Electronics Australia

Australia's Top Selling Electronics Magazine

AUGUST 1985
Aust $2.60
NZ $3.50

Registered by Australia Post — publication No. NBP 0240

5 COMPUTERS TO WIN!

A WORLD FIRST! THE NAVY'S NEW SIMULATOR

WORD PROCESSING FOR THE MASSES! DSE's NEW VZ-300

12V to 230VAC 40W inverter

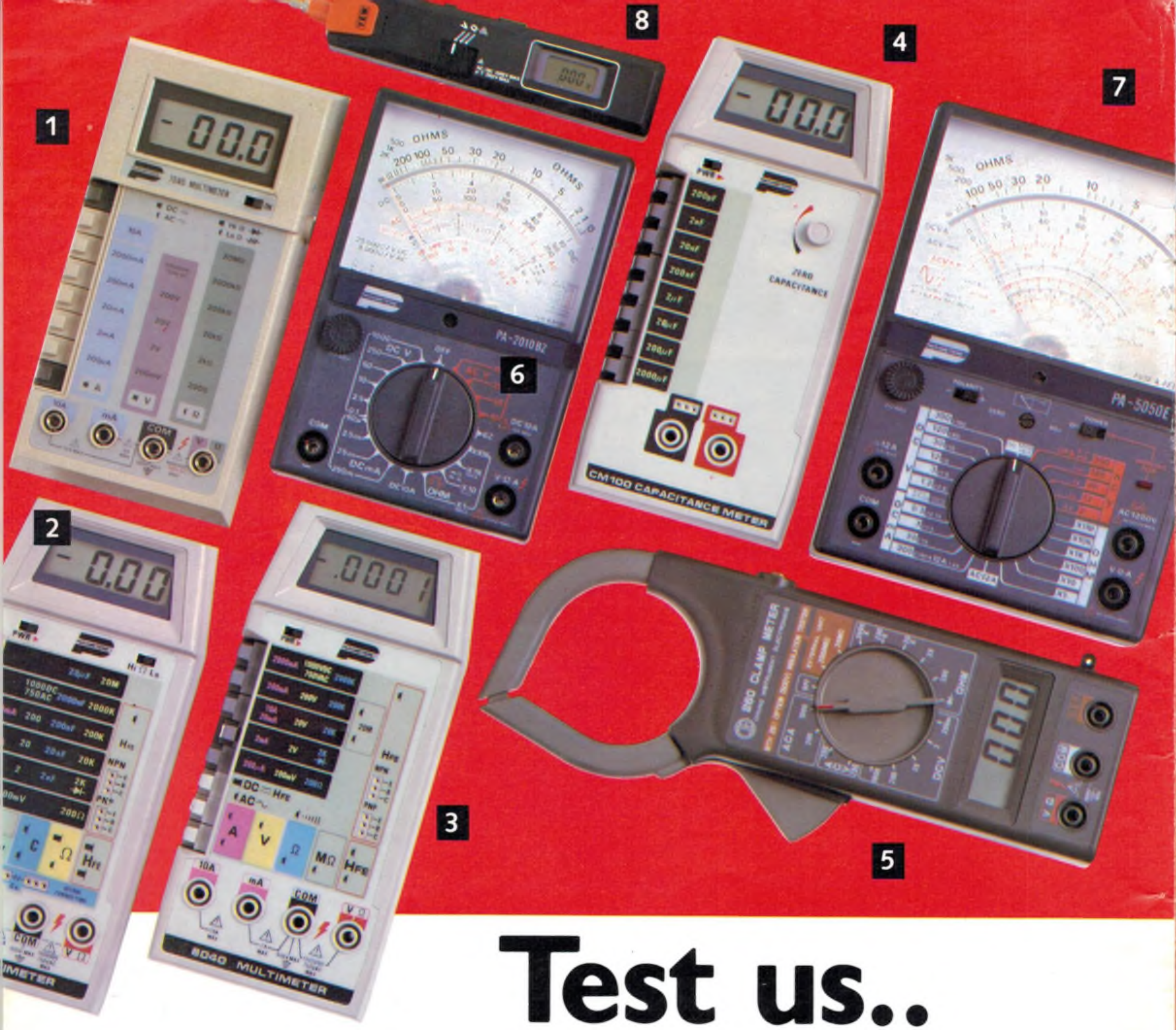
100 WATT HI-FI CAR STEREO AMPLIFIER!

Reviews:

NDK 5020 PRINTER

HUGHES SPECTRUM LOUDSPEAKERS

MARANTZ CP-430 PORTABLE CASSETTE DECK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PA-2010BZ
CM100 CAPACITANCE METER
ZERO CAPACITANCE
PA-5050E
8040 MULTIMETER
260 CLAMP METER

Volume 47, No. 8

Electronics Australia

August 1985

THIS MONTH'S COVER

Pack some punch into your car's sound system with this high-power stereo amplifier. It delivers 50W RMS per channel power output and costs much less than equivalent commercial units. Construction starts on page 36.

Features

Hifi, Video and Reviews

Projects and Circuits

Personal Computers

Columns

Departments

Digital capacitance meter

Featuring a bright 4-digit LED display, this Digital Capacitance Meter checks values from 1pF to 100μF over three ranges. It's just the thing for servicing and checking obscure capacitor markings. Details page 46.

What's coming

Next month we intend to describe a Mosfet power amplifier module capable of delivering 145W into 8Ω and 225W into 4Ω at less than .02% distortion. See also page 91.

12/230VAC 40VA inverter

This low-cost inverter can be used to power mains appliances rated up to 40W or to vary the speed of a turntable. As a bonus, the unit will also work backwards as a battery charger. Construction begins on page 64.

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Editorial Viewpoint

by Leo Simpson

Please pull your socks up ABC. We need you!

These are sad days for ABC watchers and listeners. The organisation seems to be under siege from within and without. Certainly there is no lack of criticism from without and a great deal of it has been justified.

Consider the much-maligned *National* for example. It rates so poorly that it is being surpassed by the SBS News at 7pm. That is probably a back-handed compliment for SBS News, since it is a very well presented broadcast with few of the fluffs and gimmickry of the *National.*

The wonder of it all is that the ABC has not seen the error of its ways and changed back to the old News format. After all, there was not much wrong with it, apart from the regular fluffs. Let's go back to having just one news presenter and forget all the nonsense about sports presenters. They should also put it on at 7pm, the time when civilized people want to watch the news.

Another general criticism has been the number of repeat programs. The number of old programs being rerun is a joke and it has been pointed out that the ABC does not meet the standards for Australian content that the commercial stations must comply with. The ABC has produced some very good programs but these days they are few and far between.

Nor is the radio side of the ABC any cause for listener joy and that has certainly been reflected in the recently released ratings. In Sydney, both ABC AM stations slipped. 2BL went from 5.9% to 4.5%, 2FC fell from 2.1 to 1.7 and 2JJJ went from 3.2 to 2.6%. Perhaps the ABC has not worried too seriously about audience ratings in the past but these figures are becoming very low for a major broadcaster.

There are solid reasons for the decline. Poor programming is one and sound quality is the other. 2FC's programs have been plagued by distortion and on the FM stations the ABC suffers by having horizontally polarised transmissions which give poor results for car listeners. It is about time they went over to mixed polarisation.

Apart from that, the sound quality of the ABC FM stations has always been inferior to that from the volunteer operated station 2MBS-FM. And the rock station 2JJJ is so far from the mainstream (into the idiot fringe) that it is easy to see why it does not have a bigger audience, even among the young. The situation may be better in other states but that would not seem likely.

If the situation is bad now, what is likely to happen when the ABC budget cuts begin to bite? I can envisage the cuts impinging into program activities while not affecting the staffing levels of those people in administration and technical support.

The truth is that the ABC is a poor performer overall because many of the staff are poor performers. They have been insulated from commercial reality for too long. Their present Union demand for an extra $20 million in budget funds and the threat of industrial action is yet another symptom of this.

Lest readers think that I am bucketing the ABC while ignoring the faults of the commercial broadcasters, I have one comment. How much can you watch on the commercial stations and, if you are not a rock fan, how much can you listen to on commercial radio? Precious little. We need the ABC to preserve our sanity.

Something for everyone

COMPONENTS!

ELECTRET MIC INSERTS
With pins for easy board insertion

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

COUNTER
Cat. $12.95

10,000uF 75V ELECTROS
25% more microFarads! Ideal for those who want a more powerful amp!

	1-9	10+
Cat. R16587	$10.50	$9.00

ECONOMY TOGGLE SWITCHES
Unbelievable Value!

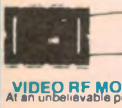
	10-99	100+
S11010 (SPDT)	1.50	1.40
S11020 (DPDT)	1.95	1.75

NEW SWITCHES

	10-9	10+
SPDT Cat. S11040	$1.50	$1.40
DPDT Cat. S11042	$1.60	$1.50

PRIME SPEC RED LEDS
We bought 100 000 so you can reap the benefits!
Cat. Z10150

1-9	10-99	100+
$0.10	$0.09	$0.08



VIDEO RF MODULATOR
At an unbelievable price!

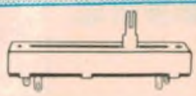
Our RF modulators are channel slectable either Channel O or Channel 1. Cat. S16040

1-9	10+
$4.95	$3.95

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



LOG SLIDES POTS
We ordered log instead of linear for the graphic equalizer, so take advantage!

1-9	10+	100+
$0.65	$0.60	$0.50

SPECTROL 43P
Equiv (Bourns 3006)
Great for precision work

R14200	10R	R14290	10K
R14210	20R	R14300	20K
R14220	50R	R14310	50K
R14230	100R	R14320	100K
R14240	200R	R14330	200K
R14250	500R	R14340	500K
R14260	1K	R14350	1M
R14270	2K	R14360	2M
R14280	5K		

1-9	10+
$1.10	$1.00

4SP TRIMPOTS

1-9	10+
$1.10	$1.00

CONNECTORS!

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	$2.95	$2.80
DB 25S	25 Pin Female	P10901	$3.45	$3.30
DB 25C	25 Pin Cover	P10902	$1.20	$1.10

36 WAY CENTRONICS CRIMP PLUG
Cat. P12200

1-9	10-99	100+
$7.95	$7.50	$7.25

SOLDER CENTRONICS PLUGS
Unreal price for absolute top quality. Normally $14.95 (Our oppostion charge up to $19.95)

1-9	10+	100+
$6.50	$5.95	$4.95

IC SOCKETS (LOW PROFILE)
How cheap can they go?

	1+	10+	100+	1000+
8 Pin Cat.	15c	14c	12c	09c
14 Pin Cat.	16c	15c	14c	10c
16 Pin Cat.	17c	16c	15c	11c
18 Pin Cat.	18c	17c	16c	13c
20 Pin Cat.	29c	28c	27c	26c
24 Pin Cat.	35c	33c	32c	28c
40 Pin Cat.	45c	40c	35c	30c

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NEW SLOPING CASES
Plastic with metal front panel available in two sizes.

Cat. H10450 190x120mm **$9.95**
Cat. H10455 256x185mm **$17.95**
(measurements are approx. only)

PROFESSIONAL SERIES RACK MOUNTING CABINETS
These beautifully crafted rack cabinet boxes will give your equipment a real 1st class appearance:

- All aluminium construction
- Removeable top and bottom panels
- All dimensioning conforms to the International Standard
- Natural or black finish
- Ventilated lid
- Deluxe brushed finish anodised front panel

	1-4	5+
H10401 Natural	$49.50	$43.50
H10402 Natural	$55.50	$49.50
H10403 Natural	$62.50	$55.50
H10411 Black	$49.50	$43.50
H10412 Black	$55.50	$49.50
H10413 Black	$62.50	$55.50

ECONOMY 19" RACK CASE
Tremendous Value! Dimensions W 480 x H 134 x D 250mm

	1-9	10+
Cat. H10400	$34.95	$29.50

TOOLS OF TRADE!

WELLER WTCPN SOLDERING STATION
The WTCPN Features:

- Power Unit 240 V AC
- Temperature controlled iron 24 V AC
- Flexible silicon lead for ease of use
- Can be left on without fear of damaged tips!

The best is always worth having

Cat. T12500 Normally $97.50 **NOW $87.50**

WE HAVE DONE IT AGAIN!!
New multimeter at unbeatable value for under $45! The new YU-FONG YFE-1030C features:

- Large 3 1/2 digit display (1/2 inch high)
- Autopolarity, "-" display for Negative input
- High over-load protection for all ranges
- Over-load display highest figure "1" or "-1" alone glows
- Power consumption 20mW approx

Cat. **$49.95**

LOGIC PROBE 3800A
Features 20MHZ memory, TTL-CMOS operation. Normally $29.50
Cat. Q11272

1-9	10+
$23.50	$19.50

DIGITAL MULTIMETER
YFE YF1100 FEATURES

- Large easy to read 3 1/2 digit display
- Facilities for transistor and diode testing
- Clearly laid out front panel
- 10A DC AC range
- Priced to undersell the others

Cat. Q16025 **$79.50**

IC's GALORE!

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4164	$3.25	$2.95	$1.95
2716	$5.90	$5.50	$5.50
2732	$6.25	$5.95	$5.50
2764	$8.25	$7.95	$6.00
27128	$12.50	$11.50	$7.50
6116	$5.50	$5.15	$3.90
41256	$14.50	$12.50	$10.00
62648	$19.50	$17.50	$14.00

WORLD MODEM CHIP
Cat. **$49.95**

BATTERIES!

NICAD CHARGES
Cat. **$24.95**

NICAD BATTERIES
Save on carbon batteries with these Appolon Nickel cadmiums. Rechargeable up to 1000 times!

	1-9	10+
Cat. S15020 AA500 MA	$2.45	$2.25
Cat. S15021 C1.8 AH	$4.95	$3.95
Cat. S15022 D4 AH	$7.95	$6.95

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Cat. W11222 3C2V 75 OHM	$22
Cat. W11224 5C2V 75 OHM	$35
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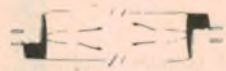
PUSH BUTTON DIALLERS
Tired of old fashion dialling and re-dialling engaged numbers? These convenient push button diallers include last number redial (up to 16 digits) and instructions for an easy changeover

Cat. A12030 **$19.95**



U.V. TUBES
Fits into standard 15W flouro holder. Suitable for Scotchcal, Eprom erasing etc. As used in ETI Eprom Erasing Kit.
WARNING: Do not look directly into UV Tubes.
Cat. H28600 **$24.95**
*If ordering by mail please include an extra $2 for "special" packing.

TELEVISION ACCESSORIES!

HYBIRD SPLITTERS
2 Way

- Input/Output 75 Ohm
- Splitting loss 3.5dB
- Isolation 25dB
- V S W R 1.3

Cat. L11310 **$3.95**

4 Way

- Input/Output 75 Ohm
- Splitting loss 6.8dB
- Isolation 32dB
- V S W R 1.3

Cat. L11320 **$5.95**

300 OHM COUPLERS
Suitable for UHF, VHF and FM
2 Set
Cat. L11300 **$2.85**
4 Set
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UHF/VHF OUTDOOR MATCHING TRANSFORMER
75/300 Ohm. Waterproof type
Cat. L11020 **$3.75**

UHF/VHF/FM ANTENNA
Frequency: VHF 48-216 MHz (Ch 1-12)
UHF 536-764 Mhz (Ch 25-62)
Up grade your TV system now before Channel 0 disappears! Includes 75ohm and 300ohm balun, incredible value!!
Impendance: 75/300 (200) Ohm
Element: VHF 4, UHF 9
Gain (dB): VHF 4-6, UHF 4-8

Cat. L11014 **Normally $39.50**
NOW $29.50

(Trade enquiries welcome)

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Female Type 75/300 Ohm
Cat. L11010 **$2.95**

PLASTIC BODY CO-AXIAL CONNECTORS

Plug Cat. P10401	$0.50
Socket Cat. P10408	$0.60

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Horizontal Buss
Cat. H19125 **$29.50**
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250ml	$1.95	1.75
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1 litre	$4.95	4.50

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Make your own kits!

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ETI478SB	1.65	84AU1	1.95
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82A03B	2.80	80PG6	5.10
81FM10A	6.95	81DC2	1.65
81FM10B	3.25	82GA5	2.10
ETI1405A	2.40	84US6	2.65
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ETI478MC	2.50	ETI458	3.25
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82IV6	6.55	83GA6	6.05
84TP2	2.75	84MS10	2.65
ETI480	2.85	ETI256	1.80
84PA11	3.75		

at Rod Irving Electronics!

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The odds against you are climbing and prevention is better than cure!

- Adjustable exit/entry time delay and alarm time (avoids unnecessary noise pollution)
- 12V D.C. 1.5Amp
- Provision for battery back-up
- Tamper switch
- Optional outputs. Sirens, bells, floodlights, automatic diallers, tape recordings, closed circuit TV, etc.
- Accepts N.C. and N.O. detectors such as infrared microwave, ultrasonic, wireless vibration sensor, magnetic switch, door mat, smoke detector glass breakage sensor panic button etc.

Cat. S15051 **Normally $99.95**
NOW $79.95

RITRON KEYLESS CAR ALARM

The first shipment sold out immediately to the trade. They didn't reach our own retail stores!

- Activated and disarmed by ignition key so you never forget to turn it on.
- Multi-function, built in siren or external siren, car signal horn output
- Easy to install, no door switch required
- Automatic reset after 60 seconds (avoids noise pollution)
- Special sensor protects Stereo or CB
- 12V DC

Cat. S15054 **Normally $39.95**
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ULTRASONIC BURGULAR ALARM

- Easy to install
- Connect with magnetic switch infrared detector, etc.
- Equip with hornspeaker lockswitch, flashlight, closed circuit TV, etc.
- Rechargeable battery circuit with recharge indicator L.E.D.
- N.O. and N.C. circuit breakdown indicator
- Low dry battery indicator

Cat. S15052 **Normally $89.95**
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MINITURE BUZZER

5-15V White or black
Cat. A15062 1-9 10+
$1.95 $1.75

HORN CRAZY!!

8W aluminium or plastic.
Normally $9.50
Aluminium Cat. C12015
Plastic Cat. C12010
1-9 10+
$6.50 $5.95

VIDEO ACCESSORIES!

TDK VIDEO TAPES AT BARGAIN PRICES!

VHS:	E60	$12.50
	E120	$12.50
	E180	$11.80
	E240	$22.40
BETA	L250	$13.50
	L500	$14.40
	L750	$17.50

VDK1 VIDEO DUBBING KIT

For Europpean and Japanese machines.
Contains:
Audio/Video: 6 pin DIN plug to 6 pin DIN plug 1.5 metres.
Audio/Video: 6 pin DIN sockt to (a) Video: RCA plug (b) Audio: 5 pin DIN plug. (Both 16cm in length)
Video: 1 each plug adaptor (PA21) RCA socket to PL259 plug. (PA23) RCA socket to BNC plug.
Audio: 5 pin DIN socket to 2 RCA plugs 16cm length 2 plug adaptors (PA60) RCA socket to 3.5mm phone plug.
Cat. **$16.95**

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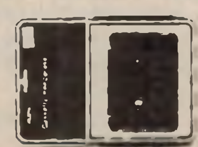
TDK AUDIO TAPE BARGAINS

Description	Cat No.	1-9	10+
DC46 TDK	A11305	2.75	2.10
DC60 TDK	A11307	2.95	2.25
DC90 TDK	A11309	3.50	5.50
DC120 TDK	A11311	5.50	4.25
AD60 TDK	A11315	3.75	2.95
AD90 TDK	A11317	4.75	3.50
AD120 TDK	A11319	6.95	5.50
ADX60 TDK	A11320	4.95	3.50
ADX90 TDK	A11322	5.95	4.50
SA60 TDK	A11325	5.35	3.95
SA90 TDK	A11327	5.95	4.50
SAX60 TDK	A11329	5.25	3.95
SAX90 TDK	A11332	6.95	5.95
MAC60 TDK	A11335	10.95	9.35
MAC90 TDK	A11337	11.50	8.75
MAR60 TDK	A11340	13.50	10.95
MAR90 TDK	A11342	17.20	15.35

SUPER HORN

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

Cat. C12102 **$12.95**



ELECTRONIC CASSETTE DEMAGNETISER

Save $2. Rec. retail **$19.95**
Cat. A1006 **NOW $17.95**

TDK LINE FILTERS

240 V 3A
Cat. **$12.50**

P.A. SPEAKERS

Low dual cone, wide range 200mm (8in.). Ideal for public address, background music, etc. Tremendous Value at these prices!
Cat. C12000 1-9 10+
$5.95 $4.95

JOYSTICKS!

CENTRE RETURN JOYSTICK

Features 2x150K pots, long shaft 40mm with 25mm control ball. Bonus adjustable offset feature on pots.
Cat. X15637 1-9 10+
$9.95 $8.95

ARCADE FIRE BUTTONS

With micro switches.
Cat. **$9.95**

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REPLACEMENT KEYBOARDS

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

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IBM* COMPATIBLE COMPUTER

128K RAM, colour graphics.
2 serial and 1 parallel ports.
2 disk drives. 3 months warranty
an incredible $1,950
*IBM is a registered trademark

RITRON (ZETA) DATASETTE

For data loading and saving, this Micron Datasette suits most home computers and features tape counter, monitor function for audio verification and slide volume control for output level.
Cat. C14900 **$24.95**

RITRON 2

Stylish swivel base monitor, available in amber or green.
1-9 10+
Green Cat. X14500
$215 $205
Amber Cat. X14500
$219 $205

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 Buad 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

RITEMAN INFO RUNNER

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$459

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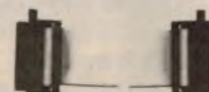
(NEW MITSUBISHI 4851)

Slimline 5 1/4" disk drive. Double sided, double density 500K unformatted, 40 track/side. Steel band drive system.
Cat. C11901 **$199**
Case & Power Supply to suit
Cat. X11011 **$99**

TELECOMMUNICATION PLUG TO 2 SOCKETS.

Ideal for modem connections.
Cat. Y16014 **$12.95**



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Parallel centronics to centronics
Cat. P19013 **$23.95**

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Top quality at a very affordable price! Blank 11 x 9 1/2", 2,000 sheet, quality 60 gsm bond paper.
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CHEAP DISKS!

DISKS GALORE!!

All prices for boxes of 10.
Single disks 10% extra.

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MD525-01 S/S D/D Cat. C12501	$29.50
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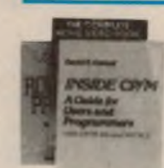

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Howard Rider

WHO'S NEW AT ROD IRVING ELECTRONICS?

We would like to introduce you to the new General Manager of Rod Irving Electronic's Howard Rider. Howard has had extensive electronics experience, over 40 years in fact. He has worked as a radio and electrical contractor, a college lecturer with the Department of Education (including 10 years overseas) and is a prominent figure in amateur radio and in particular amateur television. Howard recently retired from lecturing to take up the position of General Manager for Rod Irving Electronics. "Please feel free to drop in anytime you're in the area and make yourself known to me personally."

—Howard Rider

Errors and ommisions excepted

News Highlights

Semiconductors in Singapore

Italy's electronic giant, the SGS Semiconductor Group of Companies, has over the last 28 years, developed into a multinational conglomerate with design and production facilities in nine countries employing some 10,000 people. Recently they opened a new microchip plant in Singapore, the second in what looks to be a long and fruitful line.

The wafer diffusion plant and microchip design centre can produce up to half a billion microchips a year and is believed to be the most sophisticated facility of its kind in the Asia-Pacific region. The production complex is "completely immune from vibrations at the micron level." This condition is very important as the plant uses advanced optical alignment and photo-masking equipment.

SGS Semiconductors believe that they currently support the design needs of the consumer electronics sector in the Asia-Pacific region. The new factory will house two diffusion modules and the company's Microchip Design Centre for the region.

Both the Diffusion Plant and the Design Centre are part of a continuing investment by the company in Singapore, the cumulative commitment of which has already passed the $US100 million mark.

Satellite equipment on its way

In late October the Acesat Satellite Receiver Corp will have a complete receiver system available in readiness for the first transmission by AUSSAT on the 1st of November this year.

The firm has placed a substantial order with Plessey (Aust) for supply of the B-MAC indoor unit required for the Australian remote area satellite TV and radio services from the AUSSAT satellite. Plessey have the sole licence to manufacture the B-MAC baseband processor unit which is at the heart of the AUSSAT system. Acesat's order will secure delivery of the first production of the B-MAC equipment.

Mr Dougles Sawtell, Acesat's managing director, said that "the company order with Plessey and the successful negotiations with manufacturers of associated equipment would ensure supply of a complete receiver system including a 1.5m antenna for approximately $2000."

Multimeters donated by Altronics

School prizes are always difficult to come by and can be an expensive extra at the end of the year. But the problem has been solved, at least for the category of the most outstanding electronics student.

Altronics are making available 500 of their Q1015 Multimeters free to secondary schools, for prizes. They are to be awarded to an outstanding student and of course to qualify the school must run an electronics course.

Requests must be made in writing on the school's letter head to Altronics, PO Box 8280, Stirling St, Perth, on or before the 30th September, 1985.

Business Brief

The distribution businesses of **ANI Perkins, Warburton Franki** and **O. H. O'Brien**, are a division of the ANI Corporation. For the past two years a major reorganisation and rationalisation has been going on culminating in a new name: Anitech.

Kalextronics have ceased their Heidelberg operations. They now have outlets at: 40 Wallis Ave, East Ivanhoe, 3079. Telephone: (03) 497 3422. And the Regional Shopping Centre, Western Highway, Melton, 3337. Telephone: (03) 743 1011.

Breakthrough for starwars project

America's most exotic and controversial piece of star wars technology may have been realised. Reports state that scientists working on the X-ray laser, a beam weapon driven by its own nuclear explosions, have found a way of boosting the power of the beam by focusing its rays.

With the discovery of the process the problems involved in powering a multi-megawatt laser in space have been overcome. However the new device does not come without its own share of difficulties.

The intense beams of the X-rays are so powerful that they can penetrate and destroy conventional mirrors and optics. How do you focus and aim a beam of such power? One possible explanation involves reflecting the beams off metal plates at angles, but no-one from the research team is willing to comment on the secret.

Some observers are sceptical about the "breakthrough" as they abound at budget time.

South Pole heads Down Under

According to scientists, the south magnetic pole has always been rather nomadic. Its path revolves around the geographic South Pole and, at present, it is steadily making its way northwest towards Australia.

Now located 150km out to sea from the French base Dumont D'Urville, the magnetic pole is so far from its geographical home (2750km) that it is not even on the Antarctic sub-continent.

Since 1909, when Sir Douglas Mawson first fixed its position at 72.4° south, 155.3° east, the pole has moved more than 1000km to the north. Its latest position, fixed in 1980 and updated every five years, is latitude 65.4° south, longitude 139.4° east.

In the past 30 years, the pole has moved 300km.

Growing wafers on jets of gas

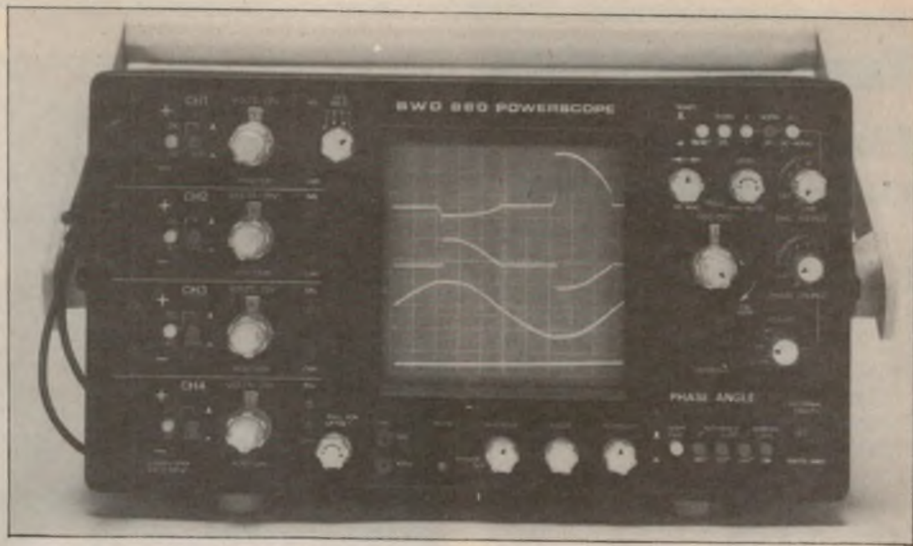
Suspending semiconductor wafers on jets of gas has been shown to improve crystal quality. In America a Bell Communications Research team has developed a technique known as vapour-levitation epitaxy to carry out the process.

Epitaxy is the method whereby thin layers of a substance are deposited onto the surface of a crystal so that the layer has the same structure as the crystal. With levitation a carrier gas suspends the crystal above the "growth station", and the gas becomes the medium which carries vapours of the materials needed to build up the crystal.

Problem devices such as semiconductor lasers and LEDs which are the best light sources available for fibre-optic communication systems do not grow well under conventional techniques. This is because the ratios of the different substances to one another are critical in controlling a device's properties, and cannot be controlled adequately under a conventional system.

Sole distribution rights

From June 1st, VSI Electronics (Australia) Pty Ltd, will be Hewlett-Packard's sole distributor in Australia and will continue to distribute the entire product line, composed of LED-based devices, fibre-optics, optocouplers, bar code products and microwave transistors and diodes.



BWD group now listed on the stock exchange

The BWD group, a manufacturer and marketer of electronics products, recently announced that they would be listing a new company within their group on Australia's stock exchanges.

The company comprises the combined resources of two organisations — BWD Instruments and Synchrotac Middleton Instruments. They have begun trading on the Adelaide Stock Exchange and Sydney and Melbourne will follow.

The group has made its mark in Australia by manufacturing several unique products, and is the only designer and manufacturer of oscilloscopes in this country.

BWD export to over 60 countries and their wide range of products have found ready acceptance in applications relating to meteorology, agriculture, water quality testing, education and training, and the computer and electrical power industries.

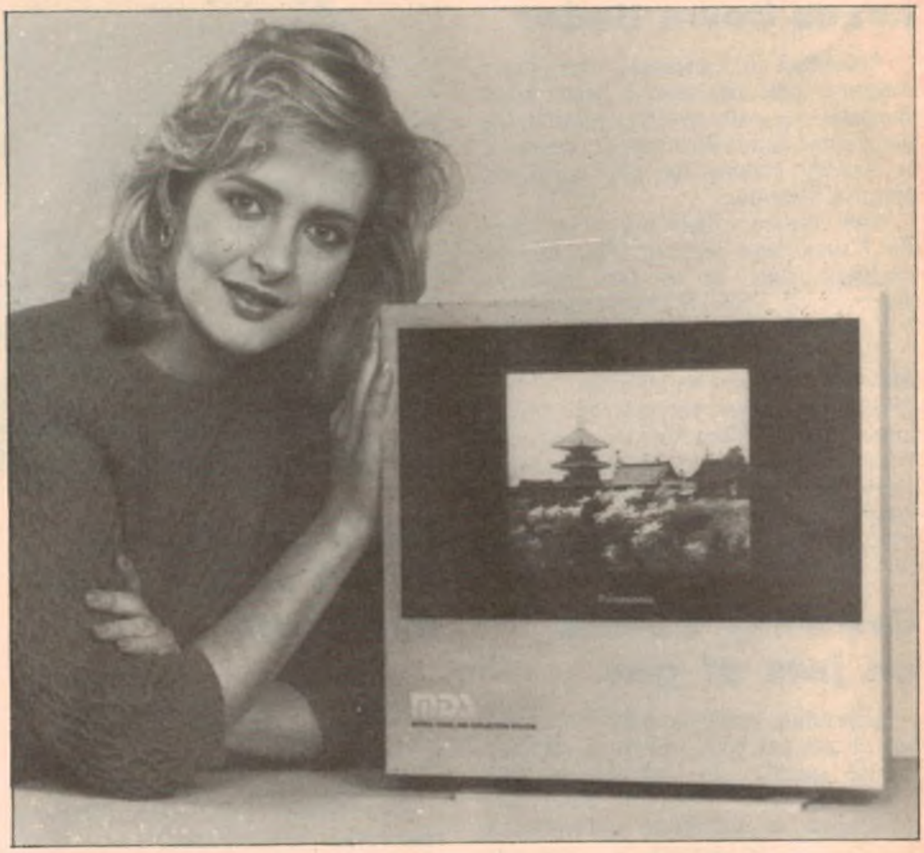
Electronics courses for women

The Royal Melbourne Institute of Technology has been congratulated by Mr Duffy, the Minister for Communications, for the special initiatives it has shown in its technician's course for women which starts this July.

Women who successfully complete the two year course will be awarded the Electronics Technician's Certificate. The main aim of the course is to train women to service electronic office equipment such as microprocessors, computers, VDUs and general data communications equipment.

News Highlights

Flat screen colour television



A revolutionary new flat-screen display panel has been developed by Matsushita and incorporated into a prototype colour TV receiver measuring just 9.9cm thick. The receiver features a diagonal screen measurement of 25cm.

The new flat panel uses Matsushita's so-called matrix drive and deflection system. The screen consists of 3000 picture cells arranged in a matrix of 200 units horizontally and 15 vertically. The picture cells are scanned by electron beams which excite phosphor stripes.

There are 3000 electron beams in all, derived by forming a matrix of 15 filament cathodes and 200 electron beam control electrodes which cross the cathodes at right angles. Each beam is horizontally deflected in six steps and vertically deflected in 32 steps to form images consisting of 192,000 elements on the display panel.

Colour reproduction is achieved by digitising the picture signal and alternately driving red, green and blue phosphors. No shadow mask is employed.

Apple to sell computers to China

The Chinese, for a long time isolated from the West, have in the last few years slowly begun to open their doors. With the acceptance of such Western culture as Coke and WHAM, it was only a matter of time before trading in technology would begin. And it looks as if the Chinese will take their first bite from an Apple.

Recently Apple Computer signed a pact that allows them to sell personal computers and peripheral products to China through the independent distributor ACI Kaihin, a company closely aligned with the Chinese government.

Apple expects to begin shipment of its computer products within a few months. Under the agreement, ACI Kaihin also becomes a certified software developer through Apple's incentive scheme, Certified/Registered Developers Program. This move will spur the development of Chinese applications software and the localisation of existing software.

In addition, the agreement establishes a working group with the Ministry of Education which can develop ideas and concepts for the use of microcomputers in the Chinese educational system.

All this coincides with China's recent outline of a four-part high technology strategy for the country's modernisation which includes integrated circuit development, the use of mainframe, mini, and microcomputers, increased communication, and software development.

Industrial robots: more to come with vision

The International Resource Development (IRD) firm, a consulting and market research group in the US, recently released the results of their latest report on the predicted growth of industrial robots both with and without vision.

Over the next 10 years US industry will buy about a quarter of a million industrial robots. A large proportion of these will be equipped with vision, enabling them to operate with much more flexibility and safety than "blind" robots.

Most robot vision systems utilise TV cameras or Charged-Coupled-Device scanners, with the output passing through image-processing and data-processing subsystems. The devices are mounted either in the body of the robot or in "the hand". In both cases the performance of the robot is largely determined by the power of the signal-processing electronics. The simpler signal-processors require very careful floodlighting or backlighting of the work scene, in order to enhance contrast between the work object and the background.

Vision capable robots are substantially more expensive than "blind robots" although the report shows that their total installed price can sometimes be less. This is because blind robots frequently require special conveyors and other systems to present work pieces at precisely the right time and in the right place.

There have been tragic instances in which industrial robots have inadvertently injured or killed human workers. Designers are working on a process whereby the vision-capable robot will recognise that a worker has entered a dangerous zone and halt its task until the area is clear.

THE BUDGET BLUES

BITS 'N' BARGAINS

Pot Core 3HI & Bobbin
18mm in diameter, Top brand Philips type P18/11. Grade 3H1, AI63-suitable for DC to DC converters, hi-value inductors etc.
Cat L-1445 **$1.50**

Computer Flash Strobe
Manufacturer's oversight - they forgot to put in a body! We've been assured that they work and at this price they're a real bargain. Everything's wired together, all you need including the light sensor. Great value for parts alone!
Cat J-1002 **INCLUDES FULL CCT DIAG.** **$14.95**

Famous Brand Swann Switches
Great value press fit mounting Swann switches! 240V, 4Amp. Ideal for that project where appearance is important. DPST Contacts. Cat J-1003. **$1.20**

Micro Switches
Quality microswitches with positive switching action! These are ideal wherever a limited switching movement is required. Don't miss this great deal! SPDT, 5A 12V or 3A 250V rating.
Cat J-1004 **FAMOUS OMRON BRAND** **99¢**

Scotchlock
Genuine 3M Scotchlok brand connectors Type UG. They're the ones used by Telecom! Now at a BARGAIN price!
Cat J-1020
PACK OF 10 ONLY **$1.99**

Fibreglass PCB.
Fantastic value for these 400mm × 300mm boards! Ideal for most projects and at this price it's worth having a few in the junk box.
Cat J-1017 **$5.95**

BF-463
Hi-voltage PNP power transistor, complement to the 2N6567 with similar specs. Cat J-1015
was 50¢ NOW **25¢**

E-12 Metal Film Resistor Pack.
300 more common values in our 1% types. Over $18 worth!
Cat R-7015 **WAS $13.95** **$9.95**

BIG SAVINGS! NEAR COST
4164 64K Dynamic RAM 150 ns. Cat Z-9312 **was $6.50** **$3.95**

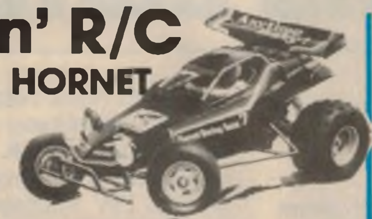
4116 Dynamic RAM 250 ns. Cat Z-9310 **was $1.50** **$1.15**

41256 256K Dynamic RAM 150 ns. Cat Z-9313 **$24.95**

Metering relay 12V/125R Cat J-1033 **$1.50**

LIMITED STOCK

Hot Wheelin' R/C



If you're into radio controlled don't miss this! If you're not - this is just the thing to change your mind. A fantastic ready to assemble model, it's the slickest off-roader you'll ever see!
Cat Y-2526 **$129**

An off-road racer built for performance! Sealed differential and gearbox, three step forward, and reverse speed control, adjustable oil damped shocks give a long trouble free life!
Cat Y-2528 **$199**

No wonder they call this the Hotshot! Shaft driven 4WD lets you take radio control anywhere!
It's got everything to keep it on its feet in the roughest terrain. Easy to control at high speeds thanks to 4WD.
Cat Y-2530 **$249**

FOR POWER AND PERFORMANCE
To keep your Tamiya kit running at peak performance you'll need reliable battery power.
Flat Ni-cad battery S-3326 **$54.95**
Quick charge leads Y-2521 **$11.95**

TAMIYA

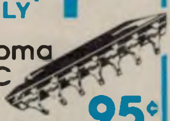
NOTE: ABOVE KITS DO NOT INCLUDE RADIO CONTROL UNITS

Quality 2CH Radio Control
Here's great value for a superb quality, 2 channel, Sanwa radio controllers. Comes complete with servos, mounting screws, everything you need. (No Batteries)! No more problems with interference or crosstalk.
Cat Y-1250 **$124.95**

MORE BASEMENT BARGAINS!
How's this for incredible value? These are limited stock items only and they're way down in price. Get in quick though — they can't last!

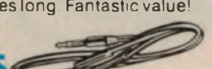
Giant Rubber Feet (pack 4)
Half price specials! These large rubber feet will protect your valuable equipment. Don't let them get away!
Cat H-1738
usually 60¢  **ONLY 30¢**

Electro. Capacitor
200/60uF 275V
Cat J-1034 **ONLY $1.95**

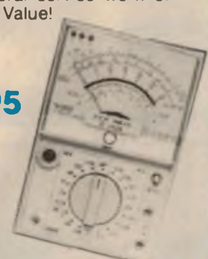


TBA 510 Chroma Combiner IC
Cat J-1028

TAA630S Chroma Demodulator I.C.
Cat J-1029
95¢ each

Audio Leads Pack.
Top quality 6.5mm stereo 3-way plug to 2.6mm stereo line connectors. 2 metres long. Fantastic value!
Cat J-1032
$9.95 

Multimeter & Logic Tester
But you don't even need much logic to use it! 20k/V with 20 ranges, plus high, low and pulse recognition LEDs. Ideal for general service work or development. Value!
Cat Q-1026
$29.95
WAS ~~$34.50~~



PERFECT FOR MARALINGA!
Monitor 4 Geiger Counter
ONLY **$285**

A miniature geiger counter useful for research, education and personal protection in laboratories, hospitals, etc. Sensitive to a broad spectrum range of ionizing radiation including alpha, beta, gamma and X-rays. Switching range - 0.5mR/hr to 50mR/hr. Extra long battery life. Complete with operating manual. This is an accurate scientific instrument at an affordable price. Cat Q-1000

A999

DICK SMITH ELECTRONICS PTY LTD

See page 53 for address details

Letters to the editor

Components in kit sets

Your readers should be made aware that not all kit sets comprise components specified within the parts list for projects published in *Electronics Australia*. I have reason to believe that substitute parts may sometimes be inferior to those nominated and have proof of one such occurence.

To elaborate, a transformer was returned to Ferguson Transformers Pty Ltd by an electronic retailer with a letter from the end user detailing faults and expressing dissatisfaction with the product. The transformer, purported to be a PF4361/1, was found to be a very poor substitute and, by inspection only, could not be expected to perform according to the design criteria of a PF4361/1. The transformer in question, unnumbered and unbranded, accompanies this letter, together with a genuine unit for you to compare.

Without reducing the transformer to scrap, the following may be observed:

(1) The mounting brackets differ from the standard product.

(2) The windings are side by side and not close coupled. It is estimated that this must degrade the regulation from 4% to approximately 6%.

(3) The bobbin is not properly wedged and this causes the noise which was the customer's prime complaint.

(4) The transformer was inadequately impregnated which compounds the problem in point three.

(5) The 15V windings do not appear to be between the primary and secondary windings which results in their purpose being minimised; ie, they would not be effective as an ES shield.

(6) The flux shorting band is poorly constructed, basically because of the divided bobbin. This, together with (2) — viz lack of coupling — and consequent excess magnetic leakage could reduce the effective as an ES shield.

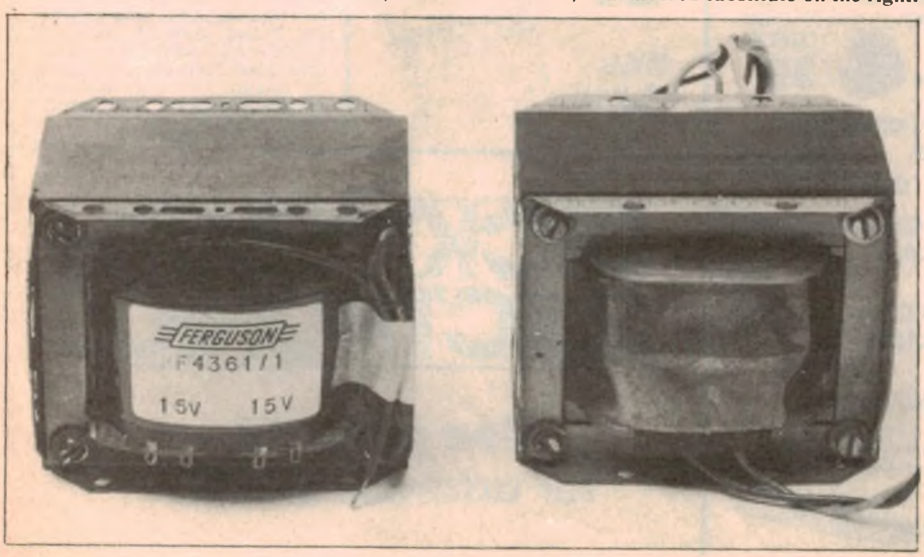
A most ironic aspect of this exercise is the fact that the supplier sent the transformer back to us for replacement under warranty — a transformer which had neither a part number nor a brand name.

Most suppliers of quality components like Ferguson Transformers are proud to display their name and/or logos. Obviously the manufacturer of this transformer, whoever it is, did not wish to be known.

As stated, these comments were made based on inspection only. Should you consider that a complete report is warranted, please return the transformer to us and we will have our laboratory test the unit and dismantle it.

D. Evans, Product Manager,
Ferguson Transformers Pty Ltd,
Chatswood, NSW.

Below: the Ferguson transformer at left, and the unbranded, unnumbered substitute on the right.



Loose coupler for antique radio

I have just finished reading through "Wireless Weekly in 1927" — a great job well done.

I became interested in wireless in about 1922, having read how to make a crystal set in the magazine Pals. It didn't work and, as I later discovered, there was no chance of it doing so as instead of a crystal it had a sewing needle resting on the carbon out of a torch battery.

This lead my father to take an interest and he later went in for valves and such and we had the only "wireless" in Ringwood in the loft over the cowshed. People used to ring our doorbell and ask to listen to this modern wonder. Very mysterious it was too — nothing but Morse in those days.

The purpose of this letter is to enquire if anyone knows of some rabid collector of old wireless bits and pieces, who would like to own a fairly well preserved "loose coupler" made by my father and I about 1923. They were at the time the very latest in tuners for crystal sets — they eliminated "dead end loss" and helped to achieve the optimum in LC ratio.

This item is at present gathering dust and spiders' webs on a high shelf in my garage. It is of no use to me and none of the family or any acquaintances are the least bit interested. It occurred to me that somebody might be if only they could be found.

J. B. Bull,
Morwell, Vic.

● *Any reader interested in the loose coupler can get in touch with Mr Bull by writing to Electronics Australia.*

Wireless Weekly well received

I was delighted to see your re-issue of "Wireless Weekly" for 1927 on the news stands. I am sure that it will be a hit with the members of the Historical Radio Society of Australia and with the many who still remember the early days of radio, when they built the family set on the kitchen table. I will buy extra copies to send overseas.

I am enclosing a copy of our newsletter. It is no rival to *Electronics Australia* — we distribute around 200 copies, including copies to the New Zealand Vintage Radio Society, British Vintage Wireless Society, Antique Wireless Association of America, South California Historical Radio Society and Sacremento Historical Radio Society. We would welcome new members anywhere in Australia. The membership fee is $10 per year.

We wish your magazine continued success in the next 60 years.

R. Kelly,
The Historical Radio Society of Australia,
49 Sharon Road, Springvale, 3172.

Corrections to June 1985 Letters

Due to an oversight, the first two paragraphs of Mr A. M. Fowler's letter in our June 1985 issue (page 13) were lost and material from another reader's letter substituted. The following two paragraphs are the correct beginning to Mr Fowler's letter:

I have worked in the electronics industry for over 40 years, first in broadcasting and communications, then in digital electronics and more recently with microcomputers. For most of that time I have been a professionally qualified engineer and have been in charge of other engineers and technical staff. I have interviewed a large number of aspiring engineers and technicians, and have watched many of them develop.

I have been buying and reading Electronics Australia since 1944, when it was Radio and Hobbies, and I am not ashamed to admit that I have learnt a considerable amount from it. I also regularly read a number of other magazines, including Electronics (USA), EDN, Wireless World, ETI, Your Computer and "68" Micro Journal. I also read regularly trade journals such as AEE, What's New in Computing and What's New in Electronics. Each of these is aimed at a different audience, and between them all, I have been able to keep reasonably abreast of current developments in my chosen field.

Given that background . . .

Another error appeared in the letter from Mr B. Ferguson. The line reading "In my view any electrical engineer . . ." should have read "In my view any electronic engineer . . ."

We apologise to Mr Fowler and to Mr Ferguson for these errors.

The longevity of modern recordings

Some very interesting points were raised in Forum for March concerning the longevity of modern recording techniques.

The problem which concerns me is slightly different. (It's an odd fact that no one ever has exactly the same problem).

I have been making sound recordings on reel-to-reel tapes, mostly of elderly people speaking on local history, items which unless preserved will be forgotten in a few years. I have an Akai X-300 tape recorder and also an Akai X-V portable machine, both giving excellent results.

The problem is spare parts. I thought I was being very prudent a year ago when I asked Akai Australia to sell me some replacement heads. Imagine my surprise when I was told that spares were not available.

Similarly I had the opportunity to buy a second-hand Akai video camera and portable R/R video recorder in black and white. I didn't buy because on checking with Akai there were no spares available for this model. It apparently belonged in the archives at eight to 10 years old.

Perhaps the lesson is to look very closely at manufacturers' policies regarding spare parts before investing in expensive equipment. All my efforts in several directions have failed to turn up any Akai heads. So it seems that when the heads wear on my recorders I will be left with a heap of expensive junk.

Your other point about deliberately omitting parents' names from children's records has horrifying possibilities. It has already been considered by the Victorian Government — they intended to remove the natural parents names from the birth certificates of adopted children (about the only time any government has considered enshrining incest in legislation!) If that had been implemented how long before brothers and sisters married if they didn't know their real parentage?

J. Lewry,
Bowra, NSW.

Join the Navy

A Lieutenant and Leading Seaman on watch in the bridge simulator.

. . . on dry land

by LOUISE UPTON

How do you teach Naval Officers ship handling in a realistic manner, without going to sea? The Navy has taken a leaf out of the airlines' book. A full size Bridge Simulator has been installed at HMAS Watson in Sydney, so training can be done without the expense of a ship at sea.

Germany, 1100 hours, Wednesday, 15th May 1985.

We had arrived at the RAN's Bridge Simulator in Watsons Bay at 10.30 that same morning but after some quick introductions to our guide, Senior Instructor Lieutenant David M. Graham, we went to where almost everything is possible!

We were now on, Lieutenant Graham informed us, the bridge of a guided missile frigate. Our destination was a Navy formation at sea and our present location, the German port of Hamburg on the Elbe river. And all this had been accomplished within minutes of our arrival that same morning.

& see the world...

The Simulator

We were actually on the Australian Navy's new bridge simulator, a life size replica fitted out with everything the naval officer could expect to find — up to and including escape hatches, and the CO's chair. Outside the windows, which afforded a 250° panorama of the passing scene, were the Hamburg riverbanks complete with wharves, freighters, trade ships and the marker buoys. It all passed by with a surprising degree of reality. Even the shadows on the water could be seen.

About the only missing feature which alerted me to the fact that I was surrounded by the overlapping video images of 11 computer-controlled projectors, was a noticeable lack of shags and seagulls!

Putting this aside, what was most uncanny was the remarkable resemblance this room bore to a ship on water. I was positive we had been on solid ground but we weren't any longer. The slight pitch and roll one experiences on a birthed Manly ferry was there the moment we stepped from the instructor's room onto the bridge simulator. As Lieutenant Graham telegraphed for increased revs, the throb of the engine became more noticeable beneath our feet. The visual images flowed past at a greater rate as we slid quietly past the Hamburg docks, at approximately 5 knots.

The radar scan on the Bridge showed the changing contours of the surrounding dockside areas while the depth indicator showed how much water lay beneath us. Many metres.

Then someone had the temerity to ask what it was like at night. The Lieutenant ducked out for a moment and the whole scene moved forward by 12 hours. It was now 2300 hours and all was quiet on the docks. We moved through the silence with nothing to guide us except for the radar and lights on the distant docks; merely pin-pricks in the darkness.

We saw what looked to be the ghostly outline of a large tanker moving in the opposite direction in the adjacent shipping lane and jumped like startled rabbits when it sounded its siren. Talk about loud!

It was a relief to get out on the open sea. Well, it was at first, as we rode the gentle swell but then the master of the bridge telegraphed for full speed ahead and the seas became distinctly rough. "Sea state five" the Navy called it. Nobody actually ran to the side in a sudden urge to commune with the depths but we were told that some previous visitors had.

Helping the overall effect was the periodic juddering of the deck which occurs as the ship rolls forward into a trough and lifts its propellers out of the water.

The entire simulator is mounted on an electro-hydraulic controlled motion base which provides pitch and roll of ±5°. This is not enough in itself to simulate a heavy sea but the accompanying pitch and roll of the computer-generated images which form the outside scene can be up to ±12°. This is sufficient to create the desired effect.

Returning to normal sea conditions we proceeded to carry out manoeuvres in formation. A close shave with an aircraft carrier demonstrated to us the pressure wave generated by its bow and the dangerous effect this can have on a craft's safety. The bridge shuddered with the force of the wave and if the Lieutenant had not been as competent as he was, we would most certainly have collided. He told us that junior officers had to practise a manoeuvre of this sort, in case they ever had to replenish a carrier's supplies.

We also experienced heavy fog and tried the simulations of other ships. We even tried running aground, which was very convincing.

The Lieutenant explained that he could simulate any situation likely to arise on a ship — from engine or steering failure to man overboard — by calling up the right information from the computers which controlled the system.

"It is of course the reason for installing this type of teaching device. It gives junior naval officers the chance to deal with a number of very dangerous situations and make the mistakes that if made at sea would be expensive and perhaps tragic. Through constant practice the right procedure becomes an habitual reaction," he continued.

All the information needed to simulate the situation was easily obtained from the computer system which we were told was made up of a network of machines controlled by a central processor.

What makes it work?

Providing such a convincing illusion is no simple task and requires a great deal of computer power. Krupp Atlas Electronik designed and supplied the equipment for the entire installation. The all-up cost, including the building in which the installation is housed, was $14 million. This was something of a bargain, partly as a result of the project being completed early and under budget. It is the first such simulator built for a Navy anywhere in the world.

A similar installation has been built at the Australian Maritime College in Launceston, Tasmania although this

Lieutenant Graham in the formation ship room, driving ships on the screen for the simulator.

Join the Navy . . . and see the world

latter system does not have a motion base.

The simulated Bridge is a room some 7.3 metres by 5.2 metres which is supported by hydraulic rams each having a thrust capacity of five tonnes. These rams are electrically controlled via the computer system which provides the motion simulation.

An officer-of-the-watch and a bridge crew of up to seven see an outside visual colour display depicting daytime, dusk or night, with all the details mentioned above. Even the bow wave and wake of ships is depicted, depending on their size and speed.

The visual images are provided by 11 high definition video projectors which are carefully overlapped to give a panoramic display of 250°. The circular screen is set about four metres outside the windows of the bridge. Picture resolution for each of the projectors is 512 × 512 pixels. The display calls for 120 basic colours, with 64 shades of each colour. In addition, the sunshine effect of the displayed scene is further interpolated among 64 possible shades.

In practice, the video projectors are not used at high levels of luminance, in order to prolong the life of the individual projection lamps.

The central processor is a 32-bit Gould 32/27, with two Megabytes of main memory, 64 Megabytes of disk storage and the ability to process in serial 600,000 instructions per second. The processor performs such functions as central management of the exercise sequence and files, coordination of individual simulators, control units and interfaces and stores a host of other relevant information.

The central processor acts via a network controller which is connected to individual control units which are Krupp EPR 1300s. The first of these is the motion control unit for the Bridge itself. The second controls the radar display while a third provides the bridge communications. A unit controlling ship formation precedes another five EPR 1300 computers which look after the all important visual images. The first, processes the models for the visual system, reading from the disks sets of descriptions and allowing 2K surfaces to be seen.

The second is a unit for co-ordinate transformation and the third generates the image.

The entire computer installation represents the major investment in the simulator and is worth some $12 million.

The whole system is protected against the outbreak of fire by a gas injection system which forces Halide gas into the room, displacing all the oxygen. If a person was in the room at the time of a fire outbreak, an alarm would sound and then he would have 20 seconds to get out before it didn't really matter anymore.

All in all, the Bridge Simulator is a most impressive installation which should pay for itself in a short time. Consider that it costs in the region of $30,000 a day to keep a capital ship at sea, and that does not take into account the wages of the crew.

However, for the system to become fully operational, the Navy still has a great deal of work to do. The intention is to be able to simulate any part of Australian waters, all those thousands of kilometres of coastline.

To that end, Navy ships have prepared miles (kilometres) of continuous coastline photographs. These, together with up-to-date coastal charts, will be used to prepare the digitised data to be fed into the computers. This is tedious stuff, since not only must the visual image of the coastline be prepared but also the radar simulation. Many man-years of work will be required to fully program selected sections of the Australian coastline.

Above: is the instructor's room, with radar at right and the bridge in the background.

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This unit will cover an uninterrupted area of up to 2000 sq.ft. It has two pitch settings for different applications. (Instructions supplied). Supplied with 240V adaptor, but will run on a 9V alkaline cell. Dimensions: 110(w) x 65(h) x 40(d)mm Cat.A 0080

Verminex Commercial Unit **$149**

Ideal for larger or more open areas. This unit has 9 pitch settings and offers more comprehensive protection from unwanted visitors. Also covers an uninterrupted area of up to 2000 sq.ft. and is supplied with AC adaptor. Dimensions: 120(w) x 80(h) x 80(d)mm **Cat.A 0075**

How Does It Work?

The normal household, or office environment is normally devoid of ultrasonic sounds (ultrasonic sound being way above human hearing range!) Evolution has not had a reason to equip insects, rodents etc. with a protective sensory mechanism to guard against ultrasonic noises or sound. When subjected to a particular ultrasonic pattern, the creature begins to behave in a predictable manner. The pest becomes disoriented, lithargic and bewildered. The reaction is to escape from the sound effected area. The sonic pattern is the secret and this is a combination of scores of frequencies mixed together. The pattern was developed by Professor **J.L.Stewart** (who developed the Bionic Ear) **It Works!**

Initially we ourselves were sceptical we asked "if its so good why haven't we heard of them before?" or surely as ultrasonics are not new if the thing is any good they would have been on the market years ago. Well these have been ultrasonic repellers around—but none of them used the Stewart complex sonic pattern, consequently past results were uninspiring.

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The Repeller serves an area of 2000 square feet (uninterupted) and is not cheap. However, if the idea of dangerous chemicals, insecticides, sprays and baits worries you, the **Verminex is a great solution.** Supplied with plug pack for 240V operation. Can be battery operated.

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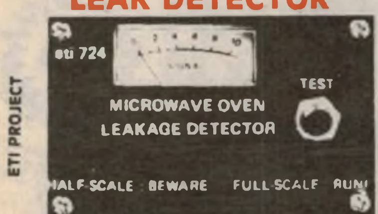

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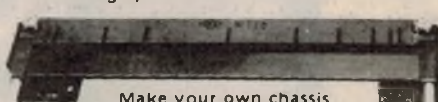

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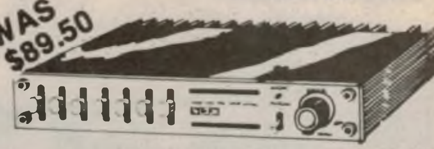

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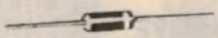

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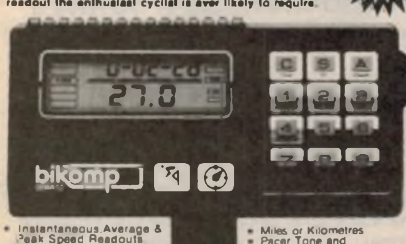

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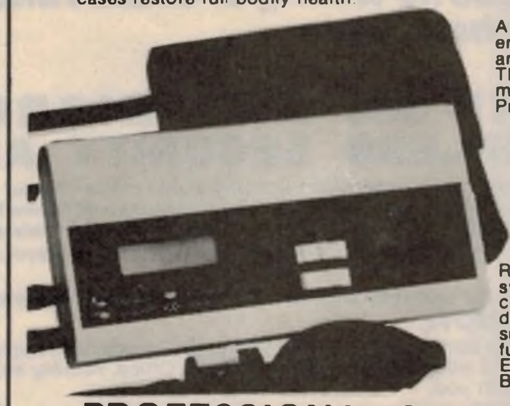

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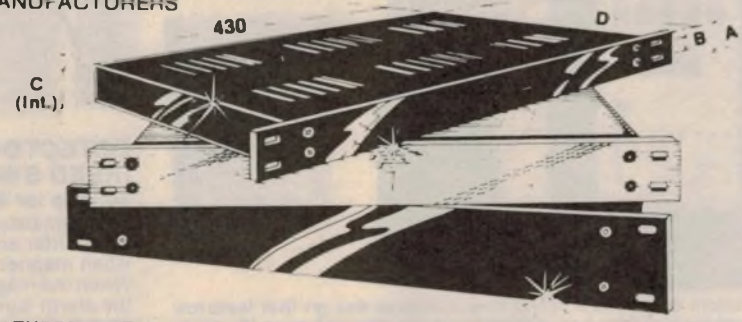

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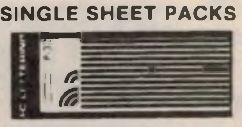

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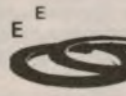

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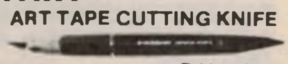

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Apart from the flawless operation of the Bonax system—one of the great features is its application with rented or leased premises--lets face it, money spent on installing a wired system in your Home or Office, Factory etc. is irrevocably lost when you move on. With the Bonax you simply take it with you.

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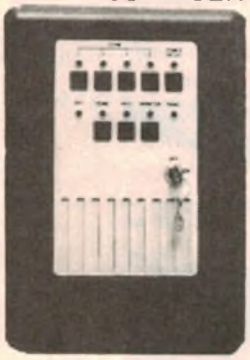
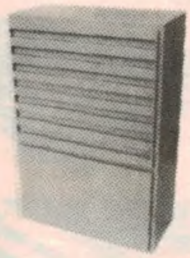
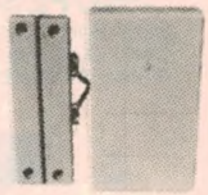


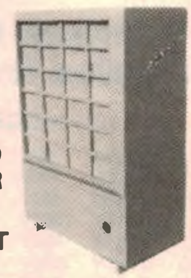
HAND HELD REMOTE CONTROL
S 5230

REMOTE SIREN
S 5250





WIRELESS REED SWITCH
S 5220



PASSIVE INFRA RED DETECTOR
S 5240

This alarm system is a brand new inovative design that features completely wireless connection to all accessories, even the reed switches. It is the most professional security system we've ever appraised. Think of how easy it is to install a 'Wireless' alarm system. The benefits are endless. e.g. arming your Flat or Townhouse with an alarm you don't need to run wires through the roof or drill great holes through your walls. When moving house the alarm is simple to dismantle and re-install elsewhere.

The system divides protected areas into four different zones, programmable by dip switches in each transmitter/detector. **Pocket remote control** can simply arm or disarm any zone i.e. alarm your house perimeter from your bedside when retiring etc. this allows essential protection in some zones while cancelling other zones as desired. Each transmitter/detector unit can be programmed into interior or perimeter zone. Zones can be programmed for instant or delayed trip. The system has a built-in ear piercing siren for intrusion and panic alarm signals. It also has another dry relay output with normally closed, normally open contacts for connecting to other alarm reporting devices such as telephone dialer, additional outdoor siren etc.

SYSTEM IS COMPRISED OF:

4-ZONE MAIN CONTROL RECEIVER S 5210 **$299.00**

FEATURES:

- Wireless reception of external or internal sensors or detectors.
- Selectable home or away modes for selecting internal and external arming or just external to allow movement inside the building.
- Built in Piezo electric siren gives different signals to indicate different functions.
- N/O + N/C Contacts.
- Sends signal down power line to activate one or more remote sirens.

The main control receiver runs on 250V AC with a 12V 1.2AH battery for emergency backup. All other units with the exception of the line carrier, run on a 9V battery each. The average life expectancy is approximately one year. System works around the 317MHz frequency where there is less chance of false alarm. The range of the unit is nominally 80 metres in open space.

ALARM AND INDICATION SOUNDS

Intrusion Alarm — Panic Alarm — Arm Tone — Disarm Tone — Exit Click Tone — Monitor Tone — Tampering Alarm.

DETECTOR/TRANSMITTER UNIT (REED SWITCH) S 5220 $39.50

Suitable for Windows and Doors

This consists of an enclosed reed switch and compact UHF transmitter and a removable enclosed magnet. The unit is at rest when magnet and reed are side by side (within 25mm or 1 inch). When the magnet is moved away more than approximately 1 inch the alarm signals to the Main Control Reciever and the alarm is sounded. In practise the Reed/transmitter is mounted on the door or window frame with the magnet on the moving door or window.

PASSIVE INFRA RED MOVEMENT DETECTOR S 5240 $99.00

Ideal for the lounge room, family room or hallways e.g. anywhere where an intruder is likely to pass through. Mounts up on the wall or on top of bookshelves etc. Detects movement within an area of 9M by 9M by sensing intruder body heat movement through the protected area. Will not false trigger with the family cat or curtain movement etc.— as is the case with the cheaper Ultrasonic alarms.

REMOTE PIEZO SIREN S 5250 $89.00

This unit is an optional line carrier receiver. Receives signal through 'AC' line i.e. it would ideally be located in, say, the roof space and plugged into mains power.

HAND HELD CONTROL TRANSMITTER UNIT S 5230 $39.50

A real joy to use— keep it at the bedside table-allows you to say alarm the house perimeters when retiring or you can take it with you when you go out, arming your system after you lock the door. Unit is a function control transmitter—to send 4 different signals.

Off—To disarm the system before entering. **Home**— To instantly arm the system with 'perimeter' detection only. **Away**—To arm complete system after a given exit delay time of about 40 sec., **Panic**—To start an emergency signal whenever needed, in any mode.

WILL IT INTERFERE WITH MY NEXT DOOR NEIGHBOUR IF HE ALSO INSTALLS A BONAX ?

Fortunately no — each system is custom coded by the owner when commissioned.

Bonus offer - Complete System $599

(to suit average home or small business)

One S 5210	Master	One S 5230	Passive IRD ★
Two S 5220	Reeds ★	One S 5250	Siren
One S 5230	R/Control ★	★ Requires 9V battery S 5009 .85¢ ea.	

Battery backup (during Mains Failure)

Both the Main Controller and Alarm Siren can be fitted with rechargeable batteries to permit normal operation independent of Mains Power. Cat S 5065 **$22.95 ea.**

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BUILD THESE FABULOUS KITS

OSCILLOSCOPE SENSATION!

(See EA Oct '84)

K 2000

Only $249

Over the years many people have asked. "Do you have a CRO kit?"—Our answer— up until now— has been that built and tested units were not dearer than kits, if you could get a kit at all. The Altronic K 2000 Cathode Ray Oscilloscope kit has a guaranteed 5MHz band width but should go to around 6.5MHz. It also features 75mm (3") CRT Blue Phosphor with accurate graticule, separate vertical and horizontal BNC type input sockets etc. Remember, a 5MHz scope is usually adequate to troubleshoot most micro processor and other digital circuitry as well! This is a wonderful opportunity to learn electronics and end up with a valuable piece of test equipment as well. The Altronic K 2000 kit is absolutely complete. The chassis is prepunched and every component including nuts and screws are provided, along with instructions.

TRANSISTOR ASSISTED IGNITION WITH DWELL EXTENSION

KEEP YOUR ENGINE IN TOP TUNE

Yes, it's bad enough paying $2.00 a gallon for petrol without wasting a fortune on an out of tune engine. Fit this transistor assisted ignition kit in minutes and start saving money from the very next petrol stop.

K 4010

$35.00

Value Plus

This unique electronic ignition system will easily double the interval between tune ups. Plugs and Points stay in top condition for much, much longer.

Greatly reduced plug breakdown at high rev's.

Dead easy to build and (even better) there are only 3 electrical connectors required to the car wiring system.

MULTI SECTOR BURGLAR ALARM STATION

Save $$$ on the cost of commercial equivalents

Within the Capacity of the beginner constructer

Professionally Engineered by the design team at Electronics Australia

(See EA Mag. Jan '85)

Protect your Home or Business from Intruders with this "State of the Art" Burglar Alarm.

FEATURES:

- Alarm has 8 separate input circuits—8 sectors can be monitored independently
- Each input circuit is provided with an indicator LED and a sector On/Off switch
- Individual sector isolation allows the user to have some areas of the premises habited while others remain protected e.g. Inside Off/Outside On
- Inputs accept both normally closed and normally open sensors
- Two Inputs provided with an entry delay (between 10 - 75 seconds)
- Internal trip warning buzzer—alerts owner/occupant of pending alarm operation—great for the "forgetful" amoungst us. This buzzer is pre-settable between 5 and 55 seconds prior to Alarm.
- Unique circuit detects automatically when any N/O or N/C loops are either open circuit or dead short. **e.g. someone trying to bridge reed switches etc.**
- Switched output can be used to send a silent alarm through an auto-dialler circuit or similar.
- Full battery back up provided via. 12V—1.2Ah battery
- Supplied in an attractive functional security case.

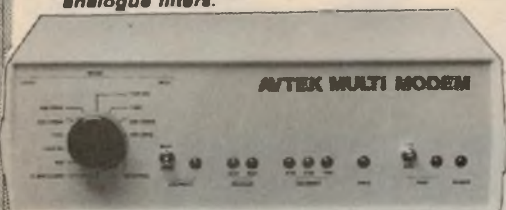
K 1900 A Mere **$139.00**

STATE OF THE ART

The Avtek MultiModem

a breakthrough in low cost modem design

Using state-of-the-art VLSI integrated circuitry, the Avtek MultiModem provides the highest standards of reliability for data communications on public phone lines. Digital signal processing is used to achieve functions normally requiring analogue filters.



MULTIMODEM NEVER REQUIRES ADJUSTMENT

MULTIMODEM WORKS RELIABLY ON LINES WHERE OTHER MODEMS CAN'T FUNCTION

Its digital filters are much sharper than on conventional modems. Line interference is screened out. You get error free data transfer, even on very noisy lines.

MULTISTANDARD OPERATION

CCITT and Bell Duplex and Half Duplex

AUTO ANSWER OPTION (MODEL D 1205)

Autoanswer is the ability of your computer/modem to receive when the phone rings. Some computer/software combinations do this. MultiModem offers the alternative for computers without this facility—hardware autoanswer. Leave your computer waiting for information.

TEST FUNCTIONS

DIG. This function enables the user to test the modem's operation over a line, testing both modem and line.

ANL. Provides testing of computer, software, cabling and modem.

SPECIFICATIONS

Data Standards:	**CCITT V.21 & V.23 Bell 103 & 22**
Data Rates:	**300, 600 & 1200 BPS**
Backward Channel:	**75 BPS in conjunction with 1200 BPS**
Computer Interface:	**CCITT V.24 (RS232C)**
Power Requirements:	**240 VAC Power drain—3 watts**

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D 1200 (Standard) **$349.00**

D 1205 with auto answer **$389.00**

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DSE's new VZ300: word processing for the masses

With stocks of the popular $99 VZ200 personal computer now virtually exhausted, DSE has announced a substantially upgraded replacement, model VZ300. It will have its own special appeal to computer enthusiasts but, as well, it opens up a whole range of options as the basis of a relatively inexpensive word processing system.

by NEVILLE WILLIAMS

My first encounter with the original VZ200 was when I took one along on a holiday and, rather than overdo the relaxation bit, I coupled it to a TV set in the flat and worked my way through the manuals. In the process, I realised its potential tuitional value, which became even more apparent when the original $199 purchase price was later reduced to $99.

Subsequently DSE came up with an excellent cassette-based word processing program, written for the VZ200 by Messrs Epps and Fackerell. On screen, it provided means to compose text in takes of up to 15,042 characters, and to freely correct, delete, insert or shuffle words, phases or paragraphs, rearrange copy, etc, using simple, easy to remember commands.

The copy could be stored on cassette tape or fed to a printer as a normal mix of capital and lower case letters, numerals, symbols and punctuation marks. There was provision to specify the length and width of print, left and right margins, indents, columns, right-hand justification, etc.

It added up to a modest but practical word processor for about $550 all up, and still under $1000 with a more pretentious printer. (See "Forum" for November '84.)

The exercise served to introduce quite a few people to the advantages of word processing and to whet their appetite for something more ambitious — an option which the new VZ300 opens up. But, first, we summarise what it offers as a basic personal computer.

While quite obviously developed from the earlier model, the VZ300 is somewhat larger overall at 305(W) × 183(D) × 63(H)mm. It is housed in a moulded plastic case, grey-green in colour, with peripherals to match.

Like the VZ200, it has an on-off switch at the right-hand end, and sockets at the rear for a plug-pack power supply, for video out and RF out (TV channels 0-1) and for cassette tape in-out. Also at the rear are ports for a floppy disk controller and/or optional expansion

The VZ300 Computer with the DOS (disk operating system) cartridge plugged in at the rear. It, in turn, has a "piggyback" socket for RAM or ROM modules. On the right is the VZ300 Floppy Disk Drive.

memory, etc, and a Centronics type printer interface.

The most obvious difference is the keyboard, which now has proper keys and a normal space bar, instead of the flat "rubber" pads fitted to the earlier model. They certainly look more professional and lend themselves to a higher typing speed. In action and "feel", the keyboard is much the same as found in other modestly priced PCs.

Inevitably, perhaps, the larger keys have crowded out the "Function" legends which appeared below the pads on the earlier model. The functions are still active and accessed by the same keys but now need to be memorised, or identified with the aid of a separate card. In practice, they are not used all that much.

A further omission is the colour coding above the numeral keys but this could presumably be corrected in due course with a suitable adhesive label.

Accessible through the bottom of the housing is a small colour/B&W slide switch — a welcome provision, when used with a monochrome monitor. With the original VZ200, the 3.58MHz clock signal could in some cases, produce a noticeable interference pattern.

It was usually not troublesome on a receiver/monitor because of the limited passband of the RF link, but it could be objectionable on a wideband monitor, unless attenuated by a 3.5MHz low pass filter in the video line.

Provision of the colour disable switch and a claimed small shift in the clock frequency appears to have considerably reduced the problem.

Internally, the layout has been completely revised to accommodate everything on a single board, with due attention to ventilation and to minimising possible hot spots in the circuitry.

A notable improvement is a substantial increase in in-built user RAM (random access memory) — from 6K for the VZ200 to 16K in the new model. This should be adequate for many purposes but external memory expansion modules in the VZ300 range of options can at least double this — an observation which calls for further explanation.

Compatible or not?

From the viewpoint of compatibility, the good news is that the Microsoft Basic II ROM is essentially the same in both models, so that software for (and from) the VZ200 should work with the VZ300 — and it does, to the extent that we have been able to verify. The printer/plotter, Centronics printer interface, cassette recorder and joysticks for the VZ200 also appear to be compatible.

The same cannot be said, however, for the memory expansion modules, mainly because of the manufacturer's decision to provide more internal user RAM in the new model. It has meant that the top address for the internal RAM (therefore the starting address in the matching extension unit) is nominally 10,000 higher in the case of the VZ300 than it is for the older model.

If the VZ200 extension unit is plugged into the VZ300, it will function but will provide only the same total memory space as for the VZ200: 22K. This comes about because it uses the same starting address in both models, simply overlapping the upper 10K of the VZ300.

It still means, however, that if you have the opportunity to trade up to the new keyboard, you can plug in the old 16K expension memory and carry right on — until you can spare $69 for the right one and the extra 10K of memory.

With its own 16K expansion module, the VZ300 provides a nominal 32K of user RAM. It is important to note, however, that the new VZ300 module will not work at all in the older model. Because of the 10K gap between the finishing and starting addresses, the VZ200 won't even know that the module is aboard!

A 64K expansion module is also available but at $149 is debatable value. The point behind this is that the BASIC Interpreter in both models (VZ200 and VZ300) can only cope directly with 34K of RAM so that, for normal BASIC programming, only 34K of RAM can be effective — so the 64k module gives a potential increase of 2K for $70!

In machine language, additional 16K banks in the 64K module can be independently selected by programming, but the facility is not available in BASIC. Curiously, the 64K cartridge would probably offer better value if used in conjunction with the VZ200, providing the same 34K of RAM — a significant increase over the previously available 6K or 22K.

While final stocks of the VZ200 were cleared at a quite low figure, the fact remains that, two years ago or more, it was hailed as a "breakthrough" at $199 for such a powerful small computer.

Now, despite rising costs, the VZ300 comes in at that same figure, with a much superior keyboard, more than double the amount of user RAM, other refinements and provision for a wider range of expansion peripherals, including a completely new disk drive and controller, described later in the article.

That must surely add up to a very attractive proposition for budget conscious PC enthusiasts.

Format conversion tape

To assist those who have accumulated cassette files compiled with the E&F word processor program, DSE have prepared a conversion cassette allowing them to be changed to the new ROM format.

The conversion tape is fed into the VZ300 (or VZ200) with extension RAM in ordinary BASIC configuration, using CLoad. When RUN, it readies the computer to receive and re-format the E&F file and displays the relevant instructions on the screen.

When the E&F file has been loaded and duly processed (the text is not displayed) it can be Saved on cassette, and can then be fed directly into a ROM format word processor, where it can be displayed, checked and re-edited if necessary.

As a word processor

With the release of the VZ300, it should be possible for anyone who has been using a basic word processing system, as mentioned earlier, simply to substitute the improved keyboard and carry right on.

In fact, by way of verification, this portion of the article is being prepared on just such a system: VZ300, an existing 16K expansion unit, DSE data cassette recorder, E&F (Epps and Fackerell) W/P program, printer interface and printer, and a "Princess" B&W TV receiver. It works well!

If setting up such a system for the first time it would, of course, be logical to purchase peripherals to suit the VZ300, partly in the interest of styling and colour, but also to ensure a full 32K of memory is available for possible future requirements.

Certain points are worth noting, however, in seeking to plan ahead for word processing facilities.

1. The VZ300, as is, will load the E&F program with memory space to spare but it will not work correctly by reason of certain "bugs". As with the VZ200, a 16K expansion module is essential.

2. The E&F program was written specifically for the VZ200 and is limited internally to 15,042 characters at a time — about the length of a 3-page article in this magazine. In its present form, it will not take advantage of the extra memory space.

3. The E&F program currently makes no provision to talk to the new DSE floppy disk memory store. If planning to buy a disk system, it will be necessary to

DSE's new VZ300

The VZ300 is slightly larger overall than the earlier model but has a much better keyboard with normal space bar.

select an appropriate word processing program, such as the one that is now available on ROM (read only memory) pack.

In planning a replacement word processor program, DSE decided that it should be on ROM rather than on tape, to avoid the 90-second routine of having to load it on each occasion prior to use. However, instead of adapting the existing E&F program, they had a completely new one prepared by Messrs Dubois and McNamara, identified as the VZ300 Word Processor.

It is mounted in a plastic case similar to that used for the extension memory and plugs into the same socket. At switch-on, the Command menu appears on the screen with the options: Edit, Print, Clear Text, Disk Commands and Tape Commands. As such, it is ready for immediate use.

Fairly obviously, with the ROM occupying the extension socket, text can be stored only in the computer's internal RAM. This presents no problem in the VZ300, which can accommodate 15,564 characters at any one time — marginally more than the 15,042 available with the E&F program.

The ROM is also functionally compatible with the original VZ200 but, because of its limited (6K) internal RAM, only 5324 bytes can be accommodated at once. Except for correspondence and short articles, the user would be heavily dependent on tape or disk storage.

The new VZ300 word processor has more on-screen edit provisions than the E&F program and, at first glance, might appear to be more difficult to memorise and to use. Perhaps it is, but not by all that much — especially if one makes up a simple guide card, as illustrated.

As with most such programs, the newcomer is well advised to concentrate initially on facilities which they prefer or need to use and to assimilate the remainder only as necessary. Personally, after having used the E&F program for some time, I found no difficulty in adapting to the new one.

On a monochrome monitor, the characters normally appear dark against a lighter background, with capital letters reversed. Up to twelve 32-character lines can be accommodated on the screen at a time, with operating mode information along the top, as appropriate.

For composing and editing text, the program provides the usual facilities to move the cursor to any desired point on the screen or in the text. Alternative edit modes are available by pressing Control (9): Mode A which allows errors to be simultaneously over-typed and obliterated; Mode B, which allows characters or text to be deleted or inserted, the rest of the text being shuffled automatically to accommodate the changes.

For major insertions — new text or from disk or tape files — the cursor can be placed at the desired point and the display flipped to Insert mode by using Control(0). The new copy can then be composed, displayed and checked out on an otherwise blank screen and will be inserted at the designated point in the main text upon return to Edit mode.

A block marker is available to designate blocks of text to be moved, copied or deleted, while there is also provision to search for and change designated "strings" (words, etc) up to 16 characters long. While all this is going on an FM (Free Memory) display indicates how much memory space is still available at any time.

Of note also is the provision for TAB stops, which can be set and cancelled as required, with their positions indicated at top and bottom of the screen. The most obvious single use is to provide an Inset at the beginning of each new paragraph, obtained simply by typing Control(T).

As indicated earlier, the main Command Menu has provision to Clear Text (with a Yes/No precaution) and other separate sub-menus to do with Print, Disk and Cassette.

Cassette commands

Of these, the cassette facility is the least complicated. It provides for: (1) Save; (2) Load; (3) Merge; (4) Verify; (5) Return to main menu. The Load function calls for special comment, in that it replaces existing text in the memory and is therefore protected by a Y/N query. To add to existing text, as in Insert mode, the Merge command must be used.

The Verify command provides means to ensure that text has actually been saved but I missed the character count that is provided on the E&F program. Neither program has provision for directly cueing the cassette deck, which must be switched manually to the required function.

The VZ300 disk storage system is completely new and has the added advantage of being compatible with the older VZ200, thereby significantly increasing its potential. At around $330 all-up, disk is admittedly more expensive

VZ300 — BASIC SPECIFICATIONS

Processor/speed	Z-80/3.54MHz
Internal ROM	16K
Internal user RAM	16K
Keyboard	46 keys, typewriter format
Text format	32 cols, 16 lines
Graphics format	64 × 32, 128 × 64
Colours	8/9
Input/output (in-built)	video, RF (TV 1&2), cassette
Cassette data rate	600 baud
Power pack (supplied)	12V/1A (nominal)

SIEMENS

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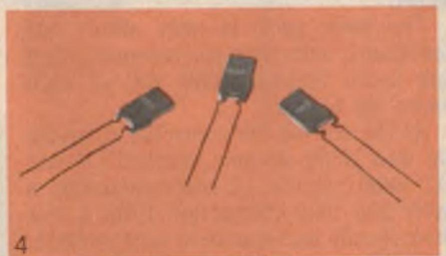

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INGENIOUS ELECTRONIC ENGINEERING

766/2495 CSA

DSE's new VZ300

to install and operate than a cassette system, and somewhat more accident prone for the newcomer, but it can save and load files in less than a tenth of the time it takes with cassette.

Three items of hardware are involved: a disk controller cartridge containing the DOS (Disk Operating System), the disk drive unit itself, and a dual power supply adapter for the drive unit, providing 5V and 12V at 0.7A.

The controller cartridge is designed to plug into the expansion socket on the back of the VZ300 (or VZ200) and draws its supply from the computer. In turn, it carries a "piggyback" expansion socket, which can accept the module which would otherwise be displaced — typically a 16K RAM or, in the present context, the new VZ300 word processor ROM.

The twin pack is only about one centimetre taller than the computer itself and could typically slide out of sight under the monitor.

At the rear of the controller cartridge are two 20-pin sockets, marked D1 and D2, each capable of accommodating a cable and plug connection from a disk drive. I only had one drive unit available (normally plugged into D1) but the system can accommodate two, if desired, each with its own separate power supply.

The drive unit, colour matched to the VZ300, measures a modest 190(W) × 70(H) × 260(D)mm and, apart from the disk "door" at the front, has no user knobs or switches. It is entirely software controlled from the computer, the details depending on the program in use, viz: BASIC or Word Processor.

I used it with standard 5-inch single-sided, soft sectored disks but I gather that it works quite happily with the hard sectored variety. The signal storage format is 40 tracks, each with sixteen 128-byte sectors. This works out at 624 sectors for a total storage of 78K bytes per single sided disk.

My observations with the disk store were primarily in the context of word processing and, as such, it gave no hint of bother. I simply connected it up, as per instructions, inserted a disk, switched on and waited expectantly but in vain for any reaction. None came until I pressed (D) in the main menu, for Disk Commands. Then it happened as per the user manual: strange noises and a red indicator light, indicating that it was poised for action!

The on-screen disk menu provides for:

INITIATE: Formatting a new disk with information relating to the word processor program.

DIRECTORY: A list of the files on the disk and the number of tracks available for further storage (up to 39 tracks at 2K each.

SAVE TEXT: A file name is called for, comprising up to eight characters, the first of which must be a letter of the alphabet.

LOAD TEXT: Subject to Y/N query. Use of the load function will replace text already in memory.

MERGE TEXT: Used to transfer text from disk file to a designated point in memory, without destroying it.

KILL TEXT FILE: Used to delete unwanted individual files from a disk.

RETURN TO MAIN MENU.

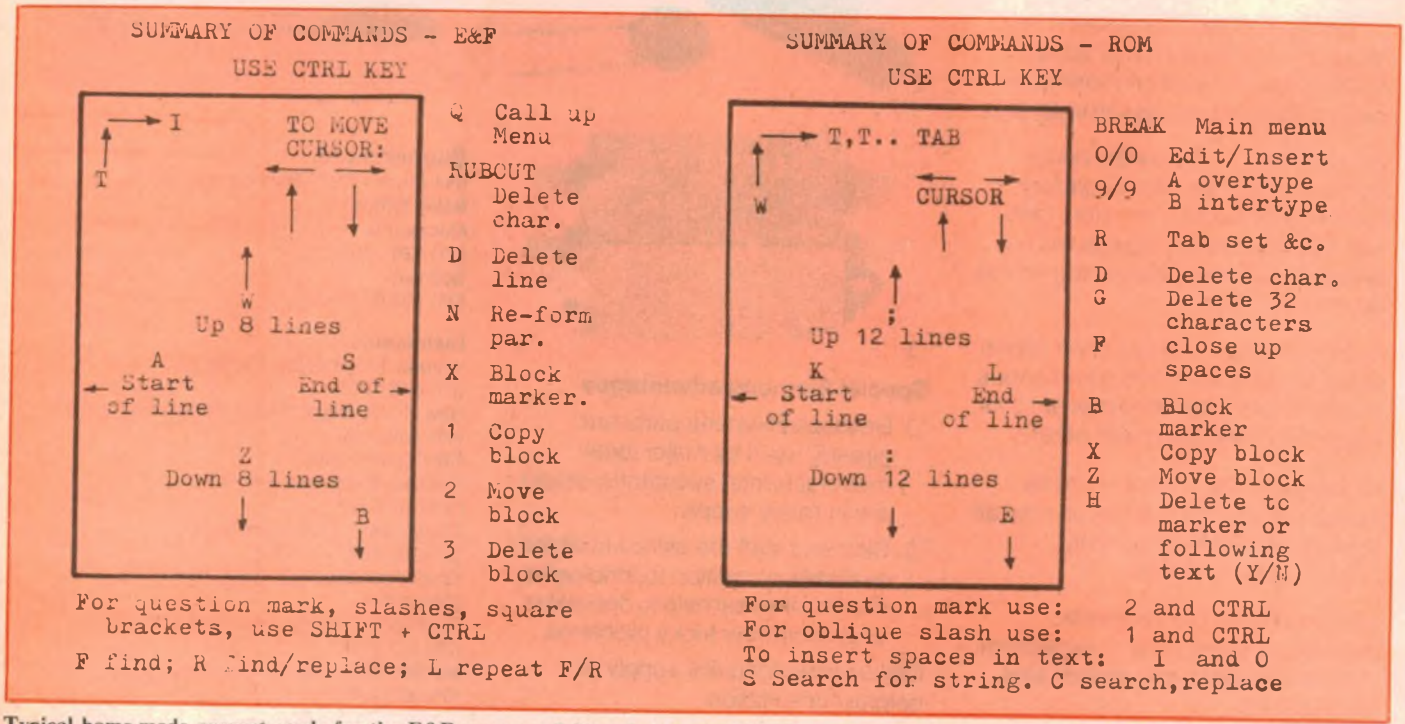
As with most new facilities, it may take a while for the newcomer to become confident with disk storage but the relative simplicity of the VZ300 system and the above menu, should ensure a head start.

How to use and organise disk facilities to advantage is probably best worked out in the light of individual needs and experience. Accepted wisdom is ultimately to install twin disk drives so that working files can be transferred to back-up disks as a precaution against accidental loss, and for long term storage.

For anyone just graduating from cassette facilities, it would probably make sense to use the single disk system as a working store, transferring completed files to cassette for long-term (and inexpensive) storage.

Print facility

Unlike Tape and Disk, the Print facility provided by the new VZ300 Word Processor does not use a separate



Typical home-made prompt cards for the E&F program (left) and the new ROM program (right). They contain most of the commands used for composing on-screen text and are helpful both for learners and for anyone needing to use more than one program.

menu, even though it involves a dozen or so potential control instructions for a typical, unpretentious printer. Unless the user has a good memory, he/she will probably have to rely on a prompt card to avoid errors and omissions.

Print instructions, preceded by a print marker, must be typed on to the screen ahead of the relevant text, giving directions as to page numbering, page length, margins, indent, justification, centring, page feed, line feed, line spacing, etc.

If desired, modified instructions can be included at points in the text, between pages or paragraphs, to change any of the relevant parameters — instructions that could be assembled and inserted very conveniently, using the Insert/Edit facility.

One of the options — D=Send to Printer (Y/N) — allows the text to be processed and inspected on screen, with selected portions being either printed or not printed, as desired.

It is also possible to print over-long documents direct from tape file or disk file, using the computer memory as a buffer.

EXPANSION OPTIONS

- 16K memory expansion RAM
- 64K memory expansion RAM
- Twin joysticks & interface
- Data cassette recorder
- Disk drive & power adaptor
- Disk controller cartridge
- Centronics type printer interface
- Printers, as required
- Word processor ROM (see text)
- Word processor cassette
- Format conversion tape
- Assorted software

Last but not least, a command N= . . . allows numbers to be sent direct to a suitably responsive printer, to control a variety of possible parameters to do with print face, line spacing, etc. The ultimate usefulness of this provision will, of course, depend on the printer selected.

Instructions relating to the new ROM-based word processor are in the course of preparation, being available only in draft form when we were putting the system through its paces. Indeed, in the process, we were able to make a number of hopefully constructive suggestions.

But, to sum up, if you're looking for a personal computer that doesn't cost the proverbial "arm and a leg", with word processing options that fit the same description, DSE's new VZ300 warrants close consideration.

Spectrum VI:2 loudspeakers

Many loudspeakers are imported from Japan but these are the only brand we know of that is assembled in Hong Kong, using European drivers. The Spectrum VI.2 is an unusual loudspeaker design in more ways than one.

Nobody could claim that the Spectrum VI.2 loudspeakers are unobtrusive. While they do not take up any more floor space than other loudspeakers, they are quite tall, at 1015mm. This seems to be emphasised by the grille cloth frame and the pronounced grain of the timber veneer which, in the review sample, was not unlike redwood in colouring. Suffice to say that the veneer is unlike any timber finish commonly seen in Australia.

If the appearance is unusual, the design is more so. Removing the grille cloth frame reveals that the cabinet is stepped back for the tweeter portion, to provide time alignment between the treble and midrange drivers.

The drivers themselves are Audax, made in France. The tweeter is a 25cm diameter dome type whiie the midrange and woofer are both the same type, nominally 130mm in diameter. The midrange is visible on the front baffle but the woofer cone is loaded by a sealed enclosure while the front is loaded by another enclosure of similar volume with the sound radiation coming via a 78mm diameter port, about 14cm long.

The midrange driver also has its own enclosure which is vented via a long port, 25mm in diameter. The midrange and bass units have neoprene roll surrounds and their effective cone diameter is about 90mm which is quite small.

The crossover frequencies are at 6kHz and 100Hz. The crossover network uses three air-cored inductors, four non-polarised electrolytic capacitors and four wirewound resistors.

Nominal impedance of the Spectrum VI.2 is 8 ohms. Our measurements indicate that the unit has a fairly normal impedance characteristic with a maximum of 20 ohms, coinciding with the upper bass resonance at around 75Hz, with another peak of about 18 ohms at around 1200Hz. The impedance minimum was about four ohms at 8kHz.

Efficiency is quoted at 88dB sound pressure level a tone watt and maximum sound pressure level (spl) is 108dB. By comparison with other systems we would rate it as fairly inefficient and we agree with the manufacturer's figure for minimum amplifier power as 40 watts per channel. Anything less would be inadequate. At the same time, the maximum spl of 108dB means that the maximum program power is around 100 watts.

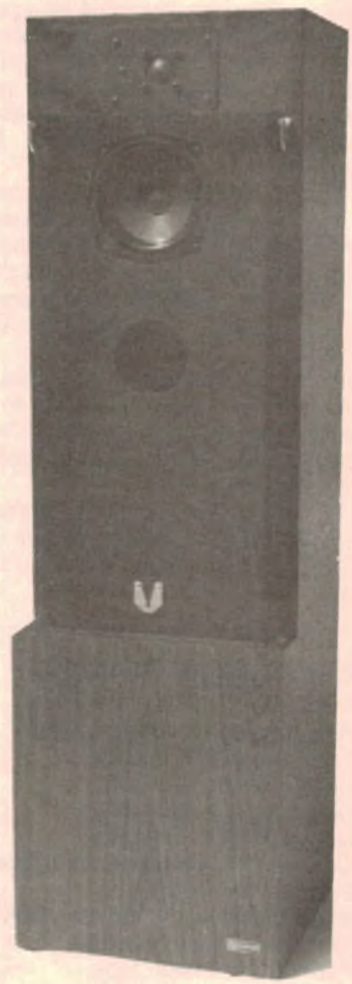
The review sample was supplied with a frequency response graph which was quite smooth. The low frequency cutoff is between 45 and 50Hz, below which the response drops of rapidly. There are a couple of peaks in the response, at around 3kHz and 8kHz but these are fairly moderate. Above 10kHz, the tweeter response tapers off.

As with most loudspeakers, room positioning is important. The manufacturers recommend that they be placed at least half a metre away from walls and preferably one metre. We go along with that.

Our first reaction to the sound quality of the system was that it was "constricted" in the treble. At the same time, it was noticeably bass heavy, particularly when listening to commercial FM stations (which tend to boost bass).

The bass quality is quite satisfying with pipe organ music though even here the treble would benefit by being more open. On jazz selections, it does not sound right. Surprisingly, it sounds best on chamber music, which does not have much bass or very extended treble content.

One problem which was noted was the excessive pumping of the midrange driver when playing records which had small undulations. Many records get these undulations after a while, or have them from new, but they seldom cause a problem with normal sized speakers. On the Spectrum they are a cause for concern, particularly if your amplifier does not have sub-sonic filter or if you wish to turn up the bass (not really necessary with these speakers).



The Spectrum VI.2 shown here with grille cloth frame removed.

In conclusion, our reaction to the Spectrum VI.2 is very mixed. They can sound quite good but only on certain types of music. They have limited efficiency and the treble response needs a lift. If you like plenty of bass but not too much sound pressure level, they could be for you. Recommended retail price is $2195.00 per pair.

For further information on the Spectrum range of loudspeakers contact the Australian distributors, Hughes Communications, 2/58 Moonya Road, Carnegie, Vic 3163. Phone (03) 568 0612. (L.D.S.)

Marantz CP430 portable tape deck

In the days before the cassette was king, the name Nagra was the byword in small portable tape machines for professional use. Now Marantz has released two portable cassette machines for professional use, the CP230 and CP430.

While there are plenty of portable stereo cassette machines of the "ghetto blaster" variety, they don't meet the requirements of professional recordists who want high performance in a rugged machine. Both these Marantz machines are intended to produce high quality results in the field.

The CP430 is the more deluxe machine, with three heads, Dolby B and dbx noise reduction, metal tape capability, fine bias adjustment, pitch control, precise microphone attenuation of 15 or 30dB, in addition to the usual recording level control, separate playback monitor control and the ability to monitor the tape or the source.

6.5mm sockets are provided for stereo headphones, external microphones and a stereo microphone may be used. There are no internal electret mikes. RCA sockets and a five-pin DIN socket are provided for line inputs and outputs. The power source may be a 4.5VDC plugpack or the internal batteries: 3 D-size cells or rechargeable nickel-cadmium battery pack, which fits into the battery compartment.

The monitoring speaker may be switched off if desired, or set to monitor left, right or a mono L+R signal. All controls are designed so that they are either concealed or not likely to be inadvertently damaged or interfered with.

Claimed frequency response of the CP430 is 20Hz to 20kHz with metal tape at 25dB below OVU and 20Hz to 18kHz for chromium dioxide tape under the same conditions.

Recommended retail price of the Marantz CP430 is $649 while the optional RBD430 battery pack is $64.

At right is the Marantz CP430 which has three heads, dbx and Dolby B noise reduction, bias adjustment and pitch control.

FORUM

Conducted by Neville Williams

How would music sound through perfect ears?

I am faced with a real smorgasbord of topics this month but audio distortion in one form or another is the dominant theme. Wouldn't it be ironic, for example, if we were to go to endless trouble and expense to obtain near-perfect reproduction, only to discover that our ears were about as linear as an amplifier from the '30s?

The above dilemma could indeed be frustrating but it is nevertheless implicit in a reader's reaction to my article in the February '85 issue: "Why the distortion on orchestral strings?" Before saying more, I'll reproduce the relevant portion of his letter:

You may not have given a direct answer to the question posed but two of your remarks combined give a possible clue.

The first, "Why the focus of attention on orchestral strings and choirs" suggests that these sections may be different from others, or have some peculiarity. Indeed, they have: not only greater numbers, but more vibrato than other sections.

The result is a very complex waveform; even when nominally in unison, many different low frequency variations are added to the intended note.

With no significant distortion present in the equipment chain (microphone to loudspeaker) a certain amount of vibrato may be desirable and pleasant. But strings and choral sections tend often to exceed what is desirable and can sound terrible as a result. Yet no intermodulation has occurred up to and including the loudspeaker.

The second comment refers to strings: "sometimes they sing sweetly but often they don't — not to my ears, anyway!"

This surely gives a lead to where the distortion occurs. Most ears have a certain amount of non-linearity, such that the multiplicity of vibrato variations become sum and difference frequencies; if of sufficient amplitude, they can be most unpleasant.

However, some ears have little or no non-linearity and are more easily satisfied with what they hear, so musical appreciation will always remain a very subjective observation.

C.M. (Westbourne Park, SA).

When I wrote that particular article, I was genuinely puzzled and more disposed to asking questions than providing answers. Time and again, when reviewing records, I had heard what sounded like intermodulation distortion on loud massed strings and voices, and wondered about the reason for it; again, as to why other loud

... it sounds as if the organ is suffering from a chronic case of mal de mer — ready to spill its partials all over the carpet!

instrumental passages on the same recording seemed not to be similarly affected.

To confuse matters further, I was convinced that I had heard similar "distortion" on occasions, in live music situations, where no electronic equipment was involved. Was it, in the first instance, an acoustic and/or aural effect, but capable of being aggravated by dubious record/replay technology? And did it become more noticeable when listening to an amplifier system, because attention is then focused entirely on the sound?

The observation "not to my ears, anyway" was in no sense casual; it was meant to convey what C.M. has spelt out in detail: that our ears could be involved in the production of sum and difference resultants, whether at the original performance or one re-created by electronic means.

... some ears have little or no non-linearity and are more easily satisfied with what they hear ...

There seems little doubt that human ears characteristically do exhibit significant non-linearity, and I wonder about C.M.'s assertion that some ears have little or none.

Will those with platinum (not just golden) ears please stand up!

You can't beat it!

In saying this, I am reminded of a debate in these columns, back in the '60s, when we were concerned with electronic organs and with tuning procedures of the day involving listening for and counting beats, typically at or slightly above one per second.

It became fairly apparent from the discussion that the ability to hear the beats, as such, was a by-product of aural non-linearity, coupled with a spot of education about their existence and significance. It seemed logical to assume that a degree of non-linearity would be a pre-requisite for a professional instrument tuner and, possibly, for anyone else playing an instrument such as a violin, where pitch has to be determined subjectively.

On that basis, C.M.'s people with ears of totally linear (platinum?) variety would have a tough time trying to tune an instrument by the traditional method, because of their inability to discern the presence or absence of beats.

They might also prove to be less than ideal record critics. Being insensitive to vibrato effects, they might rate as "bland" a performance that an average listener would judge to be very agreeable. Or, to pursue C.M.'s line of reasoning, they might rate as "desirable and pleasant" what seems to others to be "most unpleasant"!

I hesitate to consider the personal implications after my own carry on about unpleasant "intermodulation" effects in records and some live performances.

Perhaps I should also admit to an aversion to over-use of the slow electronic vibrato that is available in most electronic organs. Some organists love it but, to me, it sounds as if the organ is suffering from a chronic case of mal de mer — ready to spill its partials all over the carpet!

I'm still unclear as to whether my reaction to modulation effects is typical or extreme (tin ears?) but at least I know that it's shared by acoustic consultant and musician Denis Vaughn, quoted in the February issue, and by former Astor recording engineer Harry Mauger, quoted in June '85.

Phase splitters

A South Australian reader turns the clock back to 1955 with questions about what was then the latest thing in hifi amplifier design: partial triode or "ultralinear" operation of the output valves, with the screens tapped part way up the respective halves of the output transformer primary winding.

The idea proved attractive because, when correctly applied, it combined relatively low output impedance, as for power triodes, with relatively high conversion efficiency as for pentodes and tetrodes — this before the application of negative feedback. But how such output valves should be driven is the concern of this particular reader. I quote:

In the February 1955 issue, p109, it was stated that the plate-cathode type phase splitter should not be used for driving a partial triode output stage, as it was found that the lowest intermodulation distortion could not be achieved due, it was thought, to the inherent imbalance in output impedance.

My question is: should a triode connected pentode or beam tetrode output stage be driven from a plate-cathode phase splitter if one is after the lowest intermodulation distortion? As I see it, such a stage could be seen as a 100% of primary turns "partial triode" connection.

I am aware that this phase splitter causes drive unbalance if the output valves are driven to overload but I don't envisage that happening.

R.E. (Adelaide, SA).

After a lapse of 30 years, I had to refer back to the files to check on what R.E. was talking about. In fact the particular article was written by the then Editor, John Moyle, and had to do with the design of a 17W ultralinear amplifier using a pair of EL37 output valves.

For the life of me, I could not recall any intermodulation test equipment on which John could have made the measurements quoted. However, our then staff technician Phil Watson vaguely remembered doing some developmental work along those lines, as the basis of a possible project. It was ultimately abandoned, he said, mainly because of difficulties in providing suitable filters.

I can only assume that the observations were made on that developmental equipment and, as such, might be suspect.

However, reasons notwithstanding, I still endorse the ultimate choice of a "long-tailed pair" phase splitter for the ultralinear series of amplifiers. While there might have been no intention of overdriving them, it could happen easily enough on peaks, particularly with the limited power then available. In that situation, the advantage would normally lie with a driver offering not only balanced impedance but a greater reserve of signal output per side.

I am not impressed by R.E.'s reference to "100% of primary turns partial triode" connection. Terminology notwithstanding, the fact remains that he's talking about ordinary triode connection and that, for the most part, is a very inefficient way of using pentodes and tetrodes. Their power conversion efficiency as class-A or AB1 triodes is usually pathetic.

Froth and bubble

It may come as something of a culture shock to jump suddenly from a discussion of valve amplifiers in 1955 to speculation in 1985 about the enormous improvement in sound quality that can allegedly follow the installation of revolutionary (and expensive) specially designed, special quality, directional connecting cables in domestic amplifier systems.

The concept received a lot of publicity (promotion?) during 1984, especially in British consumer hifi publications, along the lines: it may not show up in ordinary measurements but the difference is amazing. As one reviewer put it:

"When this cable is wired into an audio system, it is like lifting a veil from the sound."

To date, the technical fraternity has shown little regard for such pronouncements, preferring the view that, while cables should be adequate in terms

of traditional parameters, exotic measures are a waste of effort and resources.

I've referred to the subject on a number of occasions, raising it at the Melbourne AES Convention in September last and stressing, in the January issue, the need for at least a modicum of objective support for the claims being made.

By the way of response, A.A. from New Caledonia forwards a photostat copy of an item from "New Scientist" (Feb 7, 1985) entitled "Solid bubbles found in inert gas".

It suggests that atoms of gases such as argon, xenon and krypton, when variously implanted in aluminium, copper, nickel and gold, tend to precipitate into local pockets of high concentration. Due to extreme pressure in the crystalline structure, they solidify into solid "bubbles", producing discontinuities in the lattice, detectable with the aid of an electron microscope.

Says A.A.: "the item indicates that there is quite a lot still to be discovered about the structure of metals and their behaviour."

That undoubtedly is true and the research as reported may have a variety of implications. It does not follow, however, that it will necessarily have any bearing on the role of those or any other metals as conductors of ordinary audio frequency signals.

From I.McP. in Melbourne comes a copy of two articles by Martin Colloms in "Hi-Fi News & Record Review". I'm unsure whether or not the writer is serious; he brackets his signature with "Rabid Audiophile" and ends his letter with the slogan "Long live the lunatic fringe"!

In the two articles, Martin Colloms — undoubtedly the cheer leader for exotic cables — is all fired up about Hitachi's "LC" (long crystal) copper wire, referred to in our January issue. He suggests that it is already being checked out in various applications by well known Japanese manufacturers, although I suspect that they may be as much interested in its publicity potential and mechanical properties as its effects on performance.

But, again, the articles are devoid of measured results, the Author's comment being:

"The multiple crystal boundary for wire 'sound' seems as logical as any other but cannot be defined by any conventional tests for distortion, even with very high resolution analysis down to –100dB".

I may be somewhat thick in the head, but that statement and others like it suggest to me that the effects which the Author is talking about involve very low level components of the signal, not apparent even on sensitive test equipment, but nevertheless audibly important to him and to others with perceptive hearing.

(Who suggested long-crystal, oxygen free platinum ears?)

However, in the very next issue, he reports having auditioned a stereo cassette (metal plus Dolby-C) containing excerpts recorded by Sony on two otherwise identical TCK555ES decks, one of them using LC wire throughout, including the heads.

Even when played back on a standard Sony Walkman with LC wiring, the excerpts from the LC deck were said to make the standard recording "sound like a fourth generation copy".

Come on now: The difference between a top quality cassette and a fourth generation copy is neither subtle (below –100dB) nor unmeasurable. You must pardon me if I have great difficulty in making sense out of such verdicts; and if I continue to reserve judgement until someone is able to quantify what they're on about!

A fair go for the Beta format!

Neville Williams' discussion of skew effect, etc, appears to be timely, given the present focus of attention on hifi VCRs.

Although centred mainly on VHS, presumably, by inference, the Beta system was also implicated.

In fairness, it should be noted that Beta manufacturers have consistently warned of the potential problem of tape stretch.

The U-loading Beta system was in fact designed to minimise the possibility of this occurring, but not before the M-loading, also under consideration by Sony at one time, was thoroughly rejected because of its inherent propensities in this regard. Yet M-loading is at the very heart of VHS and now, unfortunately, of its new hifi technology.

How much longer can consumers (and manufacturers) ignore the real issues in the so-called format war.

L.G. (Buderim, Qld).

About hifi VCRs

It would appear from the letter reproduced in the accompanying panel that the writer L.G. is still caught up in the emotions and the loyalties of the long-running tussle between Beta and VHS. It's a pity because I doubt that it ever was what it seemed on the surface: "real issues" and all that.

For sure, the Beta group laid great emphasis on their choice of loading system, but I suspect that it was based on considerations other than just tape stress. What's more, at the height of the Beta publicity campaign, National issued test results which suggested that current model VHS decks, on average, were actually better in this regard than their Beta counterparts!

In retrospect, the fact remains that neither format has suffered any real problems with tape stretch in the context of conventional video recording. If there ever was a storm, it was of the typhoon in a teacup variety!

Notable also is the fact that the emerging 8mm standard for the next generation of VCRs, involving all major manufacturers, uses M-loading.

The recent articles on hifi VCRs (March and April '85) were based on National technology simply because, at the time, National was literally the only company that had the information available in Australia. I know because I did the rounds by phone.

Because Beta/PAL HiFi used the same basic principles as VHS HiFi, it became evident that it would have to face up to and deal with the same problems, including head switching transients and dimensional instability of the tape — the more so, perhaps, because Beta uses much narrower video tracks.

Hence the assumption — not just an inference — that when details of the Beta system became available, it would be found to be broadly similar in approach to VHS: dealing with similar problems in a similar way for a similar end result.

Relax L.G., Beta has not suffered any injustice!

JAYCAR KITS - LATEST RELEASES

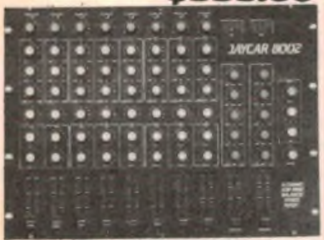
EA KITS

8 CHANNEL MIXER Model 8002

Jaycar engineers have produced a real winner with the 8002 stereo mixer. The front panel measures 19" wide x 14" high (8 rack units). This enables the 8002 to be mounted into PA racks if necessary. It has many features including: ● Balanced (600 ohm) mic inputs/line inputs ● Input attenuators ● Bass, mid and treble equalisation on each input ● "Effects" capability ● ● Foldback on all 8 inputs ● Stereo pan on all 8 inputs ● 5534A OP amps for low noise and very low distortion PLUS many other features and specs to be found in the 1985 catalogue on page 4/5.

Ref: EA April/May 1983.
Cat. KJ-6504

ONLY $535.00



IN-CIRCUIT TRANSISTOR TESTER

Ref: EA September 1983

Have you ever unsoldered a suspect transistor only to find that it checks O.K? Troubleshooting exercises are often hindered by this type of false alarm. You can avoid these hassles with the 'In Circuit' transistor, SCR and diode tester.

The kit does just that, tests devices WITHOUT the need to unsolder from the circuit! VERY handy!

The Jaycar kit includes a Jiffy box and Scotchcal panel showing the truth table for device checking.

Cat. KA-1119

ONLY $15.00

Car Booster Amp

Ref: EA August 1985.

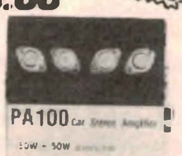
This project enables you to have 2 x 50 watts [illegible] of power for your car sound system. In order to do this, a special high voltage power supply forms part of the system. Absolutely stunning value for money. Around half the price of inferior commercial units.

The Jaycar kit is, as usual, absolutely complete.

Cat. KA-1600

ONLY $179.00

NEW



40 WATT DC INVERTER

Ref: EA August 1985.

An upgrade of a previous design featuring a smart new ABS case.

Cat. KA-1598

NEW

$79.95

Motorcycle Intercom - Ref: EA Feb 1984

What a great kit! This full duplex unit enables you to talk to your pinion passenger whilst riding with your helmets on! Powered by the bikes battery - you can both talk at the same time if you wish as there are no switches to activate. The Jaycar kit includes the special headphone inserts and all parts.

Cat. KA-1533

ONLY $39.95

"RAILMASTER" Pulse-Power Train Controller

Ref: EA September 1984

This is a state-of-the-art train controller offering tremendous features.

- ★ Variable simulated inertia
- ★ Full short circuit protection including both audible and visual indicators
- ★ Power and track monitor indicators
- ★ Adequate power for double and triple heading locos
- ★ Fixed 12V DC and 15V AC power for lighting and accessories
- ★ Optional walk-around throttle

The Jaycar kit includes realistic Scotchcal front panel and the special console case only available from us. The large paddle switches have been specially imported just for this kit. We believe that you will be delighted with this unit.

Cat. KA-1560

$79.95

Optional Walk Around Controller Cat. KA-1559

ONLY $9.95

Diesel Sound Simulator

Ref: Ea November 1984

This project mounts inside a model train (i.e. goods wagon) and produces a noise similar to a diesel locomotive. The 'speed' varies according to the throttle action for added realism. All listed parts provided.

Cat. KA-1561

$19.95

Steam Sound Simulator

Ref: EA December 1984

Build this realistic steam sound simulator for your model train layout. It features an infra-red optical switch to synchronise the "chuffs" to the wheel rotation. Like the KA-1561, it picks up the power from the railway tracks. All specified components supplied including 32 ohm headphone type transducer.

Cat. KA-1562

$15.95

FUNCTION GENERATOR with digital readout

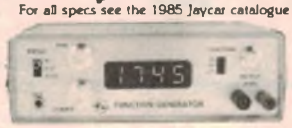
Ref: EA April 1982

This attractively housed (matches the KA-1390 DFM) unit produces sine, triangle and square waves over a frequency range from below 20Hz to over 160kHz with low distortion and good envelope stability. It has an inbuilt 4-digit frequency counter for ease and accuracy of the frequency setting.

Cat. KA-1428

$94.00

For all specs see the 1985 Jaycar catalogue



50/500 Digital Frequency Counter

Ref: EA Dec 1981/Feb 1982

This is a high performance unit that is also easy to build! The new design uses just 5 IC's, measures period and frequencies up to 500MHz (with prescaler). It features a bright 7 digit display and outperforms ready built units costing 2-3 times more!

We believe that the Jaycar version of this kit is by far the best. Not only do we supply 2 x GOLD plated BNC input connectors we supply a special pre-punched heavy plastic front panel that is screen printed in epoxy ink. The assembled unit looks a million dollars! Watch out for kits that only provide the cheap front panels!

The standard kit will work up to 50MHz.

Cat. KA-1390

$119.00

A 500MHz prescaler kit (which fits straight onto the main circuit board) is available.

Cat. KA-1392

$29.50

For all specs see Jaycar's 1985 catalogue

EA KITS

Digital Bench Type Capacitance Meter

Ref: EA August 1985

- ★ Easy to assemble
- ★ 4 digit LED readout
- ★ Measures from 1pF to 99.9uF
- ★ 3 ranges
- ★ Bench type mains powered

Cat. KA-1595

NEW

ONLY $79.95

8 SECTOR BURGLAR ALARM - Ref: EA Jan/Feb 1985

Why buy a commercially made up unit for more when you can buy this kit and SAVE money! A unique feature of this kit is the fact that you can wire N/O and N/C alarm sensors ON THE SAME LINE.

- ★ 8 SECTORS
- ★ 2 delayed entry sectors
- ★ Steel box
- ★ Includes battery and siren driver in the price
- ★ Variable exit and entry delays

Cat. KA-1580

$149.00

AUSSIE MADE!

BUSKER AMPLIFIER

Ref: EA Feb 1985

Fantastic portable amplifier kit for low-level PA, Buskers or for practice.

- ★ Battery or mains operation
- ★ Full control - bass, treble and volume
- ★ 17 WATTS RMS output
- ★ Gel battery automatically recharged when mains used.

★ INTRODUCTORY PRICE ★

ONLY $125.00

All electronics including Gel battery, 8" speaker, metal chassis etc.

Cat. KA-1592

PRE-CUT WOODEN CABINET to suit

Cat. KA-1593

ONLY $30.00

BUY BOTH AND PAY ONLY $149.00

A FURTHER SAVING

ULTRASONIC BURGLAR ALARM

- *Easy to install*
- *Connect with magnetic switch, Infra Red detector, etc . .*
- *N/O and N/C circuit breakdown indicator. Fully assembled — Don't pay up to $99. JAYCAR PRICE*

Cat. LA5140 **$69.00**

Ignition Killer

Ref: EA Feb 1984

This little project is cheap, easy to fit and is effective. It basically is a timer circuit that disables your ignition system a few seconds after it is activated. A would-be thief starts the car, it goes a few metres and stops, he immediately cranks the engine and it fires but it stops again moments later. This could continue indefinitely. Frustrated, the thief looks for easier "game" elsewhere. The Jaycar kit contains specified original components, instructions and two BONUS alarm stickers.

Cat. KA-1535

ONLY $14.95

EA KITS

PLAYMASTER SERIES II MOSFET AMP KIT

Ref: EA Jan/Feb/March 1985

". . . s stereo amplifier that will equal or better just about any integrated commercial amplifier, regardless of price". Leo Simpson, Editor of EA. February 1985

MAIN FEATURES

- ● Switchable phono input for MM and MC cartridges
- ● Electronic signal switching
- ● Full facilities for dubbing between two cassette decks
- ● Monitor loop for either of two cassette decks or a signal processor
- ● Click action pushbutton switches for selection of sources, dubbing and tape monitor with LED status indicators
- ● Centre detents on bass, treble and balance controls, multiple detents on volume control
- ● Heavy duty heatsinks
- ● Power transformer for low hum and noise
- ● Easy to build - all parts except power supply mount directly on the two printed circuit boards; wiring has been kept to an absolute minimum
- ● 100 watts RMS per channel into 8 ohm load
- ● Less than 0.01% total harmonic distortion

Cat. KA-1500

ONLY $429.00

$429

5(6.5)MHz OSCILLOSCOPE KIT

Ref: EA October 1984

Over the years many people have asked, "Do you have a CRO kit?" Our answer - up until nov - has been that built and tested units were no dearer than kits, if you could get a kit at all.

The Jaycar KJ-7050 Cathode Ray Oscilloscope kit has a guaranteed 5MHz bandwidth but should go to around 6.5MHz. It also features 75mm (3") CRT Blue Phosphor with accurate graticule, separate vertical and horizontal BNC type input sockets etc. Remember, a 5MHz 'scope is usually adequate to troubleshoot most microprocessor and other digital circuitry as well!

This is a wonderful opportunity to learn electronics AND end up with a valuable piece of test equipment as well.

The Jaycar KJ-7050 kit is absolutely complete. The chassis is prepunched and every component including nuts and bolts are provided, along with instructions.

Cat. KJ-7050

ONLY $269.00

Dual Tracking ±22V Power Supply

Ref: EA March 1982

This versatile dual polarity (dual tracking) power supply kit can provide up to ±22 volts at up to 2 amps. In addition the supply features a fixed +5V at 0.9 amp output. The supply is completely protected against short circuits, overloads and thermal runaway. Kit comes complete with case, meter and front panel.

Cat. KA-1410

ONLY $99.50

& GREAT SPECIALS! ★★★★★★★

ETI KITS

OP-Amp Tester

Ref: ETI April 1985. Test OP Amps with 741 - type pinouts (e.g. TL071, TL074, 5534 etc), with this nifty tester. Checks single, dual and quad packages!
Cat. KE-4693

ONLY $29.95

Electronic Jumper Leads - ETI 341

Ref: ETI August 1985. This project enables you to charge up a car battery via the cigarette lighter plugs in each car. A small inverter boosts the battery voltage from car No.1 to charge the flat aattery in car No.2 via its cigarette lighter socket.
It's amazing how quickly you can put enough charge in a flat battery to start the car!
Complete set of parts including 2 x cigarette lighter plugs.
Cat. KE-4703

$39.95 NEW!

ETI 1527 Economy House/Car Alarm Module - Ref: ETI May 1985

This low cost full feature module can form the basis of a sophisticated anti-theft system!
Cat. KE-4698

$24.95

ETI 699 Modem Kit

Ref: ETI May 1985
This brilliant new design is a price breakthrough. Never has a modem with such SOPHISTICATED FEATURES been offered at such an incredibly low price. Now you can have no excuse to gain the tremendous benefits that a modem will offer viz:

- ★ Access to huge data banks
- ★ Networking
- ★ Telecommunications
- ★ Electronic shopping
- ★ Software exchange
- ★ And much more

This ETI kit is a full modem with facilities similar to units costing hundreds of dollars more. It even includes a Telecom approved push button telephone! Now is your chance to use your electronic skills in your new hobby and save a fortune over ready builts. You can obtain this modem kit (which includes a telephone for us humans) for the incredibly low introductory price of only $139. That's right! $139. inc. case, down to the last nut and bolt. But hurry! Stocks of the critical modem chip are very low and will severely limit kit supply.
Cat. KE-4695

ONLY $139.00

ETI 698 Microbee Dialler - ETI July 1985

Complete set of parts.
Cat. KE-4696

ONLY $19.95

AEM KITS

The Listening Post

Ref: AEM July 1985
This device attaches between audio output of a short wave receiver and the input port of a computer. It allows decoding and printing of Morse Code, Radio teletype (RTTY), AND radio facsimile (FAX) pictures! You can, for example, watch weather maps from the Met and dump them on to your printer!
Specific software for the Microbee is in the first article. Programs for other popular computers will be printed in later issues of AEM.
Complete set od specified components (inc. IDC plug).
Cat. KM-3015

ONLY $29.50

AEM 6500 - 60/120 WATT UTILITY MOSFET AMP MODULES

Ref: AEM July 1985
This is a low cost high performance design using proven MOSFET technology. A single pair of (2SJ49/2SK134) Mosfets will deliver up to 60 watts output. Another pair may be added for 120 watt performance. The module has been designed to fit into a large variety of commonly stocked instrument cases and rack boxes. It features VERY LOW distortion and impeccable transient performance. It is unconditionally stable and virtually blow up proof. It can be powered from common transformer/rectifier/capacitor combinations. A Winner!
As usual, the Jaycar kit reflects a quality approach. All specified components for each version are included.

60 WATT MODULE Cat. KM-3010 **$49.50**
120 WATT MODULE Cat. KM-3012 **$65.00**

AEM 9500 Beat Triggered Strobe

Ref: AEM July 1985
This project provides a very bright stroboscopic effect for parties, discos, etc., but with an ADDITIONAL FEATURE! This strobe will actually flash in synchronisation with the music!
The Jaycar kit includes case, photographic reflector, flash tube etc.
Cat. KM-3018

ONLY $59.00

SPEAKER SENSATION!

European Style 2-way Speaker Kit
Sensational NEW design by Dave Tillbrook

Ever thought of buying a pair of those $1000 - odd British two-way speaker systems that are so popular at present? We agree that they sound and look great and they **ARE** expensive!
Dave Tillbrook has come to the rescue with a high power two-way system with similar (if not superior) performance specs. at around HALF the price of ready builts!
The system uses Danish-made 'Vifa' brand speaker drivers. "Vifa" actually manufactures the speaker components for many well known system manufacturers (including British) but we are not allowed to reveal which ones.
The 8" woofer cone is made of a special material called 'Polycone'. It has high internal damping and is superior to other plastic diaphragm materials such as bextrene or polypropylene.
Full specs appear below.
The tweeter is a soft dome type with the voice coil air gap filled with a magnetic fluid. This state-of-the-art technique reduces the Q value at the resonant frequency and also provides cooling for the voice coil. (Specs appear below).
The crossover network is the main secret to the high performance of the system, however, it has been especially designed by Dave Tillbrook to maximise the performance of each speaker component. It has a very high roll-off characteristic to minimise colouration at the crossover frequency.
The cabinet, of course, is a bass reflex design, calculated using the Thiele/Small parameters of the woofer. Response of the system extends from 30Hz to around 18khz. System power is conservatively rated at 100 watts RMS.
Jaycar is stocking the speaker and crossover kit components. Depending on demand we may produce a cabinet kit. Our bulk purchasing power enables us to pass the components to you at the lowest possible cost.

SPEAKERS:

Tweeter DZSTG 8 ohm Cat. CT-2020
$45.00 ea - $90.00 pair
Woofer PZ1WO 8 ohm Cat. CW-2132
$122.00 ea - $244.00 pair
Crossover Network (Kit) Cat. CX-2630
$39.95 ea - $79.90 pair
Total $413.90 for stereo

SPECIAL INTRODUCTORY OFFER

The low value of the Australian dollar may mean that the prices of these components will go up. As a goodwill gesture, we will sell the speaker/crossover set (for stereo) for only

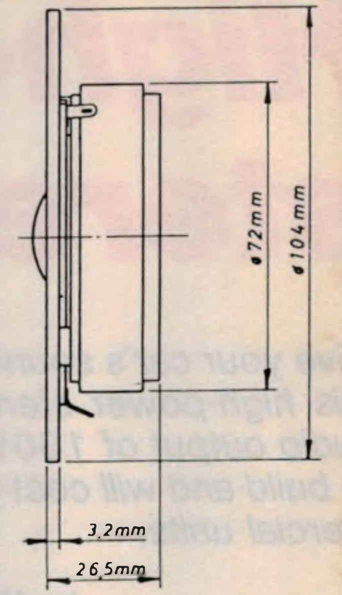
$399.00!!!

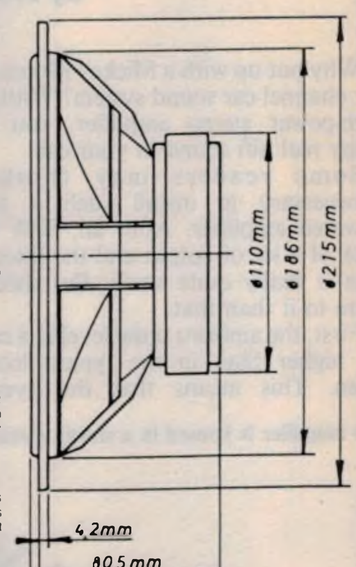
This offer is only valid for August 1985.
We estimate that you will be able to build the cabinets for around $50 - $90 (depending on finish). This means that you can end up with a superior 100 watt speaker system for under $500!!!

UNBELIEVABLE!

Technical Data - Woofer

Nominal Impedance	8 ohms
Frequency Range	26 - 4000Hz
Free Air Resonance	33Hz
Operating Power	25W
Sensitivity (1W @ 1m)	92dB
Nominal Power	60 watts
Voice Coil Diameter	40mm
Voice Coil Height	12mm
Air Gap Height	6mm
Voice Coil Resistance	5.8 ohms
Effective Diaphragm Area	222cm²
Moving Mass	20 grams
Thiele/Small Parameters	
Qm 2.4	
Qe 0.41	
Qt 0.35	
Vas 80.1	
Weight	1.65kg





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Technical Data - Tweeter

Nominal Impedance	6 ohms
Frequency Range	2 - 24kHz
Free Air Resonance	1500Hz
Operating Power	3.2 watts
Sensitivity (1W @ 1m)	90dB
Nominal Power	90 watts
Voice Coil Diameter	25mm
Voice Coil Height	1.6mm
Air Gap Height	2.0mm
Voice Coil Resistance	4.7 ohms
Effective Diaphragm Area	7cm²
Moving Mass	0.3 grams
Weight	0.53kg

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Incorporating ELECTRONIC AGENCIES
NUMBER 1 FOR KITS
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HURSTVILLE: 121 Forest Road Tel (02) 570 7000
GORE HILL: 188/192 Pacific Highway (Cnr Bellevue Avenue) Tel (02) 439 4799

QUEENSLAND **BURANDA:** 144 Logan Road Tel (07) 393 0777
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MAIL ORDER VIA YOUR PHONE

Pack some punch into your car hifi system

High-power car stereo amplifier

Give your car's sound system some real grunt with this high-power stereo amplifier. It boasts a total audio output of 100W (50W per channel), is easy to build and will cost you less than equivalent commercial units.

by ANDREW LEVIDO

Why put up with a Mickey Mouse 5W per channel car sound system? With this high-power stereo amplifier, you can enjoy real hifi sound in your car.

Some readers may think it unnecessary to install such a high-powered amplifier. After all, 50W is a heck of a lot of output and the listening area is really quite small. But there is more to it than that.

First, the ambient noise level in a car is far higher than in the typical lounge room. This means that the average listening level must be higher so that the music can be heard over the noise.

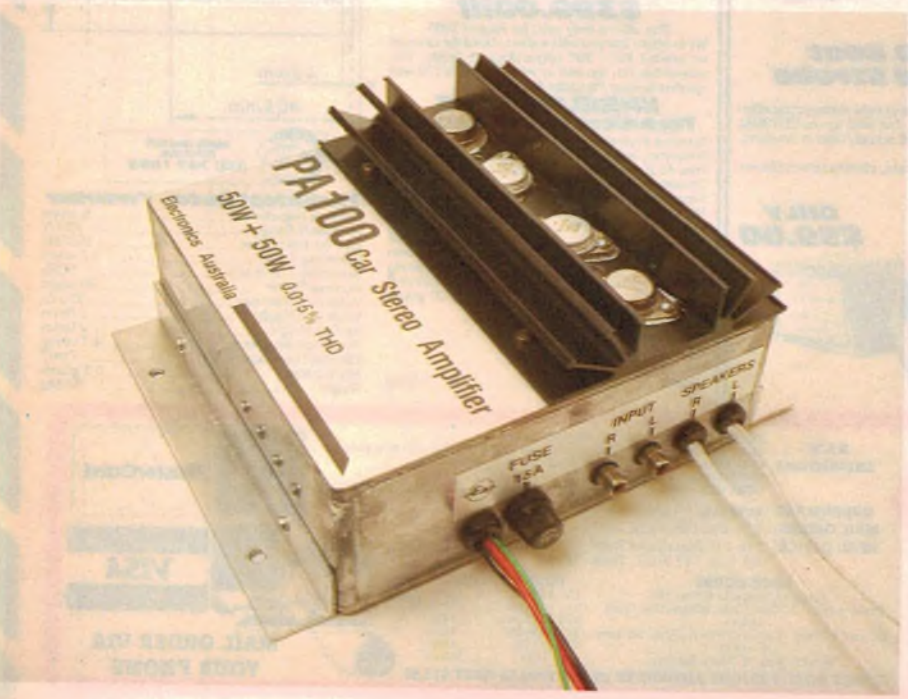
Second, a high-power amplifier is necessary to better exploit the wide dynamic range and wide bandwidth provided by the latest generation tuners and cassette decks. A high power amplifier is also desirable if you are thinking of installing a car compact disc player.

Finally, most so-called 5W car sound systems typically deliver their rated output at high distortion (often around 10%). The EA PA100 Car Stereo Amplifier is rated at a true 50W RMS per channel with just 0.5% distortion. And at 40W output, the distortion shrinks to a miniscule .015%.

These are excellent figures and are on a par with the very best commercial models. In particular, the unit should provide more than adequate drive for all foreseeable applications while keeping the drain on the car's electrical system within reasonable bounds.

Full specifications will be published next month.

The amplifier is housed in a sturdy metal diecast case which provides heatsinking.



Main features

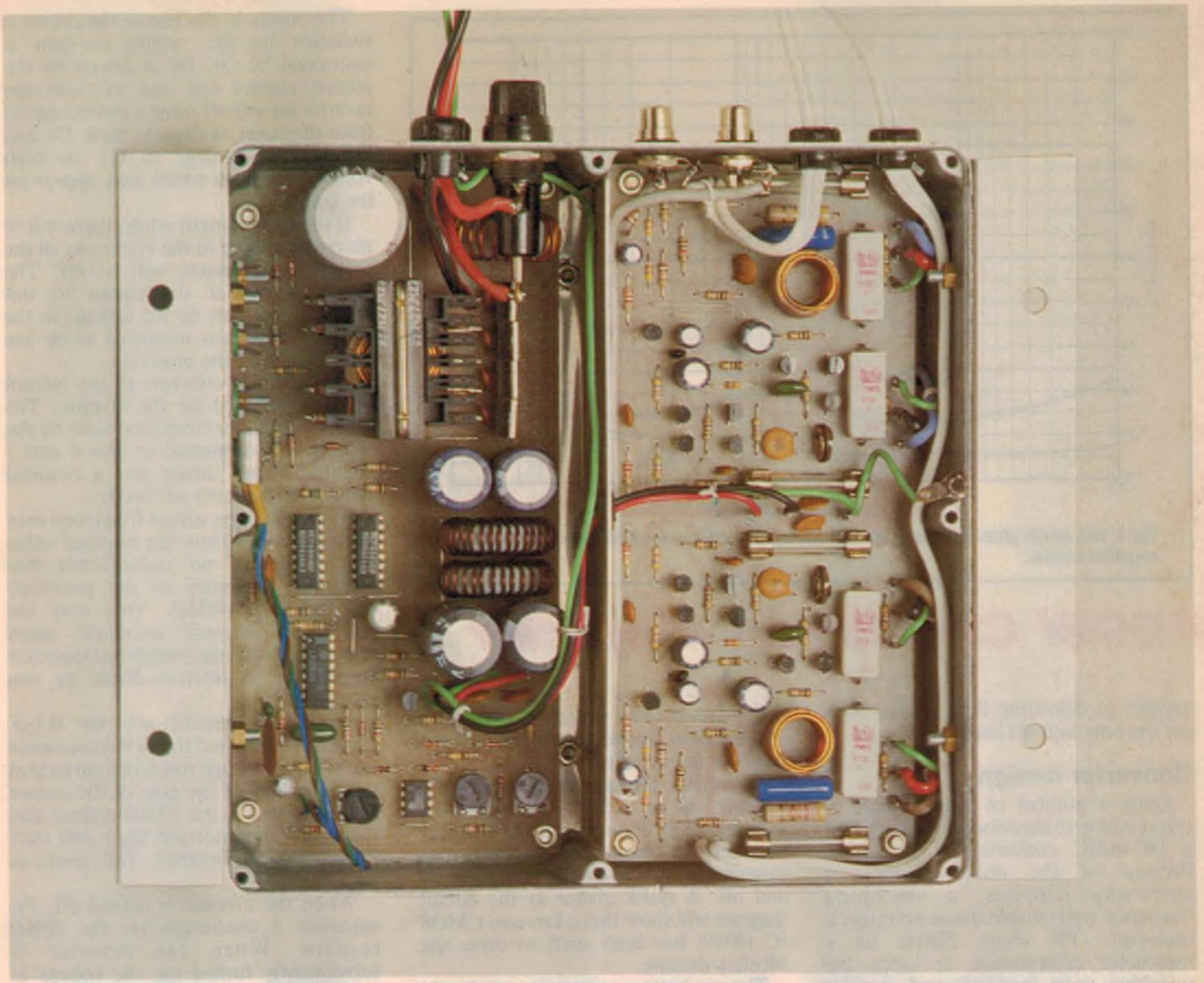
The PA100 amplifier is designed for mounting in the boot of the car or under a seat. Installation is relatively straightforward. The inputs are connected to the output of the signal source (car radio/cassette deck or CD player), while the speakers are connected to the amplifier. Power is derived directly from the car battery and the unit is switched on and off by means of a control lead connected to the signal source.

In this way, the amplifier is automatically switched on and off by the signal source.

The PA100 draws a maximum of 15A but the typical current drain is around 1A to 2A, depending on the program and the sound level you consider to be "normal". An important safety feature is an under-voltage cutout circuit which shuts off the amplifier if the battery voltage drops below a preset level. This prevents the amplifier from excessively discharging the battery if the stereo is left on while the engine is not running.

In practice, the voltage cutout level is set so that the battery has sufficient capacity remaining to start the car.

The second safety feature we have incorporated is an over-temperature cutout. In order to understand why this is necessary, we need only consider that the ambient temperature inside a car can easily reach 60°C on a sunny summer's day. This high ambient temperature, coupled with poor air circulation, means



This internal view shows the inverter PCB at left and the amplifier PCB at right. Note the metal shield between the two boards.

that the amplifier could quickly overheat, even at moderate volume levels.

To prevent destruction of the semiconductors, the thermal cutout automatically shuts the amplifier down if the temperature becomes excessive. When the semiconductors have cooled down sufficiently, the amplifier automatically restarts. In practice, the thermal cutout should operate only on very hot days and then only if the car has been sitting in the sun for some time.

As shown in the photographs, the prototype was built into a sturdy metal diecast case. This provides both mechanical strength and a substantial degree of heatsinking for the circuit. An extruded aluminium heatsink provides additional heatsinking for the power amplifier output transistors.

Design considerations

Basically, there are three different ways of designing a power amplifier to run from the battery voltage in a car. The simplest method is to use a power amplifier which runs directly from the 12V rail. Because one side of the car supply is connected to chassis, a direct coupled amplifier is out of the question.

The maximum power output available from an amplifier of this type is severely restricted by the limited voltage swing available at the output. If we allow for a 2V drop across the output transistors, the most we can expect is about 3.2W RMS into a 4Ω load. If more power is required, lower impedance speakers must be used but, even with 2Ω speakers, the maximum power available is only about 6W.

Another approach is to use a bridge amplifier. This really consists of two power amplifiers operating 180° out of phase and connected so that they drive the loudspeaker in push-pull (ie, the loudspeaker is connected across the active outputs of the amplifiers). This results in twice the peak voltage across the speaker compared to the previous case and thus four times the output power.

Thus a bridge amplifier can produce a maximum of 12.5W into a 4Ω load and around 25W into a 2Ω load. The main drawbacks of this approach are the still limited power output and the need to provide two separate power amplifiers for each channel.

If even higher power outputs are required, the best solution is to use a DC-to-DC converter to generate high voltage supply rails. These are then used to power quite conventional power amplifier stages. It is usual to generate a balanced supply — that is, equal positive and negative supply rails referenced to ground — so that a direct coupled amplifier can be used.

This is the approach adopted for this design. It uses a DC-to-DC converter to generate positive and negative 27V rails. The result is a power amplifier stage

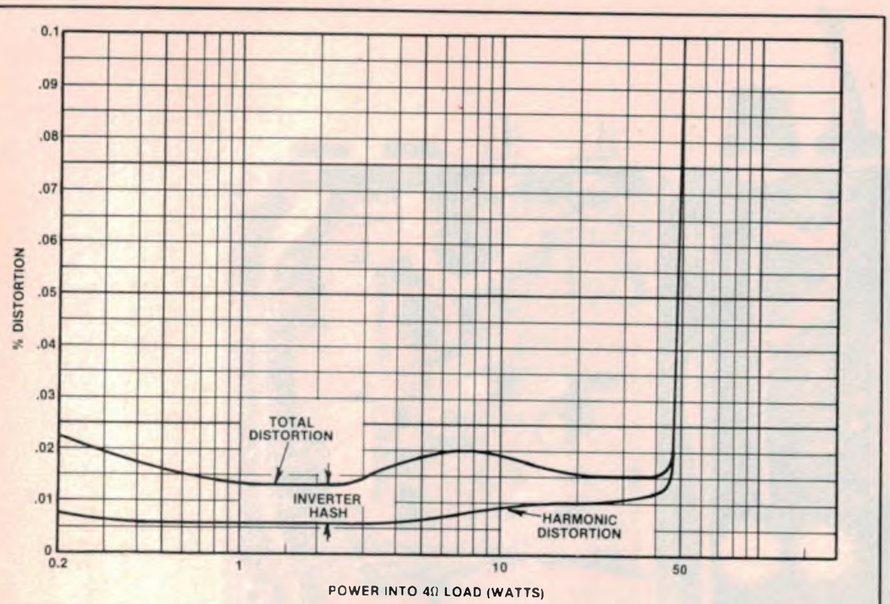


Fig.1: this graph plots the distortion and shows the very low level of inverter hash at the amplifier output.

100W Car Stereo Amplifier

capable of delivering the required 50W per channel into 4Ω loads.

Converter design

Quite a number of factors must be taken into consideration in the design of a DC-to-DC converter of this type. Because of the noise inherent in switching supplies, a switching frequency well outside the audio range is necessary. We chose 50kHz as a reasonable compromise. It keeps the switching noise inaudible and requires only a small transformer, without making the design unnecessarily complicated.

We also chose to use power Mosfets as the switching devices in the converter. There are three main reasons for our decision to use these unusual components.

First, the on resistance of a power Mosfet has a positive termperature coefficient. Thus, they can be paralleled without the need for wasteful current sharing resistors. This is important because of the low battery voltage available. At 15A, the voltage lost across a 0.1Ω resistor is 1.5V or 12.5% of the available voltage.

Second, power Mosfets are very fast, with low switching losses. This leads to a more efficient design which dissipates little power and is therefore more reliable.

Finally, power Mosfets are very easy to use. Mosfets are transconductance devices, which means that the drain-source current is controlled by a voltage at the gate. The result is a much simpler drive circuit than would be possible if conventional bipolar transistors had been used for the inverter.

To explain, the gate of a power Mosfet appears as a 1500pF capacitance, irrespective of drain current. It is simply necessary to charge and discharge this capacitance to switch the transistor on and off. A quick glance at the circuit diagram will show that a low cost CMOS IC (4049) has been used to drive the Mosfets directly.

The car battery voltage is notoriously variable, ranging from below 11V to above 15V in some cases. This represents a variation of plus and minus 15% over the mean value. This range of variation in the amplifier supply could not be tolerated, so some form of regulation is necessary.

We chose to use an LM3524 pulse width modulating regulator IC as used in the Busker amplifier described in February 1985.

How it works

Having discussed some of the design considerations involved in the development of the DC-to-DC converter, we turn now to a more detailed description of the circuitry.

The positive side of the battery supply is connected via a 15A fuse and inductor L1 to the centre tap of the converter transformer. The purpose of the fuse is self evident while the inductor serves to attenuate any switching noise on the supply lines. This measure is to prevent interference to the car radio due to switching noise.

The power to the rest of the circuit is switched by Q2, which in turn is controlled by Q1. Q1 is driven by the remote control line and so turns the inverter on and off using a control signal from the tuner or cassette deck. D1 and D2 prevent damage to Q1 by high voltage transients which may appear on the control line.

If the control input is low, there will be no power supply to the circuit, so all the switching transistors will be off. The current drain of the circuit in this situation will only be the leakage in the Mosfets. This was measured to be less than 500μA in the prototype.

The LM3524 contains all the control circuitry required for the inverter. The internal oscillator frequency is set by the components connected to pins 6 and 7 and the values shown give a nominal switching frequency of 50kHz.

In practice, the actual frequency may vary somewhat from the nominal value but this is of no consequence (the measured frequency of the prototype was actually 44kHz). Note that the LM3524's internal oscillator must operate at twice the switching frequency because of an internal divide by two function.

The 1.5kΩ resistor and the 0.1μF capacitor connected to pin 9 compensate the internal voltage regulating op amp at the frequency of the pole of the output filter. Diode D3, the 100kΩ resistor and the 2.2μF capacitor provide a soft start function to the inverter. This works as follows.

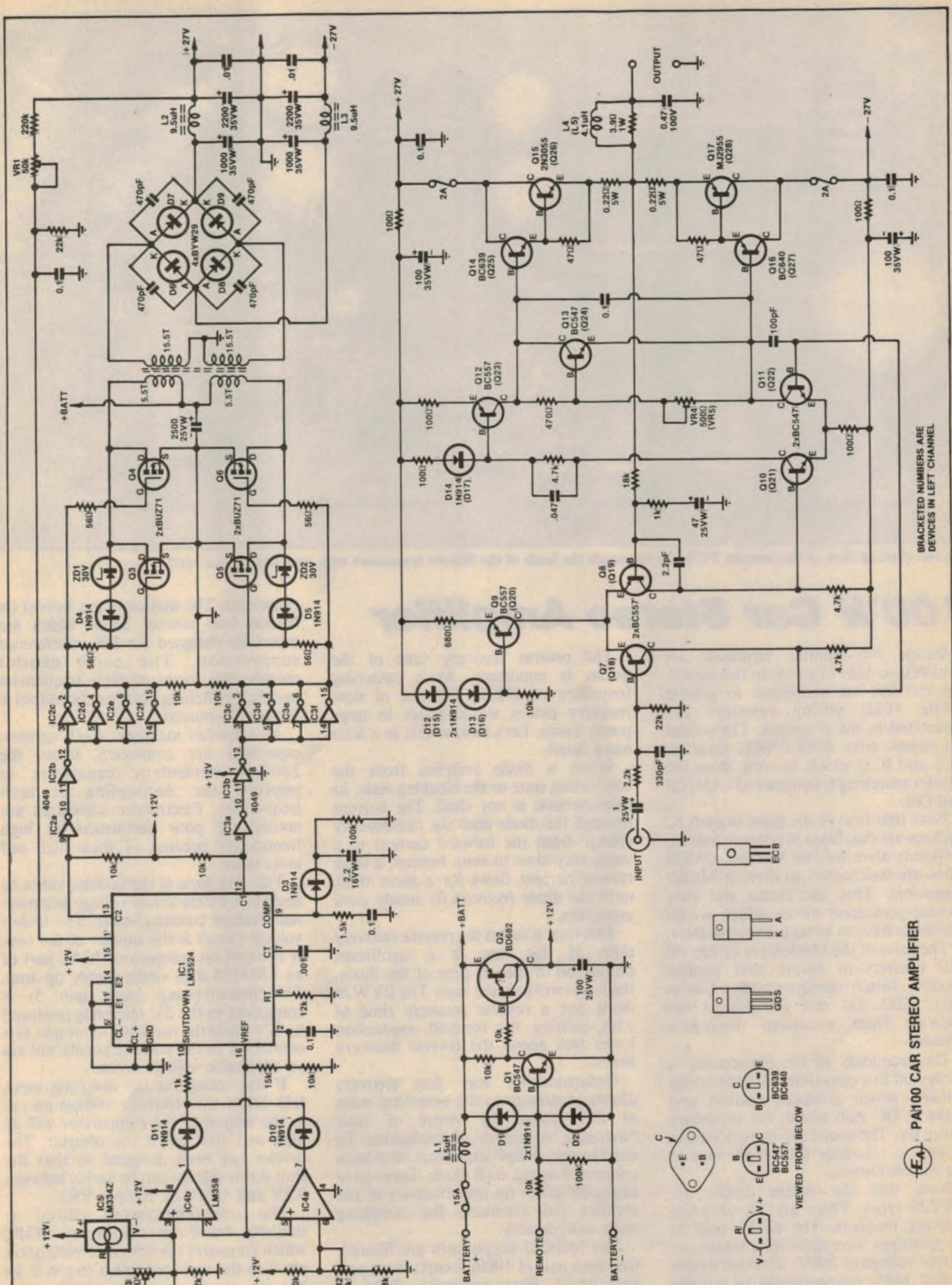
When the inverter is turned off, the capacitor is discharged via the 100kΩ resistor. When the inverter is subsequently turned on, the voltage at pin 9 will be low. This voltage will rise, as the capacitor charges up via D3, until it reaches the normal operating level.

The output pulse width is proportional to the voltage on pin 9. Thus, the pulse width will increase gradually from zero to the normal operating level.

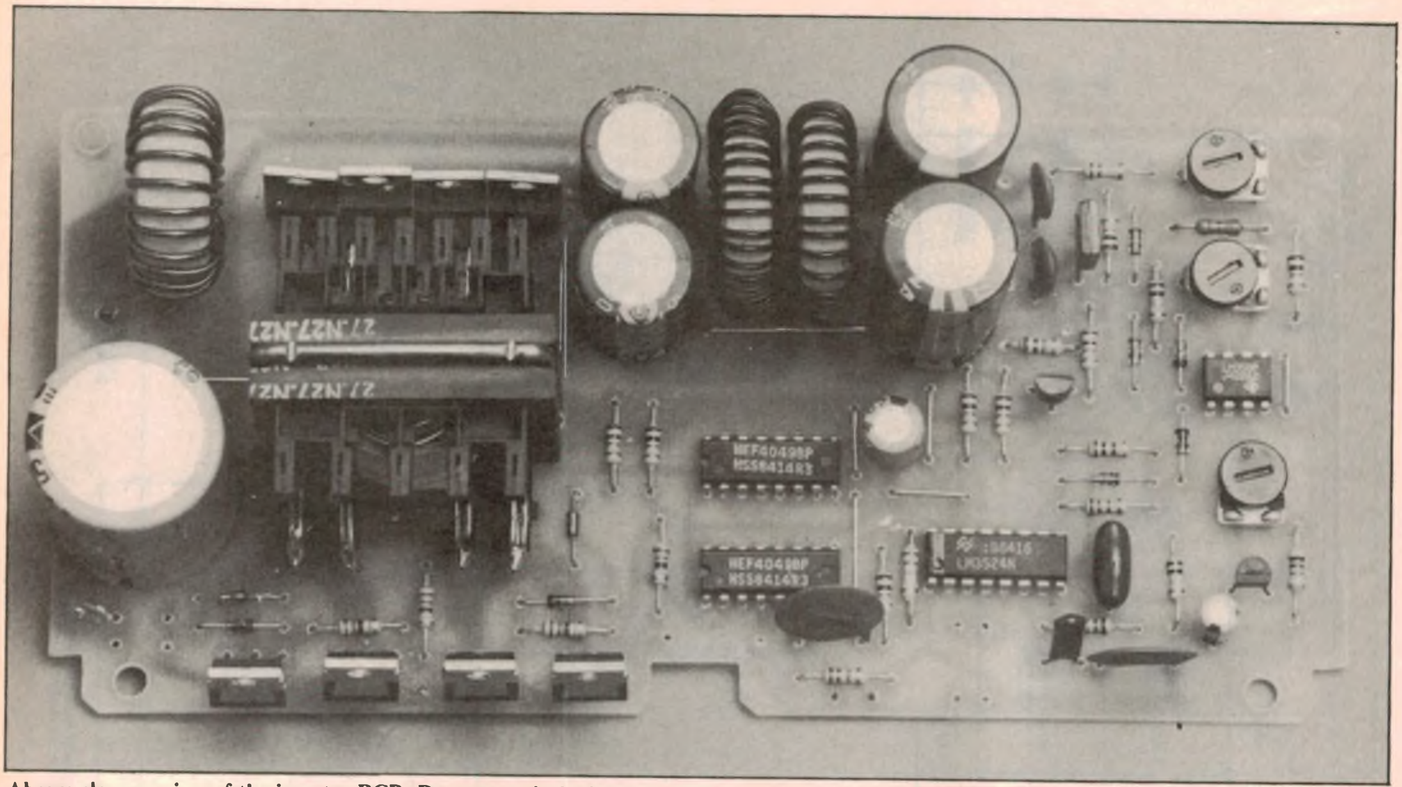
An error amplifier inside IC1 compares the output voltage of the inverter with a reference voltage, and controls the on time of the switching transistors. The reference voltage is derived from an internal regulated 5V source which is divided down to 2V by the 15kΩ and 10kΩ resistors. A 0.1μF capacitor decouples this 2V reference.

Another voltage divider, consisting of trimpot VR1 and the 220kΩ and 22kΩ resistors, reduces the converter output voltage to a similar level. The trimpot provides adjustment of the division ratio so that the output voltage can be set precisely to 27V. The divided output voltage is decoupled, again with a 0.1μF capacitor, and applied to the inverting input of the error amplifier.

The output circuit of the LM3524 consists of a pair of transistors, whose



PA100 CAR STEREO AMPLIFIER



Above: close-up view of the inverter PCB. Do not touch the leads of the Mosfet transistors with your fingers (see text).

100W Car Stereo Amplifier

collector and emitter terminals are available on pins 11 to 14. In this circuit, the emitters are connected to ground while 10kΩ pullup resistors are connected to the collectors. The output transistors drive 4049 CMOS inverters (IC2 and IC3) which, in turn, drive the Mosfet switching transistors (Q3, Q4, Q5 and Q6).

Note that four of the gates in each IC package are paralleled in order to provide sufficient drive for the Mosfets. CMOS gates are well suited to driving Mosfet transistors. They are cheap and they include protection diodes which would otherwise have to be included separately.

The gates of the Mosfets are driven via 56Ω resistors to ensure that parallel Mosfets switch simultaneously. Diodes ZD1, ZD2, D4 and D5 protect the Mosfets from excessive drain-gate voltages.

The secondary of the transformer is connected to a conventional diode bridge (D6-D9) which produces positive and negative DC rails about the secondary centre tap. The centre tap is connected to ground to reference the supply rails to the vehicle chassis.

Note that the bridge diodes are BWY29 types. These are 7A ultra-fast recovery rectifiers. The diodes used in the prototype were rated for a maximum reverse voltage of 200V, although diodes with a 100V rating should be equally suitable.

The reverse recovery time of the diodes is important. At a switching frequency of 50kHz, the use of slow recovery diodes would result in large power losses. Let's look at this in a little more detail.

When a diode switches from the conducting state to the blocking state, its characteristic is not ideal. The current through the diode does not immediately change from the forward current to a value very close to zero. Instead, a large reverse current flows for a short time, until the diode recovers its steady state properties.

This time is called the reverse recovery time. If this time is a significant proportion of the off time of the diode, the losses will be quite high. The BYW29 diode has a reverse recovery time of 25ns, putting the forward conduction losses well above the reverse recovery losses.

Unfortunately, very fast recovery diodes contribute to the switching noise in the system by virtue of their "snapping" in and out of conduction. To combat this, 470pF capacitors have been connected across each diode. These have negligible effect on the efficiency of the rectifier but attenuate the switching noise considerably.

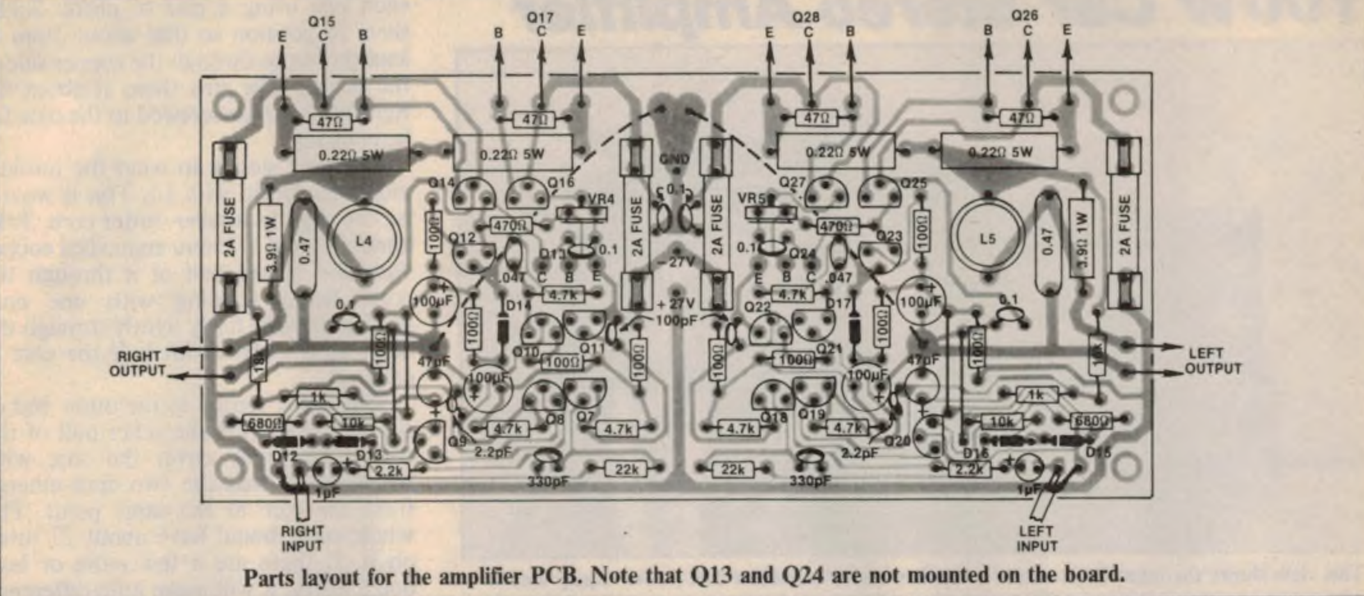
The rectified supply rails are filtered, first by a pair of 1000μF capacitors, and then by LC filters consisting of 9.5μH inductors (L2 and L3) and the 2200μF capacitors. The inductors are wound on Neosid iron powder cores, which are especially designed for RF interference suppression. The cores exhibit considerable losses at high frequencies and thus switching noise on the output is further attenuated.

As a further measure, .01μF ceramic capacitors are connected across the 2200μF electrolytic capacitors to improve the decoupling at high frequencies. Electrolytic capacitors are notoriously poor performers at high frequencies because of their high self inductance.

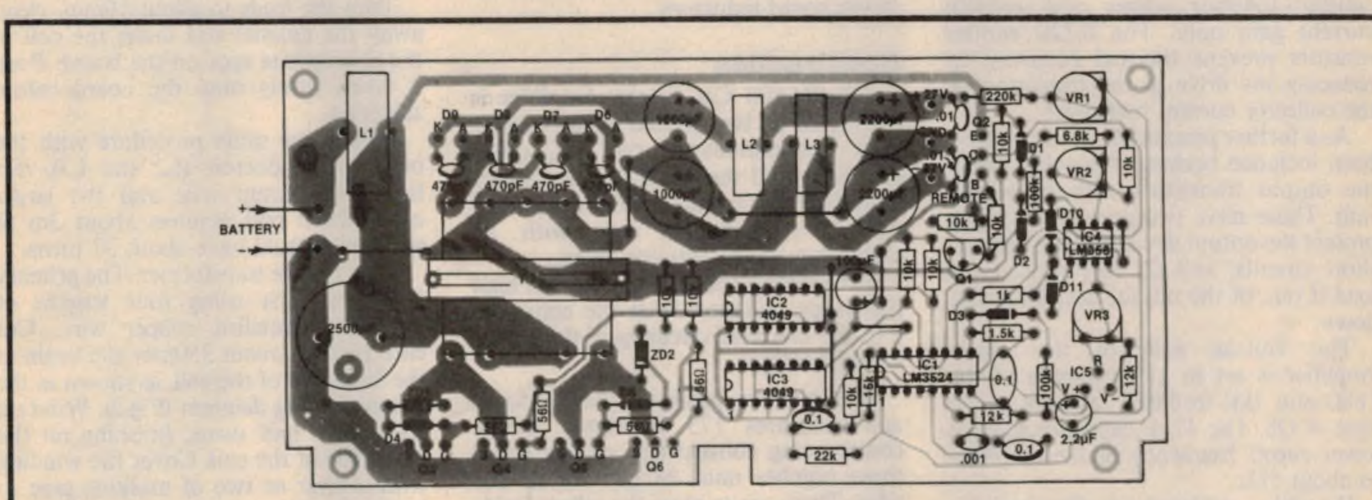
The only parts of the inverter yet to be described are the under-voltage and over-temperature cutout circuits. The under-voltage circuit is the simpler of the two. It is based on comparator IC4a, part of an LM3524 dual single supply op amp. The non-inverting input (pin 5) is connected to the 5V reference produced by IC1 while the inverting input (pin 6) is connected to the positive supply rail via an adjustable voltage divider.

If the voltage at the inverting input falls below the reference voltage on pin 6, the output of the comparator will go high and shut down the inverter. The divider has been designed so that the shut down voltage can be varied between 9.2V and 12.4V by trimpot VR2.

The over-temperature cutout is similarly based on comparator IC4b, which compares the reference voltage on pin 2 to the voltage applied to pin 3. In this case, the op amp is set up so that the inverter is switched off if the voltage



Parts layout for the amplifier PCB. Note that Q13 and Q24 are not mounted on the board.



Parts layout for the inverter PCB. The leads to the car battery must be capable of carrying at least 15A.

applied to the non-inverting input rises above the reference voltage.

The temperature sensing element is IC5 which is an LM334Z current source. This IC produces a current that is directly proportional to its absolute temperature. This current flows through the series 12kΩ resistor and the resultant voltage monitored by the comparator.

Trimpot VR3 allows the cutout temperature to be varied over a wide range. We set up the prototype to cut out when the case temperature of the switching transistors reached 95°C. Detailed instructions on setting this adjustment will be published in Part 2 next month.

Power amplifiers

The two power amplifiers are identical, so a description of the right channel only will be given.

The input signal is coupled into the first differential stage via a 1μF DC blocking capacitor and a 2.2kΩ "stopper" resistor. The 330pF capacitor shunts any RF present on the input to ground.

Transistor Q9 functions as a constant current tail for the input differential pair, Q7 and Q8. It supplies about 1mA to the differential pair, the current being shared equally between the two transistors.

The main advantage obtained by using a constant current source over a simple resistor is that of increased power supply rejection. This was of particular concern in the design of this amplifier because of the nature of the power supply. The effectiveness of the design is demonstrated by Fig. 1 which shows the level of switching noise present at the amplifier output.

The balanced outputs of the first stage are taken from the 4.7kΩ load resistors and fed to the inputs of a second differential stage. This stage, consisting of transistors Q10 and Q11, has a simple resistor "tail" and a current mirror load. The current mirror is formed by D14, Q12 and associated resistors.

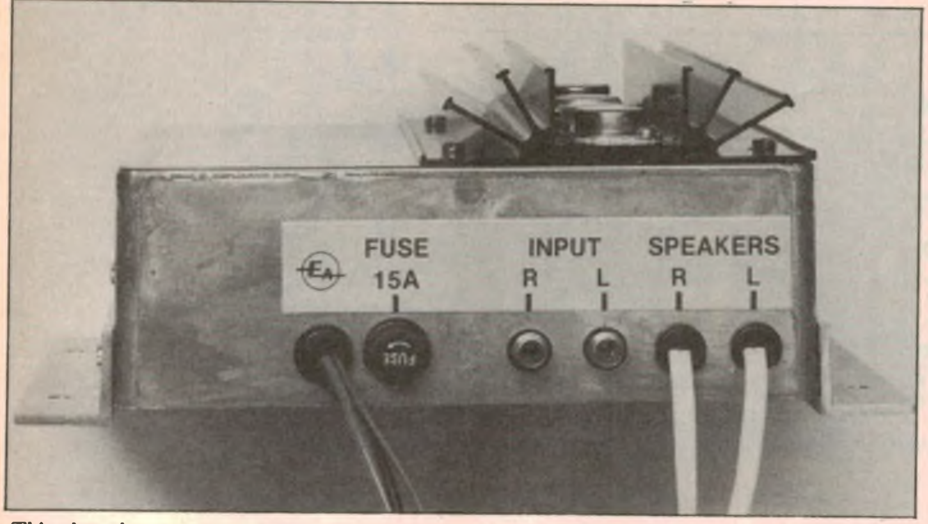
The current mirror has a very high dynamic resistance and ensures equal current through each side of the differential stage. The advantages of this configuration are high voltage gain, good linearity and wide voltage swing.

Q13 forms a Vbe multiplier or "amplified diode" which sets the bias conditions for the output transistors. This transistor is mounted on the external heatsink, next to the output transistors. This is done so that the bias automatically changes to compensate for temperature induced variations in the base-emitter voltages of the output transistors.

VR4 is included so that the bias can be adjusted to the optimum level. A 0.1μF ceramic capacitor is connected across the Vbe multiplier to ensure stability.

The output stage consists of Darlington transistor pairs Q14, Q15,

100W Car Stereo Amplifier



This view shows the input RCA sockets, speaker leads, fuseholder and power supply leads.

Q16 and Q17. These are wired as emitter follower stages and provide current gain only. The 0.22Ω emitter resistors prevent thermal runaway by reducing the drive to the transistors as the collector current increases.

As a further precaution, 2A fuses have been included between the collectors of the output transistors and the supply rails. These serve two purposes: (1) they protect the output devices against output short circuits; and (2) they protect the load if one of the output devices breaks down.

The voltage gain of the power amplifier is set to 18 by means of the 18kΩ and 1kΩ feedback resistors at the base of Q8. The 47μF capacitor sets the lower cutoff frequency of the amplifier to about 5Hz.

Double pole lag frequency compensation is applied by the 2.2pF and 100pF capacitors on Q8 and Q11 respectively. These render the amplifier stable with overall negative feedback applied. Power supply decoupling is provided by the 0.1μF ceramic capacitors, the 100Ω resistors and the 100μF capacitors.

A final refinement involves the RLC Zobel network in the output circuit. This network renders the amplifier unconditionally stable. Note that air cored inductors are specified here because of the distortion introduced by ferrite cored inductors.

Construction

The PA100 Car Stereo Amplifier is assembled on two printed circuit boards. One accommodates the DC-to-DC converter and the other the two power amplifiers. Each board is fitted into one half of the diecast case with an aluminium shield between them.

The shield is necessary to prevent high frequency radiation from the converter into the low level circuitry of the power amplifier stages.

The inverter board is coded 85cs8b and measures 175 x 84mm. Before commencing construction of this board three notches must be cut out of one edge. These are to clear the pillars inside the diecast box and are marked on the copper side of the board. Having done this, position the board inside the case and mark the mounting holes.

Begin assembly of the board by installing the seven wire links, followed by the resistors, capacitors and semiconductors. Note carefully the orientation of the polarity conscious components. The power Mosfets are quite sensitive to static electricity. Do not handle them with your fingers.

We found it best to carefully insert each one using a pair of pliers. Solder them in position so that about 1mm of lead protrudes through the copper side of the board. This puts them at about the right height to be screwed to the case for heatsinking.

The next step is to wind the toroidal inductors. Begin with L1. This is wound on the slightly smaller, fatter core. Take about 1.5m of 1.25mm enamelled copper wire and thread half of it through the core. Begin winding with one end, pulling the wire fairly tightly through the core. Stop when about half the core is covered.

This done, return to the other end of the wire and wind the other half of the core. Completely cover the core with windings, so that the two ends emerge from the core at the same point. The whole core should have about 27 turns on it. If there are a few more or less, don't worry; it will make little difference to the operation of the circuit.

Trim the leads to about 10mm, clean away the enamel and insert the coil in the appropriate spot on the board. Push it down firmly onto the board before soldering.

Follow the same procedure with the other two inductors (L2 and L3), this time using 1mm wire and the larger cores. Each coil requires about 2m of wire and should have about 37 turns.

Now for the transformer. The primary is wound first using four lengths of 1.25mm enamelled copper wire. Cut each piece to about 350mm and begin at the 4-pin side of the coil, as shown in the accompanying diagram (Fig.2). Wind on five and a half turns, finishing on the same side of the coil. Cover the winding with a layer or two of masking tape to hold it in place.

Strip the enamel off all eight wires and terminate the starts as shown. This done, use your multimeter to determine the finish of each winding and terminate these also. Finally, check that there are no short circuits between the two half primary windings.

The secondary is wound using two lengths of 1.25mm enamelled copper wire. This winding begins and ends on the opposite side to the primary and consists of 15½ turns. Cover this winding with a layer or two of tape also.

Strip and tin the ends of this winding as before and terminate the starts as shown in the diagram. Once again, use your multimeter to determine the finish of each winding and terminate these as well. Give all the windings a final check and the transformer is ready to assemble.

The photographs show how the transformer is mounted. Do not overtighten the nuts underneath the board or you may crack the ferrite cores. Solder the transformer pins to the copper track after the nuts have been tightened.

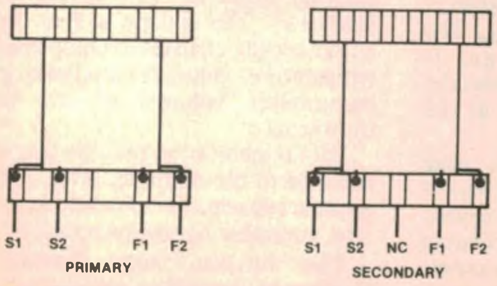


Fig. 2: this diagram shows how the leads for the inverter transformer are terminated. Do not confuse the start (S) and finish (F) ends of the windings otherwise the inverter will not work.

PARTS LIST FOR CAR STEREO AMPLIFIER

1 diecast aluminium case, 185 x 185 x 65mm
1 heatsink, extruded fin, 185mm long x 75mm wide
2 aluminium brackets, 25 x 25 x 180mm
1 piece of aluminium sheet, 170 x 70mm, 1mm thick
1 Scotchcal label, 185 x 80mm
1 printed circuit board, code 85cs8a, 178 x 79mm
1 printed circuit board, code 85cs8b, 176 x 84mm
2 Neosid 17-137-10 iron powder ring cores
1 Neosid 17-131-10 iron powder ring core
2 Siemens ferrite cores, B66339-G-X127 (100121)
1 Siemens former, B66274-B1011-T1 (100260)
1 Siemens mounting kit, B66274-B2002-X (100311)
8 PC-mounting fuse clips
1 panel mounting fuseholder
4 2A fuses
1 15A fuse
2 panel mounting RCA sockets
3 rubber grommets
3 cable clamp grommets
1 solder lug
4 TO-220 mica washers
4 TO-3 mica washers
12 insulating bushes
23 PC stakes
4 35mm x 4BA countersunk screws
4 15mm x 4BA countersunk screws
4 10mm x 4BA roundhead screws
4 6mm x 4BA roundhead screws
4 10mm x 6BA roundhead screws
24 4BA nuts
4 6BA nuts
20 shakeproof washers
4 25mm spacers

Semiconductors

1 LM3524 PWM regulator IC
2 4049 hex CMOS inverter ICs
1 LM358 dual op amp
1 LM334Z temperature dependent current source
2 2N3055 NPN power transistors
2 MJ2955 PNP power transistors
8 BC557 PNP transistors
7 BC547 NPN transistors
1 BD682 Darlington transistor
2 BC639 NPN transistors
2 BC640 PNP transistors
4 BUZ71 Sipmos power FETs
4 BYW29 100V ultra fast rectifier diodes
13 1N914 diodes
2 30V 400mW zener diodes

Capacitors

1 2500μF 35VW PC electrolytic, RP type
2 2200μF 35VW PC electrolytic
2 1000μF 35VW PC electrolytic
5 100μF 35VW PC electrolytic
2 47μF 25VW PC electrolytic
1 2.2μF 25VW PC electrolytic
2 1μF 25VW PC electrolytic
2 0.47μF 100V polyester
1 0.1μF 100V polyester
8 0.1μF 50V ceramic
2 .01μF 50V ceramic
1 .001μF 100V polyester
4 470pF ceramic
2 330pF ceramic
2 100pF ceramic
2 2.2pF ceramic

Resistors (5%, 0.25W unless stated)
1 x 220kΩ, 2 x 100kΩ, 3 x 22kΩ, 2 x 18kΩ, 1 x 15kΩ, 2 x 12kΩ, 10 x 10kΩ, 1 x 6.8kΩ, 6 x 4.7kΩ, 2 x 2.2kΩ, 1 x 1.5kΩ, 3 x 1kΩ, 2 x 680Ω, 2 x 470Ω, 12 x 190Ω, 4 x 56Ω, 4 x 47Ω, 2 x 3.9Ω 1W, 4 x 0.22Ω 5W

Trimpots

1 50kΩ horizontal cermet
1 5kΩ horizontal cermet
1 500Ω horizontal cermet
2 500Ω vertical cermet

Wire and cable

7m 1.25mm enamelled copper wire
4m 1.00mm enamelled copper wire
4m 240VAC figure-8 cable (for speaker leads)
6m 15A figure-8 cable (for power supply leads)
400mm shielded cable
1m light-duty hookup wire
6m medium-duty hookup wire

Miscellaneous

Machine screws and nuts, shakeproof washers, silastic, heatsink compound, scrap aluminium.

Finally, a number of flying leads can be soldered to the inverter board. First, solder three 100mm lengths of thin hookup wire for the temperature sensor. This done, suitable lengths of medium-duty hookup wire can be installed for the supply lead connections and for the control leads. The supply leads should be about 200mm long while the length of the control lead will depend on just where you intend to mount the amplifier.

The leads to the car battery must be capable of handling at least 15A on a continuous basis. Use the thickest wire you can lay your hands on (within reason). The negative lead must be made quite long while the positive lead can be trimmed to a length of 50mm. This wire only has to connect to the fuse holder.

Amplifier board

The amplifier board is coded 85cs8a and measures 177 x 79mm. This board mounts in the other half of the case and should be used as a template to mark the mounting holes as before.

PC pins are used to terminate for all external connections to this board and these should be installed first. The fuse clips should likewise be installed at this early stage.

This done, the remaining parts (except for Q13 and Q24) can be installed according to the layout diagram. Note that there are four wire links on this board. The two 4.1μH inductors have to be wound by hand. This is not a difficult process although it does require some care.

The first step is to locate a suitable former. This needs to be a cylindrical object with a diameter of about 11mm. A drill bit or a piece of dowel rod could be used (we actually used a marker pen). The coils are wound using 1.25mm enamelled copper wire and a 1m length should be more than sufficient for both coils.

Begin by taping about 40mm of one end of the wire along the former, then wind on 13 turns. Each turn should touch the previous one. After the requisite number of turns has been made, cover the whole winding with a layer of ordinary adhesive tape to prevent the coil unwinding.

Now wind another 12 turns over the top of the previous winding, heading back towards the start. Stop on the opposite side of the former from the start (effectively wind another half turn) and secure the whole coil with a couple of layers of tape. The coil can now be removed from the former.

Finally, clean the ends of the leads and mount the coil on the PCB. Repeat this process for the other coil.

That's all for now. Next month, we shall give the final assembly details and describe the setting up and installation procedures.

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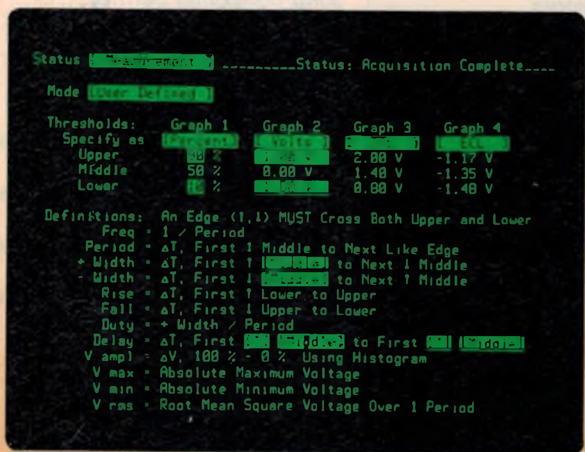

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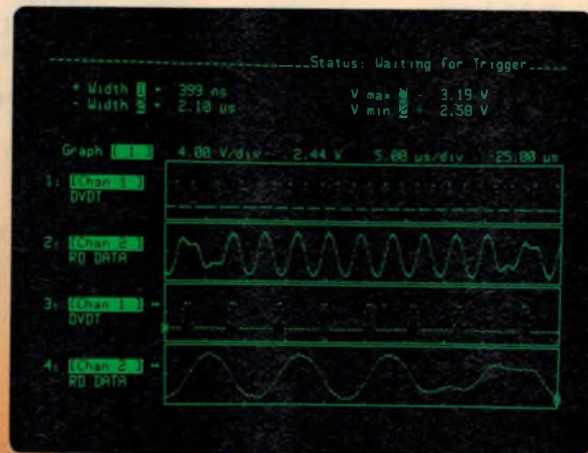

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Low-cost unit checks values from 1pF to 100μF

Upgraded digital capacitance meter

Updated from our March 1980 issue, this Digital Capacitance Meter checks capacitor values from 1pF to 99.99μF over three ranges. Its main features include a nulling circuit and a bright 4-digit LED display.

by GREG SWAIN & ANDREW LEVIDO

We have described quite a few capacitance meters but the design published in March 1980 has proven the most popular. Kit sales now run into several thousand units with constructors experiencing very few problems.

With this in mind, we recently decided to take a look at the March 1980 design to see if we could make any improvements. As it turns out, we have been able to make several worthwhile changes.

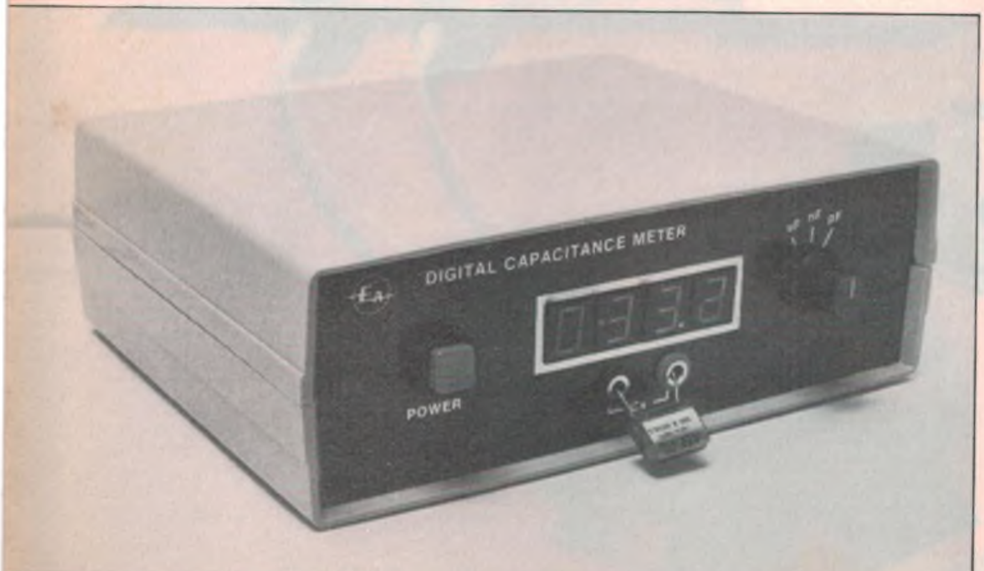
First, the circuit is now much easier to build than before. By re-designing the printed circuit boards (PCBs), we have been able to eliminate the drudgery of wiring up the range switch. Unlike the previous design, the switch is now soldered directly to the display board.

Second, a low-cost plastic instrument case has been substituted for the more expensive metal case used previously. The appearance of the instrument has thus been substantially upgraded and it now matches other items in the EA test equipment range: the 7-Digit Digital Frequency Meter, the 30V/1A Power Supply and the Function Generator.

Finally, we have made a couple of minor circuit changes to improve the performance. In particular, the nulling circuit now operates on the μF range, as well as on the nF and pF ranges. This eliminates the "bobble" between 0 and 1 that occurred on the μF range with no test capacitor connected.

To sum up, we have improved the circuit performance and made the unit much easier to build. It adds up to better value for money.

The Mk.2 version is housed in an attractive plastic instrument case.



Main features

All the features of the previous unit have been retained. The readout consists of a bright 4-digit LED display and the full scale readings for each range are 9999pF, 999.9nF and 99.99μF. No adjustments are necessary when taking a reading. You simply connect the capacitor to the test terminals and select the appropriate range.

As before, the circuit can accurately measure capacitance down to one picofarad (1pF). This is made possible by the internal nulling circuit which cancels any stray capacitance between the test terminals or test leads. So when you measure a 5pF capacitor, the unit will display 5pF.

The nulling feature also makes it possible to measure the capacitance of wiring and cables.

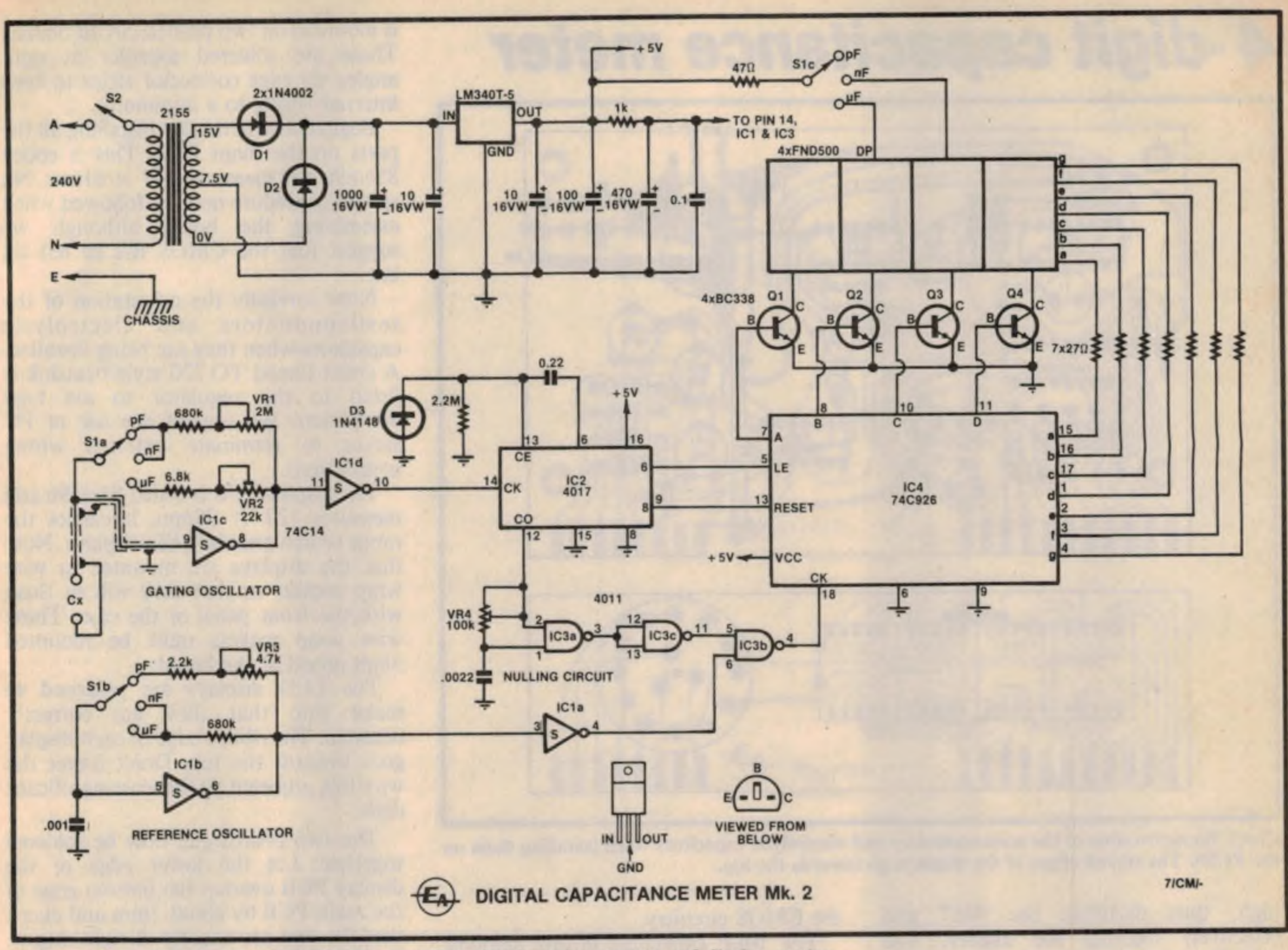
Note that the unit can also be used to check tantalum and electrolytic capacitors. The test terminals are actually polarised with a potential difference of about 3V so that all electrolytics with voltage ratings greater than 3V can be readily measured.

It all adds up to a very useful general-purpose test instrument. It is particularly useful for checking suspect components, for sorting through capacitors with unfamiliar markings, and for selecting close-tolerance capacitors for use in critical circuits.

How it works

Refer now to the circuit diagram. It consists of two simple RC oscillators, a decade counter, the nulling circuit and a counter and display section.

In greater detail, IC1c forms the gating oscillator while IC1b is the reference oscillator. Both are Schmitt



The circuit consists of two RC oscillators, a nulling circuit, and a counter and display section.

trigger inverter oscillators with switches S1a and S1b providing range selection. Their outputs are buffered and inverted by IC1a and IC1d.

The test capacitor, Cx, sets the frequency of the gating oscillator. The lower the value of the test capacitor, the longer the period of the output pulse train. These pulses gate through a series of pulses from the reference oscillator to the counter circuit via IC3b.

With this arrangement, the number of pulses gated through to the counter is proportional to the period of the gating oscillator and hence the value of the test capacitor Cx. If the reference oscillator is set to an appropriate frequency, then the counter will display the capacitance value directly.

At the heart of the circuit is IC4, a 74C926 four-decade counter with latches, BCD to 7-segment decoder drivers, and internal multiplexing circuitry. It drives four common cathode LED displays via transistors Q1 – Q4. The display segments are driven via 27Ω current limiting resistors.

The displays specified are Fairchild FND500s but high brightness FND560s can be substituted without change to the circuit. Both types have 15mm high digits and integral red plastic filters. Switch pole S1c provides decimal point switching for the displays.

In order to function correctly, the 74C926 requires two control signals: "reset" and "latch enable". The contents of the latches are used to drive the display, during which time the decade counters remain free to count up without affecting the reading.

The reset, latch enable and gating signals must be generated in a particular sequence. To do this, we have used a 4017 decade counter (IC2) which has 10 decoded outputs, as well as a "carry" output. This device is clocked by the gating oscillator and each decoded output goes high in turn for the period of the clock signal. The decoded "6" output (pin 5) provides the latch enable signal while the decoded "8" output (pin 9) provides the reset signal.

Ignoring the nulling circuit for the time being, the sequence of events is as follows. First, the gating signal arrives (ie, pin 5 of IC3b goes high) and the reference oscillator clocks the 74C926 counter. Subsequently, at the end of the gating signal, the latch enable goes high and the contents of the counter are latched and displayed. Finally, the reset goes high and the counter is cleared for the next cycle.

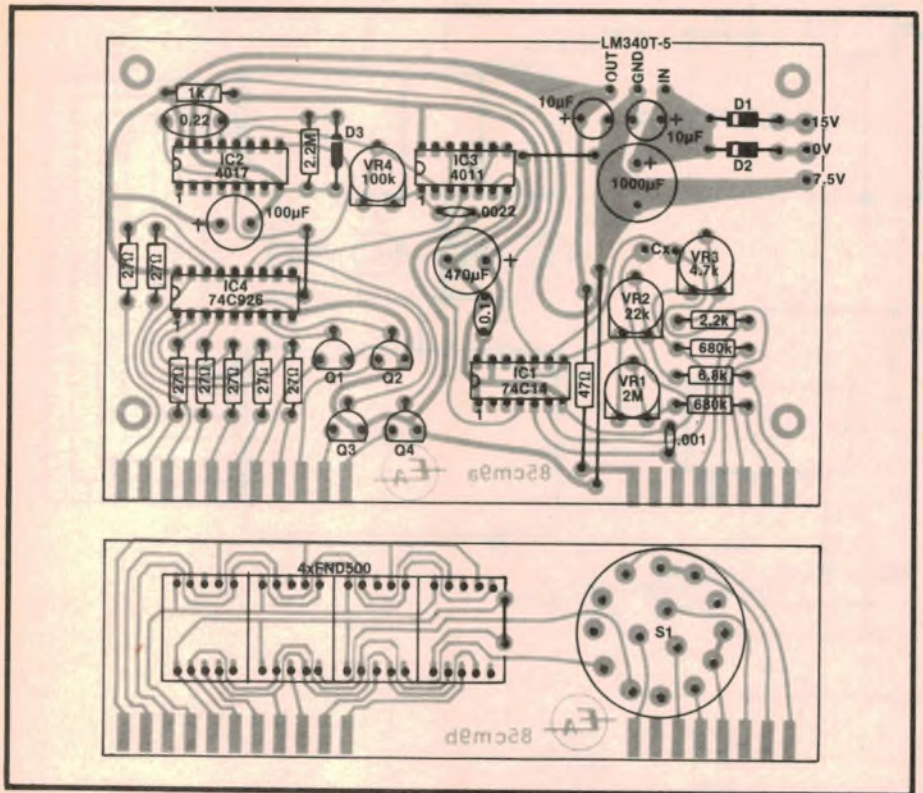
Note that the gating signal for IC3b is derived from the "carry out" of the 4017, rather than directly from the gating oscillator. Why has this been done? The reason is that the "carry out" signal is high only during the time that the "0" to "4" decoded outputs are high. This avoids conflict with the latch enable and reset signals at decoded outputs "6" and "8".

As a further precaution, there is a complete clock period between each control signal to ensure that the circuit operates without glitches.

From the foregoing, it is apparent that the frequency of the gating oscillator determines the rate at which the display is updated. This can be quite rapid when small capacitors are being measured.

To prevent the display from flickering as a result of this rapid updating, a half second delay is introduced by connecting decoded output "7" (pin 6) of the 4017 to the clock enable (pin 13) via a 0.22µF capacitor. When the "7" output goes high, the clock enable will also go

4-digit capacitance meter



Check the orientation of the semiconductors and electrolytic capacitors when installing them on the PCBs. The ribbed edges of the displays go towards the top.

high, thus disabling the 4017 and effectively freezing the display. The 0.22μF capacitor now charges via the 2.2MΩ resistor and, after about 0.5s, pin 13 goes low and clocking re-commences.

Diode D3 prevents the clock enable from being pulled below ground potential when pin 6 subsequently goes low.

Let's now take a look at the nulling circuit. This consists of NAND gates IC3a and IC3c. Its function is to shorten the length of the gating pulses to remove stray capacitance effects.

To achieve this, the gating signal is fed direct to pin 2 of IC3a and to pin 1 via an RC delay network consisting of trimpot VR4 and a .0022μF capacitor. When the original and delayed versions of the gating pulse are "NANDed" by IC3a, the length of the output pulse is reduced by the amount set by the time constant (see Fig. 1).

Trimpot VR4 allows adjustment of the null circuit while IC3c simply acts as an inverter stage to present the correct logic sense to IC3b.

Power for the circuit is derived from a 15V centre-tapped transformer which drives a full-wave rectifier and 1000μF filter capacitor. This provides about 10.5V DC, depending on the total load, and this unregulated DC is applied to a 3-terminal 5V regulator which supplies the CMOS circuitry.

The 10μF capacitors ensure stability of the regulator while the 100μF capacitor decouples the display multiplex hash. Note that the supply rail for IC1 has been decoupled from the regulator using a 1kΩ resistor and 470μF and 0.1μF capacitors. This prevents interference to the oscillators from multiplex noise on the main 5V supply.

Construction

All the circuitry, with the exception of the test terminals and the mains switch, is mounted on two printed circuit boards. These are soldered together at right angles via edge connector strips to keep internal wiring to a minimum.

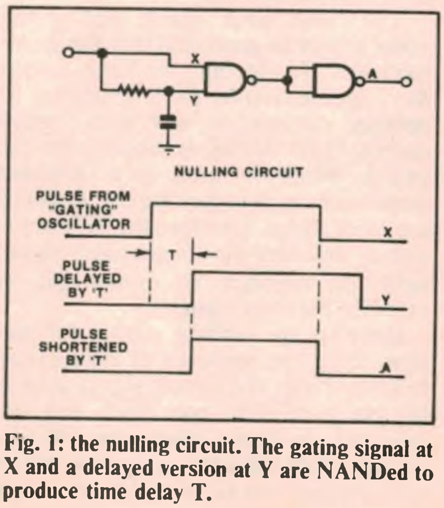


Fig. 1: the nulling circuit. The gating signal at X and a delayed version at Y are NANDed to produce time delay T.

Begin construction by installing all the parts on the main PCB. This is coded 85cm9a and measures 127 × 81mm. No special procedure need be followed when assembling the board although we suggest that the CMOS ICs be left till last.

Note carefully the orientation of the semiconductors and electrolytic capacitors when they are being installed. A small finned TO-220 style heatsink is fitted to the regulator to aid heat dissipation. We suggest the use of PC stakes to terminate external wiring connections.

The display PCB is coded 85cm9b and measures 127 × 38mm. It carries the range switch and the LED displays. Note that the displays are mounted in wire wrap sockets so that they will sit flush with the front panel of the case. These wire wrap sockets must be mounted 5mm proud of the board.

The LED displays are polarised so make sure that they are correctly oriented. The ribbed edge of each display goes towards the top. Don't forget the wire link adjacent to the least significant digit.

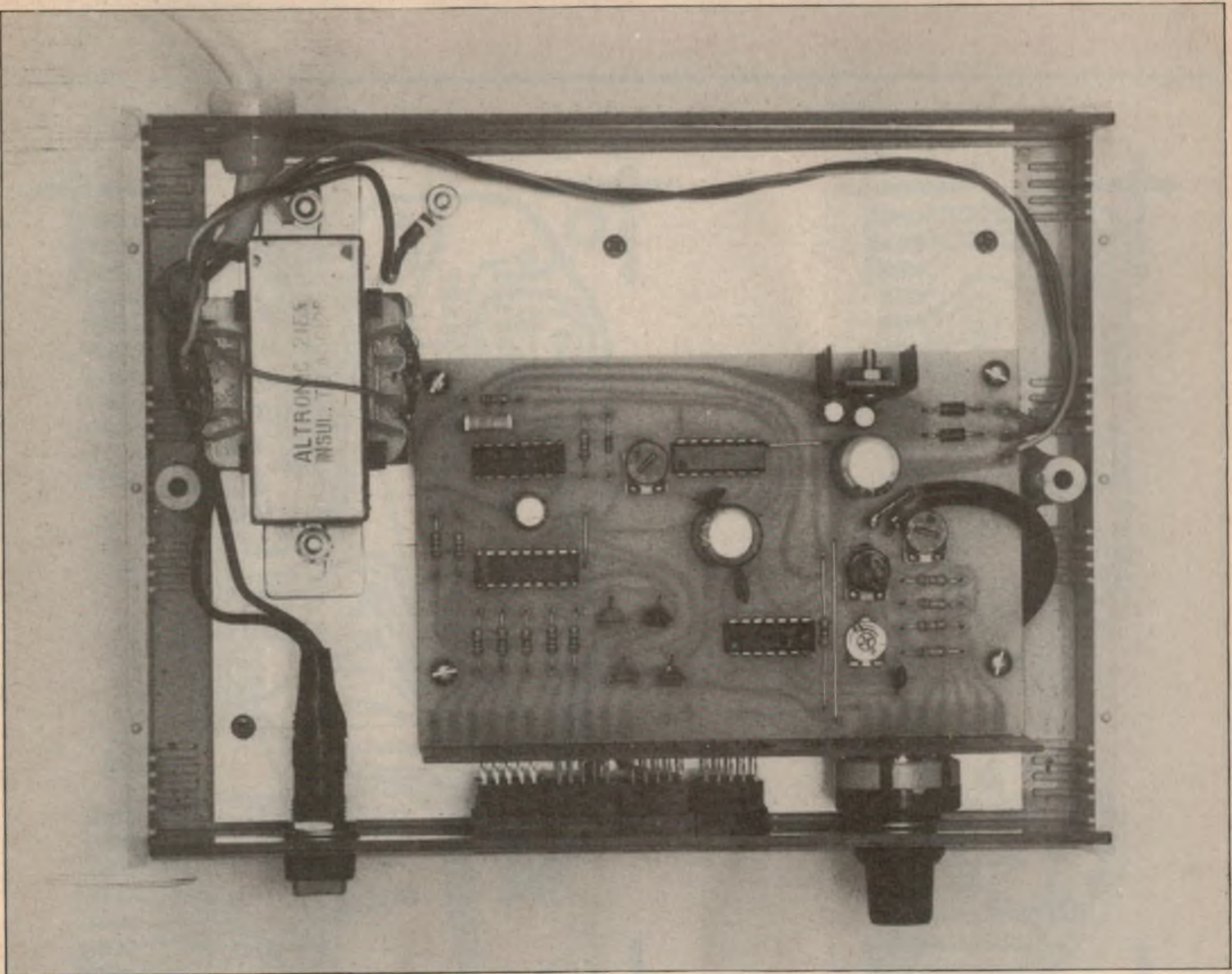
The two boards can now be soldered together. Let the lower edge of the display PCB overlap the bottom edge of the main PCB by about 2mm and check that the two are exactly at right angles. Solder tack the two end strips but do not solder the remaining connections at this stage.

The mains transformer and PCB assembly are mounted on a metal base plate measuring 170 × 142mm. This provides essential earthing for all the metal hardware and ensures reliable capacitance measurements. The plate is attached to the plastic standoffs on the bottom of the case by six self-tapping screws. Mark out and drill the holes for the self tappers, than mount the base plate in the case.

Note that the PCB assembly is mounted on four 9mm standoffs. Adjust the amount of overlap between the two boards if necessary so that the displays mate with the front panel cutout. When all is correct, solder the remaining edge connectors together.

The hardware items can now be mounted on the base plate and front panel. Mark out the mounting holes for the transformer, PCB assembly and earth lug, then remove the base plate for drilling. We used two banana sockets for the test terminals, red for positive and black for negative.

The mains switch should be of all-plastic construction and rated at 240V



View inside the prototype. The metal ground plane is necessary to ensure reliable circuit operation.

Parts List

- 1 PCB, code 85cm9a, 127mm × 81mm
- 1 PCB, code 85cm9b, 127mm × 38mm
- 1 plastic instrument case, 200mm × 160mm × 70mm, (Altronics cat. no. H 0480)
- 1 Arlec 2155 mains transformer or equivalent
- 1 aluminium sheet, 170mm × 140mm × 1mm
- 1 mains cord and plug
- 1 cord clamp grommet for mains cord
- 4 9mm standoffs
- 1 solder lug
- 1 3-pole 3-way rotary switch
- 1 knob
- 1 240V mains switch, all plastic construction
- 1 200mm length of 75Ω coaxial cable
- 3 250mm lengths of hookup wire
- 2 24-pin wire wrap sockets (cut to 4 × 5-way)
- 2 panel-mounting banana sockets (1 red, 1 black)
- 1 TO-220 heatsink

Semiconductors

- 4 FND500 or FND560 7-segment LED displays
- 1 74C926 4-digit counter
- 1 74C14 or 40106 hex Schmitt trigger
- 1 4017 decade counter
- 1 4011 quad NAND gate
- 1 LM340T-5 or 7805 5V regulator
- 4 BC338 NPN transistor
- 2 1N4002 1A diodes
- 1 1N4148, 1N914 diode

Capacitors

- 1 1000μF 16VW electrolytic
- 1 470μF 16VW electrolytic
- 1 100μF 16VW electrolytic
- 2 10μF 16VW electrolytic
- 1 0.22μF metallised polyester (greencap)
- 1 0.1μF ceramic
- 1 .0022μF metallised polyester
- 1 .001μF metallised polyester

Calibration capacitors (selected)

- 1 47μF electrolytic
- 1 0.47μF metallised polyester
- 1 .047μF metallised polyester

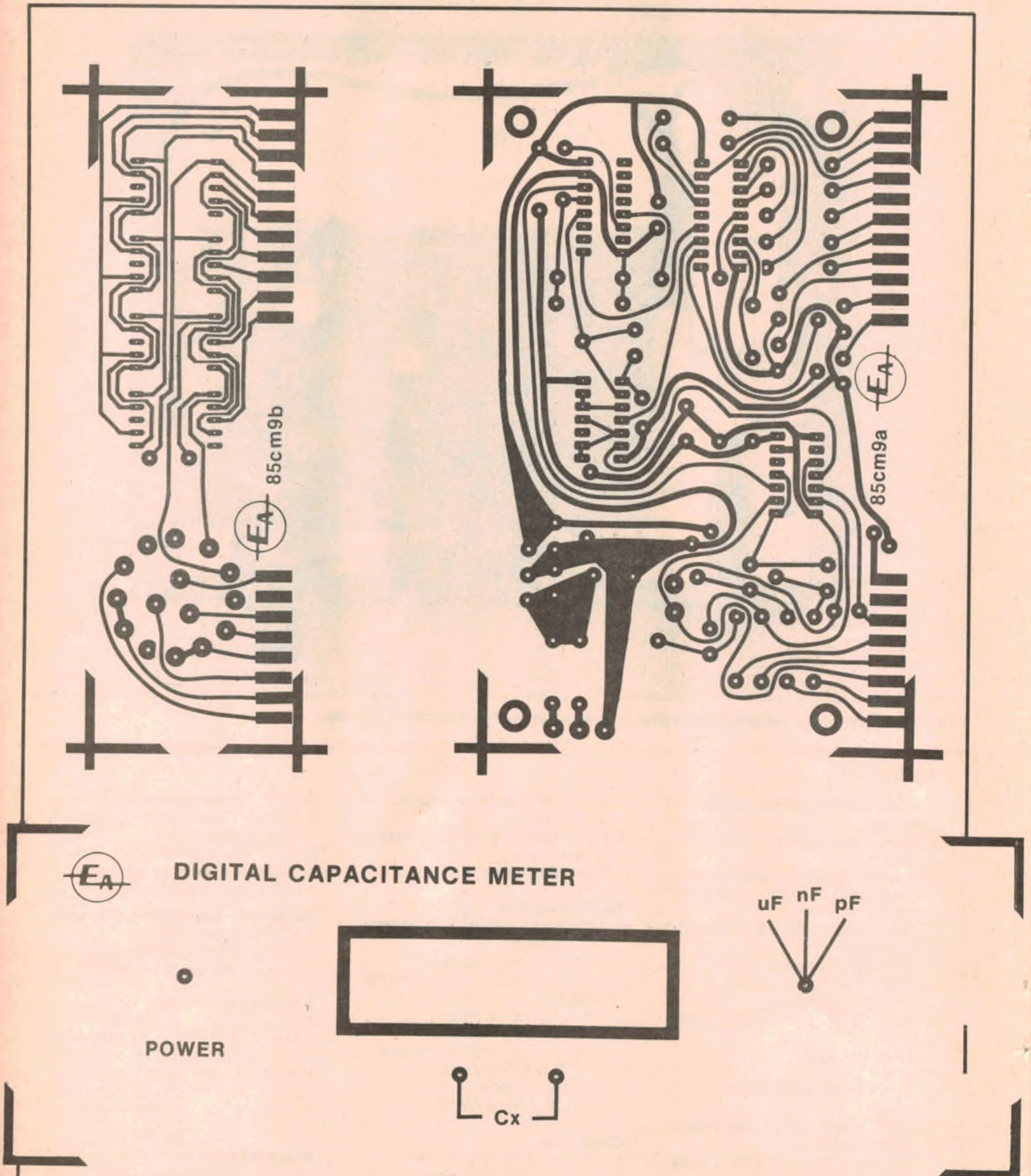
Resistors (¼W, 5%)

1 × 2.2MΩ, 2 × 680kΩ, 1 × 6.8kΩ, 1 × 2.2kΩ, 1 × 1kΩ, 1 × 47Ω, 7 × 27Ω, 1 × 2MΩ horizontal trimpot, 1 × 100kΩ horizontal trimpot, 1 × 22kΩ horizontal trimpot, 1 × 4.7kΩ horizontal trimpot

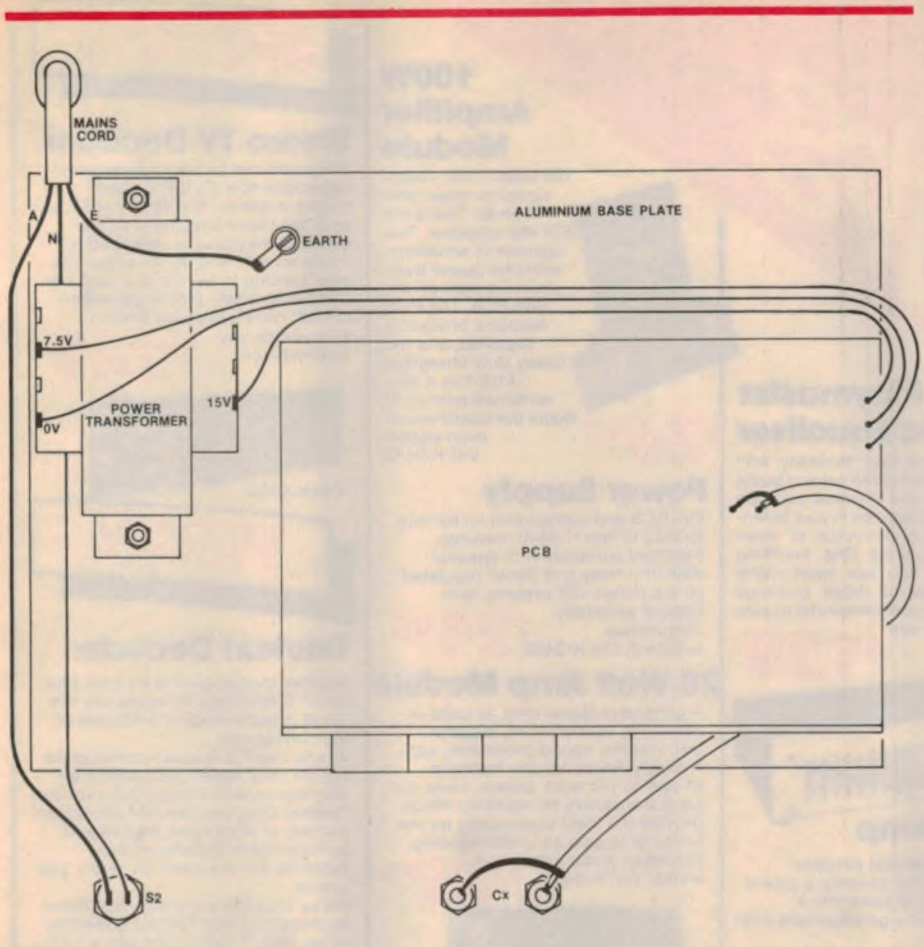
Miscellaneous

Machine screws and nuts, self-tapping screws, solder

4-digit capacitance meter



Above are actual size artworks for the PCBs and the front panel.



Use 240V AC cable for all mains wiring and anchor the mains cord using an in-line cord clamp grommet. Plastic sleeving should be pushed over all exposed mains terminals.

AC. It can be a pushbutton or toggle type.

All that remains now is to complete the internal wiring. The mains cord enters through a cord clamp grommet on the rear panel and the active and neutral leads connected directly to the switch and transformer terminals. The earth wire (green/yellow) should be connected to the solder lug.

Sleeving should be pushed over all exposed mains terminals after wiring. This prevents accidental contact with the mains while the unit is being worked on.

The remaining wiring details can be gleaned from the circuit diagram. Note that good quality 75Ω coaxial cable must be used between the PCB and test terminals. Normal audio cable is unsuitable since it changes capacitance quite markedly with temperature.

Now for the smoke test. Apply power and check for 5V DC at the output of the regulator. If you don't get a +5V reading, switch off immediately and check for wiring errors.

Calibration

Most kits will include three selected capacitors for the calibration procedure. The recommended values are .0047μF (4700pF), 0.47μF (470nF) and 47μF, although slightly higher or lower values could also be used.

Note that the calibration capacitors must be selected in order to give the required accuracy.

The "nF" range is calibrated first. Set all trimpots to mid-position and connect the 0.47μF calibration capacitor to the test terminals. Adjust VR1 for the correct reading (ie, 470.0nF).

Remove the capacitor, switch over to the "pF" range and adjust VR4 (the null control) for a reading of 0000. The correct procedure here is to first adjust the trimpot for a reading of 0001 and then nudge it back for the 0000 reading. This done, connect the .0047μF capacitor and adjust VR3 until the display reads 4700.

Finally, connect the 47μF capacitor to the test terminals and calibrate the "μF" range using trimpot VR2.

The Digital Capacitance Meter is now ready for use. Note that the least significant digit will jitter when the test capacitance is high for the range selected. This is quite normal and is dependent on the stability of the RC oscillators used in the circuit.

Sight & Sound Kits

100W Amplifier Module

100 watts RMS; 100db signal to noise ratio at 5kHz: That's the ETI 480 amplifier. The ultimate in simplicity; even the power transistors mount on the one PCB. The PCB heatsink bracket is supplied, and the heavy duty fibreglass PCB has a silk-screened overlay to make the construction even easier!
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STEREO

Stereo TV Decoder

TV sound can be very high quality - especially now it's being transmitted in stereo. But 99.9% of TV sets can't take advantage of this because they're only equipped for mono sound. And 99.9% of people aren't willing to get rid of a perfectly good colour telly just to get stereo sound! Here's the Dick Smith Electronics-low-cost-solution.

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Playmaster Graphic Equaliser

Get total control and flexibility with your sound system. With cut and boost of up to 13dB per channel you can make up for deficiencies in your listening area or sound source or even create special effects. (Big, booming bass: bewdy!) You can even make equalised tapes of those precious records. Features professional quality brushed aluminium front panel.
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Full PCB and component kit for one K-3442 or two K-3440 modules. Supplied complete with speaker dethump relay and Zener regulated plus & minus 15V preamp rails. Special assembly instructions supplied. Cat K-3438

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VIDEO

Teletext Decoder

Another money-saving kit from Dick Smith Electronics, bringing you the latest in technology at a fraction of the normal cost.
All you need is this adaptor to pluck out the information, and hold it for display on the TV screen. You can have Teletext only, or a mix of Teletext and picture, or even news flashes and, perhaps most important of all, captions for the deaf on many programs.
We've kept the price way, way down by designing this Teletext converter to be used in conjuction with a VCR.
Cat K-6315

Check with your local TV station(s) to ensure Teletext or captions are being transmitted before commencing construction!

ONLY $229

AUDIO

Playmaster Series 200 Mosfet (100W)

This is the one you've been waiting for. The all-new Playmaster Series 200 Integrated Amplifier is almost certainly the best build-it-yourself design to be published anywhere in the world! Feature for feature, dollar for dollar, it more than stacks up against the 'big names' in hi fi - with the big price tags to match.

And it has features that aren't even found on many of the 'names'. Features like electronic input switching. Circuitry to handle just about every input imaginable; moving magnet cartridge, CD player, hi fi VCR, cassette, tuner, etc etc. Plus, of course, incredible 'headroom' with 100 watts per channel output power. And much, much more!
Cat K-3516

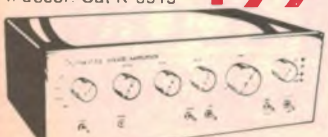
$439

Playmaster 45W

A little less power . . . a lower price: that's the original Playmaster Mosfet Integrated Stereo Amplifier, as described in Electronics Australia magazine.

With a very respectable 45 watts per channel output (enough to blow your head off!) it has most of the features of its big brother above: all components are on a single pcb, which makes construction quite simple. And the sturdy chassis and solid heatsinking make it ruggedly reliable. It includes integral speaker protection on board, along with fuse protection against massive overload. And our kit features a professionally designed front panel designed to suit today's modern hi fi decor. Cat K-3515

$199



Busker Amp

Easy-to-build general purpose microphone/guitar preamp & power amplifier, ready to build into a speaker case for a go-anywhere mini pa!
Ideal for the budding buskers in the family. Also fantastic for displays, fetes, rallies, etc.
Includes components, speaker but we leave the case to you (if you want to use away from power point you'll also need a 12V gel cell. (Cat S-3320).
Cat K-3446

GREAT VALUE

$79.95

CASE SHOWN NOT INCLUDED

50W Amp Module

Ideal for home stereo systems. Same design simplicity as the 100 watt module above, but cheaper because of lower power. And there's added economy as two units can be run from the one K-3438 power supply. An economical solution for those who want to update their old system without a huge outlay of money. Input sensitivity is 500mV. Supplied with exclusive instruction booklet and rugged fibreglass PCB with silk-screened component overlay for easy assembly. Heatsink bracket is supplied but heatsink itself is extra. Cat K-3440

$22.95

20 Watt Amp Module

A general purpose amp as used in television, tape players, musical instruments, sound projectors, etc. A handy device for any hobbyist to add to his work bench. Uses discreet transistors for reliabilty which provide the ideal opportunity for the hobbyist to gain an understanding of how an audio amp works. Cat K-3445

$15.95

Mixer Pre-amp

Designed to suit the 300W amp kit, this mixer preamp has 4 inputs with an impedance of 100K - suitable for most microphones, guitars, etc. Ideal also for use with 50W (K-3400) and 100W (K-3442) power amp modules. This unit provides bass, treble and presence control. Instructions supplied. Short form kit: no case, transformer or power supply. Cat K-3035

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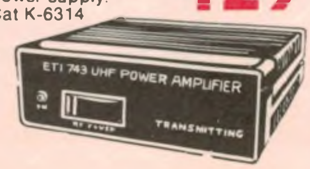
UHF Power Amp

Now a power amplifier to UHF AMATEUR AND CB radio. A very healthy 25 watts output from virtually any UHF input (from around 300mW or so.) And that could make the difference between being heard or not. The amplifier kit is complete to the last nut and bolt - including the same deluxe case used in our UHF amateur transceiver, and its matching power supply.
Cat K-6314

$129



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A must for parties, dances, discos, etc. One of the most popular kits we have ever stocked. Includes a specially designed printed circuit board for all the components, PLUS provision for adding an extra tube to double the light output — easily and economically.
Cat K-3152

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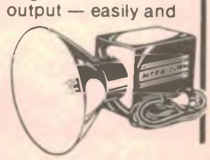

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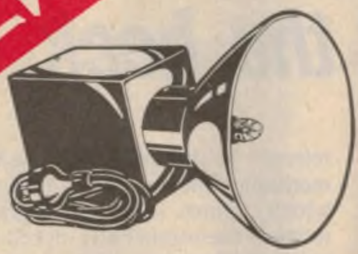

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Cat K-3153

Your choice of conventional auto flashing or flashing in time with the music! A great new design, as described in the July issue of Australian Electronics Monthly. Complete kit, including the deluxe case as used in the AEM prototype. Don't settle for inferior copies: get the best!

NOW! Infra-Red Remote Control for your Teletext Decoder

Yes, you can now have the latest - full infra red control for your Teletext decoder (see opposite page). Pro quality pushbutton handpiece duplicates all functions of wired unit: think of the convenience.

If you've built the Teletext decoder you'll find the i/r decoder child's play! Complete kit, including full construction details and how to fit it to your decoder - only available from DSE.

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Cat K-3425

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Quite often, the products we advertise are so popular they run out within a few days, or unforeseen circumstances might hold up shipments so that advertised lines are not in the stores by the time the advert appears. And very occasionaly, an error might slip through our checks and appear in the advert (after all we're human too!) Please don't blame the store manager or staff: they cannot solve a dock strick on the other side of the world, nor fix an error that's appeared in print. If you're about to drive across town to pick up an advertised line, why not play it safe and give them a call first....just in case! Thanks. Dick Smith Electronics

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The Serviceman

A friend in need, but what the heck

Your Serviceman is nothing if not versatile. If that sounds like an unnecessarily boastful statement, let me hasten to qualify it. Some people are born versatile; some have versatility thrust upon them. Yours truly is in the latter catagory.

Experienced readers will probably sense the kind of story I am about to relate. Usually, it concerns a close friend or relative with a piece of unfamiliar equipment on the blink and who blissfully imagines that, as a TV serviceman, one automatically knows all about every electronic device ever conceived.

In this case it was a distant relative, and a good friend, who was in trouble with an 8mm sound movie camera. And since it was a sound problem, he automatically assumed that I should be able to provide the answer. Such confidence may be flattering but it can also lead one into deep technical waters.

To start at the beginning, the camera was a Sankyo XL-300S; by all accounts a very well thought of unit. My friend had bought it second hand from a reputable photographic store with the assurance that it had been thoroughly overhauled and carried a six month guarantee.

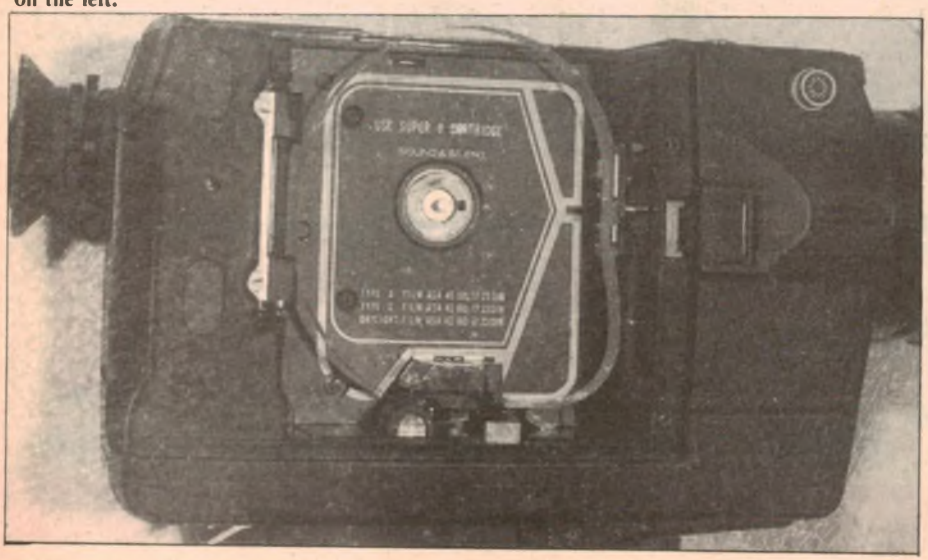
For those unfamiliar with such equipment — as I was — modern 8mm sound systems use a magnetic stripe on the edge of the film and what is virtually a tape recorder amplifier and bias oscillator built into the camera. There is a capstan, pinch wheel, and recording head located down stream from the optical gate and claw-type intermittent action.

The separation between these two recording points is 18 frames and this allows an isolating loop to be formed between the two so that the intermittent action can be smoothed out by the time it reaches the capstan and recording head. The film is packaged in a cartridge containing a single 15m (50ft) run. It is simply slipped into the camera and its presence operates various sensors, one of which zeros the film counter while another instructs the automatic exposure system as to the film speed of that particular cartridge.

The whole thing is powered from a 9V battery pack consisting of six "AA" alkaline cells accommodated in the pistol grip handle. There is also an external power supply socket, a feature which proved very useful during subsequent tests.

There are a host of other features, not relevant to this story, but one does bear mention. This is an earphone socket which allows the photographer to monitor the sound beng picked up by the microphone, even without the camera running, in order that he can be satisfied as to microphone placement, freedom from unwanted background noises etc. This is important to the story.

Below: the test film loop is in position. The hole drilled to provide access to the capstan trimpot is on the left.



All went well for the first three or four reels through the camera and, in fact, up until the end of the guarantee period. Then, suddenly, a reel came back from the processors which, while optically quite satisfactory, carried a hopelessly distorted sound track.

My friend was naturally upset. He had monitored the sound while it was being recorded and it was, according to him, "perfect". So, not only had a valuable film been lost, but there was clearly something wrong with the camera which the monitoring system did not reveal.

This was when he sought my help, feeling that, since the sound system was basically just a tape recorder, I should be able to throw some light on the problem. And, appreciating that I had little experience with 8mm cameras, he filled me in more or less up to the point that I have described the equipment so far.

My first reaction was to warn him that I was not very confident about tackling a specialised problem of this kind and that it would be economically impractical to undertake any prolonged work on such a device. Just finding one's way around such a device could take several days.

What about the agent?

I suggested that it might be far better to take the camera back to the firm from whom he bought it, or the local agents for the make if he could identify them, and let them sought it out. It would cost money, of course, but might well be the cheapest approach in the long run. But he was hesitant to do this. Previous experiences with camera mechanics, by both himself and his photographic friends, had not been the happiest. And, in addition, he was anxious to know exactly what had gone wrong in the hope that he could guard against it in the future.

So, while accepting my reluctance to

become too deeply involved, he asked that I at least listen to the recording in the hope that I might recognise the type of distortion and perhaps provide a clue. This seemed reasonable enough and so, at a mutually agreed time, he turned up at the shop with his sound projector, the camera, and the offending roll of film.

On hearing the sound I had to admit I had not heard anything like it before, and it is almost impossible to describe. Speech was virtually undecipherable, being hopelessly garbled and, seemingly, lacking in high frequency response. We played it several times, but made little progress.

The best I could do was make two observations. First, the possibility that the bias oscillator had failed. This would certainly cause severe distortion, without this being obvious in the monitored sound. On the other hand, I had to admit that it didn't sound like that type of distortion. But, of course, I could be wrong.

The other thought concerned the exact point in the amplifier chain at which the signal was monitored. If it was taken off before the final stage, driving the recording head, then it was conceivable that this stage was faulty. Again, it didn't sound like a simple amplifier fault but, in any case, I suspected that the sound was taken from the final stage, if only because the earphone supplied was a popular 8Ω unit.

Having made these points my friend's obvious reaction was to ask how practical it was to check them out. Could I measure the bias and check the amplifier for distortion? I replied that I could — assuming that I could get at and identify the appropriate components. And "get at" was the operative phrase.

Whereupon my friend made another suggestion. If he was prepared to pull the camera apart, would I be prepared to make those tests? After some thought I agreed, but added that, as far as the mechanical side was concerned, he was strictly on his own. My impression of camera manufacturers is that they all attended the same school as car manufacturers; a school which teaches that no screw, nut, or other fastening which is vital to the dissembly of an item must ever be left visible. And the more inaccessible it can be made, the higher the marks.

Anyway, this was the agreement we reached. My friend's idea was that he would pull things apart at home then bring the vital section in to me for testing. This sounded a bit risky to me, with parts getting a spread on between the two places. Instead I offered him the use of some bench space where he could work at his leisure whenever the shop was open. He accepted the offer gladly.

So it was that he turned up a couple of days later with the camera, a set of jeweller's screwdrivers, fine pliers, tweezers, and sundry other tools, plus a large photographic dish. In answer to my raised eyebrows he explained that he proposed to work on the camera in the dish. That way any dropped screws or other vital bits would be restrained. I complimented him on his good thinking.

In fact, the precaution turned out to be more important than either of us imagined. Many of the screws turned out to be watch size, and almost all of them were specials; long bolts, stepped bolts, threaded pillars — you name it. And, of course, they were all Japanese threads and extremely difficult, if not impossible, to replace. Drop one and lose it and the camera would become so much scrap. Fortunately, during this and subsequent exercises, not one piece was lost.

Quite apart from this worry, getting the camera apart turned out to be quite a traumatic experience, even though I experienced it only at a distance. Every part that needed to be removed seemed to require another part to be removed, with this in turn being baulked by something else. My friend took it in easy stages, a few hours a day over several days, removing each piece carefully for fear that some hidden spring would be released and send bits flying everywhere.

Bias checks

In fact nothing like this happened and he eventually had it stripped down to the point where we had access to the recording head terminals. Now it was my turn. I stoked up the CRO and juggled a couple of thin prods into the confined space around the terminals. And there it was — a bias signal. My friend held the prods while I juggled the CRO knobs and established that it was about 40kHz. It wasn't a very strong signal but, from experience, I felt it was probably about right.

Next I fed an audio signal into the mic socket and monitored that on the CRO. Result; a perfect sine wave and what appeared to be a perfectly adequate frequency response. So that was that; we were not one bit better off than when we started. Well, perhaps we were. As Edison would have said, we now knew two things that weren't wrong. But that was cold comfort when we couldn't think of anything else that might be wrong.

So where did we go from here? In the circumstances there seemed little more that could be done, except to put the whole thing back together again and more or less write off the sound system, at least until somebody or something provided the vital clue. My friend was naturally very disappointed, and so was I. I was particularly disturbed that I had

The Serviceman

encountered a form of distortion that I couldn't identify, the more so since there appeared to be no apparent reasons for the problem.

So, without much enthusiasm, my friend set about putting the camera back together. It was nearly as traumatic a job as taking it apart, what with the need to remember where each special screw was used, and the order in which parts had to be replaced in order not to block off the next operation. But it was eventually completed and, superficially at least, the camera appeared to be working as before.

Test problems

At this stage, had it been an ordinary tape recorder, I would have run a tape through it to see what happened. But how could we conduct such a test on the camera. In theory it appeared that the only way would be to put a film through the camera, send it off to be processed, then check the finished product; hardly a proposition. Other suggestions were made, such as sacrificing a cartridge in an effort to make a test version which could be emptied and re-loaded as necessary.

Out of all this discussion came the thought — and I'm not sure whose idea it was — that it might be possible to simply feed a short length of used film through the capstan/head assembly and make a test that way. The risk was that, without the cartridge, the film would not track properly, since there seemed to be little to restrict lateral movement.

On the other hand what did we have to lose? So, the next day, my friend turned up bright and early with his projector and about two metres of film, spliced together from scraps and finally spliced into a loop. We tried feeding this through the head and, to our surprise, it worked. The film ran perfectly smoothly with no hint of sideways drift. (Closer examination later revealed that there were, in fact, some guides, including barely perceptible steps in the capstan).

So we were all set for a test. Without worrying about a formal generator signal my friend simply plugged in the microphone and spoke a typical test sequence into it. Then he transferred it to the projector and we listened anxiously. It was a complete failure. Granted, his voice was audible, but it was also almost completely buried in the previous recording on the film.

Nor did it take a genius to figure out why. The camera was designed to simply record on a virgin track; it had recording bias, but no erase facilities. So, at my suggestion, the film was run through the projector again, this time with the projector in its recording mode, but with no audio input, thus effectively wiping the previous recordings. A run through in the playback mode confirmed this.

At this stage I had to go out on a call, having already spent more time on the problem than I should have. (Privately, I have to admit that I was hooked.) So I left my friend to it to see what results he could get.

When I returned some time later and enquired as to his progress he replied that he wasn't sure. Results were certainly a lot better, but he felt they were still not right. "Here," he said, "you can judge my voice better than I can. See what you think." So he ran the film again and I listened carefully. I was surprised to realise that the speech was quite legible and, while there was a little wow in it in places (which I put down to rather crude film feed arrangement), it was nothing like the garbled mess on the faulty film.

But there was something strange about it which I couldn't place. "Run it again", I suggested and when my friend did I suddenly realised what was wrong; the speech was decidedly low pitched.

"It sounds as though the projector is running slow".

"Can't be", said my friend, "the motor's locked to the mains."

And then the penny dropped, though it made a thump more like a 50c piece. If the projector wasn't running slow than the camera capstan must be running fast. And if the capstan was running fast a whole host of symptoms would be explained.

Film transport

In order to follow what was happening it will be necessary to fill the reader in on the finer points of the film transport system. My friend knew virtually nothing about this when we started the exercise, and I knew even less. But, by questioning various photographic associates, and by reference to an article in this magazine way back in April 1974 we had slowly pieced together a fairly complete picture of how these systems work.

There was a time when I earned my bread and dripping between a couple of theatre projectors in a country Mechanics' Institute and, as such, I was familiar with their general mechanical arrangement. The drive motor drove the main flywheel via a belt and the flywheel shaft carried the constant speed sound sprocket. From this shaft gear trains coupled the drive to all the other sprockets; upper feed sprocket, intermittent sprocket, lower feed sprocket — feeding the sound head — and finally the last sprocket between the constant speed sprocket and the take-up reel. So all sprockets ran at the same speed quite automatically.

I had assumed that, on a smaller scale, the camera would have worked the same way. But no; these cameras employ two separate motors, one driving the claw mechanism and one driving the capstan. And the trick is to ensure that they both run at the same average speed. This is done by fitting a loop sensing lever between the claw and the capstan, which varies the speed of the claw motor.

In this camera the lever senses the outside of the loop, and has a very delicate movement. As the loop grows, indicating that the claw is running faster than the capstan, the lever switches the claw motor to the lower of two speeds, which is slower than the capstan speed. Then, as the loop shrinks, the reverse happens and the claw motor is switched to its higher speed. Thus, in practice, the claw is made to run at the same average speed as the capstan, which controls the whole system.

Against this background it is easy to visualise what would happen if the capstan motor ran faster than the fast speed of the claw motor; the loop between the two would rapidly vanish and the intermittent action at the optical gate would also appear at the sound head. Little wonder the sound was distorted with the film moving past the recording head in short jerks, 18 times a second.

But it was a frustrating discovery. While it was gratifying to know what was wrong, it didn't put us much further ahead. Why was the motor running fast? What kind of speed control mechanism did it employ? Could the speed be readily adjusted and, if so, how?

We had no answer to these questions. The closest we came to it was to recall that there were five miniature trimpots along the edge of one board, visible when the camera was stripped down, and it was possible that one of these was a speed control. But which one? With several other functions likely to be involved, such as automatic sound level control, automatic exposure, plus the claw motor, neither of us felt like fiddling. In any case, it would mean pulling the camera down again.

Where to now?

So where did we go from here? Nowhere, it seemed, at least until we had more data to work on. My friend's idea was that he would continue to probe among his photographic colleagues, even though he wasn't very hopeful. My suggestion was that he write to the manufacturers in Japan, since we had their address in the instruction manual.

Once again, he wasn't very enthusiastic. Friends who had tried a similar approach in the past had met with little success. In the meantime he shrugged his shoulders philosophically and added, "Looks like I'm down to a silent camera."

And that's how we left it. Several months went by without the subject being mentioned. When he did eventually raise it, it was to relate that he had put two more rolls of film through the camera, without any attempt at sound recording. The first roll had been quite satisfactory, but the second roll was virtually a write off. Almost the whole roll was out of focus and in several places there were double images on individual frames; clear evidence that the film had moved while the shutter was open.

The explanation seemed to be that the capstan was now exerting so much tension on the film that it was pulling it back from the optical plane, against the cartridge pressure plate, and occasionally jerking it down at the wrong time. Anyway, that was enough to spur my friend into action and he announced his intention to write to Japan. Whereupon I suggested that if he was prepared to compose and type the letter, he could do it on my letterhead over my signature. That should improve the chances of a favourable reply.

And so he set out the whole story as concisely as possible and enquired whether a service manual or other data could be supplied, and what it would cost. At my suggestion he enclosed two international reply coupons to cover initial costs. Then he despatched it by airmail.

Some four weeks went by with no result and I had almost lost hope. Then one morning there was a moderately large envelope in the mail carrying Japanese stamps. And I must say the company had really tried to help. It contained a very courteous — if quaintly worded — letter apologising for the delay in replying and expressing the hope that the enclosed photocopies would prove satisfactory. It was over the signature of the chief of the service section.

There were two photocopies from the service manual. One was a complete circuit of the camera electronics, including the amplifier, capstan motor, and claw motor systems. The two latter sections had been outlined in red and some additional data pencilled in. The other copy showed the physical layout of the five trimpots with their identification. There was also data on the capstan speed and claw speeds, once again outlined in red.

Of the five pots, two involved exposure control, two set the high and low speeds of the claw motor (20 frames and 16 frames) and one set the capstan speed (18 frames, 1080rpm). This latter pot was the centre one of the five. The only thing missing, and something I had hoped for, was any comment as to the likely reason for the capstan motor changing its speed. Still, we had done pretty well.

It was now obvious that the camera would have to be pulled down again, at least to the point where the pots were accessible: almost as far as before. So my friend set to work again, with his jewellers' screwdrivers and photographic tray, but with a little more confidence this time.

At the same time, in an effort to pinpoint the likely cause, I tried to analyse the speed control circuits but, with only the circuit to work with, this wasn't easy. Both motors used the same arrangement; a small alternator coupled to the shaft and which, checked on the CRO, generated several volts at about 400Hz. This was fed into a control circuit involving differential amplifiers and power transistors which ultimately controlled the current to the motor.

At first I thought the system was sensing the frequency of the alternator but, since there was obviously no frequency reference anywhere, I concluded that it was a voltage sensitive system and, in fact, the voltage from the alternator did vary significantly with speed. Having established that much I went over the circuit looking for obvious faults, such as out of tolerance resistors or faulty capacitors, but found nothing.

TETIA Fault of the Month

AWA 'K' Chassis

Symptoms: 110V rail high. Picture hiccups when brightness advanced. Can't get good colour balance. EHT high and sometimes arcs over.

Cure: D907 (RD11E) zener in power supply goes high. Correct value is 11V, but at least one set was found with 13V zener in this position and this was zenering at 15.5 volts.

This information is supplied by courtesy of the Tasmanian branch of The Electronic Technician's Institute of Australia. Contributions should be sent to J. Lawler, 16 Adina St, Geilston Bay, 7015.

Which left us no wiser as to the nature of the fault and with little hope of finding it. All that was left was to try adjusting the capstan pot and see what happened. On trying it the response was immediate; a quite obvious change of pitch in the motor speed. What was more, the control was perfectly smooth and predictable.

This much established, the next question was how to set it to the correct speed. On the basis that the claw speeds were probably correct I decided to try something. We loaded the film loop into the capstan, set the camera running, and then, using my finger as a pressure pad, I pushed the film against the claw mechanism.

The idea worked like a charm. A loop formed immediately but continued to grow, suggesting the capstan was now running slow relative to the claw. But, by adjusting the pot, I could control the size of the loop quite easily and set it to the point where it was fairly full but quite stable.

We were both feeling quite jubilant by now, even though there were still some questions to be answered. One was whether we really had the system running at the right speed. I had assumed, for testing purposes, that the claw motor speed was correct. But was it, or could there be a fault here too?

The capstan flywheel had a single radial line painted on it, obviously provided for a strobe check. The Japanese data indicated that it should run at 18rps (1080rpm) but that didn't help much since we didn't have any such strobe. Or did we? The projector, which used a three bladed shutter, would give three times this number of pulses and should produce three stationary lines.

Brilliant though the idea sounded, it didn't work, the image being far too faint to be useful. With a little thought the reason was obvious; strobes are designed to have the shortest possible "on" time to give the sharpest possible image. The projector is designed to have the longest possible "on" time and so gave a very blurred image.

Undaunted, I tried again. Suppose we fed a film through the camera, from a reel rather than the loop, then fed it into the projector with a substantial loop in between. Then, by running both units and observing the loop, the camera speed could be compared with the projector speed. This time it worked and, what's more, confirmed that the camera speed was almost spot on. A further advantage was that it was a test which could be made without the need to dismantle the camera.

Simple insurance

That left only one problem. How could my friend be certain that, at some time in the future, the capstan speed wouldn't go haywire again, ruining another reel. Between us we evolved the following arrangement. My friend made up a loop of film, about 90mm diameter, to be carried in a small container in the camera case. Threaded into the capstan system, and pressed against the claw, it provided an instant check on loop size.

It was simple enough to be done before each film was loaded.

And if it was wrong? In theory this meant pulling the camera to pieces to reach the capstan pot; hardly a practical proposition. Ironically, the other four pots had small removable covers above them providing simple access but, for some reason, the makers had neglected this one.

The solution, though seemingly drastic, was simple; drill a small hole in the cover to provide the necessary access. This did not involve any light leakage problems, since it was an inner cover and, initially at least, a small patch of insulation tape would exclude any dust.

The final test was to make another recording in the camera, similar to the first one. The first attempt was promising but still contained some wow. At the second attempt I engaged the film with the claw, using my finger, and the result was a perfect recording. It appeared that the capstan was very sensitive to any loading on the film, and needed the claw-generated loop for proper performance.

And that is really the end of the story. The solution may perhaps be described as more practical than elegant — I would still like to know why the fault occurred — but at least my friend knows what to look for and how to cope with it; knowledge he probably would not have had if he had sent the camera to a professional repair department.

Financially, of course, the whole exercise was a dead loss; I could hardly consider making any charge in the circumstances. But then, I didn't really spend much time on the operation; my friend did all the hard yakka. On the other hand, I did learn something even if its commercial value may be limited.

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.

Adjustable supply to ±100V at 0.25A

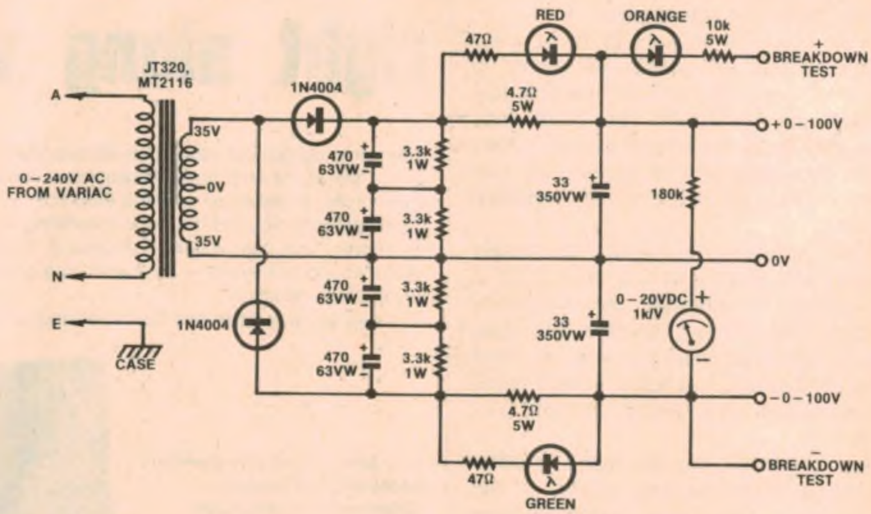
Designed to be used in conjunction with a "Variac", this power supply is useful for testing and repair work on high power amplifiers. It has current and voltage monitoring facilities and, as a bonus, a breakdown test facility for semiconductors at up to 200V.

Full power tests must be done on a larger normal supply.

The mains transformer delivers up to 70VAC which feeds a voltage doubler rectifier to give 200VDC centre tapped. The 470μF capacitors are connected in series so that only half the maximum of 100V is impressed across each. This allows 63VW capacitors to be used rather than high voltage types. The 3.3kΩ resistors across each capacitor form a voltage divider and discharge the capacitors quickly when the supply is switched off.

Current monitoring is by way of indicating LEDs. When the current across the 4.7Ω resistors reaches 0.25A, the voltage is just sufficient to switch on the green and red LEDs. The operator then can decide whether to switch off or turn down the supply.

Breakdown tests utilise the orange LED. Connect the device to be tested to the terminals, with due attention to polarity, and increase the supply from zero until the orange LED lights. Back off until it just extinguishes and read the voltage.



The circuit is designed to be used in conjunction with a Variac and can deliver up to +100V. It also provides a breakdown test facility for semiconductors.

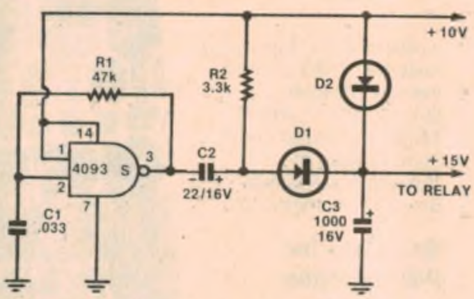
P. Allison,
Summer Hill, NSW. **$25**

Operating relays from a low voltage supply

This circuit was developed so that a 12V relay could be driven when only a 10V supply was available for a QRP transceiver on the 3.5MHz band.

Basically, the circuit comprises a Schmitt trigger oscillator and charge pump. The higher derived voltage is capable of driving the relay via a transistor switch.

An oscillator is formed with a 4093 CMOS NAND Schmitt gate. One input is permanently tied high (+10V) while the second input is connected to the output via a 47kΩ resistor and to ground via a .033μF capacitor. The NAND gate acts as an inverter such that initially its output is high and the capacitor discharged. The capacitor now begins to charge via the 47kΩ resistor until the voltage reaches the positive going threshold of the NAND gate Schmitt input. The output now goes low and the capacitor discharges until the voltage reaches the negative going threshold when the output again goes high.



The 1kHz square wave output from the NAND gate is coupled into the charge pump circuit. Initially C3 is charged to about 10V via diode D2. When the output of the Schmitt is low, C2 charges via R2. When the output of the oscillator goes high, it then "jacks up" the negative side of C2 by 10V so that, in theory, 20V is applied to C3 via D1. In practice, C3 is charged to a somewhat lower value, because of losses in the oscillator output stage and the diodes. Typically, C3 charges to 15V after several seconds.

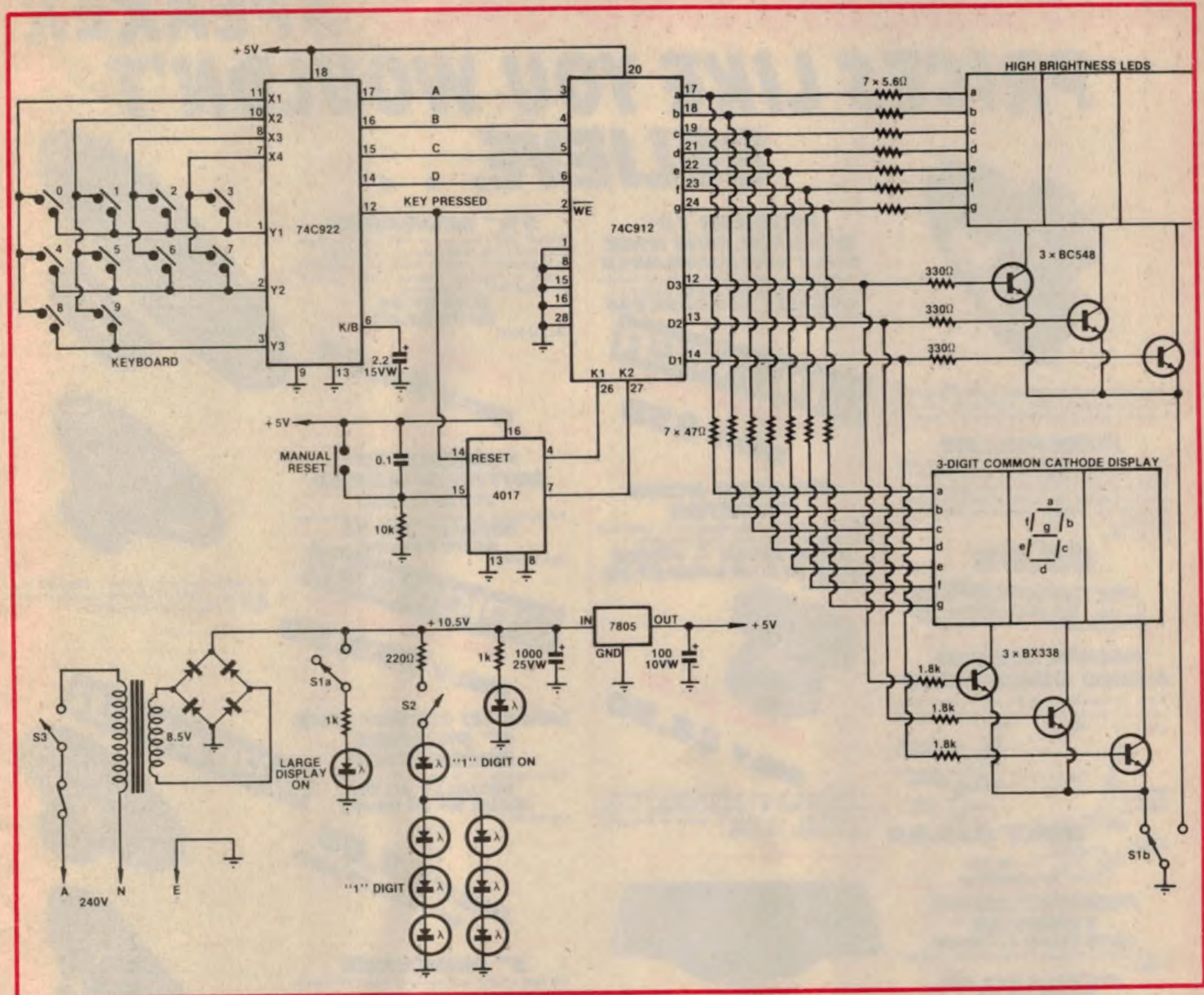
The energy stored in C3 is sufficient to close the relay which is then maintained in this state by D2.

One limitation of the circuit is that the relay cannot be operated at a faster rate than once every three seconds. This is because capacitor C3 needs time to recharge.

C. C. Wright,
Auckland, NZ. **$15**

Money for old rope

WANTED: Your circuit and design ideas. We pay between $5 and $40 per item published, depending on the merit and how much work we have to do to publish it. The payment for each of the items on these two pages is given as a guide. If you have an original idea, why not send it in to us? Every item received will be acknowledged by mail.



3½-digit display controller

Originally designed to display hymn numbers in church, this controller displays numbers up to 1999 with large seven segment digits. The number is entered using a keypad.

Two displays are incorporated. A small standard display can be mounted in a case with the keypad and the larger display mounted remotely. The large display is made up of discrete 5mm diameter high brightness LEDs arranged in a seven segment pattern. Three LEDs wired in parallel are used for each segment to provide the necessary dimensions of the display.

The 74C922 scans the keyboard and when a key is pressed, a binary code appears on the ABCD outputs. After a debounce period for the keys, the keypressed signal goes high. This signal is connected to the Write Enable bar input of the 74C912.

The display controller can multiplex 6-digits, however, only three are driven in this circuit. The memory for each digit is separately addressable and is loaded into memory as a binary code from the keypad and latched when the WE bar goes low. The controller automatically drives each display in seven segment code and lights each display one at a time. The rate that each display is lit is so fast that the eye perceives all the displays to be lit at the same time.

The 4017 is a decade counter with 10 separate outputs. It is used to count the number of times a key on the keypad has been pressed. It presents a code from the "2" and "3" count outputs to the K1 and K2 inputs of the 74C912. Initially, K1 and K2 are both low, and the least significant digit is loaded. On the next key pressing, the K1 input goes high and the second digit is loaded. On the third key pressing, the K2 input goes high (the K1 goes low) and this loads the third digit into memory.

Hard wiring is used for the most significant digit. When switch S2 is closed, a single one digit is lit.

Two-pole switch S1 selects either the small common cathode display or the large display made up of high brightness LEDs.

The 4017 is reset via the Manual Reset switch. When reset, subsequent, entries on the keyboard will begin on the least significant digit.

Power is derived via the mains and is transformed down to 8.5VAC. This is rectified with a 1A bridge rectifier and filtered with a 1000μF capacitor to provide 10.5V DC. A 5V regulator provides about 5.6V at its output due to the forward biased diode at the GND terminal increasing the 5V output by 0.6V.

K. Hamilton,
Bundoora, Vic.

$20

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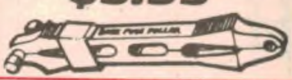

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The KSN-1071 normally sells for a very reasonable **$24.00** each (pre devaluation). While stocks last, this unit is available from Jaycar for the ridiculously low price of **$12.95 each!** That's right! A high quality, high power HI FI tweeter for a pittance! HURRY!

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The rack mounting system basically consists of specially designed aluminium-extruded frames. Moulded plastic corner and feet pieces connect the extrusions together to form a rigid frame. No spanners, screwdrivers are needed but the use of a rubber or wooden mallet is advised to securely fit together the self-aligning pieces. When assembled the frame can be further strengthened with pop rivets. The system is supplied in knocked-down (kit) form to keep costs and freight down. Assembly takes around 20 minutes and instructions are supplied. In keeping with the low-cost philosophy, side and top panels are not included. Any reasonably competent reader should be able to fashion wooden or metal panels to suit. (Edge finish is not necessary as the panels recess into the frame). Jaycar will have special side panel sets available shortly however. Please watch our ads for further details.

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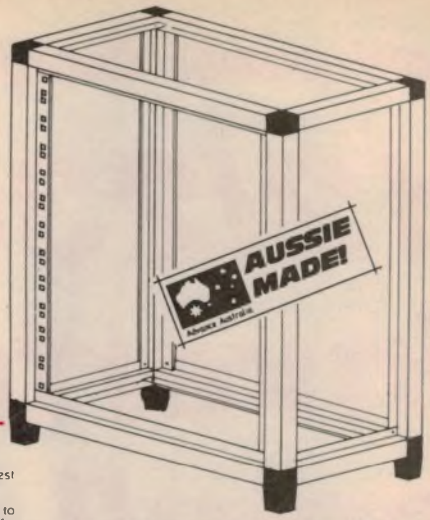

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Like us, you would be skeptical at first that this would work. Our first reaction was, "If they are so good why haven't we heard about them before?" or "Surely a product like this - if it was any good - would have been around years ago". There have been ultrasonic repellers around but none of them have the patented soundwave pattern of the Verminex. We have on our file, many letters of testimony to the fact that the Verminex is effective. The letters are from Australian Universities, Animal Husbandry research institutions, commercial Piggenes, restaurants etc. Many of them had several pest problems!

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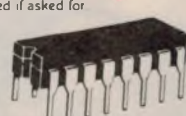

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Low power design also works as a battery charger

12/230V inverter for small appliances

Our latest low power inverter allows 240VAC appliances to be operated from a 12V battery. Most appliances which draw up to 40W may be powered at precisely 50Hz or, alternatively, driven by an adjustable frequency. When the inverter is not in use, it can be connected to the mains supply to recharge the battery.

by JOHN CLARKE

In May 1982 we published the plans for a 12/230V inverter for small appliances and capable of delivering 30VA. Although many of these were constructed, the design had a number of drawbacks. These included a fairly expensive transformer, drooping output voltage for loads above 30VA and the tendency for one power transistor to become much hotter than the other.

The first two drawbacks have been solved mainly by using a different power transformer rated at 60VA. It is considerably cheaper than the 40VA type specified in the 1982 version and allows the inverter to supply a genuine 40VA output at a nominal 230VAC.

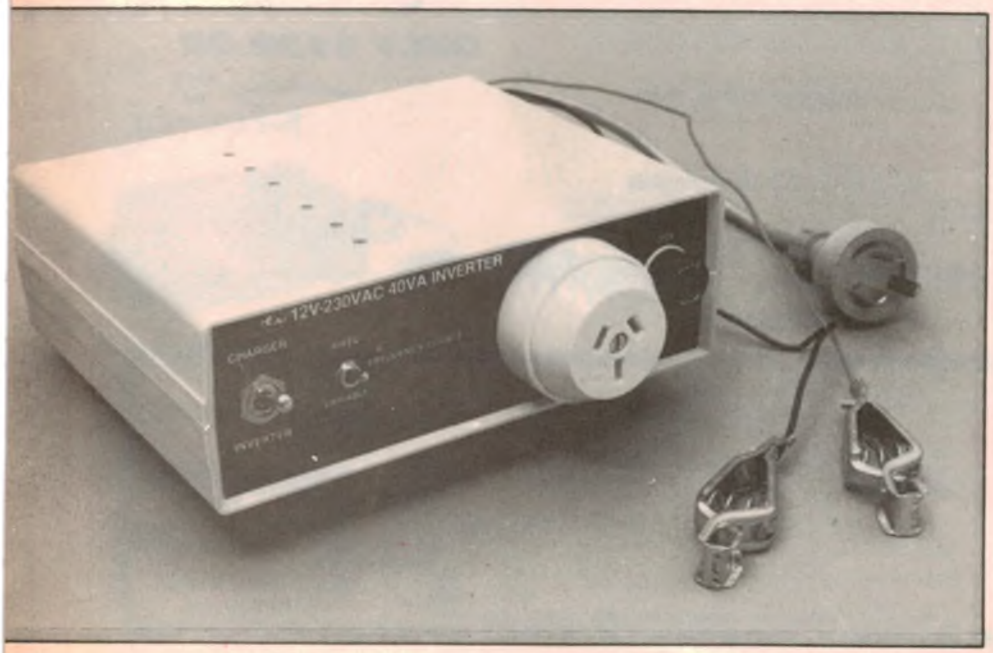
The new transformer is supplied by Altronics and is designated type M-2165. Other transformers of similar ratings may also be used provided they fit into the case, which was also supplied by Altronics.

The inverter is ideally suited to powering low wattage mains appliances from the car battery while camping. This considerably improves the comfort level of the civilised camper. Similarly, it has uses in boating. Typically, it can be used to power an electric shaver, electric blanket, electric can opener or a 40W light bulb.

Alternatively, back in the home (or still on the camp-site), frequency sensitive items such as belt or idler driven turntables can be powered at a very precise crystal controlled frequency for accurate sound reproduction. If speed variation over a small range is required, then a switch is provided to change from the crystal based 50Hz signal to a variable oscillator.

Note that the inverter will not power fluorescent tubes. The output of the inverter is insufficient to generate the requisite starting voltage of the tube.

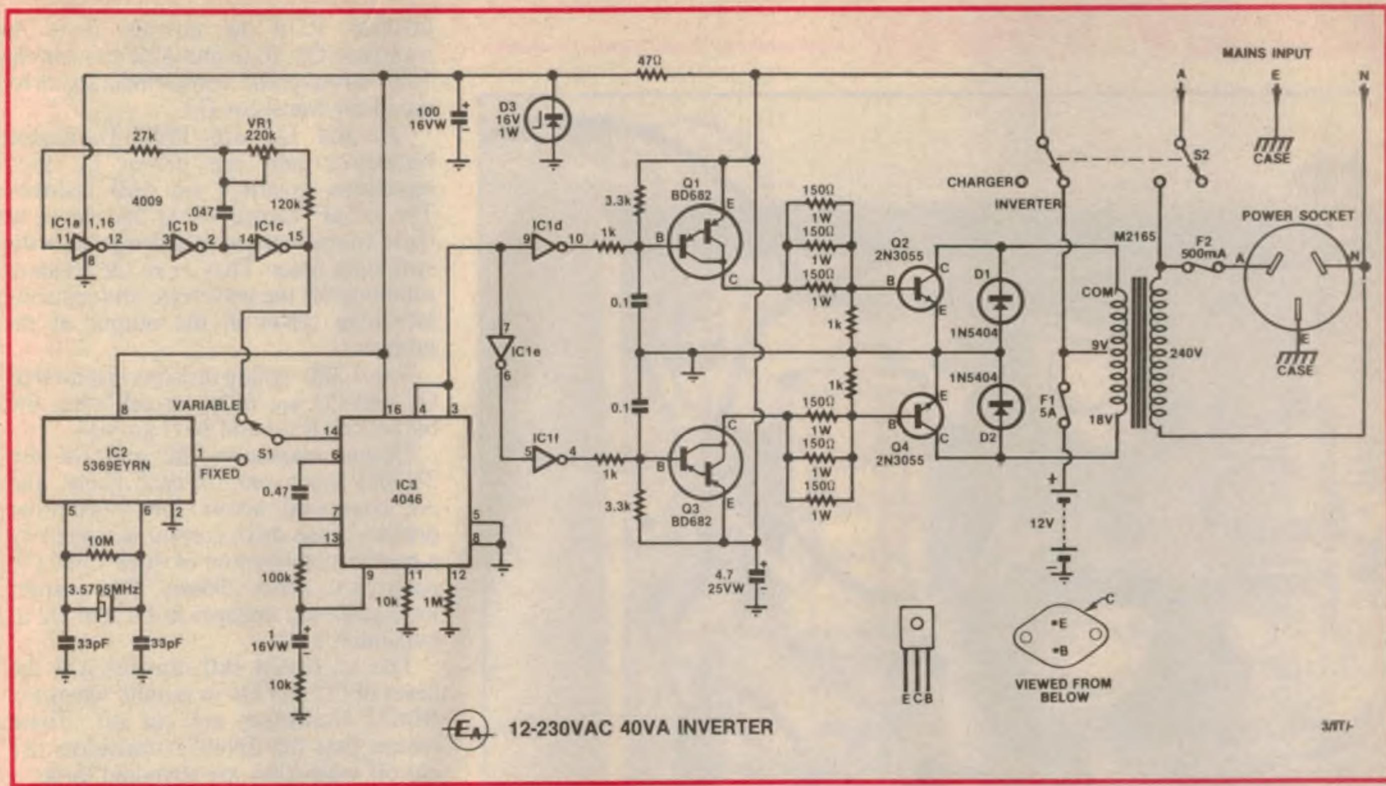
The prototype inverter is housed in an attractive plastic cabinet.



Presentation

Our inverter is a very compact unit housed in an attractive plastic case. A single mains general purpose outlet is provided for the 230V output while two switches control the inverter operation.

A Frequency/Source switch selects either the fixed 50Hz crystal timebase or the variable timebase. A Charger/Inverter switch selects either inverter mode or the battery charger mode.



The circuit has a 240VAC input to allow the unit to recharge the battery. This feature could be omitted but D1 and D2 must remain in circuit.

For the charger mode of operation, a mains cord and plug is provided. The mains voltage is stepped down by the transformer and, once rectified, is capable of recharging the battery.

Two fuses, one rated at 500mA for the mains side of the transformer and one rated at 5A for the 12V circuitry, are located in fuse holders on the front and rear panels respectively.

Circuitry

Basic operation of the inverter circuit is relatively straightforward. Two antiphase signals from either the fixed or variable frequency timebase are used to drive a transistor output stage. These transistors are in turn used to drive a transformer with a centre tapped winding which steps up the voltage to mains potential.

The variable oscillator is formed by inverters IC1a, IC1b and IC1c in a standard three gate oscillator circuit. IC1c is used to charge the .047μF capacitor via the 220kΩ trimpot, the 120kΩ resistor and the output of IC1b. IC1a senses the voltage on the capacitor and switches IC1c to charge the capacitor to the opposite polarity.

Assuming that the output of IC1c is high, then its input is low. Initially, with the capacitor discharged, the input of IC1a and output of IC1b are both low. The capacitor begins to charge, and eventually reaches the positive threshold voltage of inverter IC1a. IC1a now goes low and drives pin 2 of IC1b high.

Consequently, IC1c now has a low output and so the capacitor charges to the opposite polarity. When the negative threshold voltage of inverter IC1a is reached, all the inverters change state again and the capacitor charges to the original polarity.

The frequency is mainly dependent on the capacitor value and the resistance charging it. For this circuit, the frequency is adjustable from about 43Hz up to 100Hz.

The fixed oscillator uses an MM5369 chip (IC2) to divide down the 3.579545MHz crystal frequency to 50Hz. This CMOS divider provides a very economical means of obtaining a 50Hz output but has the disadvantage of an uneven (45%) duty cycle. This is unimportant in most applications but, in this case, would result in an uneven duty cycle for the output transistors (as in the previous design). This, in turn, leads to inefficiency and undue heating in one transistor.

To prevent this situation, a 4046 phase locked loop (IC3) has been used to give a 50% duty cycle waveform from both the variable and fixed oscillator signals. Switch S1 selects between the two oscillators.

Typically, the output from the 4046

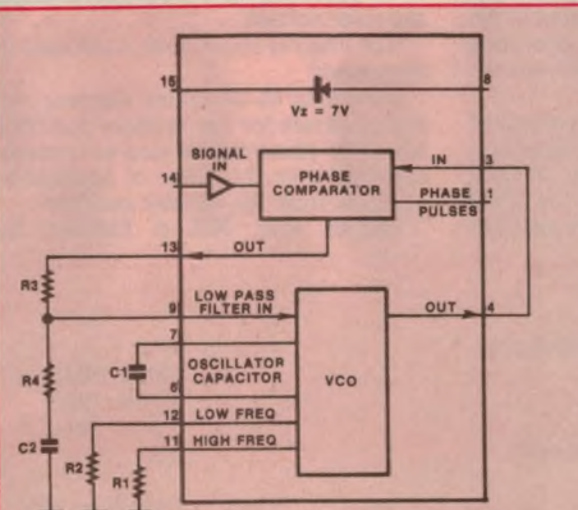
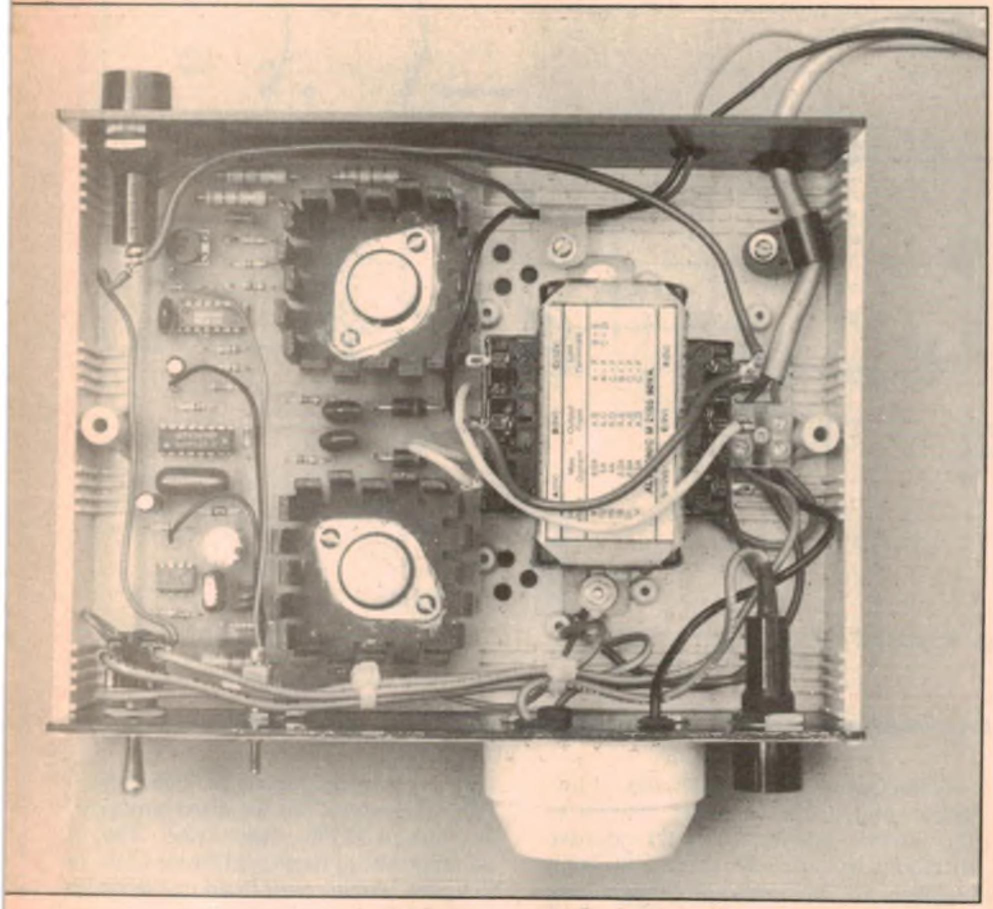


FIG. 1

Fig.1 at left is the block diagram of the phase lock loop which is used in the circuit to ensure a 50% duty cycle.

12/230V inverter



Above is the interior of the inverter, showing the transformer and printed wiring board.

PLL is a genuine square wave and, when it is in lock, the output frequency is equal to the input frequency of the selected oscillator. Fig. 1 shows how it functions.

Two basic function blocks are shown as the internal workings of the phase locked loop.

The voltage controlled oscillator (VCO) provides an output frequency dependent on C1, R1 and R2 and the voltage on the low pass filter input at pin 9. R1 sets the highest operating frequency of the VCO while R2 sets the minimum frequency.

The output of the VCO is connected to the input of the phase comparator. This block compares the phase of both the incoming frequency and the VCO frequency and provides an error signal at pin 13. This digital error voltage is filtered with R3, R4 and C2 to provide a smoothed DC voltage at the input to the VCO.

Equilibrium of the phase locked loop is reached when the VCO signal and the incoming signal are the same in terms of frequency and phase. The VCO will remain in this locked state until a change in the incoming signal frequency changes the error voltage.

The internal zener diode is not used in our circuit.

Returning to the circuit diagram, the values chosen for the oscillator and filter allow the phase locked loop to function correctly over the range of frequencies available from the variable oscillator.

Output from IC3 is buffered by inverter IC1d to provide drive to transistor Q1. IC1e and IC1f provide the 180° out-of-phase complementary drive signal for transistor Q3.

Q1 and Q3 are PNP Darlington transistors and are driven by their respective inverters via 1kΩ resistors. The 0.1μF capacitors at the bases of these transistors are designed to slow the switching times. They have the effect of rounding off the waveform and reducing switching spikes in the output of the inverter.

The 3.3kΩ pullup resistors ensure that Q1 and Q3 are fully cut off when the outputs of IC1d and IC1f go high.

Output transistors Q2 and Q4 are 2N3055 types, one for each phase, and are connected across the transformer primary. Base drive current is limited by a parallel combination of three 150Ω 1W resistors to about 200mA. This ensures low saturation voltages in Q2 and Q3 at maximum load.

The associated 1kΩ resistors pull the bases of Q2 and Q4 to ground when the BD682 transistors are cut off. These ensure that the 2N3055 transistors are cut off when they are supposed to be.

Operation of the transformer is more complex than might be expected. Consider Q2 when turned on. This pulls the collector of Q2 low and applies approximately 12V to half of the transformer primary. A further 12V is induced in the other half of the winding (by transformer action) so that the collector of Q4 has 24V applied to it. Similarly when Q4 turns on and Q2 is off, Q2 has 24V applied to its collector.

The resulting 50Hz square wave applied to the transformer induces a nominal 240V RMS at the transformer output after losses.

Diodes D1 and D2 protect the output transistors from back EMF in the transformer windings and provide protection against reverse battery connection. In the latter case, D1 and D2 will conduct and blow the 5A fuse.

A byproduct of D1 and D2 is that the circuit can be used as a battery charger. Switch S2 selects either the inverter or charger modes of operation and, in the latter case, connects the output transformer to the mains. Diodes D1 and D2 fullwave rectify the transformer output to provide a no load voltage of approximately 14V peak.

The charging current is approximately 150mA with a battery that has discharged to 12V (unloaded). This should be sufficient for trickle charging a flat battery when a mains supply is available.

Power for the inverter circuitry is derived directly from the 12V battery. The supply line for the CMOS ICs is decoupled with a 47Ω resistor and a 100μF capacitor while a 16V zener clips

Specifications

Inverter mode (at 13.8V DC input):

No load output	260V RMS
With 25W load	240V RMS
With 40W load	230V RMS
Current drain at 40W output	5A
Charger mode:	
Charging current	150mA at 12V

any high voltage spikes which may otherwise damage the ICs.

Construction

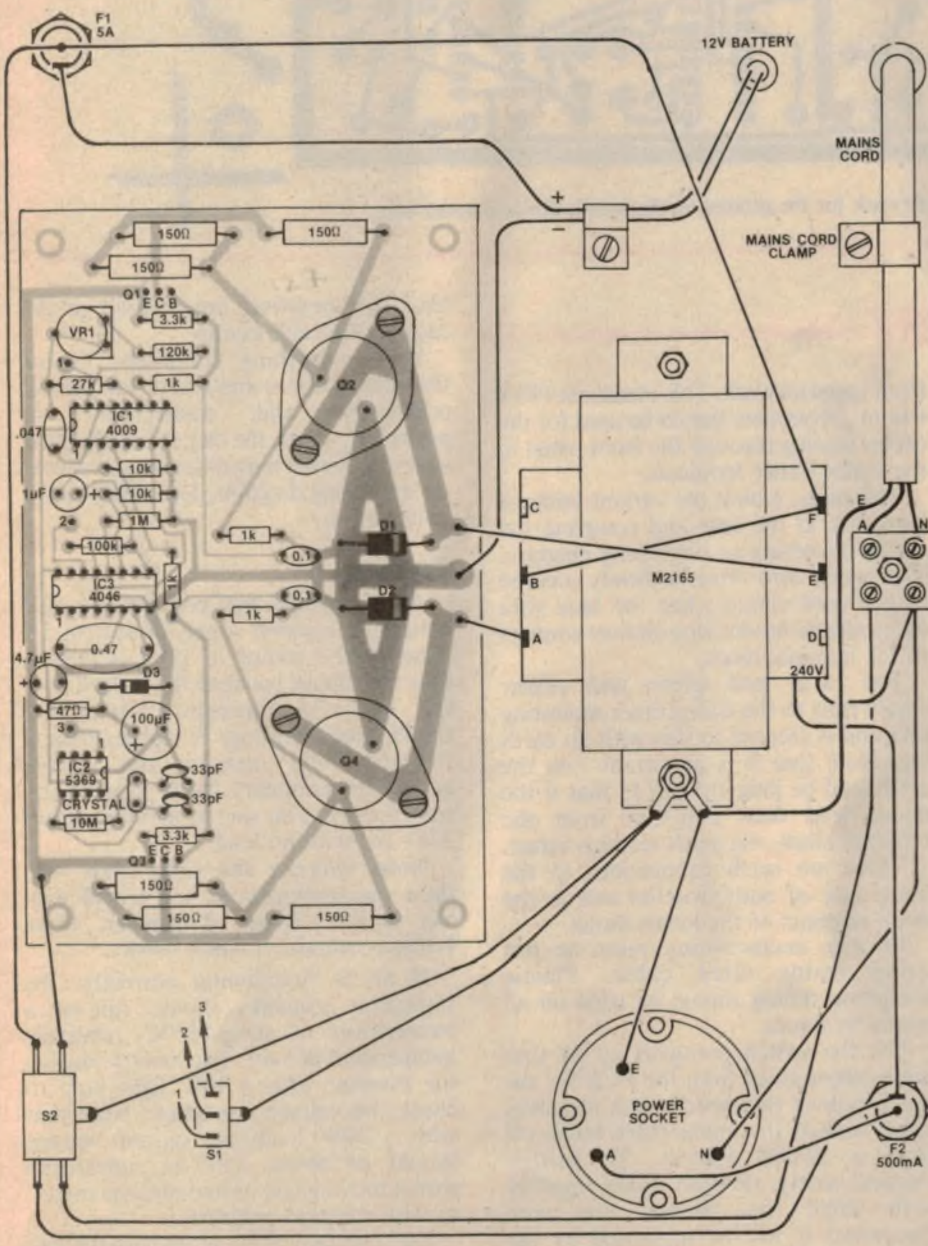
A single PCB coded 85iv9 and measuring 144 x 90mm accommodates most of the components. Follow the overlay diagram when inserting components on the PCB. Start with the low profile components such as the resistors, diodes and ICs and note that the ICs and diodes must be oriented correctly.

The capacitors, transistors and crystal can now be inserted. Note again that the electrolytic capacitors and transistors must be oriented correctly. The 2N3055 transistors are mounted on "minifin" heatsinks measuring 50mm square by 25mm high.

Use a smear of heatsink compound between the transistor body and heatsink for good thermal contact. The heatsinks are bolted, along with the transistors, to the PCB with screws and nuts.

Solder the transistor leads to the underside of the PCB. The nuts securing the transistors provide electrical connection for the collectors. Consequently, it is a good idea to solder the nuts to the PCB to ensure reliable long-term contact.

We used PC stakes for all external connections to the PCB. These facilitate wiring at a later stage.



This diagram shows the component overlay for the printed board and all the external wiring.

PARTS LIST

- 1 PCB, code 85iv9, 144 x 89mm
- 1 plastic instrument case, 200 x 160 x 70mm, Altronics Cat No. H 0480
- 1 Scotchcal label, 194 x 64mm
- 1 60VA transformer, Altronics M2165
- 1 3.5795MHz crystal
- 2 T0-3 heatsinks, 50 x 50 x 25mm
- 1 2-way insulated mains terminal block
- 4 6mm plastic PCB supports
- 1 mains cord and plug
- 2 car battery clips
- 4 6mm rubber grommets
- 1 12.7mm rubber grommet
- 4 rubber feet
- 1 mains cable clamp
- 1 small cable clamp
- 2 fuseholders, type 3AG, panel mount
- 1 5A fuse, 3AG
- 1 0.5A fuse, 3AG
- 1 surface mounting mains socket
- 1 SPDT switch
- 1 DPDT 5A, 240VAC switch
- 6 solder lugs
- 2 cable ties
- 1 10mm length of plastic tubing
- 1 metre black 240VAC rated hookup wire
- 1 metre red, 240VAC rated hookup wire
- 1 300mm length green, 240VAC hookup wire
- 1 130mm length of 3-way rainbow cable
- 7 self-tapping screws

Semiconductors

- 2 2N3055 NPN transistors
- 2 BD682 PNP Darlington transistors
- 2 1N5404 diodes
- 1 16V 1W zener diode
- 1 4046 phase locked loop
- 1 4009 hex inverter
- 1 MM5369EYRN oscillator divider (50Hz)

Capacitors

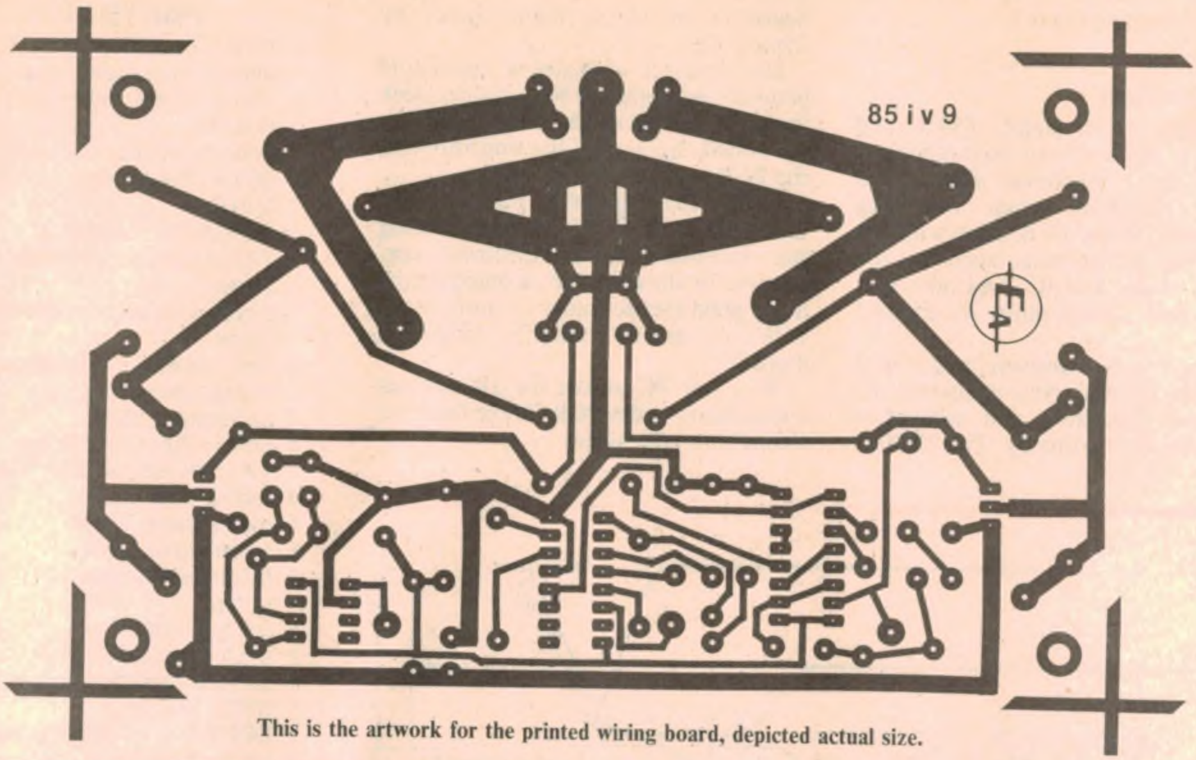
- 1 100μF 16VW electrolytic
- 1 4.7μF 16VW electrolytic
- 1 0.47μF metallised polyester
- 2 0.1μF metallised polyester
- 1 .047μF metallised polyester
- 2 33pF ceramic

Resistors (0.25W, 5% unless stated)

1 x 10MΩ 10%, 1 x 1MΩ, 1 x 120kΩ, 1 x 100kΩ, 1 x 27kΩ, 1 x 10kΩ, 2 x 3.3kΩ, 4 x 1kΩ, 6 x 150Ω 1W, 1 x 47Ω, 1 x 200kΩ miniature horizontal mounting trimpot.

Miscellaneous

Machine screws and nuts, washers, solder, etc.



This is the artwork for the printed wiring board, depicted actual size.

12/230V inverter

Once the PCB assembly has been completed, you can start fitting the hardware to the case. The plastic case used measures 200 x 160 x 70mm.

Temporarily position the PCB and transformer in the case, ready to mark out the mounting holes required. The transformer mounts conveniently on the base of the case with the mounting lugs wedged between the integral plastic standoffs. Unfortunately, there are no convenient mounting standoffs within the case to mount the PCB. Suitable holes will have to be drilled and the PCB mounted using plastic PCB supports or nylon screws, nuts and spacers.

Several ventilation holes are needed in both the base and lid of the case. We used 5mm holes located near the heatsinks on the base and a line of holes directly above the heatsinks for the lid.

Next, drill holes for four rubber feet in the base of the case so that they can be secured using self-tapping screws. For safety, it is best to drill from the inside of the base through the integral plastic standoffs at convenient locations in each corner.

On the rear panel, drill suitable mounting holes for the 5A fuseholder and for the mains and 12V cable entry grommets.

Front panel hole positions for the 500mA fuse holder, mains outlet and two switches are shown on the Scotchcal front panel artwork. This measures 194 x 64mm. Grommets should be used for the cables passing through the front panel to the mains outlet terminals.

This done, mount the various items of hardware in the case and complete the wiring according to the wiring diagram. The mains cord must be firmly secured with a cord clamp while the blue wire (neutral) and brown wire (active) connect to the terminal block.

The earth lead (green and yellow stripe) runs to the transformer mounting bolt and is secured to this with an earth lug. Note that it is important that the earth lead be long enough so that if the mains lead does pull out from the terminal block, the earth remains intact.

There are earth connections to the metal case of both switches and to the earth terminal of the mains outlet.

Further mains wiring must be run using mains rated cable. Plastic insulating tubing should be used on all mains terminals.

Use the switch terminals on S2 that are furthest away from the PCB for the mains pole of the switch. This improves safety should the mains cable break off from a switch contact. To further improve safety, tie both cables together with cable ties. Should one wire disconnect it will be supported by the remaining wire.

The battery leads, red for positive and black for negative, are secured to the case with a cable clamp.

With everything complete, recheck the wiring and components for correct orientation and connections. In particular, check the switch action of S2 since the wiring may differ to that shown on the wiring diagram, depending on the switch type.

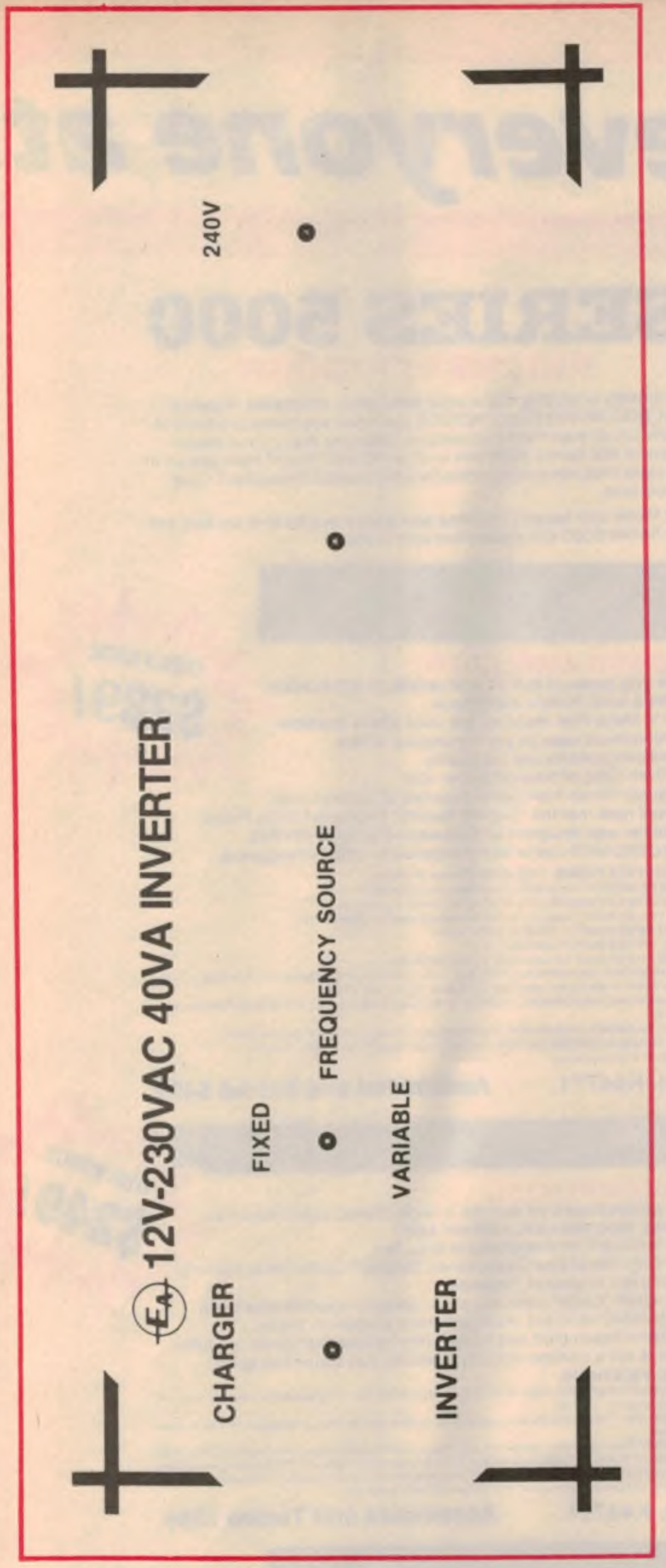
Testing

Assuming all is well, connect up a 12V battery (or a power supply of at least 5A capacity at a setting of 12V) and check that the voltage between the collectors of Q2 and Q4 (measure across the transformer winding) is approximately 24VAC. Next measure the voltage across the secondary (240V side) of the transformer. You should measure about 270VAC with no load.

Note: exercise the same care with these measurements as you would with any mains voltage. Remember, these voltages can give a nasty shock.

If all is functioning correctly, the transistor heatsinks should run at a temperature of about 65°C, relatively independent of load. You can try loading the inverter with a 40W light bulb to check the voltage regulation. Note that with a 40W load, the output voltage should be about 230VAC (measured with a moving coil or moving iron meter, or with a digital voltmeter).

Use a multimeter in series with the DC supply to the inverter to measure the current. If you want maximum



This is the actual size front panel artwork.

efficiency, adjust the variable oscillator for minimum current while the inverter is unloaded. The inverter is most efficient when operating at about 60Hz.

Note that some frequency sensitive appliances may not function correctly at 60Hz. In this case, use the fixed 50Hz oscillator. Alternatively, the variable oscillator can be used at close to 50Hz to vary the speed of turntables or film projectors.

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AM stereo is now broadcast in Australia on an experimental basis. This add-on decoder works with the Motorola C-QUAM system.
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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
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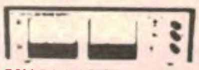
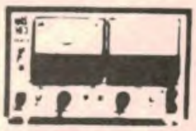
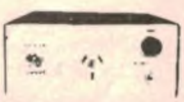
The last power supply we did was the phenomenally popular ETI-131. This low cost supply features full protection, output variation from 0V to 30V and selectable current limit. Both volatage and current metering is provided. (ETI Dec '83) ETI 162
Cat. K41620 **$52.50**



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**



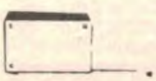
LAB SUPPLY
Fully variable 0-40V current limited 0-5A supply with both voltage and current metering (two ranges 0-0.5A/0-5A). This employs a conventional series-pass regulator not a switchmode type with its attendant problems, but dissipation is reduced by unique relay switching system switching between taps on the transformer secondary.
(ETI May '83) ETI 163
Cat. K41630 **$175.00**



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 **$54.50**

ELECTRIC DUMMY LOAD
With this unit you can test power supplies at currents up to 15 Amps and voltage up to 60 Volts. It can "sink" up to 200 Watts on a static test and you can modulate the load to perform dynamic tests.
(ETI Oct '80) ETI 147
Cat. K41470 **$109**

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 **$9.50**



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.
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Cat. **$79.50**
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EPROM PROGRAMMER EP1
No need for a Micro with EA's great Eprom Programmer suitable for 2716/2758 Eproms.
(EA Jan '82) 82EP1
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With Textool Socket **$59.95**

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 **$87.50**

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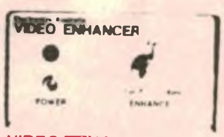
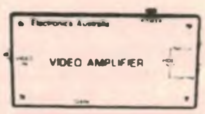
(EA Aug '81) 81MC8
Cat. K81080 **$89.00**



VIDEO ENHANCER
100's SOLD
Like tone controls in a hi-fi amplifier touch up the signal with this Video Enhancer. (EA Oct '83) 83VE10
Cat. K83100 **$35.00**



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) 83VA8
Cat. K83081 **$15.00**

SERIES 5000

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For those who haven't that time and want a quality hi-fi, we also sell the Series 5000 kits Assembled and Tested.

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POWER AMPLIFIER

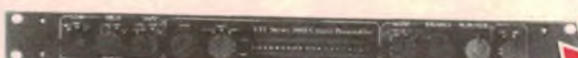
WHY YOU SHOULD BUY A "ROD IRVING ELECTRONICS" SERIES 5000 POWER AMPLIFIER.

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

Cat. K44771. **Assembled and Tested $499**



OUR PRICE $249!

PREAMPLIFIER

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

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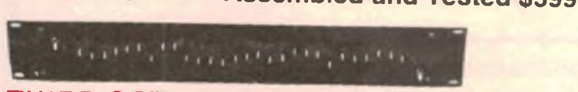
★ 14 Metres of Low Capacitance Shielded Cable are supplied (a bit extra in case of mistakes).
★ English "Lorlin" switches are supplied (no substitutes here).
★ Specially imported black anodised aluminium knobs.

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: 15 Hz-130 KHz, +0, -1 dB Low-Level input - conforms to RIAA equalisation ±0.2 dB
DISTORTION: 1 KHz <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 300 mV input signal at full output (1.2V) >92 dB flat >100 dB A-weighted MM input: master full, with respect to full output (1.2V) at 5 mV input 50 ohms source resistance connected >86 dB flat 92 dB A weighted MC input, master full, with respect to full output (1.2V) and 200 uV input signal: >71 dB flat >75 dB A weighted

Cat. K44791. **Assembled and Tested $599**



THIRD OCTAVE GRAPHIC EQUALIZER

SPECIFICATIONS:
BANDS: 28 Bands from 31.5 Hz to 16 KHz.
NOISE: <0.008 mV, sliders at 0, gain at 0 (-102 dB0).
20 KHz BANDWIDTH DISTORTION: 0.007% at 300 mV signal, sliders at 0, gain at 0; maximum 0.01%, sliders at minimum.
FREQUENCY RESPONSE: 12 Hz-105 KHz, +0, -1 dB, all controls flat.
BOOST AND CUT: 14 dB.
Cat. K44590

1 Unit... **$199**
2 Units... **$379**

POST & PACKING: $10 per SERIES 5000 KIT.

Rod Irving Electronics!

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SAVE! SAVE! SAVE!

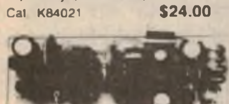
ELECTRONIC MOUSETRAP
This clever electronic mousetrap disposes of mice instantly and mercifully, without fail, and resets itself automatically. They'll never get away with the cheese again!
(ETI Aug. 84) ETI 1524
Cat. K55240 **$29.95**

PH METER KIT
Build this pH meter for the swimming pool season is here again! From swimming pools to fish tanks to gardening, this pH meter has many applications around the home. This unit features a large 3 1/2 digit liquid crystal display and resolution to .01 pH units, making it suitable for use in the laboratory as well.
(EA Dec. 82) 82PH12
Cat. K82123 **$139**

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**

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**

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 **$24.00**



SOUND SIMULATOR FOR MODEL TRAINS
Fancy a diesel sound simulator for your model train layout? This circuit mounts inside the train for added realism and even varies its "speed" according to the throttle setting.
(EA Nov. 84)
Cat. K84110 **$18.00**

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**

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)
WAS $20.00 NOW $14.95

CYLON VOICE
Have your voice transformed into that of the sinister sounding Cylons. Great fun and scary! (EA Jan 81)
WAS $19.95 NOW $14.95

UNIVERSAL RELAY BOARD
Operating a relay to switch heavy current or mains voltages is a common requirement in electronic control applications. This project permits a relay to be switched in a variety of ways and form a variety of inputs. (ETI May '81, ETI257)
WAS $13.50 NOW $9.95

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
WAS $15.00 NOW $10.95

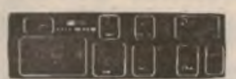
15V DUAL POWER SUPPLY
This simple project is suitable for most projects requiring a dual voltage. (ETI 581, June '76)
WAS $17.50 NOW $12.95

PREAMP FOR PAGING AMP
A versatile preamp with separate bass, treble and volume. (ETI 1421)
WAS $20.00 NOW $14.95

KITS FOR THE MICROBEES!

For those of you with Microbees and to coincide with ETI's "Microbee lift out", we have compiled this special section of kits for Microbee computers!

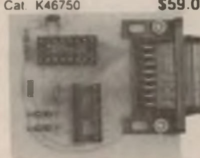
regards, Howard Rider.
General Manager



COMPUTER DRIVEN RADIO-TELETYPE TRANSCEIVER
Here's what you've been asking for, a full trasmit-receive system for computer driven radio teletype station. The software provides all the latest "whizz-bangs" like split-screen operation, automatically repeating test message, printer output and more. The hardware uses tried and proven techniques. While designed to team with the popular Mircorbee, tips are avaialble on interfacing the unit to other computers.
(ETI Nov. 84) ETI 755
Cat. K47550 **$139.00**

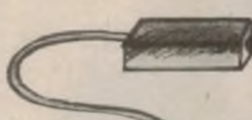
MICROBEE SERIAL-TO-PARALLEL INTERFACE
Most microcomputers worth owning have an "RS232" connector, or port, through which serial communications (input/output) is conducted. It is a convention that, for listing on a printer, the BASIC LLIST or LPRINT command assumes a printer is connected to the RS232 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**

ROM READER FOR MICROBEE
So you've written your 32K "Adventure" program and you're impressing all your friends with the graphics and the witty text - but they're not impressed at how long it takes to load the goldang program from tape! Then again, loading those short, useful utilities from tape takes a frustrating few minutes when you're hot to get on with the job. This project fixes that - transfer those tape programs to EPROM and load them with the ROM Reader.
(ETI 678, ETI MARCH '84)
Cat. K46780 **$34.95**

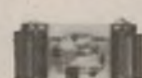


MICROBEE PARALLEL PRINTER INTERFACE
Nick-named "the Bee pee interface", this project allows you to connect your Microbee to a printer having a "parallel" or "Centronics" input. It's simple to build and low in cost. (ETI 671, ETI Oct '83)
Cat. K46716 **$14.95**

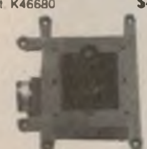
MICROBEE EPROM PROGRAMMER
This simple, low cost EPROM programmer just plugs into the MicroBee's I/O port and enables you to save programs in any of five different common EPROMs which can then be used in your MicroBee or any other microprocessor-based system. As the MicroBee I/O port is effected with a Z80 PIO chip, this programmer can be used with any other system employing the same I/O. (ETI 668, ETI.)
Cat. K46680 **$48.50**



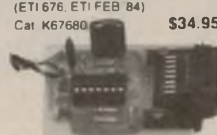
HARD COPY FROM YOUR MICROBEE
Here is the "cheap and simple" way to get printout from your Microbee. Teleprinters can be obtained for less than $100 (as cheap as $30, even!) and they make quite an acceptable substitute if you can't afford a "real" printer. This project interfaces your Microbee to a teleprinter.
(ETI 672, ETI OCT '83)
Cat. **$15.95**



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**



MICROBEE PROPORTIONAL ANALOGUE JOYSTICK
The joy of a joystick! A twiddle of the fingers as your spaceship races through the cosmos, zapping space invaders and other various baddies with searing photon torpedoes. Or a tank on a battlefield, dodging the mines. Or your Tiger Moth bucks through the turbulance as your skilful fingers guide it gently towards a landing. Fasten your seatbelts, folks, because with this latest ETI project, you'll be joining the fun.
(ETI 674, DEC '83)
Cat. K46740 **$49.50**



MICROBEE LIGHT PEN
This simple, low cost device plugs into the Microbee's 8-bit port and gives you an "entry" into the world of light pens and interactive software. (ETI 649, ETI August '83)
Cat. K46490 **$19.95**

LATEST KITS!

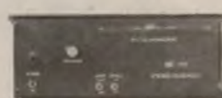
MULTI SECTOR ALARM STATION
Protect your home from intruders with this up-to-the-minute burglar alarm system, its easy to build, costs less than equivalent commercial units, and features eight seperate inputs, individual sector control battery back up and self-test facility.

Specifications:

- Eight sectors with LED status indication
- Two delayed entry sectors
- Variable exit, entry and alarm time settings: entry delay variable between 10 and 75 seconds; exit delay variable between 5 and 45 seconds; alarm time variable between 1 and 15 minutes.
- Resistive loop sensing: suits both normally open and normally closed alarm sensors
- Battery back-up with in-built charger circuit
- Built-in siren driver

Complete kit including deluxe prepunched metal work and electronics for only...
Cat. K85900 **$119**

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. 46660 **$69.95**



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**

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**

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
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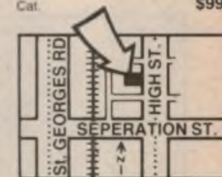

Just a reminder to all the people who live in Melbournes northern suburbs, that there's our NORTHCOTE store for your convenience!

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Errors and ommisions excepted

Simple unit checks audio & RF circuits

Signal tracer for trouble-shooting

This simple signal tracer makes a valuable servicing aid and can be used to troubleshoot both RF and audio circuits. It features an RF probe, battery operation and an in-built loudspeaker.

by COLIN DAWSON and GREG SWAIN

What, you may ask, does a signal tracer do? The answer is quite simple — it traces signals.

In fact, many hobbyists of yesteryear employed a signal tracer as a simple servicing aid. Suitably equipped with an RF (radio frequency) probe and a small audio amplifier, it was just the shot for troubleshooting AM radio receiver front ends, intermediate frequency (IF) stages and amplifier stages.

That was in the days before CROs became widely available at reasonable prices. Even so, a signal tracer is still a most useful tool.

The test procedure is quite straightforward. The probe is placed at successive signal points on the circuit — usually at the base of a transistor (or the grid of a valve) — to test for the presence or absence of a signal. If the signal disappears, then the stage immediately preceding the test point is at fault.

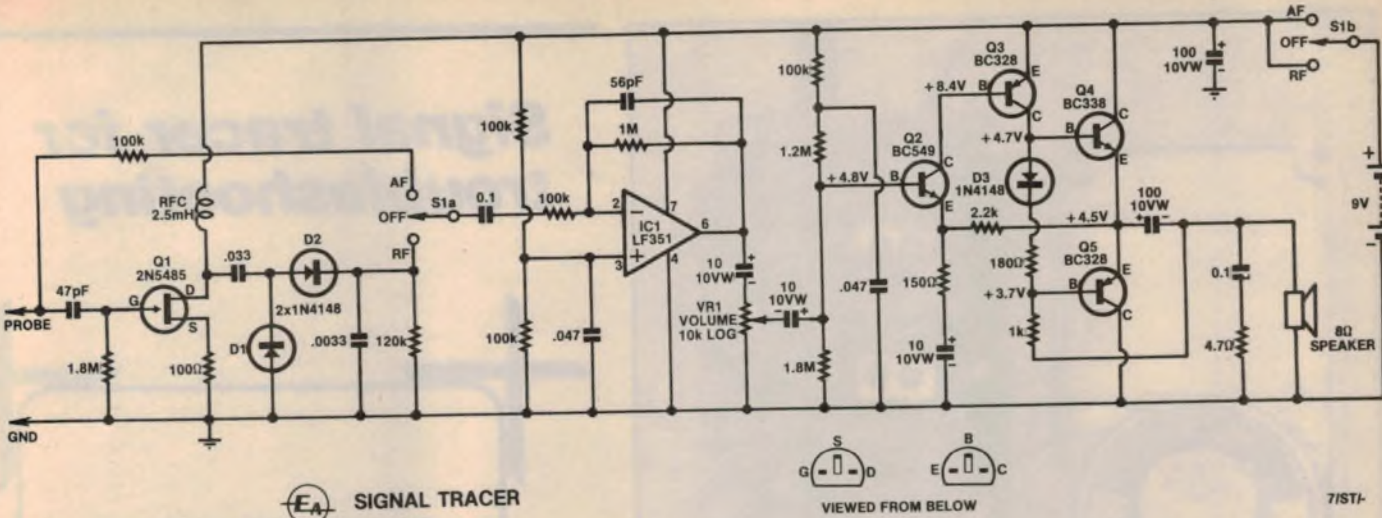
The probe is made switchable so that it can detect either audio or RF signals. In the RF position, the probe acts as an AM detector. In other words, it converts the RF signals to audio.

So a signal tracer can give a good indication of whether or not a circuit stage is working. In addition, it can also provide some indication of stage gain.

Our last signal tracer project was described in July 1966 and — would you believe it? — used valves. We did describe a solid state signal tracer. That design was published in March 1964 and used germanium transistors.

Against this background, it struck us that many readers could do with a modern version of the old-fashioned signal tracer. After all, not all hobbyists can justify spending several hundreds of dollars to buy a CRO. With this low-cost project, you will at least be able to carry out a few useful troubleshooting procedures.

The project is completely self-contained in a small box with the probe mounted at one end. This allows the box to be used as a kind of extended probe — it can easily be held in one hand. Only one other connection is necessary; a clip lead connection must be made to the circuit ground.



The circuit consists of an active detector stage (Q1, D1 and D2) followed by an audio output stage (IC1 and Q2-Q5).

Input impedance

An important consideration with signal tracers of this type is the input impedance. Particularly with RF circuits, any low impedance test equipment connected to the circuit can cause severe loading problems. This can lead to detuning or, in severe cases, the stage may cease working. Even long test leads can load the circuit down due to excessive capacitive coupling.

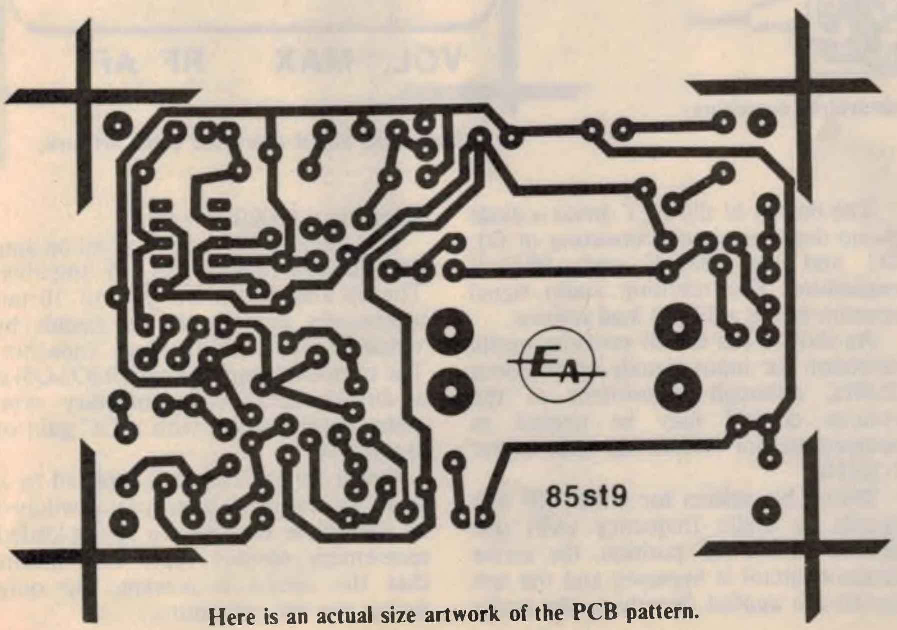
The input impedance of this signal tracer is quite high, particularly for the RF mode where it is nominally 1.8MΩ. This enables it to be used with quite sensitive RF circuits.

Impedance requirements for audio testing are generally not quite so critical. Our circuit has an impedance of around 100kΩ in the audio mode. This value is unlikely to affect the majority of amplifier circuits.

In previous EA designs, the AM detector circuit was mounted in a separate probe. This arrangement eliminated the effect of long test leads — the circuit under test could "see" only as far as the probe. The probe could thus be connected to the rest of the circuit using quite long leads without any ill effects.

While this approach worked quite well at the time, modern solid state circuits demand the use of a relatively small probe. This in turn limits the size of the parts that can be fitted inside it. For this reason, we chose to use a fixed probe (actually a multimeter probe) and to mount the detector circuitry inside the case.

This presents no great disadvantage. Unlike previous signal tracers, the parts for this design are all housed inside a small metal diecast case. Of course, there's nothing to stop you from using a separate probe if you want to, provided the detector circuitry is mounted in the probe case.



Here is an actual size artwork of the PCB pattern.

Parts List

- 1 diecast aluminium case, 122 × 41 × 67mm
- 1 8Ω speaker (50mm)
- 1 2.5mH RF choke
- 1 DPDT spring-loaded centre-off switch
- 1 PCB, code 85st9, 94 × 60mm
- 1 9V battery, Eveready 216 or equivalent
- 1 snap-on battery connector
- 1 knob to suit potentiometer
- 1 multimeter probe
- 1 alligator clip
- 4 6BA machine screws
- 4 6BA countersunk screws
- 12 6BA nuts

Semiconductors

- 1 TL071, LF351 FET-input op amp
- 1 2N5484 FET
- 1 BC549 NPN transistor
- 1 BC338 NPN transistor
- 2 BC328 PNP transistor
- 3 1N4148 diodes

Capacitors

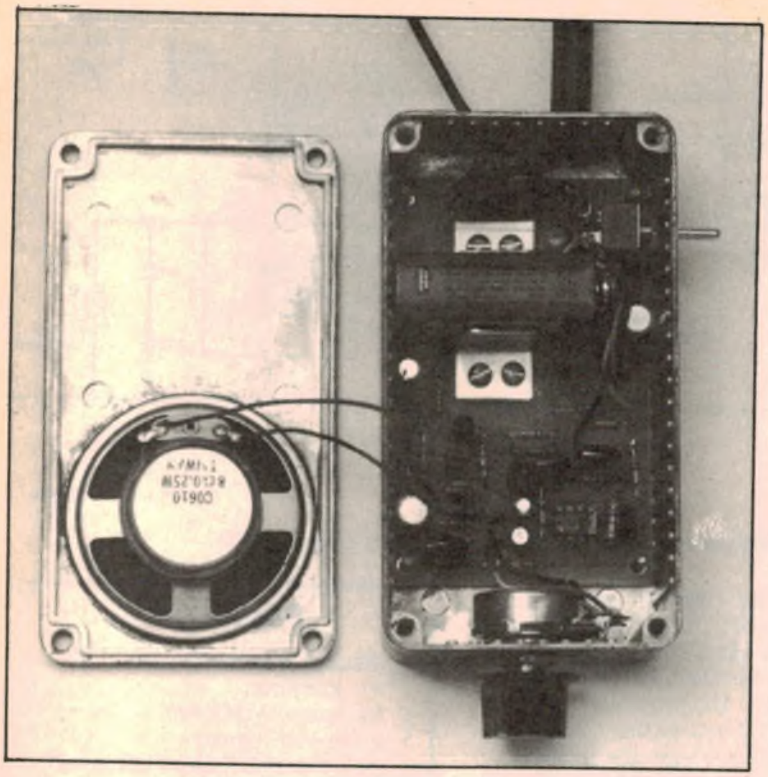
- 2 100μF 10VW electrolytic
- 3 10μF 10VW electrolytic
- 2 0.1μF metallised polyester (greencap)
- 2 .047μF greencap
- 1 .033μF greencap
- 1 .0033μF greencap
- 1 56pF ceramic
- 1 4.7pF ceramic

Resistors (¼W, 5%)

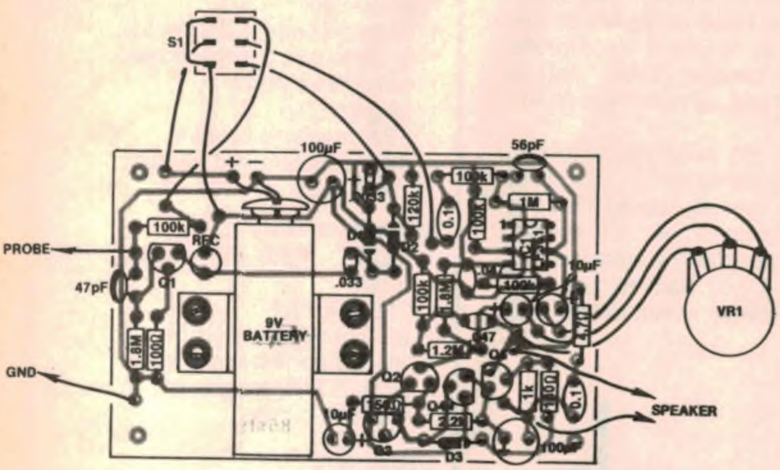
2 × 1.8MΩ, 1 × 1.2MΩ, 1 × 1MΩ, 1 × 120kΩ, 5 ×100kΩ, 1 × 2.2kΩ, 1 × 1kΩ, 1 × 180Ω, 1 × 150Ω, 1 × 100Ω, 1 × 4.7Ω, 1 × 10kΩ log potentiometer

Miscellaneous

Hookup wire, scrap aluminium, epoxy resin, etc.

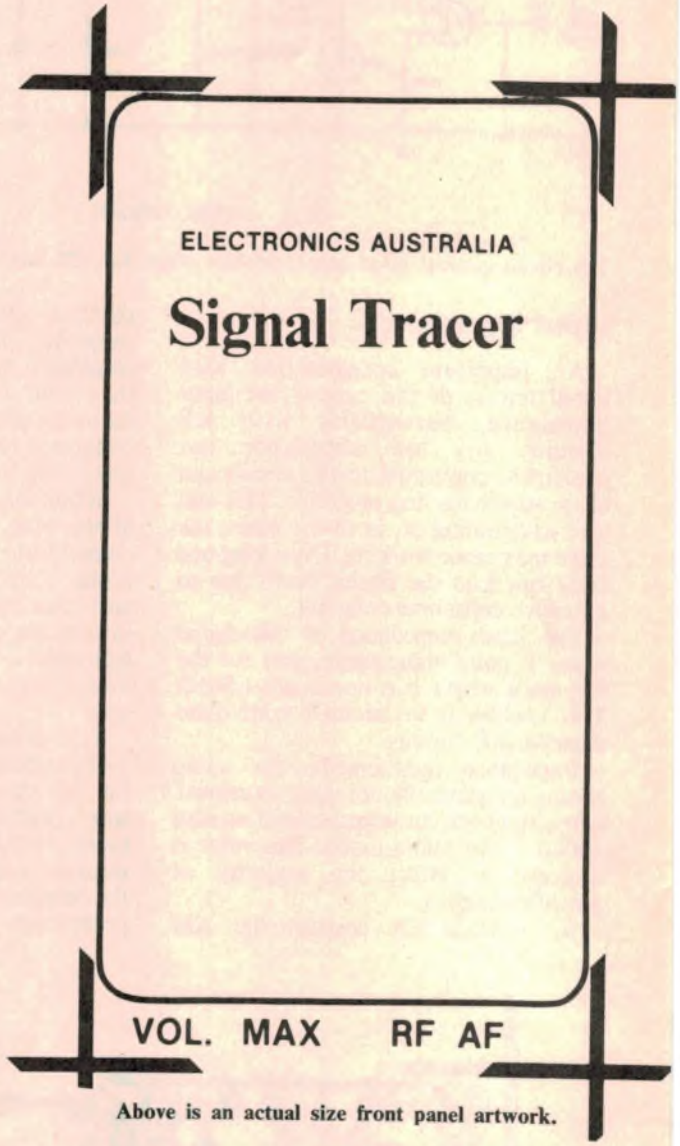


View inside the completed prototype. The speaker is secured to the lid using epoxy resin adhesive.



Check the orientation of the semiconductors and electrolytic capacitors when they are being installed on the board.

Signal tracer for troubleshooting



Above is an actual size front panel artwork.

How it works

The circuit can be broken into two separate stages: an active detector stage based on FET Q1 and diodes D1 and D2; and an audio output stage consisting of IC1 and Q2-Q5.

The active detector stage separates any audio information from a modulated RF or IF signal. RF signals from the test circuit are coupled via a 4.7pF capacitor into Q1 which is common source, self biasing FET amplifier. In addition to providing the requisite high input impedance, the FET provides a modest amount gain to improve the overall sensitivity.

The output of the FET drives a diode pump detector circuit consisting of D1, D2 and the .033μF and .0033μF capacitors. The resulting audio signal appears across a 120kΩ load resistor.

As shown, the circuit provides useful detection for input signals up to about 3MHz, although adjustment of the volume control may be needed to compensate for decreasing gain above 1.5MHz.

Switch S1a selects for either RF test signals or audio frequency (AF) test signals. In the AF position, the active detector circuit is bypassed and the test signals are applied directly to the audio stage via a 100kΩ resistor.

The audio stage consists of an op amp and the now familiar EA 1W amplifier. The op amp has a DC gain of 10 but attentuates high frequency signals by virtue of the 56pF feedback capacitor. The transistor amplifier circuit (Q2-Q5) is a direct-coupled complementary symmetry configuration with a DC gain of around 14.

Power for the circuit is supplied by a small 9V transistor battery and switched by S1b. Note that S1 is a spring-loaded momentary contact type. This means that the circuit is powered up only during the test procedure.

Construction

Most of the parts are mounted on a small printed circuit board (PCB) coded 85st9 and measuring 94 x 60mm. This fits quite neatly into a diecast aluminium case measuring 122 x 41 x 67mm.

Begin construction by mounting all the parts on the PCB. The layout diagram shows the parts placement. Note carefully the orientation of the electrolytic capacitors and the semiconductors when they are being installed.

We used PC stakes to terminate the wiring connections to the probe. This allows the use of medium gauge hookup wire.

The battery is held in position using two L-shaped aluminium brackets bent up from scrap aluminium. These are fastened to the PCB using machine screws and nuts (see photograph).

Attention can now be turned to the metal case. As shown in the photographs, the probe and the volume control are mounted at opposite ends of the case while the switch is mounted on one side of the case. Mark out and drill the mounting holes for these components and the earth lead and PCB.

Note that the PCB mounting holes should be drilled to 3mm and countersunk.

Next, spray the Scotchcal label with a hard setting clear lacquer and carefully affix it to the lid of the case. Several holes should now be drilled in the lower half of the lid to provide venting for the loudspeaker.

The various items of hardware can now be mounted in the case and the wiring completed. We fitted an alligator clip to the earth lead so that it could be quickly clipped to the circuit under test. Epoxy resin was used to secure the loudspeaker and probe while the PCB is secured using machine screws and nuts.

Finally, the switch and pot labels can be affixed to the case.

Testing

An audio oscillator can be used to quickly verify whether or not the audio stage is working. Where this is not available, an AM radio will suffice. Simply clip the earth lead to a convenient ground point and place the probe tip on a suitable test point (eg, to the active loudspeaker terminal).

The radio can also be used to check the detector circuitry. The best test point is probably just ahead of the radio's own detector, or you can try various points in the IF stages. Don't forget to press S1 in the appropriate direction each time you move to a new test point.

Finally, always wait a second or two before deciding whether or not the test signal is OK. This is to give the circuit time to stabilise whenever S1 is pressed.

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.

Wireless Weekly 3d

August 1935

Power to the graziers: the most powerful "B" class station in New South Wales is about to be established at Orange, about 140 miles by air from Sydney. The station, which will be owned by Country Broadcasting Services Limited, has been organised by the Grazier's Association and other country interests.

The equipment is being designed by AWA and will have a maximum unmodulated power of 2000W. Authoritative reports on wool, stock and general markets will be a feature of the program.

Equal opportunity: the world's first woman television announcer is Fraulein Ursula Patschke, who announces the high definition programs of the German Post Office.

Election promise: a decree has been issued by the New Zealand Broadcasting Board that during the forthcoming general elections no candidate is to be permitted to speak over the air, on any subject.

Portable radio: a radio portable the size of a large novel is being developed in England to sell at £3/15/-. It will use three midget valves and a single earpiece phone. Anode consumption will be about 1mA and the miniature HT battery is expected to last for about four months.

Penny for your thoughts: by using radio recording and amplifying apparatus, electrical impulses discharged by the human brain were photographed recently. The impulses are believed to be due directly to thought waves in response to physical sensations as well as mental concentration.

Beat this: Boston — a crystal set of such minuteness that it may be passed through the eye of a needle has been reported. The builder was defending his reputation against a challenger who built a set on a common pin.

Watch calibrator: the "Cronograph" is an invention which will tell in one minute whether your watch is properly adjusted; the inventors claim that in eight minutes they can prove an error of one part in a million.

The watch is put in a box with a microphone which picks up the ticking and sends it through an amplifier to a revolving printer. The printer is run by a motor controlled through an inverter by a temperature-regulated tuning fork.

Aviation wireless: in view of the rapid development of air lines, AWA has established a means of communication with planes over routes now in operation. The Qantas Imperial Airways planes travelling between Australia and Singapore, for example, keep in touch with one another at distances up to 750 miles.

RADIO TELEVISION AND HOBBIES · 2/6

August 1960

TV backpack: a portable TV camera-transmitter system made by a French company is what the well dressed TV cameraman will be wearing this season. Completely self contained, it can transmit top quality pictures over distances of a mile or more in favourable circumstances, and operate in places where no outside broadcast van could ever hope to reach. Already being used by several American TV stations, it may soon form part of the Australian scene.

New currency: our clumsy outdated currency system has been likened to the weather — everybody complains, but nobody does anything about it. However, there is a chance that a change might be on the way, the Government having appointed a committee to investigate decimal currency for Australia.

Electronic store-keeping: a specialised computer functions as an electronic "store-keeper". It can record up to 50 million items under 5000 different names.

The basic model costs £4750. It is a compact console unit and has an electronic typewriter specially adapted to initiate the recording of information. The machine can calculate new stock quantities after each transaction.

Sensitive TV tube: a new low light level image orthicon, made by GE, has won a coveted Emmy award for technical advance in colour TV.

The Academy of Television Arts and Sciences cites the new, supersensitive tube for "permitting colourcasting in no more light than is needed for black and white".

Microcircuits: in the increasingly complex world of electronics mere miniaturisation is no longer good enough. Microminiaturisation is the current trend. It may well be that with its advent we are now witnessing the beginning of a revolution in electronics.

The most complex micro-miniaturisation system is the solid circuit, originally developed by Texas Instruments. All the components of a circuit — transistors, capacitors, diodes and resistors — are fabricated on a single piece of semiconductor.

Strongest material: Norwegian scientists say they have discovered a material several hundred times stronger than steel. Experimental tests carried out with the material are said to have shown that it is approximately twice as strong as the needles of quartz crystals — one of the strongest materials known.

by BRYAN MAHER

OP AMPS Explained

PART 17

For some amplifier applications simple zener regulated power supplies are not good enough. For such cases we use voltage regulators to supply very steady rail voltages. Some voltage regulators are themselves operational amplifiers.

Some amplifiers and other items of electronic equipment have very high closed loop gain. Some work with very small signals. Both applications demand power supply rails with no more than minute quantities of residual 100Hz ripple from the AC rectification process. Zener regulators may reduce ripple to millivolt values but cannot reduce it to the microvolt levels sometimes demanded in critical applications.

Other amplifiers, control systems or professional equipment may be completely DC coupled and hence demand extremely stable power supply rails with very low voltage drift, some number of microvolts per day perhaps, even with changing load. No simple zener regulator can fulfil such a requirement.

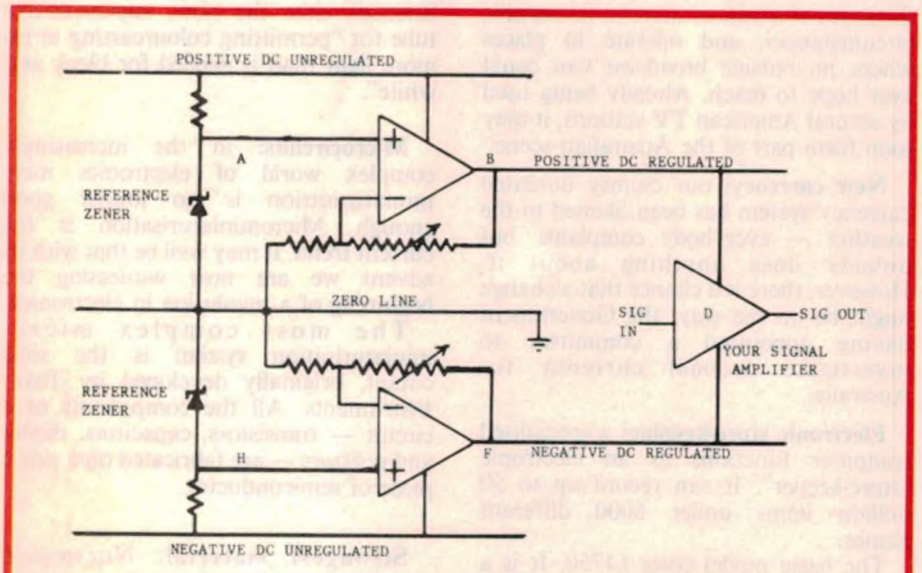


Fig. 1: positive and negative well-regulated supply rails to power signal amplifier D are provided here by operational amplifiers B and F. Amplifiers B and F are called "voltage regulators" in such an application and they are powered from the positive and negative unregulated supply rails. Input "signal" to the voltage regulator is the zener regulated voltage at A and H. Note that the voltage regulators are designed for single-polarity output and are thus considerably simpler than signal amplifier D.

Feedback active voltage regulators

We can satisfy the above requirements using special amplifiers designed to act as power supplies. Many are themselves operational amplifiers. Consider the idea of a variable gain power operational amplifier working from a DC input voltage source. Is it not true that any desired output voltage can be chosen by the gain control? And is not the output impedance very low, milliohms or less?

Fig. 1 shows the concept. It is supplied by a suitable large unregulated power source and its input is fed by a small constant voltage source. Because the input source supplies only a very small, constant current (the power op amp's input circuit), we could use a simple shunt zener regulator as the constant reference voltage source A as shown.

It supplies a very small, constant, power op amp input current, and we have a fair choice of zener voltage using the variable gain of the power op amp to provide whatever voltage out to the power load is desired. Of course the power load D is to be your amplifier, so the output of the power op amp at B is nothing more than the power supply rail for your amplifier.

As the gain from A to B, once chosen by the gain control, is held constant by the negative feedback, and as the zener voltage at A is very stable, it must follow that the voltage at B is very constant too, even when B is supplying widely changing current to the load D.

Should your amplifier D require dual supplies, we just do it all again down below to provide a negative regulated supply rail at F.

It is true that any power op amps could do the job at B and F and it would even be possible to use three identical amplifiers at B, D and F. But we can save some hard-earned cash as inspection shows that the upper op amp output B is always a positive value (zero or negative

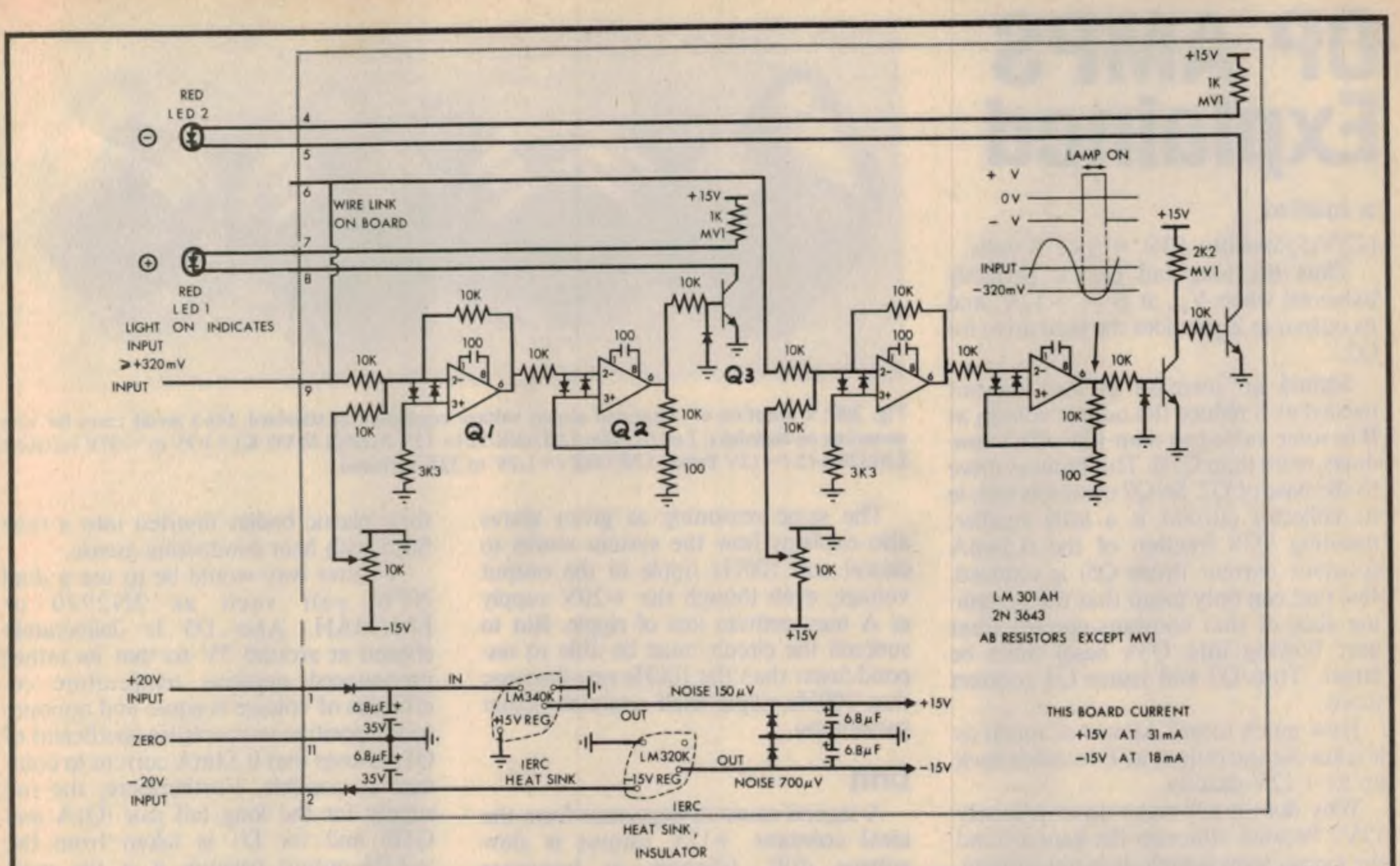


Fig. 2(a): an example of the use of integrated voltage regulators. The positive LM340K regulator supplies +15V to this board while the negative LM320K regulator provides the necessary −15V. The power supply is derived from ±20V DC rails via two diodes which protect against accidental reversed polarity. Each regulator is a TO-3 case type (denote by K in the type number) and is mounted on the board in a "claw" type IERC heatsink. The case of the LM340K regulator is grounded but the case of the LM320K is live and must be insulated. It is essential to install low and high frequency bypass capacitors on each regulator input (6.8μF solid tantalum types).

is just not required). Similarly the lower op amp output at F is only required to be negative. Because of this the upper and lower op amps acting as power supplies at B and F can be less complex than amplifier D.

Hereafter we will refer to power op amps which provide supply power rails (as B and F) as *Negative Feedback Active Voltage Regulators,* or just those last two words for short. All such circuits are intended to provide very constant, almost ripple free, DC output at suitable current capability, and have very low output impedance.

Despite the fact that most of them are indeed op amps, a glance at their circuit diagrams often fails to reveal that fact. Such diagrams are sometimes drawn in a one-sided or inverted manner, and some of the over-current protection systems used may seem unusual. Their output transistors are usually referred to as "pass transistors" as "series pass" is the most common (output current through the transistor). Occasionally we see the other kind which employs "shunt output transistors".

Integrated voltage regulators

For small load currents there are many integrated circuit voltage regulators and small modules on the market, such as the small selection in Table 1. These can be mounted on the printed circuit board along with your amplifier, as Fig. 2 shows. Such separate voltage regulation on each board can be a great advantage in terms of isolation, freedom from rail-coupled instability, and design simplicity.

Design examples

Consider Fig.3(a) which shows the essentials. Positive 20V DC unregulated power appears at A, from a previous transformer, rectifier and overcurrent protection system (not shown). Very stable +12V DC power output is provided by this circuit at B. The output point B represents an extremely low output impedance.

This particular circuit is used to supply the +12V rail for a high-stability signal amplifier, which is completely DC coupled throughout and with a closed loop gain of 50,000. Such a signal amplifier, being high gain and DC coupled, demands +12V and −12V rails of the utmost stability.

A similar circuit, with everything inverted, provides the negative rail.

In Fig.3(a), Q4 is the output or "passing transistor" connected as an emitter follower, with Q3 and Q4 making a Darlington pair. D3 produces a constant 3V drop from X, meaning that Q5's base is always 3V lower than X. Subtracting the constant 0.6 volt emitter-base potential, it follows that Q5's emitter is always 2.4 volts lower than X, so R11 always has 2.4V across it. Consequently as R11 = 4420 ohms it must always have 0.54mA flowing through it.

This small constant current divides to form both the base current of Q3 and the collector current of amplifier Q2. When some amount of output current at B is demanded by the load (not shown) then such load current must automatically equal the base current into Q3 multiplied by the product of h_{FE}'s of Q3 and Q4. Thus Q3's base takes as much of that 0.54mA constant current as it needs, with the remainder simply becoming Q2's collector current.

Q1A and Q1B are connected as a long tail pair differential amplifier with inputs to both bases. D1 was purchased to provide a nominal 5.5V (±5%) volts for Q1A's base but when measured its actual voltage was found to be 5.42785V. Therefore, R2 and R3 were selected as shown so that the +12V output at B would cause a current through R2 and R3 such that the voltage at Q1B's base

OP AMPS Explained

is equal to:

(12)V(536)/(649 + 536) = 5.4278 volts.

Thus the long tail pair is perfectly balanced when V_{out} at B = +12V, and its output at Z provides the base drive for Q2.

Should an increase in load current needed at B reduce the output voltage at B to some value less than 12V, Q1A conducts more than Q1B. This reduces drive to the base of Q2. So Q2 conducts less, ie its collector current is a little smaller, meaning Q2's fraction of the 0.54mA constant current (from Q5) is reduced. But that can only mean that the remaining slice of that constant current (that part flowing into Q3's base) must be larger. Thus Q3 and hence Q4 conduct more.

How much more? Almost as much as it takes for the output at B to come back up to +12V exactly.

Why does it not make up to precisely 12V? Because although the gain around the circuit loop is high, it is not infinite. Should less load current at output B cause the voltage there to rise, then a similar sequence, with each statement reversed, applies. The system spends its life trying hard to keep the output at B exactly at +12V. How well it succeeds depends on the ratio of closed loop system gain to the open loop gain. That's for voltage changes caused by load changes.

Fig. 2(b): a selection of integrated circuit voltage regulators in standard TO-3 metal cases for easy mounting on heatsinks. Left to right: LM340K-12 (+12V fixed); LM337 K (−1.2V to −37V variable); LM320K-12 (−12V fixed); LM338K (+1.2V to 32V variable).

The same reasoning as given above also explains how the system works to cancel any 100Hz ripple in the output voltage, even though the +20V supply at A may contain lots of ripple. But to succeed the circuit must be able to respond faster than the 100Hz rate (because that 100Hz ripple itself contains higher harmonics).

Drift

A second cause of departure from the ideal constant +12V output is slow voltage drift. Changes in transistor characteristics, zener diode temperature or resistor temperature can all cause changes in voltage in various parts of the circuit and hence in the output.

To reduce such drifts to a minimum, all the critical circuit components (ie, Q1, D1 and associated resistors R2-R7) are mounted well away from Q4 and its heatsink. And Q1A and Q1B, the SE4010's, are kept at equal temperatures by having their plastic bodies inserted into a tube filled with heat conducting grease.

A better way would be to use a dual NPN pair such as 2N2920 or LM114AH. Also D3 is deliberately chosen at around 3V so that its rather pronounced negative temperature coefficient of voltage is equal and opposite to the positive temperature coefficient of Q5, to keep that 0.54mA current as constant as possible. Furthermore, the rail supply for the long tail pair (Q1A and Q1B) and for D1 is taken from the +12V output because it is the most stable voltage available.

Q2's emitter needs to be about +6.8V above 0V. An emitter resistor is not the best way as this would cause some negative feedback and so reduce the open loop gain (and you cannot bypass a resistor for zero frequency). Therefore, we have used diode D2 to produce a fixed voltage drop of 6.8V. As Q2's emitter current is too small to cause D2 to go into sufficient conduction, we add R8 to put about 10mA through D2 to keep it happy.

TABLE 1
SOME INTEGRATED CIRCUIT VOLTAGE REGULATORS

Type	Voltage	Pos or Neg ?	Variable ?	Max Current Amps	Case
LM338K	+1.2V to +33V	POS	YES	5.0	TO-3
LM337K	−1.2V to −37V	NEG	YES	−1.5	TO-3
LM117HVK	+1.2V to +57V	POS	YES	1.5	TO-3
LM340K-5	+5V	POS	NO	1.5	TO-3
LM340K-12	+12V	POS	NO	1.5	TO-3
LM340K-15	+15V	POS	NO	1.5	TO-3
LM320K-12	−12V	NEG	NO	−1.5	TO-3
LM320K-15	−15V	NEG	NO	−1.5	TO-3
LM345K	−5V	NEG	NO	−3.0	TO-3
LM196K	+1.25V to +15V	POS	YES	10.0	TO-3
uA78HG	+5V to +20V	POS	YES	5.0	TO-3

Remote sensing

A few small points round off the description. The dotted large rectangle represents the printed circuit board and small numbers mean plug/socket pin numbers. Things outside the rectangle are external to the board. Notice that the voltage divider R2, R3 actually senses the output voltage at points *off* the board. Pins 5 and 9 are the inputs for this sensing circuit while pins 3, 4 and 10, 11 carry larger currents.

The sensing junctions B and J off the board are actually the points of regulated voltage and may, if desired, be a considerable distance from the board. This is called **Remote Sensing** and by it the voltage actually seen at the load may be stabilised. This is an improvement on local sensing on the board, as local sensing ignores small voltage drops in the board plug-socket and the cable to the load.

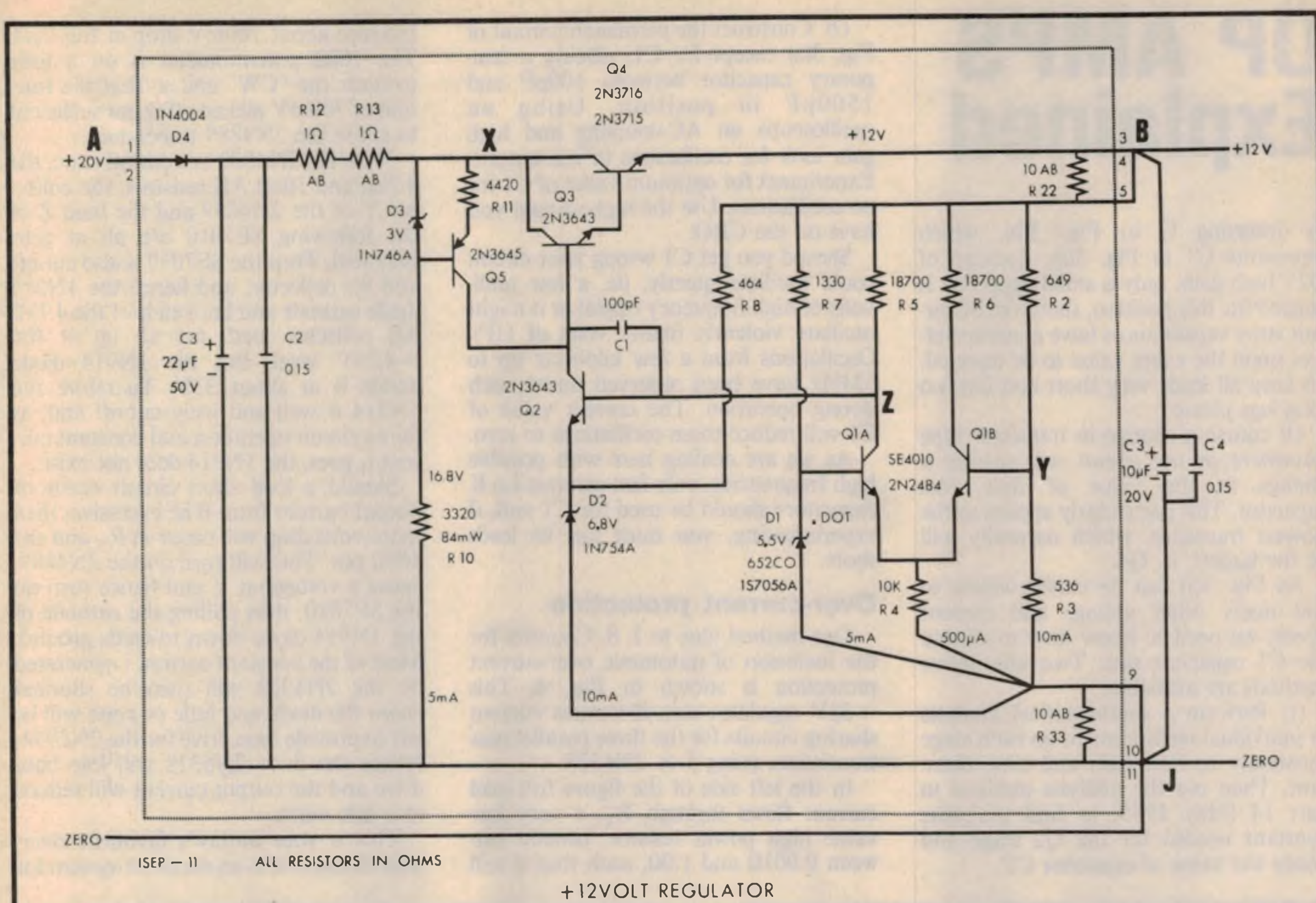


Fig. 3(a): the +12V active feedback regulator described in the text. In this case, a +20V unregulated supply which is already current-limited is used. R12 and R13 thus provide significant over-current protection (see Fig. 4 for an example of full overload protection). Because the open loop gain is very high, the output impedance is very low (approx 88 micro-ohms) and thus the ripple content in the +12V output is very low. Careful design of the circuit and layout also achieves low DC drift.

Remote sensing is an extra refinement, not necessary if you don't want it. It does present a risk of instability due to a very low frequency Pi tuned circuit comprising all shunt capacitances and the inductance of the cable to the load. To this end, if remote sensing is used, C3 and C4 are mounted at the load, not at the board.

Components

Mostly low cost transistors are specified with a few alternatives shown. Many other types will work satisfactorily. Resistors marked "AB" are 5% types. For critical positions all other resistors are Dale high stability 1% types, with temperature coefficient 100ppm/°C. D1 is chosen and operated at optimum current for minimum voltage drift and noise. The types 652CO and 1S7056A are from Texas Instruments, but other manufacturers also produce a few excellent reference diodes. Only gold contact plug/sockets should be used (avoid copper contacts). ISEP-11 or Amphenol-10 pin plugs and sockets are suggested.

Stability

As with all op amps or negative feedback systems, careful attention must be paid to closed loop stability. Fig. 3(b) is a simplified block diagram of Fig. 3(a) showing that the voltage regulator really is a power op amp. The Q2 stage has the highest gain, more than 350, because the constant current source appears as a very high impedance collector load and also D2 produces no emitter degeneration.

Recall our discussion on stability in part 14 of this series (May 1985, particularly Fig. 11) wherein we said that one sure way to achieve closed loop stability is to take the highest gain stage and deliberately slow it down until it provides the system dominant pole, ie, has by far the slowest time constant. This makes any circuit appear as a one-pole system and therefore stable.

This deliberate "slowing down" is done

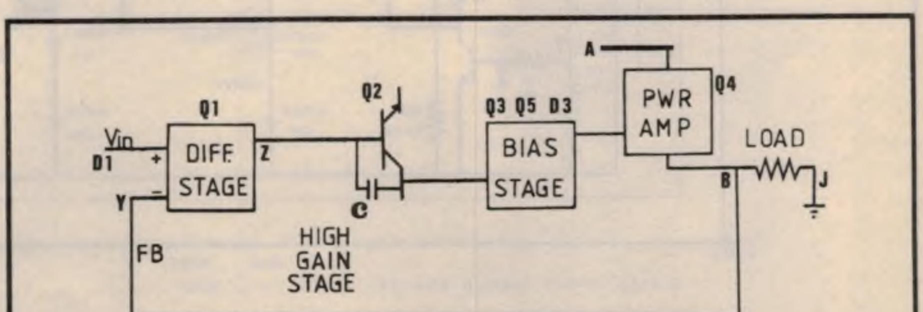


Fig. 3(b): symbolic block diagram of voltage regulator Fig. 3(a). Capacitor C is inserted to deliberately increase the time constant of the high gain stage (ie, slow it down) until it is the slowest stage in the system. If taken far enough, this makes the whole circuit appear as a one-pole amplifier and thus it will be stable. The letters identify the points on Fig. 3(a).

OP AMPS Explained

by inserting C in Fig. 3(b), which represents C1 in Fig. 3(a). Because of Q2's high gain, only a small capacitor is needed for this position, therefore all circuit stray capacitances have a marked effect upon the exact value to be inserted. So keep all leads very short and flat; no long legs please.

Of course a change in transistor type *anywhere in the circuit* will require a change in the value of that vital capacitor. This particularly applies to the slowest transistor, which naturally will be the largest, ie, Q4.

As Fig. 3(a) can be varied widely to suit many other voltage and current needs, we need to know how to choose the C1 capacitor size. Two alternative methods are available:

(1) Perform a mathematical analysis or individual measurement on each stage separately to find gain and time constant. Then use the analysis outlined in part 14 (May 1985) to find the time constant needed for the Q2 stage and hence the value of capacitor C1.

(2) Construct the permanent circuit of Fig. 3(a) except for C1, placing a temporary capacitor between 100pF and 1500pF in position. Using an oscilloscope on AC-coupling and high gain look for oscillations in the output. Experiment for optimum value of C1 for no oscillations. Use the highest gain you have on the CRO.

Should you get C1 wrong your circuit could oscillate quietly, (ie, a few millivolts of high frequency ripple) or it might oscillate violently (many volts of HF). Oscillations from a few kilohertz up to 5MHz have been observed under such wrong operation. The correct value of C1 will reduce these oscillations to zero.

As we are dealing here with possible high frequencies, only fast ceramic Lo-K capacitors should be used for C1 and, if experimenting, you must cut its leads short.

Over-current protection

One method (due to J. S. Coombs) for the inclusion of automatic over-current protection is shown in Fig. 4. This +32V regulator also illustrates current sharing circuits for the three parallel pass transistors, using 3 × 2N6328.

In the left side of the figure full load current flows through R_X, a very low value high power resistor, usually between 0.001Ω and 1.0Ω, such that it will produce about 700mV drop at full load. The 100Ω potentiometer is set a little towards the "CW" end so that the fraction of 700mV picked off is not sufficient to cause the 2N4889 to conduct.

With the 2N4889 in a cut-off state, the 4.7kΩ and 10kΩ AB resistors, the collector Y of the 2N4889 and the base Z of the following SE7010 are all at zero potential. Thus the SE7010 is also cut-off and it's collector, and hence the 1N914 diode cathode and both ends of the 4.7kΩ AB collector load, are all up at the +42.9V level. But the 1N914 diode anode is at about 33V. Therefore the 1N914 is well and truly cut-off and, as far as circuit operation and constant current i_1 goes, the 1N914 does not exist.

Should a load short circuit occur or output current from B be excessive, then more volts drop will occur in R_X and the 100Ω pot. This will turn on the 2N4889, cause a voltage at Y and hence turn on the SE7010, thus pulling the cathode of the 1N914 diode down towards ground. Most of the constant current i_1 generated by the 2N5333 will then be shunted down the diode and little or none will be left to provide base drive for the 2N2994. Hence the 3 × 2N6328 will lose base drive and the output current will reduce to a safe value.

This is your author's favourite overload circuit and is an excellent system for

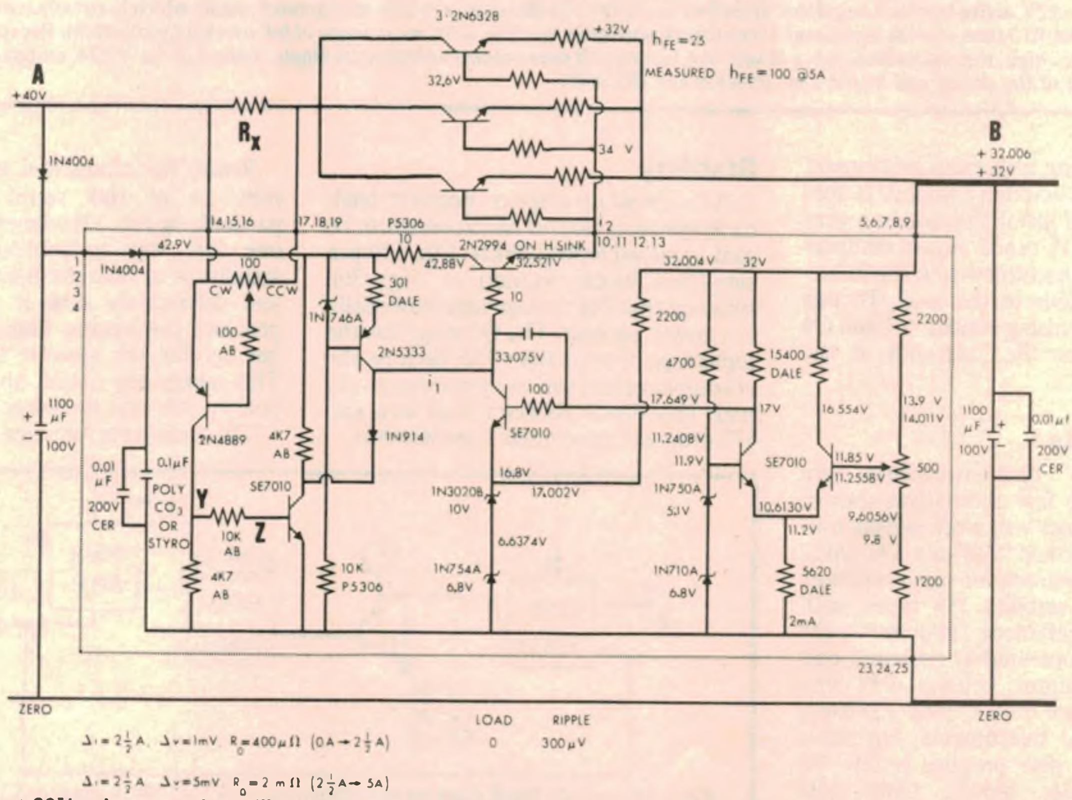


Fig. 4(a): this +32V voltage regulator illustrates many of the points discussed in the text, including parallel output transistors, current sharing and over-current protection. The voltages shown on the circuit to two or three figures are the design values expected while the voltages shown to five or six figures are those actually measured. The open loop gain is not as high as for Fig. 3 because the SE7010s have low h_{FE}.

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Continuity & Beeper	–	–	•	•	•
True RMS	–	–	–	–	•
hFe & Capacitance	–	•	–	–	–
Data Hold	–	–	–	–	•
Peak Hold AC/DC	–	–	–	•	–
Basic Accuracy Percent of Reading	0.8	0.5	0.25	0.1	0.05
DC Volts					
Maximum Resolution Microvolts	100	100	100	100	10
Lowest Range Millivolts	200	200	200	200	200
Maximum Voltage	1000	1000	1000	1000	1000
AC Volts					
Maximum Resolution Microvolts	100	100	100	100	10
Maximum Voltage	750	750	750	750	750
Frequency	500Hz	500Hz	1KHz	5KHz	5KHz
AC & DC Amps					
Resolution	1uA	1uA	1uA	1uA	100nA
Maximum Current	10A	10A	10A	10A	10A
Ohms					
Maximum Resolution Milliohms	100	100	100	100	10
Maximum Resistance Megohms	20	20	20	20	20

•Standard – Not Applicable

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Measurement Rate 2.5 measurements per second, nominal.
Operating Temperature 0°C to + 35°C 0-80% RH, +35°C to + 50°C 0-70% RH.
Storage Temperature -20°C to +65°C 0-90% RH with battery removed.
Accuracy Accuracy specifications at 23±5°C, less than 75% RH.
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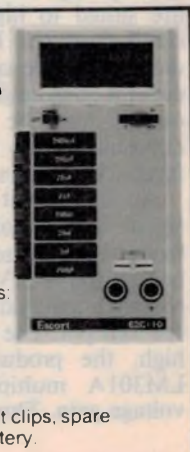

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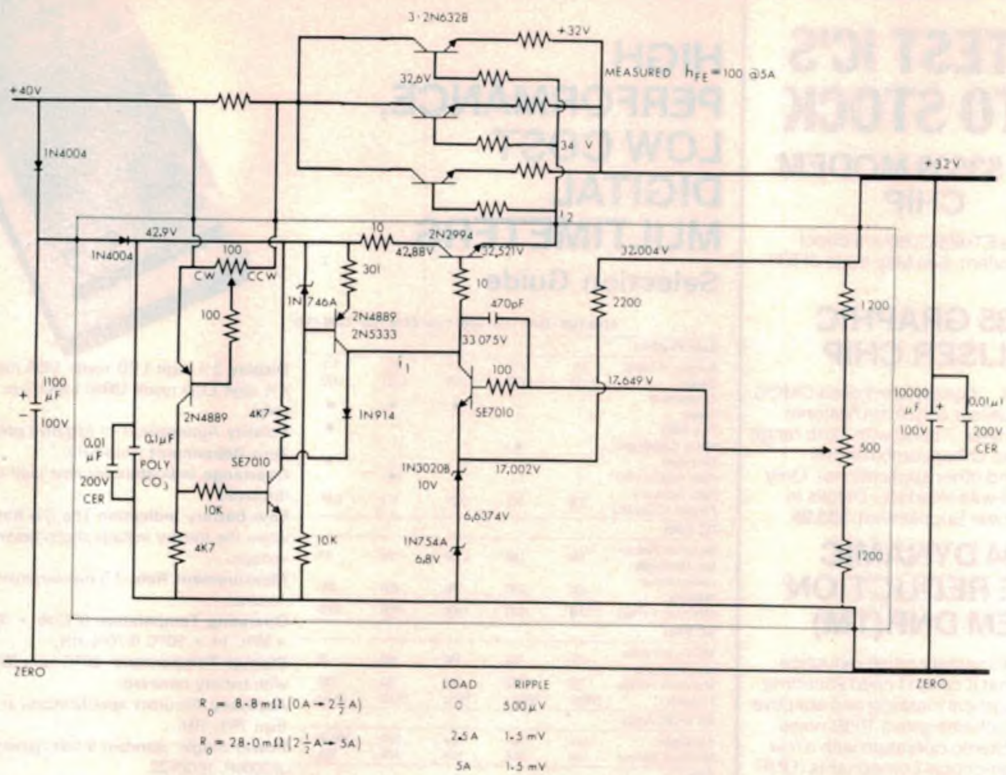


Fig. 4(b): a simplified version of Fig. 4(a) with the same voltage and current capability. Because we have deleted the long tail pair amplifier, open loop gain is lower and hence the output impedance and ripple content are higher.

OP AMPS Explained

brief accidental shorts as the system automatically returns to normal on removal of the overload. In sustained short circuits, however, we must watch pass transistor heat dissipation as they then have full voltage and full current.

The circuit of Fig. 4(a) can be simplified by deleting the long tail pair front end amplifier (2 × SE7010). The resulting less complex circuit, Fig. 4(b), has the same voltage and current ratings but lower open loop gain, therefore higher output impedance and ripple content.

Active shunt regulators

Negative feedback shunt voltage regulators are a possible alternative to the series type. Both types have their place, series types being best for medium to very large currents while shunt types are suited to higher voltage but quite small currents. Fig. 5 shows a shunt design example suited to maximum load current of around 30mA and any voltage output may be obtained by suitably choosing values in that long chain of feedback resistors marked K.

An op amp it certainly is. Its input signal is the constant −11V derived from two 5.5V zeners in series. Its feedback is the +11V derived from the long resistor chain and the 10.5kΩ resistor and the 1kΩ pot. The open loop gain is quite high, the product of 30,000 for the LM301A multiplied by the 2N3902 voltage gain. Thus its characteristics are very good as shown in Table 2.

Just to keep the record straight, let it be said that feedback or active voltage regulators, series or shunt, are not the invention of solid state technology. They were used for years in valve systems, but gave way to solid state designs when high power pass transistors appeared in the market place. Valve systems may occasionally be designed nowadays if someone wants a linear voltage regulator above about 1000 volts.

Negative voltage regulators

To provide a well regulated negative rail we have two alternatives:

(1) Take the completed circuit board of Fig. 3(a), (b) and make no change at all on the board but change the connections to it, as Fig. 6, thus:

(a) Remove the original zero line from ground and re-label it to be the new −12V regulated rail.

(b) Connect B to ground and call B the new zero line.

(c) Use the same 20V DC unregulated supply as before provided there is no ground nor any other circuit connected to it or it's bridge rectifier or its transformer secondary winding.

2. Change the circuit diagram of Fig. 3(a) thus:

(a) Replace every NPN transistor by an equivalent PNP type.

(b) Replace every PNP transistor by a corresponding NPN.

TABLE 2
Measured results — Voltage regulators

Circuit	Volts out	Current Amps	Measured Drift rate per hour	Output Impedance Milliohms	Measured output ripple
Fig. 3(a)	+12V	0.1	<200µV	<0.15	100µV
Fig. 4(a)	+32V	12.0	<1mV	0.4 to 2	300µV
Fig. 4(b)	+32V	12.0	<10m	8 to 28	500µV to 1.5mV
Fig. 5	hundreds	0.030	<18mV	60	<6mV

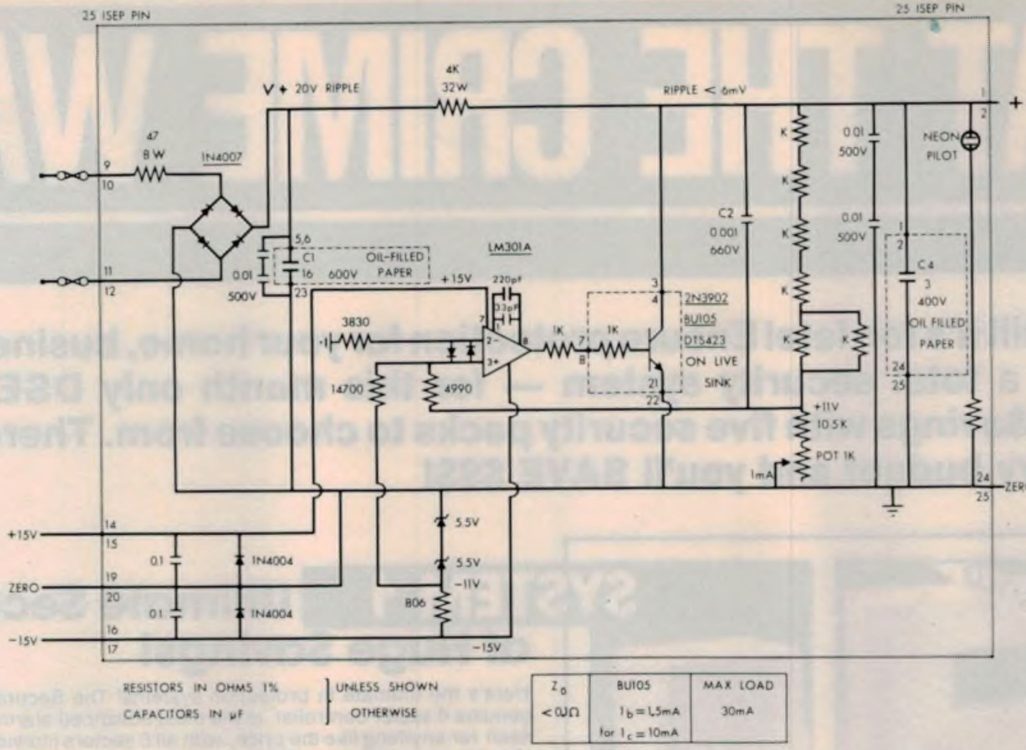


Fig. 5: example of a feedback shunt regulator for high voltages, small currents. The dotted rectangle represents the PCB while the numbers are the plug/socket pins. AC from the transformer secondary is connected to pins 9, 10 and 11, 12. The regulated positive DC output appears at pins 1, 2 with zero at pins 24, 25. This regulator reduced ripple by 72dB (from 20V to 5mV). An auxiliary +15V DC supply is also required. (Warning: this type of circuit can work at dangerously high voltages).

(c) Remove every diode and put the same diode back in the circuit upside down.

(d) Reverse the DC connectors to the bridge rectifier which supplies the circuit.

(e) Reverse connections to every polarised capacitor, ie the electrolytic and tantalum types.

(f) Possibly adjust the value of C1 as these new transistors may have somewhat different gains and/or time constants.

(g) Re-label B to be the −12V regulated output, with A at −20V unregulated and J remaining as the zero line as in Fig. 7. Detail circuits of this negative type are sometimes drawn upside down (pass transistor at bottom of page). Such a drawing may be called a "mirror circuit" of Fig. 3(a).

Comparing your choices (1) and (2) above, we see that Fig. 6, places strong prohibition against any other connection to the transformer secondary winding and/or bridge rectifier. In particular, you cannot connect any other regulator to this secondary and earthed centre-tap systems are prohibited. Watch some integrated circuit negative regulators in this respect, particularly regarding case connection and case stray capacity. Furthermore, the use of auxiliary ±15V supplies (as used in Fig. 5) is well nigh impossible.

The advantages are that you can just mass-produce these positive boards, Fig. 3, and use them for everything, both positive and negative supplies. Also large PNP pass transistors are not required. This is an advantage if very large transistors must be used as all the very largest are NPN types.

Fig. 7 may be more aesthetically pleasing but its real advantage is the ability to connect more than one circuit to the transformer secondary winding and bridge rectifier. You may, if you wish, use a centre-tapped secondary winding and use one bridge rectifier to run both positive and negative regulators. Also, because we use a solid common zero line, there is no problem if auxilliary ±15V rails are desired.

Similar action can be taken to produce a negative voltage regulator starting with any positive circuit, such as in Figs. 4 or 5. Measured results of a selected few voltage regulators are shown in Table 2 to show what can be achieved.

You may have noticed that we have dealt only with linear regulators, as this befits the title of our series. However the market place abounds with other types, such as switching regulators. These trade better efficiency for worse noise generation, so are used in applications suited to such properties.

References

1. "DC Power Supply Handbook", Hewlett-Packard Co. 1970.
2. "Transistor Circuit Design" by Texas Instruments Staff. McGraw-Hill NY, 1963 ch 9, pps 145-166.

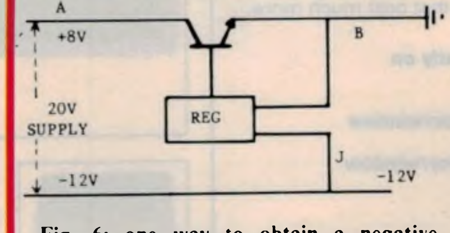


Fig. 6: one way to obtain a negative regulated supply. The circuit uses a second regulator board (the same as used for the positive rail), but connected "back to front". The advantages and disadvantages of this method are discussed in the text.

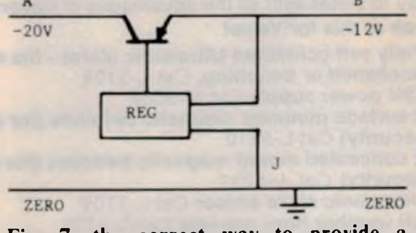
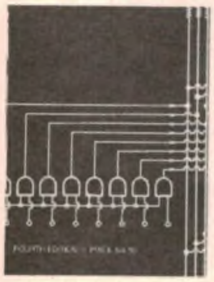


Fig. 7: the correct way to provide a negative regulated rail is to construct a negative regulator circuit as shown in this figure. The advantages and disadvantages of this scheme are also discussed in the text.

See page 53 for address details

Special Publications from Electronics Australia

FUNDAMENTALS OF SOLID STATE. Now in its second reprinting — which shows how popular it has been! It provides a wealth of information on semiconductor theory and operation, delving much deeper than very elementary works but without the maths and abstract theory which make many of the more specialised texts heavy going. Starting with a background chapter on atomic theory, the book moves easily through discussions on crystals and conduction, diode types, unijunction, field effect and bipolar transistors, thyristor devices, device fabrication and microcircuits. A revised glossary of terms and index complete the book. *Fundamentals of Solid State* has also been widely adopted in colleges as recommended reading. **$4.50**



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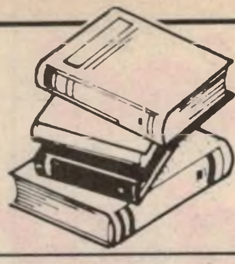
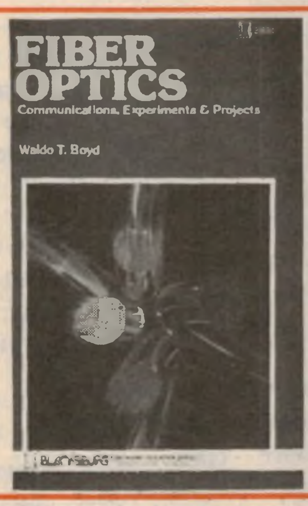
Books & Literature





Fibre Optics for experimenters

FIBRE OPTICS COMMUNICATIONS, EXPERIMENTS AND PROJECTS: by Waldo T. Boyd. Published by Howard W. Sams & Co, Inc, 1982. Soft covers, 215 × 135mm, 221 pages, illustrated with diagrams and circuits. ISBN 0672218348. Recommended retail price $29.95.

Good books on the subject of fibre optics are few and far between so this new text is of particular interest. It starts out with a very good general introduction to the subject of light and then moves on to cover the whole subject of optical fibres in a further 18 chapters and 11 appendices.

The book is split into three sections. The first of these is devoted to the fundamentals of fibre optics which are covered in six chapters. Section two is devoted to experiments. Some of these are: a light pipe, using a liquid-filled tube, a light beam modulator, and a LED-driven fibre-optic system.

Section three is devoted to constructional projects which include: AM fibre optics transmitter and receiver, light pen cable and a passive light pen.

Some of the material in the book pertains to fibre optics cable kits which are available in the USA but the general principles described would apply to any fibre optic components.

The appendices include data on the electromagnetic spectrum and scientific notation, a long list of (USA) suppliers of fibre optics hardware, information on how to cut and terminate optical fibres, code tables, a glossary and useful bibliography.

In conclusion, this is a good book on the subject, highly readable and up to date. Our review copy came from Jaycar Electronics. (L.D.S.)

Electronics text for engineering students

MICRO-ELECTRONIC CIRCUITS: by Sedra & Smith. Published 1982 by CBS College publishing, New York. Hard covers, 184 x 24.2mm, 927 pages, illustrated with diagrams, ISBN 0-03-056729-7. Recommended retail price $85.95.

This most impressive hard bound text is designed to cover the core subjects of an electrical engineering course. With many worked problems and over 200 questions with answers, it would be a valuable asset for both the student and lecturer.

Sixteen chapters take the student from elementary circuit analysis, through to semiconductor devices, filters, feedback, logic families and memory circuits. At every step, explanations are both comprehensive and understandable.

It is stated in the preface that a "modern" approach is taken to the course; h-parameters are not used in analysing transistor circuits. Initially this gave rise to some misgivings, but they were quickly allayed. The treatment of bipolar transistors and transistor amplifiers must be one of the most comprehensive available.

While a previous course in basic circuit analysis is assumed, any keen student armed with a sound knowledge of physics, Ohm's and Kirchoff's Laws should make reasonable headway. Some of the later chapters (Frequency Response, Feedback) also require familiarity with complex numbers.

Although not cheap, this text contains a wealth of explanation that might otherwise require two or three books. It comes highly recommended. (C.R.D.)

DOS handbook for the IBM PC

THE IBM PC-DOS HANDBOOK: by Richard Allen King. Published 1983 by Sybex Inc, Berkeley, California. Soft covers, 178 x 227mm, 296 pages. ISBN 0-89588-103-9. $25.50.

Let's face it. There are many people who buy an IBM or IBM PC-compatible machine and who do not buy the Disk Operating System. They get a pirate copy of the floppy disc from one of their mates and that is sufficient to get them started. Getting all the material which is in the accompanying software handbook is another matter and few people are able to make the best use of DOS as a result.

This handbook is aimed at this large and ready market. It covers most aspects of the IBM PC DOS but whether it will enable people to use DOS fully is another matter. It certainly is not a substitute for the IBM DOS handbook which treats each aspect of DOS in laborious and often impenetrable detail. If you already have the DOS handbook and are finding it difficult to work your way through, don't buy this book. It will add little in the way of understanding.

The problem with it is that it tends to talk about the various features of DOS without giving examples of how to use them.

In my opinion, there is only one way of becoming familiar with IBM PC DOS and that is to spend an inordinate number of hours making mistakes. There isn't any easy way. Most people just familiarise themselves with a few operating commands and then ignore the rest.

This text is devoted mainly to version 2.0 of DOS but does mention the additional aspects of version 2.1.

In conclusion, this book is better than having no handbook at all on DOS but it is not really all that helpful. (L.D.S.)

The myriad uses of a word processor

For anybody with only average typing skills and a tight schedule, a dot matrix printer driven by a word processor can be a saviour. Not only does it deliver accurate type but, because of its inherent versatility, its print can be visually exciting.

by JIM LAWLER

In days long passed, a good typist could make a quite attractive display page by using patterns of asterisks, hyphens, x's and zeros. There have been some spectacular creations done on a common typewriter and each one has been unique — difficult if not impossible to recreate.

As for typestyle, until the IBM Golfball machines came on the scene a typist was limited to one typeface and nothing else. Of course, there was variety — a choice of capitals or lower case. But there was no way to make bigger or smaller letters. Even the IBM could only change the shape of the letters. It could not print characters of different sizes.

With limited display capabilities and restricted typefaces, the typewriter was relegated to producing plain copy — something to convey information without any pretence. Matter that was to be read over and over or which had to catch the attention quickly was always passed to a printer, to be set in type and run off on a printing press.

Now, technology has caught up with the typist and a new machine has opened windows on a great vista of display writing. What is more, once the display has been designed it can be repeated many times. The technology is, of course, the dot matrix printer driven by a computer and word processor of one kind or another.

Dot matrix printers

The dot matrix printer came into its own with the advent of small, fast computers. It was developed to overcome the slow, laborious printout of the teletype machines which had been pressed into service to record the output of early computers. The dot matrix printer was not expected to give print quality equal to a good typewriter, but it was very fast and could be easily programmed to produce foreign characters or mathematical symbols.

To fill the need for high quality, computer-driven printout, the daisy wheel printer was developed. These could deliver "letter quality" type but were slower than dot matrix printers. Foreign characters and symbols could be produced, but only by stopping the machine and changing the daisy wheel.

As with most technological products, the Japanese took the development of both kinds of printer to a very high level. The dot matrix printer, because of its inherent versatility, has been able to produce printed matter of almost limitless variety. Driven by a suitable computer program, a dot matrix printer can produce halftone photographs, line drawings, graphs, charts and many different styles of type matter.

This article will not dwell on these more professional uses of the dot matrix printer. Instead, it will attempt to show how the machine can be used with a personal computer and a middle level word processor in domestic or community service.

Our computer is a BBC Model B (32K) fitted with a Computer Concepts "Wordwise" word processor in ROM. The printer is a Star Gemini 10X and storage is on dual 5¼-inch floppies. Our system is patterned on those used in the high school and college attended by my sons. We chose this so that their school work might be further developed at home.

The word processor and printer were chosen to assist my work as State Secretary of The Electronic Technicians Institute of Australia (TETIA). My post with the Institute generates quite a lot of correspondence and these letters once took me many hours each month to type out on the old Remington.

This is an example of the way I prepared material for the Newspaper classified advertisement. The word processor counts letters and spaces up to 36 characters and if this falls in the middle of a word, the program puts that word into the next line. It then adds spaces to the line it is working on, up to the total count of 36 characters. This

differs only slightly from the Newspaper letter count. The difference comes about because Newspapers use proportional spacing - ten i's in a row take less space that ten n's. A dot matrix printer gives the same space to every letter.

differs only slightly from newspaper counts. This is because the press uses proportional spacing - ten i's in a row take less space than ten n's. A dot matrix printer gives the same space to each letter.

The two versions of the second half of this paragraph show you how a slight change of wording can save you two whole lines, if you are aware that a change is needed.

First class typing

I am not a trained typist. If I try to type quickly I make too many mistakes and corrections to more than a couple of errors on a page makes it unacceptably messy — it has to be typed over again. Now, with the word processor I can type as fast as I am able. I correct each paragraph on the monitor as I complete it, and then check the entire document just before printing. Hopefully, it will print out free of errors and look as though it was done by a first class typist.

A useful trick with a word processor is the "Search and Replace" function. This allows the user to find every occurrence of a particular word or symbol anywhere in the document. If necessary, it can be replaced instantly with a new word or symbol.

I was writing an article about programming a computer and I used the word "programme" throughout. My younger son said: "Dad, you don't use the French spelling of program in reference to computers. It's always the American spelling — 'program'." So, using Search and Replace I changed every "programme" into "program" so quickly that I didn't see it happen.

There is a variation of this Search and Replace function. It is "Move Marked Text". In fact, this paragraph was written after I had reached the end of the article. I completed the paragraph, checked and corrected it, then marked the start and finish. When I was satisfied, I scrolled back through the article to the place where I wanted the new paragraph. A touch on the "Move Marked Text" key and the new material appeared as if by magic.

Another part of my job with the Institute is the production of a monthly newsletter. This has always been done on the Remington and the most adventurous display unit that I had been able to devise was my "end of paragraph" device —°o°—. I did not consider its display capabilities when selecting the Gemini but I didn't take long to find out just what it could do. From the first edition after the Gemini arrived, the pages of the Newsletter started to take on a new look.

The paragraph titles were printed in "emphasised" face, a means of blackening the letters to make them stand out from the rest of the copy. The same emphasis was applied to any words that were of special importance. Quotations were made to stand out by being printed in italics.

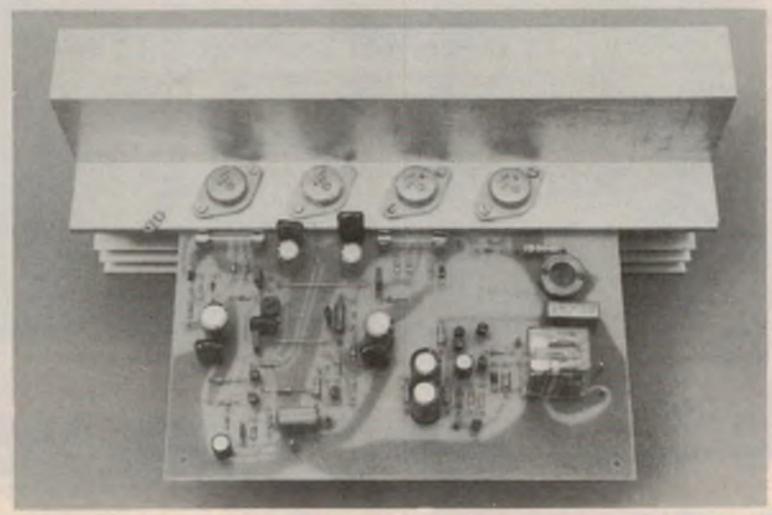
"Wordwise", and probably most other word processors, allows the lines to be set to any realistic length. They can also be justified on both left and right margins. Using these features I was able to produce copy in two columns down the page, rather than set typewriter style across the page. It worked very well and led to an interesting and very useful application of the system.

Newspaper classified ads are charged for by the line and each line is said to average four words. But counting words is not very accurate and the papers always seem to be able to squeeze an extra line or two out of any advertisement. The ads were to be run in a paper using "36 em columns" and this is very close to 36 letters per column.

I set the line length to 36 characters and turned the justification on. The printer then produced the adverts in exactly the same form as they were to

Next month in

Electronics Australia



Mosfet Power Amplifier Module

Based on the Playmaster Series 200 Amplifier, this Mosfet power amplifier module delivers 145W RMS into 8Ω and 225W into 4Ω at just .02% distortion. It features on-board loudspeaker protection and is easy to build.

12/230V AC 300VA Inverter

We've redesigned the 12/230V AC 300VA Inverter that was featured in our June 1982 issue. The latest version features auto-start, a toroidal transformer, full overload protection and a regulated output. It is housed in a plastic instrument case and is much easier to build than before.

Note: Although these articles have been prepared for publication, circumstances may change the final content.

Position Vacant

Would you like to work for *Electronics Australia?* We have an interesting position available for an engineer/technician to design projects for publication in the magazine.
The successful applicant will have a good grasp of the fundamentals of electronics and will preferably have printed circuit board design experience. An interest in computers and/or microprocessors would also be favourably regarded but is by no means essential.
Ideally, this position would suit a part-time student at the NSW Institute of Technology but you might also be a recent graduate or hold an E&C certificate. Study leave will be made available where appropriate.
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Word Processor

appear in the paper. It made obvious the words that did not fit easily into a line and gave me the chance to change them to get a more economical fit.

Anyone using classified advertising will gain real benefits by using the full facilities of a word processor. It is even possible to count lines by setting "Page length" to 10 or 20 lines. The copy is then printed in blocks for easy totalling. I have saved quite a few dollars in line charges by writing my advertisements on the word processor.

Display matter

As I learned more about the word processor and printer I became more adventurous with display matter. One application was for the production of an insert for a cassette recorded at a Town Hall concert. I wanted something that looked better than the card supplied with the cassette, and neater than a plain card with typewritten details.

The final arrangement came about only after much trial and error. As each stage was completed it was saved to disc and as work proceeded the insert began to look quite professional. The different type faces used (four in all) are called up by the use of embedded commands and it is important that each face called up is also turned off. Omission of an end command can make the following characters take on quite unexpected shapes.

These commands appear in colour on the monitor screen and they push aside the words on which they are to operate. This makes it difficult to know exactly where the words will be in the printout and the only way to be sure is to make frequent proof prints. As experience is gained the need for proofs becomes less but the user should not be surprised at unexpected results.

The newsletter mentioned earlier has always been printed on pre-headed paper but one day the inevitable happened. We ran out of newsletter headings and I had to do a quick design job on the word processor.

DERWENT
SYMPHONY
ORCHESTRA

IN CONCERT AT HOBART TOWN HALL
Saturday December 8TH 1984

Conducted by Robert Frero

with Carol Griffiths (clarinet)

D S O FRERO, GRIFFITHS.

1 Overture "The Thieving Magpie" (Rossini) 2 Clarinet Concerto in A major.(Mozart) 3 Arrangement for wind ensemble of pieces from Anna Magdalena's Keyboard Books. (Bach) 4 Movements from "Copelia" (Delibes) 5 Pomp and Circumstance March No1. (Elgar)

The word processor can be used to design labels for blank audio cassettes.

To begin, it was necessary to lay out the required design and to allocate the typefaces to be used. I then drew up on 1/10 inch graph paper the exact position to be occupied by the words in the heading. On graph paper it is easy to allow appropriate space for words that are to appear in normal, double width or condensed mode.

(I am afraid that metric purists will have to get used to working in inches. Most printers and word processors come from Japan via the USA or the United Kingdom, both of which countries are still using Imperial measures. Printers deliver 10 or 12 letters per inch, and 6 lines to the inch.)

The word NEWS on the right of the heading is built up line by line, using spaces to position the asterisks. This was difficult on our equipment because we can't edit in the 80 column (or full page width) mode. Each 80 character line in the printout is displayed as two 40 character lines on the monitor, so it is hard to tell exactly where the characters are after the first 40 letters or spaces.

Another problem is that 10 "condensed" letters only count 5 spaces in the printout and conversely, 5 "double width" letters count for 10 spaces. Thus 80 characters in condensed mode will only fill half a line, while a line is only 40 characters long in double width style.

Even the spaces between words count for half or double width if they fall between the typeface "on" and "off" commands. Outside the commands the spaces default to normal width. Keeping track of these differences is much easier if the layout has been designed on graph paper before starting.

I have made several versions of this heading, using other characters in place of the asterisks. This is very easy with the "Search and Replace" function. I had only to tell the computer to change

Continued on page 116

```
TETIA.                                                *     * ****  *        *  ****
THE ELECTRONIC TECHNICIANS INSTITUTE OF AUSTRALIA.    **    * *     *        *  *
                                                      *  *  * ***   *   *    *  ****
TESA.                                                 *    ** *      *****      *
TELEVISION & ELECTRONIC SERVICES ASSOCIATION.         *     * ****    *  *    ****
tasmanian divisions
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This standard heading was designed for TETIA newsletters.

A dot-matrix printer with letter quality output

Printstar 5025 multimode printer

To most people, a dot matrix printer is the second best choice. They would prefer a Daisywheel printer, because its output is so much easier to read. However there are now dot matrix printers which can give letter quality standard in a variety of fonts while still being able to operate at high speed. One of this new breed is the Printstar 5025.

by LEO SIMPSON

Most dot matrix printers have just nine pins to produce a character which is eight dots high for capitals and which has true descenders for lower case characters such as p, q and y. In other words, the character can occupy a maximum 7 x 8 grid within an 8 x 9 dot matrix field.

Some printers do not do this well and may use only eight pins (or only one, in the case of uni-hammer printers). These latter types do not have true descenders for lower case letters.

The big problem with dot matrix printers is that the dots which make the individual letters on the printed output are generally all too obvious. As a result the reader tends to see the dots rather than the letters. It's rather like not being able to see the trees for the wood. Dot matrix printout is really not very legible.

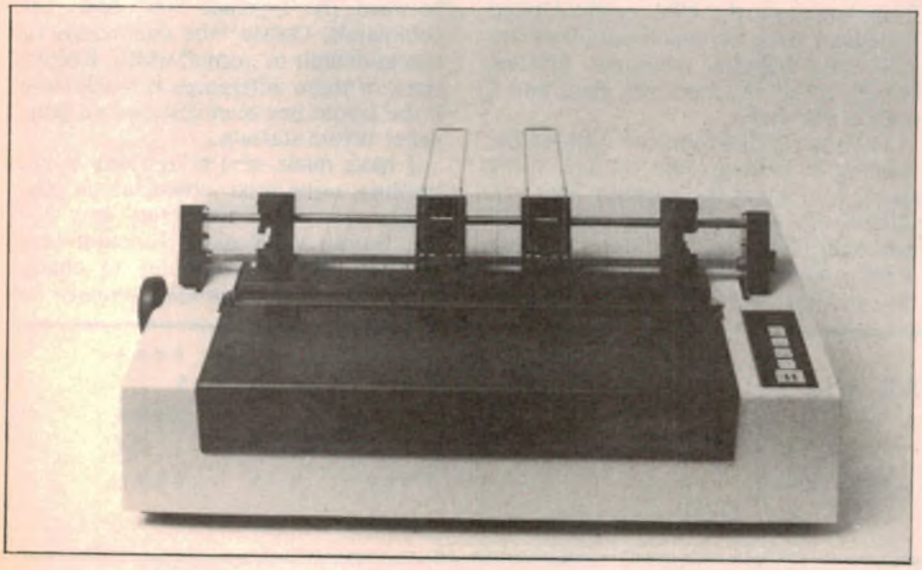
A number of more expensive dot matrix models have been produced in an attempt to overcome this problem. They can produce near letter quality (NLQ) output in different fonts by using a triple-strike mode. This means that the printhead has to traverse the same line three times to produce a printout in which the dot structure is not obvious.

This is an effective way of obtaining highly readable printout, but it does slow the printer considerably, to the point that it may be no faster than a typical Daisywheel printer. And it is even slower when bold or enhanced printing is called for.

Of course, such printers can still have an advantage over a Daisywheel printer because they can produce a variety of fonts (without the need to change print-wheels) and can still print very fast in the normal dot matrix (single pass) mode. This is often referred to as the "draft quality" mode, since it is good enough to read as the first draft of a report or business letter.

Now there is another development in the dot matrix printer field which means that you can have very good quality printout while still having a printer which operates at high speed, in all modes. These new printers have a 24-pin print head.

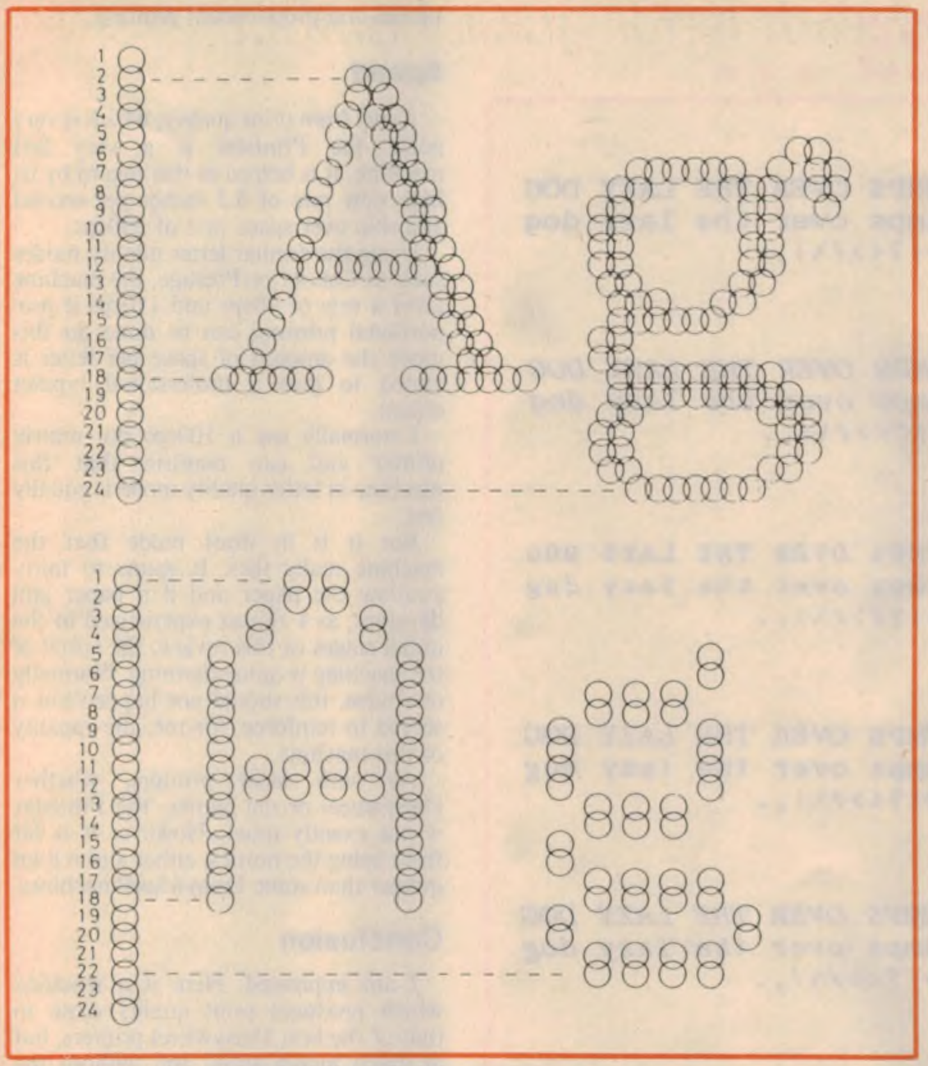
The 24 pins are arranged in a vertical line in the print head. The print head is traversed across the paper in very small increments so that the dots, which are very small to begin with, overlap. This means that you have to examine the printout very closely to detect the minute dot structure. Just how obvious it is depends to some extent on the quality of the paper and the state of the printer ribbon.



The Printstar 5025 is equipped with a tractor feed mechanism as standard.

The NDK Printstar 5025

The Printstar is a fairly large and heavy machine with overall dimensions of 580mm wide, 150mm high and 390mm deep. It weighs 15kg. Styling of the unit is conventional and the off-white finish of the plastic case is a close match to the IBM PC.



This diagram shows how the 24-pin printhead produces its output.

Some degree of noise suppression is provided by lining the case of the unit with foam rubber and the close-fitting perspex cover for the print head and platen. The original four rubber feet of the unit appear to have been supplemented (by the local distributor) by a continuous rectangle of soft rubber, which attenuates noise transmission to the supporting bench or desk.

The machine is based on an 8086 microprocessor and is claimed to be compatible with all known computers using serial or parallel interfaces, plus all software for the IBM PC or Qume type printers. It comes as standard with a Centronics parallel interface but can be supplied with an alternative serial RS232C and 20mA current loop interface. In the latter case, the data rate can be set from 50 to 19,200 baud.

The printer buffer is 400 characters standard but can be expanded to 16.4K.

User controls

On the righthand side of the case is a small panel carrying four membrane switches, two thumbwheel switches and a number of status indicators. The power switch is on the back of the unit as is the case with most printers and an inconvenient place it is too, since (as with most printers) it is often necessary to switch the unit off and back on, to initialise it.

The four membrane switches are Select, Line Feed, Top of Page and Ctrl (control). The first puts the printer on or off-line to the computer. The Line Feed and Top of Page switches only work when the unit is off line.

Pressing the Line Feed and Select switches while the power is turned on puts the unit into a self-test mode, which prints out an internal character set — complete with a zigzag graphic pattern. This test is actually a bit of a trap because it requires 15-inch wide paper, otherwise the unit prints onto its platen. This only becomes clear once you have done it, since it is not warned against in the manual!

The Ctrl switch is used in conjunction with the three other switches to set the print mode, form length and form length/top margin. Normally though, this should not be necessary if the unit is used with software which allows standard Escape sequences to be "embedded" in the data (ie, not visible on the computer screen but recognised by the printer).

The two thumbwheel switches are used to select the page length and the font mode. The modes possible are Courier 10, Prestige 12, Bold PS, Draft, Courier 10 italic, Prestige 12 italic, Bold PS italic, Compressed mode, and subscript. All except the last are shown in the sample printout on page 97 of this review. Other print modes are possible, as explained later.

There is also a "paper out" indicator and an error status indicator which lights up as 1, 2 or 3, or combinations of the three. A table in the owner's manual allows initial trouble-shooting in the event of a malfunction. When a status indication does occur, the printer is taken off-line and an alarm sounds for about one second.

The Printstar is equipped with a friction roller (ie, platen) and tractor feed mechanism as standard. There is also an optional dual bin sheet feeder which is necessary for large batch jobs involving cut sheets.

As with most printers, the pitch of characters and line spacing can be varied. The Printstar can provide six, 10 or 12cpi (characters per inch) or uses selectable pitch which can be varied in 1/216-inch increments (under software control).

Similarly, line spacing can be set at six or eight lines per inch or selected in increments of 1/120 inch. (Note that this is different from some printers which increment in 1/48 inch steps).

The available character set includes the usual 96 ASCII plus seven national sets and the Greek and mathematical symbols.

Construction

Removing the case of the Printstar is an easy job, requiring the unfastening of four screws and the platen knob. You can't remove it completely though, as it remains tethered by the flat cable to the user control panel. But this is no hardship. If necessary, during servicing for example, the printer can be operated in this way, provided a microswitch sensor for the perspex print-head cover is disabled.

A large microprocessor board is housed under a steel cover behind the platen and below it is the switchmode power supply. Both are cooled via a 10cm fan which is agreeably quiet, especially so since it only runs intermittently. (It is drowned out by the noise of the fan in the IBM PC, for example).

There are two motors, both stepper types. One drives the platen while the other drives the print head back and

Printstar 5025 . . .

Courier 10

THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG
The quick brown fox jumps over the lazy dog
1234567890!@#$%^&*()+=!?<>/\|,.

Courier 10 italic

THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG
The quick brown fox jumps over the lazy dog
1234567890!@#$%^&()+=!?<>/\¦,.*

Prestige 12

THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG
The quick brown fox jumps over the lazy dog
1234567890!@#$%^&*()+=!?<>/\¦,.

Bold PS

THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG
The quick brown fox jumps over the lazy dog
1234567890!@#$%^&*()+=!?<>/\¦,.

Bold PS italic

THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG
The quick brown fox jumps over the lazy dog
1234567890!@#$%^&()+=!?<>/\¦,.*

Draft mode

THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG
The quick brown fox jumps over the lazy dog
1234567890!@#$%^&*()+=!?<>/\¦,.

Above are six of the available fonts from the Printstar.

forth, via a toothed rubber belt.

The print head itself is a fairly large affair which slides on a 15cm diameter chrome plated cylinder. The print head has a circular housing which is finned to aid heat dissipation from the 24 solenoid coils. Rated life of the print head is 100 million characters. That's equivalent to about 16,000 4000-word documents.

If you are unlucky enough to damage one of the pins (or needles, as they are referred to in the manual), they can be individually replaced.

The printer ribbon is a Mobius loop fabric cartridge as used in Diablo and other printers. Its rated life is two million characters. The ribbon itself may be renewed up to four times before the cartridge must be replaced.

Many of the more popular word processor programs such as Wordstar can be configured to suit particular models of printer. The Printstar renders itself compatible with many of these programs by providing an emulation of the Qume Daisywheel printer, the IBM PC printer which is a version of the popular 80-series dot matrix printers, or the Toshiba P1351 dot matrix printer. The last two emulations are important if you want to make use of graphics such as are involved in programs such as Lotus 1-2-3.

I did not bother with the graphics capability of the Printstar but was most interested in its print modes which can only be fully realised if a program such as Wordstar is fully customised to take advantage of them — or if the different modes are called up with Basic routines.

By either method, the Printstar offers a number of print modes in addition to those listed above. They include elongated, underlined and superscript modes and proportional printing.

Speed

Apart from print quality, which is very good, the Printstar is a very fast machine. It is helped in this regard by its high slew rate of 8.3 inches per second and skip over space rate of 300cps.

Using the regular letter quality modes such as Courier or Prestige, the machine gives a rate of 90cps and 110cps if proportional printing can be done (in this mode the amount of space per letter is varied to give a professional typeset effect).

I normally use a 100cps dot matrix printer and can confirm that this machine in letter quality mode is equally fast.

But it is in draft mode that the machine really flies. It seems to fairly swallow the paper and if a paper jam develops, as I almost experienced in the initial stages of this review, the speed of the machine is quite alarming. Normally of course, this should not happen but it served to reinforce, for me, the rapidity of this machine.

As with most printers, whether Daisywheel or dot-matrix, the Printstar is not exactly quiet. However it is far from being the noisiest either and is a lot quieter than some Daisywheel machines.

Conclusion

I am impressed. Here is a machine which produces print quality close to that of the best Daisywheel printers, but at much higher speed and without the need to change print wheels. It can change fonts in mid-sentence. For many businesses, it would be the printer for all occasions.

About the only real complaint I have is that the manual is not as helpful and as well set out as some others I have seen.

Recommended retail price for the Printstar 5025 is $2268 plus sales tax, if applicable. It is available from Datascape International Pty Ltd, 44 Avenue Road, Mosman, NSW, 2088. Phone (02) 969 2699.

THE NDK 5025. PUTTING OTHER PRINTERS OUT OF WORK.

You may not have realised it, but there is a quiet revolution going on in printers.

Users of mini, micro's, PC's etc. have, until recently, been forced to buy unique printers for their differing applications; a daisy wheel for word processing, a high speed dot matrix for EDP and, perhaps, a specialised printer for graphics.

Now, one type of printer can do the lot!

They are known as multimode dot matrix printers. And, of these, the NDK 5025 leads the field.

But, will it work with my system and do all my work?

Firstly, the NDK 5025 copies or emulates several well-known printers, enabling you to use it with your existing software. For word processing it looks like, and does everything that the popular Qume Sprint 5 daisy wheel can do. But at 90 cps – nearly three times as fast! For draft work it "burns along" at 180 cps. If you are using an IBM-PC then, with the flick of a switch, your NDK 5025 will emulate the standard IBM dot matrix printer. But, again, at much higher speed and quality. If you're into graphics such as Lotus 1-2-3, the NDK 5025 will emulate either IBM, Epson or Toshiba P1351.

What's its print quality like?

The NDK 5025 uses a 24 pin head to form the characters, which look as good as a daisy wheel! It also has built-in fonts (just like changing daisy wheels) including Courier 10, Prestige 12, Bold P.S., Draft, Italic, Sub Super Script, Compressed and Scientific. Special customer generated fonts can be down-loaded, too.

Is it flexible?

The NDK 5025 is a full-width printer with friction roller and tractor as standard. A dual bin sheet feeder and cut sheet guide are available as options to make your printing life easier.

If you are still not convinced, look at the names behind the printer. NDK is a famous Japanese company specialising in the high quality end of the printer market – more than 3500 units are installed throughout this country – while Datascape is Australia's leading independent specialised printer company with a nation-wide support system.

Price?

That's another reason why the NDK 5025 is putting all other printers out of work.

To find out more – mail your coupon NOW!

Mail coupon to:
DATASCAPE. The printer specialists.
Sydney office: 44 Avenue Rd., Mosman.
Tel. (02) 969 2699
Melbourne office: 27 Raglan St.,
South Melbourne. Tel. (03) 690 3622

DATASCAPE

YES. I would like to know more about the NDK 5025

Please ☐ Send brochure ☐ Have a rep. call

Name ....

Title ....

Company ....

Address ....

.... Phone ....

The type of computer we use is: ....

New Products...

Product reviews, releases & services

Audio Telex TX100 PA amplifier

Audio Telex Communications Pty Ltd are introducing a range of rugged public address amplifiers which run from 240VAC or 24VDC. The first of these is the TX100 which is rated at 100 watts continuous power output.

The TX100 is a large unit for its rated power output and appears to be the epitome of conservative design. The control facilities are straightforward, involving four microphone and two auxiliary level controls, bass and treble tone controls, plus a master level control.

The four microphone inputs are balanced and are via XLR sockets. The two auxiliary inputs and an output to a tape deck are via RCA sockets. One of the microphone inputs has a switchblade VOX facility which allows it to over-ride all the other input channels, including the auxiliary inputs.

Inside the unit, there are no less than three transformers: one for power, one as the line output transformer and one as an interstage transformer. The output transformer is driven in pushpull by four 2N3055 transistors and these are driven in antiphase by the interstage transformer. This may seem like an old-fashioned circuit configuration but it is very practical. The fact that the output transformer is necessary anyhow, to provide the 50, 70 and 100V output lines, means that the push-pull configuration is a good way of obtaining the desired power from a 24VDC power supply.

The use of transformers is also desirable as it provides a high degree of reliability under adverse conditions and automatically protects the speakers against DC damage in the event of an internal failure.

A large aluminium extrusion, which forms the rear part of the chassis, is the heatsink for the four power transistors. These are protected against shorts from collector (case) to chassis by a cover bracket.

The small signal stages of the amplifier are provided by readily available Fet-input op amps.

Dimensions of the unit are 420 × 133 × 330mm although the front panel is drilled to be installed in a standard 19-inch rack. Weight of the unit is a hefty 12kg.

We checked out the performance and can confirm that the unit was able to deliver the full 100 watts at less than the rated harmonic distortion of 2%. All the other specifications were also confirmed and are certainly adequate for a public address amplifier. The unit also has a particularly effective VOX circuit for the fourth microphone channel.

For those applications where a rugged and reliable PA amplifier is required the TX100 will fill the bill.

Recommended retail price is $575 including sales tax. For further information, contact Audio Telex Communications Pty Ltd, 1 Little St, Parramatta, NSW 2150. Phone (02) 633 4344.

Flexible printed circuits

Flexible printed circuits are increasingly replacing conventional wiring, cables, harnesses and wire wrapped circuits, in the electronics, appliance and automotive industries. They interconnect rigid printed circuit boards and terminal strips with components on any other level in a sub-system. Their flexibility permits optimum adaptation of the available space.

Modern flexible printed circuit technology allows production of passive components as resistors, capacitors, coils, fanfold coils, and shielding screens of differing types. The design variants permit standard line, fine line wiring, single-sided, double-sided and multi-layer flex circuits to be produced with a substantial saving in weight, space and cost.

Compared to conventional round wire harnesses and jumper cables the use of flexible printed circuit boards can cut assembly costs by up to 50%.

Lamron Pty Ltd has been appointed as the Australian agents for Omni Switch Inc and can now provide flexible printed circuits that meet or exceed the requirements of IPC TM-650, IPC FC-240C and IPC FC-250.

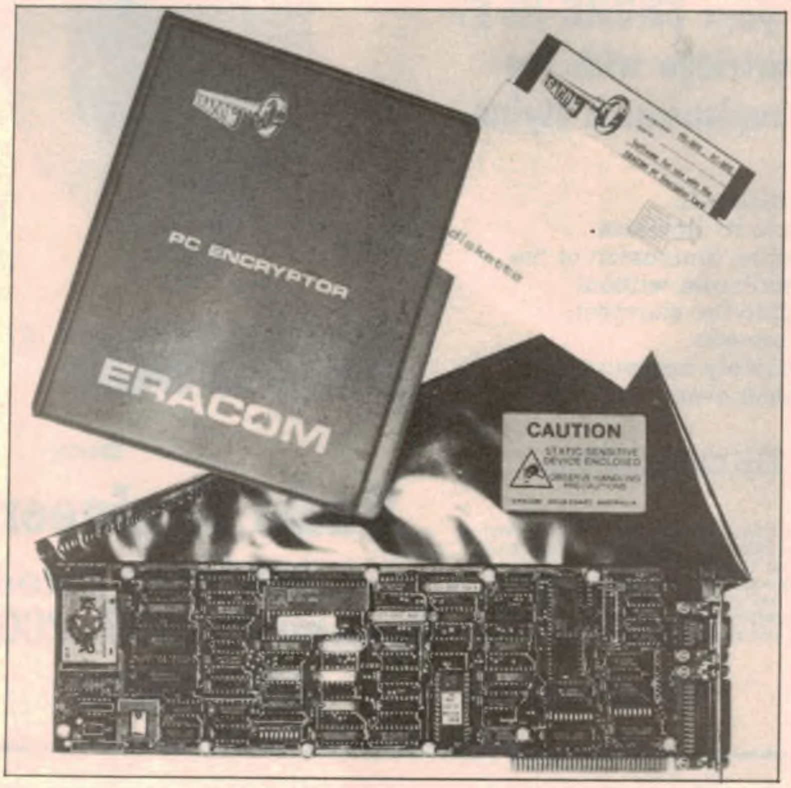
Lamron, PO Box 438, Ryde, NSW 2113. Telephone: (02) 808 3050.

New company deals in digital voice systems

Digital voice systems are now becoming an accepted business tool and are achieving widespread penetration especially in the United States and Japan. Their clarity of voice and reliability has already led to their use in the new areas of security control situations, warning alarms, customer advice on dispensing machines, medical equipment, annunciators in lifts, and as an advertising medium.

For more information contact Ectron, 8 Hinkler Rd, Mordialloc, Victoria 3195. Telephone: (03) 580 9677.

New Products...



Encryptor board for IBM PCs

The Eracom PC Encryptor Board provides encryption security for the operating system, program and data files on floppy or Winchester disk drives. It uses the Data Encryption Standard (DES) algorithm, implemented on a high speed integrated circuit chip, to perform encrypt/decrypt functions.

The PC Encryptor Board is designed for use with the IBM PC, PC-XT, Olivetti M24, and other IBM PC compatibles.

Eracom, Suite 11, Gateway Court, 81-91 Military Rd, Neutral Bay, 2089. Phone (02) 908 4177.

Overvoltage sensing circuits

Two new Motorola overvoltage sensing circuits offer a choice of power-supply overvoltage trip points ranging from 2.5 to 40 volts, and a number of alternatives for optimising system designs.

The first is the MC34061, which is a three-terminal device providing output current sufficient to drive the gate of a crowbar SCR. Overvoltage thresholds are set by means of an external voltage divider.

The second device is the MC34062 pin programmable overvoltage sensing circuit, which includes an internal user programmable resistive divider network, providing more than 120 different overvoltage trip points ranging from 2.5 to 39 volts.

The MC34061 includes a close-tolerance voltage reference, comparator

Australian power rheostats

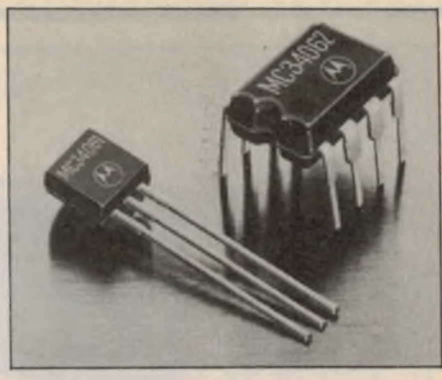
IRH Components have begun manufacturing the APR series of power wire wound rheostats in three power ratings: 25, 50 and 100 watts. Several special features are now available within the design: an "off" position for isolation of the rheostat, fixed tapping and solder or 6.3mm quick connect terminals. Resistance values down to 0.5 ohms are available in all three ratings.

For further information contact IRH Components, 32 Parramatta Rd, Lidcombe, NSW 2141. Telephone: (02) 648 5455.

and high current output. The voltage reference is a 2.5V bandgap type with tolerances of ±1.0% at room temperature and ±2.0% over temperature (a suffix device).

The internal comparator provides 250mV of hysteresis for improved noise immunity and positive threshold activation. The output stage is capable of sourcing up to 350mA, sufficient for even the largest crowbar SCR devices, and is current limited for device protection. The drain current is no greater than 1.5mA over its power supply voltage range (3.0V to 40V) and temperature range.

The MC34062 is functionally similar but also offers a pin-programmable resistive divider network. A six-resistor network provides the flexibility of programming more than 120 different overvoltage trip points ranging from 2.5 to 39V. This feature allows the user to stock only one device type to serve many different voltage sensing applications.



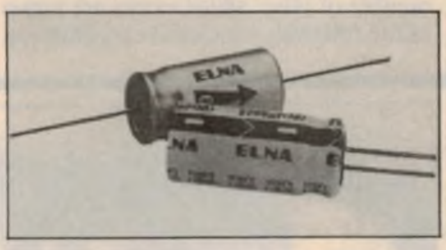
The MC34061 devices are packaged in a TO-92 case and are available in prime and standard grades specified over the commercial temperature range. The MC34062 series is available in commercial or military temperature ranges, and is packaged in plastic or ceramic 8-pin mini DIPs.

Motorola Semi Conductor Products, 250 Pacific Highway, Crows Nest, NSW 2065. Phone 438 1955.

Soanar electrolytic capacitors

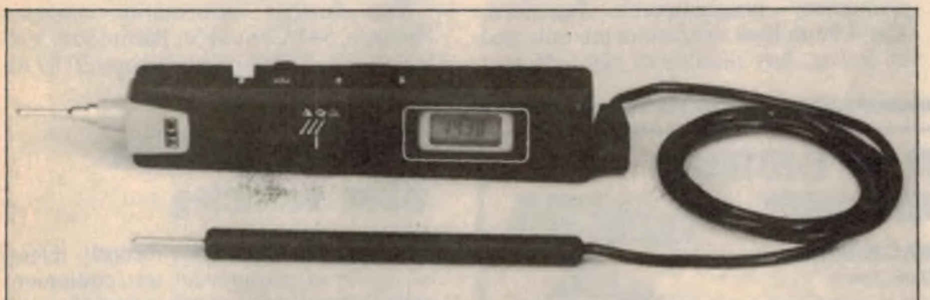
Elna have released through their sole Australian agent, Soanar Electronics, a new range of long-life electrolytic capacitors.

They are the "RK" (radial lead), the "TK" (axial lead) capacitors both of which have an extended operating temperature range of −40°C to +125°C. These extended life/temperature characteristics make the RK/TK electrolytics ideal for Telecom, military or similar applications as well as high temperature industrial and automotive requirements.



Standard tolerance is ±20% and leakage current is less than 2 microamps. The capacitors are available in the range 10 to 100 volts DC and $0.47\mu F$ to $1000\mu F$.

Full data including life-test reports is available from Soanar Electronics, 30 Lexton Rd, Box Hill, Victoria 3128. Telephone: (03) 895 0222.



YEW 2447 digital circuit tester

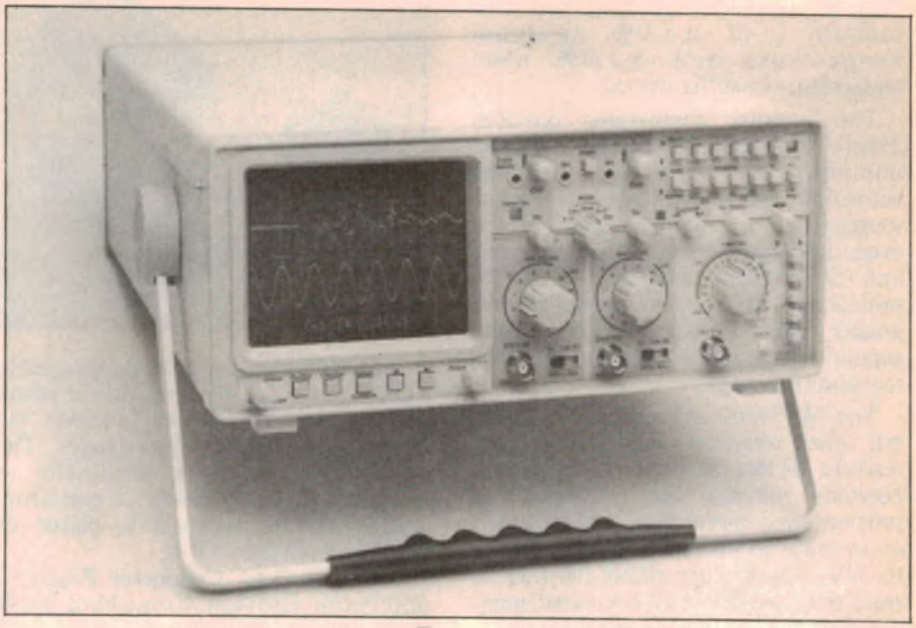
This new pocket multimeter features excellent integrated circuit design, two types of carry case and replaceable probe tips. Ranges include DCV 2-500V, ACV 2-500 V and resistance 2kΩ to 2MΩ. The instrument is low cost and has data hold and continuity test functions.

The instrument's size makes it ideal for routine checking, maintenance and field service use.

A detailed brochure on the YEW 2447 digital circuit tester is available from Parameters, 41 Herbert St, Artarmon, NSW 2064. Telephone: (02) 439 3288.

New Products...

Digital storage oscilloscope



Gould has added a new digital storage oscilloscope to the 1401 Series of compact, low-cost instruments which offers advanced measurement and interface facilities not normally found on instruments of this price level.

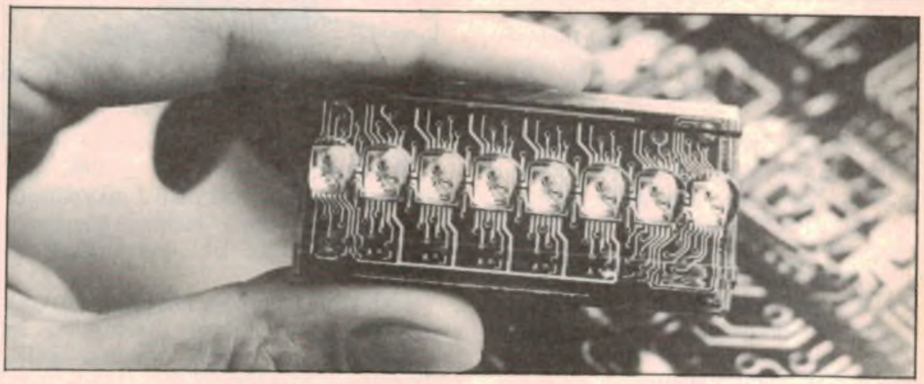
The new Gould 1425 is a 20MHz dual-trace oscilloscope which can function as a conventional real-time instrument as well as a digital storage instrument for both transient capture and high speed repetitive storage.

The Gould offers an RS432/RS232 compatible serial interface which allows data or commands to be read to and from an external computer for external storage, calculations or remote control.

The RS432 interface also allows stored waveforms to be copied out directly on a digital plotter. As a conventional 20MHz dual-trace, the Gould 1425 can be used in the real-time mode without corrupting the captured and stored traces. A number of other added extras are a part of this relatively inexpensive oscilloscope.

For further information contact Elmeasco Instruments Pty Ltd, PO Box 30, Concord, NSW 2137. Telephone: (02) 736 2888.

Intelligent and programmable LED display



Intelligent LED displays that are able to generate complete characters from simple signals have now been diversified to perform additional functions. The new PD 2816 from Siemens (eight 18-segment elements, 4.1mm) allows the user to have the characters flash or underlined and to adjust the display intensity. A CMOS circuit stores the program.

The electronics in the PD 2816 comprises the character generator (ROM), multiplex, timer logic and driver logic, and also the CMOS circuit for the supplementary programmable functions. The 4.1mm-high characters are enlarged by lenses. Any number of eight-element displays can be cascaded to form long lines of text.

For further information contact Siemens, 544 Church St, Richmond, Victoria 3121. Telephone: Sydney 436 8730.

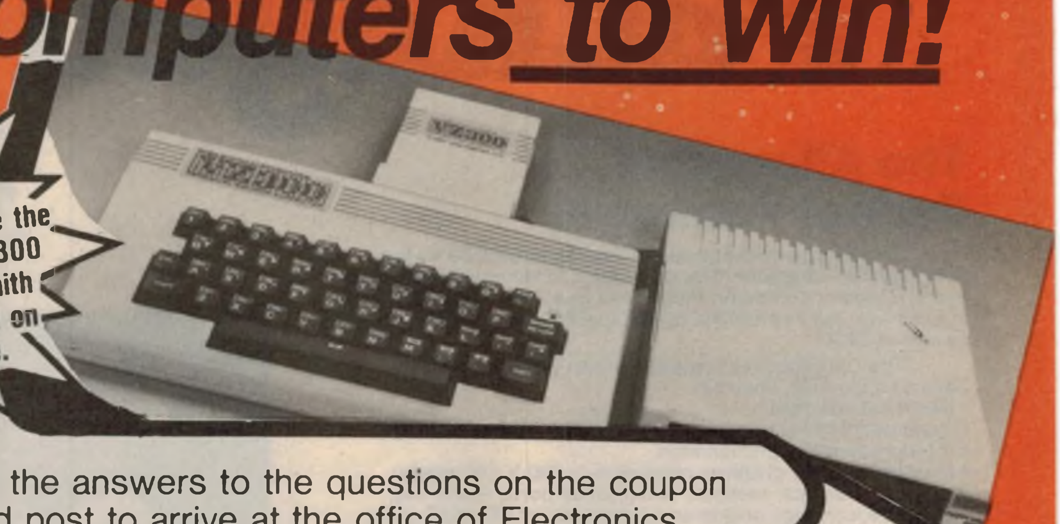
Test equipment for video servicing

Nicholson Electronics recently released a line of economical test equipment aimed specifically at the television and VCR service industry. It includes a picture tube tester rejuvenator, test tuner, shorted turns tester, zener diode tester, and VCR alarm to name just a few.

The equipment is designed and manufactured in Sydney and tested under actual service conditions. For further information contact Nicholson Electronics, 30 Brande St, Belmore, NSW. Telephone: (02) 750 8359.

Easy contest!

Five computers to win!



Just answer ten easy questions and you could be the winner of one of five VZ-300 computers from Dick Smith Electronics, as reviewed on page 42 of this issue.

Just fill in the answers to the questions on the coupon below and post to arrive at the office of Electronics Australia, PO Box 227, Waterloo, NSW 2017, by September 16th. The winners will be the five neatest correct or most correct entries.

1st PRIZE:

a complete VZ-300 system comprising VZ-300 colour computer with 32K RAM and 16K Basic ROM, Disk Drive, Disk Controller and box of ten DSDD disks, Four Colour Printer/Plotter and Printer interface

Total value $829.00

2nd PRIZE

3rd, 4th and 5th PRIZES VZ-300 COLOUR COMPUTER

Value of each $199.00

Winners will be notified by post shortly after the closing date and will be announced in the November 1985 issue of "Electronics Australia."

ANSWER THESE TEN EASY QUESTIONS TAKEN FROM THE CONTENTS OF THIS MAGAZINE:

1. How many video projectors are there in the Navy's new bridge simulator? . . . .
2. What is the clock frequency for the new VZ-300 computer? .
3. What is the normal output frequency of the MM5369EYRN? .
4. What is the secondary function of D1 and D2 in the circuit on page 65? . . . .
5. What is the purpose of Q1 in the Signal Tracer project? . . . .
6. What is one sure way to ensure stability in regulated power supplies? (clue: see article on op amps). . . . .
7. What is the highest print speed of the Printstar 5025 printer?
8. What forms of noise reduction are available in the Marantz CP430? . . . .
9. What is function of IC1a in the Capacitance Meter? . . . .
10. How far from the geographic South Pole is the magnetic South Pole? . . . .

Name . . . .

Address . . . .

. . . . Postcode . . . .

Packaged Cat

The Altogether. . . Perfect Package!

There's huge savings on the Packaged Cat! We've put it all together, computer, disk drive, etc. . . Everything you'll need in a personal colour computer! Plug it into your TV/Monitor and you're in business. Take advantage of this special package offer — you'll save over $230!

The Cat's the only computer at this price to give you advanced features, such as:
- 64K RAM standard
- Typewriter format with numeric pad and 81 full-stroke keys.
- 8 programmable function keys
- Maximum colour graphics resolution — 560 × 192 pixels
- Inbuilt Centronics, cassette, and joystick ports. PLUS Bus interface, cartridge socket and connector for RS-232C serial adaptor.

The Cat has an incredible range of software options. And it's also software compatible with most programs for the Apple II series. So there's no end to the availability of top quality programs! Take advantage of our special Packaged Cat - Save money! You'll wish you were home - so you could get the Cat out of the bag.

THOUSANDS SOLD!

Monitor shown not included in package

The Package

Cat Computer (Cat X-7500)	$699.00
Disk Drive (Cat X-7505/6)	$349.00
Disk Controller (Cat X-7510)	$149.00
R.F. Modulator (Cat X-7550)	$34.90
Usual Cost	$1231.90

Package price save over $230! $999

New Cat Software

GHOST BUSTERS. Cat X-7701. Paranormal activity. Laser stream throwers. The Temple of Zuul. A zillion ghosts! **$39.95**
ULTIMA II. Cat X-7709. Travel through space and time in this masterpiece sequel to Ultima. **$79.95**
PRINT SHOP. Cat X-7710. Automatically designs and prints greeting cards, stationery and banners. **$74.95**
LODE RUNNER. Cat X-7711. Spellbinding action as you recover the Bungeling booty. 150 different puzzles & screens! **$49.95**

Cheap software — limited stock! $19.95 each

THRESHOLD. Cat X-7703. Space game - pilot the Federation fighter.
APPLE CIDER SPIDER. Cat X-7705. Perils in the cider factory
SAMMY LIGHTFOOT. Cat X-7707. Challenge on the trapeze.
MR. COOL. Cat X-7708. Hot new game - hop to avoid the heat!

Dick Smith Electronics Pty Ltd

COMPUTERSTOP ™

B000A

REVIEWS OF RECENT

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TCHAIKOVSKY

Symphony No. 2 "The Little Russian." Tone poem "The Tempest". Chicago Symphony Orchestra conducted by Claudio Abbado, CBS Masterworks. Digital Disc IM 39359.

While Tchaikovsky's Fourth, Fifth and Sixth symphonies remain favourites in the concert repertoire, the Second is largely neglected. This is understandable because despite radical revisions by the composer it remains, except for the brilliant finale, a less than engaging work.

It is the most immediately Russian-sounding of all the symphonies, using many folk tunes with the finale a brilliant example of what a genius can do with a couple of simple tunes. The end of a Ukrainian folk song, The Crane, in the finale prompted one critic to nickname the symphony, The Little Russian.

Tchaikovsky wrote most of the symphony while staying in the Ukraine where he was surrounded by native folk music. The work even received a warm reception at first from public and critics alike but interest quickly faded and Tchaikovsky put it aside for later revisions. He wrote after the first performance: "I am not altogether satisfied with the first two movements but the finale on the Crane theme goes admirably."

He left the finale intact after revising the rest of the work six or seven years later. Before this he had described it as "my mediocre, immature symphony".

The first movement starts with a lovely melancholy horn solo repeated on the cor anglais — all very Russian. As it progresses it grows more and more impassioned with the digital dynamic range wide but well within comfortable listening. The sound has much depth with all detail easily spotted.

The second movement is more gentle, with the ending fraying beautifully into silence. The third movement is splendidly rhythmic and the reading of the whole work is always refined without gusty passion. But it is the finale that makes the work. It starts delicately, then builds up into real excitement with variety given by the big changes in tempos, harmonies and rhythms. By any standards it is a masterpiece.

The tone poem on Shakespeare's The Tempest is less alluring. It is not among the composer's best compositions and lacks the immediate attention-grabbing of Romeo and Juliet and Francesca da Rimini. There is much padding of the storms and sea bits and according to the brief program in the sleeve notes it is as episodic as Elgar's Fallstaff. But the finale of The Little Russian more than compensates for any shortcomings elsewhere in the disc. (J.R.)

STRAVINSKY

Le Sacre de Printemps (1921 version). Symphonies for Wind Instruments. Symphony Orchestra of Montreal conducted by Charles Dutoit. Decca Digital Disc 414 202/1.

This is the 1921 version of the Sacre and not the slightly revised edition of 1947. This means that you have a performance scored as it was for the boisterous reception it received in the Theatre des Champs Elysees on May 29, 1913. Dutoit's bold reading helps one to understand just what the ruckus was all about.

It is now well known that at the premiere of the ballet the audience degenerated to a rabble, showing their disapproval by blowing on whistles, shouting, stamping and, in a few cases, fighting during the performance. Dutoit's performance puts the whole score into one's lap with all its obtrusive dissonances in brutal evidence.

There is also Stravinsky's insistence on pugnacious rhythms in a work that for the first time emphasised this aspect of a musical work. He emphasised the primitive side of the composition by using the unrelenting rhythms without changes of harmony. The result is a physical pounding on the audience's senses. And this after a short time added to the Paris audience's displeasure and ultimate discomfort.

Dutoit puts all this right under our noses. The rhythms pound, disonnances grate and the whole adds up to a graphic picture of a pagan Russian rite which ends with a sacrifice of a virgin. The rhythmic stamping is quite wonderful, the linear complexities admirably clear, and the orchestra plays with spendid enthusiasm, but the line always remains audible. Much of this is due to the clarity of the recording.

The changing moods of the different sections are always defined, leading up to the final frenzy. There have been many fine performances of the Sacre recorded from time to time but this is the rawest, most pungent I have ever heard. Identification with it can be quite exhausting.

The Symphonies for Wind Instruments on the reverse side is a miniature relation to the Sacre. It is scored for a smaller combination and its impact is much slighter. But its likeness is unmistakable.

This too is admirably played and recorded and emphasises Stravinsky's reluctance to use large intervals. Indeed it is often difficult for him to leave a main note in a phrase. He once advised a pupil "Be sparing of intervals, my boy. It will pay dividends."

One small additional item — the 1910 Matisse painting, The Dance, on the record cover is as arresting as the contents. (J.R.)

LISZT

Totentanz. Dance Macabre. Malediction. Hungarian Fantasia. Jorge Bolet (piano) with the London Symphony Orchestra conducted by Ivan Fischer. Decca Digital Disc 414 079.

Jorge Bolet brilliantly solves the demonic difficulties of the Totemtanz in this Liszt recital. But despite its legion of technical problems it is not one of the composer's most attractive works. It has, however, one great virtue — it is very prophetic of the course of music which followed its creation.

But one tires of the overworked

version of the plainsong Dies Irae, despite its many ingenious disguises. Bolet tackles everything with supreme confidence — rightfully so it transpires. His technique dazzles. And the orchestra under Ivan Fischer is great too although there is much reverberation at the beginning of the disc which disappears later. I should like to mention specially for praise the overblown horns in the hunting variation.

The title of the Malediction is misleading. It is not all a curse — the word Liszt wrote at the beginning of the score. Other signals are pride, mockery, tears, anguish and dreams, all of which suggest a wider degree of interest. Among the usual 19th century rhetoric one comes across an occasional bar of startling modernity and there is a short flourish after the opening phrase unheard thereafter until the advent of Stravinsky's Petruchka.

Neither works are heard much nowadays. Not so with the Hungarian Fantasia. When I was a boy, a Norwegian pianist, Arthur de Greef, used year after year to make a round of the recital halls with only four pieces — the two Liszt piano concertos, the Grieg and this Hungarian Fantasia. He may have had other pieces in his repertoire but nobody ever heard them.

The Fantasia belongs to the sequence of Hungarian Rhapsodies and uses some of their themes. It offers some fascinating ambiguities of key and the sound is a litle reverberant but otherwise it offers no listener difficulties. The fast repeated notes are played without falter. Indeed I cannot imagine it played better, even by the legendary Liszt himself. (J.R.)

STRAVINSKY

Suite from The Firebird. Suite from Pulcinella. Israel Philharmonic Orchestra conducted by Leonard Bernstein. DGG Digital Disc 415 127/1.

I found this profoundly disappointing. It is the 1919 version containing only a small part of the riches of this lovely score. Only the Firebird's Dance, the Ronde des Princesses, Koschei's Dance, the Berceuse and the final Chorale are included.

The orchestration was revised by the composer adding a few bars and removing such bizarre instruments as the surrusaphone and others.

The orchestration is fine; the playing is not. The most important irritant is the slow, dirge-like tempos used by Bernstein. They are quite alien to the ballet. Any hapless dancer caught trying to dance to them would have to spend most of his time in mid air. It is an example of wilful self indulgence rarely met in leading conductor's today.

The sound, though beautifully clear suffers from inaudible pps and ferocious ffs. To compensate for this, a vast number of orchestral details are easily audible. But anyone failing to turn down the gain for Koschei's Dance is courting deafness.

The musicians beautiful playing is wasted on such a miserable interpretation. Not long ago a leading Sydney ballet critic told me she had never seen the Firebird. What a sagacious opinion she offers her readers!

The strong rhythms are resolutely handled, giving a hint of what was likely to happen later in Petrouchka and, later still, in the Sacre, that symphony in rhythm. Firebird was the first of the three great ballets composed between 1909 and 1913 for Diaghileff.

It is an intensely lyrical work entirely different from that pugnacious rhythmic attack of the nerves, The Sacre du Printemps. Unfortunately, most of the lyricism disappears under Bernstein's dirge-like tempos. Indeed the whole exercise is a typical example of Bernstein chutzpah.

The Pulcinella Suite, on the reverse, is much more generously chosen, being almost complete. Finished in 1920 it shows many of the hints leading up to the composer's neo-classical period. It is a reworking of pieces from various sources, all of which Stravinsky mistakenly attributed to the early 18th century composer Pergolesi. A few of them were genuine but many were not.

However, the suite remains light-hearted and makes considerable demands on the orchestra, especially the first double bass.

Bernstein's studied playing robs it of much of its wit. His soulful strings are far from being in tune with the period. The whole reading is deadpan and humourless. How Stravinsky would have hated it.

On his only visit to Australia he mentioned to me how difficult it was to find an orchestra where the strings could play without vibrato. There are several superb recordings of Firebird and you'll do better elsewhere. (J.R.)

Records & Tapes

DEVOTIONAL ALBUM

Joyce Lansdorf: "For people who don't hear the music anymore". Stereo LP, Word SPCN7-01-893110-X. (From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135. Phone [03] 729 3777.)

I may have been unobservant, or just forgetful, but this is the first album from the Word organisation that I can recall as being endorsed "Digital".

And it shows: the tracks on each side abut so unobtrusively that each group can be played, as intended, as a continuous performance. More than that, the sound is smooth and clean throughout, with no sign of "edge" on the more complex orchestral passages — a failing that can all too easily compromise music that is intended to be restful.

According to the jacket notes, vocalist Joyce Landorf suffers from constant pain which can, at times, create an overwhelming sense of loneliness.

At such times, she has experienced great help from music that reminds her of "God's merciful love" and, in this album, she presents 10 devotional songs — some her own — which she feels may help other sufferers. The titles:

In the Stillness of the Night — Short Cut Home — Where Are You? — Falling — I'll Keep My Eyes on You — 'Til You Hear the Music — I Need Thee Every Hour — Your Dear Face — Blessed Assurance — He Is Able.

Diction is about average but it is an album that could well have carried the lyrics on a separate sheet.

Produced and conducted by Kurt Kaiser, the sound is appropriately smooth and restful, and likely to be especially appreciated by those it is intended to help. (W.N.W.)

BITTER & SWEET

Roger Whittaker: "Take a Little — Give a Little". Stereo LP Tembo/RCA VPL-16686.

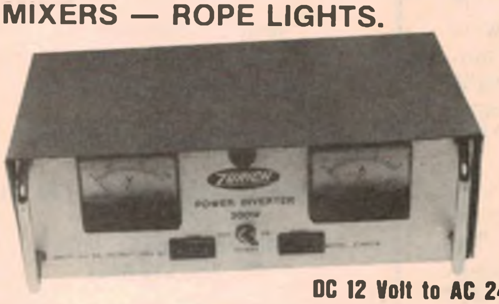
Be warned about possible confusion if you go looking for this album, as well you might. The title on the jacket is as above: "Take a Little — Give a Little", from Tembo Records. But, on the label, RCA Victor takes precedence and the title is shown as "Bitter and Sweet" — the lead track on side 1.

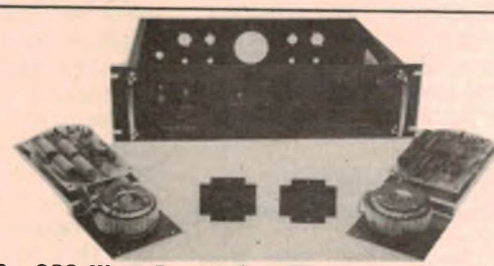
If the 1984 copyright mark means anything, these are all recent tracks, and they certainly sound that way. From the outset I couldn't help but notice the frequent similarity in voice and diction between Roger Whittaker and our own Kamahl and this was emphasised when someone walked in and inquired whether I was reviewing a new Kamahl album!

Be that as it may, Roger Whittaker offers 11 pleasant middle of the road songs with melodic, well arranged accompaniments that will please those who prefer songs written in the way that they used to write them! The titles:

Bitter and Sweet — Brave and Strong — Dover to Calais — Old Mother Nature's Garden — Happy Everything — Boogaloo, Bossanova & Rock'N Roll — Take a Little, Give a Little — Mary — So Far (Safari) — Charlie Mahon — My Silver Eagle.

The sound quality is agreeably clean and smooth. (W.N.W.)





INSTRUMENTAL & SONG

The Petra Youth Choir Collection. Arranged by John Lee. Stereo LP 7-102-05686-9. From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic. 3135. Phone (03) 729 3777.

If I can venture a free translation, Petra might be taken to mean "Dwellers in the Rock", which would accord with the claim that the lyrics of their songs are "literally filled with truths from God's word". But I can only attribute to

Continued on page 111

SENTIMENTAL MOOD

Sylvia: "Surprise". Stereo LP Album. RCA Victor APL1-4960.

This new Sylvia album is "Surprise" by name and a surprise by content. It opens with a driving "Give 'em Rhythm" and one tends to assume that the remaining tracks will be in similar style. But, instead, Sylvia reverts to a predominantly sentimental mood, with lush, rhythmic backing of the Nashville kind. The titles:

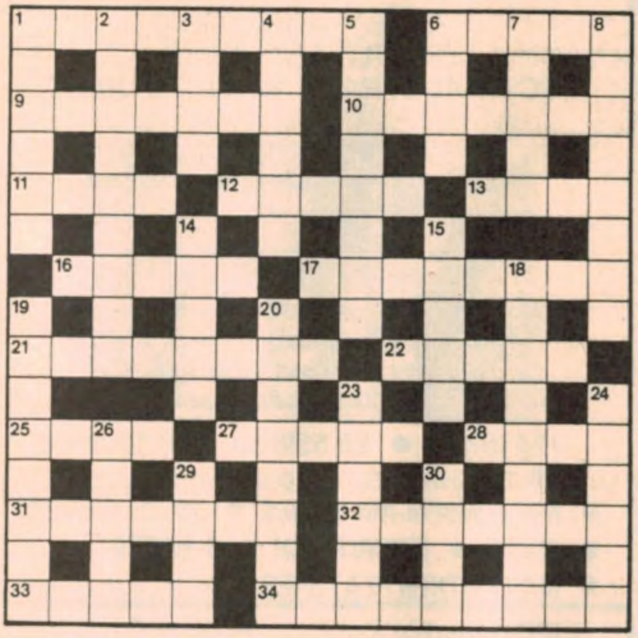
Give 'em Rhythm — Unguarded Moments — Victims of Goodbye — Isn't It Always Love — Love Over Old Times — I Just Don't Have the Heart — One Foot on the Street — On the Other Side of Midnight — Surprise — It's Still There.

While the end result is very listenable, it owes much to the Nashville "backing" industry. Sylvia provides the solo voice, and a basic instrumental group the rhythm with keyboards, guitars and percussion. But then comes the Nashville treatment, with a chorus including the Cherry Sisters and the Jordanaires, the Nashville String Machine, pan-pots, echo, reverb and sundry other electronic wizardry. But, as I said, the end result is very listenable. (W.N.W.)

AUGUST CROSSWORD

ACROSS

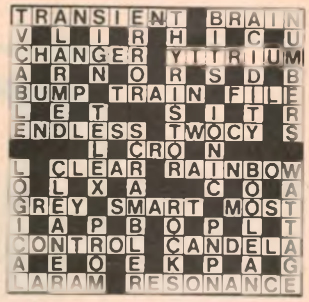
1. Dielectric. (9)
6. Gray, BCD, Baudot, etc. (5)
9. Distant sources of electromagnetic waves. (7)
10. Prepare programs, crosswords, etc. (7)
11. Solder parts together lightly. (4)
12. Flux. (5)
13. Electrical maximum. (4)
16. Component of an alarm system. (5)
17. Inventor of the discharge tube. (8)
21. Resistor. (8)
22. Spurious signals. (5)
25. Transistor. (4)
27. Control area in electronic equipment. (5)
28. Type of antenna. (4)
31. Conducting systems. (7)
32. Single-circuit switch. (3,4)
33. Former observational satellite. (5)
34. Early source of coherent radiation. (4,5)



DOWN

1. Type of diode with microwave application. (6)
2. Said of good tuners and their astute buyers. (9)
3. Component of a simple electroscope. (4)
4. Checked operation of a device. (6)
5. Integrated communication unit. (8)
6. Kind of filter. (4)
7. Disk module. (5)
8. Transducers. (8)
14. Respond to a stimulus. (5)
15. Nobel Prize-winning inventor of the mass spectrograph. (5)
18. Name of figure resulting from sinusoidal interaction. (9)
19. Activities featured in Electronics Australia. (8)
20. Adjustable reactor. (8)
23. No gain, no loss . . . (4,2)
24. Having a uniform input-output relationship. (6)
26. Alterable memory. (5)
29. Circuit problems. (4)
30. World-famous laboratories. (4)

SOLUTION FOR JULY



Records & Tapes

Continued from page 109

somebody's sense of humour the name of their support organisation: "Petrafied Productions"!

As listed for this recording, the Group comprises seven singers and seven instrumentalists playing piano, keyboards, synthesiser, bass, guitars, drums and percussion.

In keeping with their specialised youth ministry, the emphasis is on contemporary devotional songs, presented in the contemporary manner.

I gather from the jacket that a choral book and accompaniment tapes are available through the Word organisation, so that the album could be of particular interest to aspiring church groups who are on the look-out for material and an example of how best to present it. The track titles:

Doxology/Praise Ye the Lord — Why Should the Father Bother? — Never Say Die — Not of this World — More Power to Ya — Godpleaser — Stand Up/Lift Him Up — The Coloring Song — Grave Robber — Not By Sight — Road to Zion.

With material like this, a lyric sheet would have been helpful but, more to the point, the presentation combines a sense of sincerity with professional musicianship. The recording quality, too, is well up to standard. (W.N.W.)

ARABIAN NIGHTS

Rimsky-Korsakov: Scheherazade. Glinka: Russlan and Ludmilla Overture. Played by the London Symphony Orchestra, conducted by Loris Tjeknavorian, with violin soloist Irvine Arditti. Varese Sarabande compact disc VCD-47208. From P.C. Stereo Pty Ltd, PO Box 272, Mt Gravatt, Qld 4122. Phone (07) 343 1612.

Inspired by contact with Balakirev, Mussorgsky and Borodin in the early 1860s, a young Russian naval officer cadet cum musician, Nikolay Rimsky-Korsakov, toiled to compose his first symphony during a three-year tour of duty at sea. It was an unhelpful environment but one that nevertheless provided a rich background, 20 years later, for what proved to be his most popular composition, the symphonic suite "Scheherazade".

It is based on the story of the cruel Sultan Schahriar, who had so little regard for the fidelity of women that he had sworn to execute each of his wives on the day following the nuptial night.

But he reckoned without the beautiful and resourceful Sultana Scheherazade

who determined to captivate his interest by recounting for a thousand and one nights diverting tales borrowed from anywhere she could find them.

The Suite opens, fortissimo, with the Sultan proclaiming his cruel sentence but, almost immediately, the Sultana's beguiling theme is heard as she begins the story of Sinbad, to the sound of water lapping gently against the sides of his small wooden ship (the first movement).

From time to time, the Sultan becomes restive as he remembers his commitment but, nothing daunted, Scheherazade carries on with the story of the Kalandar Prince (second movement) and of The Young Prince and Princess (third movement). But it is the Festival of Bagdad, the Sea and the ultimate Wreck of Sinbad's Ship (fourth movement) that so captivates the Sultan that his evil resolve is set aside.

And my guess is that it will be that same fourth movement that will convince many to buy their own copy of this digitally mastered CD version of Scheherazade.

I don't wish, by that remark, to diminish the first, second and third. Tjeknavorian moves them along purposefully, with the solo and lightly textured instrumental passages being eminently satisfying. But it is in the glittering, even exhilarating, finale that the LSO really cuts loose with a torrent of superbly defined sound.

Glinka's Overture which follows is shaded only by the brilliant sonic display that precedes it but it contributes agreeably to the overall playing time of 47'12".

I would recommend this disc on one understanding only: that you don't surrender to caution and restrain the volume level on the basis of the opening theme. If you do, you'll fall victim to the large dynamic range and not do justice to what follows. (W.N.W.)

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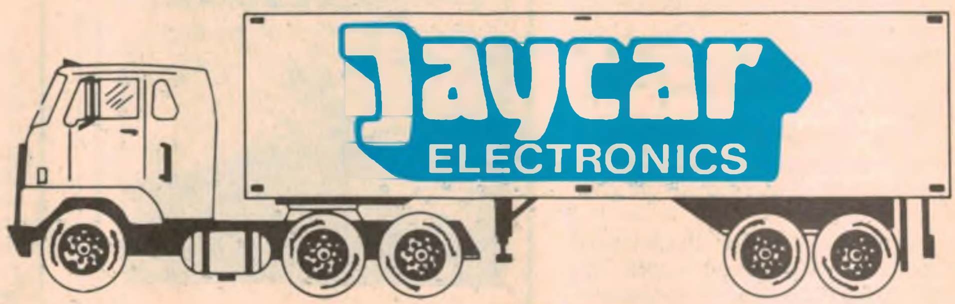

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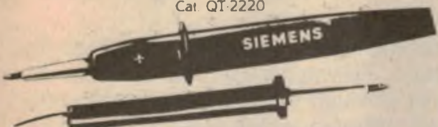

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Technical Information
Illumination: **22W Fluoroscent**
Weight: **8.16kg**
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Lens: **(see text)**

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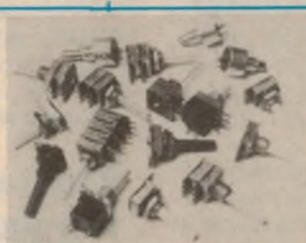

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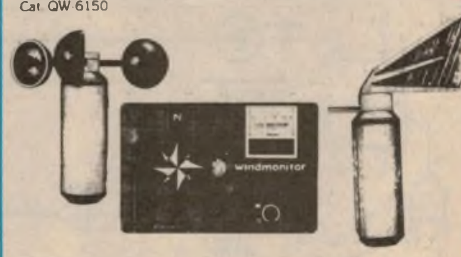
Full specifications can be found on page 85 of the Jaycar 1985 catalogue.
Cat. QW-6150



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Information centre

Multi-sector Burglar Alarm

I would like to point out an oversight in the circuit of the Home Burglar Alarm (EA, January 1985). Sector inputs 1 and 2 are supposed to have an exit delay of between five and 45 seconds. Unfortunately, the circuit as it stands does not allow a person to exit the house without tripping the alarm if movement sensors are used on these two inputs.

The problem can be traced to IC6a, where the reset (pin 4) is normally held low. If the exit delay is 45 seconds and the alarm is set, then 45 seconds later pin 13 of IC7b will go high. If the input is triggered on exit, flipflop (IC6a) clocks a high onto the Q output (pin 1) and starts the entry delay sequence. At the end of the entry delay, pin 12 of IC7b goes momentarily high.

If, by this time, pin 13 is already high, the alarm will trigger. This means that the true exit time is really the exit delay minus the entry delay.

The solution is to hold flipflop IC6a reset for the exit period, using the reset of IC6b. This can easily be done using a couple of diodes to "OR" the two reset functions (see diagram) and thus disarm sectors 1 and 2 for the total exit period. When the exit period expires, the reset goes low and allows flipflop IC6a to be triggered normally by any detections.

Note that a 100kΩ resistor should be installed between the diode anodes and ground. (J.L., One Tree Hill, SA).

● You're absolutely right J.L., and your solution is quite clever. We erred when we said that it was only necessary to make the exit delay longer than the entry delay. In fact, it would be necessary to make it much longer to achieve reliable operation. This applies whether or not movement detectors or other types of sensors are employed.

The advantage of your scheme is that the exit delay can be set to any time desired, quite independent of the entry delay. There is another solution however and this uses just one diode (see following letter).

Multi-sector Burglar Alarm

I would like to detail and recommend solutions to problems that I experienced with your Multi-Sector Burglar Alarm (EA, January 1985).

The main problem with the circuit was tripping off the alarm just after I left my home. This stems from the fact that the door through which I leave home is the door through which I enter — a fairly normal situation, but one which means that the delayed entry timer is tripped whenever one leaves the house. This should not, in theory, happen due to the operation of the delayed exit circuit.

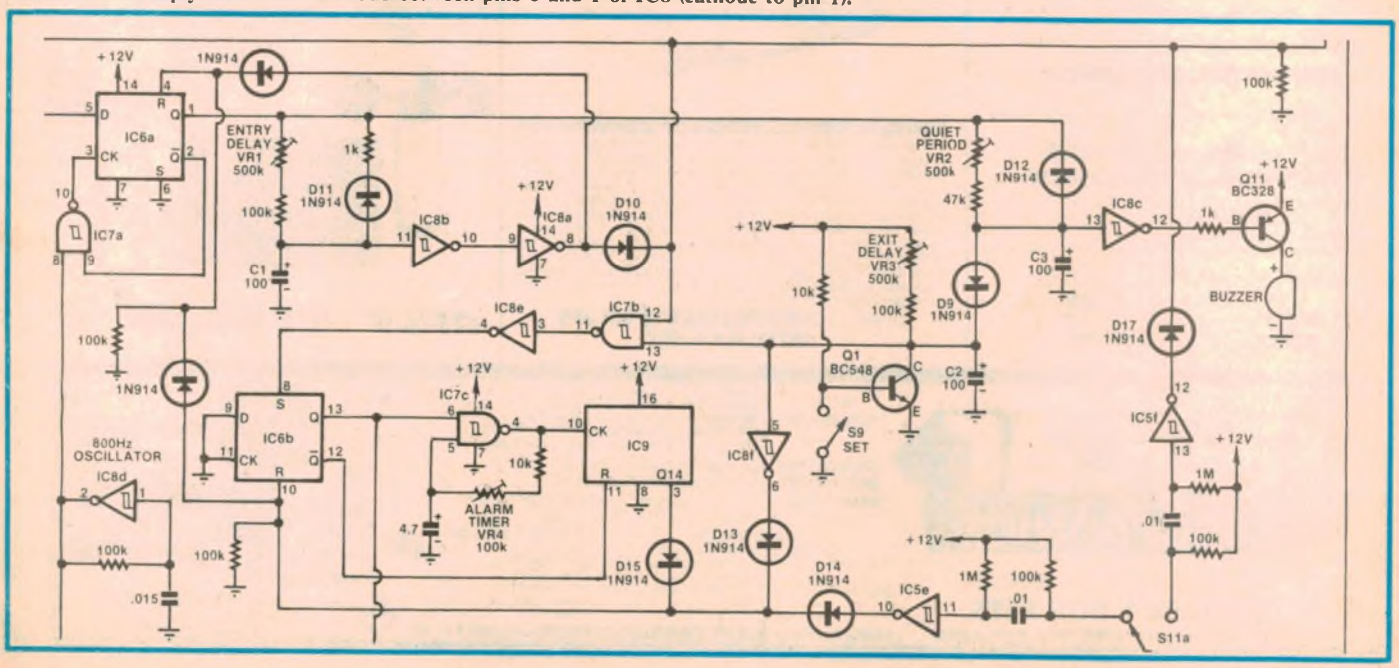
However, because of the Q output of IC6a is high during the entry delay time, C2 charges more quickly than normal, via VR2 and S9. In fact, the exit delay time is very much reduced, depending upon the setting of VR2. The result — IC7b is enabled too soon, delayed entry pulses can trip the alarm, and the owner is suitably embarrassed.

The short term solution to this problem is to set VR3 (exit delay) and VR2 (quiet period) to maximum, and VR1 to the shortest period humanly possible to make a mad dash to disable the alarm when you get home. The side effect of this is that the warning buzzer cannot be used.

The best remedy is to disable IC6a during the exit delay period. This can be done by disabling the 800Hz oscillator by installing a diode between pin 6 of IC8f and pin 1 of IC8d (cathode to pin 1).

Another problem which I experienced

This circuit shows how the diode OR gate is added to the Multi-Sector Burglar Alarm to hold IC6a reset during the exit period. An alternative scheme is to simply add a 1N914 diode between pins 6 and 1 of IC8 (cathode to pin 1).



was a very long alarm time. A check of the clock input to IC9 showed a period of 50 to 500 milliseconds, which results in an alarm time of around eight to 80 minutes. If other users are having the same problem, it can be solved by cutting the track connected to Q14 of IC9 and reconnecting D15 to either the Q10 or Q11 outputs. Q10 gives an alarm time of 30 seconds to five minutes and Q11 an alarm time of one minute to 10 minutes. (C.McK., Kurrajong Heights, NSW).

● The points that you raise concerning false triggering on exit are quite valid. Your suggestion that a diode be installed between pins 6 and 1 of IC8d solves the problem quite nicely and this is the scheme that we recommend to readers.

The problem with the alarm time is caused by the wide tolerance of Schmitt trigger levels that occur in the range of 4093's available. This was covered in the notes and errata published in the June issue of the magazine.

The best solution is simply to reduce the 4.7μF capacitor connected to IC7c. In your case, reducing this to about 1μF will bring the alarm time down to a more reasonable figure.

Multi-sector Burglar Alarm

I have built the EA Home Burglar Alarm (EA, January 1985) and have found that even when the quiet period and entry delay timers are set well within the exit delay time, the alarm still fired from the delayed sectors. The instant sectors worked correctly — they did not trigger the alarm during the exit delay.

By disconnecting D9 the problem with the delayed sectors was cured. It appears that C2 was being charged via D9, thus arming the alarm.

To prevent the warning buzzer from sounding when the alarm is switched off, I have replaced D9 with a BC548 transistor. The transistor's collector is connected to the positive side of C3, the emitter is connected to negative (earth) and its base is in parallel with the base of Q1. S9 controls both Q1 and the new transistor. (R.McL., North Atlanta, Vic).

● Your scheme is an improvement on the original circuit but is still not foolproof. The recommended cure is set out in the letter immediately above (see also notes and errata).

Training for TV servicing

I have been in Australia for about seven months. Before I came here I was an electronic serviceman for 10 years in my country so I have started a course in electronics at a TAFE college. In addition, I am also one of *Electronics Australia's* readers since January 1985.

Please give me some advice as follows:

(1) Which books do you recommend for studying colour TV, VCRs and computers?

(2) I want to buy a collection of circuit diagrams for TV sets, amplifiers and cassette decks (eg, AWA, Sony, Pye, Sanyo, etc). Where can I buy them? (H.L., Launceston, Tasmania).

● Unfortunately, we are unable to provide you with any of this information. We suggest that you contact the Television and Electronics Technicians' Institute of Australia. The address of the Tasmanian branch is TETIA, c/- Jim Lawler, 16 Adina St, Geilston Bay 7015.

Problem with Teletext Decoder

I seek your advice with regard to the Teletext Decoder project featured in your magazine. I have completed construction of a Dick Smith kit but have a problem in that the decoder appears not to be working properly.

Although I get a stable Teletext display on the TV screen, it consists of four vertical columns of characters and symbols repeated across the screen. The displayed characters do change periodically.

When I first built the kit I was able to obtain a proper display, although the clock didn't update. I thought that this may have been because all the TV stations were only broadcasting test pages.

Because there was considerable interference in the form of vertical bars, I replaced the LVM2AU01 supplied in the kit with the alternative 1285-8. This improved the picture quality, but since then I have had the problem described above. I may be wrong, but I don't think that the modulator itself is at fault.

I have noticed that IC1 (the SAA5030) gets very hot, to the extent that it is almost too hot to touch, but I don't know if this is significant. The temperature of this IC appears to be about the same as that of the two regulators. Would there be any benefit in bonding a heatsink to the surface of this chip?

I have closely examined all solder joints and can see no faults in that area. I have considered buying another Mullard chipset and embarking on a chip swapping exercise, but as these chips are not readily obtainable, and no doubt quite expensive, I thought I would solicit your advice first.

Please note that I do not have any test equipment other than a multimeter, therefore troubleshooting must be of the "swap it and see" variety. To this end, I would be grateful if you could define a sequence of actions to follow. (G.S., Tullamarine, Vic).

● We feel that it would be a pointless exercise to replace any of the ICs in the Teletext Decoder since, from your letter, it appears that the problems lie in other areas. The SAA5030 IC will get quite warm in normal operation, but a heatsink is unnecessary.

We suggest that you return to using the original modulator, at least until the Teletext decoder is working correctly — it makes no sense to complicate the problem by using non-standard parts.

The vertical bars that you can see on the screen may well be caused by excessive power supply hum. Check that all the power supply components have been installed correctly, paying particular attention to the diodes and capacitors.

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ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 227, Waterloo, 2017.

Assuming you are back to the situation that you describe in your letter (ie, a Teletext display that will not update), we suggest the following. First, make absolutely certain that the VCR is tuned exactly to the desired TV station. If this is so, follow the setting up procedure detailed in the article very closely.

Your letter suggests that there is in fact no major problem with the decoder itself, but rather that it has not been set up correctly.

VIC-20 memory expansion

I believe I have seen a project for a VIC-20 memory expansion in a magazine somewhere. Having checked all my indexes, I have either missed the project or don't have that index. Has your magazine produced such an article; if not do you have any plans for such a project?

On another point, do you have an index of your magazine available on floppy disk. I would be interested in such an index in one of the following formats: Tandy TRSDOS, APPARAT NEWDOS 80, or LOGICAL SYSTEMS LDOS (all 5¼-inch SSDD).

Limited use could be made of such an index in DBASE II format on 8-inch DSDD format. If an index is available on your own computer system, could public access be made via dial up line? (R.G., Lesmurdie, WA).

● An item entitled "Extra RAM for the VIC-20" was featured in the Circuit and Design Ideas pages of the January 1984 issue. In addition, a collection of add-on circuits for the VIC-20 was featured in the January 1985 issue. We can supply back copies of both issues for $3 each, including postage. Unfortunately, we cannot assist you with your other enquiries.

Silence is golden

I have built the Playmaster Mosfet Stereo Amplifier. I am very satisfied with its hifi capabilities but with the introduction of cassette decks and CD players with very large signal-to-noise ratios I was wondering whether it would be worth my while upgrading the C-core transformer to a toroidal type or maybe the Ferguson PF 4361/1. If so, which one would be best? (L.P., Box Hill North, Vic).

● If you have followed the recommended wiring layout for this amplifier there should be very little hum in the output. At normal volume control settings and with your head one and a half to two metres away from the speakers, you shouldn't be aware of a noise problem. This especially applies to the high level inputs. If this is the case, there would be little point in changing the transformer.

Out of tune Electrochune

Some months ago I purchased an Electrochune kit from Dick Smith Electronics and although it did not work first time I have been able to get it operating.

Unfortunately, the extreme right section of the keyboard is considerably out of tune. I have no wish to bring the unit to standard tune with A at 440Hz, but would like to have all the notes in reasonable tune.

Basically, my main problem is that E sounds like D, whilst A flat, B and C sound virtually the same. I have double checked the values of the tuning resistors and all the soldering. In addition, I have replaced the .01μF capacitors in the area together with the 10MΩ resistors and the two 4016 ICs and a number of the relevant tuning resistors. The only effect was to change slightly the pitch of the A flat note.

I have been told by Dick Smith Electronics that the original specifications have not been changed and would appreciate confirmation of this. I have wondered whether in view of the closeness of some sections of the printed circuit board, the problem is due to bridging between tracks.

As a matter of interest, can you advise me of the formula used to determine the values of the various tuning resistors prescribed. I have calculated the total resistance of the tuning resistors set out for each note and have been unable to detect any pattern in these values. I put this question to Dick Smith Electronics but they referred me to you.

I would be most grateful for your comments. (D.M., Baxter, Vic).

PS. I have been unable to obtain the non-standard resistors as these are not readily available from DSE.

● We suspect that the potential dividers are not functioning correctly for the notes in question. You can check the dividers by temporarily lifting the R100 series resistors. The voltage at the input of each 4066 analog switch should now be at ground potential.

Note that it is important to reconnect each R100 series resistor once checked. If the divider is not at ground or is permanently at ground or at the positive supply rail, then there are either shorts between the PCB tracks or an open circuit supply track to the divider.

The formula for calculating the frequency is not simple. It is related to capacitor C1 and the 120kΩ resistor at pin 7 of IC4. By varying the voltage at the end of this resistor (which is what happens when a new note is selected), the current flow through the 120kΩ is altered and this sets the frequency of operation. Without going into too much detail, the change in frequency is equal to: 0.32/120kΩ × C1 Hz/V.

The non-standard resistors are E24 series values and are available from Jaycar Pty Ltd.

Notes and Errata

HOME BURGLAR ALARM (January and February 1985, 3/MS/112, 113): a 1N914 diode should be connected between pins 1 and 6 of IC8 (cathode to pin 1). This will hold IC6a reset during the exit delay and prevent false triggering of the delayed sectors when the premises are vacated. It also allows the exit delay to be set to any period, independent of the entry delay.

The uses of a word processor . . . ctd from p93

asterisks into zeros, or figure eights, and the change was made.

So with all these problems and difficulties, it might be asked "Is it all worthwhile?" If you are prepared to accept plain typewriter copy then this is not worth the effort. But if you enjoy presenting an attractive display, without the necessity of sending your work out to a printer, then these exercises are well worth it.

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$3.50 P-P $1.50
5 RPM Plenty of torque With Cam and N/O N/C microswitch 15 switch contacts per min OA size 65 x 60 x 35mm.

MJE 350 TRANSISTORS

PNP. 300V A
10 FOR $3.50

2SD200 = BU205 TRANSISTOR

NPN VCBO 1500V • VCEO 700V 2.5 AMPS
4 FOR $3.75 P-P $1.50 INTERSTATE $1.70

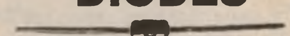
A1 QUALITY TRANSISTORS 2N3055

10 FOR $6. P-P NSW $2 INTERSTATE $2.95

POWER TRANSISTORS

140V 20AMP
MJ15003 NPN
MJ15004 PNP
$9.90 PAIR P-P $1.35

DIODES



650piv 3 AMP
50 FOR $9.50
P-P NSW $1.35. INTERSTATE $1.70

HIGH GRADE POTTER AND BRUMFIELD RELAY

P-P $1.50 **$3.50**
KU series • 240 VAC 50Hz operation • 3 sets of 240V 10 amp change over contacts • perspex cover and mounting base included • size 50mm x 37mm x 35mm • ex-computer • as new condition. At less than ½ of the normal price.

CRYSTAL

3.579545 MHz. Mini Solder in.
95c P-P 75c

WE BUY

★ NEW MODEL ★

50 WATT RMS SPEAKERS

ETONE FACTORY SCOOP
EVEN LOWER THAN FACTORY PRICE
A PAIR FOR $46.50 OR $25.95 EACH

RUGGED TOP QUALITY HI-FI WOOFER. 30cm 8 ohms • 90 DAYS FACTORY WARRANTY • FOAM POLY SURROUND • STURDY SUSPENSION FOR RICH REPRODUCTION • 3.5cm VOICE COIL • FERRITE MAGNET • FREQ. RESPONSE ... 35- 0Hz. RESONANCE 35Hz
P-P NSW FOR ONE $4.50. INTERSTATE $6.90. P-P NSW FOR TWO $6.50 INTERSTATE $8.50.

Or for Silent Burglar Alarm

ROTATING FLASHING RED DISTRESS BEACON

12 VOLT 2A
Ideal for Car, Truck, Boat. Also Disco.
$12.95 P-P NSW $2.50 INTERSTATE $3.50

PERSPEX DUST COVER AND PLINTH

Brand new top quality stock — factory close down

FULLY MOULDED SMOKEY TINT COVER 415 × 330 × 75MM INSIDE — WALNUT VINYL BASE IS 450 × 357 × 75MM. AND INCLUDES A BLACK PLASTIC DRESS INSERT 337 × 288MM WHICH HOLDS THE RECORD PLAYER MOUNTING BOARD. WERE $59

TO CLEAR . . . ONLY $34.95 P-P NSW $4.50 INTERSTATE $7.50
Separate plinth or dust cover for sale @ $17.95 each. PP NSW $3.50 interstate $5.50

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95c EACH
HIGHLY GLAZED CERAMIC
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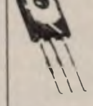
★ HIGH GRADE ELECTROLYTICS ★

FRESH AS A DAISY

2200µF 63V DCW	4000µF 75V DCW	10,000µF 40V	P-P NSW $2.00 INTERSTATE $3.50
2 for $3.50 CHASSIS MT	$8.50 each CHASSIS MT	$5.95 each PCB MT	
4700µF 35V AXIAL 4 for $6.40	4700µF 16V AXIAL 4 for $3.00		P-P NSW $1.50 INTERSTATE $2.50

MJE 3055 TRANSISTORS



10 FOR $9 P-P $1.50

MJE 2955
10 FOR $12 P-P $1.50

TIMER 555

10 for $3.95 P-P $1.50

MODEL MOTOR

1½ TO 3VDC
Mini Size 34 × 24mm
Shaft 1.5 × 8mm
High RPM. Good Torque. A1 Quality
$2.75 EACH P-P $1.35

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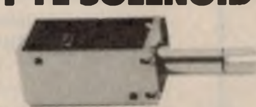

HEAVY DUTY • 12MM DIA PLUNGER
24V DC 10 WATT CLOSED • PULL ... 18MM 50 GRMS • 12MM 100 GRMS • 6MM 300 GRMS • 2MM 1 KG • AT 10MM SNAPS IN SHARPLY OFF 13.8 VDC •
$7.95 P-P NSW $1.50 INTERSTATE $2.50

TRANSISTOR TIP 31 NPN

with Heat Sink
60V. 3A.
10 FOR $7.50 P-P $1.50

FOR REGISTERED POST, ADD AN EXTRA $3.65 TO PACK & POST CHARGE.

EA marketplace EA marketplace

FOR SALE

NEW RADIO VALVES: For entertainment or industrial use. Waltham Dan, 96 Oxford St, Darlinghurst, Sydney. Phone (02) 331 3360.

AMIDON FERROMAGNETIC CORES: Large range for all receiver and transmitter applications. For data and price list send 105X220 SASE to: R.J. & U.S. Imports, PO Box 157, Mortdale, NSW 2223. NSW: Geoff Wood Electronics, Rozelle. VIC: Truscott Electronics, Croydon. WA: Willis Trading Co., Perth.

EX-ABC AUDIO TAPES: ¼" wide on 10½" metal spool, $6.85; plastic spool, $5.85; 7" spool, $2.25; 5" spool, $1.25. Post extra. Also in stock: ½", 1" and 2" tapes. Waltham Dan, 96 Oxford St, Darlinghurst, Sydney. Phone (02) 331 3360.

TRANSMITTING VALVES: STC Type 3J/170E, Forced air cooled triodes, 3.5 KW plate dissipation. Also type 450 TL triodes. Contact Industek (02) 476 2818.

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APOLOGY & CORRECTION

An ad for Trio-Kenwood oscilloscopes that appeared on the back cover of the July 1985 issue of Australian Electronics Monthly contained some incorrect prices due to a typesetting error.

The current correct prices for Trio-Kenwood oscilloscopes are:

Model	Tax Free Price	Tax Paid Price
CS-1022	$795	$914.25
CS-1040	$1395	$1604.25
CS-1060	$1795	$2064.25
CS-2075	$2425	$2788.25
CS-2110	$2895	$3329.25
CS-2150	$2995	$3444.25

All models include two free probes.

We apologise for any inconvenience caused to our resellers and customers by this error.

Parameters Pty Ltd
41 Herbert Street, Artarmon 2064.
Phone (02) 439 3288
53 Governor Road, Mordialloc 3195.
Phone (03) 580 7444

Prices subject to change without notice.

TELEPRINTER: Seimens 100 MK1. + Handbook. Worked with M/BEE. $60. Box 280 Condobolin, NSW. (068) 95 3842.

MAGAZINES: EA Sept 67 — May 85 (Complete), ETI Apr 71 — Aug 77 (Complete), Audio Jan 71 — May 85 (Complete), High Fidelity Feb 60 — May 85 (125 issues). Sold as 4 lots. Phone (03) 459 1717.

SUPER 80 ASSEMBLER: W/full screen Editor $15. Disassembler $9. Vowels, 93 Park Dv, Parkville 3052.

HI FI SPEAKER KITS: Raw Drivers, X-overs, Plans, Replacement Speakers and Accessories from the world's finest manufacturers. For Audiophiles and beginners. Kits from $99. Dynaudio, Foster, Magnavox, Peerless, Phillips, Scanspeak etc. Send $2 for catalogue. Audiocraft, PO Box 725, Toowong, Brisbane 4066.

WIRELESS WEEKLY: Vol. 1 No. 1 to latest "Electronics Australia" July 1985. Most well bound. Offered as one lot. Box 142, PO Potts Point 2011.

VALVE TESTER: Paton, ET4 New cond. $150. L.E. Chapman, PO Box 156, Dee Why, NSW 2099.

½ PRICE PCB SALE. All EA & ETI Project PCBs reduced to 50% of Cat price. (Stock items only. This month only. P&P 80c). Catalogue 1976-85 (inc components) $1.00. Bankcard, MasterCard welcome.
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PC Boards, Computer Repairs
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SELLS EVERY PCB & FRONT PANEL
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Brisbane's leading audio and video repair company requires qualified service technicians, above award wages paid, 4 weeks annual leave, excellent working conditions. Applicants can apply in writing to the service manager stating qualifications, age, references where applicable. All applications treated in strickest confidence
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219 Bennetts Road
Norman Park, Qld 4170

DISPLAY ADVERTS IN MARKETPLACE are available in sizes from a minimum of 2cm x 1 col rated at $15 for a col cm. Ad sizes may be increased up to a maximum of 10 col cms.
CLASSIFIED RATES $3.60 for 40 letters or part thereof per insertion payable in advance. Minimum 80 letters.
CLOSING DATE is six weeks prior to the on-sale date. Issues are on sale the first Monday of each month.
PAYMENT & COPY to the Advertising Manager, Electronics Australia PO Box 227, Waterloo, NSW 2017.

TRIO: CS 2100 4CH 8 trace 100MHz dual time-base oscilloscope, as new, 4 probes. $2,500 ONO. Ph (02) 588 2304.

DISK CONTROLLER: Single density kit $130. Double density adapter kit $130, Ass. $160. RS232c board $129. Ring (076) 910 0196 for discount rate. Agro Data, John Street, Southbrook 4352.

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RTV & H: Back numbers 1952-59 approx 80 copies $30. Ph. (03) 596 5581 AH.

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The Wireless Institute of Australia, established in 1910 to further the interests of Amateur Radio, conducts a Correspondence Course for the A.O.C.P. and L.A.O.C.P. Examinations conducted by the Department of Communications. Throughout the Course, your papers are checked and commented upon to lead you to a successful conclusion.
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48 HOUR PCB SERVICE
Single Sided .... 7c per cm²
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DRILLING (0.8mm) .... 2.5c per hole
Send artworks on film or transparency P&P $2.50
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122 PITT ROAD, NTH CURL CURL.
MAIL ORDERS: BOX 156, DEE WHY, NSW. 2099.
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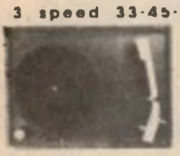
BSR GRAMO MOTOR AND PICKUP 240V

3 speed 33-45-78 includes cartridge and stylus turnover



$12

P&P NSW $2.75
INTERSTATE $4.20
WA, NT $5.20

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FM STEREO KITS

Sets of 3 modules includes FM tuner decoder and if detector. Circuit diagram supplied.

ONLY $22 PP $1.60

SPECIAL

BALANCE METERS

CENTRE ZERO

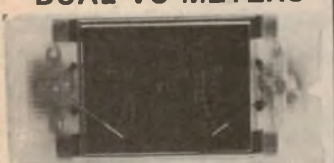
$2 PP $1

6P VALVE SOCKETS

9 pin 25c — 7 pin 25c — octal 25c

SPECIAL

DUAL VU METERS



$3 PP $1

SPARK GAPS 10 for $1

455KC IF Trans for valve radios $1 each
OS coils 75c each

THERMISTERS 4 for $1

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CAR RADIO Suppressors 5 for $1

SPECIAL
Chrome ¼ shaft push-on knobs. 10 for $1. Usual price 60c to 80c each.

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24 pin	35c
28 pin	40c
18 pin	25c

Slide pot knobs 10 for $1

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AD 161-162	$1 pair
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100 mixed resistors
Handy values ¼ ½ 1 watt $2

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TV 20-SC $1 each

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EF86	$4.00	VT128 955	$5	6S2	$3
12AX7	$4.00	CV423	$4	7V4	
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12AX7	$4.00	EM84		6CU5	$5
6BM8	$3.00	VR101 102/280	$4	IL4	$4
6BL8	$3.00	IC4	$5	6BW7	$4
6BQ5	$4.00	EL37	$12	6AT6	$4
6K8	$10.00	ID8	$4	6BA8	$4
6K7	$7.00	41	$6	6GW8	$5
5AS4	$4.00	42	$6	6BD6	$4
6V6	$10.00	6B7	$6	6AM6	$4
6AL3	$4.00	80	$6	6BF5	$4
6GV8	$4.00	6F6	$10	QQV03	$6
6SA7	$5.00	6BX6	$4	12AV6	$4
6Y9	$4.0U	6BD7	$5	12AN7	$5
6BE6	$5.00	6HG8	$5	12AQ5	$6
6BH5	$5.00	6AX4	$5	IA3	$4
IT4	$2.00	6DQ6	$6	6AD8	$5
6AV6	$3.00	6CW7	$3	6CW5	$5
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6X9	$5				

SPECIAL

12 mixed switches $4 PP $1.40 not a lucky dip, c wot u get! P.P. $1.60

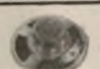
POTS ROTARY

½ Meg	50c	10K Switch	50c
1 Meg	50c	250K	30c
100K	30c	50K	30c
100K Switch	50c	20K	30c
50K Double Pole Switch	50c	10K Min Pots	25c
7 500	30c	50/ohm	50c

Extra Pots ¼mg LIN 50c
1 Meg log switch $1 — ½ Meg log switch $1
½ 1 meg dual Concentric tapped at 100K $1
2 meg ganged double pole switch $1
1.5 meg dual ganged 50c — 2 meg ganged log $1
1 meg dual ganged $1 — ½ meg dual ganged LIN 75c
25K 50K dual ganged Concentric double switch $1
100K dual ganged linear pots 75c

200K single line	30c	10K sub min log pots	50c!
20K wire wound	75c	250K ganged pots	75c
dual log 10K	75c	25K in ganged pots	75c

SUPER SPEAKER SPECIAL



15/ohm 2¼ inch four for $1 P.P. $1.60

MICRO SWITCHES

5A 250V 50 cents

SLIDE POTS

½ meg dual	$1	1K dual	$1
1 meg dual	$1	50K single	50c
2 meg dual	$1	250K single	50c
25K dual	$1	10K single	50c
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TOUCH MICRO SWITCHES

As used in front control panels in colour TV sets.

4 FOR $1

SPEAKER

2-way crossover networks
30 WATTS RMS **$2**

CRYSTALS for colour TV — $1 each

AM FM TUNING CAPACITORS

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4 PIN SPEAKER SOCKETS
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8in x ⅛in with coils $1.50

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1000 UF 50V	each	$1	1MFD 50V	10 for	$1
1000 UF 63V	each	$1	33 UF 10V	10 for	$1
22 UF 160V	3 for	$1	33 UF 10V	10 for	$1
1000 UF 16V	each	50c	1MFD 50V	10 for	$1
63 UF 25V	5 for	$1	33 UF 10V	10 for	$1
470 UF 63V	each	50c	0.0039 1500V		
47 UF 160V	3 for	$1	8 MFD 350 V	each	50c
470 UF 25V	4 for	$1	6N8 1500V	each	50c
40 UF 25V	5 for	$1	220 UF 35V	4 for	$1
470 UF 40V	3 for	$1	1000 UF 25V	each	50c
47 UF 10V	10 for	$1	680 UF 50V	each	50c
100 UF 25V	5 for	$1	22 UF	10 for	$1
25 UF 25V	10 for	$1	100 UF 6.3V	10 for	$1
470 UF 16V	5 for	$1	330 UF 25V	3 for	$1
220 UF 50V	each	50c	2000mfd 25V chassis mount		$1
47 UF 200V	each	50c	500V 12V		50c
1000 UF 10V	4 for	$1			
2.2 UF 200V	4 for	$1			

Dual chassis mount 20MFD 450V, 75MFD 65V $1

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SHIELDED CABLE

SINGLE STRAND

25 meters for **$2.50**

SUPER SPECIAL

ICs new packed in original tubes.
20 popular types for **$2** P.P. $1 anywhere in Australia.

CONTACT SWITCHES
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Recond player 2 speed 33 and 45 RPM 11 inch turntable pickup arm counter balanced cuing facility. Ceramic cartridge, diamond stylus works off 240V 9V or 12V.

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for B & W TV sets $1

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25 WATTS RMS EACH SPEAKER

$29 ea

SIZE 19½ by 13½

PP NSW $5 INTERSTATE $7 WA NT $10

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240V pair 25V taps
260V
117V $10

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EBM209 4 for $1

SPEAKER SPECIALS

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5x7 7 watts RMS in 8 or 15/ohm	$4.50
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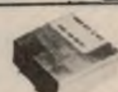

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6.5 to 3.5MM 7ft	$1
6.5 Single ended	50c

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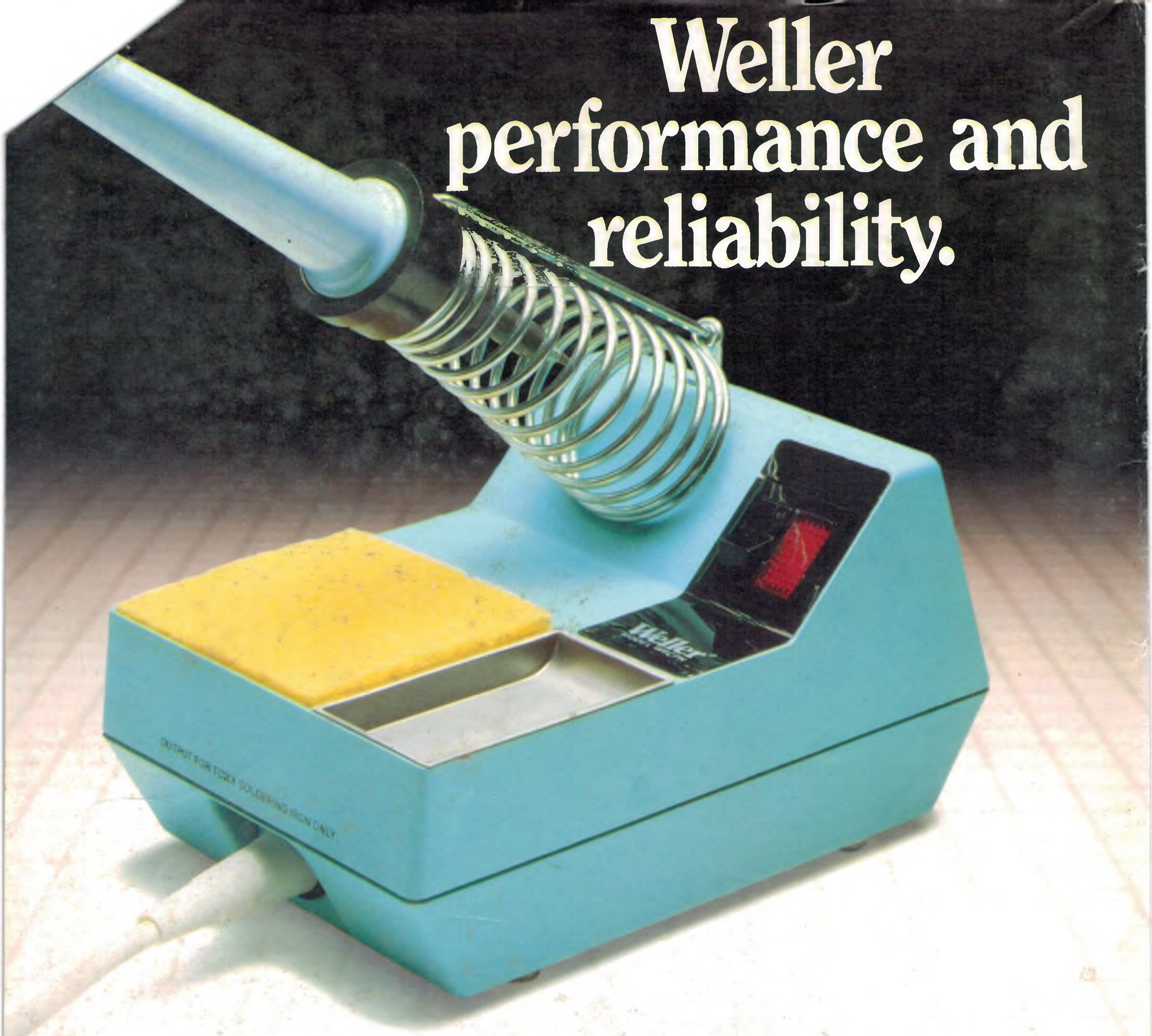
Weller performance and reliability.



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The Weller WTCPN

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