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Australia's Top Selling Electronics Magazine

Electronics Australia

JANUARY 1986
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Sony's brilliant new 8mm video system

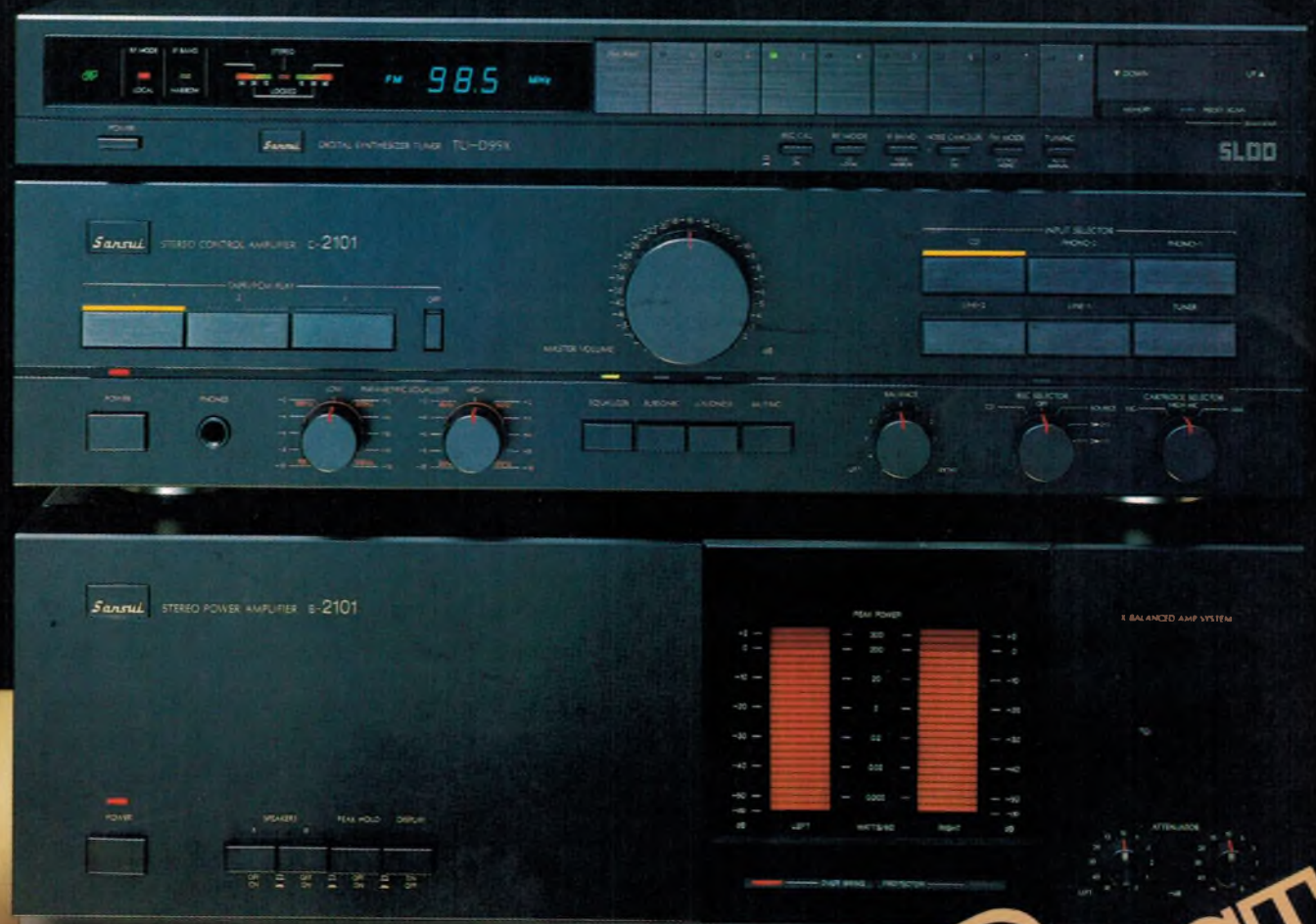
How to match your CD player to your amplifier

Reviews:
Toshiba T-1100 portable computer

Carver DTL-100 compact disc player

Build your own video fader

Special Supplement: Compact Disc Directory



TU-D99X SLDD Digital Synthesizer Tuner
C-2101 Stereo Control Amplifier
B-2101* X-Balanced Power Amplifier

X BALANCED AMP

*RMS power output: 200 watts × 2 (8 ohms), 20Hz – 20kHz, less than 0.003% THD. Dynamic power output: 680 watts × 2 (2 ohms).

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THIS MONTH'S COVER

Is your favourite record available on compact disc? Find out with our comprehensive compact disc directory. Pt.1 begins on page 97. (Photo by Greg McBean).

Features

Entertainment Electronics

Projects and Technical

News and Comment

Departments

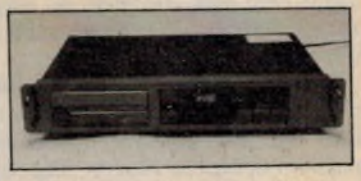
Low-cost video fader

Add a touch of professionalism to your home video movies. This simple video fader circuit lets you fade a scene to black (and back again) without loss of picture lock.

What's coming

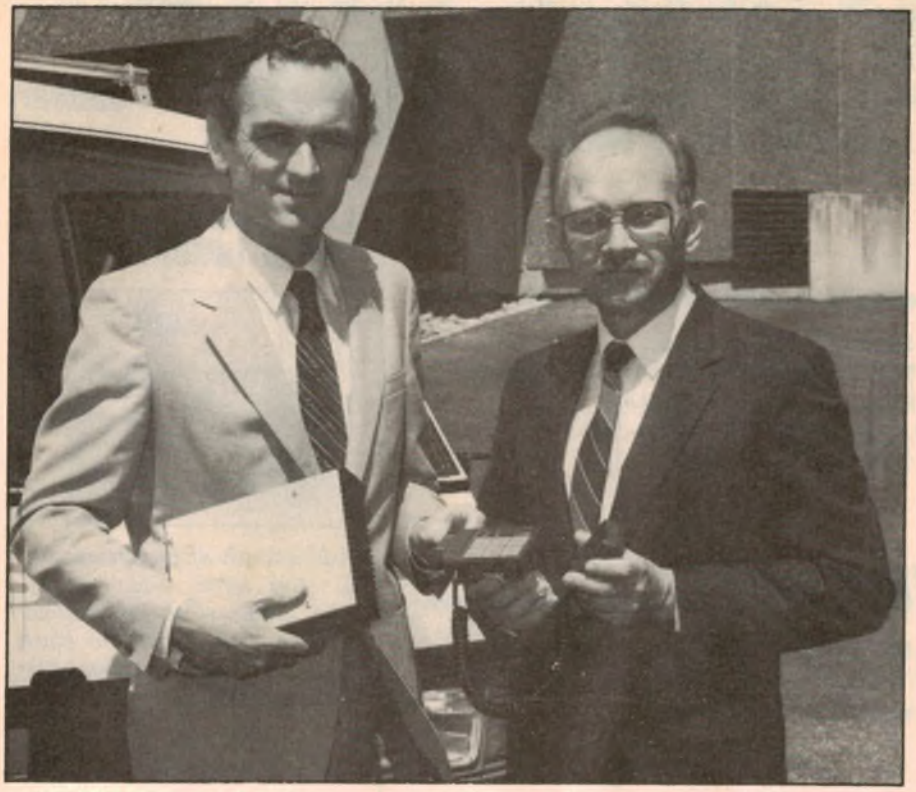
Next month we intend to describe a radio direction finder. See page 116 for further details.

Carver DTL-100 CD player



This month we review Carver's new DTL-100 CD player with "digital time lens" circuit. Find out how it performs by turning to page 26.

News Highlights



AWA is to supply 260 RT-85 Carphones to the Australian Gas Light Company.

AWA to produce mobile radios locally

Amalgamated Wireless (Australasia) Limited has transferred the manufacture of its RT-85 mobile radios from Japan to its New Zealand company, AWA New Zealand Ltd.

This means that, under CER, the manufacture of the radios is now considered as local, opening the way for additional government contracts to be awarded to AWA.

The VHF-UHF mobile radio is preprogrammable and operator selectable, with 64-channel capacity and a pushbutton digital display control unit with microphone.

The RT-85 Carphone has a wide range of options that can expand the capabilities of the system. Among these are: automatic number identification, selective calling and vehicle to vehicle communication.

AWA has, in fact, recently been awarded a contract to supply the Australian Gas Light Company with 260 RT-85 Carphones for their customer service fleet and the emergency gas maintenance services.

Erasable optical disks are on the way

Impressive advances in optical disk technology were highlighted at the National Computer Conference in Las Vegas last year. This new technology offers 20 times the information density of existing magnetic storage devices at a lower cost per byte.

The technologies for read-only and write-once versions of optical disks are well in hand. What has proved elusive is the formula for an erasable optical disk. One of the leading contenders in this field is Verbatim Corporation who unveiled their new 3½ inch, 40 megabyte (formatted) erasable, removable magneto-optical disk and drive.

Two approaches have been followed in the search for the erasable optical disk; the phase-changing media and the magneto-optical approach. The latter is the basis favoured by the Verbatim Corp and they have a cool $800,000 staked on their device. It seems appropriate that it was first shown in the city whose name epitomises a gamble.

In magneto-optical recording, the active layer of the disk is uniformly magnetised in a direction perpendicular to the plane of the substrate. To write, an electrically modulated laser beam is focused on a 2μm spot of the active layer. The beam raises the temperature only in the spot being irradiated, making the magnetic domains susceptible to reorientation.

A magnetic coil working with the laser can easily reverse the polarity of the domains by applying a bias field of just a few hundred oersteds and allowing it to cool. This typically takes only about a microsecond. To erase a bit, the process is repeated but the field direction is reversed.

The danger of information inadvertently being destroyed is no more likely to occur than with traditional magnetic disks. The sequence of events would have to involve simultaneously applying heat and a magnetic field to the film.

To provide an inexpensive pregrooved disk, two alternatives are being considered by the company. The first is a plastic layer bonded to a glass substrate, but glass is expensive and easily broken.

The second is an injection-moulded plastic substrate impressed with the pregrooved pattern, but this requires an established plant and the use of an expensive sputtering technology.

Verbatim acknowledges that there are still sizeable technical hurdles to overcome. The access time must be made comparable to high-end Winchester technology, slow data-rate transfers must be improved, and an inexpensive alternative to sputtering needs researching.

Wiring AUSSAT

Technicians at STC's Liverpool factory in Sydney are working on a wiring harness for one of the AUSSAT satellites. The harnesses are produced under contract to the Hughes Company of the US and consist of interlinked wiring and electrical components which control the positioning motors and telecommunications equipment. STC wiring harnesses will be built into other satellites currently under contract for Indonesia and the US.

Radar for F/A-18 strike fighter

Australia's new F/A-18 strike fighter will work wonders for the tactical strength of the RAAF and it won't be done with mirrors. It will be performed through the aircraft's radar system.

The tactical radar has five major component parts of which one, the radar data processor (RDP), is being produced by Philips Communications in Sydney. The radar production line at Philips' Moorebank factory is now in full production and employs about 60 people.

The APG-65 incorporates digital technology with full multi-mission capabilities. Advanced radar technology gives it all the necessary features for both air-to-air and air-to-surface missions. The radar provides moving target and fixed target track modes; air-to-surface ranging on designated targets; a terrain avoidance mode for low-level penetration; and a sea-surface mode that adapts its clutter threshold to prevailing sea conditions.

The APG-65 is located in the nose cone of the aircraft. It has its own built in test system which provides a thorough radar checkout prior to operation and continuous monitoring while in use. It can detect 98% of all faults.

Optical fibres will control Sydney Harbour Bridge traffic

The Department of Main Roads has selected Amalgamated Wireless Australasia Limited (AWA) to supply 144 optical fibre lane change indicators for the Sydney Harbour Bridge.

By the time this issue goes to press, the DMR crews, police escorts and rubber lane divider flaps, will be replaced by the programmable easy to read indicators. Costing a total of $350,000, the indicators will be mounted on eight trusses above the traffic lanes.

Optical fibre traffic indicators are already extensively used in such countries as the UK, France, West Germany, Austria and Singapore.

The advantage of this type of indicator is that it has an unusually high light intensity and is clearly visible at extremely long distances — day and night, in all weather conditions, including Sydney's winter fogs.

The indicator matrix board can accommodate any configuration to produce a symbol, number or word and several different messages can be displayed from the same signal face. The light source comes from quartz halogen lamps with a life of 8000 hours.

Further uses for optical fibres are being researched at AWA and could include traffic control and pedestrian crossing signals.

Columbia modified for re-entry research

Significant changes have been made to NASA's first Space Shuttle orbitor, Columbia, to accommodate three experiments designed to measure orbiter aerodynamic and thermodynamic characteristics.

The most obvious change to Columbia is a cylindrical housing which has replaced the fintop on the vertical tail. The pod contains all the equipment for the experiments which will be used to obtain high-resolution infrared images of the upper surfaces of Columbia's port wing and fuselage as the orbitor re-enters the atmosphere.

By acquiring data that cannot be adequately simulated in ground tests, NASA will have realistic results on which to base further space transportation developments.

New sonar test facility

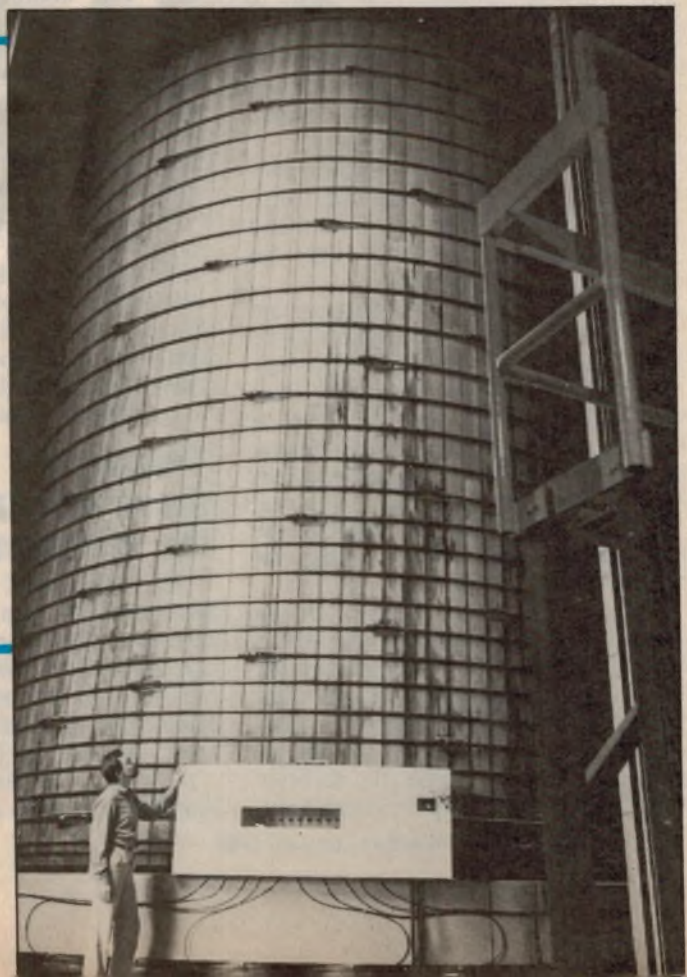
Boasting the latest equipment, this advanced underwater sonar test facility for the Department of Defence has been established at the Meadowbank plant of Plessey Australia Pty Ltd.

The $750,000 test facility, which took 11 months to complete, will be fully operational once the instrumentation is commissioned.

The facility consists of an American Redwood tank 8.7 metres high with a diameter of 7.6 metres, housed in a special building. The tank contains nearly 400,000 litres of water and is mounted on 32 double convoluted air cushions to isolate it from ambient noise.

Plessey is involved in the manufacture of high-sensitivity sonar and sonic equipment for the RAAF and the RAN. This equipment includes the passive Barra sonobuoy and the Mulloka surface ship active sonar.

According to Plessey, the tank will enable the development of improved sensors to keep Australia at the forefront of anti-submarine warfare.



BASF Tape Offer

BASF has advised that their "special tape offer" (EA, November 1985) actually expired at the end of October. The company apologises for any inconvenience this may have caused to readers.

News Highlights

10-inch colour liquid crystal display

Researchers at the Toshiba Corporation have developed a 10-inch colour LCD flat panel — prototype of a device that could be used for future TV displays or home TV receivers. It is an active matrix type LCD with 640 x 480 (307,200) pixels and can display bright, high quality graphic images in up to eight colours.

An active matrix LCD has a transistor at each pixel. This means that the new LCD has 307,200 amorphous-silicon thin film transistors (TFTs). The TFTs function as switches to control each pixel.

The new LCD has a brightness of more than 300 candelas per square metre in white. The picture quality does not deteriorate even under 10,000 lux of lighting and it can display up to eight colours with two grey scales.

According to Toshiba, the fundamental colours (red, green and blue) are nearly the same as standard colour picture tubes.

Prodigious picture phone potential

Business users are to be the first target for the long awaited launch of the picture phone. Technological trends have finally made this much fabled device a realistic prospect. The ability to send digitally encoded TV signals over relatively low-cost 56kb/s telephone lines (in the US), will give a picture capability to the desk-top picture phone.

Some of the more excited proponents of the device contend that the falling price of the electronic hardware could put this type of telephone into the home, in less than a decade.

One of the trends that is boosting the current enthusiasm for the system is the availability of the switched 56kb/s service. AT&T have a planned 34 cities tied to the network and they hope to add 36 more next year. Other companies such as Argo Communications Corp., New Rochelle and also local telephone companies are seeking the new digital service, thus opening the work even further.

The development of the dial-up 56kb/s service has sparked a race to see who can get the best video codec on the market. These devices are all important if full motion picture telephony is wanted. The key to the device lies in the algorithm which compresses the 4.2MHz video output signal from a camera down to a 56kb/s digital signal for transmission. In Europe the digital subscriber connections are made at 64kb/s.

A number of companies have come up with systems that include colour monitors, built-in cameras and their own codecs. Some are even offering a local area network to allow multiple phones to share the codec. Others don't believe it will ever take off and are sticking to freeze-framed teleconferencing; which can be transmitted over regular voice-grade phone lines and is certainly much cheaper.

Work on the algorithms being developed by each firm, with an interest in the field, means that in the US there will have to be multiple standards to accommodate each of the companies preferred methods. However the International Telegraph and Telephone Consultative Committee (CCITT) is attempting to produce one standard.

Trouble for those abusing the airwaves

The Department of Communications has been making an effort to curb interference on the airwaves. The account of a recent court action in Adelaide is an indication of the penalties that can be imposed as a result of illegal use of radio equipment or licence breaches.

A south Australian man made the Adelaide CB radio repeater useless for operation by hundreds of other licensees and was fined the maximum of $40, with his $300 transceiver also being confiscated.

Evidence showed that departmental officers traced the man to a site at Mount Gawler where he was found to be making what the Department considered to be unnecessary and unauthorised transmissions on the Adelaide CB radio repeater. In addition to the penalties listed, the defendant was ordered to pay $17 court costs and $150 towards the Department's investigation costs.

US-Japan trade war

Citing the Trade Act of 1974, the US Semiconductor Industry Association (SIA) recently filed a complaint with the Office of the US Trade Representative against the Japanese. The complaint alleges unfair trade practices by the Japanese electronics industry and restrictive governmental policies which have limited US chip sales to 10% of the Japanese market.

According to the complaint, the Japanese have relegated American semiconductor manufacturers to the position of "residual suppliers" by only buying from one another rather than on the basis of competitive merit. The SIA is demanding negotiations with the Japanese Government to prevent chip dumping in the US and has called for retaliation if no solution can be found.

Portable voltage standard

Commercial production of an electronic DC voltage transfer standard instrument is the outcome of an 18-month joint project involving CSIRO and Statronics Power Supplies of Sydney.

The device was developed as a replacement for the conventional electrochemical standard cell group. Although electrochemical standard cells have served the international measurement community well, they are no longer readily available. They are also difficult to maintain and transport, and are sensitive to mechanical shock, vibration, temperature change and electrical loading.

This solid-state voltage reference is much more robust, an important consideration when it comes to transferring voltage from one laboratory to another over large distances.

One of the annoying difficulties with standard cells is that their voltages can be temporarily affected by extremely small charging or discharging currents.

The beauty of an electronic reference is that it can be designed to be completely immune from such loading effects.

The project has resulted in a 6kg device with four 10V and four 1.0186V outputs which are virtually independent of temperature and which are not invalidated by an inadvertent short circuit.

The annual drift of each output is within 3ppm. The instrument has a maximum power rating of 15W and operates within a 20% range of both 240 and 120V at 45-60Hz. Internal standby battery power is provided to ensure 24 hour operation.

The V84 carries a five year warranty and costs $5820 including initial certification records.

New company backs inventions

A new company, Engineering Innovation Ltd, has been formed to bring Australian engineering inventions to commercial production. The company is jointly owned by McPherson's Ltd and the Australian Industry Development Corporation.

McPherson's and the AIDC will provide funds of up to $3 million to the venture over the first three years. Further funding would be based on the venture's progress and requirements.

The company plans to work with CSIRO, university and government research laboratories, as well as with private inventors. It has established an office at 6 Buckhurst Street, South Melbourne and is actively seeking products for development.

Australian company in new non-volatile RAM process

Newtech Development Corp Ltd, an Australian company, has secured the rights to a revolutionary new non-volatile RAM device known as Rampac. Developed by the University of Colorado at Colorado Springs, the new electrically erasable programmable read-only memory (EEPROM) uses a thin ferroelectric layer (potassium nitrate) over silicon to give the non-volatile properties.

The biggest market potential is seen as being in the automotive field. So much so, that the company is reported to be on the verge of signing a licensing agreement with General Motors, for aerospace and automotive applications.

Your car could stop dead!

Automotive engineers face a continuing design challenge as the electronic content of the car increases. The problem is to prevent critical and not so-critical systems from being zapped by electromagnetic interference (EMI).

For example, improperly installed cellular radio telephones have been a recent headache. A cellular system that is not properly grounded can set up ground or current loops running through the chassis. Some cars have actually stopped due to ignitition failure.

EMI generated by radio and TV broadcast stations, mobile radio transmitters and fixed radar installations may also cause problems. They could, for example, interfere with vehicle-control systems in nearby cars, creating potentially dangerous situations.

A number of solutions can be employed to prevent interference, including filtered connectors, shielding, and the future development of fibre-optics systems which are substantially EMI-immune.

Sony's new 8mm video camcorder

Recently released in Australia, Sony's new CCD-V8 8mm video camcorder (camera/recorder) is a pointer to the shape of things to come. Technically, it is soundly based; commercially, it remains to be seen whether it will signal the beginning of a major worldwide shift towards the new, more compact format.

by NEVILLE WILLIAMS

Most readers will be aware, by now, of the new international 8mm video standard, destined for adoption as and when the existing 12.65mm (half-inch) formats — VHS, Beta and V-2000 — cease to be commercially viable.

Some years ago, in the face of market confusion over the multiplicity of formats, standards and speeds, video manufacturers realised that, if at all possible, they had to avoid a repetition of the situation. Discussions to that end began in 1980, culminating, in February '85, in ratification by 127 companies of a new international standard 8mm format.

The new format is not based on way-out technology but it does incorporate the most desirable and proven features of existing systems, with the present exception of 6-8 hours playing time.

Sony describes it as "evoluntionary rather than revolutionary".

From the front, the CCD-V8 looks much like any other modern domestic video camera, except that it is completely self-contained. Unlike Betamovie, it contains full in-built playback facilities.

Using a cassette of about the same dimensions as a compact audio cassette, its most obvious attraction is the potential reduction in the size and weight of the associated hardware. This is especially true of portable video camcorders and Sony apparently see them as the most promising point of market penetration for the new format, with the present as the appropriate time to make their move.

In fact, Sony are not the first in the field. Sensing a crisis ahead for 8mm photographic home movies, Kodak announced their plan to market 8mm video in early '84, using hardware manufactured by Matsushita (National) and tape by TDK. Polaroid followed with a similar announcement, naming Toshiba as their principle suppliers.

However, neither Kodak nor Polaroid appear to have ventured beyond their immediate NTSC marketing area, leaving Sony as the true pioneer in the overall electronics marketplace — PAL/SECAM as well as NTSC.

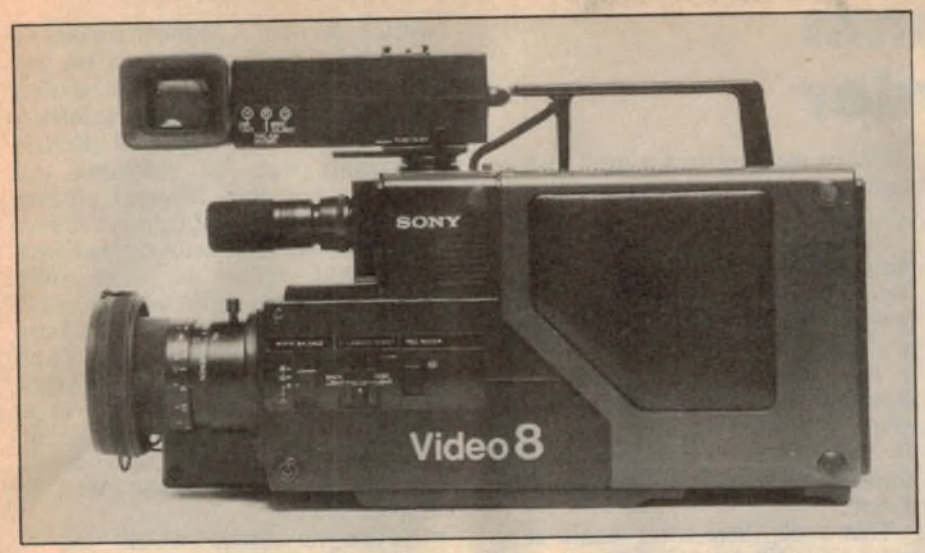
To grab a viable market share is not going to be easy for Sony, in the face of stiff competition from the solidly entrenched VHS system offering VHS-C, VHS Movie from their own Betamovie, and highly specified separate cameras — with new high-tech models just around the corner.

So much for the background; now for a look at the new product:

What you get:

The version supplied for the Australian 240V PAL market is designated as the CCD-V8AS. (We refer to it elsewhere simply as CCD-V8). "CCD" indicates the use of a solid-state charge coupled device in lieu of the usual thermionic camera tube; but more about that later.

The basic camcorder comes, well packaged, in a heavy cardboard carton, complete with supplied accessories: shoulder strap; a 1-hour rechargeable battery pack; a mains power pack cum battery charger; a charger/adaptor to accommodate up to 3 batteries; RF converter, splitter and "antenna" cables to connect to a TV receiver or VCR; a P5-30 metal particle tape for 30-minute recording and playback (or 60 minutes in



Apart from the Record State and Telephoto buttons, other controls necessary for picture taking are operated by the fingers of the left hand, as it simultaneously steadies the front of the camera.

LP mode).

While the original packaging could be used initially for in-car transport, a hard-shell LC-V801 carrying case is available, as an optional extra, to accommodate the CCD-V8, along with the standard accessories. This, and a variety of other optional extras should be available by the time you receive this issue.

The basic CCD-V8 measures 117(W) × 193(H) × 344(D)mm with viewfinder folded and weighs 2.3kg, including battery and cassette. It is normally used, resting on the right shoulder and further supported by an adjustable right-hand grip with built-in stop/start and telephoto drive buttons. A supplementary shoulder brace attachment is available, if required.

Viewfinder, lens

Unlike Betamovie, the CCD-V8 has an electronic viewfinder using a quick-heating 25mm (dia) B&W tube, which can be viewed directly or through an adjustable-focus lift-up eyepiece. The viewfinder assembly can be extended, for convenient viewing through either eye, or used in a variety of positions, even detached from the camera, when working from a tripod.

Important also is the fact that it can be used for on-the-spot picture search, review and editing.

Associated with the viewfinder are yellow, red and orange indicators, for low light, tape run/low battery, and white balance.

A rigid slip-off cover protects the front of the camera, involving the lens system and microphone. It can be left in place when the record/replay unit is being used with the camera inoperative.

The lens is a manual focus Sonoptor 6X power zoom, f12-72, F1.4 (1.8 telephoto) with macro facility. Filter diameter is 46mm, with a filter kit available as an optional extra. At the front of the lens is a removeable, flexible hood, which also accommodates an opaque white-reference filter.

Just above and behind it is a undirectional electret microphone, readily removeable to permit the substitution of an external unit.

Camera controls

With the left hand steadying the camera, the fingers fall naturally on a number of supplementary controls, relevant to video photogrpahy:

- A Camera Power switch which actuates the camera and places the recorder in standby record mode — doubly effective because the CCD is ready for immediate use at switch-on.
- A 3-position switch providing for incandescent lighting (3200K), natural sunlight (5800K) and automatic white balance.
- A 3-position switch providing for normal lighting, back lighting, and strong highlights.
- A "Rec Review" button which automatically replays the last few seconds of the previous recording and readies the camera for the next shot.

When the equipment is in camera record mode, using these controls, they automatically assume priority over the push buttons on the rear of the unit.

Record/replay functions

These controls come into their own when the CCD-V8 is placed flat on a shelf alongside a TV receiver or colour monitor for viewing the tapes. Better than that, the literature shows an optional viewing tray which allows the CCD-V8 to be combined with a power supply and tuner/timer to form a complete video deck.

However presented, the push-button controls are reminiscent of those on separate portable recorders: Power on/off; Eject; Fast forward, Play, Rewind, Stop, Pause, Record.

The tape count plus other information appears in an LCD display window, controlled by Reset and Memory buttons. Also on the panel is an Insert button to facilitate the insertion of titles, &c, a standard/long-play switch, and sockets for a cord remote controller and earpiece.

A 24-pin multiway socket on the right-hand side provides access for the RF output adaptor and/or other possible external fitments — again reminiscent of separate portable decks.

Off-air recording

As much as anything to gain familiarity with the CCD-V8, we set it up initially for off-air recording and replay. In the absence of a companion tuner at the time, this involved interconnecting it with an existing conventional VCR via the respective video and audio input and output sockets, as detailed in the User Manual. (Extra cables are required to do this.)

Unlike the earlier Betamovie, the CCD-V8 processes the signal internally in the standard CCIR/PAL format so that it can operate in conjunction with other PAL-standard equipment — tuner, VCR, recevier or monitor.

Interconnection involves the RFU-85

BRIEF SPECIFICATIONS

Video system	Rotary, two heads, plus erase
Audio system	FM, two rotary heads
Tape speed (mm/sec)	SP:20.051 LP:10.058
Record/play time (mins)	SP:90 LP:180
Fast forward time (mins)	3 (approx.)
Lens	6X power zoom; f = 12-72 F1.4-1.8; macro; 46mm
Colour temp	(1) 5800K; (2) 3200K; (3) auto
Illumination range	22-100,000 lux
Operating temperature	0-40 degree C
Dimensions (approx.)	117 x 193 x 344mm (w/h/d)
Weight (including battery and cassette)	2.3kg
Power sources	rechargeable battery, battery belt, mains adaptor, 12V DC supply adaptor

Sony's new 8mm video camcorder

adaptor (supplied) which plugs into the 24-pin connector mentioned earlier. It carries four RCA sockets for video and audio in and out, plus an antenna style socket for RF out (channels 0-1 selectable on the Australian model). A small switch serves to set the video/audio carrier separation to the normal 5.5MHz ("I" position) or 6.5MHz ("G").

Our first reaction to the RFU-85 was that, for a unit providing the anchor point for several cables, it should lock more firmly into position. In practice, however, it and the cables are likely to be attached more or less permanently to the fixed equipment and simply plugged into the CCD-V8 as necessary.

Using the existing VCR as a tuner (the format is immaterial) we fed a selection of program material and test patterns to the CCD-V8 as direct video and audio, recording it first in standard play (SP) mode and then in the long play (LP) position.

For all practical purposes, in standard play mode, the on-screen program material was indistinguishable from the original or from a similar recording from the standard VCR. Put another way, any differences in the picture quality from the respective sources were less noticeable than variations in the program material itself.

In long play mode, the video noise level was obviously higher, but the picture was still entirely watchable. Interestingly, however, the sound quality remained virtually unchanged at the lower tape speed, due to the fact that, in the CCD-V8, sound is recorded as an FM multiplex component in the video tracks and is not greatly affected by the linear tape speed.

Future potential

In short, while our observations were entirely subjective, they confirmed that, in addition to its size advantage, the format has the capacity to take over from VHS and Beta Hifi in terms of both picture and sound quality.

Playing time for movie length recordings still poses something of a problem, however, involving either some loss in picture quality (in LP mode) or else the ultimate development of longer playing or super quality tape.

We used a 30/60 minute cassette, but 60/120 and 90/180 cassettes (in PAL mode) are due on the market about the time this article is published.

Incidentally, like the Philips V-2000 system, the 8mm format assumes the use of dynamically mounted heads, obviating the need for a control track on the tape or a manual tracking control on the panel.

Consistent with this, the CCD-V8 uses automatic track following but, with its basic 2-head drum, it does not include provision for viewing noise-free pictures in Pause, Review or Cue mode. Images in the viewfinder allow scenes to be identified for purposes of cueing and editing in the field but they are traversed by noise bars which can become proportionately more intrusive on a large screen.

That aside, there is no reason at all why a CCD-V8 should not fill a dual role in the home: (1) for the production of home video movies and (2) as a back-up VCR for those special occasions when one wants to catch three programs at the one time! How the CCD-V8 can be used in this way is explained in the Manual.

In camera mode

As mentioned earlier, the CCD-V8 uses a solid-state CCD image sensor rather than a camera tube. It saves space, weight and battery drain, provides excellent resolution and sensitivity (22-100,000 lux), avoids screen burn and flare, and is substantially free from "microphonic" image jitter. It is also ready for instant use at switch-on.

Perhaps it is confidence in the CCD that prompts Sony, in the manual, to instruct the user — without coyness — to place the opaque filter over the lens and point it directly at the Sun or other light source, in order to set the automatic white balance. It is quick and effective and, along with the automatic iris, provides even, well balanced pictures under a wide variety of light conditions.

Specifications and focussing provisions are broadly similar to other video cameras, and pose similar problems as to how to get by with two hands and one brain, when you could really do with an extra one of each! Sony have done their best to rationalise the controls, even to providing a roughened prominence on which to rest that errant right thumb, instead of (inadvertently) on the "Record" button!

Automatic focus would be of considerable assistance but it is still apparently a difficult option to provide in an ultra-compact camera recorder. So one has to rely on familiarity and practice, or else on more frequent resort to a tripod or the VCT-3 Handy Stand for hands-off recording — items listed as optional extras.

When the user is able, with practice, to string together a sequence of acceptable shots, he/she will discover that the CCD-V8 has managed to merge them without noise breaks or other ugly effects. In itself, that's not unique but Sony technology and the new 8mm format provides frame by frame ("flying") erase, achieving more precise juxtaposition of scenes.

In testing the camera, I simply walked around the house and garden, taking

When placed flat on a shelf or in its adaptor tray for playback &c, the CCD-V8 takes on the appearance of a portable deck, with the usual array of user controls. Add a timer/tuner and it becomes a complete VCR.

at the leading edge

100 MBYTE OPTICAL DISK DRIVE MAKES AUSTRALIAN DEBUT
US manufacturer, **ISI**, has commenced shipments of its model **525 IBM-PC** compatible **Write-Once/Read-Mostly** drive. Supplied as a **user installable kit,** the 525 is designed as a rapid access **(100 msec)** archiving and distribution medium for backing up hard disk drives as well as an Online Direct-Access storage for local and distributed databases. The removable cartridge will withstand electromagnetic fields, heat, light and even scratching offering a data integrity exceeding that of the Winchester drive it is designed to back up.

SOFTWARE BACKUP UTILITY ELIMINATES NEED FOR TAPE DRIVES
FASTBACK can back up a full **10 MByte** hard disk on 5.25" floppies in less than 8 minutes on an IBM-PC, XT or compatibles or **20 MByte** in the same time on an **IBM-AT.**
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Sony's new 8mm video camcorder

numerous independent shots, long distance, close-up and even macro, under a variety of lighting conditions, of flowers and whatnots of every imaginable hue. In between shots, the camera was left sometimes in Pause mode, at other times switched off altogether.

When replayed at the end of the day, the shots were pleasingly consistent in general colour balance, with no obvious missing hues. The pale purples had not washed out to white and there was no mistaking the pink of a *Queen Elizabeth* rose. The greens were all there from the grey-green of the eucalypts to the many hues of a mirror plant.

Overall, my impression was that the CCD image sensor offered results as good, if not better, than its thermionic contemporaries, along with its obvious mechanical and functional advantages.

Inserting, dubbing

As mentioned earlier, the CCD-V8 has an Insert Function, which allows a title, a replacement scene or video/audio from another source to be substituted for an unwanted scene on the tape.

The end of the unwanted segment is located by playback through the viewfinder and pinpointed by pushing the Memory button and setting the counter to 0000. The start of the segment is then located and pinpointed by pushing the "Insert" button, which changes the mode to Record/Pause ready for the new material.

On pressing the Pause or Start button, new incoming video and audio is substituted, without "glitches", between the "Insert" and "0000" points on the tape.

Completed tapes can be replayed directly from the CCD-V8 into a TV receiver or monitor, or readily copied on to tapes of another format by connecting it to a second VCR, preferably at direct video and audio level. Indeed, we were pleasantly surprised at how good such copies turned out.

Incidentally, the CCD-V8 senses whether individual scenes have been shot in SP or LP mode and switches automatically from one to the other during replay, with scarcely a flicker on the screen.

Sound recording

At about 2cm/sec, the linear tape speed of the 8mm format is even less than that of the audio microcassette (2.4cm/sec), falling to 1cm/sec in LP mode. Not only is this too slow for satisfactory analog audio recording but very thin layer tapes also present a problem.

Recognising these limitations, the 8mm standard specifies the use of an FM sound channel, frequency multiplexed with the video signal, much like the original Beta NTSC hifi system. However, it also reserves space along the respective edges of the tape for possible linear audio and cue tracks, but lists them as optional.

The CCD-V8 provides only for simultaneous mono FM sound recording multiplexed with the video track and there is therefore no way, using the CCD-V8 alone, that a new audio track can be added to an existing video recording.

At first glance, this appears to be a major disadvantage for the amateur video photographer, because he/she would have to provide a spontaneous on-the-spot commentary while, at the same time, composing the picture — a rather tall order.

Experience with the CCD-V8, however, suggests a different approach, rather than an impasse. Thanks to the FM recording system, high quality actuality sound is preserved, along with the picture — evidence, in our case, by the pleasant chirping of birds as we toured the garden.

Such actuality sound would always be available for live presentation of the tape, or for mixing into a rehearsed commentary, where the recording is to be dubbed to another format.

Sony Australia further suggest that full-size domestic 8mm decks will probably carry facilities for adding an extra soundtrack using, not analog, but PCM technology, as envisaged in the standard. Time multiplexed with the video signal, PCM would store a "packet" of audio samples just ahead of the video field information (therefore along the edge of the tape) to be decoded and reassembled during replay.

This aspect of the format would obviously need to be looked into before making a final decision but we would be surprised if the industry in general, and Sony in particular, have not planned adequately for post audio dubbing.

That aside, we were impressed with the CCD-V8 and think that it deserves to do well in the market place.

The basic CCD-V8AS is available now through Sony outlets at $2199 RRP, and a comprehensive range of accessories should also be on hand by the time you read this. (W.N.W.)

Letters to the editor

Aussat: bulldust & flies

Through your magazine I would like to point out that due to the development of the AUSSAT domestic satellite service there has been generated a flurry of activity within the electronic industry, in the form of advertising/claims through trade journals, printed media and catalogues.

This activity has also resulted in a number of "fly by niters" emerging from the 4GHz market.

These facts are based on my actual observations and hands on experience.

Therefore, intending dealers/purchasers should obtain in writing a guarantee or similar of warranty cover, after sales service, spare parts back-up and professional installation should this be required.

The operators mainly originate from the capital cities and have no idea what weather conditions can do to electronic equipment.

Remember the Top End of Australia is a rugged place to test electronic equipment. Temperatures range from 0°C to 60°C in the direct sun, and the wet bulb thermometer pops its cork in the wet season.

In the Centre you have to cope with the bulldust and flies, not to mention the spiders that build nests in the scalar feed assembly.

Severe lightning strikes have knocked out more than one T.V.R.O. installation. And of course there is the usual human abuse to receiving dishes, screens and active components. For example TV transmitters and baseband receivers, together with down converters and L.N.A in remote communities are often pelted with rocks etc. by the children there.

When one drives 700 miles then flies 300 miles to repair this equipment, they are certainly very grateful that it is in operation for their football matches.

The moral to this is that without the crucial back-up service, these operators could end up being hunted off the site, literally.

P.S. The advice issued from time to time by D.O.C. is a sound guide line and very informative.

Andrew Sutherland,
VK9KAS 8RWB,
Spinafex Electronics,
Tennant Creek, NT.

B-MAC well-planned and researched

The letter published in your November issue from Garry Crapp of Dick Smith Electronics regarding the cost of HACBSS earth stations and the B-MAC transmission system reveals a surprising lack of comprehension of modern technology. Mr Crapp also, I note, has got his prices wrong.

HACBSS homestead earth stations are currently being marketed by distributors for around $2300, plus delivery and installation (although these may be installed by the buyer). Dick Smith Electronics has been marketing PAL satellite receiver components for around $3600, this equipment for use with the Intelsat IVA satellite.

The Department has widely published warnings to earth station buyers about the equipment needed to receive HACBSS broadcasts via AUSSAT satellites.

It is most important that intending purchasers of earth stations are aware that equipment capable of receiving signals from the Intelsat IVA satellite (transmitting on the 4GHz band) is quite incompatible with AUSSAT (broadcasting on the 12GHz band).

They should also be aware that ABC broadcasts via Intelsat IVA are to cease on 18th December, and that satellite is expected to cease functioning in February 1986. It is probable that other television transmissions currently received in Australia via IVA will cease when

Audible distortion on strings

With reference to your discussions in the August 1985 and other issues of EA on audible distortion in "live" instruments (particularly strings), I have some points to make which may be of interest.

Taking the violin as an example, sound is produced by drawing a horse hair bow dusted with rosin across a metal/gut string suspended by a resonating box. This system is far from perfect — non linearities being present at every step. Imperfect distribution of rosin on the bow causes uneven "sounding" of the string. The string itself is constructed of a length of gut wound on metal wire (usually nickel). Most violin strings are machine wound.

No string is perfect either in consistency of the gut or in perfectly even wiring. As a consequence of this, both mass and compliance vary down the length of the string. When the string is set vibrating, it vibrates in a number of modes (represented "sonically" by a fundamental and a number of partials). Because of the uneven mass and compliance distribution, the higher numbered modes are not exactly harmonically related to the fundamental.

A performer may go through several strings before he/she finds a pleasing combination. The resonator to which the string is fixed is set into sympathetic vibration. It also vibrates in a number of modes, though not at all harmonically related.

The amount that each mode is excited depends on the vibration modes of the string(s). These resonator modes are of course dependant on the construction of the instruments and the wood itself. It is for these reasons that no two instruments sound exactly alike.

It is bad enough considering just the one instrument. When a number of them combine, it is a wonder that the final result is in any way musical. If a number of violins were to play the same note, at least one player would be slightly off note, creating a "beat" in the fundamental. When a note is played on one string, sympathetic vibrations are set up in other strings. It would be almost impossible for every string on every instrument to be perfectly in tune.

The previously mentioned string par-

the satellite "dies", because future Intelsat satellite television services will be transmitted in beams not receivable in Australia.

Mr Crapp is also taking a "television only" view of the satellite broadcasting. He ignores the Department's intensive research in the planning stages of AUSSAT which revealed that residents of remote Australia considered the reception of radio services to be at least as important as reception of television.

B-MAC, as the article in September 1985 by Neville Williams explained in detail, is capable of transmitting one television and six audio channels (two for television, up to four for radio), as well as Teletext and data. HACBSS will provide two such signals, one to be used by the ABC and the other by commercial licencees in four separate zones of Australia.

Certainly this new technology requires new reception equipment, and considerable resources have gone into planning and developing the MAC system, which is currently being considered as an international satellite transmission standard.

It is sad that those with vested interests in "traditional" equipment should be actively seeking to disparage efforts to bring radio and television services to outback people, many of whom do not receive any such services or have to put up with very poor quality reception.

R. B. Lansdown, Secretary,
Department of Communications,
Canberra.

tial vibrational modes, being different for every string, would also beat from one instrument to another. Ditto the sympathetic vibrations of each resonator. On top of this, each player will use a slightly different vibrato technique. One might expect the final result to sound more like a swarm of bees.

Wind instruments are relatively free of these problems — a column of air has more consistent mass and compliance. Consequently, relatively large changes have to be made to the construction of an instrument to cause a significant change to the produced sound.

I hope these points have been of interest.

A. L. Jones,
Lane Cove, NSW.

Editorial Viewpoint

by Leo Simpson

Don't worry about the electronics industry

Over the last few months there has been quite a lot of soul-searching in the media concerning the fate of Australia's electronics industry. This has been triggered by the closure of the Rank plant in Sydney which was assembling colour TV sets, microwave ovens and major whitegoods appliances. From that single event there have been forecasts of gloom: no Australian electronics industry at all in a few years time; we'll all be ruined and so on.

Before concluding that Australia's electronics industry is on the ropes it is wise to consider what was the basis for growth of the electronics industry in the past. The first point to consider is that if it had not been for the existence of high import tariffs in the fifties and sixties and the advent of television, first black and white, and then colour, it is unlikely that we would have had much of an electronics industry at all.

Television was a wonderful opportunity for our budding electronics industry. Originally based on valves, and using point-to-point wiring (this was before printed circuit boards arrived on the scene), the manufacture of television sets employed lots of people and the industry had a boom time for quite a few years satisfying a wide-open market.

Today all that has changed. The market is saturated, with many households having two or three colour sets. The sets rarely require service and far fewer people are needed to make sets for what is now a replacement market.

So even without the removal of tariff protection, there was bound to be a great reduction in the number of people employed in making television sets. The removal of tariff protection in 1975 merely accelerated the process. The United States and virtually every country in Europe has experienced a similar scenario, with intense competition from the Asian countries.

So we cannot rely on the consumer electronics market to provide the level of employment that it did in the past. In reality, there is quite a lot of electronic equipment being manufactured in Australia although none of it is intended for the home consumer. Nor is it necessarily being made by the companies which were big in the consumer electronics market years ago.

These days the typical Australian electronics manufacturer is likely to be a relatively small concern and the product is likely to be related in some way to computer technology, possibly for export. There are a few large companies which are happy exceptions to this. They still employ considerable numbers of people and generate a lot of export income.

Some small measure of this can be gathered from the existence of companies such as Printronics. We told the story of this company in our September 1985 issue. This large company exists solely to supply large numbers of double-sided and multi-layer printed circuit boards to the local electronics industry. If the Australian electronics industry was on the ropes, companies such as Printronics and its competitors could not exist.

The end of an era:

Sydney's last DC power main switched off

by NEVILLE WILLIAMS

Recently, the Sydney County Council turned off the last remaining DC power main, serving Sydney's central business area. The supply had been maintained for just over 81 years but its ultimate phasing out came a neat century after the historic AC/DC confrontation in the USA between the competing interests of Westinghouse and Edison.

Nowadays, because of greater overall economy and versatility, the vast majority of domestic supply mains throughout the world provide consumers with alternating current (AC). The nominal RMS voltage and frequency per phase is most commonly either 117V at 60Hz (American continent, Japan, Taiwan, parts of Asia & Africa) or 240V at 50Hz (Europe, Australia, NZ, Oceania, parts of Asia, Africa).

However, while what was once known as "alternate" current dates back to the original rotating electric generators, it hasn't always been in such a dominant position. This would have been evident to anyone who followed the series of articles in EA from September to November '83, entitled "The inventive genius of Nikola Tesla". As indicated, DC gained a strong lead in the 1890's, before people like Tesla and Westinghouse intervened.

Destined to become a leading proponent of AC technology, Tesla was still a relatively unknown European student/engineer when, in 1879, the American inventor, Thomas Alva Edison, created a whole new scenario with the first really viable incandescent light bulb, using a carbonised filament.

The basic idea was also being investigated by Swan and others in the UK but, with access to better facilities, including vacuum and de-gassing equipment, Edison was able to work his way systematically through cotton, jute, bast, manilla and hemp fibres, before finally settling on bamboo threads as the most suitable source material for carbon filaments.

Electric lighting would no longer be dependent on the optically harsh and temperamental arc.

Realising that incandescent lamps could open the way to a share of the highly profitable lighting market, currently dominated by the gas industry, Edison immediately turned his attention to the ways and means of generating and distributing electricity to power them.

In September, 1882, he opened the Pearl Street (New York) steam driven power station, with 59 household subscribers, providing them with a 110V DC supply — the first of many such systems to be installed in major American cities.

This view shows the main DC sub-station in Clarence Street as it existed during the 1930s.

Renewed interest in AC

In the meantime, however, the Croatian-born Nikola Tesla had been patiently expanding the concept of AC-based (alternating current) electric power systems but, finding little support for his ideas in Europe, he sailed to America and secured a position with Edison. Perhaps not surprisingly, the association between the two was short-lived and Tesla was left to his own meagre resources.

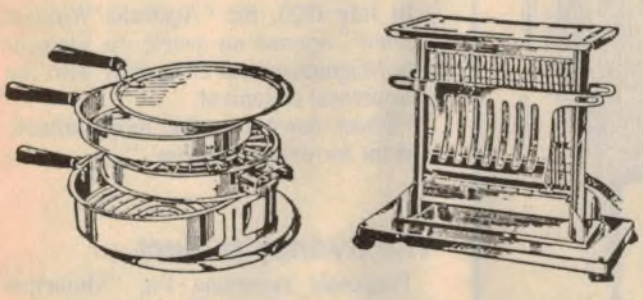
Despite this initial setback, he managed to document and patent the essential features of a complete AC system in 1887, which duly came to the attention of George Westinghouse, inventor, industrialist and gas tycoon.

With an eye to the future, Westinghouse had just founded the Westinghouse Electric Company and had become personally intrigued by the idea of an AC-based supply, reticulated at high voltage (and low current) but with step-down transformers to serve local areas.

He forsaw that this would get around the line resistance problems which Edison was by then encountering, as his DC systems expanded, with anything up to 30V variations in the nominal 110V supply, depending on the load current and the consumer's remoteness from the power station.

Westinghouse signed a licence agreement with Tesla in 1888, causing Edison to resort to extravagant, even bizarre, propaganda intended to highlight the "dangers" of the AC system, in an unsuccessful effort to discredit the poten-

These battery banks were used to buffer load variations and occupied an entire floor of the sub-station.



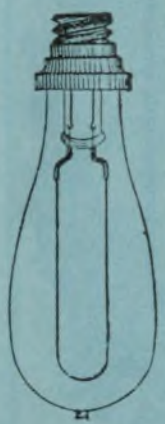
A "modern" electric griller and upright toaster, 1921 style, again normally suitable for use on either AC or DC.

How Edison lamps were made:

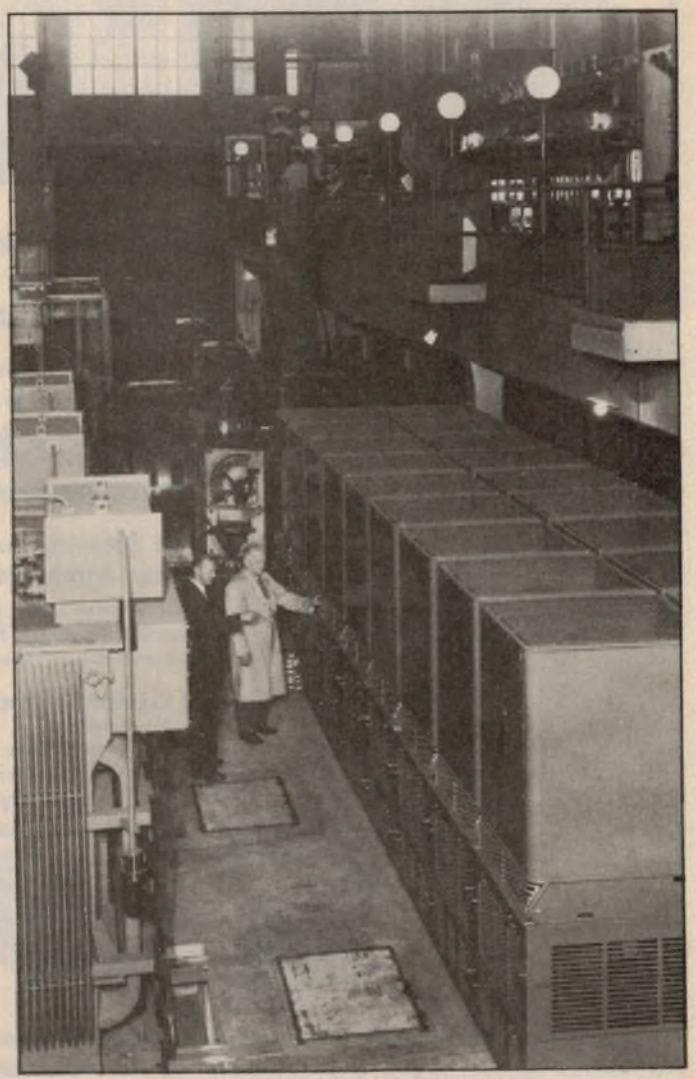
A bamboo rod is cut to the length required, divested of its hard soliceous coat, and split into six pieces, each one of which is reduced in thickness until its diameter is not much greater than a horsehair.

Each thread of bamboo is then placed in a mould formed by cutting a U-shaped depression in a plate of nickel, another plate of the same metal covering it over. The mould is then placed in a muffle, and is subjected to such a heat that the horseshoe shaped fibre is carbonised.

It is then placed in a glass bulb in connection with an air pump, the two ends of the horse-shoe carbon wire are fastened to platinum wires, which are sealed into the glass, and the ends of these wires form conductors for the electric current.



(From Cassell's "Science for All", published 100 years ago.)



These mercury arc rectifiers and transformers replaced the original motor-generator sets. Note the original switchboard on the upper gallery.

The end of an era

tial threat to his own DC technology.

Said Edison: "Just as certain as death, Westinghouse will kill a customer within six months after he puts in a system of any size. He has got a new thing and it will require a great deal of experimenting to get it working practically. It will never be free from danger".

AC on the move

In 1893, Westinghouse won a milestone contract to power the huge Columbian Exposition, which was to spread over an area of 16 hectares and consume more power, at the time, than the entire city of Chicago.

This was followed by contracts to harness energy from Niagara Falls with an ambitious AC hydro-electric system — contracts ultimately shared with the General Electric Company, which had reluctantly been forced to acknowledge the superiority of AC for the project.

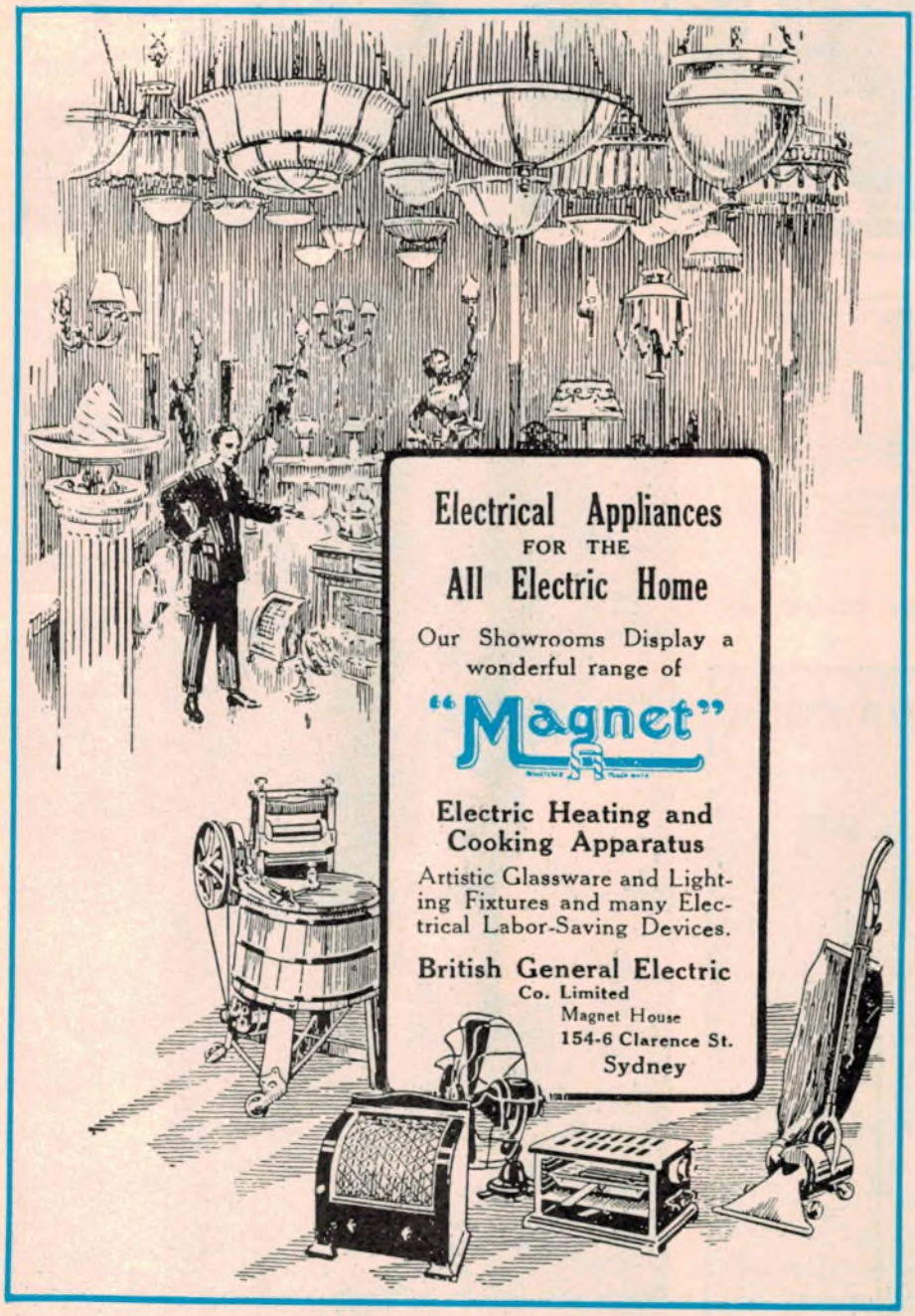
AC technology was clearly on the march but, with many major centres in the USA, by this time, deeply involved with DC systems, there could be no abrupt turnabout and a mix of DC and AC mains was perpetuated way beyond the turn of the century.

In fact, even in the '30s and '40s, the ubiquitous RCA Receiving Tube Manuals were still carrying details of recommended valve types and typical designs for 117V AC/DC receivers.

Behind the lingering support for DC mains, especially in industrial situations, was the greater ease with which DC motors could be set up and controlled. Lighting and heating could use either source and electronic equipment, with its affinity for AC mains, did not become a consideration until at least the mid '20s.

In July 1923, the "Australia Wireless Review" opened an article on Elementary Magnetism and Electricity with the unequivocal statement:

"Direct current is the most suitable current for power purposes."



Australian home-makers in 1921 were tempted by this inducement to get rid of their kerosene lamps, washtubs, wood fires and brooms, and to equip with the very latest in Magnet brand electric appliances, most of them AC/DC compatible. What, no radio, TV or hifi? (From "Sea, Land & Air" magazine).

The Sydney project

Proposals regarding the "Municipal Council of Sydney's Electricity Undertaking" extend back to the early 1880's — approximating the opening date of Edison's original Pearl Street power station.

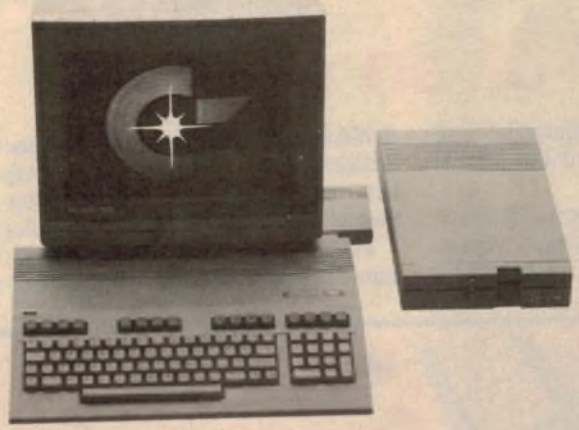
The basic concept was to provide electric power for the central business area of Sydney — an area which involved a high concentration of commercial and industrial activities, with a potential role for electric motors powering everything from lifts and hoists to factory and workshop machinery.

So it was not surprising, when the worthy councillors sought the advice of Edison, Swan (by then, his British associate) and others, that they should decide in favour of an Edison style, 3-wire DC system.

However, to minimise the effects of mains resistance, they selected a higher voltage: +240V and −240V relative to a common earth return conductor. Subscribers could be connected to one pair of mains for a 240V DC supply, or have access to the full 480V DC for high-power requirements.

The system became a reality in July of 1904, with electric street lights operating from a power station in nearby Pyrmont. And, as planned, the DC mains soon

If you own an Apple IIc, you'd have to add all this



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Keeping up with you.

BEEMAN MAYRHOFER STOTT/CC422

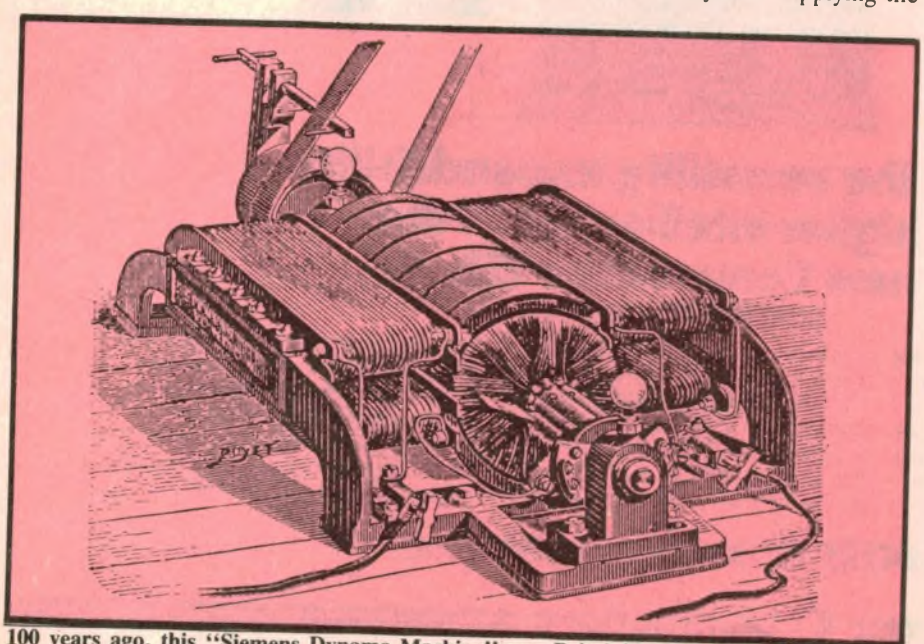
This view shows the original motor-generator sets in the Clarence Street sub-station, before their replacement by the mercury arc rectifiers and transformers.

The end of an era:

found their way into commercial and factory premises throughout the central business area.

In due course, as the versatility and economy of the AC system became more apparent, the DC system was deliberately restricted to the central business area, and subsequent expansion, in both service and generating capacity, was confined to AC technology.

Then, as increasing AC resources became available, the job of supplying the inner city DC network was taken over by a network of regional sub-stations equipped with large rotary converters — single rotor machines driven by AC from distant power stations and delivering DC to the local mains.



100 years ago, this "Siemens Dynamo Machine" was Britain's most powerful generator. It weighed just under 190kg, occupied 113 litres, and provided the Lizard lighthouse in Cornwall with a 3,620 candlepower etc.

Typical DC sub-station

The 0.5 megawatt rotary converters were designed to produce ±250V DC (or 500V) overall at up to 1000A apiece. Across the line was a huge bank of storage cells, each cell measuring about one cubic metre, with the battery bank occupying a complete floor of the large sub-station. By day it would buffer variations in the load; late at night, the rotary equipment would often be shut down.

The basic converter and battery system was designed to feed 250V DC to each line, allowing a 10V margin for voltage drop.

However, associated with the main supply were special "buck and boost" rotary converters, capable of delivering ±10V at up to 1000A each. By controlling the field system current and polarity, the output could be added to or subtracted from the line voltage, to maintain it at 250V under a variety of load conditions.

With the emergence of high power

electronic technology, the rotary machinery and batteries were, in turn, replaced by special transformers providing 12-phase AC input to multi-anode mercury arc rectifiers which, with resonant filters, could produce relatively clean DC.

As a consumer . . .

I knew nothing of all this when, fresh from the country, I obtained my first job as an assembler and wirer with Reliance Radio. It was a new venture — I was their first bench-hand — set up in an old building, demolished later to make way for the AWA head office in York Street.

My introduction to DC mains came when I was shown the ancient wiring and power points and warned that, on no account, was any ordinary radio or test equipment to be plugged into them. The result would be blown fuses and/or a blown power transformer and a very angry employer!

I was then taken down into a dungeon-like basement and shown a small rotary converter whining away in the gloom and turning DC mains power into 240V AC at 50Hz. I was to learn later that both figures were approximate only and that just so many receivers could be tested or demonstrated at the one time.

Even at best, radio reception still had its problems, arising partly from hash produced by the converter itself and partly from the horrendous interference level on the DC mains. After all, every single motor on the mains used a commutator and, fifty years ago, sensitivity about hash suppression was not all that evident.

A rather more dramatic introduction to DC mains followed a few days later, when one of the overhead light globes failed. It was a fairly large globe — about 150W — hung from a porcelain "rose" on the wooden ceiling by a metre or so of twisted, cotton-covered rubber flex.

As the filament parted, it set up an arc between the support wires, which proceeded to track up through the glass base into the bayonet holder, then through that to the flex, thereafter heading up towards the wooden ceiling like a miniature fireball. That was when somebody hit the switch.

I had seen for myself the ability of DC mains to maintain an arc, once started.

Tea . . . DC style

But that wasn't quite as salutory as the experience of a fellow wirer who attempted, one day, to "boil a billy" using an "immersion heater" — a spiral tube with an internally insulated element, fitted with a couple of metres of twin lamp flex and a bayonet adaptor, and plugged into a lamp socket.

Why would anyone be using such a potentially hazardous contrivance?

This was fifty years ago, remember, when a large proportion of suburban homes had two power points, at most, which could be English style 3-pin round, 2-pin round, American 2-pin flat or even the new fangled Australian 3-pin flat! Any number of gadgets, including the new radio set could end up being plugged into a lamp socket with a little help from a 2-way bayonet adaptor.

Indeed, the men delivering and installing new radio sets encouraged us to despatch them with unterminated power leads, so that they could more easily fit whatever plug proved necessary on arrival. So there was nothing startling about the immersion heater.

The trouble was that the would-be tea maker forgot about the DC supply and simply unplugged the bayonet adaptor with the power still switched on. There was a sizzle and an arc, and he ended up with a handful of fire and smoke!

Somewhat more bizarre was the tale, related to me recently by an engineer friend, concerning a group of tea makers in a small city office, set up by the electronics company from which he recently retired.

They equipped themselves with an electric jug of now unremembered vintage, with an ordinary open element. It worked apparently normally on the DC mains but, in rather short order, they all went down with some mysterious malady. It was ultimately traced, he said, to a toxic effect caused by a product of electrolysis, resulting from the DC supply.

It was a new one on me!

AC/DC receivers

But my pet hate was undoubtedly DC or AC/DC receivers, for the most part made and sold for use in the adjacent central city area. It generally fell to my lot to test and/or service them.

Being designed to operate without a mains power transformer, there had to be a direct conductive path between the mains and the internal signal circuitry. Even the normally innocuous valve heater wiring was "live", being a series string fed directly from the mains through a large and very hot resistor or a current regulator (barretter) tube.

In some models, the chassis was also "live"; in others, it was connected to the mains through a bypass capacitor of 0.1μF more. And, when operating from earth-positive DC mains, all the normally "earthy" circuitry had to be at −250V for the receiver to operate!

The owners of these rather unpleasant receivers were suitably isolated from them by all-round cabinet work and an interlocking mains plug, but technicians and servicemen had no such protection.

DC or AC/DC receivers designed for 117V mains weren't so bad, because the voltages were modest and the heater series resistor commonly of low enough value and wattage to be incorporated in the mains power cord. But whereas an accident with 117V can be embarrassing and unpleasant, a similar inadvertence with 240V could be decidedly fatal!

It was a fate that I managed to avoid but I was not the least bit sorry to read that, as a guest of the present Sydney City Council, Mrs Lorraine Ashby had switched off that longstanding reason to perpetuate transformerless radio sets — one that had been activated, 81 years earlier by her grandmother, Lady Mayoress Amy Sarah Lees!

Have former customers of the SCC been left lamenting? Not really; the phasing out process has been quite gradual and, with today's technology, there is no special problem for a customer who still needs DC, to produce it on the spot from polyphase AC.

I am indebted to a former EA staff member, Norman Marks, for his recollections of the Kent/Clarence St, DC sub-station, in which he served part of his apprenticeship in 1944.

Electric lighting in the UK

The principle public installations of the incandescent system in this country have been in the Savoy Theatre, London, which is entirely lighted by Swan lamps; at the International Fisheries Exhibition, 1883, where more than one thousand were seen on one circuit; at Holborn Viaduct, which thoroughfare, with houses adjoining, has been lighted by Edison's lamps; and at the Electrical Exhibition at the Crystal palace, where the suitability of the system for both public and private use was most successfully demonstrated. To Edison must always attach the credit of having been the first to serve entire streets with a supply of electricity in lieu of gas.

(From "Science for All" published 100 years ago by Cassell & Co Ltd, London).

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A handy reference book every enthusiast should have! A comprehensive listing of valuable information: frequencies of long, medium and short range broadcasters; charts; and more.

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B 094/CW

New eight-month course from Control Data

How to become a computer technician

The Control Data Institute is well known for training computer operators and programmers. Recently they began a new course for computer maintenance technicians which they hope will be just as successful.

by LOUISE UPTON

Computer Maintenance Technician wanted. Duties include providing maintenance on IBM compatible computer systems and multi-user systems, install and maintain networks. Workshop repair component level. Qualifications: an approved Technical Certificate or equivalent qualifications in a relevant field.

Open the papers today and jobs of this sort jump out at you from everywhere. But how do you qualify? One answer comes from Control Data Institute, which specialises in this field.

The school is at St Leonards in Sydney and offers a number of courses in computing and office skills but the Computer Maintenance Technology course is the newest part of the Institute's services, having begun in April 1985, with the first students having graduated around the middle of December, 1985.

Thirty-four students were enrolled in the first course, two of whom were girls. The number is expected to be higher this year, in line with an Institute survey which highlighted the need for trained technicians.

The Manager of the Education Services, Julia Delavere, feels that, "although many companies were making an effort to train their own maintenance crews, the growth in demand has made starting the course an excellent way for people to upgrade existing skills or start a new career."

The training takes place in groups, although the method is largely a self-teaching one with an instructor on call at all times to give individualised attention as it is needed. The old concepts of chalk and talk are not a part of this school's philosophy.

In comparison to similar courses being offered by technical colleges the Institute's program is expensive. This is mainly due to the method of teaching which is heavily based on using the computer at all times and this is fairly costly. However, the results for the job seeker appear to justify the price.

The course lasts 8½ months on a full-time basis and the Institute awards qualifying students with a Diploma.

Within the course structure, practical work and gaining experience occupies a vast proportion of the student's school time. Working on prototype boards they learn the uses of the multimeter, oscilloscope and other test instruments for trouble-shooting a computer's printed circuit boards.

Sometimes there will be repairs to make at the component level. But often as not, the checks that these technicians are being taught to run are all a part of what is called preventative maintenance. It is this type of work which will take up the bulk of their time in a job.

The Control Data Institute also offers courses in programming and operating for those who don't feel they have the engineering patience or talent to search for and isolate the fault(s) in a malfunctioning micro. These courses are conducted along much the same lines as the Maintenance Technician course.

It is also possible to buy certain modules or parts of courses if you don't wish to do the whole thing.

The Computer Programming and the Maintenance Technician courses cost $6,250 and an operator's course is $4,150.

continued on page 120

The course emphasises the practical aspects of training to be a technician.

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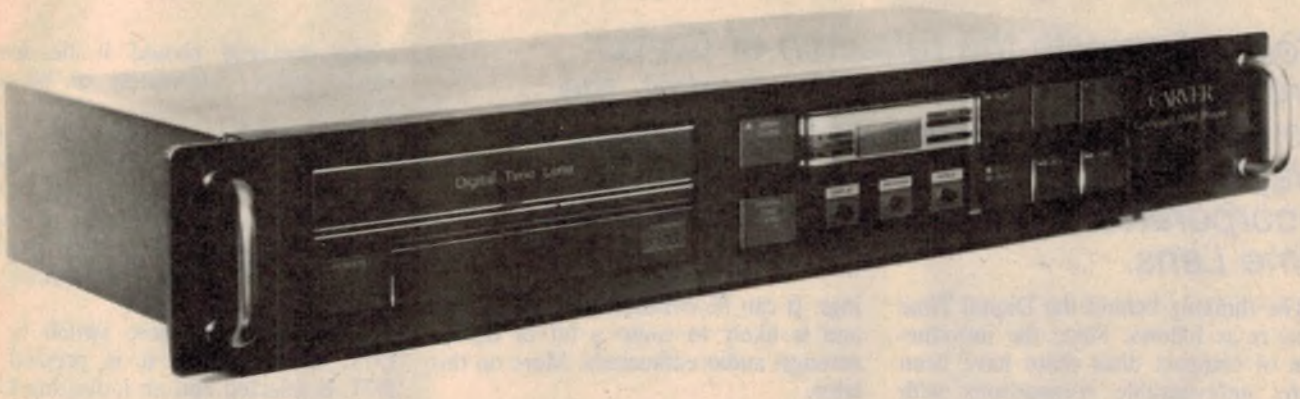
Powerful · Musical · Accurate



THE CARVER COMPACT DISC PLAYER WITH DIGITAL TIME LENS.

The Carver Compact Disc Player is the world's leading compact disc player to address the problem of the bright, hot, harsh sounding midrange and lack of ambiance and spatial detail characteristic of the majority of compact discs currently available.

The Carver Compact Disc Player answers the audiophile's demand for a CD Player which provides not only the greater dynamic range, quietness, and richer bass expected from compact disk technology, but also the musicality, spectral balance and spatial qualities of well executed high fidelity stereophonic reproduction.

FEATURES:

- 16 Bit D/A Conversion for precise reproduction
- Extraordinary high tracking accuracy by 3 beam laser pick up virtually eliminates distortion.
- Random memory selection.

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Carver DTL-100 compact disc player

Coinciding with the relaunch of Carver products onto the Australian market, the company has released its first compact disc player, the DTL-100. The new machine incorporates a unique feature: the Digital Time Lens.

The thinking behind the Digital Time Lens is as follows: Since the introduction of compact discs there have been many unfavourable comparisons with equivalent recorded material on vinyl discs. CDs have been said to lack ambience, musicality and a whole lot of other qualities which have been largely undefined. Bob Carver is one who believes there is a problem with CDs concerning the three dimensional perspective of the sound.

He arrived at this conclusion by comparing 23 compact discs against their analog equivalents on vinyl. By quantifying the differences, Carver came to two conclusions. Firstly, CD sound has more energy above 400Hz than analog recordings and secondly, the L-R channel information differed by 1.25dB.

Carver's Digital Time Lens (DTL) circuitry is designed to correct for these perceived differences. It is supposed to restore the octave balance and L-R component to those of analog recordings. It can be switched in or out at will and is likely to cause a lot of debate amongst audio enthusiasts. More on this later.

Operating features

The Carver DTL-100 Compact Disc Player is a large unit suitable for 19-inch rack mounting. It is very well finished with a rugged cast aluminium front panel. The styling is subdued without being spartan and would fit in with almost any decor. Overall dimensions are 485 x 80 x 282mm (W x H x D).

The front loading disc drawer operates very smoothly. It responds promptly to the Open/close switch located immediately to the left of the display. When the draw is open the display says so by showing "OPEN". To close the drawer, you can either press the Open/close switch again or just push gently on the drawer itself to make it withdraw. This feature is a good one since it prevents the drawer mechanism being damaged should it be forced closed either deliberately or by accident.

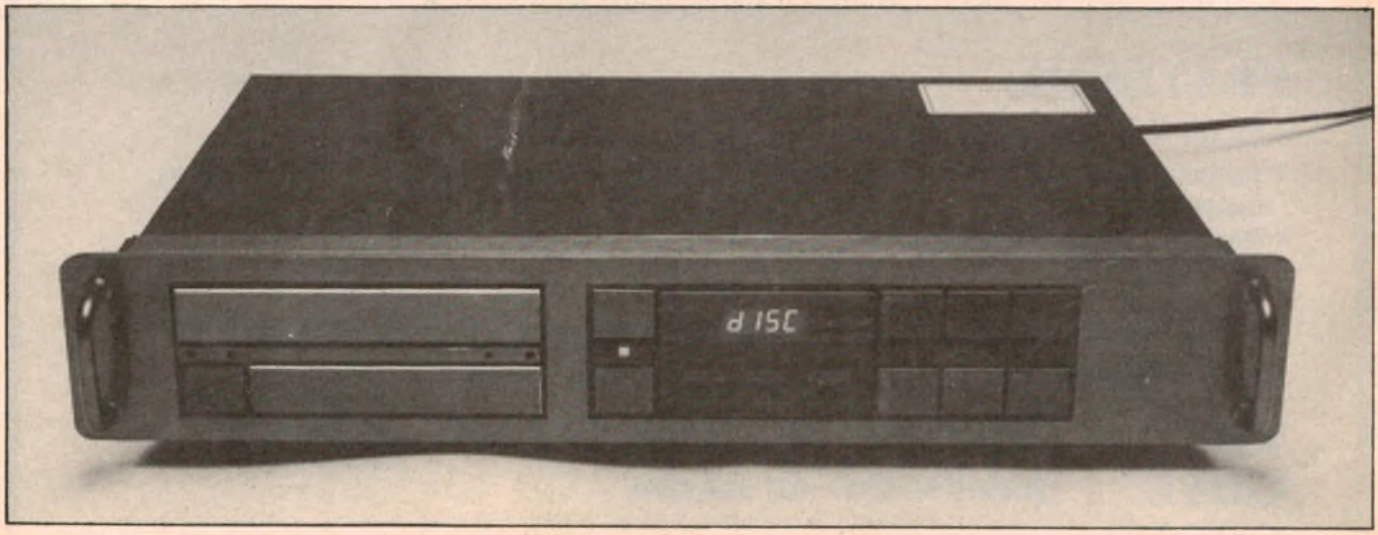
If the drawer is closed without a disc, the display indicates a flashing "dISC". If a disc is loaded correctly, the display initially indicates the number of tracks present on the disc and then displays "100". The DTL-10 is now ready to play.

Below the Open/close switch is the DTL switch. When it is pressed in, DTL is selected and an indicating LED lights up.

Pushing the Play switch causes the word "PLAY" to be indicated by the display for a brief period. Then the track number is displayed and the music starts. To display elapsed time, the Display switch is pressed. Press it again to return to display of track number.

If the CD has index codes which sectionalise certain passages of the recording, this fact is displayed by the Index LED. The DTL-100 can be used to search for these index locations by using the fast forward (FWD) or fast reverse (REV) switches.

These FWD and REV switches also give audible cue and review facilities. When either of the switches are pressed, the volume is reduced. For the first three seconds after pressing either switch the rate of incrementing or



Carver's DTL-100 CD player has all the usual features plus the Digital Time Lens circuit.

decrementing the CD recording is in small rapid bursts. After that it moves much faster with larger jumps.

The FWD and REV switches are located to the right of the display along with the Pause/Stop, Play, – and + switches.

The + and – switches control selection of tracks on the disc such that the + switch selects tracks in a forward direction and the – switch for the reverse direction. These switches are also used for programming when chosen combinations of tracks have been selected for playing. Up to nine program selections can be made in any order or combination.

A Repeat switch sets the player to repeat the entire disc or the programmed sequences. This function is indicated by a LED in the display window.

At the rear of the unit are the audio output RCA sockets, voltage selector switch and two-core mains flex. Our review sample had the US-style 110V, 2-pin plug fitted and was not wired to established double-insulation standards. We assume that machines on sale to the public will comply with Australian standards in this regard.

Mechanical details

Internally, the mechanism and the main circuit board all appear to have been produced by Yamaha. Carver have modified the unit by adding a printed board which accommodates ten small integrated circuits (including two pseudo-random digital noise source ICs) and associated passive components.

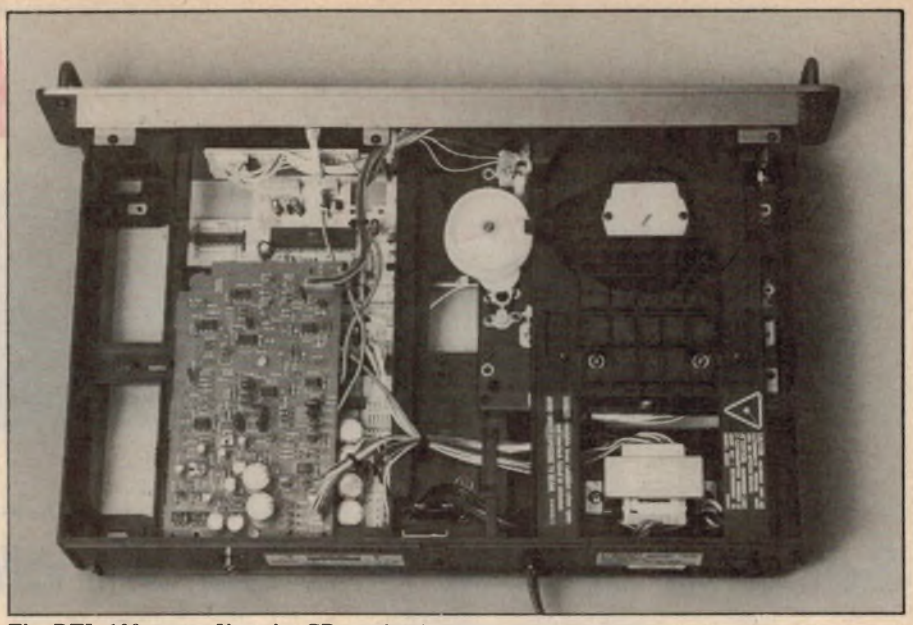
Carver is certainly not alone in this approach to marketing CD players. Many other companies, Japanese, American and European, have taken a similar approach in taking a standard CD machine and modifying it to their requirements.

The method of signal conversion is to use a single 16-bit digital-to-analog converter with two times oversampling at 88.2kHz. It uses digital filtering and a third order active low pass filter.

Performance

We tested the Carver DTL-100 using a Technics SH-CD001 test disc and Sound Technology distortion measuring equipment.

First, we tested the player with the Digital Time Lens feature switched out. Under this condition, the frequency response was to the expected high CD standard — very flat, with a rise of 0.5dB at 10kHz and 12kHz and falling to -2dB at 20kHz. Signal-to-noise ratio



The DTL-100 uses a Yamaha CD mechanism and main PC board.

with respect to full output was 98dB with a 20kHz low pass filter.

Separation between channels was measured at 85dB at 100Hz, 80dB at 1kHz and 61dB at 10kHz and 20kHz. These results were the same for both channels.

Linearity results were satisfactory, with a 1dB error at -70dB and -80dB. At -90dB signal level, the measured signal level was -90dB, which might lead to the conclusion that there is no error at this level. That is not valid, however, since the measurement was predominantly noise with very little signal component.

This means that the effective signal to noise ratio of the unit is closer to -90dB than to the -98dB figure achieved above.

Total harmonic distortion results were good at .0055% at 20Hz, .013% at 1kHz and 0.1% at 10kHz and 18kHz. The rising level was due to the residual 44.1kHz and higher harmonic sampling artefacts which are not completely removed by the filtering process.

When checking tracking performance with the Philips 4A test disc, the Carver DTL-100 mistracked at the 600μm black dot although it tracked the 900mm interruption layer and simulated fingerprint defects successfully. This performance is not as good as some previously tested CD players although no doubt the Carver will happily play the vast majority of discs without any audible hiccups.

The player was also somewhat susceptible to mistrack if jarred at the sides of the chassis. Again, we have measured other compact disc players which were better in this regard.

Digital Time Lens

We were very interested in the effect of the Digital Time Lens (DTL) on the measured performance. Having already listened to the audible changes it brought about, we were intrigued.

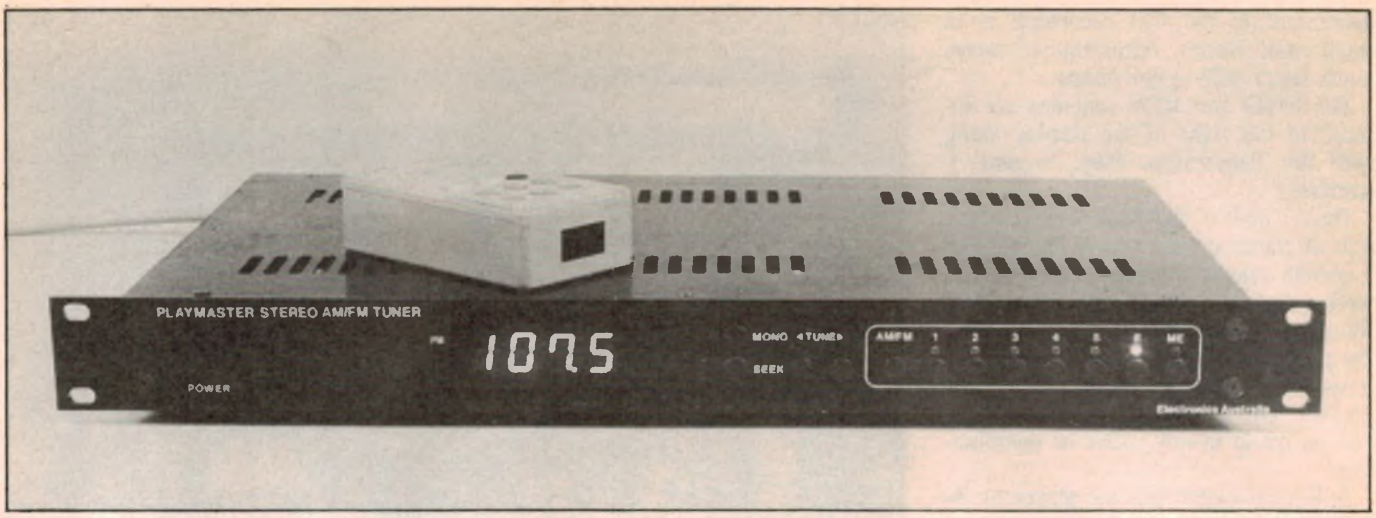
Frequency response with DTL in circuit is quite irregular. There is a broad rise of about 2dB between 50Hz and 200Hz, with respect to the 0dB reference at 1kHz. At the high frequency end of the spectrum, there was another rise, +3.5dB at 18kHz and +2dB up at 10kHz. In the midrange meanwhile, there is a 1.5dB trough in the response between 2kHz and 5kHz.

Signal-to-noise ratio also was different and we suspect that the presence of noise source ICs on the add-on Carver board means that noise has been deliberately added to the output signal, possibly to gain the same benefits given by the addition of dither to CD recordings. As a result, the signal-to-noise ratio with DTL in circuit was 83dB (compared to 98dB without DTL).

Distortion at all frequencies was higher by a factor of two with DTL in circuit. This is probably a natural result of the add-on circuitry rather than by design intention.

The effect on the separation was intended though and amounts to a major reduction on the CD levels down to less than the standard of typical good quality phono cartridges: 16dB at 100Hz, 18dB at 1kHz and 22dB at 10kHz and 20kHz. On the other hand, a good stereo effect can usually be obtained with only 18dB separation.

continued on page 56



Second article has all the circuit diagrams

Playmaster AM/FM stereo tuner Pt.2

Last month, we introduced our new synthesised AM/FM stereo tuner and described the block diagram. In part 2 this month, we give the full circuit details and list the specifications.

by JOHN CLARKE

The circuit for our new Playmaster Stereo AM/FM Tuner is quite large and, as a consequence, covers several pages. This is something of a blessing, however, since it breaks the circuit into three manageable sections: AM tuner, FM tuner and microprocessor control. We will describe the operation of each circuit section separately.

As discussed last month, microprocessor IC1 performs a major roll in driving the display, tuning the AM and FM front ends, and switching power to either tuner as appropriate. Before we discuss this further, let's first take a look at the AM and FM tuner circuits.

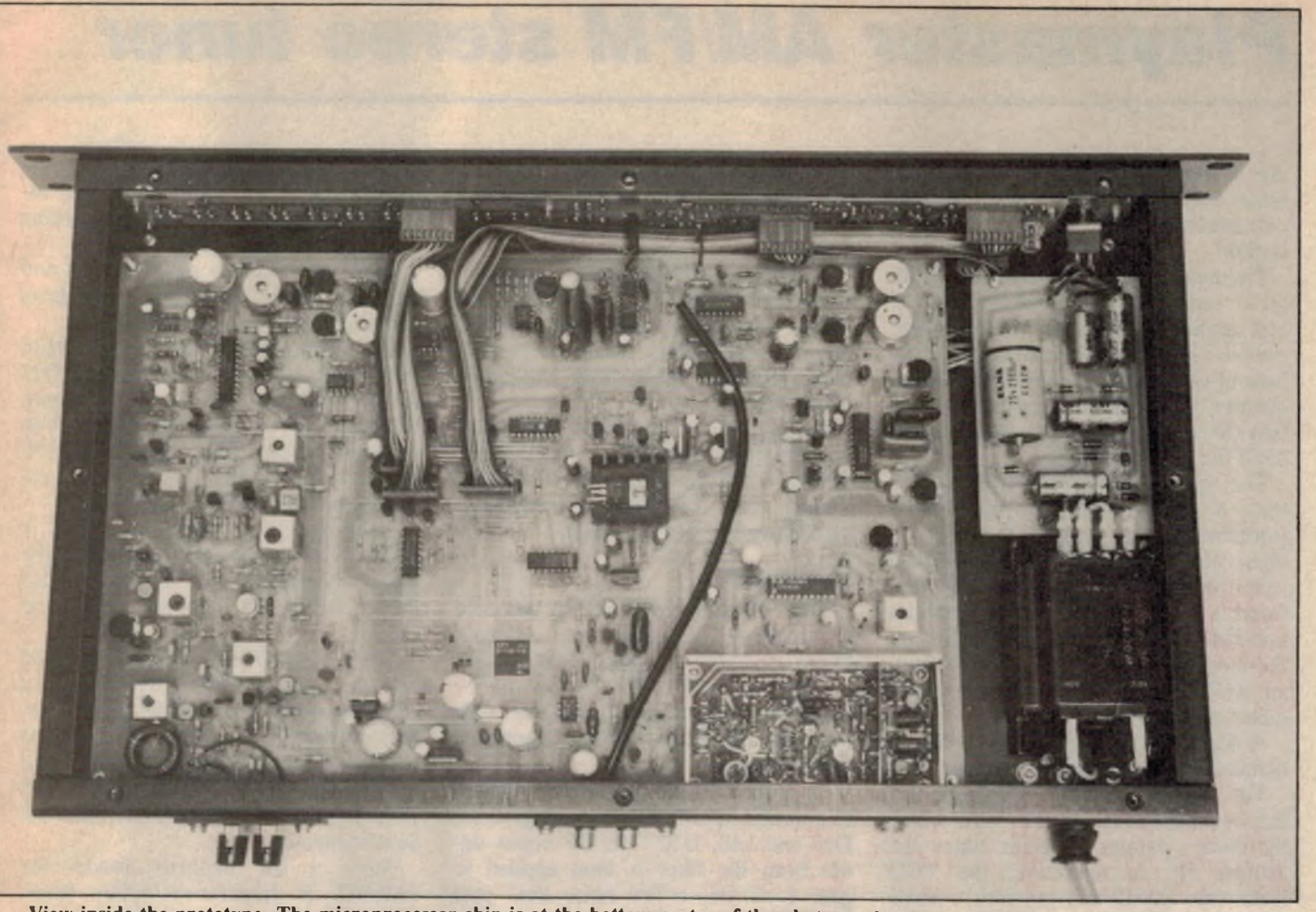
AM tuner

The AM tuner circuit is a high-performance superheterodyne design employing varicap tuning, a double-balanced mixer, ceramic filters and stereo decoding. It is a brand new design, developed completely from scratch.

Input signals from the loop antenna are fed to a balanced circuit consisting of toroidal transformer T1. As stated last month, this acts to reduce common-mode interference so that the tuner is provided with a noise-free signal. The unbalanced secondary of T1 is direct-coupled to terminal 5 of antenna coil L1.

The winding across terminals 4 and 5 is a special modification to the standard 7210 coil assembly and comprises a few hand-wound turns on the L1 coil former. These provide very light coupling to the tuned winding across terminals 1 and 2.

RF tuning of the antenna circuit is provided by varicap diode D1 in conjunction with the 3-30pF timmer connected across the 7210 winding. A tap-



View inside the prototype. The microprocessor chip is at the bottom centre of the photograph.

ping of the winding at terminal 6 directly couples to gate 1 of dual gate MOSFET Q1.

Q1 is used as a self-biased common source amplifier with the L2 winding (7211) forming the drain load. Varicap diode D2 and its associated 3-30pF trimmer are capacitively coupled to L2 to form the second RF tuned circuit. The 1MΩ resistor across D2 discharges the varicap when the control voltage at its cathode is altered.

Note that self-bias for Q1 is provided by the 220Ω source resistor while the AGC (automatic gain control) voltage is applied to gate G2 via the 100kΩ and 47kΩ resistors.

The output from the second RF stage appears at terminal 6 of L2 and is coupled to the differential input of double-balanced mixer stage IC5 (MC1496) at pins 1 and 4. The open collector outputs at pins 6 and 9 are loaded with the balanced primary windings of L3 and its parallel 560pF capacitor which form a tuned circuit at 450kHz.

Supply decoupling is via a 560Ω resistor and 0.1μF capacitor.

Q4, L5, D3 and the associated 3-30pF trimmer form the local oscillator. A feedback tapping between Q4's emitter and terminal 4 of L5 ensures continued oscillation, while VR1 sets the level of oscillation. Note that D3 is isolated from the L5 winding via a 680pF capacitor. This reduces the maximum tuned circuit capacitance.

To explain further, the RF stages must be tuned from 522 to 1611kHz which represents a capacitance ratio of 9.5:1 (which is the square of the 1611/522 ratio). The local oscillator, on the other hand, must be tuned from (522 + 450) kHz to (1611 + 450)kHz which represents a 4.5:1 capacitance ratio.

A separate winding on L5 couples the oscillator output to the second differential input stage of the mixer (IC5) at pins 7 and 8.

Because the mixer is a balanced type, only the sum and difference frequencies appear at the output. This fact is very useful since it allows the use of a wide band ceramic filter (SFP450D) in the IF stage.

As stated last month, the filter sharply rolls off the response beyond ±12kHz and is 60dB down at ±40kHz. However, it also has secondary peaks in its response so that the attenuation of the filter is only 15dB down at ±150kHz. Normally, this would render the filter useless, since signals around 600kHz would pass through the IF filter virtually unattenuated.

The balanced mixer neatly solves this problem, however. It rejects both the incoming RF and local oscillator signals, and allows only the mixed signal through to the IF stage. Consequently, the rising response outside the passband of the ceramic filter is unimportant.

The output from the ceramic filter is coupled to gate 1 of Q2, another BFR84 dual-gate MOSFET transistor. L4 and the 390pF capacitor form a tuned drain load for Q2 which provides some gain for the IF stage.

At this point, the IF output is split into two paths. One path is derived from the drain of Q2, amplified by common emitter stage Q3, and applied to a narrow band ceramic filter (SFZ450C3N). This filters a very narrow band centred on 450kHz which means that it passes signal only when

Playmaster AM/FM stereo tuner

the IF stage is centred on 450kHz. In other words, an output from the filter only occurs when the tuner is exactly on station.

The output from the narrow-band filter is rectified by D4 and D5, filtered and applied to the base of Q5. Whenever the signal is sufficiently strong, the base of Q5 is pulled below 0.6V. Consequently, Q5 turns off and supplies a station detect or stop output signal to pin 13 of the microprocessor.

The second signal path from the IF stage is derived from a tapping on L4 (terminal 6) and coupled to the pin 3 input of IC4, an MC13020P Motorola stereo decoder. This versatile chip performs a range of functions. It provides low-distortion synchronous detection of the incoming IF signal, stereo decoding, an AGC output and automatic stereo-mono switching.

A forced mono input (pin 9) allows manual switching to mono operation.

The 3.6MHz ceramic resonator sets the frequency of an internal VCO which therefore operates at eight times the 450kHz IF. In operation, the VCO locks onto the IF and provides a phase reference for stereo decoding. The decoded left and right audio outputs appear on pins 7 and 8 respectively and are fed to the notch and low-pass filter circuits.

The AGC output from IC4 appears at pin 4 and is applied to inverting amplifier IC6b. The resulting AGC output signal appears on pin 7 and is used to control the gain of MOSFET transistors Q1 and Q2 as discussed previously. In this way, a constant signal level is provided at the input to IC4 over a wide range of signal conditions.

Further, IC6a inverts and level shifts the AGC signal to drive an NSM39152 LED-bargraph signal strength meter. This features 10 LEDS and has a logarithmic response. It accepts a DC signal and displays the relative level compared to RLO (ground) and RHI, the high reference set by the 2.2kΩ and 6.8kΩ resistors.

Diode D10 isolates the output of IC6a from the FM signal meter drive circuitry.

The left and right audio outputs from IC4 are fed to 9kHz notch filters based on L6 and L7. These remove any 9kHz whistles caused by adjacent stations. VR2 and VR3 are used to adjust the depth and sharpness of the notch (in each channel), while tuning is provided by adjusting the slugs in the L6 and L7 inductors.

Following the 9kHz notch filters are active filter stages IC7a and IC7b, each with a gain of 1.2. These filters roll off the response above 10kHz to remove high frequency noise from the audio output signals.

Finally, the left and right audio outputs are applied to IC12, a 4052 CMOS analog switch (shown on the FM tuner circuit) page 37) which selects either the AM or FM tuner outputs.

FM tuner

The FM tuner front end is designed to accept a 75Ω unbalanced antenna. When used with a balanced 300Ω dipole antenna, a 300Ω to 75Ω balun will be necessary. The standard adaptor type used for television antenna inputs is quite suitable.

L8 is the 75Ω input and this couples to a double-tuned filter consisting of L9, D19 and L10, D20. The RF ouput signal from the filter is then applied to gate 1 of Q6, a low noise dual gate MOSFET with L11 as its drain load. The amplified output appears at the drain of Q6 and is fed via a 1.5pF capacitor to another tuned stage consisting of L12 and varicap diode D21.

AGC is applied to gate 2 of Q6 and operates during very high signal level conditions to prevent overload.

The local oscillator has a tuned circuit comprising L13 and varicap diode D22 for the collector load of Q8. Feedback via the 3.3pF capacitor from emitter to collector ensures that the circuit oscillates. A 2.2kΩ resistor and 6.8μF capacitor provide supply decoupling.

Local oscillator injection to mixer stage Q7 is via a 4.7pF capacitor to the base, while the output signal from L12 is also fed to the base via a 6.8pF capacitor.

Mixer stage Q7 has a 10.7MHz tuned collector load consisting of L15 and a 47pF capacitor. The output signal is extracted from pin 3 of L15 and applied to ceramic filter CF1 and to the wide band AGC input (pin 20) of IC2, an LM1865 FM IF/detector chip from National Semiconductor.

Quite a lot happens inside the LM1865. It contains a buffer stage, limiter amplifier, quadrature detector,

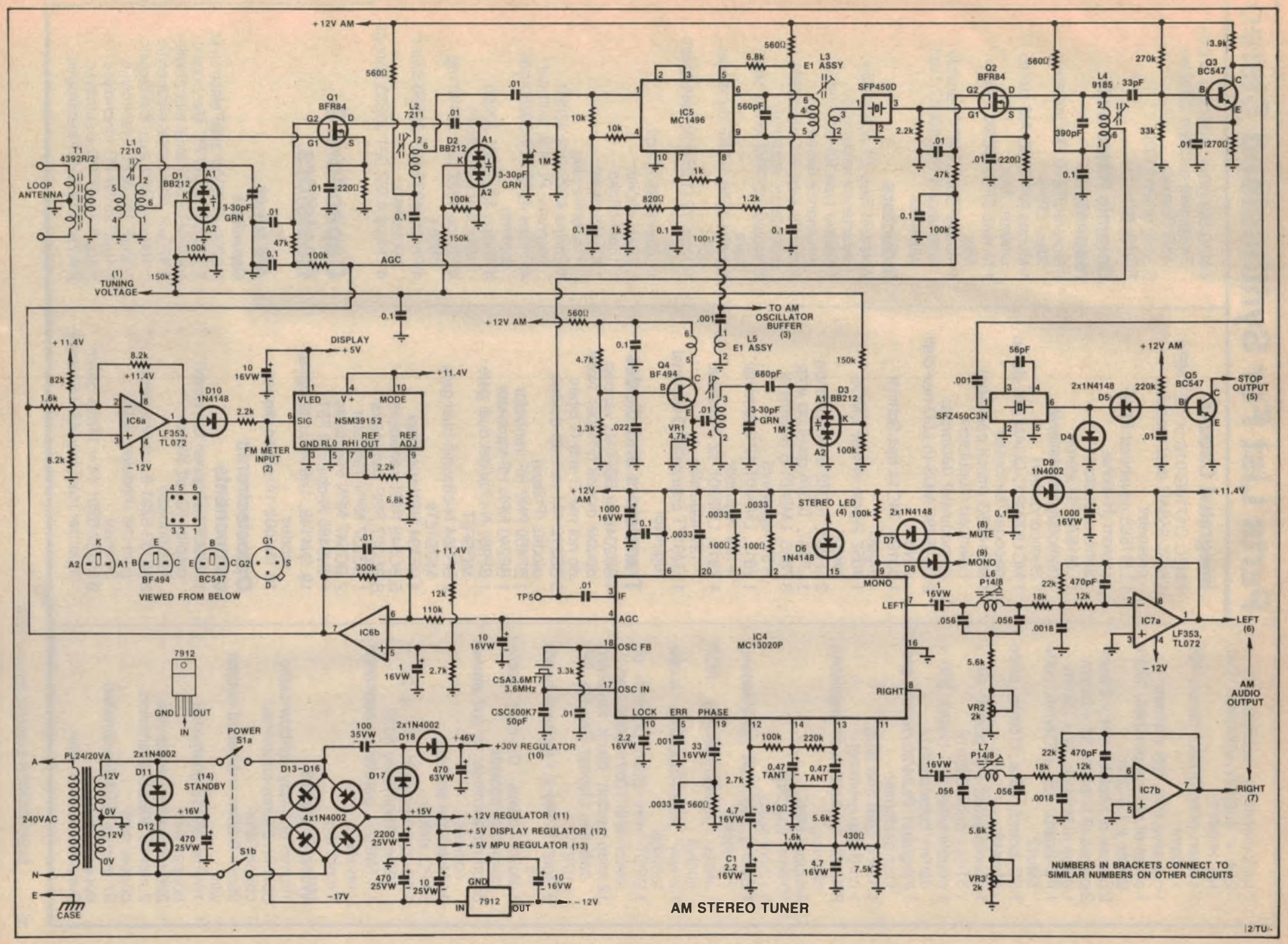
Specifications

AM Tuner

Tuning Range	522 to 1611kHz
Frequency Response	−3dB at 5.5kHz (see graph)
Harmonic Distortion	mono: 0.4% at 30% modulation stereo: <1% at 30% modulation
Audio Output	450mV RMS into 4.7kΩ load at 100% modulation
Stereo Separation	typically 30dB
AGC Range	40dB for a 6dB change in audio output
Signal-to-Noise Ratio	70dB with respect to full output for signal levels of 9 and 10 on bar graph display; better than 60dB with respect to full output for signal levels greater than 6
Usable Sensitivity	350μV at −6dB audio level

FM Tuner

Tuning Range	87.9 to 107.9MHz
Frequency Response	−1dB at 20Hz, −0.5dB at 15kHz
Harmonic Distortion	mono: 0.15% (100Hz); 0.15% (1kHz); 0.2% (6kHz) stereo: 0.4% (100Hz); 0.4% (1kHz); 0.4% (6kHz)
Audio Output	450mV RMS into 4.7kΩ load at 100% modulation
Stereo Separation	34dB (50Hz); 34dB (1kHz); 36dB (10kHz)
Subcarrier Product Rejection	48dB
19kHz Rejection	62dB
Signal-to-Noise Ratio	see graph


+12V AM
560Ω
6.8k
L3 E1 ASSY
SFP450D
Q2 BFR84
L4 9185
Q3 BC547
IC5 MC1496
Q1 BFR84
L2 7211
D1 BB212
D2 BB212
T1 4392R/2
L1 7210
LOOP ANTENNA
3-30pF GRN
1M
10k
560pF
2.2k
47k
390pF
33pF
270k
3.9k
33k
220Ω
1k
820Ω
1.2k
100k
150k
AGC
(1) TUNING VOLTAGE
TO AM OSCILLATOR BUFFER (3)
L5 E1 ASSY
Q4 BF494
D3 BB212
680pF
VR1 4.7k
3.3k
.022
+11.4V
8.2k
82k
1.6k
IC6a
LF353, TL072
−12V
D10 1N4148
DISPLAY +5V
NSM39152
VLED V+ MODE
SIG
GND RL0 RHI REF OUT REF ADJ
FM METER INPUT (2)
6.8k
BF494
BC547
VIEWED FROM BELOW
IC6b
300k
110k
12k
2.7k
TP5
IC4 MC13020P
IF
AGC
OSC FB
OSC IN
CSA3.6MT7 3.6MHz
CSC500K7 50pF
LOCK ERR PHASE
MONO
LEFT
RIGHT
STEREO LED (4)
D6 1N4148
2x1N4148
D7
D8
(8) MUTE
(9) MONO
D9 1N4002
56pF
SFZ450C3N
D4
D5
Q5 BC547
STOP OUTPUT (5)
L6 P14/8
L7 P14/8
IC7a
IC7b
LF353, TL072
LEFT (6)
RIGHT (7)
AM AUDIO OUTPUT
VR2 2k
VR3 2k
5.6k
7912
GND OUT IN
POWER S1a
S1b
PL24/20VA
240VAC
2x1N4002
D11
D12
(14) STANDBY
+16V
470 25VW
D13–D16
4x1N4002
D17
D18
+46V
+30V REGULATOR (10)
+15V
+12V REGULATOR (11)
+5V DISPLAY REGULATOR (12)
+5V MPU REGULATOR (13)
2200 25VW
−17V
CASE
NUMBERS IN BRACKETS CONNECT TO SIMILAR NUMBERS ON OTHER CIRCUITS
AM STEREO TUNER

Parts List For Synthesised Stereo

1 rack-mounting cabinet, 44 x 254 x 430mm (Altronics Cat. No. H-0411)
1 screen printed front panel, 486 x 46mm
1 negative film, 185 x 31mm
1 sheet of neutral perspex, 179 x 24mm x 1.5-3mm
2 pieces of tinplate, 101 x 24mm
2 pieces of tinplate, 52 x 24mm
1 piece of tinplate, 52 x 20mm
1 PC board, 330 x 216mm, code 85tu12
1 PC board, 66 x 110mm, code 85ps12
1 double-sided PC board, 94 x 51mm, code 85fm12
1 double-sided PC board, 370 x 35mm, code 85db12
1 Ferguson PL24/20VA low profile transformer
1 mains cord and plug
1 cord grip grommet
2 bullet sockets with insulating sleeving
4 rubber feet
10 6mm spacers
4 12mm spacers
1 Belling Lee 75Ω panel-mounting socket
1 stereo panel-mounting RCA socket
1 2-way panel-mounting screw terminal
1 DPDT mini push on/push off switch with 10mm black cap
12 snap action black keyboard switches (Jaycar Cat. No. SP-0721)
9 Molex 8-way 0.1-inch pin headers
8 Molex 8-way 0.1-inch cable connector sockets
64 crimp terminals to suit above sockets
94 Molex pin sockets
50 PC stakes
1 TO-220 heatsink, 30 x 27 x 12mm, Thermaloy 8030
1 4.5MHz parallel resonance crystal
1 earth lug

Wire & cable

100mm of 8-way rainbow cable
300mm 0.8mm enamelled copper wire
25mm 0.6mm enamelled copper wire
130mm 26B&S enamelled copper wire
220mm twin shielded wire
2 metres 30B&S enamelled copper wire
37 metres 36B&S enamelled copper wire
3 metres hookup wire

Integrated Circuits

1 NEC D1710G/016 or /227 MPU
1 NEC 553AC dual modulus prescaler
1 LM1865 advanced FM IF system (National Semiconductor)
1 LM1870 FM stereo demodulator (National Semiconductor)
1 MC13020P C-QUAM AM stereo decoder (Motorola)
1 MC1496G (metal package) balanced modulator/demodulator (Motorola)
2 DS75492 MOS to LED hex digit drivers
1 40106, 74C14 hex Schmitt trigger
1 4052 2-pole, 4-way CMOS switch
2 LF353, TL072 dual op amps
1 LF347, TL074 quad op amp
3 7805, LM340T-5 3-terminal +5V regulators
1 7812, LM340T-12 3-terminal +12V regulator
1 7912, LM320T-12 3-terminal −12V regulator
1 LM317T adjustable 3-terminal regulator

Transistors and diodes

4 BB204B or BB204G varicap double diodes (Philips). Note: do not mix B and G types.
3 BB212 AM varicap double diodes (Philips)
1 BF450 PNP HF transistor
1 BF240 NPN HF transistor
1 BF981 N-channel dual gate MOSFET
2 BFR84 N-channel dual gate MOSFETs
1 BF494 NPN transistor
5 BC549 NPN transistors
8 BC327 PNP transistors
1 BC337 NPN transistor
2 BC547 NPN transistors
1 2N5485 N-channel FET
19 1N4148, 1N914 small signal diodes
10 1N4002 1A silicon diodes

Optoelectronic components

1 NSM39152 green bar graph display (Geoff Wood Electronics)
2 MU03-5201 6 x 9mm green light bar modules (A&R Soanar)
2 MU02-5201 14 x 14mm green light bar modules (A&R Soanar)
4 NAG163 green common anode 7-segment displays (Stanley, A&R Soanar)
6 3mm green LEDs
1 3mm red LED

Ceramic filters and resonators

2 Murata SFE10.7ML ceramic filters (IRH)
1 Murata SFP450D AM stereo IF ceramic filter
1 Murata SFZ450C3N ceramic filter
1 Murata CSA3.6MT7 ceramic resonator & CSC500K7 50pF capacitor

Inductors

2 Neosid type E1 adjustable inductance assemblies
1 Neosid type E3 adjustable inductance assembly
1 Neosid type A5 adjustable inductance assembly
1 Neosid 4329R/2 ferrite ring core
1 Jabel 7210 1st RF bandpass coil
1 Jabel 7211 2nd RF bandpass coil
1 Jabel 9185 IF coil
1 22μH choke
1 18μH choke
1 6.8μH choke
1 F16 ferrite slug
4 Philips 4322 022 22260 potcores, PL14/8, with nut
4 Philips 4322 021 30250 coil formers
4 Philips 4322 021 30950 inductance adjustors
4 Philips 4322 021 30440 tag plates
4 Philips 4322 021 30520 brass containers
4 Philips 4322 021 30630 springs

Capacitors & Resistors

AM tuner

Capacitors

1 2200μF 25VW axial electrolytic
2 1000μF 16VW PC electrolytic
1 470μF 63VW axial electrolytic
2 470μF 25VW axial electrolytic
1 100μF 25VW axial electrolytic
1 33μF 16VW PC electrolytic
1 10μF 25VW PC electrolytic
3 10μF 16VW PC electrolytic
2 4.7μF 16VW PC electrolytic

AM/FM Tuner

2 2.2μF 16VW PC electrolytic
3 1μF 16VW PC electrolytic
2 0.47μF 16VW tantalum
11 0.1μF ceramic
4 .056μF metallised polyester
1 .022μF metallised polyester
10 .01μF ceramic
2 .01μF (10nF) ceramic plate, Philips 222 629 09103
4 .0033μF metallised polyester
2 .0018μF metallised polyester
1 .001μF metallised polyester
1 .001μF ceramic
1 .001μF (1nF) miniature ceramic plate, Philips 222 630 09102
1 680pF miniature ceramic plate, Philips 2222 630 09681
1 560pF ceramic
2 470pF ceramic
1 390pF ceramic
1 56pF ceramic
1 33pF ceramic
3 5.2-30pF Murata D series trimmers

Resistors 0.25W, 5% unless stated)
2 x 1MΩ, 1 x 300kΩ 2%, 1 x 270kΩ, 2 x 220kΩ, 3 x 150kΩ, 1 x 110kΩ 2%, 7 x 100kΩ, 1 x 82kΩ, 2 x 47kΩ, 1 x 33kΩ, 2 x 22kΩ 2%, 2 x 18kΩ 2%, 3 x 12kΩ 2%, 2 x 10kΩ, 2 x 8.2kΩ 2%, 1 x 7.5kΩ 2%, 2 x 6.8kΩ, 3 x 5.6 kΩ, 1 x 4.7kΩ, 1 x 3.9kΩ, 2 x 3.3kΩ, 2 x 2.7kΩ 2%, 3 x 2.2kΩ, 2 x 1.6kΩ 2%, 1 x 1.2kΩ, 2 x 1kΩ, 1 x 910Ω 2%, 1 x 820Ω, 5 x 560Ω, 1 x 430Ω 2%, 1 x 270Ω, 2 x 220Ω, 3 x 100Ω, 1 x 4.7kΩ miniature horizontal trimpot, 2 x 2kΩ miniature horizontal trimpots

FM front end

Capacitors

1 6.8μF tantalum
7 .01μF (10nF) miniature ceramic plate, Philips 2222 629 09103
3 .001μF (1nF) miniature ceramic plate, Philips 2222 629 09102
1 47pF miniature ceramic plate, Philips 2222 652 10479
1 27pF miniature ceramic plate, Philips 2222 652 10279
1 6.8pF miniature ceramic plate, Philips 2222 652 09688
1 4.7pF miniature ceramic plate, Philips 2222 652 09478
1 3.3pF miniature ceramic plate, Philips 2222 652 09338
1 1.5pF miniature ceramic plate, Philips 2222 652 09158
3 4.2-20pF Murata D series trimmers
1 3-11pF Murata D series trimmer

Resistors (0.25W, 5%)
1 x 1MΩ, 4 x 56kΩ, 1 x 33kΩ, 1 x 18kΩ, 2 x 10kΩ, 1 x 3.3kΩ, 1 x 2.2kΩ, 1 x 1.5kΩ, 1 x 1kΩ, 1 x 220Ω, 2 x 22Ω

FM IF and stereo decoder

Capacitors

1 220μF 16VW PC electrolytic
2 47μF 16VW PC electrolytic
1 22μF 16VW PC electrolytic
2 10μF 16VW PC electrolytic
2 4.7μF 16VW PC electrolytic
3 2.2μF 16VW PCelectrolytic
3 1μF 16VW PC electrolytic
1 0.33μF metallised polyester
1 0.22μF metallised polyester
3 0.1μF ceramic
1 .047μF metallised polyester
4 .012μF metallised polyester
5 .01μF (10nF) miniature ceramic plate, Philips 2222 629 09103
2 .0056μF metallised polyester
3 .0047μF metallised polyester
2 .0018μF metallised polyester
2 .0015μF metallised polyester
1 .001μF metallised polyester
2 150pF ceramic
1 82pF miniature ceramic plate, Philips 2222 652 58829

Resistors (0.25W, 5% unless stated)
2 x 390kΩ, 2 x 270kΩ, 3 x 100kΩ, 1 x 47kΩ, 1 x 33kΩ, 2 x 22kΩ, 2 x 20kΩ 2%, 4 x 15kΩ, 1 x 12kΩ, 3 x 10kΩ, 6 x 10kΩ 2%, 1 x 8.2kΩ, 1 x 7.5kΩ 2%, 2 x 4.7kΩ, 1 x 4.3kΩ 2%, 2 x 3kΩ 2%, 1 x 2.2kΩ, 1 x 330Ω, 1 x 22kΩ horizontal cement trimpot, 3 x 10kΩ horizontal cermet trimpot, 1 x 5kΩ horizontal cermet trimpot

Tuner control circuit

Capacitors

1 47,000μF (.047F) 5VW super capacitor
2 1000μF 16VW PC electrolytic
4 47μF 16VW PC electrolytic
4 10μF 25VW PC electrolytic
4 10μF 16VW PC electrolytic
2 1μF 63VW PC electrolytic
1 1μF 35VW PC electrolytic
1 1μF 25VW PC electrolytic
1 0.33μF metallised polyester
1 0.1μF ceramic
2 .01μF ceramic
2 .01μF (10nF) miniature ceramic plate, Philips 2222 629 09103
1 .01μF metallised polyester
1 680pF miniature ceramic plate, Philips 2222 630 09681
1 100pF miniature ceramic plate, Philips 2222 652 58101
2 22pF ceramic
2 4.7pF ceramic

Resistors (0.25W, 5%)
1 x 1MΩ, 1 x 220kΩ, 1 x 150kΩ, 1 x 33kΩ, 9 x 10kΩ, 4 x 5.6kΩ, 2 x 4.7kΩ, 1 x 2.7kΩ, 1 x 2.2kΩ, 1 x 1.8kΩ, 7 x 1kΩ, 6 x 820Ω, 1 x 680Ω, 1 x 470Ω, 1 x 330Ω, 1 x 220Ω, 2 x 120Ω, 2 x 82Ω, 2 x 56Ω, 4 x 47Ω, 7 x 22Ω

signal strength meter drive circuit and an AGC output. In addition, it provides a stop output which is connected directly to the stop input (pin 13) of the microprocessor.

The output from the input buffer stage of IC2 appears at pin 3 and is fed to a second 10.7MHz ceramic filter (CF2). It then passes to the limiter amplifier which ensures that the input signal is driven well into clipping. The limiter, in turn, drives the quadrature FM detector associated with the tuned circuits on pins 10 and 11.

The circuit effectively performs quadrature detection by measuring the voltage across L16 and the parallel 82pF capacitor. L17 limits the voltage swing across the quadrature coil while the 4.3kΩ resistor reduces the Q of the tuned circuit to provide more linear detection.

The AGC output is extracted from pin 18 and applied to gate 2 of Q6 in the front end via a 1kΩ/33kΩ voltage divider. It operates when a strong signal is present or when a strong out-of-band signal is detected at the wideband AGC input (pin 20). In the latter case, the AGC acts to reduce intermodulation distortion.

Pin 8 of IC2 provides the meter output signal which is split into three separate paths. First, it drives the signal strength meter via D23. Second, it drives the stop threshold (pin 13) via a voltage divider consisting of a 4.7kΩ resistor and trimpot VR4. And third, it drives the blend input of IC3, the LM1870 phase locked loop FM stereo demodulator.

VR4 sets the stop input threshold while VR5 sets the blend threshold (ie, the signal level below which blending from stereo to mono begins). The idea behind blending is to improve the signal-to-noise ratio at very low signal levels. It does this at the expense of stereo separation of the upper treble frequencies.

In addition to the blend signal, IC3

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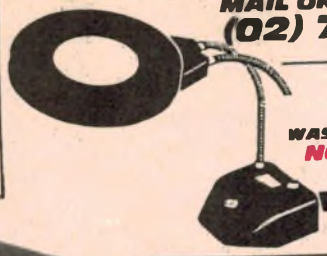

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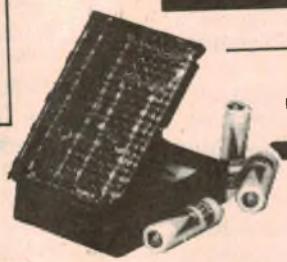

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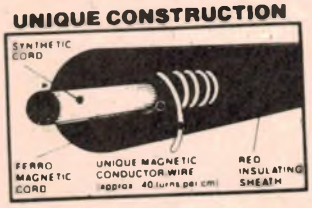

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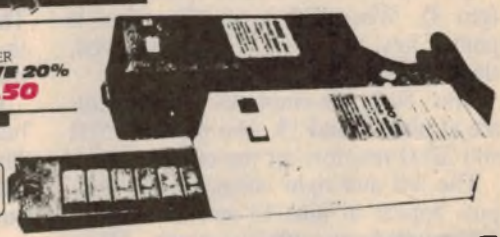

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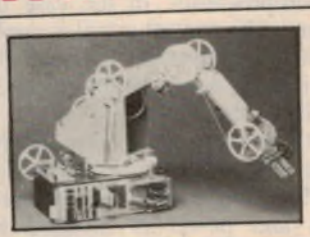

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Playmaster AM/FM stereo tuner

also accepts the detected audio signal from pin 15 of IC2. This signal is fed via two 2.2μF capacitors to pins 2 and 19.

VR6 sets the frequency of the VCO which forms part of the phase locked loop. The PLL locks onto the transmitted 19kHz stereo pilot tone and drives an electronic switch at a 38kHz rate to decode the stereo information.

Q9 connects to the forced mono input (pin 4). When Q9 is on, the input is pulled low and the VCO is stopped, thus forcing mono reception.

The 50μs de-emphasis components are at pins 14 and 15. The parallel 15kΩ and 22kΩ resistors set the output level.

The left and right channel audio outputs appear at pins 13 and 12 and are AC-coupled to 19kHz notch filters based on L18, VR7 and L19, VR8. Adjustment of the notch filter frequency in each channel is by means of a tuning slug in the relevant inductor, while the associated trimpot adjusts the sharpness and depth of the null.

Following the notch filters are two simple third order low pass filters based on IC8b and IC8c. These roll off the response above 19kHz to remove the residual 38kHz switching components.

The resulting left and right channel audio outputs appear at pins 7 and 8 and are fed to pins 11 and 4 of IC13.

Audio switching

IC13 is a 4052 analog multiplexer/demultiplexer used here as a 2-pole 3-position switch.

The A and B inputs control the switch input selection. Input A selects either the AM or FM audio inputs. When A is high, the FM audio at inputs 3X and 3Y are fed through to the outputs at X and Y. When A is low, the AM inputs at 2X and 2Y are fed to X and Y.

Input B is the mute input and selects either the 0X, 1X or 0Y, 1Y inputs which are all connected to ground. Thus, when B is low (ie, during tuning), the audio inputs are tied to ground and the outputs at X and Y are muted.

Inverting op amps IC8a and IC8d buffer the X and Y outputs of IC13. These each have a gain of 1.44 and provide a nominal 450mV RMS audio output signal.

Microprocessor control

The A and B control signals for IC13 are derived from IC1 which is the NEC microprocessor. In the case of the A input, the control signal is applied from pin 29 via inverters IC9d and IC9e. The B input is direct driven by pin 2.

IC9e also drives Q10, Q11, Q12 and Q13 to switch the power supply rails to the AM and FM tuners. When pin 13 of IC9e is high, Q12 and Q11 are turned on and power is supplied from the +12V regulator to the FM tuner.

When pin 13 of IC9e is low, Q12 and Q11 are off and Q13 is on. This switches on Q10 so that power is now applied to the AM tuner.

Pin 30 of IC1 (ST) controls mono/stereo switching of the AM and FM tuners. When the tuner is switched to mono, pin 30 goes high and the output of IC9b goes low to switch on the mono LED indicator.

Assuming that FM is selected, Q9 also switches on and pulls pin 4 of the FM stereo demodulator (IC3) low. If AM is selected, pin 7 of IC9b goes low and pulls pin 9 of the AM stereo demodulator (IC4) low via D8.

Pin 9 of IC4 is also connected via D7 to the mute output of IC1. This forces pin 9 low during muting, and enables stereo reception almost immediately a station is received. Without this feature, the decoder would detect noise during tuning and go into a long count mode before switching to stereo.

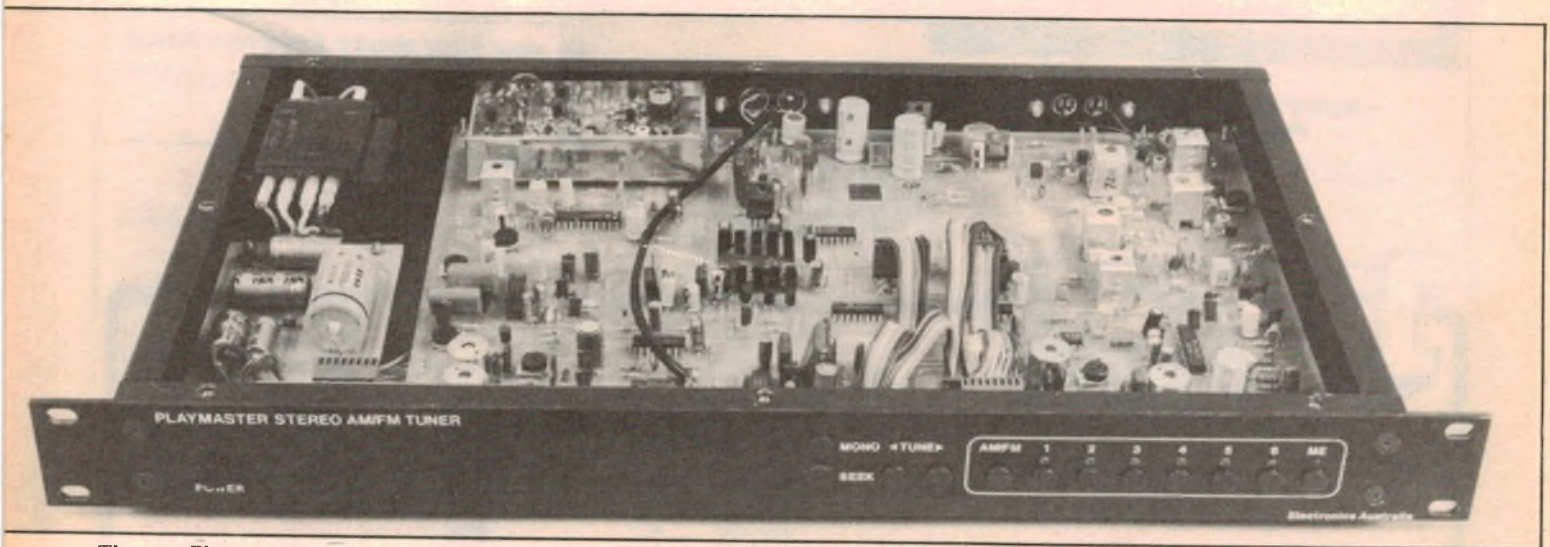
Control loop

The synthesised control loop for the AM and FM tuners involves local oscillator buffer stages Q16 and Q17, dual modulus prescaler IC11, and error output buffer stage Q15 and Q14.

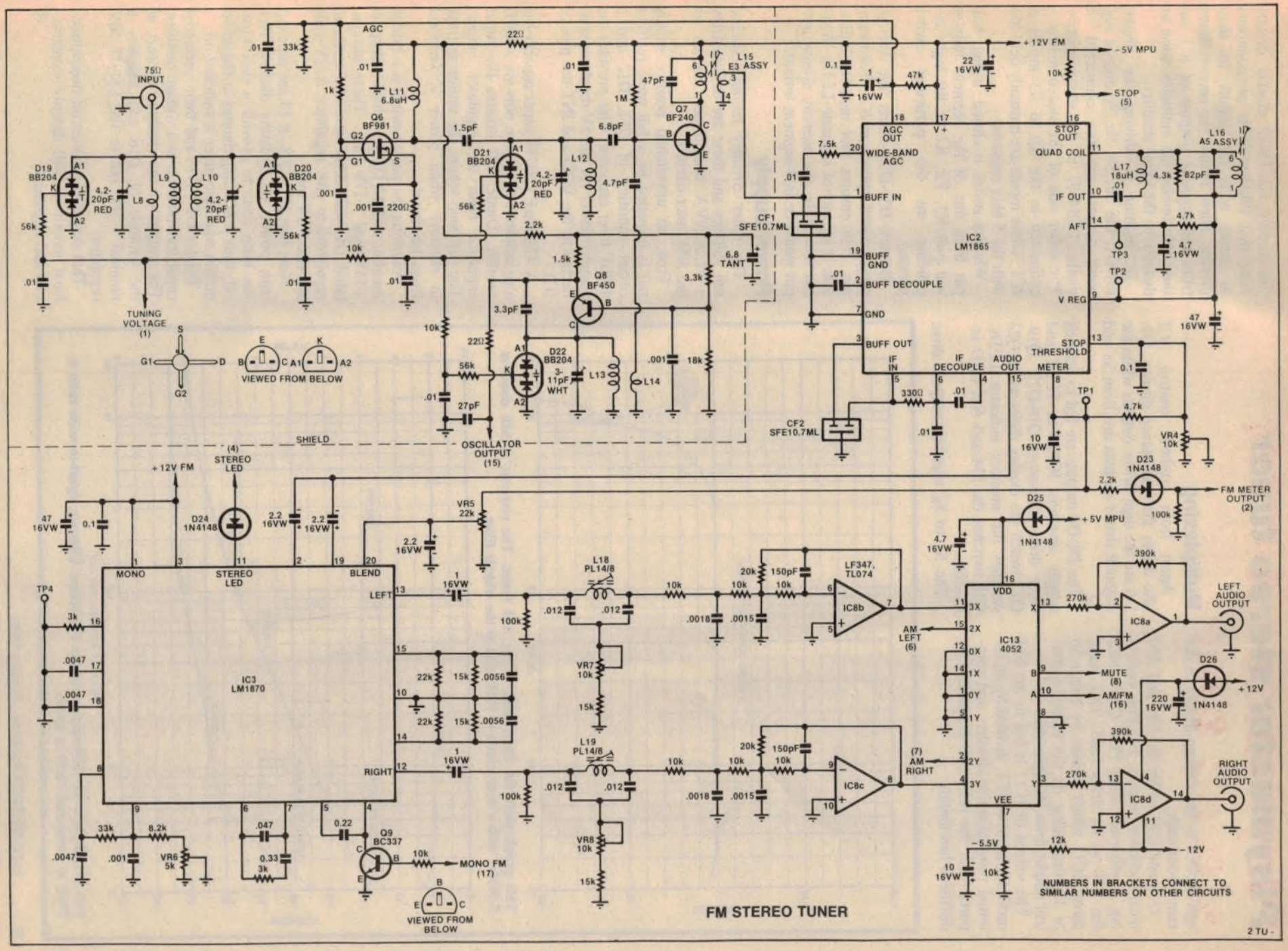
Pin 11 of IC1 drives the error output buffer. It controls the buffer such that, if the local oscillator frequency is lower than the internal reference frequency, the error voltage is low and Q15 and Q14 turn off.

Conversely, if the local oscillator frequency is greater than the internal reference, the error voltage goes high and Q15 and Q14 turn on. When both frequencies are equal, the error output floats (ie, goes open circuit).

A high voltage supply for the error output buffer is derived from an LM317T 3-terminal adjustable regulator. The 2.7kΩ resistor connected between the adjust terminal and ground sets the output of the LM317 to +30V. Q15 and Q14 then set the tuning volt-



The new Playmaster tuner is built into a slimline rack-mounting case fitted with a screened front panel.


FM STEREO TUNER
NUMBERS IN BRACKETS CONNECT TO SIMILAR NUMBERS ON OTHER CIRCUITS
IC2 LM1865
IC3 LM1870
IC13 4052
LF347, TL074
IC8a
IC8b
IC8c
IC8d
AGC
75Ω INPUT
TUNING VOLTAGE (1)
VIEWED FROM BELOW
SHIELD
OSCILLATOR OUTPUT (15)
+12V FM
-5V MPU
STOP (5)
WIDE-BAND AGC
BUFF IN
BUFF GND
BUFF DECOUPLE
GND
BUFF OUT
IF IN
IF DECOUPLE
AUDIO OUT
STOP THRESHOLD METER
QUAD COIL
IF OUT
AFT
V REG
MONO
STEREO LED
BLEND
LEFT
RIGHT
MONO FM (17)
AM LEFT (6)
(7) AM RIGHT
MUTE (8)
AM/FM (16)
FM METER OUTPUT (2)
LEFT AUDIO OUTPUT
RIGHT AUDIO OUTPUT
VDD
VEE
-5.5V
-12V
+12V
TP1
TP2
TP3
TP4
D19 BB204
D20 BB204
D21 BB204
D22 BB204
D23 1N4148
D24 1N4148
D25 1N4148
D26 1N4148
Q6 BF981
Q7 BF240
Q8 BF450
Q9 BC337
CF1 SFE10.7ML
CF2 SFE10.7ML
L8
L9
L10
L11 6.8uH
L12
L13
L14
L15 E3 ASSY
L16 A5 ASSY
L17 18uH
L18 PL14/8
L19 PL14/8
VR4 10k
VR5 22k
VR6 5k
VR7 10k
VR8 10k
4.2-20pF RED
3-11pF WHT
6.8 TANT
VIEWED FROM BELOW

Playmaster stereo tuner

age applied to the varicap diodes in the tuner front ends.

Q16 and Q17 buffer the FM and AM local oscillator outputs. For FM, buffering is achieved using FET Q16 which has L20 as its drain load. This stage drives IC11 which divides by either 16 or 17, depending on the modulus control output from IC1 (pin 16).

The output of IC11 is fed to the FM oscillator input of IC1, divided by an internal programmable divider, and compared with the reference frequency, as discussed last month.

Multiplexing

Apart from synthesis control, IC1 also drives the multiplexed display. D1-D6 are the digit driver outputs while the segment driver outputs are from Sa and Sg.

The D1-D6 outputs are fed to Schmitt trigger inverters IC12a to IC12f and these drive transistors Q18-Q23. Q19-Q22 switch the display digits while Q23 switches the memory indicator LEDs. Q18 switches the FM and AM LED indicators.

The Sa to Sg segment outputs drive the display via 75492 display drivers. Note that 10kΩ resistors are connected in series with the inputs to these drivers. These reduce the current drawn from the segment outputs of IC1 and thus help reduce the multiplex noise induced into the tuner circuitry.

In addition to driving the display drivers, the Sa, Sb, Sc, Se and Sf segment outputs are also connected via diodes D28-D32 to the switch matrix. The other side of the switch matrix is connected to the K0 to K3 inputs of IC1. These inputs are normally held low with the 5.6kΩ resistors.

When a switch is closed, a high output from one of the segment outputs will pull K3, K2, K1 or K0 high, depending on the particular switch pressed.

Diodes D33-D36 select the various programmed options in IC1. For example, D36 ensures that memory indication is by way of separate LEDs. Without this diode, the memory display output would be in 7-segment format.

Power supply

The tuner circuitry requires several rail voltages and these are derived from a PL24/20VA transformer (shown on the AM tuner circuit).

First, an unswitched positive supply rail is provided by a full wave rectifier circuit consiting of D11, D12 and a 470μF filter capacitor. This provides the standby power for the 5V regulator connected to the VDD and INT-bar pins of IC1.

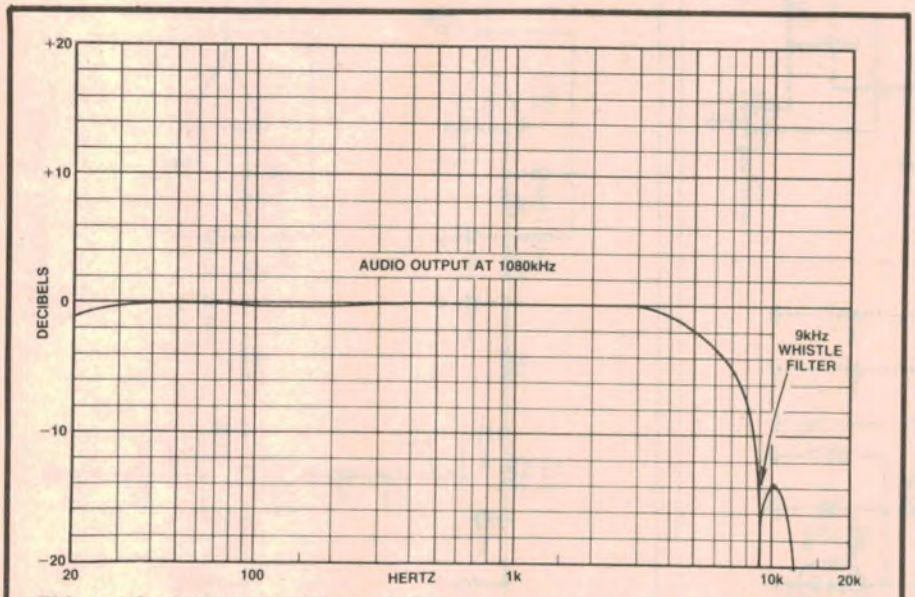
A 47,000μF (.047F) super capacitor is also connected to these pins via a 680Ω resistor. Diode D27 isolates the super capacitor from the regulator output. The supercap retains the station settings in memory when power is removed from the circuit.

Following the power switch is a bridge rectifier (D13-D16) which supplies +15V and −17V rails. These unregulated DC rails drive several 3-terminal regulators to give regulated ±12V rails and two +5V rails.

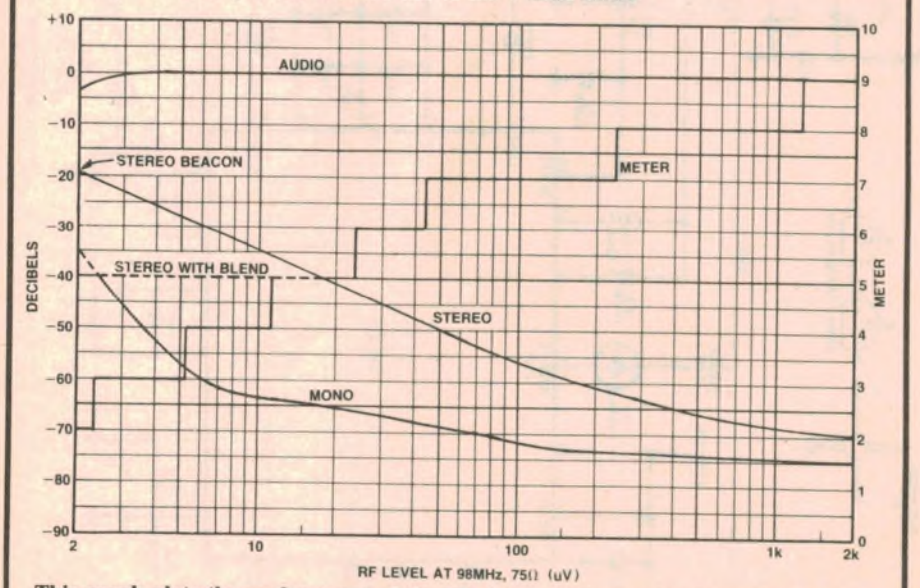
Note that ICs 6,7,8, & 13 are supplied with power via isolating diodes. This has been done to provide a slow turn-off, thus preventing thumps in the audio output when the tuner is switched off.

Diodes D17, D18 and their associated capacitors function as a voltage doubler. The output of the doubler appears at the cathode of D18 and supplies a nominal +51V rail to the LM317 30V regulator.

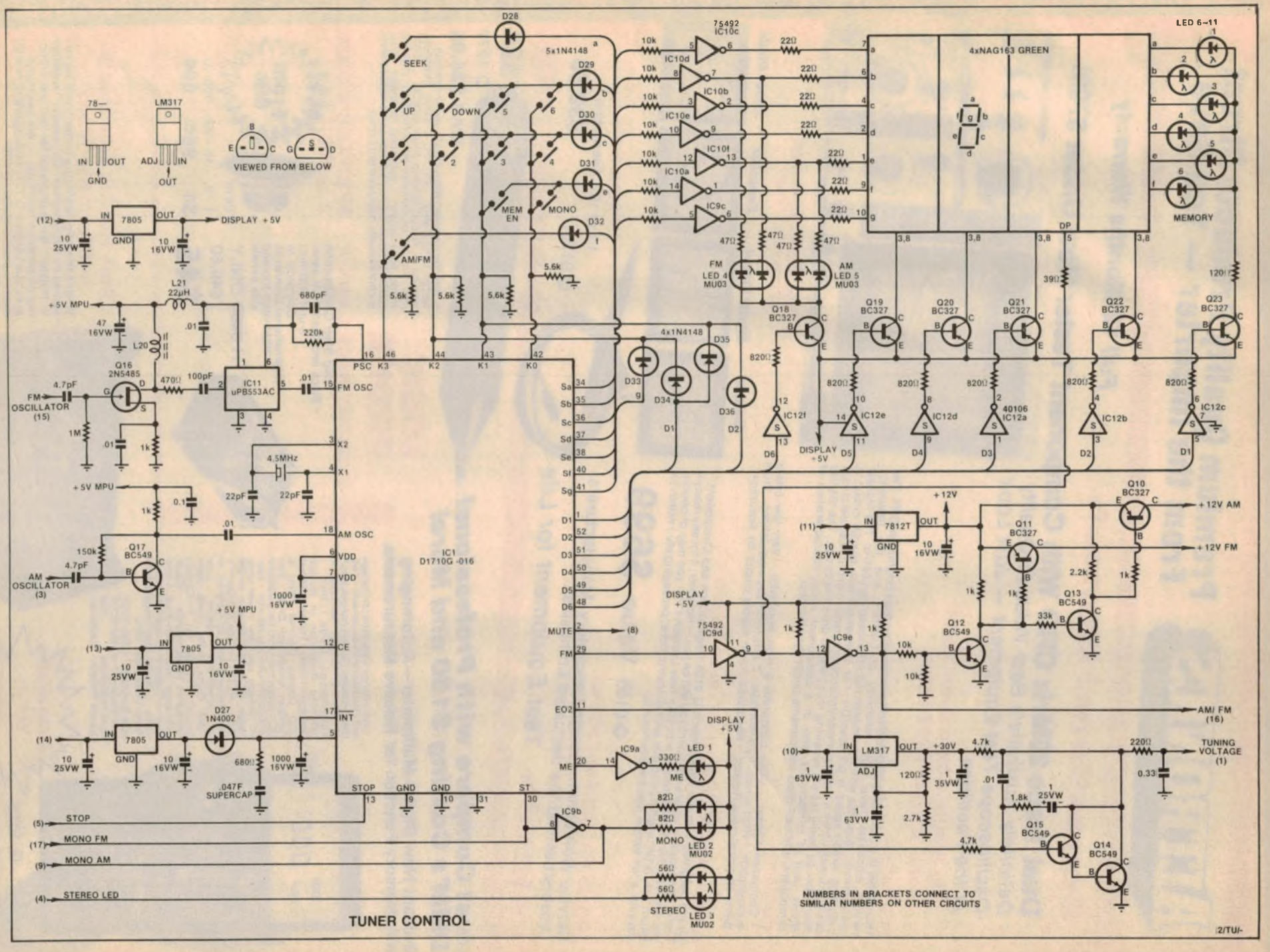
That completes the circuit description. Next month we will describe construction and alignment.



This graph plots the bandwidth of the AM tuner. The response is 3dB down at 5.5kHz, with a deep notch at 9kHz due to the whistle filter.



This graph plots the performance of the FM tuner. Ultimate signal-to-noise ratio is 75dB in mono and 70dB in stereo.


TUNER CONTROL
NUMBERS IN BRACKETS CONNECT TO SIMILAR NUMBERS ON OTHER CIRCUITS
IC1 D1710G -016
4xNAG163 GREEN
LED 6–11
MEMORY
SEEK
UP
DOWN
MEM EN
MONO
AM/FM
5x1N4148
4x1N4148
75492 IC10c
IC10d
IC10b
IC10e
IC10f
IC10a
IC9c
FM LED 4 MU03
AM LED 5 MU03
Q18 BC327
Q19 BC327
Q20 BC327
Q21 BC327
Q22 BC327
Q23 BC327
IC12f
IC12e
IC12d
40106 IC12a
IC12b
IC12c
DISPLAY +5V
+5V MPU
DISPLAY + 5V
7805
7812T
LM317
+12V
+30V
+12V AM
+12V FM
AM/ FM (16)
TUNING VOLTAGE (1)
FM OSCILLATOR (15)
AM OSCILLATOR (3)
FM OSC
AM OSC
PSC K3
K2
K1
K0
Sa
Sb
Sc
Sd
Se
Sf
Sg
D1
D2
D3
D4
D5
D6
MUTE
FM
EO2
ME
INT
CE
STOP
GND
ST
Q16 2N5485
Q17 BC549
Q10 BC327
Q11 BC327
Q12 BC549
Q13 BC549
Q14 BC549
Q15 BC549
IC9a
IC9b
IC9d
IC9e
LED 1
LED 2 MU02
LED 3 MU02
MONO
STEREO
D27 1N4002
.047F SUPERCAP
4.5MHz
L21 22µH
L20
STOP
MONO FM
MONO AM
STEREO LED
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Pages: 1520 **Year 1983**

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The 1982 edition of the National Semiconductor Linear Data book is the most comprehensive available. It presents approximately 2000 pages of specifications for our high-technology linear products. Applications, descriptions, features and diagrammes in this data book include detailed sections for Voltage Regulators, Op Amps, Voltage Comparators, A to D, D to A Converters, Industrial Blocks and Audio and TV Circuits. The data book also features advanced telecommunications devices and speech synthesis (DIGITALKER). Plus other non state-of-the-art linear products offering performance, economy, quality and reliability.

Pages: 1952 **Year:1982**

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The 1984 Linear supplement provides the most recent information on Nationals new linear products. This supplement also provides a comprehensive index published in the Master Data book. New products designed are indicated by an Asterisk and in bold type. Revised data sheets are listed in bold type. Nationals supplement data book system allows you to make product selections of their latest product offerings.

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Page: 1520 **Year: 1984**

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The Serviceman

Aversion therapy for the Sony KVA-1830AS receiver

It is probably true that most servicemen have an aversion to working on certain makes or models of sets. In many cases that can be justified on the basis of awkward physical design, insufficient data from makers, shortage of spare parts, and so on. But in some cases there is no real justification at all; just a blind prejudice based on hearsay horror stories, or an unfortunate first-time experience.

The truth is that few of us can afford to pick and choose on this basis; we have to take the good with the bad and what we lose on the swings we gain on the roundabouts. Maybe we do miss out once in a while but the benefit in goodwill and public relations usually more than compensates.

These comments were prompted by a set I handled recently and which, for no reason I have been able to discover, seems to have gained a reputation — quite undeserved in my opinion — of being difficult to service. So much so that some servicemen I know simply refuse to even look at them. Others accept them, but always reluctantly.

The set in question is the Sony KV-1830AS, along with the KV-2000AS. The 1830 model uses an 18in (46cm) Trinitron tube while the model 2000 uses a 20in (51cm) Trinitron. Apart from size the main differences are minor cabinet styling details. These sets first appeared on the market about eight years ago.

Just why they seem to have gained a poor reputation among some servicemen is not clear, and my own experience with them suggests that they are no more difficult to handle than the average set. However, in telling this story I will touch on some of the preliminary checks I have developed which assist considerably in pinpointing the general nature of a fault.

The story started with a phone call from the owner's wife, along the lines that their TV set was playing up. When I enquired as to the exact nature of the symptoms the best answer she could give was rather vague; as nearly as I could make out the picture was breaking up in some manner, although the sound did not seem to be affected.

After a little more questioning I concluded that it did not seem to be an outside interference problem, or even an antenna problem, but almost certainly in the set itself. I also concluded that this would be no "15-minutes-in-the-lounge-room" type of repair; I would need to get it on the bench. In these circumstances, and because the customer lived some distance away, I suggested that they could save some costs if they could bring the set in themselves. This was readily agreed to.

Two symptoms

So the set was duly delivered and I eventually found time to switch it on and see what the trouble was about. The result only seemed to confirm my worst fears; that it wasn't going to be easy. There appeared to be two quite distinct symptoms, though whether they both originated from the same fault I had no way of knowing.

The first symptom I observed consisted of dots and streaks on the screen, rather similar to the effect caused by spasmodic arc-over somewhere in the EHT system, although I could hear nothing to confirm that this was actually happening. Then, as I watched, the second symptom appeared; quite marked variation in picture width, to the extent, at times, of 50mm or so on each side.

This effect was quite random; the width would decrease, jitter around for awhile, open out part way, decrease again, open out fully, and so on. At the same time the dots and streaks were playing havoc with the picture, but I couldn't be sure whether the effects were related or not.

I pulled the back off the cabinet and prepared to make some preliminary measurements. Fortunately, this model is reasonably easy to work on, contrary to what might be implied by those who reject it. My first check, as with most faults, is the HT voltage. This can often reveal a good deal about the likely nature of a fault.

In this set the HT rail should sit at about 135V and is easily checked at the output of the power supply at points F-3 or F-4. And this was the first clue. The value was anything but 135V, varying from a maximum of around 100V down to 90V. On this basis it was surprising that the picture width was holding as well as it was.

But why was the voltage varying? Was it a fault in the power supply, whereby it was unable to generate a steady voltage of the correct value? Or was there a fault somewhere in the set which was imposing a random load on the supply, thus causing it to fluctuate?

EHT checks

One possibility was a fault in the EHT supply system, a situation not unknown in these sets. Fortunately, it is a simple matter to check out this possibility, at least in general terms, by simply pulling out one plug. The horizontal deflection-cum-EHT system is a little unusual in this set, in that the normal line output transformer with EHT overwind is replaced by two transformers; the horizontal output transformer T801 and a step-up EHT transformer, T851, driven by T801.

T801, along with the transistor driver chain and associated circuitry, is accommodated on board E and connected to the rest of the system via five plugs, designated E-1 to E-5. The EHT transformer, T851, is mounted separately, along with the tripler and associated components, on the chassis. It is connected to the board via plug E-1.

So, if one suspects a fault in the EHT transformer, tripler, or associated components, it is a simple matter to isolate this section by pulling plug E-1. On more than one occasion when I have encountered a shut down power supply, pulling E-1 has been sufficient to bring the supply back on line, thus restoring the sound and normal behaviour in the rest of the set. It has then been a mat-

ter of replacing the transformer, tripler, or other faulty component. (Many servicemen who reject these sets are not aware of this simple check.)

In this case the effect of pulling the plug was negative; the HT remained low and fluctuating as before. This suggested another routine check I have found very valuable. This is to measure the total current being drawn by the set, and is relatively easy to perform on the power supply board (board F). There is a small choke, L604, on this board and it is a simple matter to break into the supply rail at this point.

Normal current consumption for this set is around 600mA and, in this case, it was somewhat less and fluctuating in sympathy with the rail voltage variations. More to the point, the test indicated that there was nothing causing excessive current drain, thus suggesting that the fault may well lie in the power supply itself.

From previous experience I mentally nominated a number of likely components on this board which have failed in the past. The first choice was several transistors, particularly Q607 (the main regulator transistor) and Q601 to Q605. Q606 and Q608 were, statistically, less likely contenders, but would have to be tested if all else failed.

Other likely offenders were three thermistors, TH601 and 603, which can become intermitent. Two other resistors were also suspect, namely R628 and R639 which are 1Ω, 1W units connected in parallel. These can go high resistance and produce some wierd and wonderful effects in the regulator circuit.

If only because it was easiest I checked out the thermistors and the two 1Ω resistors first. The thermistors are best checked by replacement, and this check proved negative. The same applied to the two 1Ω resistors.

Transistor checks

This left one of the transistors as the next likely suspect. Unfortunately, there are no short cuts to checking these. They have to be taken out and, as I have learned the hard way, it is not sufficient to simply check them in a tester. They can check OK but still refuse to work. The only real answer is replacement.

So I went through the ritual of replacing each of them, one at a time, and came up with a complete blank. Which more or less exhausted the possibilities based on previous failures; I would have to search further afield. Based on broad experience, rather than this particular set, my next suspects were the electrolytics.

Two of these were the main filter capacitors associated with the bridge rectifier, 120μF, 400V units designated C606 and C621. These were tested on a replacement basis, but I wasn't really surprised when they checked out OK. I was more suspicious of the very small values which, for some strange reason, seem to be the least reliable types.

So began the rather fiddly task of replacing each of the smaller electrolytics in turn. And, of course, Murphy was well to the fore. It was not until I had replaced almost all the units and came to C612, a 3.3μF device that I scored. On replacing this the HT rail voltage came up to normal and was rock steady. Even more gratifying was the effect on the set; the picture width was restored and, most importantly, the dots and streaks had vanished. In short the set was back to normal.

This was more than I had hoped for. I had assumed, when I found the faulty HT rail voltage that this was almost certainly the cause of the width problem, but I imagined the streaks and dots were most likely from another cause. However, it seemed most logical to fix the power supply problem first, then look for the second fault, if there was one. As it turned out, I didn't have to.

Routine checks

After that it was more or less routine; a soak test with the HT rail under surveillance, followed by a routine once-over of controls and adjustments, and a grey scale check. Everything checked out and the set was returned to the customer, who was delighted with the result.

In fact, it turned out that he had been half inclined to write the set off, on the basis that it was a few years old and the fault looked, at least to him, to be pretty drastic. So there was another grateful customer.

But before we leave this story a few more comments about typical behaviour of this set, under fault conditions, may be helpful. I am referring particularly to the behaviour of the power supply under a fault condition somewhere else in the set. Based on experience, most of us have a pretty good idea of the broad nature of a fault by the way the power supply behaves; ie, whether it shuts down or hiccups.

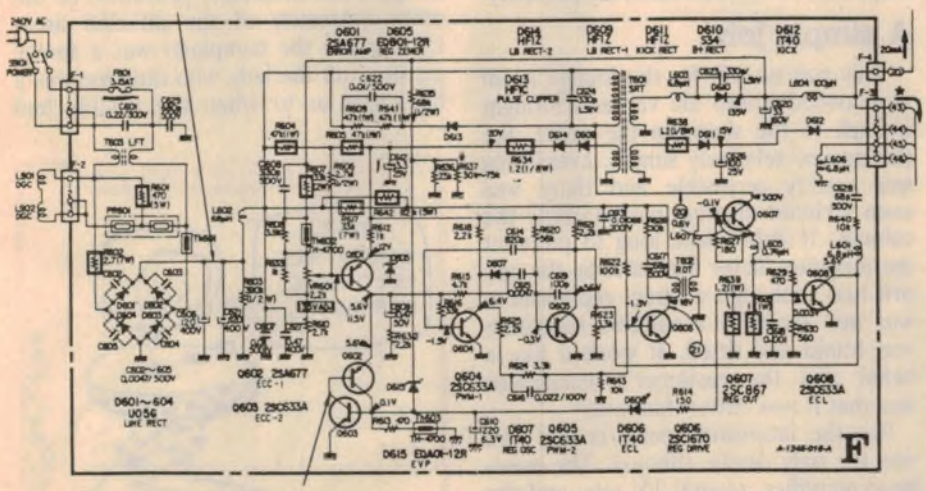
If the power supply in this set shuts down it is a pretty good indication of an over-current condition; ie, a short or heavy load on the HT rail. The most likely cause is, as already mentioned, the EHT transformer, tripler, etc, and can be pinpointed by pulling plug E-1.

Should this fail the line board (E) and associated circuitry is the next place to look. One possible fault is a breakdown of the line drive transistor, Q901, an SCR type SG613. Failure of this device need not indicate any other failure in the set; they can simply fail spontaneously.

Another possibility is the failure of diode D806, the horizontal damper diode. This can become either short circuit or leaky. Similar comments apply to diode D807, rectifier for the G2 supply line. There are also some electrolytics on this board which seem to give more trouble than the rest; C809, C816 and C827 (C827 on KV-2000AS).

Supply hiccups

If the power supply should hiccup it is usually an indication of an under current condition. A typical cause would be a failure of the line drive transistor, Q901, but to an open circuit condition



Above: the power supply circuit for the Sony KV-1830AS TV receiver.

rather than short circuit. A more complex situation would be excessive current drain on the line board, causing a shut down, followed by hiccups if this board is isolated by pulling plug E-3.

Such a situation could easily "throw" someone not familiar with the set, and particularly those more familiar with the older Philips and Kreisler sets — and others — which characteristically hiccup under over current conditions. I suspect that this behaviour could be another reason why the set has gained a reputation for being difficult to handle.

So there are some points for what they are worth. They are only a few compared with what could happen, but they are the more frequent ones. Together with power supply behavioural characteristics, they make things a little easier for anyone not familiar with this set.

Lightning strikes

To change the subject, here is a story from my colleague on the NSW south coast concerning an electrical storm and the quite unpredictable results of a severe lightning strike. It also gives a new twist to the old gag about lightning never striking twice in the same place. Anyway, here is my friend's story, more or less as he related it.

I was some distance away from my home base when this storm struck; about 15km away in fact, delivering several repaired sets to customers in that area. I had just carried the last set into the house and checked it out when the heavens opened and it rained by the bucketful. It was so bad that I didn't dare try to reach the van parked in front of the house; I would have been drenched to the skin in seconds. Instead I gratefully accepted a cup of morning tea and waited about half an hour for the rain to clear.

During that time there were several moderate lightning flashes, and one quite big one, but all were some little distance away, judging by the following thunder clap. On returning home I learned that the electrical aspect of the storm had been much more severe there than where I had been, and that there had been one extremely violent lightning flash with virtually simultaneous thunder.

However, nothing in the workshop or house appeared to have been damaged and I thought little more about it for about a week, when the first of several calls came in. And, as it ultimately transpired, they were all within about a 2.5km radius of a central point.

In fact, this first call was the most distant one of those that followed, and the location was well out in sparsely populated open country. But it did have a reputation for lightning strikes. There is a pole transformer not far from this customer's home and, on two previous occasions, it has been totally demolished.

At the same time, these strikes have caused a lot of damage in his home; the TV set copped it on one occasion and his masthead amplifier on two occasions — it was literally blown to pieces in one case.

So I wasn't altogether surprised at the call, but I was a little at the victim. This time it was the customer's AM tuner, part of an elaborate AM, FM, tape deck, and amplifier stereo system. And it was his favourite because he was a sports follower and this was the only set he had which would bring in his favourite Sydney station and Saturday afternoon sports results. This was really all it was used for, hence the delay in discovering the fault.

The TV set copped it on one occasion and his masthead amplifier on two occasions.

The equipment carried the HMV label but, I suspect, came from the General stable. It was some eight or nine years old and this worried me in case a vital component had been damaged for which there were no replacements. A quick inspection in the home confirmed that the AM tuner was completely dead but that everything else — the FM tuner, tape deck, disc player, amplifier, etc — was behaving perfectly.

A simple job

This was no job for the lounge room so I loaded it into the van and brought it back to the shop. In the event, the job proved relatively simple; everything was readily accessible and there was even a circuit diagram pasted inside the cabinet. It didn't take long to pinpoint the mixer/oscillator transistor as the culprit and, although a direct replacement was not available, a suitable substitute was found and fitted. It worked like a beaut and the customer's assessment was that it was better than ever!

But the interesting point is that this was the only device affected. The masthead amplifier, several TV sets, and the other sections of the tuner/amplifier setup had all escaped. Why, and by what mechanism, did the strike seek out that particular transistor? Or was it just coincidence?

The next call came from a customer who lives only about 500 metres from the first customer, and this time it was the TV set that was in trouble, the picture from both local channels being described as "very snowy". The set was a quite new AWA Thorn Mitsubishi model, purchased less than 12 months previously.

A check with the field strength meter showed that there was plenty of signal coming from the antenna and it didn't take long to confirm that the front end of the tuner had been knocked out. I seldom tackle tuner repairs; I find it much more economical to send them to a tuner specialist in the city. So the tuner was removed and despatched, to be subsequently returned, refitted, and checked out satisfactorily.

But the TV set wasn't the only victim. The customer's phone line had been knocked out, as had that of his next door neighbour; one of the local amateur fraternity. And strangely enough, in spite of a multiplicity of antennas and sensitive equipment, plus the usual TV and domestic radios, that was all that had been damaged.

Incidently, the owner subsequently made a successful claim against his householder's insurance policy to cover the cost of the repair; something he hadn't thought about until I suggested it.

The third call

The next call came a couple of weeks later from a location several kilometres away, which ultimately proved to be the other extremity of the affected area. Once again the complaint was a snowy picture, but the lady who rang me was a bit vague as to when the trouble had

appeared; she thought it was immediately after the storm, but wasn't sure.

Knowing the location, and the nature and age of the antenna system, I was more or less inclined to suspect that this was the problem, the timing with the storm perhaps being coincidental. But I was wrong. A check on the signal strength from the antenna showed that it was quite adequate. So the tuner came under suspicion again, and this was quickly confirmed. It was duly removed and despatched to Sydney for repair.

But here's the tag line. The set was the same make and model as the first one and, apparently, had suffered exactly the same fate. It had to be pure coincidence of course; not even Murphy would pull a gag like that.

The next job was only a few hundred metres away on the opposite side of the street. Once again the complaint was a snowy picture on each of two sets which this customer uses. And, because of the need to feed two sets, plus a relatively poor signal location, the installation uses a masthead amplifier.

With both sets showing the same symptoms I immediately suspected the amplifier. This proved to be correct and a new amplifier had to be fitted. But, significantly, nothing else in the house had been damaged.

Well that was the end of that story but I subsequently had occasion to talk to another customer who lives about half a kilometre away and, while he had suffered no damage to TV sets or radios, three telephones in his house were all written off. But that was Telecom's problem, not mine.

The next call was from another area again and, as before, involved a snowy picture. Once again, I suspected an antenna problem. (It was now some four or five weeks after the storm). This suspicion was based mainly on the age of the antenna, which I knew had been up for at least 15 years, plus the fact that I imagined that any lightning damage would have been reported much earlier.

But I had jumped to the wrong conclusion. The antenna was not only intact, but was delivering a very substantial signal. And this turned out to be the reason why the owner had not reported the trouble earlier; even with the front end of the tuner knocked out — for this was what I found — there was still enough signal to give a passable picture.

In fact, there was only a hint of snow on channel 4, but it was rather more obvious on 5A. And so it was that the customer had not been immediately aware of the fault and had not associated it with the storm. It was only when I raised the matter that he realised that the trouble first showed up after the storm.

And so another tuner was removed for despatch to Sydney for repairs. But — wait for it — the set was the same make and model as the other two! And so the lightning, if it didn't actually strike twice in the same place, struck three times at the same place in the same make of set.

So what is the answer? Was it pure coincidence, or is this particular tuner more vunerable than most to the stress of lightning strikes? I must admit that three in a row seems to be stretching the coincidence theory a bit far, though I suppose it is possible.

Why did three sets of the same model all suffer the same fault

On the other hand I hesitate to point the finger at the set, or criticise it in any way. It is a very good set, with an excellent fringe area performance; a matter of considerable importance in this area and a very good reason why it is often recommended for difficult locations.

Well, that's my friend's story, and a most interesting one it is. As with most lightning strike stories, one of the most puzzling and intriguing features is the completly random nature of the damage. Why is one appliance in a house picked out, or why is one on one occasion but not on another? And why do underground telephone lines appear to be just as vulnerable as when they were above ground, as in the past? Finally, why did three sets of the same model all suffer the same fault, while other sets were not affected.

I don't profess to have any ready made answers to these questions. The only comment I can make is that, based on published literature, strikes do not involve the component or appliance being struck at all, in the usually accepted sense. In the case of the three TV sets it is possible that neither the antennas nor the power mains were actually struck.

In fact, if they had been struck it is almost certain that the trouble would have been much more severe. The real culprit in these cases would appear to be the intense electromagnetic field generated by the strike and which can damage sensitive components at a considerable distance. In fact, colour tube shadow masks have been severely magnetised from adjacent strikes, without any other damage to the set.

As for the apparent coincidence of the three sets, I can only theorise that the excellent fringe area performance may have been achieved — quite unwittingly — by the use of a front end device which just happens to be more than usually sensitive to these electromagnetic fields.

Perhaps some of our readers may have experiences or comments which may throw some light on the problem.

TETIA Fault of the Month

Toshiba C810

Symptom. Highlights flare badly as brightness increases. Good pix obtainable only at low brightness level.

Cure. R262 (1120Ω ½W.) not connected to earth track on video output module. This is a design fault — even the board pattern in the service manual shows the resistor unconnected to ground.

Video fader for home movie buffs

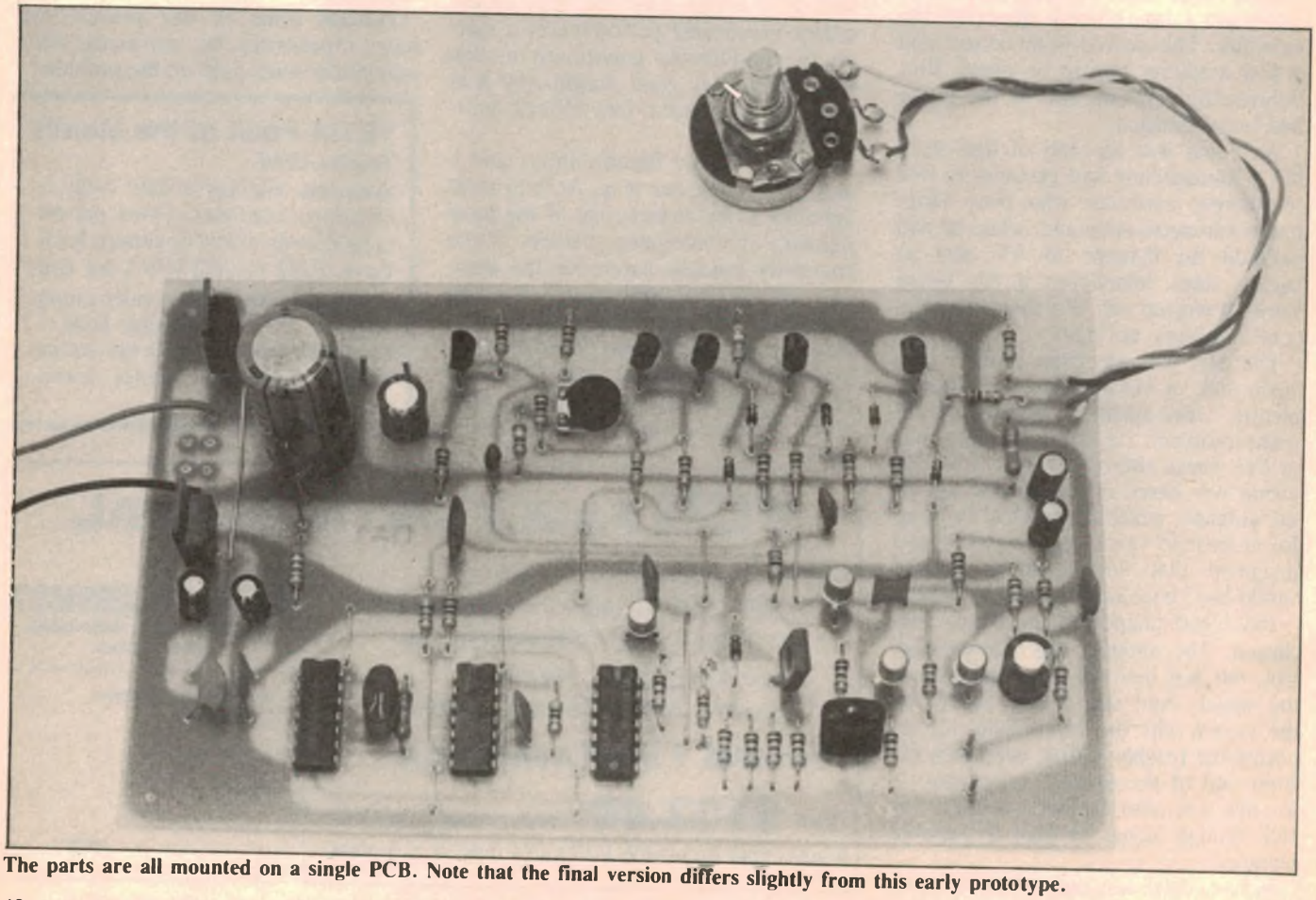
Add a touch of professionalism to your video movies with this simple Video Fader circuit. It enables you to fade a scene to black (and back again) without loss of picture lock (sync) or colour.

by COLIN DAWSON

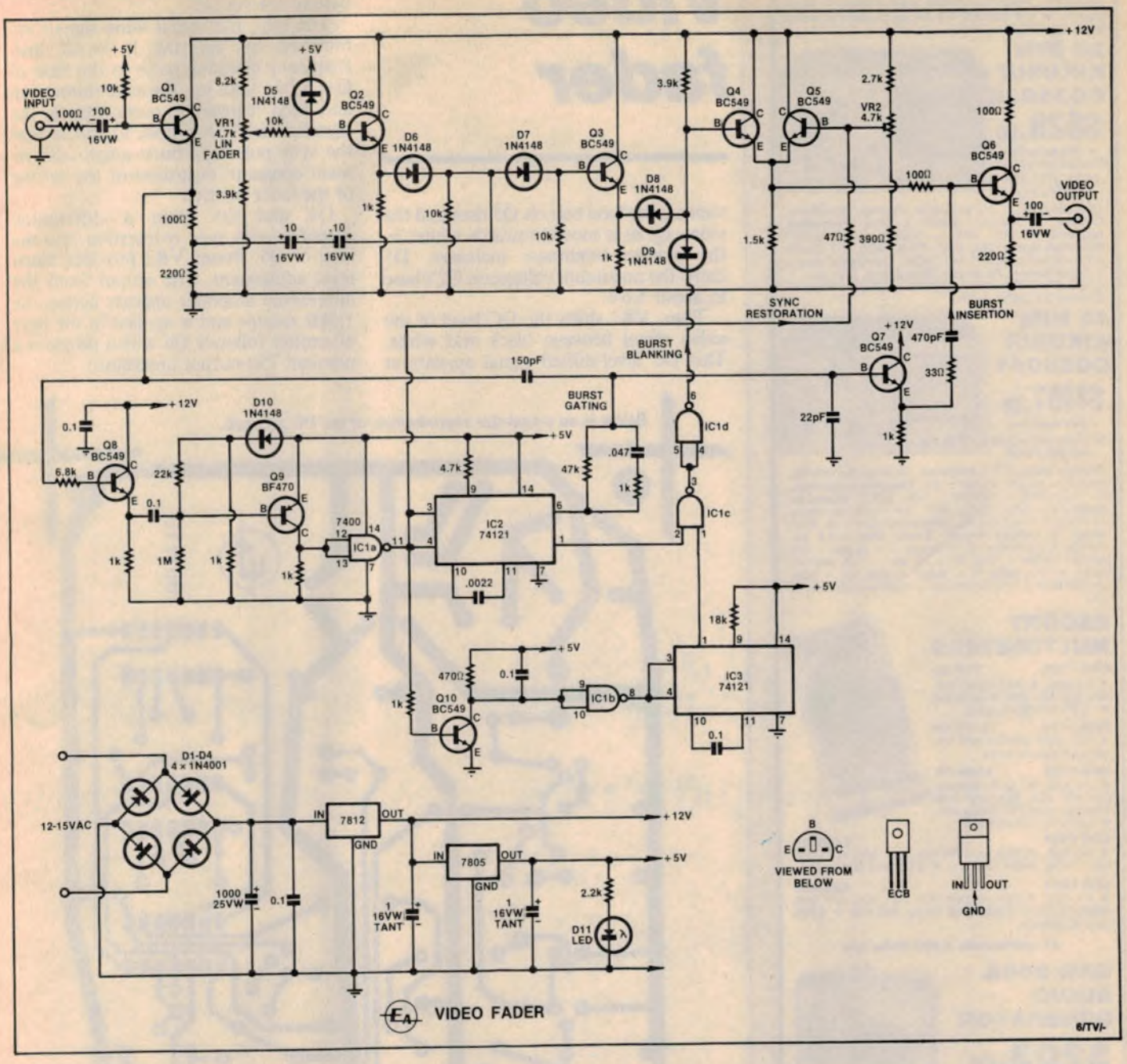
There's no doubt that home movies have been revolutionised by the advent of portable video equipment. Even the size disadvantage of electronic video gear is steadily disappearing — the new 8mm video camera from Sony, for example, is not much larger than a typical Super 8 camera.

Electronic video, of course, has the tremendous advantage of instant replay. Additionally, once you get the video home, it's quite a simple matter to duplicate and edit the recorded material.

Unfortunately, the range of effects available for electronic home movies is rather limited unless you have the budget of a television network. That's where this project comes in. It can be built for around $20 and will allow you to fade smoothly from one scene to



The parts are all mounted on a single PCB. Note that the final version differs slightly from this early prototype.



The input video signal is processed by an attenuator, a sync separator and a colour burst blanking/insertion circuit.

another, as well as simulating night time scenes.

Simply reducing the amplitude of the whole video signal would produce fading, but loss of sync would also occur long before the picture had faded to black. A video fader circuit must therefore maintain the sync pulse at full amplitude while attenuating the video information. It is also preferable that the circuit maintain the colour burst signal to prevent loss of colour at low levels.

The circuit presented here first appeared in the May 1985 issue of *Television* (UK). It preserves both the sync pulse and colour burst signals at full amplitude. Only the brightness information is affected by the attenuator.

Circuit description

Not surprisingly, the circuit has three main sections with the input video signal processed by an attenuator, a sync separator and a colour burst separator. Prior to the output, the sync pulse and colour burst signals are re-inserted into the "faded" video signal.

The input video signal is fed to emitter follower Q1 which acts as a buffer with a nominal input impedance of 75Ω. The signal appearing at Q1's emitter is split into two paths. The full amplitude signal is fed to the sync separator circuit (Q9) via buffer stage Q8, while a reduced amplitude version is fed via two 10μF capacitors and D7 to the base of Q3.

VR1, in conjunction with Q2, D6 and D7, sets the DC bias on emitter follower Q3. When VR1 is at the bottom end of its travel, Q3 is off and the video signal is effectively pulled to black. As VR1 is ad-

Video fader

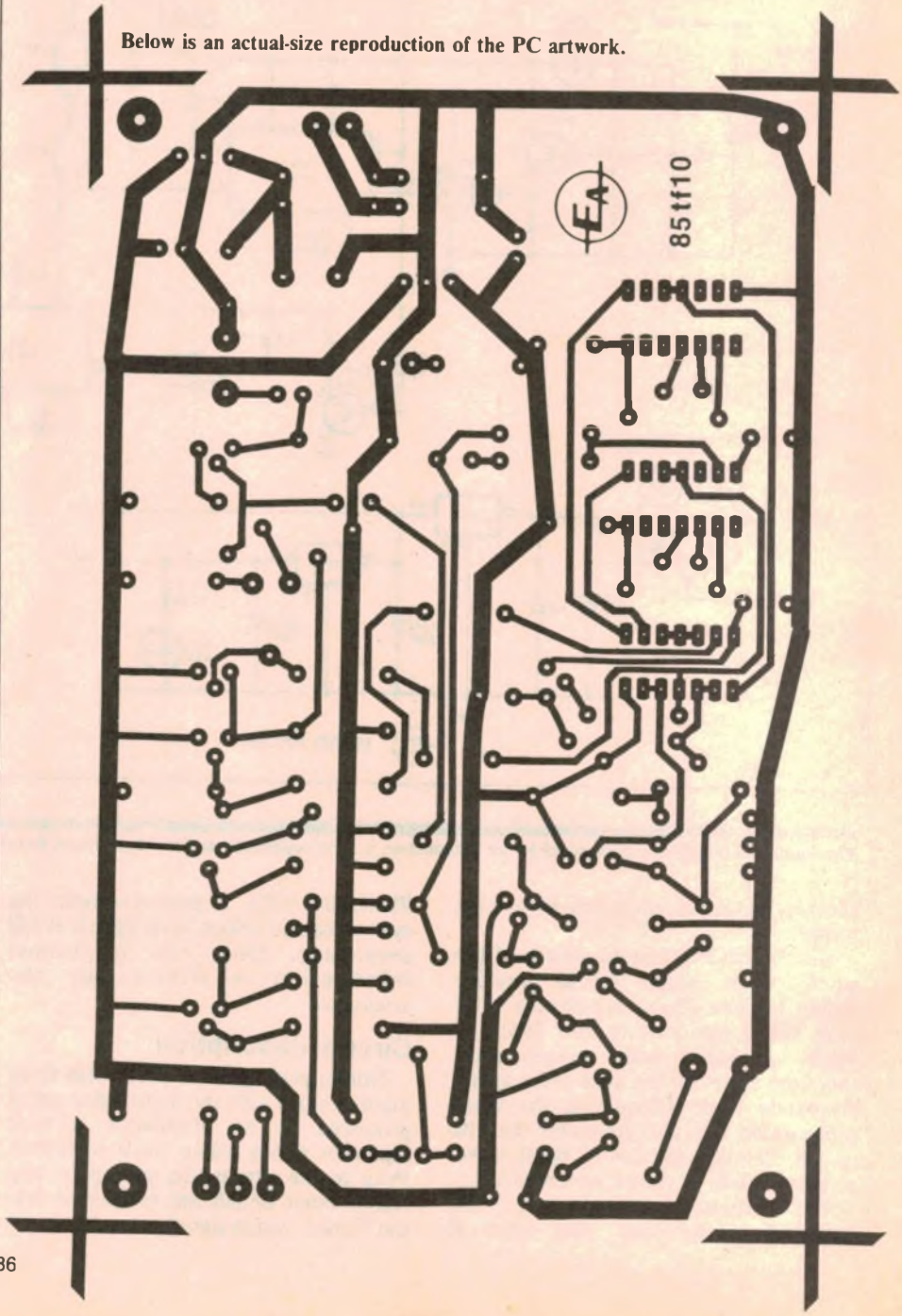
vanced, the base bias on Q3 rises and the video signal is moved towards white; ie, the picture brightness increases. D5 limits the maximum voltage on Q2's base to about 5.6V.

Thus, VR1 shifts the DC level of the video signal between black and white. This DC level-shifted signal appears at the emitter of Q3 and is applied to the base of Q4 via D8.

The sync and colour burst signals are removed by applying a broad line-frequency blanking pulse to the base of Q4. As we shall see, the sync restoration and burst re-insertion occur later in the signal chain. This is done to ensure that the sync pulse and burst amplitudes remain constant, regardless of the setting of the fader control.

Q4 and Q5 form a differential amplifier with sync re-insertion into the base of Q5. Preset VR2 provides black level adjustment. The output from the differential amplifier appears across the 1.5kΩ resistor and is applied to the base of emitter follower Q6 which provides a nominal 75Ω output impedance.

Below is an actual-size reproduction of the PC artwork.



The colour burst signal is simply re-inserted into the base of Q6.

So much for the video signal path. Let's now take a look at the sync separator and burst blanking circuitry.

The video signal appearing at the emitter of Q1 is buffered by Q8 which, in turn, drives sync separator stage Q9. The output of Q9 consists of a train of positive-going line and field sync pulses and these are inverted by NAND gate IC1a and applied to the base of Q5 via a 47Ω resistor.

IC1a also drives monostable multivibrator IC2 and transistor Q10. IC2 operates on the leading edge of the sync pulses and provides the burst blanking signal via IC1c and IC1d. It also provides a burst gating signal to Q7 via the shaping network on its pin 6 output.

This means that Q7 passes the colour burst signal present at the emitter of Q1 to the base of Q6 when it is gated on (ie, at the end of each line sync pulse).

Monostable IC3 produces the field blanking pulses. Compared to IC2, this monostable has a relatively long time-constant and is triggered by field sync pulses derived from integrator Q10 and inverter IC1b. IC1c NANDs the outputs of IC2 and IC3, with IC1d providing inversion for correct logic sense.

Thus, when either or both the pin 1 outputs of IC2 and IC3 are low, pin 6 of IC1d is also low and the base of Q4 is pulled low via D9 to blank the signal.

Power for the circuit is derived from a 12-15V AC plugpack transformer which feeds a bridge rectifier. This drives two 3-terminal regulators to give regulated +12V and +5V supply rails. LED D11 provides power on/off indication.

Construction

The parts are all accommodated on a single PCB measuring 161 × 112mm and coded 85tf10. Note that the board shown in the photograph is a prototype — the power supply section is slightly different in the final version.

No special procedure need be followed when assembling the board although it is a good idea to install the wire links and resistors first. This done, the capacitors and semiconductors can be installed. Note carefully the orientation of all polarised components (diodes, transistors, ICs, regulators and electrolytic capacitors).

Provided they are mounted close to the board, the input and output RCA sockets can be connected using short pieces of tinned copper wire. Note, however, that shielded cable should be used if the sockets are mounted away from the PC board.

Although we have not mounted the video fader in a project box, this would be the recommended procedure. Several of the popular project boxes would be suitable.

To test the circuit, set the fader control fully anti-clockwise (normal) and connect the video output of a VCR or camera to the fader input. The fader output can be connected to the video input of an editing VCR or to the video input of a TV receiver.

Assuming that the TV receiver is displaying an image, try adjusting the fader control. A substantial change in brightness should result, but don't worry if the circuit won't initially fade to black. The black level may need adjusting and trimpot VR2 is used for this purpose.

PARTS LIST

1 PCB, code 85tf10, 161 x 112mm
2 RCA sockets
1 project box to suit

Semiconductors

9 BC549 NPN transistors
1 BF470 PNP transistor
6 1N4148 diodes
4 1N4001 diodes
1 red LED
1 7400 TTL quad NAND gate
2 74121 TTL monostables
1 7812 12V regulator
1 7805 5V regulator

Capacitors

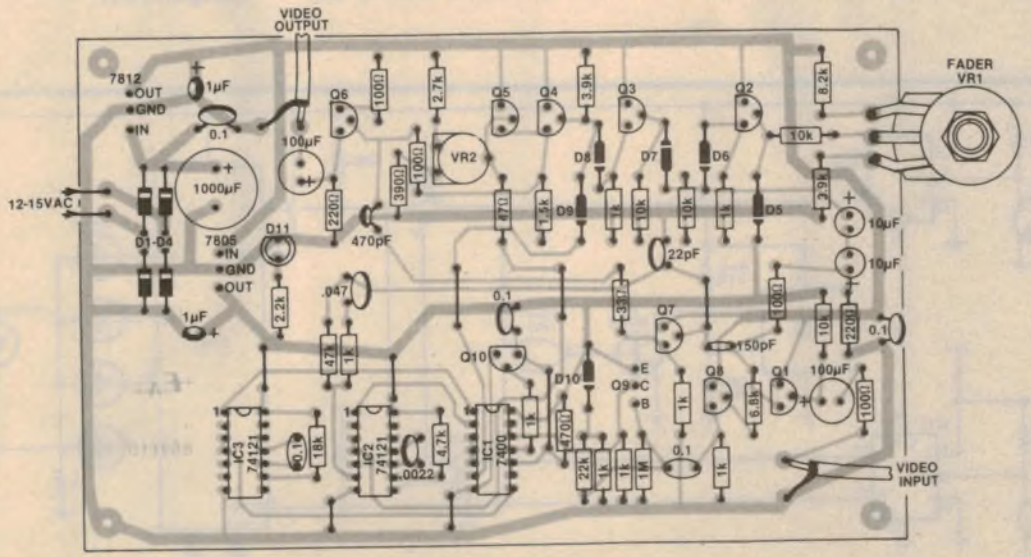
1 1000μF 25VW PC electrolytic
2 100μF 16VW PC electrolytics
2 10μF 16VW PC electrolytics
2 1μF 16VW tantalum
5 0.1μF ceramic
1 .047μF ceramic
1 .0022μF ceramic
1 470pF ceramic
1 150pF ceramic
1 22pF ceramic

Resistors (¼W, 5%)

1 x 1MΩ, 1 x 47kΩ, 1 x 22kΩ, 1 x 18kΩ, 4 x 10kΩ, 1 x 8.2kΩ, 1 x 6.8kΩ, 1 x 4.7kΩ, 2 x 3.9kΩ, 1 x 2.7kΩ, 1 x 2.2kΩ, 1 x 1.5kΩ, 8 x 1kΩ, 1 x 470Ω, 1 x 390Ω, 2 x 220Ω, 4 x 100Ω, 1 x 47Ω, 1 x 33Ω, 1 x 4.7kΩ, linear potentiometer, 1 x 4.7kΩ, horizontal trimpot (10mm)

Miscellaneous

Plugpack transformer (12-15V AC), shielded cable, hook-up wire, machine screws and nuts, etc.



This diagram shows the PC board as viewed from the component side. Take care when installing polarised components.

Circuit & Design Ideas

Ignition advance for alternative fuels

To obtain reasonable engine performance with alternative fuels such as LPG or CNG, it is necessary to advance the spark ignition, compared to that required for petrol.

This circuit has been proved on the bench and can be connected between the points and a transistor-assisted ignition, or used with the TAI shown (from the December 1979 issue of EA).

All commercial electronic ignition designs for alternative fuels actually delay the spark, so it is necessary to set the points up with the required advance for LPG (or CNG, compressed natural gas) and switch in the delay when using petrol.

A feature of this design is that the points can be set as for the manufacturer's specifications for petrol and then the advance introduced for LPG or CNG.

Therefore it is not necessary to keep moving the points to tune the motor on gas. The advance can be preset or switch-selectable and, in the event of failure, the unit can be bypassed for the engine to be used on petrol.

The concept is to use two counters clocked by a common oscillator. The first counter, IC6, counts up between two successive openings of the points. The contents of IC6 are then transferred to the "down" counter, consisting of ICs 8, 9 and 10. IC6 is then reset and the cycle begins again.

When the down counter reaches zero the output is used to switch the TAI and hence deliver the spark.

Provided that the counters are both clocked at the same rate, there is no spark advance.

To advance the spark, it is necessary to clock the "up" counter at a slightly lower rate. This means that it will have a lower count at the time its contents are transferred to the "down" counter. The down counter then reaches zero in a shorter time and hence advances the spark.

To provide adjustable advance, 4527 BCD rate multipliers, IC4 and IC5, are used. These divide the clock oscillator by a proportion set on their programmable inputs, either by preset links or thumbwheel switches.

IC4 is the most significant multiplier and would normally be set to multiply by 0.9 whereas IC5 is the least significant, giving an adjustment from 0.9 to 0.99. The amount of advance in degrees depends on the number of cylinders of the engine.

For a four-cylinder engine, the points open twice per revolution and so the counter contents represent 180 degrees. The BCD rate multipliers provide a resolution of 1% (1-0.99, etc) which is therefore 1.8 degrees of advance. For example, to give 14.4 degrees of advance (over and above the normal petrol ignition advance) the rate multipliers would be set to a value of 0.92. To get this rate, IC4 would have pins 14 and 3 (A & D inputs) and IC5 would have pin 15 (B input) high.

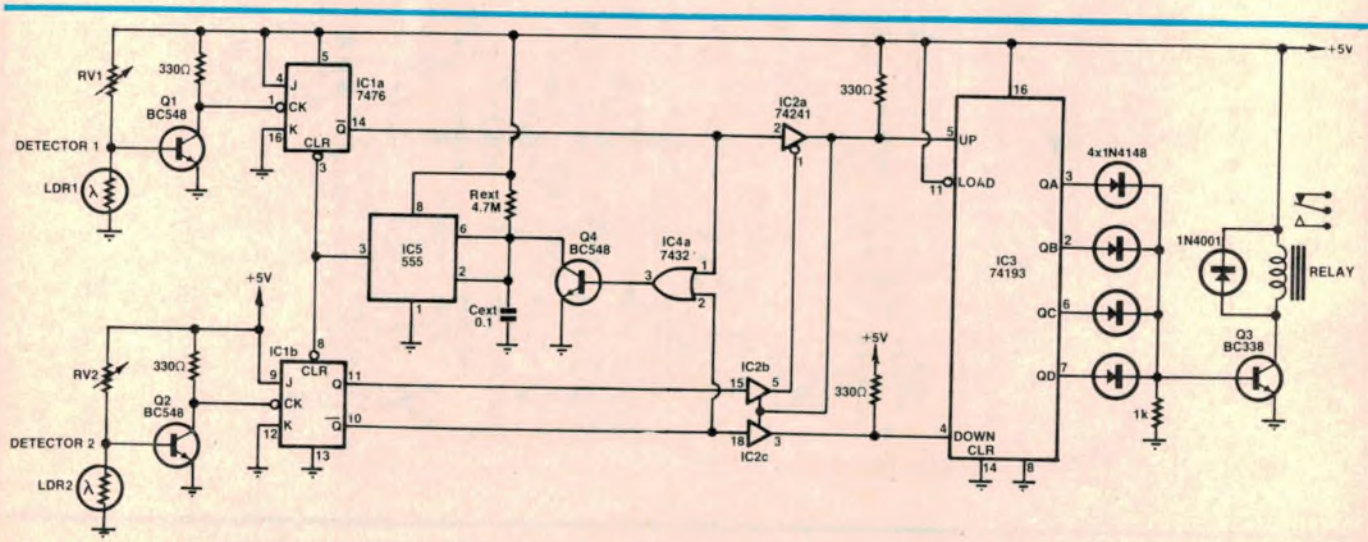
The master oscillator (IC7) is set at a nominal frequency to ensure that the up counter does not overflow at very low engine speeds. Note that any drift in the frequency has no effect because the up and down counters are locked together.

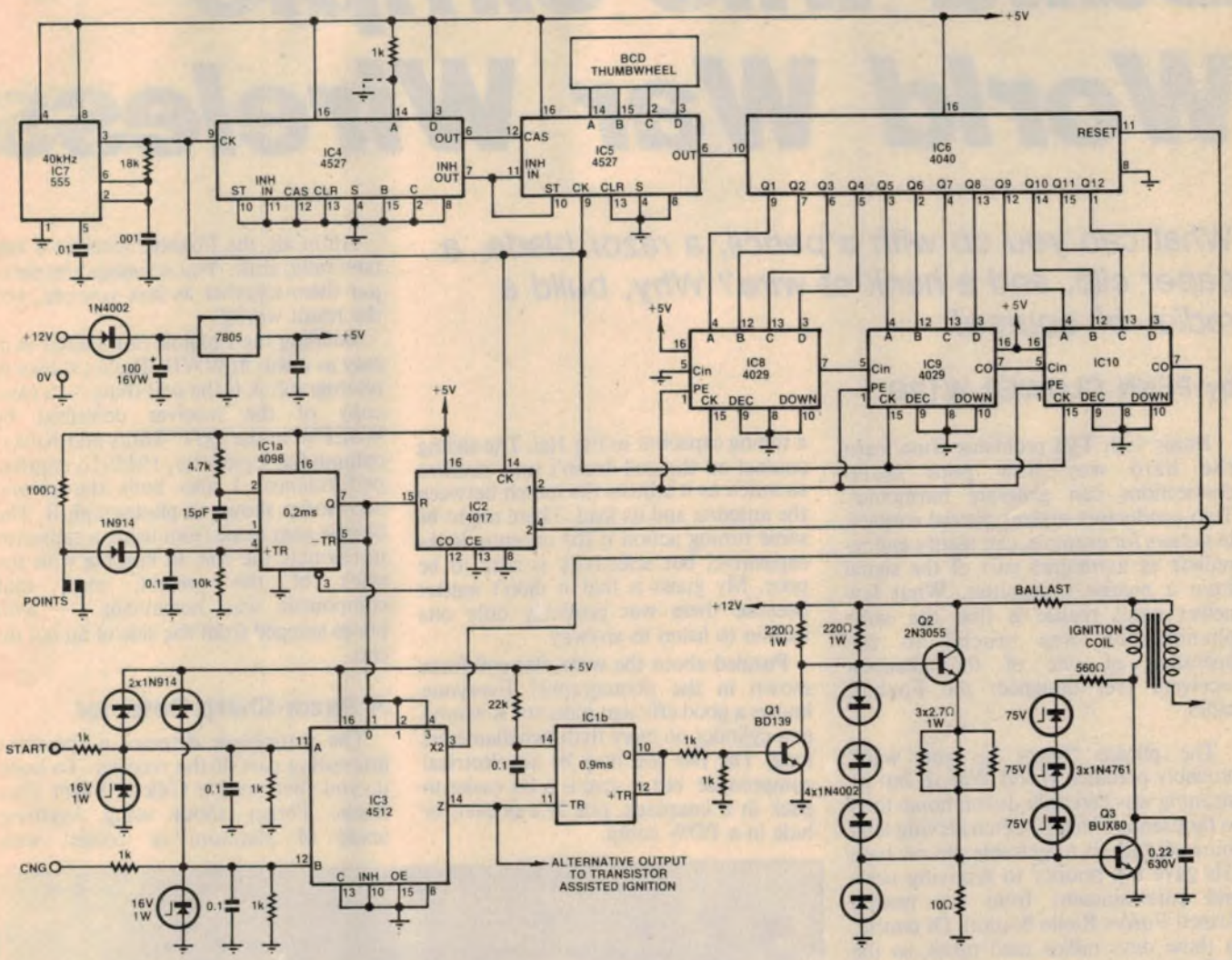
The points are filtered and trigger a monostable (IC1a). This removes the reset from IC2 which then generates the load pulse to store the up counter contents in the down counter and then the reset for the up counter. Finally, it also resets monostable IC1a.

IC3 forms the selector to switch in the advance. When the CNG line is high, the output of the down counter is selected, to trigger the TAI or monostable as shown. During starting, or when not on CNG, the points are switched to the output via the monostable.

D. Preston,
Pakapura, NZ

$35





People monitor & light switch

This circuit automatically keeps track of the number of people in a room and could be used to switch off lights when nobody is present.

Basically, it consists of two light sensors which are placed 200mm apart in a doorway so that one is tripped before the other. If the detectors are suitably angled, a common light source could be used. The concept is as follows:

When LDR1 is activated by a person walking between it and the light source, Q1 is momentarily biased (as the resistance of LDR1 goes high) on. This produces a negative-going pulse at the CK input of the 7476 dual JK flipflop. This causes the Q-bar output of IC1a to go low which, in turn, causes the "UP" input of the 74193 up/down counter to also be pulled low.

In addition, the change of state of Q-bar also disables the 74241 Tri-state buffer.

When LDR2 is activated the Q-bar output of IC1b also goes low. This signal is ORed with the Q-bar output of IC1a to turn off transistor Q4 which enables the 555 timer. After a delay set by the resistor and capacitor connected to pin 6, the 555 low going output clears the two flipflops, allowing them to respond to the LDRs again. The up/down counter now registers one person in the room.

If that person now walks out of the room, LDR2 is activated before LDR1 and the 74193 is made to count down (to zero).

The outputs of the 74193 are monitored by a four-input diode OR gate which turns on the transistor and thus the relay while ever there is more than one person in the room. As it stands, using the 74193 counter, the circuit can monitor the presence of up to 15 persons in a room, provided there is only one entrance.

D. Lilley
Holder, ACT.

$20

Don't fret in the foxhole . . .

Build this simple World War Wireless

What can you do with a pencil, a razor blade, a paper clip, and a hank of wire? Why, build a radio, of course!

by PENN CLOWER W1BG

Hams with TVI problems often learn the hard way how poor metal connections can generate harmonics. Two conductors making partial contact, in gutters for example, can rectify and re-radiate as harmonics part of the signal from a nearby transmitter. What few newer hams realise is that the same phenomenon was crucial to the operation of one of the cheapest receivers ever designed: the Foxhole radio.

The phrase "hurry up and wait" probably predates World War II, but its meaning was certainly driven home then to thousands of hams. Often serving long tours of duty in forgettable places, ham GIs gave top priority to receiving news and entertainment from the nearby Armed Forces Radio Station. Of course, in those days radios used tubes, so the bulk and power requirements of typical receivers limited their availability. This was especially true in forward locations where the Army had more important services to provide — things like food and ammunition.

So some genius, and we can only hope he was a ham, invented the Foxhole radio. Made from commonly available components, its chief distinguishing feature was the use of a razor blade for the detector diode. A flat coil of enamelled wire and a headset (probably "borrowed" from a field telephone) completed the circuit.

While not an outstanding performer, the radio was compact, obtainable, and best of all — it worked! Copies were built and used all over the world.

The original design has several interesting features in addition to the razor blade detector. Note the absence of a tuning capacitor in Fig. 1(a). The sliding contact on the coil doesn't tune stations so much as it adjusts the match between the antenna and its load. There might be some tuning action if the antenna looks capacitive, but selectivity is sure to be poor. My guess is that it didn't matter because there was probably only one station to listen to anyway.

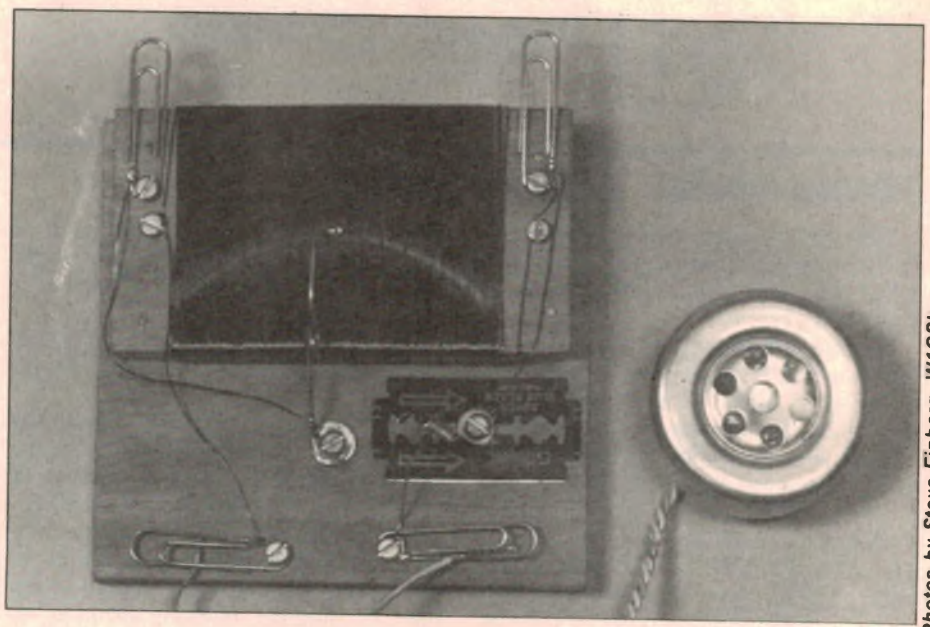
Puzzled about the wide, flat coil form shown in the photographs? Everyone knows a good efficient inductor is wound as a cylinder no more than two diameters long. The flat coil may be an electrical compromise, but it sure is a lot easier to pack in a knapsack, put in a pocket, or hide in a POW camp.

All in all, the Foxhole receiver is real ham-radio stuff. You scrounge the parts, put them together as best you can, and the result works!

Building the Foxhole radio today is as easy as it was in WWII. The set shown in photograph A is the real thing — a close copy of the receiver described by W8EFW in the *QST* "Hints and Kinks" column for September, 1945. To improve performance, I also built the several accessories shown in photograph B. The biggest gain came from using a capacitor to resonate the coil. In keeping with the spirit of the project, even that component was homemade — with plates snipped from the side of an old tin can.

A Razor-Sharp Detector

The razor-blade detector is the most interesting part of the receiver. To build it, you first need a Gillette Super Blue Blade. Forget about using anything made of platinum or coated with



Photos by Steve Finberg, W1GSL.

Photo A. A close replica of a set W8EFW described in 1945, this Foxhole radio can be built for pennies and works amazingly well. The razor blade is the diode. The earphone was borrowed from a telephone.

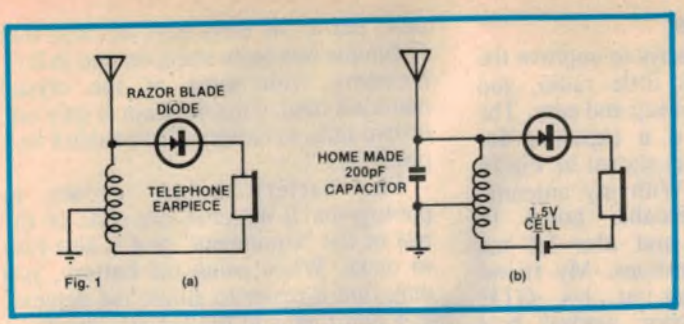


Fig. 1: Complete schematic of the Foxhole radio. The original circuit (a) was built by GIs all over the world during WWII. The addition (b) of a tuning capacitor and a dry cell (to bias the detector) improves reception.

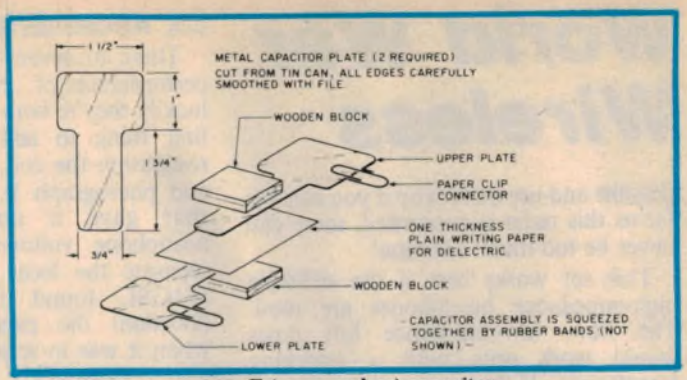


Fig. 2. Home-brew 250pF (more or less) capacitor.

Teflon™. To simulate war-time conditions, I used my blade for its intended purpose until it hurt — about three weeks. That may not be necessary, but I wanted to do things right and my wife wouldn't let me dig a foxhole in the backyard. Compromises are sometimes unavoidable.

I clamped the used blade to the baseplate with a short woodscrew (W8EFW recommended thumb or carpet tacks). The same mounting screw clamps the contact wire to the blade, so I scraped away some of the bluing to ensure a good contact.

The rectifier contact point is made from a 1-inch (2.54cm) piece of pencil lead. Start by sharpening a pencil, then carefully carve away the wood at the tip. Break off the sharpened length of lead and tightly wrap its blunted end with eight or nine turns of fairly stiff wire. Leave a 1-inch or 2-inch pigtail of wire to clamp under the "phone jack" terminal screw when you mount the rectifier

In operation, the point of the lead is moved over the surface of the razor blade until a sensitive spot is found. When that happens, the radio starts to work and the lead is carefully released so that its mounting wire holds it in the correct position. I found rectification was best when the point contact was resting on one of the silver letters etched into the blade. Of course, it goes without saying that the blade is thoroughly cleared of soap or oil before rectification is attempted. This is a crude system and a little tricky to adjust, but once set up, it works surprisingly well.

Scrap Wood Chassis

Construction of the rest of the radio is shown pretty clearly in the photographs. The baseplate is a 4-inch by 4-inch square of ⅜-inch or ¼-inch wood. The coil is about 175 turns of #26 enamelled wire wound on another scrap of the same wood, this one 2-inch by 4-inch. Any wire size from 22 to 28 will work as long as the wire is enamelled to keep the turns from shorting.

The antenna, ground, and headphone terminals are made from paper clips. The sliding coil contact is a paper clip bent and mounted to maintain downward pressure on the coil. I soldered the pivot end of this arm to a washer and fastened that to the board with a screw. W8EFW simply bent the end of the paper clip around a tack. Running the arm back and forth across the coil several times makes enough of a mark to show where the insulation must be scraped away for the arm to make contact. I also soldered all the wire connections to improve reliability. The radio will work without that step, but it does make life a little easier.

It goes without saying that this radio, like its brother, the crystal set, needs a good antenna and ground. The easiest thing to use for a ground is the house water supply. An acceptable antenna can be made from 50 feet (16 metres) of wire routed out a window and away from the house. Keep the far end as high as

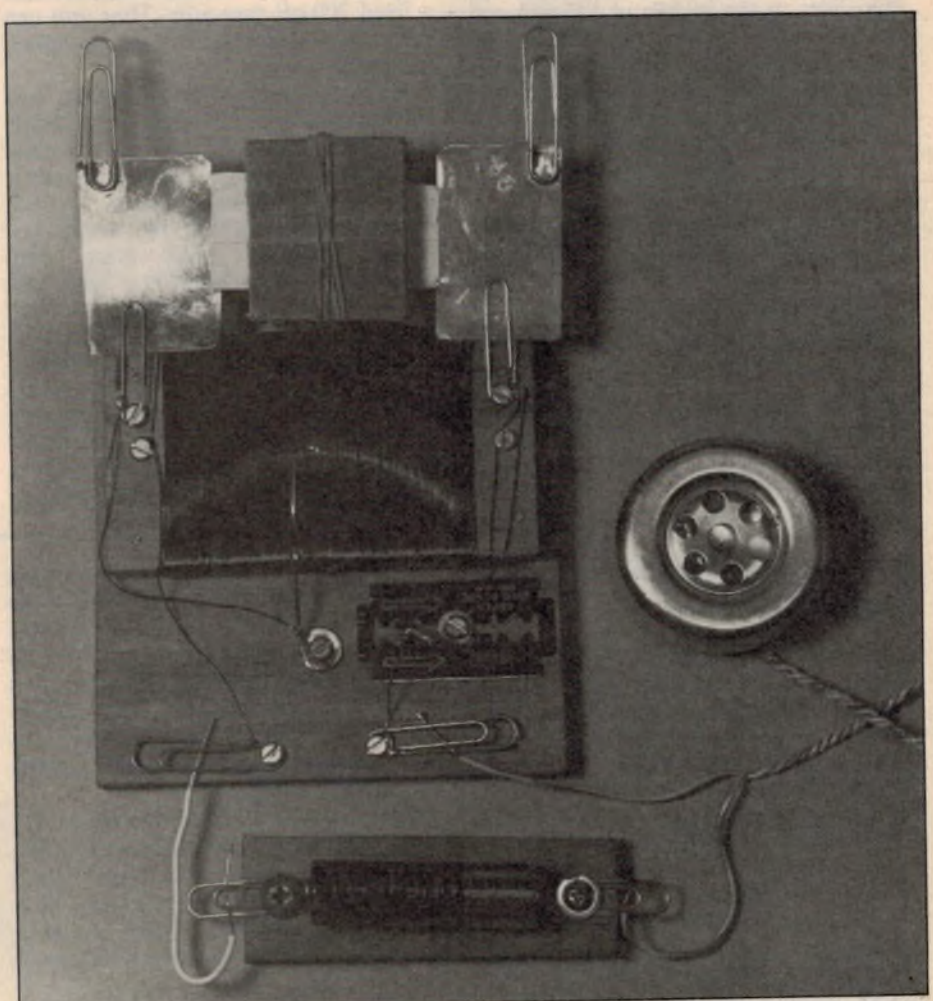


Photo B. Never content to leave well enough alone, the progressive amateur will be looking for high-performance modifications. Here are two: The homemade tuning capacitor and detector bias pack will boost both selectivity and sensitivity.

World War Wireless

possible and use more wire if you can. As far as this radio is concerned, there can never be too much antenna!

This set works best if the old-style high-impedance headphones are used. The new, low-impedance hifi types would work only with a matching transformer. If the proper phones aren't available, you can always do what the GIs probably did — borrow the earpiece from a telephone handset. The Ma Bell earpiece shown in the photographs has a DC resistance of 6Ω and an AC impedance of about 150Ω. It works almost as well as real headphones.

Operation

There's certainly nothing sophisticated about tuning the Foxhole radio. Check the wiring, hook up the antenna and ground, and connect the earphones. Set the slider to the middle of the coil and start listening. Move the point of the pencil lead slowly across the lettering on the razor blade until you hear a station. Try several different spots because some will work better than others. As a final step, move the slider across the coil until the signal strength is maximised.

The performance of the Foxhole radio will depend on your skill in adjusting the detector and the efficiency of your antenna. W8EFW claimed a range of 25 miles with a good antenna and ground. At my location, two nearby stations (about five to seven miles away) dominate the set so I can't hear anything further away. Those local stations are quite clear, though, and come in with reasonable volume.

DX Accessories

There are several ways to improve the performance of this little radio, and luckily they're both cheap and easy. The first thing to add is a capacitor for resonating the coil, as shown in Fig.1b and photograph B. With my antenna, that gave a noticeable boost to headphone volume and also let me separate the local stations. My friend W1GSL found that at his QTH (location) the capacitor worked best when it was in series with the antenna. The capacitor always improved reception, though, so it's certainly a worthwhile addition.

An old 365-pF broadcast variable capacitor is perfect for the job, but you'd be cheating to use one. It's more sporting to make your own capacitor with plates cut from a tin can.

First cut (very carefully, those edges are sharp!) a pair of T-shaped plates, as shown in Fig.2. Smooth the edges with a file and solder on two paper clips as shown. These two plates, separated slightly by an insulator, will be clamped together between wooden blocks to make a fixed 200-pF capacitor. That unit can then ride piggyback on the set, as shown in photograph B.

At first I tried using cellophane tape for the dielectric. That had a lot of DC leakage, so plain writing paper was used in the final version. One layer of paper between the plates makes a nice capacitor and gives about 100pF per square inch of plate area. Any capacitance value between 150pF and 350pF will work, and the final value can be adjusted if necessary by sliding the plates to change the amount of overlap.

The other circuit improvement is the addition of a 1.5V battery to bias the detector further into its non-linear region. What? A "crystal" set with a battery? The idea may seem strange now, but in the early days of radio that technique was quite common and in fact, necessary with some of the crystal materials used. Current drain is only one or two mA, so battery life shouldn't be a problem.

The battery holder shown in photograph B matches the style of the rest of the "equipment" and is also easy to make. When using the battery, you may find it easier to adjust the detector first and then add the battery bias for a boost in signal strength. The battery simply goes in series with the headphones. Try flipping the battery polarity several times, as one direction may work better than the other.

Conclusions

The Foxhole radio is cheap to build and fun to operate, but it certainly isn't the world's best "crystal" set and you won't spend hours listening to it. Amazingly, though, it does work, and its story is a truly fascinating bit of radio history. More than just a history lesson, however, this project will also leave you with two long-term benefits.

First, it gives you a perfect way to win "sucker bets" with friends who don't believe you can build a working radio using household materials and no commercial tubes, transistors, or diodes.

Second, you'll have a lot more respect for the rectifying properties of imperfect connections. That's helpful in those cases of harmonic-type TVI which occur despite the use of a properly adjusted transmitter and a good low-pass filter. Rectification generates harmonics, but when searching for the diode, it sure is easy for the inexperienced ham to overlook the rusty joints in his neighbour's TV mast!

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Carver DTL-100

continued from page 27

It is interesting that the DTL frequency response is also akin to that available from many typical phono cartridges. Is Carver merely trying to produce phono cartridge sound from CDs? That is what it seems like.

Listening tests

On listening to the Carver DTL-100 without the digital time lens feature switched in circuit, it gave the excellent quality of sound that is expected from compact discs. With DTL in circuit, the sound quality is markedly different.

To begin with, although the specifications show a vast reduction in channel separation on listening, the stereo effect is not noticeably reduced. What does happen, however, is that sounds normally located centrally in the stereo image are broadened so that there is a less precise location of central sounds. Solo instruments or vocalists which are normally able to be pinpointed by the listener, become diffuse.

There is also a subtle change in the tonal balance. Depending on the particular recording, there is a richer sound given to the voice with perhaps a little tendency to edginess. There is also a suggestion of slightly more background hiss.

The overall sound with DTL is more reminiscent of a quality analog disc and cartridge combination. This is not surprising considering the reduction in separation, altered frequency response and higher noise that the DTL circuit provides. To be frank, we preferred the sound quality without the Digital Time Lens although we are prepared to concede that many audiophiles may prefer it with DTL. It should be the subject of animated discussion in many hifi shops. We suggest you go along and have a listen.

Recommended retail price of the Carver DTL-100 compact disc player is $1590. Carver products are available from selected hifi dealers and are distributed in Australia by Odyl Communications, 6th Floor, 3 Smail Street, Broadway 2007. Phone (02) 212 6617 or 212 6618.(J.C).

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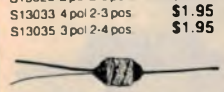

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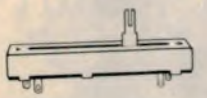

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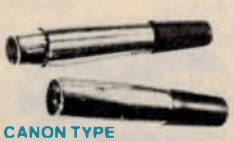

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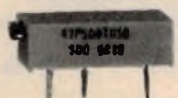

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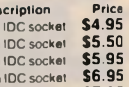
P12101	16 pin IDC socket	$5.50
P12102	20 pin IDC socket	$5.95
P12103	20 pin IDC socket	$6.95
P12104	34 pin IDC socket	$7.95
P12106	34 pin IDC socket	$7.95
P12108	40 pin IDC socket	$8.95
P12110	50 pin IDC socket	$9.95



ELECTRET MIC INSERTS

With pins for easy board insertion

Cat. C10170

1+	10+	100+
$1.25	$1.10	$1.00

RELAYS

Massive 3A connectors.

	1-9	10+	100+
S.P.D.T. S14060	$1.20	$1.10	$0.90
D.P.D.T. S14061	$1.50	$1.40	$1.20

CRYSTALS SPECIALS

Prime Spec's. We just have too many in stock!

Description	Cat No.	1-9	10+
1MHz	Y11000	$7.50	$6.50
1.8432MHz	Y11003	$7.50	$6.50
4MHz	Y11020	$2.50	$2.00
4.194304MHz	Y11022	$2.50	$2.00
4.433618MHz	Y11023	$2.50	$2.00
4.75MHz	Y11025	$2.50	$2.00
4.915200MHz	Y11026	$2.50	$2.00
5MHz	Y11030	$2.50	$2.00
6MHz	Y11040	$2.50	$2.00
6.144MHz	Y11042	$2.50	$2.00
6.670MHz	Y11045	$2.50	$2.00
8MHz	Y11050	$2.50	$2.00
8.867238MHz	Y11055	$2.50	$2.00
10MHz	Y11060	$2.50	$2.00
12MHz	Y11070	$2.50	$2.00
14.31818MHz	Y11072	$2.50	$2.00
15MHz	Y11075	$2.50	$2.00
18MHz	Y11082	$2.50	$2.00
18.432MHz	Y11085	$2.50	$2.00
20MHz	Y11090	$2.50	$2.00

RELAY AND BASE

Can carry 10A at 28V DC or 5A at 240V AC. Supplies with Chassis Mounting Socket with screw terminals. Great for school projects and demonstrations, switching DC power supplies, central circuits and with contacts parallel up to 20A can be switched.

Normally $8.95

Cat. S14074 NOW $6.95

10 TURN WIRE WOUND POTENTIOMETER

Spectrol Model 534

1/4" shaft.

Equiv (Bourns 3540S, Beckman 7256)

Dials to suit 16-1-11, 18-1-11, 21-1-11

R14050	50R	R14100	5K
R14055	100R	R14110	10K
R14060	200R	R14120	20K
R14070	500R	R14130	50K
R14080	1K	R14140	100K
R14090	2K		

1-9	10+
$9.50	$8.50

NEW JOINABLE PCB MOUNTING SCREW TERMINALS

Less than half the price of the old ones!

	1-9	10+
2 Way Cat. P10542	$0.50	$0.40
3 Way Cat. P10543	$0.75	$0.65

(please note these are the new blue ones)

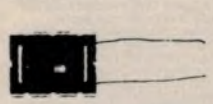
QUALITY RIGHT ANGLE TOGGLE SWITCHES

S11040	S.P.D.T. RA PCB	$1.50
S11042	D.P.D.T. RA PCB	$1.60

MINI JUMPERS

- Contact terminal: Phospor bronze
- Material: P.B.T. 94V-0
- Gold plated

Qty	Cat. No.	Price
10	P12053	$ 2.95
25	P12055	$ 4.95
100	P12057	$21.95



VIDEO RF MODULATOR

At an unbelievable prices! Our RF modulators are channel selectable either Channel 0 or Channel 1.

Cat. S16040

1-9	10+
$4.95	$3.95

TDK LINE FILTERS

240 V 3A

Cat. $12.50

IC SPECIALS! 8000 SERIES

	1-9	10+
8085	4.50	3.50
8212	1.50	1.40
8216	1.50	1.40
8226	1.70	1.50
8243	4.50	3.90
8251	3.90	3.50
8253	3.50	3.30
8255	2.90	2.50
8257	3.50	3.10
8259	3.50	3.10
8279	3.50	3.10
2532	7.50	6.90
2764	5.50	5.10
27128	7.50	6.90
1488	55	45
1489	55	45

RS232 & 'D' TYPE CONNECTORS

PART	DESCRIPTION	CAT. No.
1-9		10+
DE 9P	9 Pin Female	P10880
$1.75		$1.60
DE 9S	9 Pin Male	P10881
$2.25		$2.45
DE 9C	9 Pin Cover	P10992
$2.55		$2.45
DA 15P	15 Pin Male	P10894
$2.10		$1.95
DA 15S	15 Pin Female	P10895
$2.25		$2.10
DA 15C	15 Pin Cover	P10892
$1.15		$1.05
DB 25P	25 Pin Male	P10900
$1.95		$1.80
DB 25S	25 Pin Female	P10901
$2.95		$2.70
DB 25C	25 Pin Cover	P10902
$1.20		$1.10

Rod Irving TOP 40 Kits

EA AM STEREO DECODER

AM stereo is now broadcast in Australia on an experimental basis. This add-on decoder works with the Motorola C-QUAM system.
(EA Oct. 84) 84MS10
Cat. K84100 **$27.50**

FUNCTION GENERATOR

This Function Generator with digital readout produces Sine, Triangle and Square waves over a frequency range from below 20Hz to above 160Hz with low distortion and good envelope stability. It has an inbuilt four-digit frequency counter for ease and accuracy of frequency setting.
(EA April 82, 82AO3A/B)
Cat. K82040
Cat. K82041 **$109**

CYLON VOICE

Have your voice transformed into that of the sinister sounding Cylons. Great fun and scary! (EA Jan. 81)
Cat. K80012 **$19.95**

PARABOLIC MICROPHONE

Build a low cost parabola, along with a high gain headphone amplifier to help when listening to those natural activities such as babbling brooks, singing birds or perhaps even more sinister noises. The current cost of componenets for this project is around $15 including sales tax, but not the cost of batteries or headphones. (EA Nov. 83) 83MA11
Cat. K83110 **$14.95**

EPROM PROGRAMMER

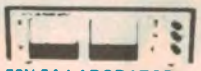
If you have ever wanted to rewrite or extend the operating system of your microcomputer or if your re interested in dedicated microprocessor applications then this EPROM Programmer is just the thing. It is an inexpensive unit that uses readily available IC's, interfaces directly to the expansion bus on the back of all the popular 8080/Z80 microcopmputers and programs 2708's, 2716's, 2758's and 2732's. (EA July 80) 80PP71
Cat. **$79.50**
(Horwood case supplied)

EFFECTS UNIT

An "effects unit" that can create phasing, flanging, echo, reverb and vibrato effects.
(EA June 83) 83GA6
Cat. K83060 **$75.00**

CUDLIPP CRICKET

A fascinating Electronic Cricket with just two ICs. The Cudlipp can be used to bug your home, office etc! Great fun! (EA Feb. 82) 82EG2
Cat. K82022 **$12.00**



50V 5A LABORATORY POWER SUPPLY

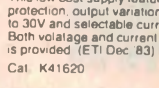
New switchmode supply can deliver anywhere from three to 50V DC and currents of 5A at 35V or lower. Highly efficient design.
(Ea May June 83) 83PS5
Cat. K83050 **$149**

1W AUDIO AMPLIFIER

A low-cost general-purpose 1 watt audio amplifier, suitable for increasing your computers audio level, etc. (EA Nov. 84)
Cat. K84111 **$9.95**

30 V/1 A FULLY PROTECTED POWER SUPPLY

The last power supply we did was the phenomenally popular ETI-131. This low cost supply features full protection, output variation from 0V to 30V and selectable current limit. Both volatage and current metering is provided. (ETI Dec. 83) ETI 162
Cat. K41620 **$52.50**



TEMP PROBE

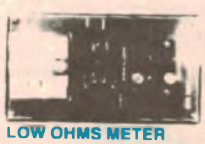
Can measure temperature from -50 to 150-c. It simply plugs into your multimeter - great for digital multimeters. Accuracy of 0.1-c resolution of 0.1-c
(ETI June 83) ETI 153
Cat. K41530 **$27.50**

VIDEO ENHANCER

Like tone controls in a hi-fi amplifier touch up the signal with this Video Enhancer. (EA Oct. 83) 83VE10
Cat. K83100 **$39.50**

VIDEO AMPLIFIER

Bothered by smeary colours, signal beats and RF interference on your computer display? Throw away that cheap and nasty RF modulator and use a direct video connection instead, it's much better! The Video Amplifier features adjustable gain and provides both normal and inverted outputs. Power is derived from a 12V DC plugback supply.
(EA Aug. 83) 83VAB
Cat. K83081 **$17.95**



LOW OHMS METER

How many times have you cursed your Multimeter when you had to measure a low-value resistance? Well with the "Low Ohms Meter" you can solve those old problems and in fact measure resistance from 100 Ohms down to 0.005 Ohms.
(ETI Nov. 81) ETI 158
Cat. K41580 **$39.50**

40 W INVERTER

This 12-240 V inverter can be used to power up mains appliances rated up to 40 W, or to vary the speed of a turntable. As a bonus, it will also work backwards as a trickle charger to top up the battery when the power is on. (EA May 82) 82IV5
Cat. K82050 **$57.50**

MUSICOLOR IV

Add excitement to parties, card nights and discos with EAs Musicolor IV light show. This is the latest in the famous line of musicolors and it offers features such as four channel "color organ" plus four channel light chaser, front panel LED display, internal microphone, single sensitivity control plus opto-coupled switching for increased safety.
(EA Aug. 81) 81MC8
Cat. K81080 **$89**

15V DUAL POWER SUPPLY

This simple project is suitable for most projects requiring a dual voltage. (ETI 581, June 76)
Cat. **$19.50**

ELECTRONIC MOUSETRAP

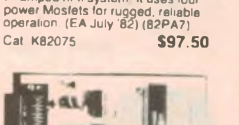
This clever electronic mousetrap disposes of mice instantly and mercifully, without fail, and resets itself automatically. They'll never get away with the cheese again!
(ETI Aug. 84) ETI 1524
Cat. K55240 **$27.50**

VOICE OPPERATED RELAY

EA's great Voice Operated Relay can be used to control a tape recorder, as a VOX circuit for a transmitter or to control a slide projector. (EA Apr. 82) 82VX4
Cat. K82043 **$17.95**

100W SUB-WOOFER AMPLIFIER

Capable of up to 120 watts RMS into 4 ohm loads and up to 80 watts RMS into 8 ohm loads, this power amplifier module has been specifically designed for use as a sub-woofer driver amplifier in a tri-amped hi-fi system. It uses four power Mosfets for rugged, reliable operation. (EA July 82) (82PA7)
Cat. K82075 **$97.50**



MICROBEE SERIAL-TO-PARALLEL INTERFACE

Most microcomputers worth owning have an "RS232" connector or port, through which serial communications (input/output) is conducted. It is a convention that, for listing on a printer, the BASIC LLIST or LPRINT command assumes a printer is connected to the RS232 port. Problem is, serial interface printers are more expensive than parallel "Centronics" interface printers. Save money by building this interface. (ETI Jan. 84) ETI 675
Cat. K46750 **$59.00**

HEADPHONE AMPLIFIER

PRACTICE WITHOUT ANNOYING THE FAMILY!
If you play any type of electronic instrument, this headphone amplifier will surely interest you. It will let you practice for hours without upsetting the household, or you can use it to monitor your own instrument in the midst of a rowdy jam session. (EA Feb. 84) 83MA11
Cat. K83011 **$29.95**

300 BAUD DIRECT CONNECT MODEM

Modem? What do I want with a modem? Think of these advantages:

- Can't afford a floppy disc? Use your telephone to access one for the cost of a call.
- Bored with your old programs? Download hundreds of free programs.
- Want to get in touch with fellow computer enthusiasts? Use 'electronic mail'.
- Ever used a CP/M system? CP-DOS? UNIX? Well a modem will make a your computer a remote terminal on some of the most exciting systems around.

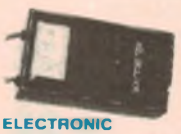
Save on ready built modems.
Cat. K97050 **$99**

STEREO ENHANCER

The best thing about stereo is that it sounds good! The greatest stereo hi-fi system loses its magnificence if the effect is so narrow you can't hear it. This project lets you cheat on being cheated and creates an 'enhanced stereo effect' with a small unit which attaches to your amp.
(ETI 1405, ETI, MAR '85)
Cat. K54050 **$79.50**

TRANSISTOR TESTER

1000's SOLD
Have you ever desoldered a suspect transistor, only to find that it checks OK? Trouble-shooting exercises are often hindered by this type of false alarm, but many of them could be avoided with an "in-circuit" component tester, such as the EA Handy Tester. (EA Sept '83) 83TT8
Cat. K83080 **$17.95**



ELECTRONIC WATT METER

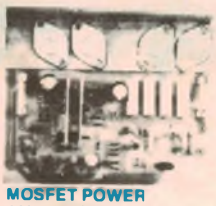
This unit will measure the power consumption of any mains appliance with a rating up to 3 kilowatts. It makes use of a special op amp called an "output transconductance amp" or OTA, for short.
(EA Sept. 83) 83WM8
Cat. K83082 **$89.95**

RADIOTELETYPE CONVERTER FOR THE MICROBEE

Have your computer print the latest news from the international shortwave news service. Just hook up this project between your short wave receivers audio output and the MicroBee parallel port. A simple bit of software does the decoding. Can be hooked up to other computers too. (ETI Apr. 83)
Cat. **$19.95**

ZENER TESTER

A simple low cost add-on for your multimeter. This checks zeners and reads out the zener voltage directly on your multimeter. It can also check LEDs and ordinary diodes.
(ETI May '83) ETI 164
Cat. K41640 **$9.95**

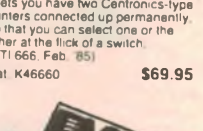


MOSFET POWER AMPLIFIER

Employing Hitachi Mosfets, this power amplifier features a "no compromise" design, and is rated to deliver 150 W RMS maximum and features extremely low harmonic, transient and intermodulation distortion.
ETI 477 (ETI Jan. 81)
(Single module only)
Cat. K44770 **$79.50**
Plus power supply (No trans) **$49**
Plus transformer PF4361/1 **$49.50**

PARALLEL PRINTER SWITCH

Tired of plug swapping when ever you want to change from one printer to another? This low-cost project should suit you down to the ground. It lets you have two Centronics-type printers connected up permanently, so that you can select one or the other at the flick of a switch.
(ETI 666, Feb. '85)
Cat. K46660 **$69.95**



BIPOLAR PROM PROGRAMMER

Every digital workshop should have one! Can be used to program the popular fusible-link PROMS like the 74S188/288, 82S23 & 82S123 etc.
(ETI June 83) ETI 688
Cat. K46880 **$49.50**

ELECTRIC FENCE

Mains or battery powered, this electric fence controller is both inexpensive and versatile. Based on an automative ignition coil, it should prove an adequeate deterrent to all manner of livestock. Additonally, its operation comforms to the relevant clauses of Australian Stnd 3129. (EA Sept. 82) 82EF9
Cat. K82092 **$19.50**

FAIR DINKUM RS232 FOR MICROBEE

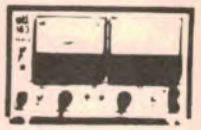
The Microbee, among other home computers, has a "sort of" RS232 port in that it doesn't implement negative-going portion of its ouput signal (TxD). Most peripherals with an RS232 input can cope with that, but inevitably, there are those that can't. This project fixes that.
(ETI 676, ETI FEB 84)
Cat. K67680 **$34.95**

PHONE MINDER

Dubbed the Phone Minder, this handy gadget functions as both a bell extender and paging unit, or it can perform either function separately. (EA Feb. 84) 84TP2
Cat. K84021 **$27.50**

AUDIO TEST UNIT

Just about everyone these days who has a stereo system also has a good cassette deck, but not many people are able to get the best performance from it. Our Audio Test Unit allows you to set your cassette recorder's bias for optimum frequency response for a given tape or alternatively, it allows you to find out which tape is best for your recorder.
(81AO10) (EA Oct. 81)
Cat. K81101 **$47.50**

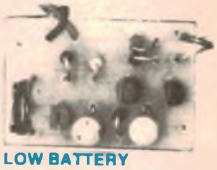


LAB SUPPLY

Fully variable 0-40V current limited 0-5A supply with both voltage and current metering (two ranges: 0-0.5A/0-5A). This employs a conventional series-pass regulator, not a switchmode type with its attendant problems, but dissipation is reduced by unique relay switching system switching between taps on the transformer secondary.
(ETI May '83) ETI 163
Cat. K41630 **$182.50**

300W "BRUTE" AMPLIFIER

The "Brute" develops 300W into 4 ohms, 200W into 8 ohms!
For many adulo applications there's no substitue for sheer power - low efficiency speakers, outdoor sound systems, or maybe you like the full flavour of the dynamic range afforded by a high power amp. Whatever your requirement - this 'super power' module should fill the bill. (ETI 466) (ETI Feb '80)
Cat. K44660 **$89.95**
(Heatsink not included)



LOW BATTERY VOLTAGE INDICATOR

Knowing your batteries are about to give up on you could save many an embarrassing situation. This simple low cost project will give your early warning of power failure, and makes a handy beginner's project.
(ETI 280, March '85)
Cat. K42800 **$7.95**

MOTORCYLCE INTERCOM

OVER 300 SOLD!
Motorcycling is fun, but the conversation between rider and passenger is usually just not possible. But build this intercom and you can converse with your passenger at any time while you are on the move. There are no "push-to-talk" buttons, adjustable volume and it's easy to build!
(EA Feb. 84) 84MC2
Cat. K84020 **$45.00**

LOW-COST BIPOLAR MODEL TRAIN CONTROLLER

Here is a simple model train control for those enthusiasts who desire something better than the usual rheostat control. It provides much improved low speed performance and is fully overload protected, yet contains relatively few componenets. Best of all, you don't need to be an electronic genius to construct it. (80TC12) (EA Dec. 80)
Cat. K80120 **$39.95**

THE BRILLIANT SERIES 5000

INDIVIDUAL COMPONENTS TO MAKE UP A SUPERB HIFI SYSTEM!

PRICES MUST RISE!
STRICTLY LIMITED STOCK AVAILABLE AT THESE PRICES.

AUDIO/MIKE PROFESSIONAL MIXER

This compact mixer has a host of unique features and is ideally suited for the most discerning user. Just look at these features...

- Two microphone inputs with pan-pot control and high/low impedance selectors
- Stereo 8 segment LED level meters to monitor outputs
- Two stereo phono inputs with magnetic/ceramic selectors and fader control
- Two stereo tape inputs with dubbing outputs
- Two stereo line inputs
- Slide master volume control
- Rear/front microphone input selector
- Talkover switch with talkover variable volume control
- Cannon socket for talkover microphone
- AC operation

Input Sensitivity:
Mic: Low 0.3mV 600 ohms · High 3mV 50k Ohms
Phono Mag. 3mV 50k ohms · Ceramic 150mV 50k Ohms
Tape/Tuner 150mV 50k ohms
T.H.D: Less than 1%
S/N Ratio: More than 58dB
Crosstalk: Better than 50dB at 1kHz
Frequency Response: 20 - 20kHz RIAA + - 2dB
Ouput Level: 900mV at 600 ohms
Recording Output: 280mV at 60 ohms
Talkover Range: 0 - 24dB
Power Source: 240V AC 50Hz
Size: 355 x 230 x 75mm
Weight: 3.2kgs

RRP **$357** **OUR PRICE $319**

UNIVERSAL STEREO MIXER WITH GRAPHIC EQUALISER

The MM4 is our most flexible mixer. Incorporating the most advanced IC technology for performance and reliability. Built in graphic equaliser virtually eliminates the need for a pre-amplifier. Features 4 stereo program and 2 microphone inputs.

SPECIFICATIONS:
Input Sensitivity
Mic: 1.5mV at 10k ohm
Phono: 1.5mV at 50k ohm
Line: 75mV at 50k ohm
Rated Output:
Amp: 1V/600 ohms
Rec: 1V/600 ohms
T.H.D.: Less tham 1% at 1kHz
Hum and Noise
Mic: -52dB
Phono: -62dB
Line: -65dB
Frequency Response:
Mic: 30 - 16kHz (-1dB)
Phono 30 - 20kHz (RIAA + - dB)
Line 20 - 30kHz (-1dB)
Power Source: 240V AC 50Hz
Size: 360 x 260 x 85mm
Weight: 2.9kg

EQUALISER SECTION
Control of Frequency: 60Hz, 250Hz, 1kHz, 3.5kHz, 12kHz
Control Range: + - 12dB boost or cut, centre detent
Headphone Output: (Cue)50mW at 75 ohm at 0.5% T.H.D
Talk Switch: -14dB

RRP **$354** OUR PRICE **$319**

POWER AMPLIFIER

WHY YOU SHOULD BUY A "ROD IRVING ELECTRONICS" SERIES 5000 POWER AMPLIFIER...

- 1% Metal Film resistors are used where possible.
- Alumimium case as per the original article.
- All components are top quality.
- Over 1000 of these kits now sold
- Super Finish front panel supplied at no extra cost.

Please note that the "Superb Quality" Heatsink for the Power Amplifier was designed and developed by ROD IRVING ELECTRONICS and is being supplied to other kit suppliers.

SPECIFICATIONS: 150 W RMS into 4 ohms
POWER AMPLIFIER: 100W RMS into 8 ohms (+ - 55V Supply)
FREQUENCY RESPONSE: 8Hz to 20Hz + 0 - 0.4 dB 2.8Hz to 65KHz, + 0 - 3 dB. NOTE: These figures are determined solely by passive filters.
INPUT SENSITIVITY: 1 V RMS for 100W ouput
HUM: 100 dB below full output (flat).
NOISE: 116 dB below full output (flat. 20KHz bandwidth).
2nd HARMONIC DISTORTION: 0.001% at 1 KHz (0.0007% on Prototypes) at 100W ouput using a + - 56V SUPPLY rated at 4A continues 0.0003% for all frequencies less than 10KHz and all powers below clipping.
TOTAL HARMONIC DISTORTION: Determined by 2nd Harmonic Distortion (see above).
INTERMODULATION DISTORTION: 0.003% at 100W (50Hz and 7KHz mixed 4:1).
STABILITY: Unconditional.

Cat. K44771 **Will be $359, limited stock available at $319**
Assembled and tested $525
packing and post $10

DISCO MIXER WITH GRAPHIC EQUALISER

This stereo mixer is especially designed for discotheques and radio studios. It is a versatile rack or console mounting mixer with varied features which enable high quality broadcasts through its 3 microphone inputs, 3 phono inputs or 3 line inputs.

- 6 channel monitoring system
- 9 point dual LED output level display
- Output panpot
- 3 outputs
- Adjustable talkover with LED display
- Master level control

SPECIFICATIONS
Input:
Talk Mic: 47k ohms nominal 5mV
Mic. 2,3: 47k ohms nominal 5mV
Phono 1,2,3: 47k ohms nominal 5mV
Line 1,2,3: 37k ohms nominal 300mV
Output: 1k ohm nominal 0.775V
Rec. Out: 1k ohm nominal 250mV
Line Out: 1k ohm nominal 250mV
Frequency Response:
Talk Mic: 150Hz - 7kHz -3dB
Mic. 2,3: 15Hz - 30kHz -3dB
Phono 1,2,3: 20Hz - 20kHz + -2dB
Line 1,2,3: 15Hz - 100kHz -3dB
S/N Ratio: (IHF-A input short)
Talk Mic: -73dB/5mV
Mic. 2,3: -73dB/5mV
Phono 1,2,3: -76dB/5mV
Line 1,2,3: -80dB/300mV
Crosstalk: Better than 60dB/1kHz
T.H.D.: Less than 0.1%/1kHz
H.P. Out Level: 55mW/80 ohms - 1k ohm
Eq. Frequency: 60/250/1k/4k/12kHz + - 12dB
Talk Over Level: -14dB
Meter Level: 0dB=0.775V/1.5V
Power Consumption: 15 watts
Power Supply: 240V 50Hz
Dimensions: 482(W)x222(H)x130(D)mm
Net Weight: 4.5kg

RRP **$649** OUR PRICE **$579**

12 CHANNEL STEREO MIXING CONSOLE

Loaded with professional features but simple to operate. A 3 position attenuation switch with -15dB, 0dB, +15dB, together with separate mic. and line inputs allows perfect matching with any input signal. Foldback with the pre-fade send or on stage monitoring. Includes bass and treble controls plus a left and right 5 band graphic equaliser. Other features include effect return panning, P.P.I. overload indicators and stereo headphone monitoring. Ideal for disco's with 2 stereo disc inputs with cross fade. A high quality 12 channel mixer for the professional enthusiast.

SPECIFICATIONS
Inputs:
12 x Mic -46dB at 47k ohm
12 x Line -20dB at 20k ohm
12 x Phono -52dB at 50k ohms (approx 2mV at 1kHz)
Effect Return -20dB at 50k ohm
Ouputs:
PGM Out 0dB at 10k
F/B Out 0dB at 10k ohm
Effect Send 0dB at 10k ohm
Rec. Out -4dB at 10k ohm
Headphones +10dB at 600 ohm (100 - 1k ohm)
Equaliser (Channel): Bass + - 12dB(100Hz) Treble + - 12dB(10kHz)
Equaliser (Master): 100/330/1k/3.3k/10kHz. (5 band stereo) + - 12dB
Frequency Response: 20 - 20kHz (+ 1dB - 3dB)
S/N Ratio (IHF-A): 120dB
T.H.D.: 0.15% at 1kHz
Peak Indicators: 12 x LED
Power Supply: 240V AC 50Hz
Power Consumption: 8W
Dimensions: 662(W) x 356(D) x 105(H)mm
Weight: 8kg

RRP **$999** **OUR PRICE $899**

PREAMPLIFIER

THE ADVANTAGES OF BUYING A "ROD IRVING ELECTRONICS" SERIES 5000 PREAMPLIFIER KIT ARE...

- 1% Metal Film Resistors are supplied.
- 14 Metres of Low Capacitance Shielded Cable are supplied (a bit extra in case of mistakes)
- English "Lorlin" switches ae supplied (no substitutes here.)
- Specially imported black anodised aluminium knobs

Available Assembled and Tested. (We believe that dollar for dollar there is not a commercial unit available that sounds as good!)

SPECIFICATIONS:
FREQUENCY RESPONSE: High-level input: 15Hz - 130KHz, - 0 - 1dB. Low-Level input conforms to RIAA equalisation + - 0.2dB
DISTORTION: 1KHz -0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation).
S/N NOISE: High Level input, master full, with respect to 300mV input signal at full output (1.2V) -92dB flat -100dB A-weighted. MM input, master full, with respect to full output (1.2V) at 5 mV input 50ohms source resistance connected: -86dB flat/92dB A-weighted MC input, master full, with respect to full output (1.2V) and 200uV input signal: -71dB flat -75dB A-weighted.

Cat. K44791 **Will be $289, limited stock availble at $269**
Assembled and tested $599
packing and postage $10

THIRD OCTAVE GRAPHIC EQUALIZER

SPECIFICATIONS:
BANDS: 28 Bands from 31.5Hz to 16KHz.
NOISE: -0.008mV, sliders at 0, gain at 0(=103dB0).
20KHz BANDWIDTH DISTORTION: 0.007% at 300mV signal, sliders at 0, gain at 0, maximum 0.01%, sliders at minimum
FREQUENCY RESPONSE: 12Hz=105KHz, +0,=1dB, all controls flat.
BOOST AND CUT: 14dB

Cat. K44590
1 Unit ... **$199**
2 Units ... **$394**
packing and postage $10

SUPER HORN TWEETER

- Requires no crossover and handles up to 100W!
- Sensitivity: 100dB/0.5m
- Frequency Response: 3kHz-30kHz
- Impedance: 8 OHMS
- Size: 96mm diameter

Cat. C12102 **normally $14.95**
NOW $12.95

SUPER HORN

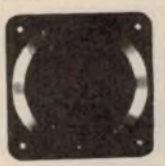
- Wide dispersion tweeter handles up to 100W.
- Sensitivity: 105dB/0.5m
- Frequency Response: 3kHz-30kHz
- Impedance: 8 OHMS
- Size: 145x54mm

Cat. C12103 **normally $14.95**
NOW $12.95

10W RMS SPEAKERS

Including boxes!! At this price you can afford to put a set of speakers in every room!
Dimensions: H 47c x W 24c x D 30cm

Cat. C12002 **Per Pair $9.50**



PHILIPS SPEAKERS

"Hopefully, we should have Philips speakers back in stock by the time you read this." -Rod

Cat. C12030 AD01610 T8 **$12.95**
Cat. C12040 AD02160 SQ8 **$34.95**
Cat. C12045 AD70620 M8 **$49.00**
Cat. C12050 AD12550 W8 **$79.00**
(or Philips equivalent supplied)

SERIES 4000 SPEAKERS

8 Speakers On	**$295**
8 Speakers with Crossovers	**$499**
Speaker Boxes (assembled with grill and speaker cutout)	**$325**
Crossover Kits	**$199**
Complete kit of parts (speakers, crossovers, screws, innerband boxes)	**$799**
Assembled, tested and ready to hook up to your system	**$895**

Errors and Ommissions Excepted

COMPUTER CHESS! by SciSys.

SciSys computer chess games are endorsed by Garry Kasparov, world's highest rated chess player and are available from Rod Irving Electronics!

ELECTRONIC CHESS MK10

- Streamline design tabletop chess.
- New 8 level program from beginners to experts.
- Ideal teacher or strong opponent.
- Turn on/off any time. One year memory.
- 1,000 hours play with 3AA batteries.
- Optional mains adaptor available.
- Take back moves, verify, solve problems to mate in 3 and beyond.
- Player vs. player mode, thinks on opponents time, built in opening library.
- Beginner to expert. Estimated 1,500 Elo.

MK10 offers so much for so little!

Cat. C30002 **$149**

TRAVEL MATE

- Worlds most compact sensor chess.
- Ideal teacher or strong opponent.
- Turn on/off anytime. It remembers positions for up to one year.
- Plays for over 6 months on 3AA batteries.
- Knows all the rules and will not accept illegal moves.
- Low cost. 4 powerful skill levels. Estimated 1,400 Elo.

Cat. C30000 **$99**

COMPANION 1!

SciSys No. 1 selling full size computer!

- Very strong chess program.
- 9 levels with special zero level for beginners.
- Ideal teacher or formidable opponent.
- Turn on/off anytime, one year memory.
- 6 months play on 3AA batteries or optional mains adapter available.
- Take back moves, verify, solve problems to mate in 4 and beyond.
- Player vs. player mode, thinks on opponent time, built in opening library and strong end game.
- Beginner through club player to expert. Estimated 1,650 Elo.

Cat. C30004 **$199**

3 IN 1 GAMES

CHESS, TIC TAC TOE, AND CHECKERS!

CHESS: 8 levels, solves up to mate in 4 moves.

TIC TAC TOE: 4 levels of skill, big easy to use pieces, quick response, take back facility.

CHECKERS: 8 levels of skill, take back facility.

Perfect for the whole family!

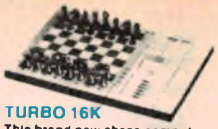
Cat. C30008 **$149**

EXPRESS 16K

Instant response hand held chess computer.

- Instant response - uses opponents thinking time to prepare instant replies to several alternative opponent moves.
- Strong program beats 90% of all chess players (estimated SciSys-Elo 1800.)
- Automatic Display Move function.
- Extra flat. High-value metallic finish.
- Fast 8 MHz 16K chip.
- 17 playing levels: 1 beginner, 8 casuals, 6 club, 2 special (analysis and problem to Mate in ten moves).
- Very long battery life, 1000 hours playing, one year memory.

Cat. C30006 **$199**



TURBO 16K

This brand new chess computer sets new standards in user convenience, and beats 92% of all chess players with its powerful 16K program

Features:

Instant response

- Solves mate in 10 moves.
- Internal clock with 2 LCD displays.
- Displays moves considered.
- Thinks in opponent's time.
- Takes back.
- 17 Levels.
- 2 Year memory.
- Mains adaptor socket.

Cat. C30010 **$295**

5¼" FLOPPY DISK SPECIALS!

	1-9	10+
XIDEX		
S/S D/D Cat C12401	$31.00	$29.00
D/S D/D Cat C12410	$38.95	$36.50
VERBATIM DATALIFE		
S/D D/D Cat C12501	$27.95	$26.95
D/D D/D Cat C12504	$39.95	$37.95
VERBATIM VALULIFE		
S/D D/D Cat C12421	$24.95	$22.95
D/D D/D Cat C12425	$31.95	$29.95

3½" XIDEX DISKETTES!

Yes, that's right, we now have 'hard to get' 3½" diskettes!

Cat. C12600 S/S box of 10 **$65.95**

Cat. C12602 D/S box of 10 **$89.95**

DELUXE 5¼" DISK STORAGE UNIT

Features:

- Clear smoked plastic lid.
- Diskette fan display system elevates the disks for easy identification and access.
- Lockable lid (2 keys supplied).
- High impact plastic base.
- 45 diskette capacity.

Cat. C16050 **$49.50**

MINI DISK STORAGE BOX

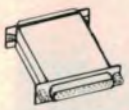
Holds up to 30 x 5¼" diskettes.

Cat. C16020 **$16.95**

RS232 MINI PATCH BOX

- Interface RS232 devices.
- With male to female 25 pin inputs.
- 25 leads with tinned end supplied.
- Complete with instructions.

Cat. X15654 **$25.95**



RS232C NULL MODEM ADAPTOR

- Male to female connections.
- Pins 2 and 3 reversed.
- All 25 pins connected.

Cat. X15658 **$19.95**

MODEM PHONE

Check the features and the value for money of this stylish new modem phone.

- Auto/Manual Answer, Manual Originate, Auto Disconnect.
- Speaker Phone with Built-in Amplifier for Detecting Busy Signal during communication.
- Carrier Detect Indication.
- 20 Memories (each with 18 Digits Capacity) for Auto-dialing.
- BELL 103 CCITT V21 Compatible.
- 300 BPS Full Duplex.
- Last Number Redial.
- Pushbutton Keyboard.
- Volume High or Low Control.
- "In-use" Dialing Indicator.

Cat. X19105 **only $174**

(Not Telecom approved)

RITRON MULTI PURPOSE MODEM

Our New RITRON Multi Purpose Modem has arrived and has all the standards you require. Just check the Ritron's features:

- CCITT V21 300 Baud Full duplex
- CCITT V23 1200/75
- Bell 103 300 Full duplex
- Bell 202 1200 Half duplex
- Auto answer, auto disconnect.

Telecom Approval No. C84/37/1134

$379

1200/75 BAUD RATE/BIT CONVERTER

For computers not capable of split baud rates. Buffers characters at 1200 and converts to 75 baud.

Cat. X19105 **$99**

NEW PHONE PLUGS & SOCKETS

We hear on the grapevine that all future installation will use the U.S.A type of plug and sockets for communication lines.

TELEPHONE CURL CORD

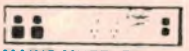
- U.S. plug to U.S. plug.
- Replacement hand set cord.
- Length 4.5 metres.
- Colours: cream, dark brown.

Cat. Y16022 **$7.95**

TELEPHONE ADAPTOR

- Australian plug to U.S. socket.
- Length 10cm.
- Cream colour cable.

Cat. Y16026 **$6.95**



MAINS MUFFLER

Sudden mains distrubances can seriously affect your computer equipment, and stored data. Why risk it when you can have a Mains Muffler, particularly when the cost of one failure is likely to be greater than the purchase price! So Vanish these dangerous clicks and Voltage spikes forever with the Mains Muffler.

Specifications:

Maximum total load:
1000w 4 AMP 250v 50Hz

First Stage- Single "PI" Section
Attenuation - 150KHz - 40dB
500 KHz - 65dB
10 KHz - 80dB

Second Stage- Dual "T" Section
Attenuation - 150KHz - 20dB
500 KHz - 60dB
10 KHz - 70dB

VDR Transient Suppression
Surge capacity 2000 AMP 8x20 uS

Cat. **$249**

IC SPECIALS!

	1-9	10+	100+
4116	$1.80	$1.70	$1.60
4164	$1.95	$1.75	$1.70
2716	$5.90	$5.50	$5.50
2732	$5.25	$4.95	$4.50
2764	$6.25	$5.95	$5.00
27128	$7.00	$6.50	$6.25
6116	$2.50	$2.25	$1.95
41256	$7.00	$6.50	$6.00
6264	$7.00	$6.50	$6.00

MSM5832 BACK IN STOCK!

1-9	10+
$12.50	11.50

NEW IC's

	1-9	10+
MCS2400	$ 4.90	$ 4.75
41256	$ 9.00	$ 8.00
27128	$ 7.00	$ 6.50
74LS169	$ 2.50	$ 2.40
AY-3-1050	$12.50	$11.95
WD2791	$69.00	$67.00
WD2793	$69.00	$67.00
WD2795	$69.00	$67.00
WD2797	$69.00	$67.00
LM11CN	$ 2.95	$ 2.75
LM1871	$ 5.95	$ 5.75
LM1872	$ 5.95	$ 5.75
Z80ADART	$13.50	$12.95
LM338K	$10.60	$ 9.50
AMI53530	$24.95	$23.95
AM7910 (World Modem Chip)	$49.50	$45.00
UPC1031 R.F. Module	$19.50	
57716	$64.95	$59.95
27256	$69.00	$59.00

IC SPECIALS! 8000 SERIES

	1-9	10+
8085	4.50	3.50
8212	1.50	1.40
8216	1.50	1.40
8226	1.70	1.50
8243	4.50	3.90
8251	3.90	3.50
8253	3.50	3.30
8255	2.90	2.50
8257	3.50	3.10
8259	3.50	3.10
8279	3.50	3.10
2532	7.50	6.90
2764	5.50	5.10
27128	7.50	6.90
1488	.55	.45
1489	.55	.45

Rod Irving Electronics, No.1 for peripherals!!

TELECOMMUNICATION EXTENSION LEADS

Cat. Y16010 5 metre **$12.50**

Cat. Y16012 10 metre **$14.95**

TELEPHONE EXTENSION CABLE UNIT

Allows 15 metres of telephone extension cable to be neatly wound into a potable storage container. The reel sits on a squared off base and the reel has a handle to wind cable back on to it after use. No tangles - no mess! Ideal for the workshop, around the house, office pool etc.

Cat. Y16013 **$24.95**

TELECOMMUNICATION PLUG TO 2 SOCKETS.

Ideal for modem connections.

Cat. Y16014 **$12.95**

RS232 GENDER CHANGERS

- Saves modifying or replacing non-mating RS232 cables by changing from male to female to male.
- All 25 pins wired straight through.

Male to Male

Cat. X15650 **$19.95**

Female to Female

Cat. X15652 **$19.95**

RS232 MINI TESTER

- Male to female connections.
- All pin wired straight through.
- Dual colour LED indicates activity and direction on 7 lines.
- No batteries or power required.

T.D. Transmit Data
D.S.R. Data Set Ready
R.D. Receive Data
C.D. Carrier Detect
R.T.S. Request to Send
D.T.R. Data Terminal Ready
C.T.S. Clear to Send

Cat. X15656 **$39.95**

COMPUTER CASSETTES

Quality 20 minute tapes.

Cat. D11141

1-9	10+	100+
$1.50	$1.40	$1.20

QUALITY SWITCH MODE POWER SUPPLY FOR APPLES

INPUT: AC 240V

OUTPUT: DC +5V 5A +12V 4A
DC -5V .5A -12V .5A

Cat. X11095 **$139**

130W IBM COMPATIBLE SWITCH MODE POWER SUPPLY

DC output: +5/13A -5V/0.5A
+12V/4.5A -12V/0.5A

AC input: 240V AC + - 15% 1.5A
47Hz - 63Hz

Cat. X11096 **$239**

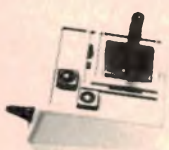
5¼" DISK STORAGE

Efficient and practical. Protect your disks from being damaged or lost!

Features:

- Smoked plastic cover.
- Lockable (2 keys supplied).
- High impact ABS plastic base.
- Dividers/spacers.

Cat. C16020 **$29.50**



JOYSTICK FOR IBM

Features Selectable "Spring centering" or "free floating". Electrical trim adjustments on both axis. 360 degree cursor control.

Cat. C14205 **$39.95**

APPLE JOYSTICKS

Ideal for games or word processing. Fits most 6502 "compatible" computers.

Cat. C14200 **$29.95**

IC STORAGE CASE

Electro static charge proof plastic IC case with conductive sponge. Dimensions: 75 x 130 x 19mm.

Cat. H10095 **$5.95**

UV EPROM ERASER

Erase your EPROMs quickly and safely. This unit is the cost effective solution to your problems. It will erase up to 9 x 24 pin devices in complete safety in about 40 minutes (less for less chips).

Features include:

- Erase up to 9 chips at a time.
- Chip drawer has conductive foam pad.
- Mains powered.
- High UV intensity at chip surface ensures EPROMs are thoroughly erased.
- Engineered to prevent UV exposure.
- Dimensions 217 x 80 x 68mm.

Cat. X14950 **$99.50**

COMPUROBOT

Simply key in a list of commands to the amazing Compurobot and watch him go about performing even your most complex manuevers - up to 48 steps! Forward, backward, left/right turn, left/right curve, robot noises, flashing lights and a multi speed gearbox!

Cat **$49.50**

Save on peripherals at Rod Irving Electronics,

APPLE* COMPATIBLE SLIMLINE DISK DRIVE

Japanese Chinon mechanism

Normally $225 **This month $195**

(*Apple is a registered trade mark.)

ADD ON HARD DISK DRIVE FOR IBM

Includes disk controller card. Available and installed free only at our city store.

Cat. X20010

10 M Byte $1,195

20 M Byte $1,350

THE 'C' PROGRAMMER'S HANDBOOK

This handbook is an introduction and a reference to the C programming language, both for beginning and experienced programmers. C is a general purpose language featuring economy of expression, and modern flow control and data structures. Concise structure and fast execution make C the ideal language for applications and system-level programming.

$27.50

INSIDE CP/M

A Guide for users and programmers with CP/M-86 and MP/M2 by David Cortesi

This book is both a guide and a reference manual for CP/M, an operating system for small computers. The book has two sections. The Tutorial presents the basics of the management, use, and programming of a small computer and CP/M. In the Reference, CP/M information is organised for quick access by prog[illegible]

$47.50

READY MADE CABLES

Serial to serial, 2 m

Cat. P19011 **$24.95**

Parallel centronics to centronics, 2m

Cat. P19013 **$29.95**

SOLDER CENTRONICS PLUGS

Cat. P12210 **only $4.50**

REPLACEMENT KEYBOARDS

- For Apple
- 42 single key BASIC command
- One chip custom design encoder
- Made by ALPS, life time, 10 million operations
- Dimension: L340xW110xH42mm

Cat. K12010 **$79.50**

- For Apple
- 45 built in function keys, BASIC and CP/M command.
- 45 user defined keys
- Built-in shift lock
- Made by ALPS, life time, 10 million operations
- Dimension: L340xW130xH42mm

Cat. K12012 **$99.00**

COMPUTER AND DISK DRIVE CASES AND POWER SUPPLIES

5¼" DRIVES

1 x 5¼" Slimline Drive Case

X11001 Bare Case $49

X11011 Case and Pwr Supply $109

2 x 5¼" Slimline Case

X11002 Bare Case $69

X11012 Case & Pwr Supply $149

1 x 5¼" Standard Drive Case

X11003 Bare Case $45

X11013 Case & Pwr Supply $109

2 x 5¼" Standard Drive Case

X11004 Bare Case $59

X11014 Case & Pwr Supply $149

8" DRIVES

1x 8" Standard or 2 x 8" Slimline, and computer Case (BB1)

X11006 Bare Case $99

X11016 Case & Pwr Supply $399

2 x 8" Slimline Drives and Computer Case

(BB1 and BB2 etc)

X11007 Bare Case $145

X11017 Case & Pwr Supply $399

1 x 8" Slimline Drive Case

X11020 Bare Case $95

X11022 Case & Pwr Supply $159

Dual 8" Slimline Drive Case

X11025 Bare Case $99

X11026 Case & Pwr Supply $275

MITSUBISHI DISK DRIVES

MF353 (3½" DRIVE)

Double sided, double density, 1 M/Byte unformatted, 80 track per side.

Cat. C11953 **$280**

MF351

3½" Standard size disk drive. Single sided, double density.

Cat. C11921 **$225**

M2896-63

Slimline 8" Disk Drive. Double sided Density No AC power required. 3ms track to track. 1.6 Mbytes unformatted. 77 track side 10s/su10 bit soft error rate.

Cat. C11916 **$550**

Case & Power Supply to suit

Cat. X11022 **$159**

M4854

Slimline 5¼" disk drive. Double sided, double density, 96 track/inch 9621 bit/inch. 1.6Mbyte unformatted 3ms track to track access. 77 track/side.

Cat. C11904 **$350**

Case & Power Supply to suit

Cat. X11011 **$109**

M4853

Slimline 5¼" disk drive. Double sided, double density. 1 Mbyte unformatted, 3ms track to track. 80 track/side. 5922 bits/inch.

Cat. C11903 **$260**

M4851

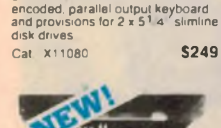
Slimline 5¼" disk drive. Double sided, double density 500K unformatted, 40 track/side. Steel band drive system.

Cat. C11901 **$199**

KEYBOARD AND CASE

A stylistic low profile case to give your system the professional look it deserves. Comes with an attached encoded, parallel output keyboard and provisions for 2 x 5¼" slimline disk drives.

Cat. X11080 **$249**

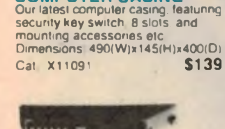


"IBM AT STYLE" COMPUTER CASING

Our latest computer casing, featuring security key switch, 8 slots, and mounting accessories etc.

Dimensions: 490(W)x145(H)x400(D)

Cat. X11091 **$139**



"IBM PC TYPE" COMPUTER CASING

Give your kit computer a totally professional appearance with one of these "IBM type" casings. Includes room for 2 5¼ inch disk drives, connection ports and mounting accessories etc.

Dimensions: 490 x 390 x 140mm.

Cat. X11090 **$119**

APPLE COMPATIBLE CARDS!

PRINTER CARD

"Grappler" style card allows hi-resolution screen dumps to your Epson compatible printers. Fully functioned for flexible flow of output.

Cat. X17029 **$89**

80 COLUMN CARD

Ideal for use with CP/M. Your computer becomes capable of upper and lower case, with a full width screen of 80 characters. If you want to run Wordstar, or any good wordprocessing software, get this card.

Cat. X17019 **$85**

P.A.L. COLOUR CARD

Get some colour into your games. Use your Apple or compatible on the second television. Has both UHF and composite video outputs. Fully adjustable so you can fine tune it for a crisp clean image.

Cat. X17025 **$95**

SUPER SERIAL CARD

No card does it better. Want to hook in to bulletin boards or mainframes? Turn your computer into a dumb terminal. That's right! This serial card comes complete with software.

Cat. X17035 **$129**

SPEECH CARD

Simple to use software controlled speech synthesiser kit. Complete with demonstration programs and text to speech software. Impress your friends with your talking Apple!

Cat. X17009 **$69**

MUSIC CARD

Three channel synthesiser can create a single polyphonic output or three monophonic outputs. Control of pitch and volume is possible. Up to three cards can be used at the one time. Complete with demonstration software.

Cat. X17011 **$99**

RGB CARD

True high definition colour for your Apple or compatible.

Cat. X17039 **$79**

IBM COMPATIBLE CARDS

MULTIFUNCTION CARD

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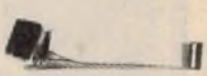

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Toshiba's T1100 sits comfortably on your lap

For anyone still under the impression that portable lap-top computers are little more than toys, the new Toshiba T1100 should be a real eye-opener. Functionally it's near enough to a portable equivalent to the IBM-PC, crammed into a case only 310 x 316 x 66mm — and able to operate for up to eight hours from its internal rechargeable batteries.

by JIM ROWE

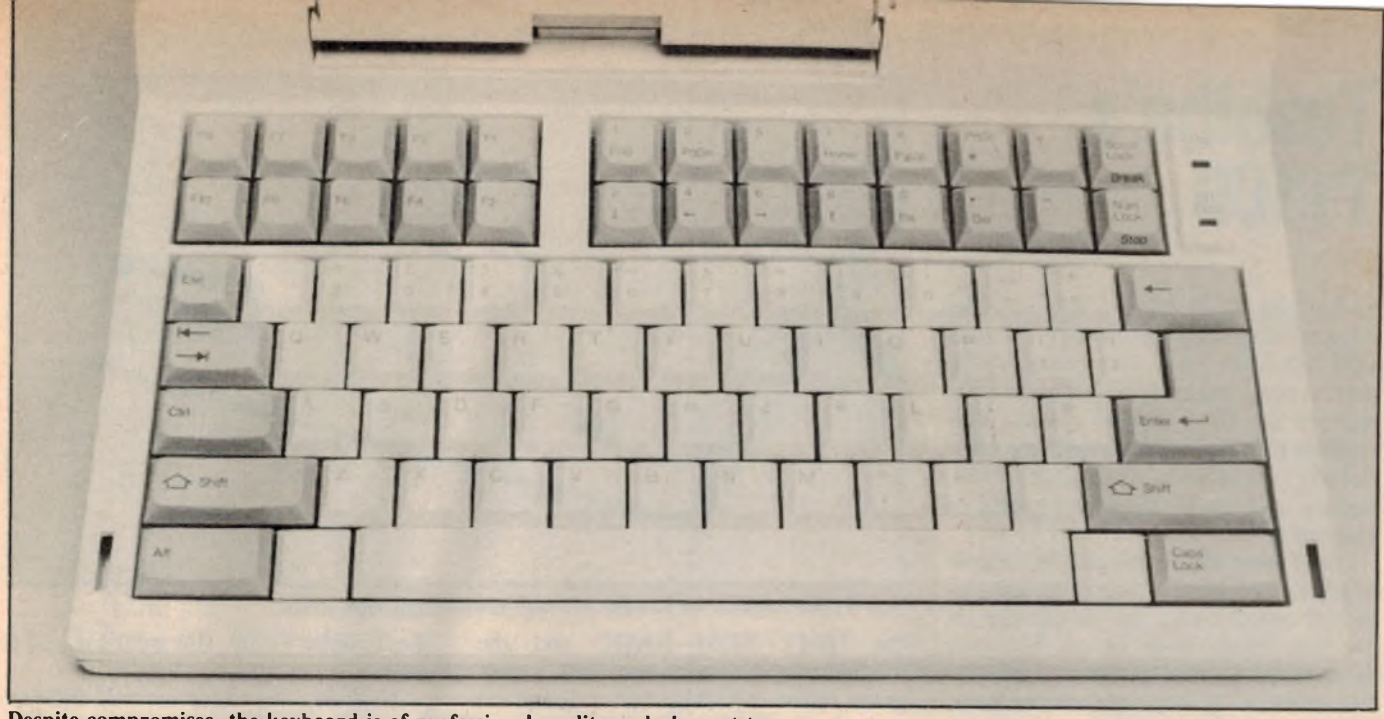
Lap-top portable computers have been available for a couple of years now, and have sold in reasonable numbers. They've been popular with journalists as portable word processors, and also with gad-about executives, who found that they could use them for "homework" on business trips. At least this was the theory.

In practice, I wouldn't be at all surprised if many of those early lap-top portables are now quietly gathering dust in cupboards, because they weren't actually capable of much serious use. With painfully small display screens, limited memory and generally rather crude tape cassette storage for files, they were really little more than executive toys. If you wanted a serious personal computer, you had to go for a "solid" desktop model taking up most of a desk and powered from the mains.

But things are now changing. Lap-tops are rapidly coming of age, and have now reached the point where you can have serious computing power *and* portability in the one machine.

The Toshiba T1100 is an example of this new breed of lap-tops, and a very impressive example it is. With an 8/16-bit CPU, 256K bytes of inbuilt RAM (expandable to 512K) and an inbuilt microfloppy disk drive taking 720K byte

Toshiba's T1100 lap-top computer — a portable equivalent to the IBM PC.



Despite compromises, the keyboard is of professional quality and pleasant to use.

double-sided double density disks, it offers more computing power than most desktop machines — plus a very high level of compatibility with the industry reference IBM-PC.

Display screen

Instead of the cramped 1-line or 4-line displays of earlier lap-tops, the T1100 features a large swing-up LCD screen with an active area measuring 223 x 97mm. This displays exactly the same amount of data as the monitor screen of the IBM-PC and many other desktop machines — 25 lines of 80 characters. It has the same graphics resolution too: 640 x 200 pixels, although they're all in LCD-grey rather than colour.

As an alternative to the inbuilt LCD screen, the T1100 will also operate with a normal external monochrome or colour video monitor (either composite or RGB). Not that you'd want to lug such a monitor along with you on the plane, of course, but it does allow you to get a full colour display when you're back at the desk.

Along with the LCD screen, the T1100 provides a keyboard with 83 keys — the same number as the IBM-PC, and although there are differences the two are functionally very close.

The T1100 also provides an inbuilt Centronics-type parallel printer port, with a 25-pin D-type connector pin-compatible with that on the IBM-PC.

In short, then, the T1100 offers virtually everything you get with the base level IBM-PC — *plus* the fact that it is portable and can run for up to eight hours from inbuilt NiCd batteries. Back at the desk, you charge the batteries via an 18V/600mA plugpack power adaptor, which can also run the computer as a desktop unit when the batteries are charged.

All this in a trim and compact package measuring only 310 x 306 x 65 mm, and weighing about 4kg — less than all but the lightest and most flimsy portable typewriters!

So it's a powerful little package, and anything but a toy. In fact I can well imagine people buying it in preference to full size desktop models like the IBM-PC, not because they want to take it on their travels, but simply because of its neatness and compact elegance. Even as a desktop it will have considerable appeal — especially if you don't want to expand it dramatically.

Expansion

Needless to say, in the T1100's compact little case there just isn't space for the usual row of "expansion slots" beloved of committed computer freaks. But the machine is still capable of quite a deal of expansion — probably quite enough for the majority of professional and business users.

For example, there's a 37-way D-type connector at the back to plug in a second disk drive, and Toshiba provides a choice of two add-on drives. There's another 3½ inch microdrive to add a second 720K bytes of storage, or a 5¼ inch minifloppy with the standard 360K bytes of storage if you want to be able to swap data and/or software with an IBM or more conventional IBM clone.

Interestingly enough, the add-on 3½ inch drive has an inbuilt NiCd battery, like the T1100 itself. So if you really need to, you can take the second drive away on your travels — or do your homework in comfort out on the patio, without having to search for an extension cord! The 5¼ inch drive doesn't offer this feature.

Of course the inbuilt Centronics-type printer port lets you hook up the T1100 to a wide variety of standard printers. It worked quite happily with my TEC-Itoh F-10/40 daisywheel, for example.

Incredibly enough, the T1100's designers have allowed space inside its compact case for two further internal expansion options. There's provision for an RS-232C serial communications adaptor, so you can hook it up to a telephone modem, a serial printer or some other serial format peripheral. The second option is a memory expansion card providing an additional 256K bytes of dynamic RAM.

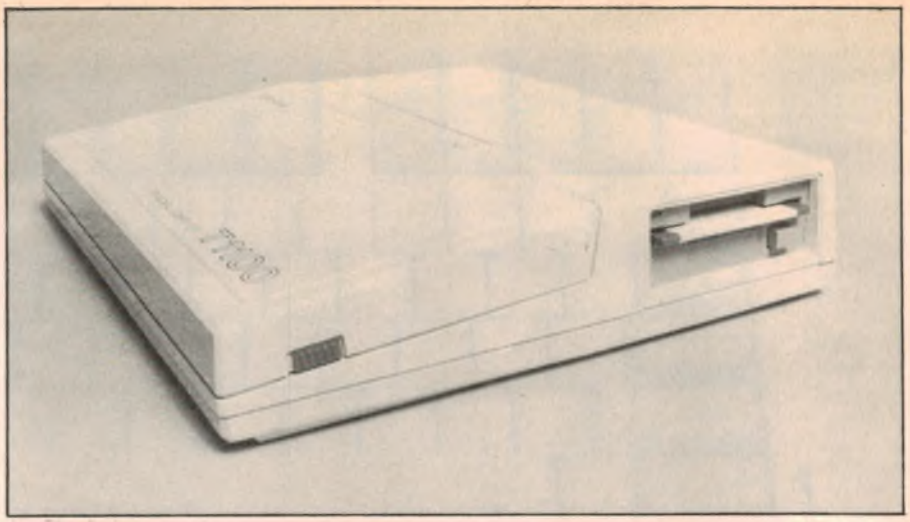
By the way, these expansion options are quite independent of each other. You can fit either or both as you wish. The RS-232C port adaptor fits just inside the rear of the case, which has a small break-out piece to allow access to the adaptor's 9-pin D type connector.

So if you wish, the T1100 can be expanded to a full-blown system with RGB colour monitor, 512K bytes of RAM, two disk drives with 1.44 Megabytes of storage, a printer of your choice and a communications modem. This is more powerful than most existing IBM-PC systems in use, and quite sufficient for a lot of serious work.

Software

On the software side, as I mentioned

Toshiba's T1100



The T1100 features an in-built 3½ inch microfloppy disk drive.

earlier, the T1100 offers a high order of compatibility with the IBM-PC. It runs with MS-DOS, and also seems to be able to run a majority of programs written for the IBM and its clones. This suggests that its BIOS routines are functionally very close to those in the IBM, making it about as close to the IBM as you can get.

I have been able to try out the sample machine with quite a few programs, either as supplied with the sample unit on 3½ inch micro disks or on 5-¼ inch disks which I know to run on my IBM. Just about all of them worked normally, including Flight Simulator — which often comes to grief on "compatible" machines, because it makes direct call to the the graphics hardware.

Wordstar and Multiplan seemed to work quite happily, as did Crosstalk — although I couldn't try this out properly as the sample machine wasn't fitted with the RS-232C port.

I tried booting up PC-DOS itself, using the external 5¼ inch drive (the T1100 has a slider switch on the back which allows you to make the external drive the "A" drive, and the internal drive "B", if you desire). Although it seemed to function quite normally handling programs and files on its own drive, it didn't like trying to find files on disks in the microdrive — presumably the directory is formatted differently.

Similarly the IBM version of BASICA wouldn't run, no doubt because this version is designed to graft itself onto the IBM's ROM BASIC and the Toshiba doesn't have any. But a program called BASICA that I found on one of the T1100's microdisks did run some programs written on and for the IBM without any problems.

Even though this was called BASICA on the microdisk directory, presumably it is really a version of Microsoft's sister product GW-BASIC, tailored for the T1100. Its file size on the disk is shown as 53440 bytes, which suggests the free standing RAM resident GW-BASIC rather than BASICA.

Not that these complications with the DOS and BASIC are of any real consequence, I hasten to add. Since the T1100 comes with its own version of MS-DOS and (ultimately) BASIC, and both seem to be able to cope directly with IBM software, it's fairly easy to do almost anything most people are ever likely to want.

Using the T1100

Right then — so much for the basic hardware and software capabilities of the Toshiba T1100. But what's it like to use?

Generally, very nice indeed, although it does have a few shortcomings. There are also a few things which are bound to irritate anyone like myself, used to using an IBM. I'll go through these in approximate order of importance.

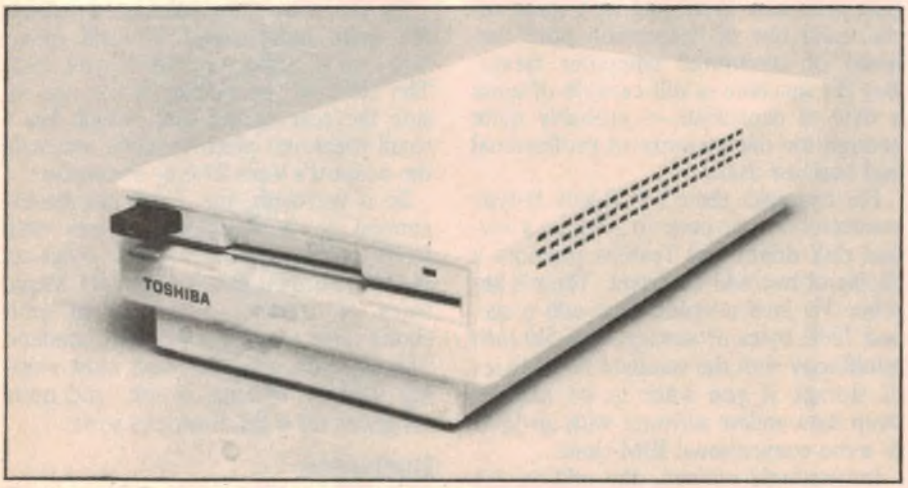
Probably the first thing that struck me when I fired up the sample T1100 was the modest contrast and visibility of the LCD screen, particularly in certain types of ambient lighting. After having used it for a few days now, I'm inclined to think this is probably the machine's main shortcoming.

Being a passive display, the LCD panel is very dependent on the surrounding light level — without any ambient light, there's no display. So you must have a reasonable amount of light; yet at the same time you can't have it coming from an angle such that it produces annoying reflections from the front glass. Diffused light seems to be best, but here again if it's too bright, you tend to get an annoying reflection of yourself.

Like all LCD displays the T1100 screen has to be tilted at just the right angle for best contrast, too, producing a further element of complication.

Mind you, I'm not suggesting that the T1100 is any worse than any other machine with an LCD display. At this stage of their development LCD displays are rather more finicky and a little inferior to CRT screens in terms of readability. But they do have one big advantage, that of compactness and the ability to consume very little power. So if you want a truly portable machine like the T1100, an LCD screen is really the only choice.

In the case of the T1100, my reaction is that despite the limitations of the



The external 5¼ inch minifloppy drive adds an extra 360K bytes of storage.

LCD screen, it will still be found quite acceptable when the machine is used as a portable. But back at home base when it is used on the desk top, most people will find that a conventional CRT-type monochrome or colour monitor makes a very worthwhile addition.

By the way the T1100 does provide a control to adjust LCD contrast, and this does help in getting the best display.

One further point should be noted about the LCD screen. Unlike a CRT monitor, it can't provide two levels of display contrast to correspond to the IBM's "normal" and "enhanced" character display modes. The T1100 designers have apparantly elected to substitute a flashing underline for the "enhanced" mode, when the LCD screen is being used. This causes a further problem with some software programs which happen to make extensive use of the enhanced mode.

I discovered this initially with Wordstar, which uses the enhanced mode for displaying all of your text. This means that on the T1100's LCD screen, every single character of your text is displayed with a flashing underline. The problem is that Wordstar also uses a flashing underline as its cursor, so the "real" cursor tends to get lost in a forest of pseudo cursors. It can be quite irritating.

Fortunately, when you switch the T1100 over for use with an external video monitor, it changes over to the usual "enhanced" display mode — so the problem disappears (another reason for using an external monitor when you are back at the desk).

Keyboard

The only other area in which the T1100 seems to have a few shortcomings concerns the keyboard. Basically, these seem to be the result of some inevitable compromises forced upon the Toshiba designers in achieving their goal of squeezing a keyboard of 83 keys into an area only 281 x 138 mm.

Like the IBM, the T1100 combines the cursor control keys with the numeric keypad. However, because of the space limitation these keys are no longer in the familiar and convenient square array to the right of the main QWERTY section. Instead they're in two horizontal rows, above the number/punctuation row of the main section. The odd numbered keys are in the top row, with the even keys below them.

I guess the designers had little choice about this, but it has made the numeric keypad as such virtually useless; you're better off using the normal number keys. The cursor control keys are also considerably less convenient than on the IBM and similar machines, although you would probably get used to them if you were using the T1100 all the time.

The programmable function keys F1-F10 are also in two horizontal rows above the main section of the keyboard, to the left. This is again not quite as convenient as having them in two vertical columns at the far left. There are also quite a few minor differences from the IBM keyboard, such as the double quote mark being in the shift position on the "2" key like a normal typewriter keyboard. But as before, if you're using the T1100 all the time you'd no doubt adjust to these differences in short order. They are really quite minor points.

On the positive side, the keyboard seems quite positive in its action and is pleasant to use. The highly important (ENTER) key is better shaped and more conveniently placed than on the IBM, as are the two SHIFT keys. The (ALT) and (CAPS LOCK) keys are also one removed from the space bar at each end, making it rather less easy to hit them by mistake. The (NUM LOCK) key also has the word STOP engraved on its front, making it easier to remember its control function with MS-DOS.

So all in all, the pros and cons of the keyboard should balance out reasonably well, particularly if you're going to use the T1100 by itself and not flit back and forth between it and another machine.

Conclusion

In summary, I have to say I am most impressed with the Toshiba T1100. It is a very professional machine, and is far more powerful than you'd normally expect to find in something so compact. In fact it's the nearest thing you're likely to find to an IBM-PC, squeezed into a lap-top case and able to operate from batteries.

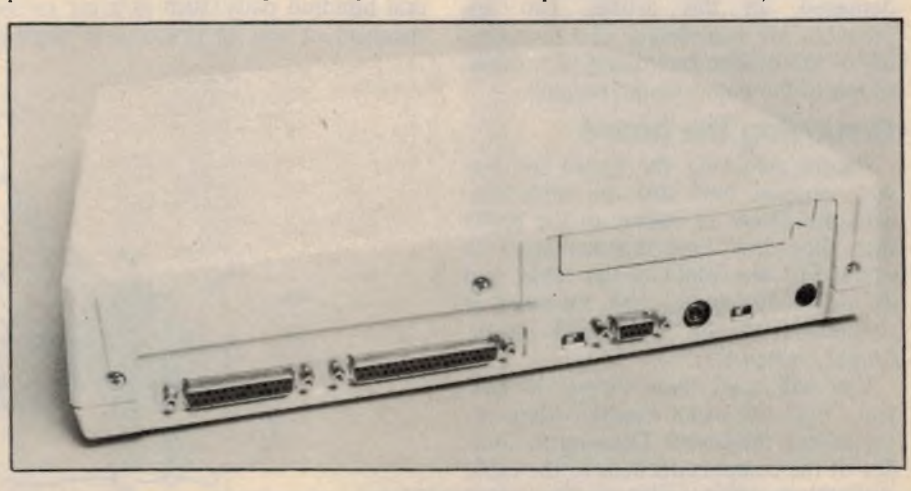
Whether you're after a serious portable PC, or just a serious desktop PC that takes up less space, it has to be a strong contender.

The review sample came from Dick Smith Electronics, who quoted a price of $2995 for the basic 256K machine complete with inbuilt 720K microdrive, power adaptor/charger, operating manuals, MS-DOS system disk and two disks with "Access-4", an integrated spreadsheet/desk manager package. This sounds very good value for money.

The add-on 720K 3-½ inch microdrive costs a further $899, while the alternative 5-¼ inch minifloppy drive costs $699. Both come complete with power adaptor and connection cable. The optional 256K RAM expansion board costs $649, and if you want the RS-232C communications adaptor this costs $165.

At the time of writing, the T1100's version of BASIC is not yet available for sale, but is expected shortly. Other systems and applications software should also be coming along soon, and may well be available by the time this is published. It is also likely that a lot of the software becoming available on 3-½ microdisks for the IBM model JX will run quite happily on the T1100, and suppliers like Dick Smith Electronics will no doubt be able to advise you regarding specific programs.

For those readers who have somehow managed to get this far without becoming aware of Dick Smith Electronics (!), the company has stores in most cities and large towns. If there isn't one near you, their head office address is PO Box 321, North Ryde 2113. The head office phone number is (02)888-3200



The rear panel has ports for an external disk drive and printer plus sockets for RGB and composite video outputs.

A practical approach to Electronics — PART 4

Salvaging damaged PC Boards

Most printed circuit boards will survive reasonable abuse during their useful life, repairs being mainly confined to the components mounted on them. However, they may be damaged in various ways and must be either salvaged or replaced.

by KINGSLEY HOWE

Ordering a new board may involve lengthy delivery delays, during which time, the owner is deprived of the use of the equipment. In such circumstances, the costs may be considered excessive.

Boards can often be salvaged at a reasonable cost unless they are severely damaged. In this article, two approaches are considered: (1.) re-assembly of the broken board and (2.), duplication of the board by the repairer.

Removing the board

Before removing the board for service, examine both sides for cable connections. Draw an outline of the board first, then draw lines representing each cable. List the colour of the cable, and its use in the circuit; also, its point of connection at the other end (transformer, switch etc).

You will need these listings in case you forget the exact location when reassembling the board. Drawing the outline of the components near to the cable connections will help locate the correct position from your diagram.

You may find several cables with the same colouring. In this case, label the wiring with masking tape before removing it from the board. Make sure the wording is listed against the corresponding line on your diagram.

Where a circuit board has a large number of connecting cables, and several hundred pads (such as a car radio-cassette), it will be practical to draw a layout such as the one described above. In this case, even the removal of one wire may make the original connection point difficult to locate.

About the only solution to this is to cut the cable using side cutters. Cut close to the board, leaving 3 or 4 mm of insulation still attached to the joint. This will enable positive identification amongst a mass of 'look-alike' pads. Where a colour has been used twice, cut one cable off at right angles, and the other at 45 degrees, so there is no confusion. Make sure that you match the ends before stripping and resoldering, otherwise the identity of the cable may be lost.

Work only on one wire at a time. On some units there may not be enough slack cable to enable rejoining, if the suggested 3-4mm is left on the board. You will then be forced to cut much closer to the surface, leaving only a small 'ring' of insulation remaining. Care must be exercised so as not to accidentally remove this small ring, by dragging the board across the bench, or brushing it off.

One precaution to note with the system is to make sure that all the strands of short wire are removed from the copper pad before attaching the original cable. Should a pad lift from the surface, it may be fixed to the board by a drop of contact adhesive applied on the end of a toothpick. Further security may be obtained by a small dab on the component leads on the other side as well.

Some boards are more conveniently removed with the cables attached, disconnecting the ends from transformers or sockets, etc. A diagram of the connections to the boards is still advisable (apart from the diagram of cut connections), because in handling the board during the course of repair, one or several wires may break off.

Damaged PC boards can often be salvaged. This article tells you how.

A fairly practical method to reduce the likelihood of accidental fracture is to tape the cables to the board with masking tape. A break may still occur, but in this case the offending piece will be held in position and the broken end then points to its proper place.

Also, with the loose cables taped down, handling of the board becomes easier. Removal of the tape when repairs are effected should be done slowly.

The most convenient method of anchoring cables to the board is to feed the cables to the edge and tape them down firmly. Leave about one centimetre or so of tape over the edge, then apply a similar length of tape to the other side, again allowing about a one centimetre overhang. The two adhesive surfaces should now be brought together, so as to form a 'sandwich', with the cable and board in the middle.

This relieves any strain on the joints caused by the cables swinging with mobile use or in places where there is constant vibration.

Whilst the adhesive will eventually dry out and become hard, this may take several years, and it is more likely that the board will require servicing well before this occurs.

PVC based electrical tape is not suitable for this purpose, as there is insufficient adhesive coating. The best tape to use for this work is medical tape, which has a heavy woven cloth base and a very tacky white coating.

Hairline cracks

Hairline cracks can occur through shock loading on a board (eg. when the device is dropped) or when insufficient support causes deformation by heavy components. Cracks can also be made by excessive external pressure on board-mounted switches or pots, etc. The latter are, in general, restricted to the locality of the said pressure point and are fairly easy to locate and rectify.

The other type (pre-assembly fracture) may take place if the board is bent during manufacture or transport. The latter are sometimes not visible and, in instances where a batch of several thousand boards is involved, quite a few may pass through unnoticed.

The hairline crack often does not become apparent until the board is fully assembled and tested. The most obvious way to find the fault is to apply pressure to the board by use of an insulated tool, such as a plastic rod. The fault may come and go as the board is flexed, or the circuit may cease to function entirely. Noting which area is the most sensitive to this treatment usually pinpoints the particular tracks. It is then merely a matter of bridging the fracture with wire links and plenty of solder.

Transport damage to a unit is the most noticeable form of physical abuse. The cabinet or metal housing may have dents on one face, or a corner may be pushed in. Sudden shocks from this sort of treatment may cause heavy components to pull right off the board, or cracks may occur when the housing distorts, straining the board with the change of shape.

In salvaging those boards it is important to firstly restore the original shape of the housing, such that the mounting holes in the board match those of the cabinet. Fitting a repaired board without doing this will apply undue pressure to the board and consequently a re-occurence of the fault condition. In some cases, enlargement of the holes may be the only solution.

A more subtle condition arises when a unit is dropped dead flat. No external damage is apparent, but the innards may have taken a severe jolt. Removal of the cover may reveal a loose transformer, and various screws may have pulled away.

A safe bet in the above cases is to examine the board close to the mounting posts. Often, these are rigid and inflexible; any sort of fracture near them should arouse suspicion.

Large capacitors, such as filter types, can exert enough stress on impact to cause hairline cracks. Grasp the capacitor body firmly then rock the component slightly. This may reveal a crack that is otherwise hidden underneath. Otherwise, the board may have to be removed and carefully examined.

Locating hairline cracks

Several methods are applicable in aiding crack detection in PCBs.

A slight flexing of the board when removed can show up the larger cracks, while lesser cracks may be seen when the board is held up to the light. It is preferable to use daylight as a source, holding the board in a vertical position, and then tilting it to and fro slightly to show the slight difference in colour between the main (unaffected) base colour and the lighter shade exhibited by the crack.

The most difficult of all to find are the very fine fractures. Some of these are so slight that they are not visible, even with a good light and strong magnifier. Some of these may be confined to only one or two tracks, being very

Salvaging damaged PC boards

Hairline cracks can develop for all sorts of reasons.

localised. Flexing the board in this case will achieve nothing positive, as some of these do not penetrate the board, being confined to the surface only.

A more extreme and frustrating condition arises where only the copper track is fractured. The board has flexed in such a way that the copper has reached the elastic limit and parted at the weakest point. This does not imply that the narrow part of the track is the place to look. The particular track under these conditions may appear intact.

In some cases, the gap at the point of fracture will have closed physically, but not electrically. Even worse, the application of multimeter probes to a track in this condition to test continuity will read dead short. The current passing across the small point of contact is enough to operate the meter, but will not carry the load current to allow the circuit to function properly, if at all.

With plain copper tracks, the solution is to power up the circuit, provided it operates on low voltages or proper safety precautions have been observed, and the said board is rigidly fixed in place. Now take a hard "lead" pencil, such as a 2H or 3H type, and carefully run the tip over the suspect track. Make sure that you do not run off the track onto the board, as the graphite is conductive and will short out adjacent tracks.

On crossing the fracture the pencil effectively bridges the fine gap and its exact position is then apparent.

Note that the pencil should be covered with clear PVC tubing, such that the top end is covered by an extension of at least 25mm. The graphite core of the pencil is live when in contact with the circuit, and should be well insulated to prevent shock.

Boards covered with a solder-resistant lacquer present problems not found with uncoated boards. Firstly, the green coating obscures all but the most serious cracks, when attempting to use the backlighting technique. The suspect area may require removal of the lacquer to expose the copper.

Before this is done, however, examine the board with a good magnifier. Sometimes the copper will show at the edge of the fracture, the red colour contrasting well with the green coating. Removing the lacquer by scraping with a sharp knife may well hide the gap entirely.

One type of fracture shows up as a spidery pattern (multiple fracture running from one point). These are commonly found where heavy components are mounted on the board or at corners where the board is fixed by means of screws to posts or insulated mounts. These should be reinforced, as described later in this article.

Regardless of the type of crack, small or large, steps should be taken to determine the direction of the crack. The tracks along the path of the crack should also be bridged with wire reinforcing, in the event that the crack runs further.

Board reinforcing methods

All damaged boards should be strengthened to minimise further breakdown.

The most important aspect of board repair is the correct adhesive and surface treatment. Super Glue (cyanoacrylate), has good penetrating ability, but is too brittle when set for butt joins. Araldite will cover the crack and adhesion to the board is good, as long as the components are well mixed before applying.

An easy, low cost, and less messy method is to apply a coat of Bear Contact Adhesive to both surfaces of a broken board, and then push these together.

Sufficient adhesive should be used so that a bead of adhesive forms at the line of contact. Support of the whole board overnight is suggested until curing is complete. Clothes pegs may be employed to hold the edges level; these act as spring-loaded clamps. To prevent a peg sticking to the board, apply a piece of sticky tape to each jaw. The pegs can then be removed after setting has taken place, and the tape then peeled from the board.

Where space permits, scrap pieces of circuit board cut to suit, may be glued on the board across the crack. This supplies rigidity to the repaired board and prevents sagging at the joint.

Partly cracked boards may be strengthened in the same way. Boards with corners broken off require a patch to be glued to the affected area. Glue the piece on the top of the main board (make sure that the copper foil is removed from the scrap piece), even if the piece required covers some component holes. These holes can be drilled out the following day and the parts remounted on the new piece.

Styrofoam blocks may be used to support the board after repair. Blocks may be cut from ceiling tiles, which are of a convenient thickness and readily available from hardware and home decorator outlets. Blocks may be joined using Aquadhere Adhesive. This glue will join a styrofoam block to timber or metal.

With metal, allow 24 hours for complete setting, due to its non-porous nature. Provided there is no oil on the metal surface, the bond is very strong, in fact, the block will break into pieces, before it will lift from the metal. Painted surfaces will also hold well if cleaned first with methylated spirits.

Leads protruding through the underside of the board need not be trimmed when using foam blocks for board supports. These will penetrate the foam easily, and aid in holding the board in place.

Burnt boards

Burnt boards are not a rarity. Many TV sets use SRBP for all their boards. These can fall victim to the heat from high-wattage wire wound resistors. Several types of burn occur:

(1). Dark brown area with board intact.

(2). Charred patch with raised blister.

(3). Hole burnt right through the board.

In category (1) the area affected has a level but discoloured surface, and the most serious problem could be the state of the tracks.

A typical history of such a board would be heat from the leads causing deterioration of the adhesive bond between the copper track and the board. Along with this, the solder loses its tin content, and appears dull grey and wrinkled. The weight of the resistor then causes the leads to sink through the board, and detachment of the copper track begins.

These boards can be salvaged by fitting a piece of uncoppered board over the area and fixing this with 6BA screws. This done, attach wire links to the resistor in place of the burnt tracks. Double-sided copper circuit boards may be cut to a suitable size, drilled, and slid onto the resistor legs. This arrangement acts as a heatsink, and reduces the amount of heat reaching the main board. Solder should be applied to both sides of the foil.

On badly burnt boards, it may be easier to cut two pieces of uncoppered board to cover the area where the resistor leads fit the board. Fit one piece on each side and drill through the original holes, then fix both with 6BA screws.

The resistor leads may now be soldered directly to the screws after wrapping several turns around them.

In groups 2 and 3, the boards would be in very poor condition. If they are small, it may be practical to reproduce the board. A quick method is to firstly draw a diagram of the layout, and mark the identity of each component. Then remove all the components from the board. Cut a fresh piece of board to the same dimensions, lay this copper side up, then place the old board track side up and use it as a drilling template.

Drill one hole and insert a thick wire or a board pin, then drill the next hole and insert another pin or wire. This will prevent the boards from moving when the other holes are drilled. After all the holes are drilled, lay the boards side by side, and then copy out the tracks with a Dalo etch resist pen, using the original board as a guide. Check the track pattern before etching.

Some burnt areas may be small, and not warrant a reproduction. If some of the tracks are destroyed, the area may be removed by a drill or file. A small 'sub-board' can be built from Veroboard, and the parts concerned mounted on this. Solder stiff wire through the holes in the Veroboard, then drill holes in the main board to enable reconnection. The finished 'sub-board' should then look something like an overlarge IC, sitting clear of the surface.

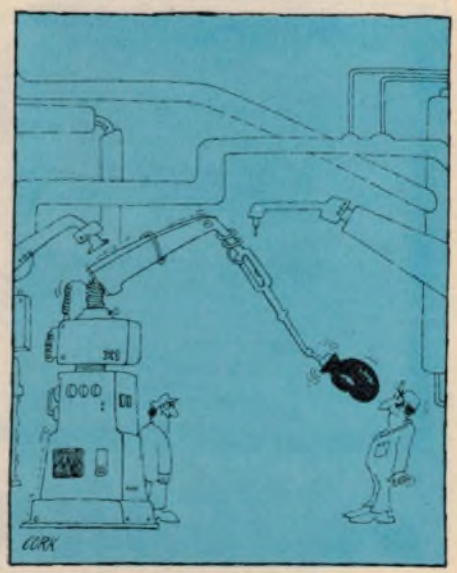
With vertically mounted resistors, a piece of board may be inserted between the body and lead, and the lead soldered to the copper. Tinning the board with solder, and cleaning and tinning the resistor lead will enable a quick secure joint to be made.

Copper tracks

Copper tracks may be found to have burnt and lifted from the board. It is not advisable to glue these back into place and then attempt to solder in replacement components. The condition of the tracks renders them virtually unsolderable, they are physically weak, and their current carrying capacity is reduced. Replacement of the tracks is possible using a self-adhesive copper foil.

Remove the old foil back to a clean shiny area, then attach the new copper strip directly from the roll. Should the foil not adhere, roughen up the surface with emery cloth.

Wire links may be used to replace burnt tracks. Note that the wire will need to be fixed to the board with glue. Care must be taken when soldering component leads to wire; these joints often prove to be unreliable unless a small loop is made on the end of each wire to substitute for the copper pads.



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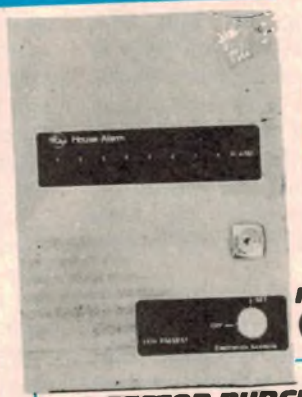

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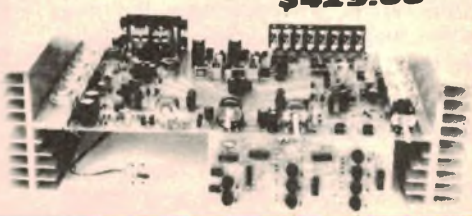

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FORUM

Conducted by Neville Williams

Some rough ideas about video tape!

If a reader from Concord, NSW is to be taken seriously, BASF must be coating their video tape with raw emery powder rather than "tiny, smooth chromium dioxide particles" densely packed in a "mirror finished" binder. Take your pick as to whether the letter revives or discredits a once lively argument.

In so phrasing the above introduction, I am not seeking to ridicule the correspondent. He is, I feel, genuinely disappointed and genuinely puzzled, although possibly misinformed. We'll go into that later but first read his letter:

Dear Sir,

"Buy our super-dooper chrome audio and video tapes for better results", the advertisements tell us.

But in what way are the results better? Are we being conned?

Let me explain: Last December I invested in a Beta video camera to replace an aging Bell & Howell 8mm sound movie camera that was objecting to present-day film cartridges.

The salesman stressed the need not to use cheap tapes, only top brands, so I chose BASF Chromdioxid. All the family, especially the grandchildren, were delighted with the results.

After 7 months use and perhaps 6 hours of taping, the new camera ceased to function. It was taken to the vendor for repair under guarantee and, after explaining the problem, the technician asked what tape had been used.

On being told it was BASF chrome, he said that could be the cause of the trouble; please call back in 7 days. A week later, and the repair complete, I asked what had gone wrong.

Well, the Record head was judged to be 25% worn out and the running mechanism clogged with dust from metal particles — all due to the allegedly abrasive nature of the tape coating.

Chrome is a hardening agent used in steel making, the technician explained and, while picutre quality is boosted, so is the wear rate on components. This is more apparent on cameras and car tape players than it is on domestic systems, which are larger and inherently more robust.

He strongly urged that only non-chrome tape such as TDK Super Avilyn be used in cameras and car tape players. I should mention that the camera is still performing faultlessly, after many hours of use.

I have not seen this matter discussed in the many tape reviews in EA and other magazines and you may care to comment. (I really enjoy your Forum articles, and the magazine as a whole).

W.S. (Concord, NSW).

By way of response, let's recall what gave rise to the "once lively argument":

As you may be aware, BASF produced the world's first commercial consignment of ferric oxide recording tape in Ludwigshafen, Germany, in 1934, in collaboration with AEG.

In the following years, ferric oxide tape technology was progressively refined but, in 1971, BASF took up an American DuPont development and released a new line of high-bias, high performance tape coated with chromium dioxide (CrO_2).

According to company literature, the new chromium formulation offered reduced modulation and bias noise, increased MOL (maximum output level), wider frequency response with greater dynamic range, a more durable coating and better retention of the recorded information.

Companies which were committed to ferric technology had to embark on an intense program of research, involving more extensive processing and/or the use of dopants such as cobalt, in an effort to match the performance figures of chromium formulations.

They certainly closed the gap but their upgraded tapes also benefited from an allegedly inspired notion that chromium dioxide particles, being harder than ferric oxide, caused significantly greater head wear.

BASF and other CrO_2 licencees denied this most vigorously in their literature, but I was subseqently able to discuss it at a personal level with BASF engineers, here and in Germany. They made the following points with apparent conviction:

- As a powder, the harder but finer particles of CrO_2 do have a different frictional characteristic from their ferric equivalent, being slightly more abrasive to harder heads (oxide and sendust) but less abrasive than the larger ferric particles to softer heads (e.g. mu-metal).
- When embedded in a highly calendered binder, however, as on plastic tape, it is the binder, the surface finish and the environment, rather than the powder, which determines head abrasion.
- In any case, the surface texture is specified to manufacturers licenced to JVC (for VHS) and Sony (for Beta) such that it will burnish the heads, without causing unnecessary wear.
- In practice, the differences between premium quality tapes in terms of head wear are marginal — something that may not be true for tapes of dubious origin.

Head life

Over and above arguments about tape formulation, there was a lot of apprehension, early on, about possible head fouling and head wear in domestic VCRs, with talk of heads needing to be cleaned every few months and replaced altogether at somewhere between 1000 and 2000 hours.

Nowadays, the subject hardly rates a mention, possibly because other consumers have shared my own experience in this respect.

In early '82, I took delivery of a then new National NV-7200A domestic VCR for review in the April/May issue of "VideoMag". I liked it well enough to acquire it for permanent domestic use and, while I have reviewed various other VCRs since then, there has been no particular urge to make a change.

So, for well over 3 years or 1300-odd

days, the 7200A has been churning away, at the beck and call of various members of the family. It requires an average of less than two hours per day, recording or playing back, to aggregate 2500 hours of operation — at least!

In all that time, it has never missed a beat. The heads have never been cleaned and to the eye, as judged on program material or test patterns, the on-screen picture is much the same as it ever was.

Yes, it has been protected from fumes, dust and extremes of temperature, and kept covered when not in use. But it has also spent a lot of hours playing BASF Chromdioxid tape of various grades, along with PD-DuPont CrO2, and a variety of non-chromium brands.

The foregoing remarks are not intended as a gratuitous plug for National VCRs, because there are possibly plenty of others around that could match those figures. But they do indicate that the early speculation of up to 2000 hours of head life was realistic, even conservative, tape formulation notwithstanding.

Back to the camera

In the face of that experience and expectation, the present proposition that any top brand tape could be so abrasive that it would visibly wear the head and clog the mechanism of correctly designed normally operating video equipment after just 6 hours of taping is manifestly ludicrous.

The tape would indeed have to be coated with raw emery powder!

There just has to be another dimension to the story, beyond any arguable characteristic of chromium coated tape.

- Did the camera have a pre-history unknown to the correspondent?
- Was the record head cracked or out of position enough to gouge the coating from the tape?
- Is the camera now working correctly because the head or the mechanism was readjusted?
- In any case, why would a technician blame CrO2 tape before even looking inside the camera?
- How could he believe that a top-selling tape, running for thousands of hours in other equipment, could ruin this camera in 6 hours?
- Prejudice? A handy cop-out? Or is there something odd or critical about the particular model?

I'll leave the matter open for discussion, W.S., to see what it brings to light but, in the meantime, I haven't the

RSI: Not a programmers' problem!

I refer to the letter "Beat Repetitive Strain Injury" from B. Daniells in the September issue of EA, page 29.

I am NOT a computer programmer, nor am I any longer a mere "typist". The "typing" pool has been largely taken over by word processors, the majority of which are mini-computer based.

Mr Daniells has made several good points with which I concur. However, as noted in Mr Muscio's letter in "Forum" in the same issue, much of the RSI problem can be traced to the design of keyboards.

I have been typing for over twenty years and have played the piano for thirty. I have never had an aching joint until I began using a PC based word processor three months ago. Prior to that, my hands might have suffered some muscular tiredness after a busy day; I now type for only 30 minutes before my wrists and forearms begin to ache.

To use an analogy, I expect my back to ache after I have dug up the garden; I don't expect it to do so when I pick up the shovel!

Mr Muscio makes the point that typists' hands no longer have the support of the home keys and that the problem may be so simple that it has been overlooked. More than that; it has been dismissed as irrelevant. I have been voicing the same opinion to my colleagues (programmers), my employer (software company) and my family (mostly computer buffs).

Programmers, in their "hunt and peck" immunity, assure me that the height of the keyboard is the problem. Hardware manufacturers advise altering the height of the keyboard, monitor, &c. Both reflect the attitude that I am "moaning" or "looking for a reason to bludge".

The company staff representative assures me that drinking less water will lower the fluoride level in my bloodstream, and the chance of developing severe RSI. However, since I live in the country and run my house on tank (rain) water, my fluoride intake is fairly low.

If a keyboard could be designed to incorporate Mr Daniells' "striking force" arguments and Mr Muscio's "wrist strain" logic, I believe the RSI problem could be alleviated. (I would expect any form of wrist support to detract from a typist's speed and accuracy.)

Mr Daniells may spend several hours daily at his keyboard but I wonder how much time he actually spends implementing continuous keystrokes. Any typist worthy of the title can type at least 60wpm accurately and will do so consistently for several hours in a working day.

Modern computer keyboards not only require a typist (as opposed to a programmer) to maintain speed and accuracy on a constant, repetitive basis, but to do so much with the hands in a state of constant muscular strain.

On an overly sensitive keyboard, the hands are maintained at a constant UNNATURAL upward angle, with the wrist joint and tendons bearing the strain, while the forearm muscles and elbow joint bear the constant supporting load.

The trend in the business and technical community is to alleviate postural RSI by the provision of adequate workstations, chairs, &c, although companies, which don't wish to admit to the problem, try simply to sweep it under the carpet.

Hardware design companies seem to have fallen into the trap of seeking the opinion of their "hunt and peck" engineers and programmers. When will manufacturers realise that the real expertise in keyboard comfort lies in their secretarial and typing pool?

Computer programmers mostly suffer neck, back and shoulder strain, which is fairly easily alleviated by improving posture, positioning and alternate activity levels, as noted by Mr Daniells. Unless they are good (touch) typists, programmers generally do not suffer hand and wrist problems.

There are some thirty programmers and five secretary/typists where I work. No programmers have any problem as yet but we have two typists with diagnosed RSI. On a percentage basis, this would indicate that the major risk area is in the continuous, high volume keystroke occupations.

Hardware manufacturers have an obligation to keep their designs within reasonable limits, remembering that the human animal has not evolved in any measurable form for several thousand years.

My Cro-magnon ancestors had the same finger and wrist joints that I have. This may offend the highly technical but natural evolution cannot be speeded up to match technical advances. It would seem logical to me that technical advances must be kept within the capacity of Nature's ability to cope.

Mrs J.H., Lower Macdonald, NSW.

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slightest intention of discarding the BASF tapes on my shelf. If they haven't ruined or clogged the faithful old 7200A during its 2500+ hours, they're hardly likely to do so in the foreseeable future.

RSI: another viewpoint

To change the subject, RSI or repetitive strain injury has been the subject of considerable debate during the past year but I feel that the letter herewith, from Mrs J.H. of Lower Macdonald (via Wiseman's Ferry) NSW, adds an interesting dimension to what has been said.

If you haven't done so already, I suggest you read it now.

Quite fairly, I think, the writer points out that most of the opinions about RSI — its nature, cause and cure — have been expressed by males: doctors, managers, programmers, engineers, technicians, staff officers, technical writers and computer buffs. Few such people, she believes, have actually experienced the symptoms of RSI or are ever likely to.

The reason: they simply do not use keyboards in the manner of a professional, full-time touch typist. They may encounter postural problems but, having dealt with them, seem to think that they have dealt with RSI. I guess that I stand accused, along with the rest!

If Mrs J.H. is right — and her reasoning makes a lot of sense to me — the one EA correspondent who seems clearly to have picked the problem is Winston Muscio, in the September "Forum". B. Daniells mentions it but only in a context of other observations to do with posture, &c.

Mrs J.H. isn't impressed by the notion of supplementary wrist supports, presumably because of their possible interference with the fluidity of movement. Nor does she seem to be optimistic about typists being physically able to adapt to feather touch keyboards.

Could it be that the only real solution is to produce word processor keyboards with a touch more like that of traditional typewriters — deliberately designed to provide the optimum degree of "home key" support?

My use of the word "traditional" was quite intentional in that I gather, from conversation with another professional typist, that feather touch electric typewriters pose much the same RSI hazard as that of computer based word processors. When using either, she has to take the 10-minute break in every hour, obligatory in Government departments.

Maybe we need to be reminded that machines should be designed to serve people, not to frustrate them!

Something of that same thought is behind a brief letter from a Queensland reader, voicing objection to something that most will have noticed at one time or another, but tamely accepted: the confusing hotch-potch of controls on typical bedside clock radios.

Dear Sir,

The attached sheet is intended for your Editorial Consultant, who may be able to use it in "Forum". My only comment: "what a mess!" Surely the controls on clock radios could be simplified, if not actually standardised. Most old people must be flat out to discover, and remember, how to work them.

One other observation: Isn't it amazing how the quality of headphones has improved in the last few years — even the cheap ones?

H.S. (Bulimba, Qld).

To make his point, the writer encloses a sketch of the control arrangements on seven current model clock radios, although a tour of the stores would probably have yielded still more variations.

Those illustrated use a conglomeration of push-buttons, pads, slide switches and rotary switches, variously branded, with no two the same. All differ, in turn, from the one that adorns my own bedside table, or from those I've encountered from time to time in hotels and motels.

If they're confusing when you're awake and alert, they're doubly so when you're crawling into bed, without your glasses, already half asleep — or still semi-conscious in the pale light of dawn.

You have a point H.S. and you've made it, but one would have to be a supreme optimist to expect standardisation of a cut-priced product churned out by every second radio factory in Asia!

Your observation about the headphones is certainly valid, especially to anyone who is old enough to have been brought up on the old black bakelite magnetics. They were about as comfortable as a concrete pillow and as musical as an Edison phonograph!

By comparison, modern stereo dynamics — even the cheap ones — are better in every way except perhaps for resolving faint Morse Code signals.

Morse what?

Books & Literature

Electronic Manuals

A number of Japanese IC data manuals covering various types of integrated circuits are now available from Hi-Com Unitronics International Pty Ltd, 7 President Lane, Caringbah, NSW 2229. The following titles are available for $22.95 each:

The Transistor Manual; The Transistor Substitution Manual; The Interface IC Device Manual; The Diode Manual; The TTL IC Manual; The Microcomputer Peripheral LSI Manual; The A/D:D/A Converter IC Manual; The FET Manual; The Op Amp Manual (monolithic op amps).

Electromagnetic design for AC power equipment

Low Frequency Electromagnetic Design: by Michael P. Perry. Published by Marcel Dekker Inc, New York, 1985. Hard covers, 160 x 236mm, 243 pages, illustrated with diagrams and photographs. ISBN 0-8247-7453-1. Price $US59.50

This book is likely to have rather limited appeal, despite the fact that it is well researched and written. It presents formulae, explanations and data likely to be of use to engineers working in the field of power transmission or similar areas. It is not a student text with questions and worked examples and the subject treatment is rather more rigorous than a typical engineering degree student would require.

There are only four chapters, entitled Introduction, Series and Parallel Concentric Coils, Low Frequency Cables and Shielding, Torque and Braking in a Magnetic Field. In addition, there are four appendices, on Properties of Bessel functions, Integral Formulas for Bessel functions, Approximations for Bessel functions and on Surface Impedence.

For those people involved in relevant areas of the industry, it is likely to be a useful though expensive source of information not otherwise readily available. Our copy came direct from the publisher. (C.D.)

Programming the 8086 and 8088

Programming the 8086, 8088: by James W. Coffron. Published by Sybex of Berkeley, first edition 1983. Soft covers, 148 x 228mm, 311 pages, illustrated with diagrams. ISBN 0-89588-120-9. Recommended retail price $22.95

Although one might expect that a book about programming 16-bit micro-

Digital Electronics

Crash Course in Digital Technology: by Louis E. Frenzel, Jr. Second edition published 1984 by Howard W. Sams & Co. Inc. Soft covers, comb binding, 222 x 280mm, 198 pages, illustrated with diagrams and photographs. ISBN 0-672-21845-3. Recommended retail price $34.95

processors would be heavy going, this one is particularly easy to read. Beginning with an introduction to programming, this book examines flow charting, chip architecture, and then the various aspects of programming the 8086 and 8088. No prior knowledge of programming would be necessary.

The 8086/8 programming book deals with the devices strictly from the software point of view. Even though peripheral devices are described, along with suitable interface commands, we were not able to find any pin out diagrams. The book is clearly intended for use by people with a built-up development system, or something more sophisticated.

The last few chapters are dedicated mainly to program development for the IBM personal computer (which uses the 8088 microprocessor). An example program is suitable for transmitting the data held in the buffer to a printer via an RS-232 interface.

The full instruction set for the 8086/8 is given, along with comments and some examples. Ideally, the comments might have been more comprehensive. The chapter on the instruction set is more difficult to follow than the rest of the book.

Overall, this book might best be regarded as an assembler language programming guide for the IBM. It is generally readable and offers good explanations. Our copy was supplied by Dick Smith Electronics. (C.D.)

Here is a book intended as a standalone introduction to digital electronics. This is a rather ambitious objective — to provide a grounding in logic circuit analysis, design and troubleshooting, without any other reference material or tuition.

The text is arranged in an example/question format. A description of each concept is given, followed by a question (there are no answers at the back of the book). Each chapter has a self test, with answers given at the end of the chapter.

Topics such as binary counting and arithmetic, Boolean algebra, ASCII codes, IC families, flip-flops and gate types are dealt with. Explanations are easy to follow and sufficiently detailed for the intended readership.

For someone with little or no experience in digital circuits, this book would make interesting reading, as well as providing a lot of useful information. Our review copy came from Jaycar Electronics. (C.D.)

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THE USER'S GUIDE TO APPLE. The editors of *Consumer Guide* have compiled a thorough introduction to the Apple IIe and II Plus computers, software and peripherals. With colour illustrations and a clearly written text, this reference will guide the newcomer through all phases of learning how to use the computer: From setting the system up, learning what each key does, expanding the system with peripherals, to buying new software. Specific exercises are included for each of the keys. Spiral bound, 80pp. **H0061G** **$8.50**

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PROJECTS & CIRCUITS. If you like building electronic projects in your spare time, you can't afford to miss out on this exciting book of popular projects from *Electronics Australia*. Just look what's inside! **Audio and Video Projects:** Video Amplifier for Computers and VCRs, Video Enhancer, Vocal Canceller, Stereo Simulator for Tuners and VCRs, Guitar Booster for Stereo Amplifiers. **Automotive Projects:** Transistor-assisted Ingition System, Breath Tester, Low Fuel Indicator, Speed Sentry, Audible Turn Indicator. **Mains Power Control Projects:** Musicolor, Photographic Timer, Driveway Sentry, Touch-lamp Dimmer. **Power Supplies and Test Equipment:** Battery Saver for Personal Portables, Dual Tracking ±22V Power Supply, 3 1/2-Digit LCD Capacitance Meter, In-Circuit Transistor Tester. **Plus EA's 10-year project index.** **C0069A** **$4.50**

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THE BEST APPLE SOFTWARE. The editors of *Consumer Guide* have compiled comprehensive reviews of Apple II, II Plus and IIe programs based on ratings by user groups; further evaluation is given by the editors and Apple software expert Roe Adams. Each program has been rated for ease of use, clarity of written and on-screen instructions, and overall performance. The program's price, publisher, format and hardware requirements are also included. The reviews are presented in sets by topic: Word Processing, Business, Home, Education, Networking, Strategy Games, Arcade Games and Programming Aids. Spiral bound, 160pp. **K0060G** **$8.50**

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New Products...

Product reviews, releases & services

Digital multimeter checks transistors and capacitors

Jaycar has recently added the Metex digital multimeter to its range of test equipment. It is aimed at the low-price portable DMM market, although it has some handy features not found in most other instruments in the same price bracket.

These days, nearly all test equipment submitted for review in *Electronics Australia* is well up to standard. The Metex 3530 is a typical case. Priced at $129, it is within the reach of most hobbyists and has a performance which would easily meet their needs.

The 3530 is a manually adjusted 31-range instrument. The 10A DC current range is selected by inserting the test lead into a separate socket: this is virtually standard for DMMs. The remaining 30 ranges are selected by positioning the front panel rotary switch.

Operation of the switch is firm and positive — it sits cleanly in the detents. It does, however, lack the solid feel of more expensive instruments. The multi-coloured front panel artwork is particularly good and indicates clearly which mode and range have been selected.

A feature which we wholly approve of is the separate On/Off switch. This is much more convenient than including an Off position for the rotary switch.

The unusual features of the 3530 DMM are the capacitor and transistor testing facilities. There are five ranges of capacitance, from 2000pF to 20μF The capacitor under test is inserted into special sockets on the front panel — it is not necessary to use the test leads.

The capacitance ranges must be manually zeroed using a small knob on the front panel. Although the zeroing is quite easy to perform, it is necessary to readjust when changing ranges.

Accuracy of the capacitance ranges appears to be quite acceptable. The readings corresponded closely to those on our workshop capacitance tester.

By setting the rotary switch to "hfe", transistors can be tested by means of a special socket, again on the front panel. This socket is arranged in PNP and NPN halves, each having the format E B C E.

The socket is circular, but not entirely compatible with the pin configuration. For most PNP transistors, the pin layout is correct. For most NPNs, the base pin is offset the wrong way.

The low resistance range (diode test) also incorporates a continuity tester. This has audible and visible indicators. It's as good as any continuity tester we've seen on a DMM.

One particularly impressive feature of the 3530 is the fuse. This is accessible through the battery compartment, which is a much better arrangement than having to remove the back panel as with some instruments.

With respect to general accuracy, we found the 3530 to be within the claimed range of ±0.5%. Using a 10.00V standard, a value of 10.02V was indicated.

The operating manual seems to be clear and easy to follow. It is quite up to standard for this type of instrument.

Supplied with the instrument are test leads and a protective carry box. The test leads are flexible and of sufficient length. The protective box can be closed completely, with the front cover clipping shut.

In practice, though, a protective cover is generally a hindrance and is eventually discarded, irrespective of its protective value.

Overall the Metex 3530 is a useful test instrument for the hobbyist or serviceman. For further information contact Jaycar Electronics, 115-117 Parramatta Road (PO Box 185), Concord 2137. Telephone (02) 747 2022. (C.D.)

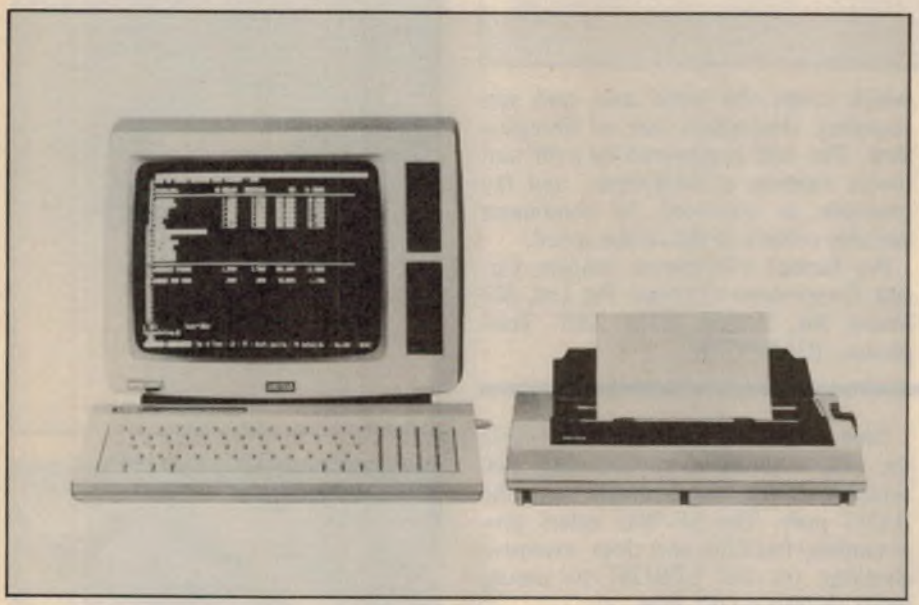
Multimeter works in the dark

A novel low-power fluorescent strip backlighting option in Philips' new extended four-digit PM 2518X hand-held digital multimetre enables the LCD to be read in low-light conditions, such as aircraft cockpits or behind instrument racks, yet gives 10 times the battery life of equivalent LED instruments.

The PM 2518X provides comprehensive bench-top specifications, including 0.1% accuracy, in a compact and highly portable package. The new multimeter offers DC voltage and current ranges, true RMS AC voltage and current, and resistance measurements. In addition, dB measurements, diode voltage drop, audible continuity testing and temperature measuring facilities are included. A simple zero-set facility permits direct reading of tolerances and variations on all ranges.

Measurements are possible for voltages up to 1000V DC or 600V RMS AC with a maximum resolution of 100μV; current, both AC and DC, up to 20A with a maximum resolution of 10μA; and resistance up to 100MΩ with a maximum resolution of 100mΩ.

For further information contact: Philips Scientific & Industrial, 25-27 Paul St, North Ryde 2113. Phone: (02) 888-0403



New personal computer from Amstrad

Amstrad's new PCW 8256 computer comes with 256K of RAM and the CP/M Plus operating system which allows access to over 5,000 commercial applications programs including spreadsheets, databases and communications. It also comes complete with a variety of extra programs including Dr Logo and the GSX Graphics Extension.

The computer has a high resolution green screen monitor, an 82-key keyboard and a built-in disc drive operating on 3-inch disks. Price is under $1500, including the printer which has letter or draft quality modes.

For further information or demonstration contact AWA-Thorn, PO Box 11, Rydalmere 2116. Telephone: (02) 638-8444.

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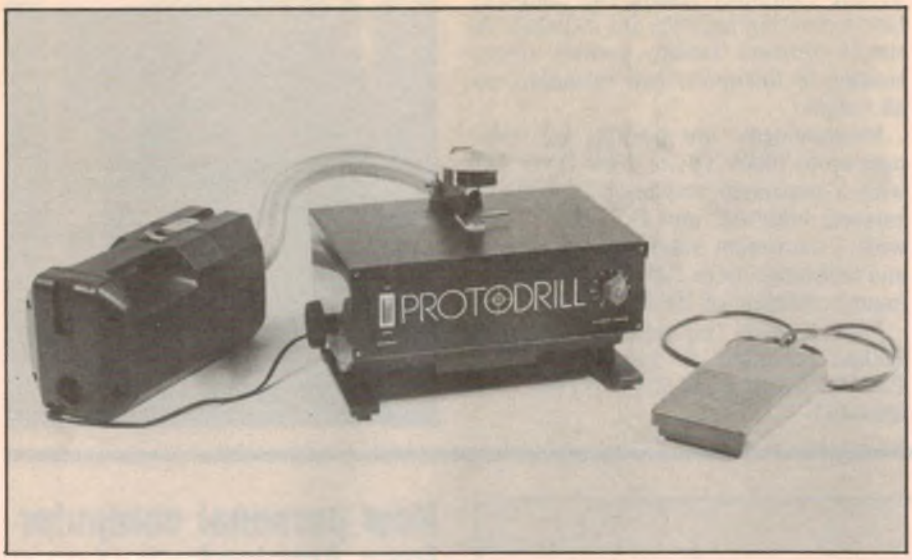

Table top drill for short run PCB production

Amden have released a new table top drill for short-run printed circuit board production and prototyping in-house.

The drill is easy and clean to operate. It features an adjustable, tilting worktable which is footswitch activated, and it has a dust absorbing vacuum system which keeps the work area and surrounding atmosphere free of fibreglass dust. The unit is powered by a 90 watt motor running at 30,000rpm, and the precision is enhanced by continuous variable control of the stroke speed.

For further information contact: Circuit Components (A'Asia) Pty Ltd, 383 Forest Rd, Bexley, NSW 2207. Telephone: (02) 59-3720.

Portable EPROM/EEPROM programmer

The SE-4942 is a fully portable programmer that fits easily into a briefcase. Weighing only 1.8 kg and having a wide operating voltage range from 85 to 249 volts AC makes this unit ideal for field service.

Nine standard transfer formats enable the user to down or up-load data. Full remote control is available via the RS232 port. The SE-4942 offers programming facilities and does extensive checking on the EPROM to ensure faulty devices do not pass.

For more information contact Alfatron Pty Ltd, 1761 Ferntree Gully Rd, Ferntree Gully, Victoria 3156. Telephone: (03) 758-9000.

Scanning receiver

Recently released by Dick Smith Electronics Pty Ltd, the HX 2000 AM/FM programmable hand-held scanning receiver covers seven frequency bands and boasts 20 channel memories, a liquid crystal display, and automatic search and scanning controls. The unit is supplied complete with a small whip antenna.

For further information contact Dick Smith Electronics Pty Ltd, PO Box 321, North Ryde, NSW 2113. Telephone: (02) 888-3200.

Personal alarm for mugging deterrent

The Electro-Guard Personal Alarm from ACS Systems is a pocket-sized unit which doubles as a convenient torch. Pressing a button causes it to emit a piercing alarm sound. It can also be used as a simple door alarm or window alarm to guard against intruders. It is priced at $9.95.

For further information contact ACS Systems, 109 Alexander Street, Crows Nest 2065. Telephone: (02) 437-6206.

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We're talking about the exciting new David Tilbrook designed speaker kit which uses VIFA's high performance drivers from Denmark. His 2-way, digital-ready 100 Watt capable masterpiece. The name Tilbrook is synonymous with brilliant design and performance characteristics and this new system keeps the legend alive and well. The magazine 'The Australian Electronics Monthly' – where David is Project Manager – published full details of the design in their August issue. Already there has been considerable interest and many speakers have now been built with superb results.

You'll save around $800 when you hear what you get from this system when compared to something you buy off the shelf with similar characteristics. If you compare its performance to fully imported, high priced speakers from Mission, Heybrook, Monitor Audio, Bang & Olufsen and many others, you'll see that they too use these VIFA speakers.

This kit of 2-P21WO Polycone Woofers and 2-D25TG-55 Ferrofluid Cooled dome tweeters with Polymer Diaphragms, is available for $350. Cross-overs, cabinets and loudspeaker stands are also available.

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The Scan Speak 200 Kit offers you the opportunity to build and enjoy a speaker system which produces magnificent results over the entire sonic spectrum – at a price which would be trebled, or more, in ready-made speakers.

The key to performance lies in the components used. Both the woofer (180mm) and tweeter (19mm) are manufactured in Denmark by Scan Speak – and are the same as those chosen by such world leaders as ProAc, Carlsson, Linn, and NAD – just to name a few.

Frequency Response is 50 to 20KHz ± 3db. Sensitivity (1mtr/1w) is 89db. Crossover Frequency is 3000Hz and Distortion on 2nd and 3rd harmonics 100 to 20KHz is less than 0.7%.

At around $800, the kit comes with complete technical data plus easy-to-follow instructions. All exposed cabinet areas are timber veneer. When assembled, each speaker measures 650 x 260 x 360mm.

For further details please contact the Sole Australian Distributor or your nearest dealer.

scan·speak

SCAN AUDIO Pty. Ltd.
PO Box 242, Hawthorn, Victoria 3122.
Telephone (03) 429 2199.

Dealers: Melbourne – Penny Lane Audio 259 9641, Diamond Hi-Fi 435 8400. Sydney – Dave Ryall Electronics 982 7500. Brisbane – Sound Centre 221 0821. Adelaide – The Sound Craftsmen 272 0341.

New Products...

Laser module with 10mW output power

By using an improved optical resonator and a higher quality mirror, Siemens have been able to boost the output power of their HeNe laser module to 10mW, making it a good choice for use in laser printers.

The specified 10mW output refers to the "end-of-life" condition, with life expectancy being 25,000 hours. All the HeNe laser tubes and modules from Siemens except the 25mW version feature coaxial design and integral mirrors, with output power ranging from 0.5mW upward.

The tubes are manufactured using glass to metal and ceramic-to-metal technology. For further information contact Siemens Ltd, 544 Church St, Richmond, Vic 3121. Telephone: Sydney (02) 436-8720.

Miniature air variable capacitors

The Murata-Erie Miniature MVM series of air-variable capacitors are suited to VHF, UHF, microwave military communications, navigation, fire control, and various RF applications.

The MVM has internal air meshing shells which are silver plated to provide conductivity and long life. The high density ceramic insulator is used between stator and mounting bushing and this construction contributes to the overall strength. A rubber gasketed threaded end cap effectively seals the unit against humidity and contamination.

The MVM series have a maximum working voltage of 250VDC and capacitance ranges from 0.8-10 pF to 1.0-20 pF.

For further information contact IRH Components, 32 Parramatta Road, Lidcombe 2141. Telephone: (02) 648-5455.

Business Brief

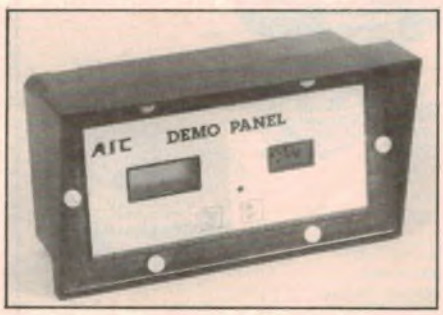
Data Cable Pty Ltd have moved. Their new address is 538 Mountain Highway, Bayswater, Victoria, 3153. The company has installed a toll-free number for interstate callers. This is 008 33 7463, while the normal telephone number is (03) 729 0044.

Weatherproof UV-resistant plastic enclosure

The Amalgamated Instrument company originally designed this weatherproof case for their range of swimming pool test equipment.

The main body of the unit is moulded from a plastic material called ASA which is highly UV resistant. The front is made from toughened acrylic which is also UV resistant.

The enclosure can be surface or panel mounted. Retail price is $22.50.



For further information contact Amalgamated Instrument Co Pty Ltd., PO Box 134, Terry Hills 2084. Telephone: (02) 450-1744.

Power amplifiers for 900 MHz cellular radios

Motorola has power amplifiers fc 900 MHz portable cellular radios. The are the MHW802-1 and the MHW802- which are rated at 2.2 watts outpu power and are intended for one wa portables. They proivide over 3dB re serve power to compensate for norma duplex filter losses. The amplifier oper ates at a supply voltage of 9.4V DC.

The MHW802 is packaged in a rugge housing designed to provide a self-con tained heat sink permitting safe opera tion of the module at case temperature up to 100°C.

Hitachi 40MHz digital storage scope

The Hitachi VC6041 features 40MH channel operation in conventional mod and in digital mode, a large memory ca pacity of 4000 words/channel in each c the inputs, data save and display memc ries and a horizontal axis resolution c 400 words/div with x100 magnification.

The dual save memories enable th display of newly stored and save memory comparisons and the curso functions display time and voltage infor mation on the LED and annunciatio panels.

Most of the features are selected by single pushbutton operation and th scope is backed by a two-year warranty

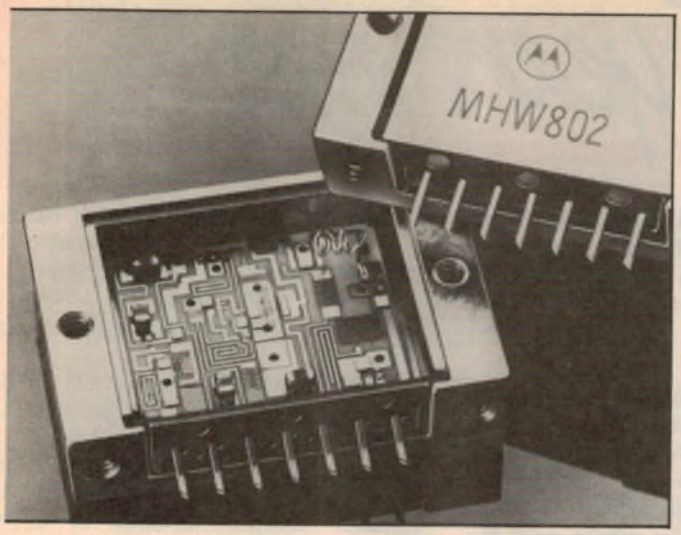
For further information contact IRH Components, 32 Parramatta Road, Lid combe 2141. Telephone: (02) 648-5455.

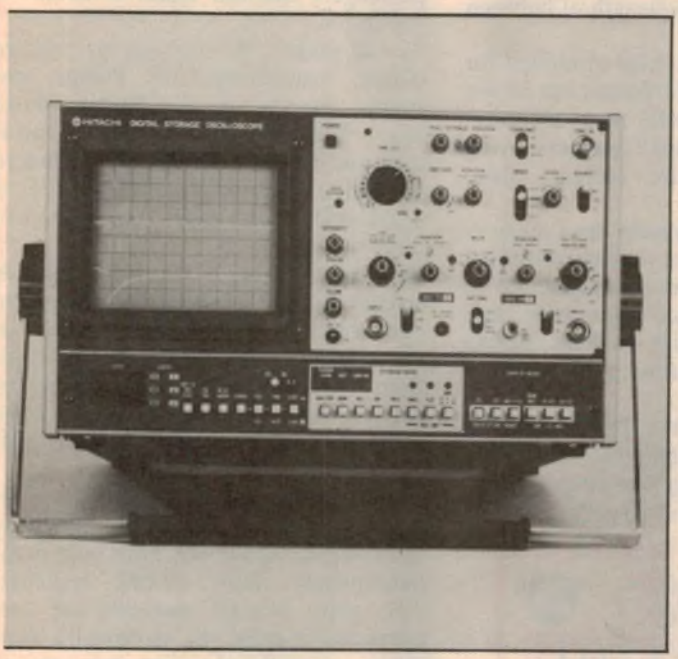
Modular work benches and cabinets

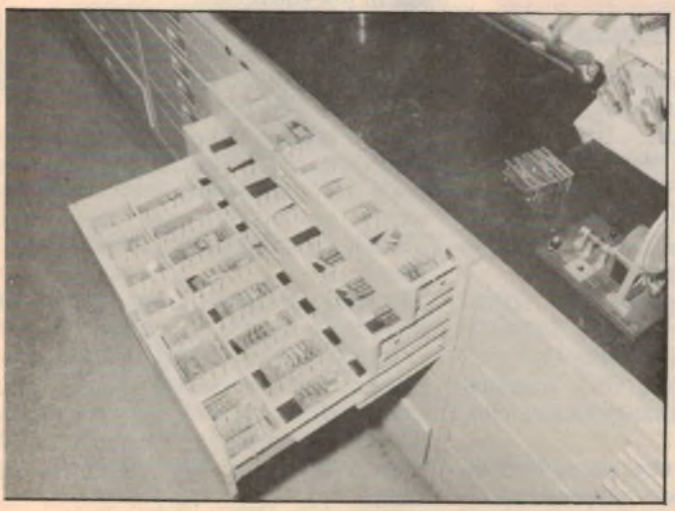
Lamson Engineering has extended it range of material handling products b acquiring full production and marketin activities for modular work benches an dense storage tool cabinets.

The modular work benches are avai able in a variety of standard sizes wit above bench shelf levels and belo bench cupboard and drawer units avai able as easy add-on equipment to matc individual requirements.

For further details contact: Lamso Engineering, 165 Rockwood Rd, Bank town 2200. Telephone: (02) 70-0381.







50 and 25 years ago...

"Electronics Australia" is one of the longest running technical publications in the world. We started as "Wireless Weekly" in August 1922 and became "Radio and Hobbies in Australia" in April 1939. The title was changed to "Radio, Television and Hobbies" in February 1955 and finally, to "Electronics Australia" in April 1965. Below we feature some items from past issues.

January 1936

Missed opportunities: most of the radio factories closed down right over the holiday season and missed untold business. Apparently a lot of suburban and country dealers managed to sell sets in far greater numbers than expected, and we had the unusual experience of answering phone calls from dealers making frantic inquiries as to where to obtain sets.

Car radio trends: with the advent of all steel car bodies, the roof type of antenna has had to be discarded in favour of various types of under-car antennas. As these antennas have proved to have considerably less pick up, more sensitive receivers have had to be designed. The latest have a sensitivity factor of a third to half a microvolt!

Windmill power: the International Radio Company of Sydney always seems to be adding something new to its line up. The latest is the Pioneer "Airflo" battery charger. In a nutshell, it is a battery charger generator driven entirely by a small windmill.

The job is a neat and compact unit which will charge batteries of six volts at up to five amperes., having a specially designed blade which takes the greatest possible power from even slight breezes.

Frequency modulation: there is little chance of stagnation in radio development. It was revealed by Major E.H. Armstrong at a recent meeting of the Institute of Radio Engineers in USA that he has been working on a system of frequency modulated transmissions. Major Armstrong will be remembered for his work in connection with early superheterodynes and super-regenerators.

He announced that for some months past he had been carrying out practical tests with a new transmitting technique, with which he established more consistent communication over a distance of 85 miles than did the 50kW broadcast stations, although the power used was only 2 kilowatts. The transmissions were in the ultra-short wavelength of between 7 and 8 metres.

Making radium: the value of radium for medical treatment is colossal, but so too is the price. As a result, many laboratories have their research workers trying to create inexpensive radium substitutes.

Considerable steps have been taken in the production of a radium substitute with the manufacture of a huge electron whirligig. This device does away with the need for very high voltages, having an acceleration chamber with a strong magnetic field.

TV in Hollywood: the Twentieth Century studies are opening the first Hollywood television stage, making it a memorial to the late Will Rogers.

January 1961

World's largest: a fantastic spider web covers an entire peninsular at the easternmost tip of Maine, USA. — 750 acres of bronze lace 800 feet and more above the ground. This is the antenna for the most powerful transmitting station ever built. Its purpose — to talk to submarines under water.

Ordinary radio signals cannot penetrate water. Until the new 2,000,000 watt station goes on air early this year, submarines must raise their antennas above the ocean surface to receive messages.

Boeing helicopter: a new era of helicopter transportation was ushered in recently with the first flight of the Boeing Vertol 107. The result of a completely new concept in helicopter design, the 107 is said to be the fastest, smoothest and most versatile helicopter flying today.

The twin rotor Boeing Vertol is the culmination of a four year program to produce the best configuration for a medium transport helicopter in the turbine era of the 1960s. Powered by two General Electric turbines of 2,300 horsepower, it can carry from 26 to 30 passengers and can cruise in excess of 155 m.p.h.

Car 45 player: the new car type record player, manufactured by Philips, was shown recently at the British Motor Show. It takes 45 r.p.m. records and is designed to play through any standard car radio. The makers claim that it is unaffected by bad roads, acceleration or braking.

New transformer: in the trend towards smaller and lighter electronic equipment one component, the transformer, has proved a stumbling block. The materials from which it is made are naturally heavy, while there is a limit to the miniaturisation possible without seriously degrading performance.

Serious attempts to replace the electromagnetic transformer are underway following the development of lead zirconate-titanate piezo electric ceramics. Two piezo electric elements are mechanically coupled. By electrically energizing one of the elements, it is possible to produce a strain and thereby a voltage in the other.

Sintered magnet: a stronger type of magnet has been obtained by sintering insulated magnetic flakes instead of the usual nickel-iron powders.

The magnetic flakes align themselves before pressing. This means there are fewer air gaps in the finished component. This in turn can double the amount of magnetism carried by the pressing.

Threshing machine: a novel type of threshing machine, or combine harvester, weighs only two thirds of a ton compared to the usual weight of three tons. It depends on the fact that the grain is threshed against a rubber roller filled with air instead of the usual threshing board.

LITTLE DICK'S SUMMER SIZZLERS

WIRELESS BURGLAR ALARM

Crime is on the increase! Your home, unit or office needs 'effective' security. And with DSE's Wireless Alarm System, you'll have total protection and enjoy peace of mind. This is a complete package. Included with the sophisticated Central Processor are a **passive infrared sensor** for whole room monitoring, **remote reed switch** for guarding entry/exit points and **personal remote control**. You can even extend the system by adding on more of these affordable peripherals shown below.

And because it's wireless there are no expensive installation costs. Just plug the Central Processor into the power point, connect the peripherals and set the alarm. As simple as that! It's like having a personal security guard — but without the cost. Cat L-5120

Extend your system by adding 'more' of these. . .

PERSONAL REMOTE CONTROL
Use to remotely turn the alarm on and off. Convient! Cat L-5124
$39.95

PASSIVE INFRARED SENSOR
Monitors whole rooms (covers 64sq.m.). Any movement is instantly transmitted to the CPU. Cat L-5122
$119

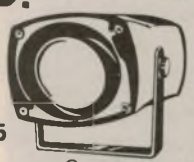
REMOTE REED SWITCH
Guards entry/exits. Any intrusion and the alarm sounds. Cat L-5126
$39.95

LOCAL AUDIO ALARMS

LARGE PIEZO ELECTRONIC
Compact but it delivers an earsplitting sound! Ideal for car, home or van alarms. Operates from 12V DC at 500mA; 110dB output at 1m. Cat L-7030
$24.95

REDUCED!

PIEZO ELECTRONIC ALARM
What a bargain! Amazing output for such a tiny unit! Suits most systems. Working voltage: 7.5-15 (200mA at 12V). Sound ouput: 110dB at 1 m. Frequency: 2800Hz.
~~$14.95~~
NOW $9.95



Cat L-7025

VALUE!!

REMOTE SWITCHED CAR ALARM

Stops thieves 'stealing off' with your valuable car! Hard to imagine that real protection could be so affordable — but DSE covers all the angles. Features boot and bonnet trigger, ignition cut-out, battery backup capability and more. Loud 110dB siren should scare off thieves instantly. Cat L-5096
$159

CAR COMMANDER

Tells you what's happening under the bonnet!

Incredible! Every family car can have the monitoring facilities of a Formula One racer with this inexpensive unit. An LCD displays the status of vital functions: oil pressure, RPM, voltage and water temp. Programmable RPM and water temp. alarm warns of impending problems. Built-in stopwatch too! Cat Y-3011
$84.95

BARGAIN!

B.093/MM

DICK SMITH ELECTRONICS PTY LTD

NOW AVAILABLE AT ALL 52 DSE STORES THROUGHOUT AUSTRALIA & PARTICIPATING RESELLERS.

Algernon:

a low cost robot for any 8-bit computer

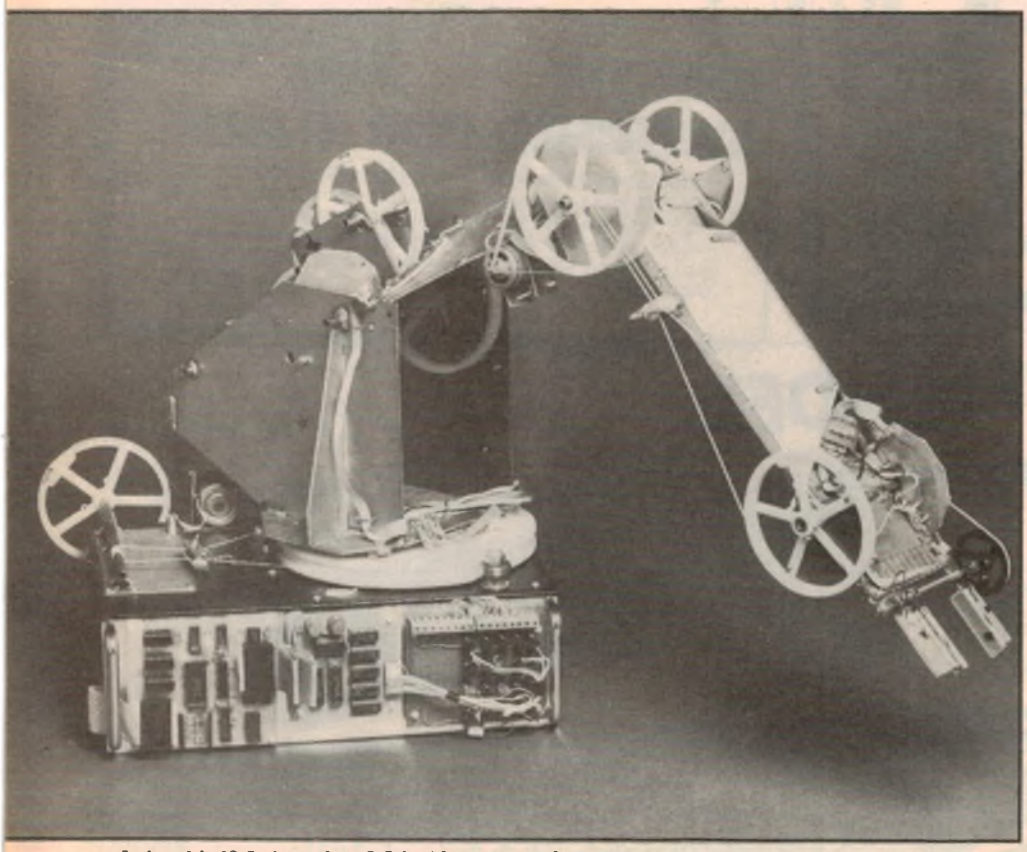
If you've always had a hankering to get involved in robotics but could never justify the expense, Jaycar's new robot kit is cheap enough to put you in the picture. This is a real do-it-yourself project with plenty of challenge for imaginative constructors and computer hackers.

by COLIN DAWSON

With powerful personal computers available to hobbyists, robotics is now a more practical hobby than ever. The only obstacle preventing hobbyists from developing a reasonably sophisticated system has been the cost of the robot itself.

Even quite elementary robot arms usually have a price tag with four figures. At $189 for the basic kit, Jaycar's new robot opens up the field for a lot of people on a low budget.

An unlikely combination of printed circuit board copper laminate, radio dial drives and pulleys, electric motors, rubber bands and other commonplace items, the new kit can be assembled into a versatile computer controlled robot arm. Its impressive "experimental" appearance is also a good talking point — it never fails to elicit an exclamation of "What's that thing?"



Is it a bird? Is it a plane? It's Algernon and you can have him for your very own.

In fact, we thought that the new robot had so much "character" that he, it (she?) ought to be christened. We cast about for a monniker suitable for such a personage and came up with "Algernon". Yup. Algernon. He is quite a capable fellow and can be controlled by a Microbee or ultimately, any eight-bit computer.

Algernon compares well with other robot arms in terms of movement and freedom: it has separately controllable waist, shoulder, elbow, wrist and grippers, 270 degrees of rotation (at the waist), position sensors for all of its (his?) joints and pressure type limit switches for the fingers. Its only real limitation is that the wrist does not rotate.

The basic kit contains all of the parts needed for the arm assembly, including motors and position sensors. Not included are the motor control board and the computer interface board, both of which are available as separate kits. The interface board is suitable for use with the parallel ports of the Microbee but could be adapted to any 8-bit parallel computer port.

Two manuals are supplied with the basic kit. One contains the mechanical

details and the other is the construction manual. Both are illustrated — the mechanical details manual also has PCB artworks for the arm assembly.

Most of the rigid structure for the robot arm is copper clad phenolic board — the raw material of printed circuit boards. Certainly, this is an unusual application for the PCB, but it actually works very well. The phenolic board provides a strong and lightweight backbone for the robot, while the copper cladding makes it easy to solder joined pieces together.

Phenolic board is also very cheap, which has been a major factor in keeping the cost of the kit low.

The robot is powered by five permanent magnet DC motors. These are used to actuate the waist, shoulder, elbow, wrist and gripper. Each motor has a rated current drain of 1A.

They could all be operated simultaneously if your robot control program is sufficiently comprehensive but a simpler program would operate each motor in sequence, thereby keeping the total current drain to a reasonable figure.

Drive is transmitted from the motors to the various knuckle joints of the arm through a system of quite large diameter pulleys. These were originally intended for use in radio dial drives and vary in size from 42mm to 112mm and are driven by nylon cords and rubber bands. Yep. It sounds a bit Heath Robinson-ish but it works!

To limit the amount of free play in the system, all of the longer drive cords have tensioners operating on them. This prevents jerkiness in operation and permits the operator to position the arm more accurately. However, the arm will still flex a little and the maximum practical load would be around 200 to 300 grams.

The position sensors for the waist, shoulder, elbow and wrist joints all have a resolution of one part in 192.

They each consist of an etched PCB disc carrying a matrix of eight diodes. The PCB pattern is arranged such that there are three concentric rings. The inner ring has eight pads, the second 64 and the outer 192 pads. A slide contact operating on each of the rings provides a unique code for each of the 192 positions.

The gripper sensor is a linear contact system with eight pads giving a position resolution of only one part in eight, but pressure limit switches on the grippers themselves compensate for their reduced resolution.

In preparing a control program, the range of positions can be equated to codes either by calculating all the possible codes or by "reading them in" from the sensor disc. This would necessitate setting up the computer port to read the disc ouput code whilst moving the joint through its full range of movements.

If the position codes are to be calculated, location of the slide contacts will be critical. For the alternative method, positioning of the contacts is not particularly important. Each position will correspond to some unique code — it does not matter what this code is.

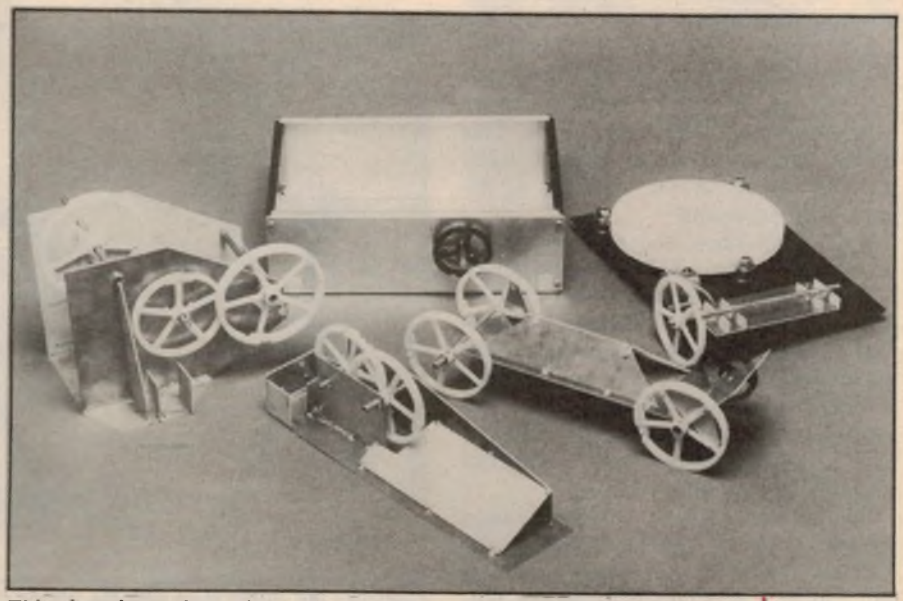
The interface board is designed so that each of the motors can be operated at two speeds, in forward or reverse. The lower speed is achieved by operating the motor with a pulsed waveform. The pulse duty cycle can be easily set by selecting RC components.

We understand that a microprocessor controller for the robot is under development. This would eliminate the need for a computer and allow the arm to be controlled by a simple array of switches.

There are two low speed circuits available, although the particular circuit to be used with each motor must be nominated during construction. When the motors are operated at maximum speed, the chopper circuit is bypassed.

Next month we will describe how Algernon is put together. By the looks of it, the only tools required will be a screwdriver and soldering iron.

Algernon consists of PCB laminate, dial drums, rubber bands and electric motors.



This view shows the various sub-assemblies, prior to final assembly.

Don't buy a new amplifier . . .

Build this CD Adaptor

Inexpensive and easy to build, this CD Adaptor will match your fancy new compact disc player to your stereo amplifier. All you need is a switch, a few resistors and four RCA sockets.

by COLIN DAWSON

Compact disc players have become enormously popular, with many people buying them for their convenience as much as for their sound quality. But beware! Your fancy new CD player might not be compatible with your amplifier.

While it is true that many amplifiers do not have the performance to take full advantage of a CD player's potential, this is not the main factor affecting compatibility. The problem is that the signal level from the CD player may exceed the maximum level permitted for the amplifier input.

Let's take a closer look at this. Prior to the advent of CD players, the auxiliary inputs on most amplifiers were rated at about 500mV sensitivity. This means that a signal of 500mV RMS must be fed in for the amplifier to deliver its rated output.

And that's where the problem comes in. Compact disc player manufacturers seem to have standardized on a 2V output level and this can overload the auxiliary inputs of some amplifiers. This particularly applies to low-cost amplifier systems where the volume control follows the tone control circuitry. The result is unpleasant distortion regardless of the volume control setting.

Where the volume control comes straight after the auxiliary input, the fact that the CD player signal is so high still causes a problem because the volume control has to be at such a low setting for normal listening levels. At such low settings the volume control will probably have very poor channel balance, as well as being quite "savage" in action. Fortunately, there is a simple cure.

The circuit

Basically, all that is needed is a resistive attenuator between the CD player and the amplifier. In this instance, we've taken the concept a little further by devising a switchable attenuator. The circuit is shown in Fig.1.

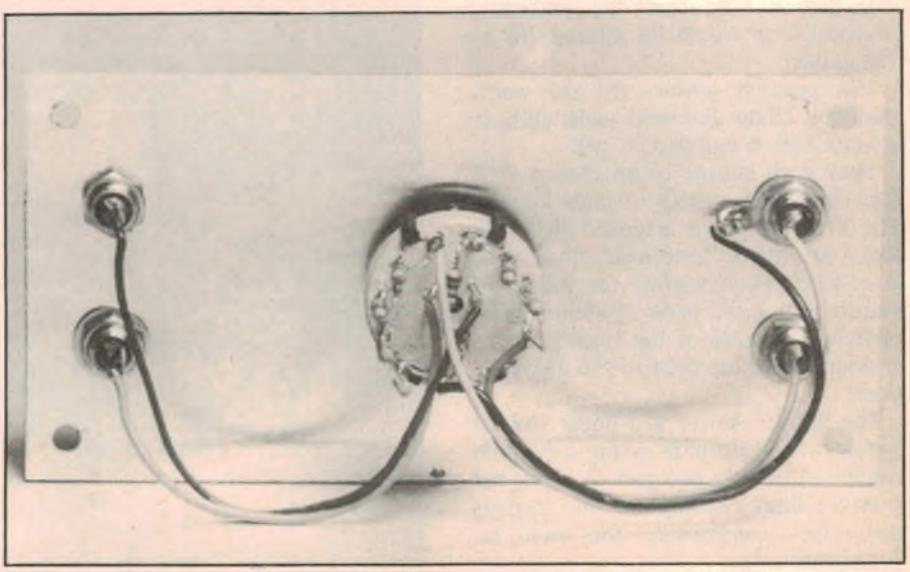
As shown, the output of our CD Adaptor is switchable between four levels. In addition to the full 2V output, there are three levels of attenuation. These correspond to output levels of 1V, 600mV and 300mV respectively.

While much the same result could be achieved using only a dual gang potentiometer, the matching between the tracks on most pots is not up to standard. In addition, there is always the risk that the pot will become noisy.

The use of a switchable attenuator makes this a virtually universal circuit. It can be used to match a CD player to almost any amplifier without any component changes.

Construction

Because the circuit is so simple, we have not bothered to design a printed



Compare this inside view with the wiring diagram at far right.

The circuit is built into a low-cost plastic case.

PARTS LIST

1 3-pole 4-position rotary switch
1 plastic project box, 130 x 67 x 40mm
4 panel-mounting RCA sockets (2 red, 2 black)
1 Scotchcal artwork (optional)
5 80mm lengths insulated hook-up wire

Resistors (0.25W, 5%)
2 x 4.7kΩ, 2 x 2.2kΩ, 4 x 1.5kΩ

circuit board. All of the resistors are mounted on the back of the switch as shown in the wiring diagram (Fig.2).

The prototype was mounted in a plastic project box measuring 130 x 67 x 40mm. Use the type with an aluminium lid as this can be used for the circuit earth. In addition to the rotary switch, the only other components required are the input and output RCA sockets.

Most of the constructional details can be gleaned from the photographs and the wiring diagram. Note that the resistors should be mounted close to the switch terminals so that they will clear the bottom of the box.

Artwork for the front panel is reproduced actual size with this article and can be used as a drilling template for the front panel. A self-adhesive label made from photosensitive aluminium (Scotchcal) could also be used if available.

Although the lid of the box serves as the signal earth, the attenuator circuit also needs an earth. We made this connection via an earth lug attached to one of the input sockets. Use light-duty hook-up wire to complete the wiring connections between the switches and the sockets.

Testing

To test the circuit, connect the outputs from your CD player to the CD Adaptor inputs. The output terminals of the CD Adaptor go to the amplifier auxiliary inputs. Switch on and check that the audio level shifts dramatically each time you alter the switch setting.

The correct switch setting can easily be found by trial and error. All you have to do is switch the level back until the signal is free of obvious distortion. At the same time, the audio level from the amplifier should be about the same as for other signal sources (volume control kept constant).

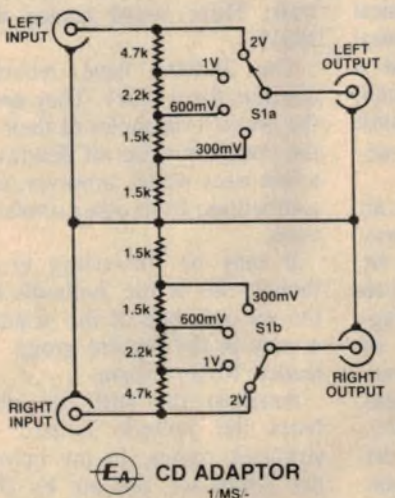


Fig.1: here is the full circuit diagram.

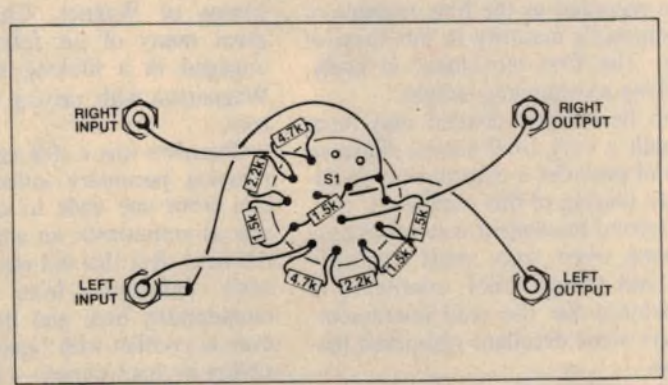


Fig.2: construction is easy — just follow this simple wiring diagram.

REVIEWS OF RECENT
Records & Tapes
CLASSICAL • POPULAR • SPECIAL INTEREST

MOZART

Quartet for Oboe, Violin, Viola and Cello. Divertiment: for Oboe, Cor Anglais, Two Horns, Double Bass and String Quartet. Heinz Hollinger (oboe), Hermann Baumann (horn), and the Orlando String Quartet. Philips digital disc 412 618/1.

In the Oboe Quartet the oboe takes the place of the first violin, the other instruments — second violin, viola and cello — make up the four. This gives the oboe prominence, even dominance in the score, a responsibility Heinz Hollinger assumes with graceful virtuosity.

After composing 15 quartets Mozart abandoned this form for 10 years except for four works for strings and flute and the oboe quartet under review. It may well be regarded as the first example of the composer's maturity in this form of writing. The first movement is lively, the scoring a continuing delight.

It can be roughly divided into three parts with a very brief silence between them and provides a constant joy in listening to playing of this perfection.

The second movement consists mainly of a long oboe solo, most elegantly played and though brief, continuing a little cadenza for the solo instrument. There are some excellent whispered pianissimos.

The finale is a jolly 6/8 rondo played with the nicest imaginable sense of rhythm unruffled by a sudden break into 4/4 time for a moment or two. Here again the oboe's virtuosity is gallant but never flashy. It contains a lovely long serious melody in a pensive mood and I found the whole disc a total delight.

The Divertimento written to celebrate his well-loved sister Nannerl's birthday, is a suite of seven short pieces each for a different combination of instruments — oboe, cor anglais, two horns, double bass and string quartet and is a continuing wonder of originality. In this work the oboe is less prominent than in the quartet but is none the less always in evidence. Everything so affectionate that it warms the hearts of listeners.

The suite is played throughout with complete accuracy, perfect intonation, peerless coordination and unanimously subtle phrasing and inflections. This abiding pleasure is also light-hearted, described in the sleeve notes as social music, an opinion this reviewer endorses. Everything shines with the innocence of genius. (J.R.)

CHAUSSON

Concert for violin, piano and string quartet. Itzak Perlman (violin), Jorge Bolet (piano), Juillard Quartet. CBS Masterworks Digital Disc D37814.

There's a great meeting of talents in this fine recording. Chausson was working in France towards the end of the 19th century when the whole musical world was influenced by the musical genius of Wagner. Chausson, and a great many of his fellow-countrymen, engaged in a lifelong struggle against Wagnerism with varying records of success.

Chausson was a rich amateur with no pressing pecuniary influences to sway him from one style to another but he was as enthusiastic an anti-Wagnerist as the next. But this did not prevent Wagner's influence from creeping in momentarily here and there; not however in conflict with typical French sensibility in this Concert — not Concerto.

The delightful scoring has all the transparency of the French school. There are many sudden changes of key which, however, do not, in the first movement, disguise the influence of Cesar Franck, himself influenced by Wagnerism.

The busy piano is always nicely balanced against the other instruments. A grave-voiced cello adds to the charm. The music is always fresh despite an occasional intrusion of memory. The brief second movement is a swooping waltz, all very easy on the ear.

The third movement is funereal but shows no great profundity. It is characterised by the complete ease of the players. Here is a case of Chausson challenging Fafner with a quill. The Finale consists of a set of Variations on a syncopated theme. The engineering is most lifelike and the cooperation of the players of the highest sensitivity.

The form is cyclic, everything is vigorously musical and the scoring of beguiling clarity. To sum up the "concert" is more in the manner of a sextet than anything else and the composer's conflicts of style developed ultimately into the delights of Debussy and Ravel and other charmers. If your enthusiasm for French music about the turn of the century is strong this is certainly for you. (J.R.)

BARTOK

The Six String quartets played by the Juillard Quartet. CBS Masterworks Portrait. Three boxed analog discs. M3P 39817.

The Juillard have recorded these quartets three times. They are probably the greatest examples of their kind since the posthumous set of Beethoven's. It is a fine issue which, however, faces tough competition from other similar combinations.

It may be interesting to note that though this is the Juillard's first go at the set only one of the original players is now in the present group. He is the leader, Robert Mann.

Amongst the stiff competition that faces the present Juillard issue the strongest comes, in my opinion, from the Tokyo set, put out by DGG some four or five years ago. I still have it and play it alongside the Juillard.

Despite the many merits of the latter I favour ever so slightly the Tokyo issue. The edge, however, is the slightest imaginable and is based on detail — and occasional at that — only. The playing of the Juillard may be described at the least as illustrious despite a tendency to a slightly too wide a vibration sometimes in the leader's tone.

When we come to the sound the Tokyo's has a slightly wider dynamic than the Juillard's and they seem to me to apply just a little more passion, not noticeable, however, until you know the works really well — no easy task. But the Juillard wins No. 3 hands down.

Detailed examination of both these examples of the recording leaves one with nothing but admiration for both the Juillard and Tokyo sets, though I must repeat here that my preference goes ever so slightly to the latter. But do not let this sway you. Either set is of the highest standard and would make a valuable addition to any music library. A pity some of the discs are not available separately. Juillard's is in a boxed set.

The present issue is a re-engineered set of the original 1949 mono issue but you will be surprised at the quality of the sound. (J.R.)

STRAUSS

Ein Heldenleben (A Hero's Life) Tone Poem. The Cleveland Orchestra conducted by Vladimir Ashkenazy. Decca Digital Disc 414 292.

Ein Heldenleben (A Hero's Life) is just what the title indicates — the life of a noble fellow, in this case the composer.

In this monstrous autobiography we have him as a swaggering youth, fighting off spiteful critics, going into battle, making love and settling down in peace. There is no question of his death, for this Strauss would probably have us go to his Death and Transfiguration which also has a noble ascension to somewhere or other at the end.

But all this is not to undertake it as music. It has great moments and is vividly graphic, especially in the haunting love music with its alternative chattering and eroticism in which Strauss leaves nothing to the imagination and much to the memory.

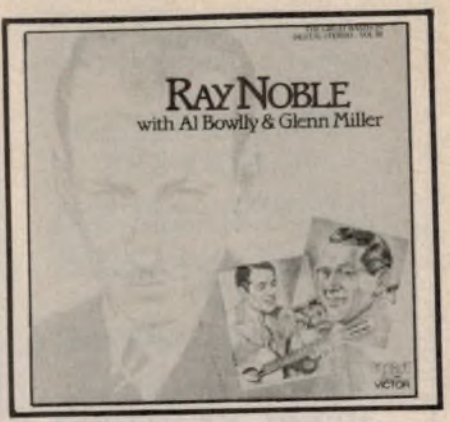
The work despite its many merits is one of the least often recorded of the Strauss poems. Its faults must be weighed against its virtues — the autobiographical bombast and vulgarity of the battle music against — I must repeat it — the beauty of the love music. In this last the very difficult solo violin part is admirably played by Daniel Majesky.

The music follows on from there so beguilingly that one is happy to delay as long as possible the vulgar battle music that follows. In this the hero plunges radiantly into combat, lays about him lustily and, of course, emerges scatheless and victorious.

This egocentricity precedes the hero's earlier victories, signified by quotations from his earlier works. Peace, pipes its joys and contentment with Ashkenazy doing full justice to every bar in the splendidly scored piece. It is a brilliant reading in which he controls everything with complete understanding. Strauss fans of all but the most selective kind will adore it. (J.R.)

BIG BAND RE-MASTERED

Ray Noble with Al Bowlly & Glen Miller. The Great Bands in Digital Stereo — Vol III. Simulated stereo LP, RCA Victor VPLI-0465.



Here is yet another in the recent series of albums compiled from original 78s, reprocessed by recording engineer Robert Parker. (See E.A. Sept. '84 p20).

Whereas earlier recordings in the series have been mainly orchestral — big band and jazz — this one has vocalist Al Bowlly up front in most of the tracks singing hits of the '30s. Also on hand is the vocal group the Freshmen. As such, the album will probably have a nostalgic appeal to a wider audience.

Glen Miller, who had helped form the band, played trombone for Ray Noble and assisted with the arrangements, before ultimately forming his own highly successful orchestra.

And Al Bowlly? Who else, asks Ron

Records & Tapes

Wills the producer of the record, can claim to have made over a thousand different records — in a space of 13 years?

To modern ears, Al Bowlly might have less appeal than vocalists such as Bing Crosby, Frank Sinatra or Perry Como but he certainly wowed them in the '30s!

There are 16 tracks on the album, with Al Bowlly's hit songs include: A Little White Gardenia, Top Hat, Lazy River, Red Sails in the Sunset, You and the Night and Music, and many more. Non-vocal tracks are: Bugle Call Rag, Way Down Yonder in New Orleans, and Dinah.

As we've come to expect, Robert Parker's re-mastering has again transformed noisy, acoustically dead, mono 78rpm recordings to virtually noise-free, discreetly simulated stereo with ambience, undoubtedly getting much closer to the true sound of the original performance.

If you have an interest in musicians and music of the '20s and '30s, I doubt that you will hear them to better advantage than in this series of discs — including the present one. (W.N.W.)

THEATRE ORGAN

Five Alive, Premiere Recording on the Capri Theatre Pipe organ, Goodwood S.A. Digitally mastered stereo LP, Digipipe WB-1001. [From "Five Alive", TOSA (S.A. Div.), GPO Box 595, Adelaide 5001]

This new recording is certainly "alive" with interest for Australian fans of the theatre pipe organ but, in terms of organ sound, it is best regarded as an indication of what's in store for the future.

The intriguing story behind the Capri organ is summarised on the jacket but was related at greater length in the brochure issued for the inaugural concert in April '83.

Originally installed in the Brisbane Wintergarden theatre in 1923 as a 2-manual 7-rank Wurlitzer, it was transferred to the Sydney Plaza and enlarged in 1940. Dismantled in the mid '50s, it was purchased by organist Penn Hughes and installed in his Sydney home, along with extra ranks from redundant instruments in Burwood NSW, Dunedin NZ, Southhampton UK and elsewhere.

The current 4-manual console was a surplus "slave" unit obtained from the State Theatre, Melbourne.

At about this stage in its evolution, the organ was purchased by an overly ambitious enthusiast from Darwin but subsequently found its way back to Adelaide as the property of the Theatre Organ Society of Australia (S.A. Div.), being installed in their own theatre — the Capri at Goodwood. As a 4/22 instrument, it is probably destined to be the largest and most valuable theatre organ ever installed in this country.

The recording features tracks by five highly regarded local organists: Tony Fenelon, Neil Jesen, John Atwell, David Johnston and Ray Thornley who, between them, offer over 52 minutes of the instrument.

Involving five different artists over a three month period, the presentation lacks a sense of occasion but the most serious limitation has to do with mic. placement and building acoustics. The bass is rather boomy, while low frequency ambient (air?) noise is much too high by modern standards.

As the inaugural recording of Australia's largest theatre pipe organ, it will have its own historic appeal but, overall, the sound quality can only be described as average. The recording is available from the address given above for $14 (incl. P&P) to anywhere in Australia or New Zealand. (W.N.W.)

CLASSICAL FLUTE

James Galway plays Schubert: Sonata for Flute & Piano in A minor, D821; Introduction & Variations on a theme from Dia Schone Mullerin, D802; Serenade, D957, With Phillip Moll, Piano, RCA digital stereo LP, VRLI-7486.

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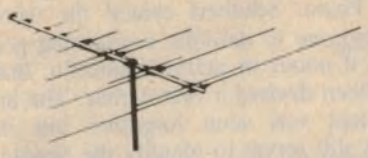

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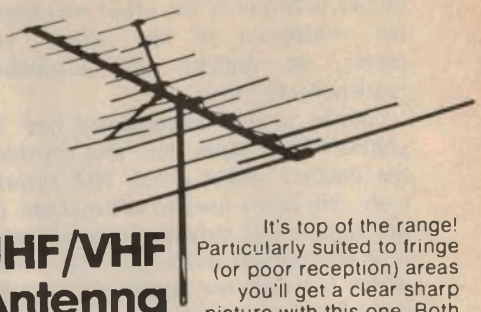

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B.097/JL

Records & Tapes

comes as an eloquent reminder of James Galway's alter ego. Maybe I should have put it the other way round but, whichever of his "alters" you prefer, he remains an outstanding musician/entertainer!

Galway is ably accompanied here by pianist Phillip Moll, who also provided the detailed jacket notes. Not surprisingly, his notes tend to concentrate on the genesis and structure of the works, with appropriate references to the composer, but with not as much as a mention of Galway or himself.

As Moll points out, Schubert had a short and productive life (1797-1828) but certainly not a merry one. He had no talent for dealing with publishers and little empathy with the Viennese musical establishment.

He relied on friends and supporters for his meagre income and introduced many of his works at "Schubertiads" — evenings with a few musicians and music lovers who "had grown devoted to the good-hearted little man with his seemingly inexhaustible outpouring of inspired melody."

The D821 Sonata on side 1 was written in 1824 as a Sonata for Arpeggione and Piano. Schubert coined the word Arpeggione to describe a six-string guitarre d'amour or guitar-violincello, that had been devised a year earlier. The instrument was soon forgotten but its name still serves to identify the Sonata, ultimately published in 1871, and commonly performed since then on various instruments of the string family or, in this case, on flute. It comprises three movements: Allegro Moderato, Adagio and Allegretto.

The Introduction and Variations on side 2 was also written in 1824, again arising from an interest shared with a small circle of friends, including flautist Ferdinand Bogner. As finally published in 1851, the work comprises an introduction, the theme and seven variations, summarised in Moll's jacket notes.

Whether or not you are familiar with the major works, you will certainly recognise their final item, one of several songs written just before Schubert's death, and described by Moll as "the world's best loved serenade".

If the contents appeal, you need have no apprehension about the recording itself. "Mastered on Sony digital equipment in the CBS, London studios, it offers clean, well balanced sound, free of surface noise. A good one. (W.N.W.)

TRUMPET CONCERTOS

Trumpet Concertos, Ludwig Guttler, with the Neues; Bachisches Collegium musicum Leipzig and the Kammerorchestra Berlin, conducted by Max Pommer. Compact disc, Capriccio 10-009. [From P.C. Stereo Pty Ltd, PO Box 272, Mt Gravatt, Qld 4122, Phone (07) 343 1612]

This is a similar disc to one reviewed in the June issue (Capriccio 10-010) — another recital by Ludwig Guttler with essentially the same orchestra and conductor but playing compositions by Mozart, Molter, "Anonymus" (an unidentified contemporary) and Haydn.

On this present recording, the concertos are by Theodore Schwartzkopff, Franz Querfurth, Johann Hummel and, again "Anonymus" but provisionally identified here as Ernst von Sachsen Weimar.

Unfortunately, the notes supplied with this disc are in German only and will therefore be incomprehensible to most prospective purchasers. However, while somewhat frustrating, lack of notes need not compromise your enjoyment of this very listenable music.

For your guidance, Ludwig Guttler is a professor at the Academy of Music in Dresden, has travelled as soloist with the Bach Orchestra and the Berlin Chamber Orchestra and since 1969, has been resident trumpet soloist with the Dresden Philharmonic.

Tracks 1 to 5 carry the quite brief movements of Schwartzkopff's Overture in C-major for Trumpet, Strings and Basso Continuo (8'04"). This is followed on tracks 6-8 by Querfurth's 3-movement Concerto in C-sharp major, again for Trumpet, Strings and Basso Continuo (12'41").

Sachsen Weimar's (?) Concerto in C-major for Trumpet, Strings and Basso Continuo has 5 movements and a playing time of 6'57".

Consistent with the instruments of the baroque period in which they were written, the foregoing concertos are all pitched predominantly in the clarino (high) register.

The final and major work, Hummel's Concerto in E-major for trumpet and orchestra (3 movements, 16'11") was written after the development of Weidinger's new and much improved trumpet with its extended range, particularly in the low register. As such, it provides a fitting climax to the recital.

Manufactured in Japan by Sanyo, the recording provides clean, noise-free sound and excellent balance between soloist and the supporting orchestra. As with its companion disc, it's one that will appeal to those partial to small or chamber groups and, of course, to anyone interested in solo orchestral trumpet. (W.N.W.)

A change in direction

Next month the format of our record reviews will change. We will be reviewing compact discs exclusively, in two broad categories, popular and classical.

This is in recognition of the rapid rise in popularity of compact discs and the renewed interest in recording quality on the part of audiophiles.

Our new reviewers, to be introduced next month, are especially well qualified to write on contemporary and classical music.

We thank Julian Russell and Neville Williams, our long-standing reviewers, for their valued contribution to these pages over a period of 25 years.

CD Player Directory

The following information was compiled from manufacturers' literature and with the help of most local distributors. It was correct at time of preparation but it is likely that some prices and specifications have changed since then. You should check prices and other information before making any purchase.

BRAND	MODEL	Loading system — Front/Top?	Frequency response: Hz-kHz ±0.5dB	Signal-to noise ratio @ 1kHz re 0dB	Channel separation @ 1kHz re 0dB	Total harmonic distortion % @ 1kHz @ 0dB	D-A conversion — bits	Oversampling?	Headphone output?	Fixed or Variable line output?	Remote control	Warranty — years	Dimensions mm (W x H x D)	Weight kg	Recommended retail price
ADC	CD-100X	Front	20-20	96	90	.004	16	No	No	Fixed	No	1	341 x 88 x 293	3.3	499.00
AIWA	DX-1200	Front	2-20	96	90	.003	16	Yes	Yes	Var.	No	3	330 x 71 x 298	5.8	899.00
AKAI	CD-A7	Front	5-20	90	85	.005	16	No	Yes	Fixed	IR	2	440 x 76 x 255	5.8	699.00
AKAI	CD-M88	Front	5-20	90	85	.005	16	No	Yes	Fixed	IR	2	350 x 72 x 255	5.3	699.00
B&O	CDX	Top	20-20	90	90	.004	14	Yes	No	Fixed	No	1			1500.00
CARVER	DTL-100	Front	5-20	96	86	0.05	16	Yes	No	Fixed	No	1	485 x 80 x 282		1590.00
dbx	DX-3	Front	20-20	96	90	.002	16	Yes	No	Var.	No		435 x 94 x 290	4.6	n.a.
DENON	DCD-1800	Front	5-20	96	94	.003	16		Yes	Fixed	No	2	464 x 110 x372	9.5	1079.00
DENON	DCD-1800R	Front	5-20	96	94	.003	16		Yes	Fixed	IR	2	464 x 110 x372	9.5	n.a.
DUAL	CD-130	Front	5-20	95	94	.003	16		Yes	Fixed	IR	3	435 x 110 x264		599.00
HITACHI	DA-800	Front	5-20	95	92	.003	16	No	Yes	Fixed	No	1	435 x 83 x 264	5.9	599.00
HITACHI	DA-501	Front	5-20	95	92	.003	16		Yes	Fixed	IR	1	435 x 88 x 264	4.3	699.00
JVC	XL-400	Front	5-20	96	90	.002	16	No	Yes	Fixed	IR	1	435 x 93 x 294	4.0	849.00
JVC	XL-200	Front	5-20	96	90	.002	16	No	Yes	Fixed	No	1	435 x 93 x 294	3.8	579.00
JVC	XL-V20	Front	5-20	96	90	.002	16	No	Yes	Fixed	No	1	340 x 80 x 294	3.4	579.00
KENWOOD	DP-1100/2	Front	2-20	95	90	.0015	16	No	Yes	Fixed	Yes	1	440 x 88 x 310	6.8	1390.00
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LUXMAN	D-405	Front	5-20	96	90	.003	16		Yes	Fixed	No	5	438 x 84 x 313	6.0	990.00
LUXMAN	D-03	Front	5-20	90	90	.004	16		Yes	Fixed	IR	5	453 x 90 x 360	8.1	1400.00
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NEC	CD-607	Front	5-20	90	70	.01	16	No		Fixed	No	1	430 x 90 x 320	9.8	699.00
ONKYO	DX-150	Front	10-20	96	90	.005	16	Yes	No	Fixed	No	5	435 x 92 x 350	5.0	649.00
ONKYO	DX-200	Front	2-20	96	93	.003	16	Yes	Yes	Var.	IR	5	435 x 102 x350	6.0	1199.00
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PIONEER	PD-5010	Front	2-20	96	93	.002	16	No	Yes	Fixed	No	1	420 x 91 x 320	4.7	599.00

PIONEER	P-DX500	Front	20-20	95	93	.0045	16	No	No	Fixed	No	1	360 x 98 x 260	4.6	
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REVOX	B-225	Front	20-20	90	90	.0005	14	Yes	Yes	Fixed	IR	1	450 x 109 x322	8.5	
SANSUI	PCV-1000	Front	5-20	96	90	.003	16	Yes	Yes	Fixed	IR	2	430 x 111 x297	8.6	1299.00
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TECHNICS	SLP-2	Front	4-20	96	100	.003	16	No	Yes	Fixed	IR	2	430 x 82 x 334	5.3	849.00
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YAMAHA	CD-X2	Front	5-20	95	90	.005	16	Yes	Yes	Fixed	No	5	340 x 92 x 290	3.6	499.00
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Guitar Bach — guitar, bass and drums
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Harpsichord concertos, BWV1052, 1057, 1064: Gustav Leonhardt, Anne Uittenbosch, Alan Curtis, harpsichords; Leonhardt Consort
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Harpsichord concertos, BWV1053-1056: Leonhardt Consort, Gustav Leonhardt cond. and harpsichord
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Harpsichord concertos: Igor Kipnis, harpsichord; Stuttgart Chamber Orch; Karl Munchinger cond.
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Harpsichord works, BWV915, 916, 989, 992
Capriccio 10.034

Historical Organ Concert at Waalse Kerk, Amsterdam: Praeludium in G minor, BWV568; Sonata in E minor; Praeludium et fuga in D major, BWV532; etc: Jacques van Oortmerssen. organ (Christian Muller 1772)
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Isaac Stern 60th Anniversary Concert — concerto in D minor for two violins and orch; plus — concerto in F major for three violins (Vivaldi); sinfonia concertante in E flat major (Mozart): Pinchas Zukerman, Itzhak Perlman, Isaac Stern, violins; New York Philharmonic, Zubin Mehta cond.
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Italian concerto in F BWV 971; prelude in A minor BWV992; fantasia and fugue in A minor BWV904; chromatic fantasia and fugue in D minor BWV903; chorale prelude Ich ruf zu dir, Herr Jesu Christ BWV639; chorale prelude Num komm der Heiden Heiland BWV659: Alfred Brendel
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Italian concerto, BWV971; fantasia BWV906; capriccio BWV992; chromatic fantasia and fugue, BWV903; four duets, BWV802-805: Tatyana Nikolayeva, piano
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Lute works, BWV996-1000
Capriccio 10.033

Magnificat BWV243; Jauchzet Gott in allen Landen BWV 51: Emma Kirkby; Nancy Argenta; Patrizia Kwella; Charles Brett; Anthony Rolfe-Johnson; David Thomas; English Baroque Soloists, John Eliot Gardiner cond.
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Magnificat in D major; also — German Magnificat in A minor (Hoffmann): Jane Bryden, soprano; Jullianne Baird, soprano; Jeffrey Gall, alto; Frank Hoffmeister, tenor; Bach Ensemble, original instruments, Joshua Rifkin cond.
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Motets BWV225-230: Rostock Motet Choir
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Motets Vol 2, BWV226, 228, 229, 230
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Orchestral suites No 1 and No 2: English Baroque Soloists, John Eliot Gardiner cond.
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Orchestral suites No 1-4, BWV1066-69: Festival Strings Lucerne, Rudolf Baumgartner cond.
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Capriccio 10.038

Organ works, BWV545, 552, 769: Trost organ at Altenburg
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Organ works, BWV565, 542, 572, 547
Capriccio 10.035

Orgelmeisterwerke: Toccato and fugue in D minor, BWV565; fugue in G minor BWV578; prelude and fugue, BWV544; etc: Helmuth Rilling, organ of Gedactniskirche, Stuttgart
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Peter Crossley is a man with considerably more than your average knowledge of high fidelity sound.

He is an electro-acoustics engineer with leading Australian consulting engineers Lobely, Treidel Davies & Partners.

Peter's job is designing and supervising the installation of audio visual systems for concert and convention centres. The futuristic Jupiters Casino on Broadbeach Island, Queensland, is his latest project.

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String quartet; plus — string quartet (Ravel); Orlando Quartet.
Philips (DDD) 411 050-2

Suite bergamasque; images (oubliees); pour le piano, Estampes; Zoltan Kocsis, piano.
Philips (DDD) 412 118-2

The Prodigal Son: Jessye Norman; Jose Carreras; Dietrich Fischer-Dieskau; Stuttgart Radio Symphony Orch and Chorus; Bertini cond.
Orfeo ORF 0012

Trois nocturnes; Jeux: Women's voices of the Collegium Musicum Amstelodamense.
Philips (AAD) 400 023-2

DEBUSSY/RAVEL
String quartets: Galimir Quartet.
Vanguard CD-25 009

DEL TREDICI, David
In Memory of a Summer Day: David Del Tredici.
WEA 79043-2

DELALANDE
Symphony pour les Soupers du Roy: Jean-Francois Paillard Chamber Orchestra; J-F Paillard cond.
Erato ECD-88 088

DELIUS
Miniatures: Bournemouth Sinfonietta; N del Mar cond.
Chandos CHAN-8372

Song of the High Hills: Walker; Lott; Johnson.
Unicorn DKP(CD) 9029

Summer Night on the River; On Hearing the First Cuckoo in Spring; etc; plus — The Wasps overture; Serenade to Music; etc (Vaughan-Williams).
Chandos CHAN-8330

Violin concerto; suite; legende; Ralph Holmes, violin; Royal Phil Orch; Vernon Handley cond.
Unicorn DKP(CD) 9040

DIABELLI
Sonata for Guitar in F major; plus — Guilianil Legnani; Paginini; Eduardo Fernandez, guitar.
Decca 414 160-2

DIETRICH
Violin concerto; plus — notturno (Joachim): Maile; Berlin Radio Symphony Orch; Lopez-Cobos cond.
Schwann SCH 11622

DONIZETTI
Don Pasquale — highlights: Gregor; Ivan Fisher.
Hungaraton HCD 12610-2

L'Elisir d'Amore — complete opera: Lucia Popp; Weikl; Nestorenkpo; Munich Radio Orch and Chorus; Wallberg cond.
Ariola-Eurodisc 610 097-233 (3CDs)

Lucia de Lammermoor: Sutherland; Milnes; Pavarotti; Ghiaurov, Royal Opera House Orchestra and Chorus; Richard Bonynge cond.
Decca (DH) 410 193-2

DUKAS
Ariane et Barbe-Bleue: soloists; Chorus of Radio France; New Philharmonic Orch; Armin Jordan cond.
Erato ECD-88 097 (2 CDs)

La Peri; Symphony in C: Orch de la Suisse Romande, Armin Jordan cond.
Erato ECD-88 0889

DURUFLE
Requiem; motets on Gregorian themes: Teresa Berganza; Jose van Dam; Ensemble Voc Audite Nova de Paris; Cologne Chorus and Orch; Corboz cond.
Erato ECD-88 132

DVORAK
Cello concerto in B minor, Op 104; plus — cello concerto Elgar; Heinrich Schiff, Concertgebouw Orch Amsterdam; Sir Colin Davis cond.
Philips (DDD) 412 880-2

Cello concerto in B minor; Waldsruhe for cello and orch: Frans Helmerson, cello; Gothenburg Symphony Orch; Neeme Jarvi cond.
BIS BIS CD-245

Cello concerto; plus — Kol Nidrei (Bruch); Lyn Harrell cello; Philharmonia Orchestra; Vladimir Ashkenazy cond.
Decca 410 144-2

Cello concerto; plus — Rococo variations (Tchaikovsky); Mstislav Rostropovich, cello; Berlin Philharmonic Orch; Herbert von Karajan cond.
DG (DDD) 413 819-2

Gypsy melodies and love songs: Peter Schreier, tenor.
Capriccio 10.053

Legends: Rochester Philharmonic Orch, David Zinman cond.
WEA 79066-2

Piano trio No 3, Op 65; Borodin Trio.
Chandos CHAN-8320

Piano quintets in A, Op 5 and 81; Sviatoslav Richter, piano; Borodin Quartet.
Philips (DDD) 412 429-2

Polanaise; plus — Vocalise Rachmaninoff; Malinconia Sibelius; Heinrich Schiff; Elisabeth Leonskaja.
Philips (DDD) 412 732-2

Requiem, Op 89; Benackova; Czech Phil Orch; Wolfgang Sawallisch cond.
Supraphon SUP CD7427/28 (2 CDs)

Rusalka — complete: Benackova Novak; Czech Phil orch, Neumann cond.
Supraphon Sup CD7201/3 (3CDs)

Serenade for strings in E; serenade for wind instruments in D minor; Chamber Orch of Europe; Alexander Schneider cond.
ASV COE 801

Serenade for strings, Op 22; plus — serenade, Op 48 (Tchaikovsky); Berlin Philharmonic Orch; Herbert von Karajan cond.
DG (DDD) 400 038-2

Serenade for winds, Op 44; plus — Petite Symphony (Gounod); Munich Wind Academy; Brezina cond.
Orfeo ORF C051

Serenade in E Op 22; serenade in D minor Op 44; Academy of St Martin-in-the-Fields; Neville Marriner cond.
Philips (DDD) 400 020-2

Serenade, Op 22; Nocturne, Op 40; waltzes: Prague Musici; Sagrestano cond.
Rodolphe RPC 32401

Serenade, Op 22; Waldsruhe, Op 68; Notturno, Op 40; Douglas Davis, cello; Los Angeles Chamber Orch.
Delos 3011

Slavonic dances, Op 46 and 72; Czech Phil Orch; Neumann cond.
Supraphon SUP CD7491

Slavonic dances, Op 46 and Op 72: American Suite; Royal Philharmonic Orch; Antal Dorati, cond.
Decca (DH2) 411 735-2

Slavonic dances; Slavonic rhapsodies: Czech Phil Orch; Vaclav Neumann cond.
Teldec 8.42 203

Stabat Mater, Op 58: Benackova; Wenkel; Dvorsky; Rootering; Czech Phil Orch; Wolfgang Sawallisch cond.
Supraphon SUP CD7378/79 (2 CDs)

String quartet No 10; plus — string quartet in E minor (Verdi); Vermeer Quartet.
Teldec 8.43 105

String quartet No 12 in F major 'American'; quintet in A major for piano and string quartet; Smetana Quartet; Josef Hala, piano.
Denon C37-7339

String quartet No 2: Turina String Quartet.
Bellaphon 690.01.032

String quartets No 10 in E flat major, Op 51; No 14 in A flat major, Op 105; Kocian Quartet.
Denon C37-7235

String quartets No 12 in F major, Op 96 'American'; No 13 in G major, Op 106; Kocian Quartet.
Denon C37-7234

String quartets No 2, Op 87, and 14, Op 105.
Bellaphon 690.01.018

Symphonies Nos 7 and 8; symphony No 9: Minnesota Orch; Neville Marriner cond.
Philips (DDD) 412 542-2 (2 CDs)

Symphony No 4: Czech Phil Orch; Neumann cond.
Supraphon SUP CD7442

Symphony No 5: Czech Phil Orch; Neumann cond.
Supraphon SUP CD7377

Symphony No 6: Czech Phil Orch; Neumann cond.
Supraphon SUP CD7242

Symphony No 7: Vienna Philharmonic Orch; Lorin Maazel cond.
DG (DDD) 410 997-2

Symphony No 7: Czech Phil Orch; Neumann cond.
Supraphon SUP CD7067

Symphony No 7: Philharmonic Symphony Orch; Carlos Paita cond.
Lodia LOCD 782

Symphony No 8 in G, Op 88; Nocturne for strings: London Philharmonic Orch; Vernon Handley cond.
Chandos CHAN-205-2

Symphony No 8: Vienna Philharmonic Orch; Lorin Maazel cond.
DG (DDD) 415 205-2

Symphony No 8: Czech Phil Orch; Neumann cond.
Supraphon SUP CD7073

Symphony No 9 From the New World: Minnesota Orch; Neville Marriner cond.
Philips (DDD) 412 224-2

Symphony No 9 'From the New World': Czech Phil Orch; Neumann cond.
Supraphon SUP CD7002

Symphony No 9 'From The New World': London Symphony Orch; Enrique Batiz cond.
Varese Sarabande 47216

Symphany No 9 'From the New World': Vienna Philharmonic Orch; Lorin Maazel cond.
DG (DDD) 410 032-2

Symphony No 9 in E minor 'From the New World': Berlin Philharmonic Orch; Klaus Tennstedt cond.
EMI 747071

Symphony No 9 in E minor, Op 9: Chicago Symphony Orch; James Levine cond.
RCA RCD14552

Symphony No 9, 'New World'; Carnaval overture, Op 92: London Philharmonic Orch; James Conlon cond.
Erato ECD-88 036

Symphony No 9 'From the New World': Chicago Symphony Orch; Sir Georg Solti, cond.
Decca (DH) 410 116-2

Symphony No 9 'From the New World': Wiener Philharmoniker; Kiril Kondrashin cond.
Decca (DH) 400 047

Te Deum; Psalm 149; Hymnus; Benackova; Czech Phil Orch; Neumann cond.
Supraphon SUP CD7230

Trio No 4 in E minor, Op 90 'Dumky' Suk Trio.
Denon C37-7057

ELGAR
Cello concerto; plus — cello concerto (Dvorak); Staatskapelle Dresden; Neville Marriner cond.
Philips (DDD) 412 880-2

Four overtures — In The South, etc; Scottish National Orch; Alexander Gibson cond.
Chandos CHAN-8309

Miniatures (with L. Goosens); Bournemouth Sinfonietta; N. del Mar cond.
Chandos CHAN-8371

Music for violin and piano; Nigel Kennedy, violin; Peter Pettinger, piano.
Chandos CHAN-8380

Piano quintet; string quintet; John Bingham, piano; Medici Quartet.
Meridian ECD-84 082

Violin concerto, Op 61; Itzhak Perlman, violin; Chicago Symphony Orch; Daniel Barenboim cond.
DG (DDD) 413 312-2

Volin concerto; Nigel Kennedy, violin; London Philharmonic Orch; Vernon Handley cond.
EMI 747210

Wand of Youth suites; Nursery suite; Ulster Orch, Bryden Thomson cond.
Chandos CHAN-8318

Works for string orch; English String Orch.
Nimbus NIM 5008

Enigma variations; Crown of India suite; March of the Mogul Emperors; Pomp and Circumstance marches No 1 and 2; BBC Symphony Orch; Leonard Bernstein cond.
DG (DDD) 413 490-2

ERKEL, Ferenc
Hunyadi Laszio: Gulyas; Sass; Kalmar; Solyom-Nagy; Denes; Molnar, Janos Kovacs.
Hungaraton HCD 12581-83-2 (3 CDs)

de FALLA
Nights in the Gardens of Spain; plus Albeniz: Rapsodia Espanola; Turina; Rapsodia Sinfonica; London Philharmonica Orch; Rafael Frubeck de Burgos cond.
Decca (DH) 410 289-1

The Three Cornered Hat (complete ballet); El amor brujo; Ritual Fire Dance; Frederica von Stade; Pittsburgh Symphony Orch; Andre Previn cond.
Philips (DDD) 411 046-2

The Three Cornered Hat; Orchestre Symphonique de Montreal; Charles Dutoit cond.
Decca 410 008-2

The Three Cornered Hat; La Vida Breve—interlude and dance: Teresa Berganza; Orch de la Suisse Romande; Ernest Ansermet cond.
Decca 414 039-2

FAURE
Pelleas et Melisande-Suite Pavane; Masque et Bergamasque—Suite; Academy of St Martin-in-the-Fields; Neville Marriner cond.
Argo 110 552-2

Requiem Op 48; Lucia Popp; Simon Estes; Staatskapelle Dresden; Colin Davis cond.
Philips (DDD) 412 743-2

Requiem; Elgie; Messe Basse for female voices and organ: Monte Carlo Phil Orch, Armin Jordan cond; Marie-Claire Alain, organ.
Erato ECD-88 126

Requiem; Messe Basse: B. Thomas Chamber Orch and Piquemal Choirs.
Forlane UCD-16 536

FIELD
Piano concertos No 6 and No 7; John O'Connor, piano; New Irish Chamber Orch; Furst cond.
Sound 3414

FRANCK
3 Chorals for organ; Peter Hurford.
Argo (ZH) 411 710-2

Organ Works, Vol 2; Jennifer Bate, organ.
Unicorn DKP(CD)9014

Organ Works, Vol 3; Jennifer Bate, organ.
Unicorn DKP(CD)9030

Organ works; Marie-Claire Alain, organ.
Erato ECD-88 110

Symphony in D minor; plus—Le Rouet d'Omphale (Saint-Saens); Orch Nationale de France; Leonard Bernstein cond.
DG (DDD) 400 070-2

Three chorals; prelude, fugue and variation, Op 18; Pastorale, Op 19; Peter Hurford, St Sernin Basilica organ, Toulouse.
Decca (DDD) 411 710-2

Violin sonata; also Ravel—violin sonata; Jean-Jacques Kantarow, violin; Jacques Rouvier, piano.
Denon C37-7079

Violin sonata; plus horn trio (Brahms); Itzhak Perlman; Vladimir Ashkenazy.
Decca 414 128-2

FUCIK
Entry of the Gladiators; Florentine March; etc; Czech Phil Orch; Vaclav Neumann cond.
Teldec 8.42 337

GERSHWIN
A Symphonic Picture of Porgy and Bess; (arr. Bennet); plus Grand Canyon Suite (Grofe). Detroit Symphony Orchestra; Anton Dorati cond.
Decca 410 110-2

An American In Paris; Cuban Overture; Porgy and Bess; Dallas Symphony Orch; Eduardo Mata cond.
RCA RCD14551

Porgy and Bess (highlights); Simon Estes; Roberta Alexander; Diane Curry; Siegfried Stockist; Berlin Radio Chorus; Berlin Symphony Orch; Leonard Slatkin cond.
Philips (DDD) 412 720-2

Porgy and Bess; etc; London Symphony Orch; Andre Previn cond.
EMI 747021

Rhapsody In Blue; An American In Paris; Cincinatti Symphony Orch; Erich Kunzel cond.
Telarc 80058

Rhapsody In Blue; An American In Paris; piano concerto in F; Andre Previn piano; Pittsburgh Symphony Orch; Andre Previn cond.
Philips (DDD) 412 611-2

Rhapsody In Blue; etc; London Symphony Orch; Andre Previn cond.
EMI 747161

Rhapsody In Blue; I Got Rhythm; etc; Alexis Weissenberg, piano; Berlin Philharmonic Orch; Seiji Ozawa cond.
EMI 747152

Rhapsody In Blue; plus—West Side Story: symphonic dances (Bernstein); Los Angeles Philharmonic Orch; Leonard Bernstein cond.
DG (DDD) 410 025-2

GIODANO
Andrea Chenier; Pavarotti, Cabrelle; Nucci, National Philharmonic Orchestra; Ricardo Chailly cond.
Decca 410 117-2 (2 CDs)

GIULIANI
3 Guilianate from Op. 148; etc; Eduardo Fernandez, guitar.
Decca (DH) 414 160-2

GLUCK
Dance of the Blessed Spirits; plus Albinoni, Boccherini; Pachelbel; etc; Stuttgarter Kammerorch; Karl Munchinger cond.
Decca (DH) 411 972-2

Orpheo and Euridice; Kweksilber; Jacobs; Falewicz; La Petite Band; Kuijken.
Accent ACC 48223/4 (2 CDs)

GOLDMARK
Overtures, Budapest Philharmonic; Korodi cond.
Hungaraton HCD 12552-2

GOTTSCHALK
Piano works — 'The Lady Fainted'; Alan Marks, piano.
Nimbus NIM 5014

GOUNOD
Faust Ballet; Ballet aus Margaret; plus Offenbach; Gaite Parisienne; Orchestre Symphonique de Montreal; Charles Dutoit cond. Cecilia Mass; Barbara Hendricks; Nouvel Phil Orch; Georges Pretre cond.
EMI 747094

GRAINGER
Music of Percy Grainger; Youthful suite, etc; Bournemouth Sinfonietta; K. Montgomery cond.
Chandos CHAN-8377

GRANDADOS
Goyescas; El Pelele; Alicia de Larroche
Decca (DH) 411 958-2

Seis piezas sobre cantos populares espanoles; Allegro de concierto; Escenas romanticas; Alicia de Larroche.
Decca (DH) 410 288-2

Spanish Dances; Alicia de Larroche.
Decca 414 557-2

Favourite Guitar Pieces by Grandos, Ponce, Terrega Scharom Isbin and Machiko Kikuchi, guitars; Tokyo Metropolitan Symphony Orch; Hideomi Kuroiwa cond.
Denon C37-7054

GRIEG
Holberg suite Op. 40; 2 lyric pieces; plus—Karelia suite and The Swan Of Tuonela (Sibelius); Academy of St Martin-in-the-Fields; Neville Marriner cond.
Philips (DDD) 412 727-2

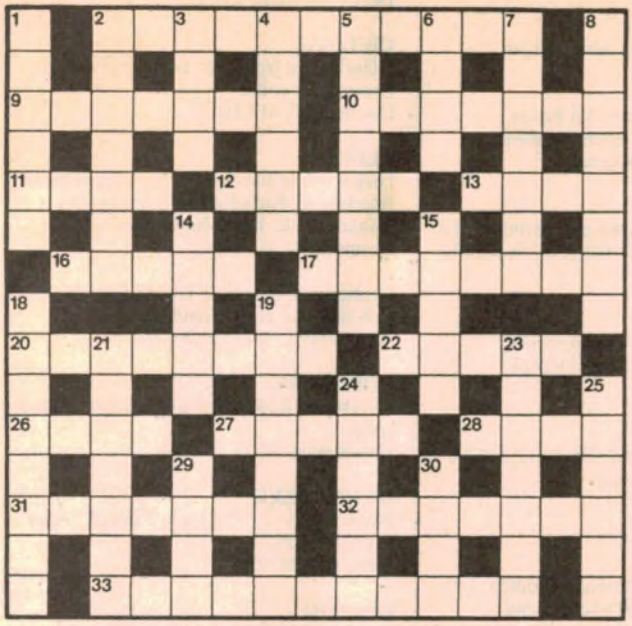
Peer Gynt suite; Academy of St Martin-in-the-Fields; Neville Marriner cond.
EMI 747003

Peer Gynt suites No 1 and 2; plus—Pelleas et

JANUARY CROSSWORD

DOWN

1. Directed physical quantity. (6)
2. Unwanted audio frequency modulation. (7)
3. Lightning. (4)
4. Type of TV aerial. (6)
5. The application of electronics to aircraft. (6)
6. Radio and electronics engineers organisation. (1,1,1,1)
7. Said of design, etc, having the most elegant simplicity. (7)
8. Useful tool for constructors. (8)
14. Name of a connection method used to transform 3-phase to 2-phase.
15. Regions of low potential. (5)
18. This can amplify microwaves. (8)
19. Again cover wire, etc, with tubing. (8)
21. Connects to a point of zero potential. (7)
23. Entered the telephone service. (7)
24. Physicist famous for his ionising radiation detector. (6)
29. An emergency device is the _____ switch. (4)
30. What EPIRBs do with signals. (4)



ACROSS

2. Process of construction of semiconductor devices, etc. (11)
9. A CCD is a charge _____ device. (7)
10. Computers often do this. (7)
11. A prefix used in electronics where light is involved. (4)
13. Physicist after whom an electrical law is named. (4)
10. Path of 26 across. (5)
17. In semiconductors, gallium may be an _____ impurity. (8)
20. Device that interacts with a computerised display. (5-3)
22. Type of control. (5)
26. Stationary trace on a CRO. (4)
27. Part of a lead-acid cell. (5)
28. Electrode of a bipolar transistor. (4)
31. Period to execute a program. (3,4)
32. Interval between device operation and response. (4,3)
33. Said of a device that oscillates, etc, without a separate circuit. (4-7)

SOLUTION FOR DECEMBER

T	O	G	G	L	E	■	J	U	N	C	T	I	O	N
R	■	A	■	O	■	P	■	N	■	O	■	R	■	E
E	A	R	A	C	H	E	■	I	M	A	G	I	N	G
B	■	B	■	K	■	D	■	F	■	X	■	D	■	A
L	O	A	D	■	B	A	S	I	C	■	T	I	N	T
E	■	G	■	Z	■	L	■	L	■	Q	■	U	■	I
■	R	E	S	E	T	■	V	A	C	U	U	M	■	V
E	■	■	N	■	A	■	R	■	A	■	■	■	■	E
N	■	H	O	E	R	N	I	■	T	R	U	T	H	■
H	■	E	■	R	■	A	■	W	■	K	■	H	■	P
A	D	A	M	■	U	L	T	R	A	■	B	O	H	R
N	■	D	■	K	■	Y	■	I	■	N	■	M	■	O
C	O	S	I	N	E	S	■	T	R	A	N	S	I	T
E	■	E	■	O	■	I	■	E	■	S	■	O	■	O
D	A	T	A	B	A	S	E	■	C	A	N	N	O	N

Car Burglar Alarm Flasher

This is the "Claytons" burglar alarm — the alarm you connect when you can't be bothered fitting a proper alarm. It simply flashes a light on the dashboard.

CD Adaptor for Cars

How do you connect a portable compact disc player to your car sound system? With our CD Adaptor, of course. It's a simple circuit and easy to build.

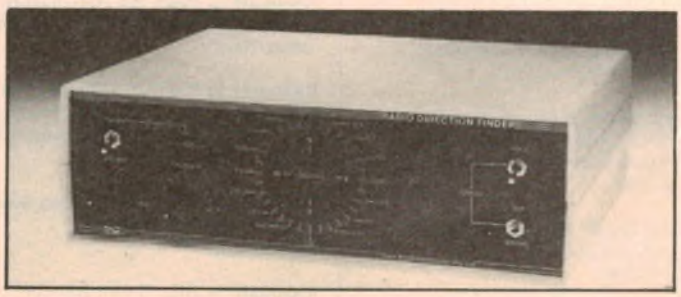
Annual Hifi Awards

Next month, we will announce the winners of the 1985 Hifi Grand Prix Awards. The awards have eight categories: best amplifier, tuner, receiver, CD player, cassette deck, turntable, loudspeaker system and a special category labelled "technological development"

Note: Although these articles have been prepared for publication, circumstances may change the final content.

Next month in Electronics Australia

Radio Direction Finder



Employing an electronically "rotating" antenna, this radio direction finder rapidly indicates the direction of a transmitted radio signal. It should find ready use with radio amateurs, CB operators and marine enthusiasts.

COMPACT DISC CATALOGUE

Melisande (Sibelius); Berlin Philharmonic Orch; Herbert von Karajan cond.
DG (DDD) 410 026-2

Peer Gynt, Op. 23—incidental music; Elly Ameling, soprano; San Francisco Symphony Orch and Chorus; Edo de Waart cond.
Philips (DDD) 4111 038-2

Piano concerto; plus—piano concerto (Schumann): Krystian Zimerman, piano; Berlin Philharmonic Orch; Herbert von Karajan cond.
DG (DDD) 410 021-2

Piano concerto; plus Schumann: piano concerto: Radu Lupu, piano; London Symphony Orchestra; Andre Previn cond.
Decca (DH) 414 432-2

Piano works, incl Lyric Pieces; Norwegian dances No 2 and 4; Morning Mood from Peer Gynt Suite 1; Cyprien Katsaris, piano.
Teldec 8.42 925

Sonatas for violin: Sitkovetsky, violin; Davidovich, piano.
Orfeo ORF CO47

GROFE
Grand Canyon Suite; plus Symphonic Picture of Porgy and Bess (Gershwin arr Bennett); Detroit Symphony Orchestra; Antal Dorati cond.
Decca (DH) 410 110-2

GUITAR MUSIC
Bizet; Carmen Suite; Chapi: La Revoltosa; Falla: Dances from La vida breve; El sombrero Espanolas No 4, 5 and 7; Torroba; Sonata trianera: Los Romeros.
Philips (DDD) 412 609-2

Famous Spanish Guitar Music; Anon Jeux Interdits; Albeniz; Asturias; Malats; Serenta espanola; Sor: Introduction and variations on a theme by Mozart; Tarrega: Recuerdos de la Alhambra; etc; Pepe Romero, guitar.
Philips (DDD) 411 033-2

Famous Spanish Dances for 2 guitars by Granados; De Falla Albeniz; Transcriptions; Pepe Romero; Celin Romero.
Philips (DDD) 411 432-2

GULDA
Variations; For Paul; prelude and fugue; sonatina; for Rico (Baroque Rock); plus—Children's songs Nos 19 and 20, Corea; Friedrich Gulda, piano.
Philips (DDD) 412 115-2

HANDEL
12 concerti grossi Op 6: Academy of St Martin-in-the-Fields; Iona Brown; Neville Marriner.
Philips (DDD) 410 048-2 (3 CDs)

6 concerti grossi Op 3: Academy of St Martin-in-the-Fields; Neville Marriner cond.
Philips (DDD) 411 482-2

Alexander's Feast concerto: Alice Harnoncourt, cello; Herbert Tachezi, organ.
Teldec 8.43 050

Alexander's Feast: Palmer; Johnson; Roberts; Bach Choir Stockholm; Concentus Musicus Vienna; Nikolaus Harnoncourt cond.
Teldec 8.35 671 (3 CDs)

Aminta and Fillede: Fisher; Kwella; London Handel Orch; Darlow cond.
Hyperion HYP CDA66118

Arias—recital: Marilyn Horne, mezzo; I Solisti Veneti; Claudio Scimone cond.
Erato ECD-88 034

Ballet music—Alcina; Il Pastor Fido; Terpischore: English Baroque Soloists, John Eliot Gardiner cond.
Erato ECD-88 084

Belshazar—complete: Tear; Palmer; Esswood; Stockholm Chamber Choir; Concentus Musicus Vienna; Nikolaus Harnoncourt cond.
Teldec 8.35 326 (3 CDs)

Chamber cantatas and duets: Concerto Vocale.
Harmonia Mundi HM 90.1004

Choice of Hercules.
Capriccio 10.019

Concerti grossi Op 3: Concentus Musicus Vienna; Nikolaus Harnoncourt cond.
Teldec 8.35 545 (2 CDs)

Concerti grossi, Op 6 No 1-12: Concentus Musicus Vienna; Nikolaus Harnoncourt cond.
Teldec 8.35 603 (3 CDs)

Concerti grossi, Op 6 No 1-4: The English Concert; Trevor Pinnock cond.
Archiv (DDD) 410 897-2

Concerti grossi, Op 6 No 5-8: The English Concert; Trevor Pinnock cond.
Archiv (DDD) 410 898-2

Concerti grossi, Op 6 No 9-12: The English Concert; Trevor Pinnock cond.
Archiv (DDD) 410 899-2

Concerto a due cori: Academy of Ancient Music; Christopher Hogwood cond.
Decca (DH) 411 721-2

Concerto grossi, No 1-4.
Capriccio 10.021

Concerto grossi, No 5-8.
Capriccio 10.022

Concerto grossi, No 9-12.
Capriccio 10.023

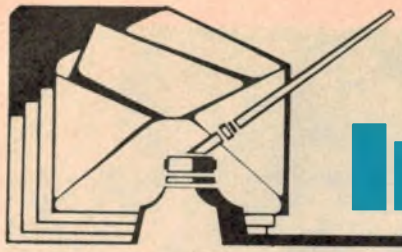
Concertos for organ: Edgard Krapp, organ.
Ariola-Eurodisc 610 260-234

Coronation Anthem: Choir of Westminster Abbey; Simon Preston, organ; The English Concert, Trevor Pinnock cond.
Archiv (DDD) 410 030-2

Coronation Anthems; excerpts from Judas Maccabeus; Academy of St Martin-in-the-Fields and chorus; Neville Marriner cond.
Philips (DDD) 412 733-2

TO BE CONTINUED

Due to a limit on space in this issue, we will continue our listing of classical and popular compact discs in the February issue.



Information centre

Voice operation for CB transceiver

I am undertaking a project to do away with the PTT switch on my handset on the CB. I purchased a voice-operated switch kit (EA) and built it. Now I want to know how to connect it to the PTT switch to make it transmit on talk and receive on silence.

Also, a lot of my projects used the buzzer type warning and call for intercoms. I wish to change this to the same tone as on Telecom phones. Please advise on the circuit, if possible. (C.P., Arrawarra Headland, NSW).

• Fitting a voice-operated relay system to a CB radio may not be very straightforward although it may seem simple enough initially. First, the relay must be connected into your CB so that it effectively replaces the PTT contacts which change over operation from transmit to receive. That much should be fairly easy.

Second, the microphone output signal from the VOX must be substituted for the output of the preamplifier in your CB. You will need a copy of your CB's circuit to do this.

Having achieved that, you will then have to make sure that the VOX circuit is not affected by the RF output of your CB and is not triggered by the sound of the received signal coming from the speaker. The latter may simply be a matter of keeping the microphone well away from the loudspeaker and keeping the audio gain low.

We are not sure what tone you mean when you refer to Telecom phones. We have designed a circuit (Telephone Bell Extender, February 1984) which approximates the ringing tone of a telephone. It must be used with a speaker rather than a buzzer.

Inverters for solar electricity supply

I am writing to seek your assistance concerning inverters for use in a solar electricity supply to our somewhat remotely located home. I hope you will be patient while I explain our problems before getting down to specifics!

We have installed a solar panel-battery bank which is adequate for our projected needs, providing some 600 ampere-hours of storage and 200 watts input. Initially, we installed 12V fluorescent lighting in the house as recommended and supplied by a leading solar firm. Expensive disaster! Reasonable lighting but intolerable radio interference, especially on AM. The problem is exacerbated by interference between each individual inverter in each lamp. There seems no solution to this and additionally we found that the power consumption was greater than expected, a 20W lamp using closer to 35W.

We then considered a single inverter feeding a house full of Phillips' SQ type lamps, which should be better. We purchased a 400VA inverter which works well but we discovered a characteristic of these devices — low efficiency at low power output. While it will be most useful for intermittent power supply, drills, mixers, small vacuum cleaners, etc, we cannot use it for lighting.

Having tried SQ lamps we are impressed with them and calculate that we can light the whole house and most of the farm with about 100W of power. This is the option we wish to pursue along with a 12V supply for radio and TV. There seems no point in going to the large sophisticated 1000VA+ inverters. In those times when we need big power we may as well use our petrol generator.

Our difficulty has been to locate inverter circuits in the required power range. Among other less suitable ones, we encountered those published by you in May and June 1982. The latter is too big for our needs. The former, 12V/230V 40VA inverter, is just a little too low powered. This brings me to my specific questions.

1. The 40VA inverter: both the Darlingtons and the 2N3055s are capable of handling higher currents than provided for, and presumably it is the selection of the transformer which limits the circuit. Can the circuit be modified with another transformer and changed component values to give a higher output? 80-100 watts would be fine but 60W might do us. You also mentioned that the circuit given will not start fluoros. Will it start SQs, and if not can it be made to do so?
2. Can some of the regulator circuitry of your 300VA inverter, (EA, June, '82) be grafted on to the smaller one, particularly the error regulation circuit, to increase the efficiency at lower powers? There are times for instance when we may wish to use only two 9W SQ lamps. Sounds pretty stingy, doesn't it?! But we get 100 inches of rain a year and there are periods of prolonged cloud so we need the option of being conservative.
3. The inverters are both clearly differentiated into signal generator and power amplifier stages. Can we arrange to use one signal section to drive more than one power stage so that effectively one selects an output to suit the load? Is it also possible to feed the outputs of such synchronous inverters into the same household power circuit? Losing 35W in inefficiencies represents the output of one $400 solar panel.
4. Our 400W inverter gives a little RF interference, again more on AM than FM and not as bad as the fluoros. Is this inherent in square wave inverters and how is it best alleviated? How much more inefficient would be the use of sine wave? Can some of the cheap 50W-100W power audio amplifiers in kit form be used as output stages for inverters?
5. Our 400VA inverter has a stand-by starter. How do these devils work and can one be incorporated into the modified 40VA circuit?

Reading this, I realise that I seem to have battered you with questions. Forgive me but in the two years that we have been trying to get ourselves going our biggest problem has been to get reliable information. With many "expert alternative energy advisers" the advice goes little beyond telling you to plug this gizmo in here and switch on the light. And the natty gizmo will cost you an arm and a leg!

There must be many people like us tucked away under bushes in the jungles

of Australia, not really hippies but a bit odd and not willing to spend $10,000 to bring the power in half a kilometre.

If in the future your magazine were to publish an extensive summary of inverter and regulator circuits and their problems it would be received with acclaim. Please can you help us? (K.P., Berry, NSW.)

• Let us answer your questions in order. 1. The 40VA inverter can be uprated simply by increasing the size of the transformer as you suggest. An updated version along these lines was published in our July 1985 issue but it would probably not be big enough to suit your purpose. Unfortunately too, we are unable to nominate a suitable off-the-shelf transformer with a rating around 100VA.

As an alternative why not consider the new 300VA version published in the September 1985 issue? This has the virtue that it is quite efficient at low outputs. It is also more efficient than the 40VA version, mainly because of the toroidal transformer. It would probably also drive Philips' SQ lamps although we must stress that we have not tried this. Note that it also has an auto-start circuit.

It would be possible to arrange for the front end of the 300VA inverter to drive two or more output stages but they would really need to be in parallel, driving the one large transformer so that the feedback system could work properly.

Unfortunately, all square wave inverters inherently produce some radio interference, more on the AM bands than on FM. Putting in filter components to remove this interference is bound to have the effect of reducing overall efficiency.

Deluxe Car Burglar Alarm

I have recently fitted the Deluxe Car Burglar Alarm and at the time of purchase I also bought the optional hazard flasher components. Some difficulty has been encountered when attempting to wire this option to my car, a 1985 Magna.

The problem occurs because the hazard lamp wiring in the Magna differs from that used in earlier cars. The relay on the alarm system is intended to close a set of points and bridge out a single pole hazard lamp switch. However, the hazard lamp switch in the Magna is a multi-pole unit.

The easiest way I can see to overcome the problem is to use the existing relay contacts to control a second slave relay which has enough poles to bridge the Magna's multi-pole hazard switch. Maybe someone else has encountered this and solved it another way.

The Magna has in a convenient position a relay box to hold numerous Repco relays, of which possibly another one could be utilized to solve this problem. (B.R., Kurri Kurri, NSW.)

• The easiest way of overcoming your problem would be to substitute a multi-pole relay directly for a single-pole relay originally specified.

This could be mounted off the board and wired using short lengths of hook up wire.

Trouble with low-power inverter

I have purchased the inverter kit described in the May 1982 edition. I am having trouble with it and would appreciate your advice. The no-load current is very high (2.5 amps), the waveform shows various spikes and peaks which are unexpected and the output drops off prematurely to 110V with a 30W load.

The only modification I have made is to replace the PL18/40VA transformer with a PL18/60VA. I have included a pencil sketch of the various waveforms, with a few extra notes. I hope you could suggest some way of improving the performance, or some component which I may try replacing. (M.P., Kelvin Grove, Qld.)

• By the look of your waveforms, nothing appears to be seriously wrong with most of the circuit although, unfortunately, you have not bothered to show the amplitude of the waveforms.

The no-load current is high but that is probably partly attributable to the use of the bigger transformer.

We suggest you check the waveform between emitter and collector of each of the output transistors, Q2 and Q4. Check that they are saturating (ie, 1V or less at the collector) when they are turned on. If not, check that they are getting full drive from the Darlingtons via the paralleled 150Ω resistors.

Using the Railmaster with Marklin locos

In Information Centre for March 1985, R.B. of Sydney presented a rather interesting solution to the problem of

Information Centre . . . ctd

running Marklin AC operated locos with the Railmaster controller.

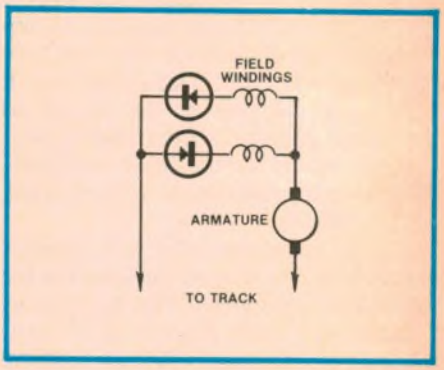
However, it would appear that there is a simpler solution. All that is necessary to convert the loco to DC operation is to place a diode in series with each of the two field windings as shown in the circuit, and disconnect everything else.

Best of all is the fact that this method completely eliminates the jerky and totally unrealistic reversing changeover caused by the application of 24V to the track to operate the reversing solenoid.

Note that the field windings have opposite senses which is necessary with AC operation to permit rotation in either direction (using a mechanical reversing switch inside the loco). Only one field winding is in use at any given time.

For DC operation, the two diodes select one or the other field windings, depending on the polarity applied to the track. The back EMF generated by the operational winding will be blocked by the diode, but operation of the loco is nonetheless quite smooth.

As the motor appears to perform equally well on either AC or DC, I would dearly like to know why Marklin have chosen the relatively complex AC arrangement with its associated cumbersome reversing solenoid, particularly as nearly all other makes of locos and controllers run on DC. (A.H., Morley, WA.)



• Thank you for your letter. Your solution is delightfully simple and will no doubt be received with much interest by Marklin operators. Incidentally, while the back-EMF may be blocked by one of your diodes, it will be conducted by the other and so the feedback feature will work.

Notes and Errata

RALLY COMPUTER (June 1985, 3/AU/43): The Fairchild FND508 ±1 digit display is now in short supply. An equivalent is the Fairchild FND568 which is a higher brightness version. The matching brightness FND567 7-segment display is equivalent to the FND507.

Alternatively, Radio Spares stock pin equivalent displays under catalogue number 587-945 for the 7-segment type and 587-967 for the ±1 type. These do not have the integral red filter.

As a last resort, the FND507 or FND567 can be used in place of the FND508. In this case, the "1" will be displayed as normal. However, the plus sign will be indicated by the "A" segment and the minus by the "D" segment.

Control Data Institute

Continued from page 24

For many students it would be impossible to pay cash on the spot, so the Institute runs two schemes which can either forestall the payments, or at least make them more manageable.

There is a pay-as-you-study scheme in which the student pays a monthly sum during the course. The other method is to qualify for a loan from a branch of the National Australia Bank, specified by the Control Data Institute. Repayments to the bank do not start until one month after the student's graduation date.

Control Data Institute have branches in Melbourne and Brisbane. In Sydney, the telephone number is (02) 438-1300.

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