head function) ● Reel size 7"
- Tape speed 3 $\frac{3}{4}$ ips and 7 $\frac{1}{2}$ ips ● Triple motor mechanism ● Wow and flutter .06% at 7 $\frac{1}{2}$ ips ● F/R 25 to 24,000 Hz at 7 $\frac{1}{2}$ ips
- S/N ratio 58dB

Make music - not noise

You may not realise it, but until now, even the best tape decks allowed a degree of noise during recording and playback. This may have been all right for conventional tapes, since they were far from perfect.

But with the recent introduction of the low noise/high output tapes, it's no longer permissible.

Which brings us to a new generation of decks by TEAC. And TEAC calls them Superior Sound/Low Noise decks: decks designed to get the most out of the low noise tapes as well as the conventional types.

Five of these new generation decks are described here. If you'd like to know more, write to us and we'll send you further information (catalogue, dealer list and price list) on the unit(s) that interests you.



Stereo Tape Deck Model A-3300

- Reel size 7" ● Tape speed 3 $\frac{3}{4}$ ips and 7 $\frac{1}{2}$ ips ● Triple motor mechanism ● Wow and flutter .06% at 7 $\frac{1}{2}$ ips
- F/R 25 to 24,000 Hz
- S/N Ratio 55dB



Stereo Tape Deck Model A-1230

- 3 heads-4-head function
- Reel size 7" ● Tape speed 3 $\frac{3}{4}$ ips and 7 $\frac{1}{2}$ ips ● Triple motor mechanism ● Wow and flutter .08% at 7 $\frac{1}{2}$ ips
- F/R 30 to 22,000 Hz at 7 $\frac{1}{2}$ ips ● S/N Ratio 55dB



Automatic Reverse Stereo Tape Deck Model A-1250

- 3 heads-4-head function
- Reel size 7" ● Tape speed 3 $\frac{3}{4}$ ips and 7 $\frac{1}{2}$ ips
- Triple motor mechanism ● Wow and flutter .08% at 7 $\frac{1}{2}$ ips ● F/R 30 to 22,000 Hz at 7 $\frac{1}{2}$ ips ● S/N Ratio 55dB



Combination Head Stereo Tape Deck Model A-1030

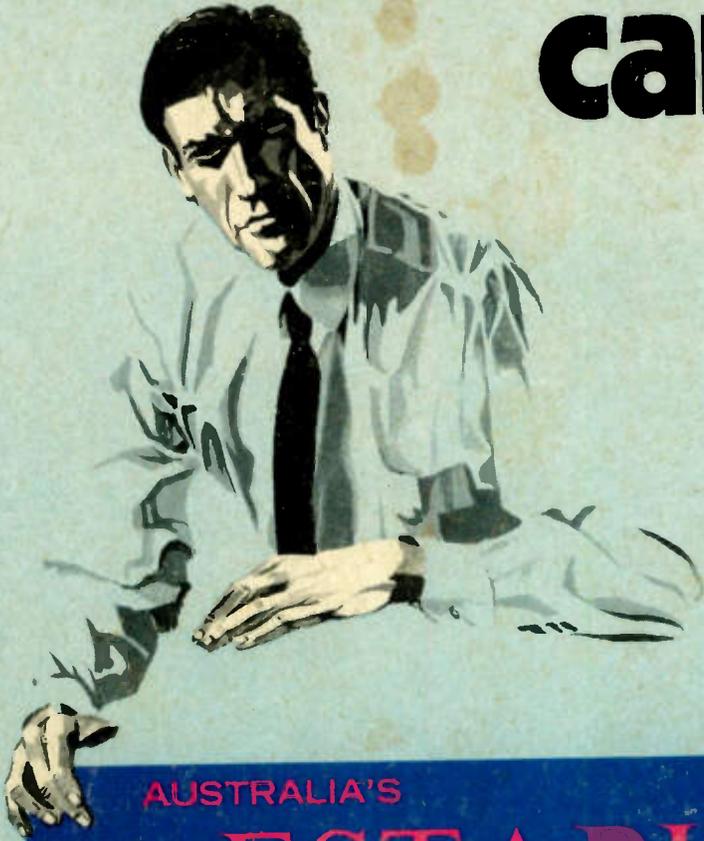
- Reel size 7" ● Tape speed 3 $\frac{3}{4}$ ips and 7 $\frac{1}{2}$ ips ● One motor mechanism ● Wow and flutter .08% at 7 $\frac{1}{2}$ ips
- F/R 30 to 22,000 Hz at 7 $\frac{1}{2}$ ips ● S/N Ratio 55dB
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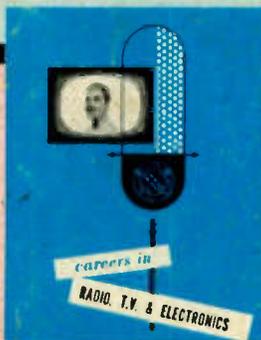
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