THE LEADING UK CONSUMER ELECTRONICS TECHNOLOGY MAGAZINE

TELEVISION

SERVICING·VIDEO·SATELLITE·DEVELOPMENTS

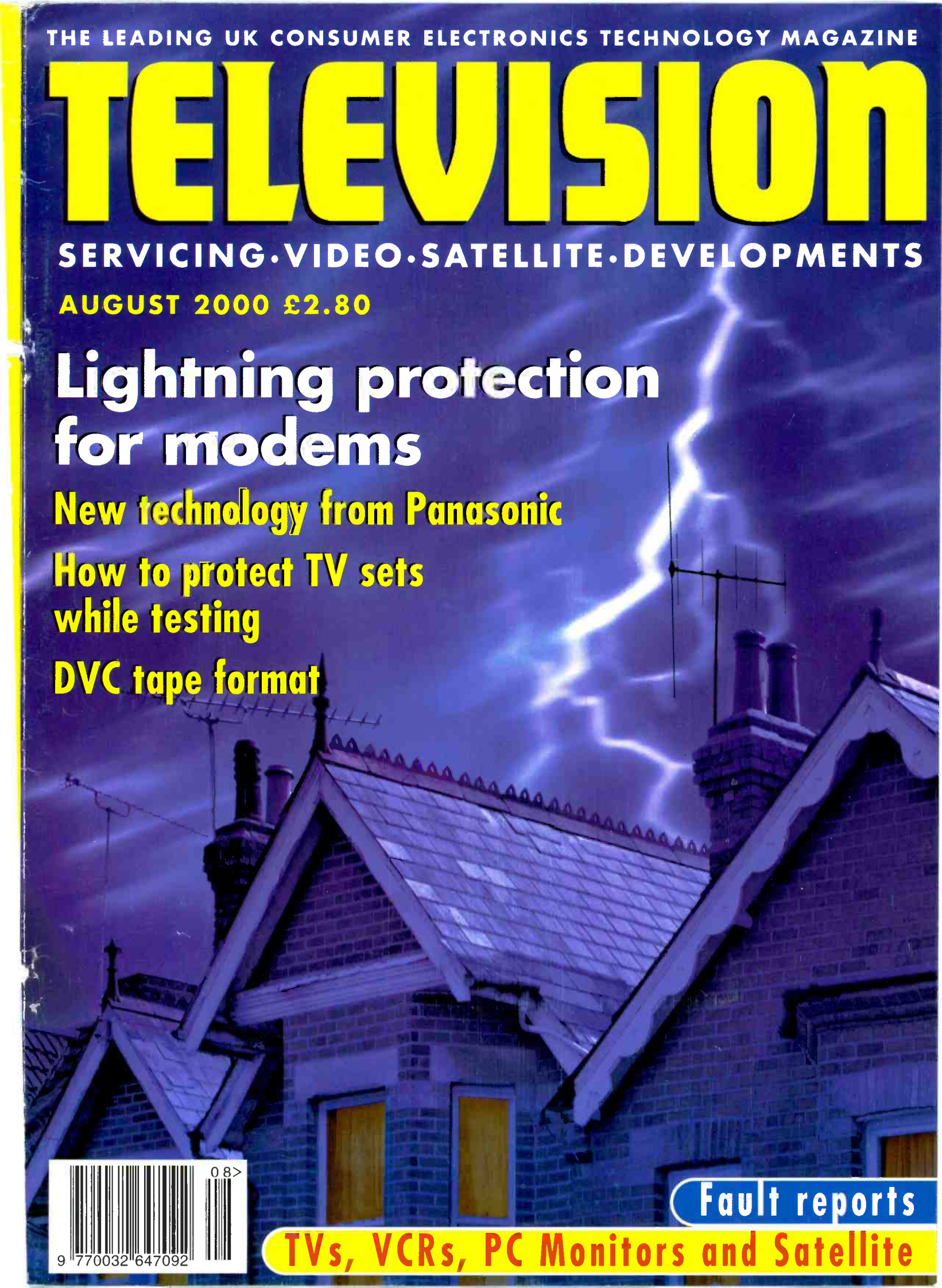
AUGUST 2000 £2.80

Lightning protection for modems

New technology from Panasonic

How to protect TV sets while testing

DVC tape format



9 770032 647092 08>

Fault reports

TVs, VCRs, PC Monitors and Satellite

KÖNIG
ELECTRONIC

Video Spares

- Video Heads
- Pinch Rollers
- Repair Kits
- Clutch Assemblies
- Belts

Visit our on-line Konig Part Finder 2000 System

@ www.konig.co.uk

Available from your KÖNIG CLUB Founder Members

CHS · epc · Seme · WILLOW VALE ELECTRONICS LIMITED

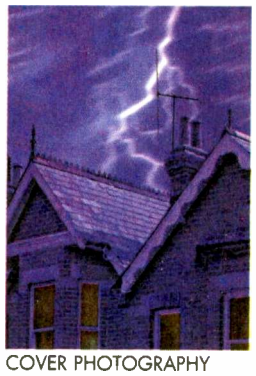
Also available from your König Approved Stockist

the KÖNIG repair

Technical help line: 01635 278678
E-mail: technical@konig.co.uk

CONTENTS

August 2000 Vol. 50, No. 10



COVER PHOTOGRAPHY
MARK SWALLOW

Editor
John A. Reddihough

Production Editor
Tessa Winford

Consultant Editor
Martin Eccles

Publisher
Mick Elliott

Advertisement Sales Manager
Matthew Harradine
0181-652 3033

Group Advertisement Sales Executive
Pat Bunce
0181-652 8339
Fax 0181-652 3981

Editorial Office
0181-652 8120
Fax 0181-652 8111

Note that we are unable to answer technical queries over the telephone and cannot provide information on spares other than that given in our Spares Guide.

August issue on sale July 19th.

Next issue, dated September, on sale August 16th.

www.telepart.co.uk

You can search our www site for video spares, semiconductors, remote controls, satellite gear, line output transformers and CCTV components. Its simple and will only **cost the price of a local call.** You can order parts, enquire about parts, or simply send a message.

have you got Economic Devices OFFICIAL HASSLE COLLECTOR

Yes! I've got HASSLE

HASSLE!!!

Our experienced staff WANT WANT WANT to help you.

Remote Controls

from **£5.95** each

Stock held for over **5000** different models

Remote controls in stock for 1000's of models at exceptional prices. If we don't stock the remote for your model number - send the old one and we will even get one made for you.

...and look at the special offers.....

(strictly while stocks last)

BUT11A @ 29P each BUT11AF @ 41P each
BU508A @ 60P each Fully wired scart lead 99P

a slight inconvenience....

....you must buy more than one.

BU208A	X 5	£3.75	TEA2018A	X 5	£3.70
BU508A	X 5	£3.00	UC3842	X 5	£2.95
BU508AF	X 5	£4.25	CNX62A	X 5	£1.45
BU508D	X 5	£4.45	S2000AF	X 5	£4.20
BUT11A	X 5	£1.45	TDA3653B	X 5	£2.75
BUT11AF	X 5	£2.35	TDA3654	X 5	£3.45
Philips type 1.2 volt Back up battery				X 5	£2.95
Philips type 2.4 volt Back up battery				X 5	£6.00
Scart - Scart lead 1.5m Fully wired				X 2	£1.98
Positor PT37,TH98009 (White)				X 5	£2.95
Thorn TX100 Chssis 110 DGR LOPTX				each	£11.24
Philips CP90 Chassis LOPTX				each	£11.63

.....and now ask for a full price list ..

MAJOR STOCKIST PHOENIX

PSU repair - refurb kits

Look for the PHOENIX stamp of approval

Over **200,000** kits sold

USE ONLY GENUINE PHOENIX REPAIR AND REFURB ELECTRONIC KITS

NEW

Pace Digibox Repair / Refurb Kit

YOU!! NEED ECONOMIC

USE your ACCESS or VISA

OUR PROMISE

If we can't find the part required immediately, we will HASSLE and HASSLE our suppliers. HASSLE and HASSLE the manufacturer. We will make phone call after phone call, Fax after Fax on your behalf.
WE WILL DO ALL THIS FOR YOU. We will do it willingly and we will do it for FREE

SEMICONDUCTORS

Just a few of the types stocked - all QUALITY products at KEENEST prices

REMEMBER we can help you with over 34,000 different types

1N4001	2SC2482	AF200	BC637	BU208A	BZV10	MPSA06	TA8215H	TDA4605-3
1N4002	2SC2500	AN5265	BC639	BU208D	CD4001	MPSA42	TA8216H	TDA4605J
1N4003	2SC2655	AN5512	BC640	BU250AF	CD4013	MPSA56	TA8221	TDA4943
1N4004	2SC2705	AN5516	BC8468	BU2508DF	CD4017	MPSA92	TA8251H	TDA4950
1N4005	2SC2785	AN5521	BC847C	BU2520AF	CD4053	NE555	TA8403K	TDA7052
1N4007	2SC3226	AN5601K	BC848	BU2525AF	CD4066	NE555D	TA8427K	TDA7263
1N4148	2SC3311	AN7174K	BC8488	BU326A	CD4069	OA47	TA8718N	TDA7394
1N4936	2SC3425	AN7190K	BC848C	BU406	CD4094	P600A	TAA550B	TDA8138
1N5062	2SC3795A	BA157	BC850C	BU426A	CNX62A	P600J	TAA611CX1	TDA8140
1N5400	2SC3807	BA158	BC8568	BU500	CNX82A	P6KE130A	TAA761	TDA8145
1N5401	2SC3885A	BA159	BC858	BU506D	CNX83A	P6KE180A	TBA120U	TDA8170
1N5402	2SC3892A	BA39106	BC8588	BU506DF	CNY17F	R2KL	TBA820M	TDA8171
1N5404	2SC3953	BA3918	BC858C	BU508A	CNY75B	R2M	TBA920	TDA8172
1N5406	2SC3955	BA4558	BC859A	BU508AF	D2VREM	R4060	TC154AP	TDA8178
1N5408	2SC39738	BA5406	BC875	BU508AFI	DCREG	RG2	TDA1013A	TDA8178FS
1N5822	2SC4231	BA5412	BCY59	BU508APH	DTA114ES	RGP10G	TDA1013B	TDA8179S
1N914	2SC4517A	BA6209	BCY71	BU508D	DTC124ES	RGP15G	TDA1015	TDA8180
2N2222A	2SC5129	BA6209N	BD131	BU508DF	DTC14EF	RGP18J	TDA1044	TDA8190
2N3055	2SC5149	BA62198	BD132	BU508V	DTC144ES	RGP30M	TDA1060	TDA8218
2N3055H	2SC536	BA6247	BD136	BU806	FR606	S2000A	TDA1085C	TDA8380Q
2N3440	2SC946	BA32L	BD139	BU807	FX749	S2000A3	TDA1170	TDA8380
2N3773	2SD1138	BAT43	BD140	BU908	H1000L	S2000AF	TDA1170N	TDA8391
2N3904	2SD1207	BAT85	BD234	BU405A	HA13119	S2000N	TDA1170S	TDA9503
2N4401	2SD1292	BAV20	BD241A	BUH515	HA13150	S2055AF	TDA1178	TEA1039
2SA1012	2SD1330	BAV21	BD243	BUH515D	HA13151	SAB3035	TDA1519A	TEA2018A
2SA1013	2SD1398	BAX14	BD243C	BUH517	HM6261	SG264A	TDA1521A	TEA2029C
2SA1015	2SD1426	BC107B	BD244C	BUK444500B	IRFBC40	SGSIF344	TDA1824A	TEA2029CV
2SA1015Y	2SD1439	BC108	BD317	BUL54AR	JC501	SL1431	TDA1854Q	TEA2031A
2SA1016	2SD1441	BC108C	BD433	BUT11	KA2206	SR2KN	TDA1557Q	TEA2164
2SA1020	2SD1453	BC109B	BD434	BUT11A	KA22066	STA441C	TDA1558Q	TEA2164G
2SA1020Y	2SD1497	BC141	BD435	BUT11AF	KBU602	STK4132II	TDA1675A	TEA2165A
2SA1145	2SD1841	BC182	BD436	BUT12A	KIA6210AH	STK4141II	TDA1904	TDA2260
2SA1302	2SD1845	BC182L	BD437	BUT12AF	KSR1004	STK4142II	TDA2006	TEA2261
2SA562	2SD1846	BC184L	BD438	BUT18AF	LA4282	STK4152II	TDA2006	TEA5101A
2SA673	2SD1848	BC212	BD839	BUT56A	LA4705	STK4192II	TDA2030H	TEA5101B
2SA683	2SD1854	BC212L	BD901	BUW11A	LA6324	STK5332	TDA2030V	TEA5170
2SA684	2SD1855	BC237	BD911	BUW12A	LA7176	STK5342	TDA2050	TIC106D
2SA733	2SD1856	BC237B	BD912	BUX84	LA830	STK5372H	TDA2541	TIC246D
2SA933	2SD1650	BC238	BDW94C	BUZ71A	LA832	STK5481	TDA2577A	TICP106D
2SA940	2SD1651	BC238B	BF199	BUZ77B	LA833	STK7253	TDA2578A	TIP110
2SA950	2SD1761	BC239	BF240	BUZ80	LA7835	STK730-060	TDA2579A	TIP111
2SA962	2SD1815	BC258	BF245A	BUZ90A	LA7837	STK73410II	TDA2581Q	TIP112H
2SA966	2SD1858	BC307	BF258	BUZ90AF	LA7838	STK7348	TDA2593	TIP120
2SA970	2SD1877	BC307B	BF324	BY127	LC7132	STK3907	TDA2611A	TIP2955
2SA984	2SD1878	BC308	BF420	BY133	LED3G	STR10006	TDA2653A	TIP29E
2SB1010	2SD1879	BC309B	BF421	BY184	LN1203N	STR11006	TDA2822M	TIP3055
2SB1143	2SD1884	BC327	BF422	BY227	LM317T	STR50020	TDA3301B	TIP31A
2SB1243	2SD1887	BC238	BF423	BY228	LM324N	STR50103	TDA3505	TIP41C
2SB560	2SD1889	BC337	BF458	BY229	LM339N	STR50103A	TDA3560	TIP42A
2SB649A	2SD2012	BC338	BF459	BY255	LM358N	STR5142M	TDA3561A	TIP42C
2SB688	2SD400	BC368	BF469	BY298	LM381	STR54041	TDA3562A	TIP761A
2SB774	2SD400F	BC369	BF487	BY299	LM386N	STR5412	TDA3565	TIP791A
2SB793	2SD467	BC372	BF494	BY399	LM29381	STR58041	TDA3576B	TL072CP
2SB8922	2SD669A	BC546A	BF758	BY448	M49481	STR59041	TDA3592A	TL082
2SC1383	2SD718	BC5463	BF759	BY476	M51182L	STR6020	TDA3603P	TLP731
2SC1740	2SD837B	BC547	BF788	BYD14J	M54544L	STR61001	TDA3650	TOP204YA
2SC1740S	2SD856	BC547A	BF869	BYD33D	M58655P	STRD4429	TDA3653B	U2829B
2SC1815	2SD965	BC547B	BF871	BYD33J	MC13002P	STRD6008X	TDA3653C	U46148
2SC1815Y	2SD965R	BC548	BF960	BYD33M	MC1310P	STRD6202	TDA3653CQ	UC3842
2SC1846	2SK1118	BC548B	BF970	BYV10-40	MC34063API	STV8730ST	TDA3654	UC3844
2SC2023	2SK135	BC548C	BF981	BYV27200	MCR100-8	STV9379	TDA3654Q	UPC1018C
2SC2120	2SK1507	BC550B	BF990	BYV95B	MJ15003	T6071V	TDA4500	UPC1025H
2SC2229	2SK241	BC550C	BF990A	BYV95C	MJ2955	T9053V	TDA4503	UPC1032H
2SC2230	2SK30A	BC556A	BFR556A	BYV96D	MJE13005	T9064V	TDA4505E	UPC1365C
2SC2235	2SK526	BC5568	BR100	BYV96E	MJE18004	TA7140P	TDA4505M	UPC1378H
2SC2236	7407	BC557A	BRX49	BYW56	MJE30055T	TA7280P	TDA4510	UPC1394C
2SC2240	7805	BC557B	BSX20	BYW76	MJE340	TA7281P	TDA4600	UPC1488H
2SC2274	7806	BC558B	BT139600	BYW95C	MJF18004	TA7698AP	TDA4600/2/3	UPC1498H
2SC310	7809	BC558C	BT1181600R	BYW96E	MJF18006	TA8205AH	TDA4601	UPC574H
2SC2314	7812	BC635	BTA08400S	BYX10	MJF18204	TA8207	TDA4601D	ZTK33B
2SC2335	78L05	BC636	BTA12600	BYX55600	MN650	TA8210H	TDA4606	ZTX650

Over 34,000 types of transistors, IC's, diodes etc. or equivalents stocked

REMEMBER TO ADD £1.50 POST & HANDLING U.K. MAINLAND ONLY. EXPORT AT COST. ADD 17.5% VAT TO TOTAL

Economic Devices

32 Temple Street, Wolverhampton, WV2 4AN, UK Tele ++ 44 (0)1902 773122 Fax ++ 44 (0)1902 429052

Changes

This is the last issue of *Television* for which I will have full editorial responsibility. From next month Martin Eccles, at present Consultant Editor, will take over. You haven't got rid of me yet however! Martin and I are swapping titles. I'm now well past the normal retirement age and have been appointed Consultant Editor. But Tessa Winford and I will continue to prepare editorial pages each month, concentrating on the regular and servicing features. We are leaving RBI to form a partnership and will continue to work together on a freelance basis.

I've been with the magazine for a long time, since mid 1967 in fact, as editor from November 1977 (I was also on the cover that month!), and have enjoyed every minute of it. Well, almost every minute. There were, inevitably, a few times when things didn't go right, most notably with the first colour TV receiver project in 1972. That threatened to be a complete disaster, but in the end we got it right with good pictures. It taught me lot, about what can go wrong in practice with apparently straightforward circuitry, modifications, component specifying and so on. That was a major exception however: otherwise, things have gone very well over the years. Our readers have been magnificent in their loyal support and appreciative comments. I think those in the TV repair trade must be an exceptional breed, with their perseverance, patience and sense of humour. They probably require these characteristics, given the problem of day-to-day dealings with recalcitrant equipment and, all too often, difficult customers. I have also had the support of an fine group of regular contributors who have always come up with the goods and have been unfailingly helpful in dealing with queries and odd little problems. My thanks to you all – and I hope we will long be able, under Martin's leadership, to shed light on the complications and difficulties that beset those involved with consumer electronics. This will be particularly important as the pace of change escalates in TV's digital age.

Back in 1967 we were still dealing with mainly valved TV receivers and video was in its infancy – there were just a few open-reel recorder/players. Transistors were beginning to appear in TV chassis, mainly in the signals stages, and before long the first IC put in an appearance. The big change that year however was the advent of regular colour TV transmissions. We all had to learn about many new systems and techniques. Probably the one that caused the greatest confusion came a little later when, in 1969, Thorn first used a switch-mode (chopper) power supply in a TV receiver. By now we are all well used to chopper supplies of various sorts.

Since the early Seventies we have had to cope with a steady stream of major technological changes, including the VCR, the advent of teletext which first brought digital technology to TV, satellite broadcasting and reception, the use of microcontroller chips for system control in TV and video equipment and, most recently, digital broadcasting. It has been a stimulating time, with never a dull moment, though with the inevitable headache from time to time!

We've not only had to understand how new systems work but also how they fail. This back-up information to supplement basic theory has been a major purpose of the magazine. I am ever impressed with how those in the field have managed to cope with all this change. As my good friend E.T. once put it, a car mechanic would be surprised if he was suddenly expected to put a helicopter to rights!

Life would have been dull without these technological advances however. There have also been changes, though on a much lesser scale, with the magazine itself. We've changed size twice during the period, and have had to go through the print revolution from hot-metal typesetting to today's page make-up on computer.

So next month Martin takes over and we wish him every success. For the time being however Tessa and I will still be here. We hope that our readers and contributors will continue to give him and us your support. In particular, keep the know-how rolling in!

There is a curious twist to the change of editorship. I was the first separate editor *Television* had: prior to 1977 *Television* had been run in conjunction with *Practical Wireless*. It's to revert to that way of working, and will now be run in conjunction with *Electronics and Wireless World*, of which Martin Eccles is and will continue to be the editor. A quarter of a century ago I would never have imagined that we would become associated with this eminent journal. Whatever next?! We'll see.

John A. Reddihough

E-mail: Please in future send fault reports etc. to jackie.lowe@rbi.co.uk

Head them *Television* so that they can be separated out and forwarded to us. John and Tessa.

CORRESPONDENCE
All correspondence regarding advertisements should be addressed to the Advertisement Manager, "Television", Reed Business Information, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Editorial correspondence should be addressed to "Television", Editorial Department, Reed Business Information, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

INDEXES AND BINDERS
Indexes for Vols. 38 to 48 are available at £3.50 each from SoftCopy Ltd., who can also supply an eleven-year consolidated index on computer disc. For further details see page 630.
Binders that hold twelve issues of *Television* are available for £6.50 each from Television Binders, 78 Whalley Road, Wilpshire, Blackburn BB1 9LF. Make cheques payable to "Television Binders".

BACK NUMBERS
Some back issues are available at £3.00 each. For further details see box on page 615.

SUBSCRIPTION ENQUIRIES

Telephone:	01444 445 566
Fax:	01444 445 447
Credit card orders:	01622 778 000

Address: Television, Subscriptions Dept, PO Box 302, Haywards Heath, West Sussex RH16 3YY, UK.

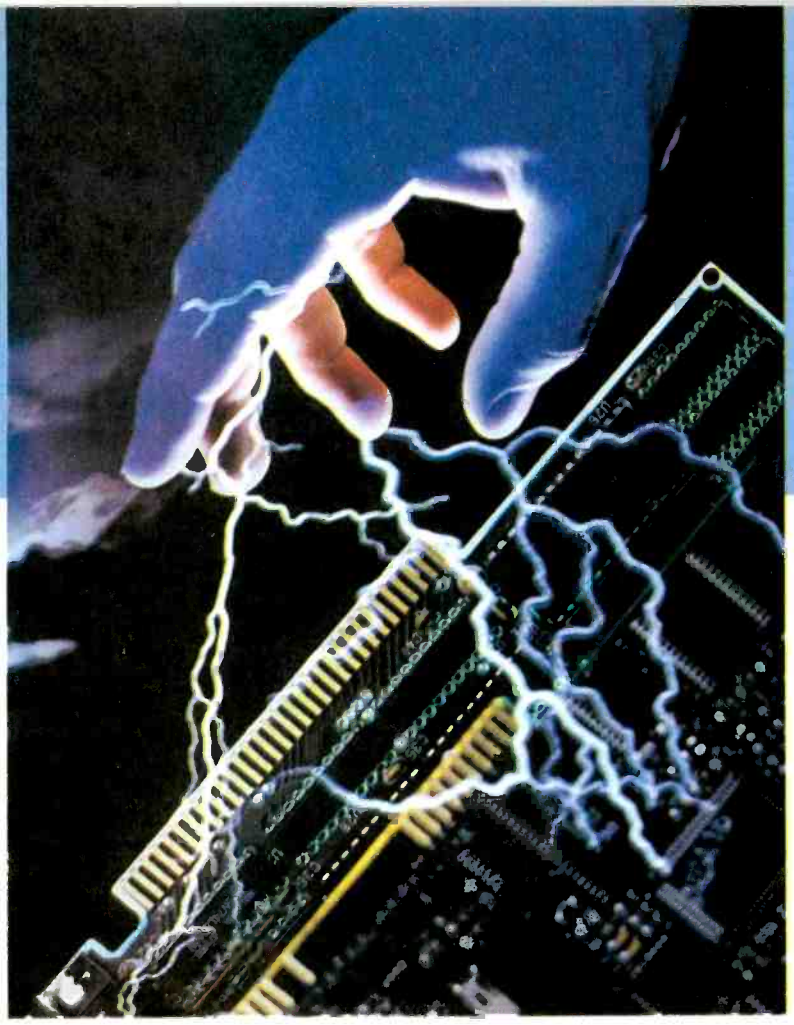
Make cheques payable to:	Television
Subscription rates:	
UK	£32.00 per year
Airmail Eire	£36.00 per year
Airmail Europe	£46.00 per year
Airmail Rest of World	£59.00 per year

NEWSTRADE ENQUIRIES
Distributed by MarketForce
Telephone: 0207 261 7704

WEB SITE
For a full list of RBI magazines:
http//www.reedbusiness.com

ISSN **0032-647X**

REED BUSINESS INFORMATION



A lot of damage can occur when the maximum voltage rating of an opto-isolator in a piece of telephone equipment is exceeded by a lightning-induced electromagnetic pulse. Steps can be taken to avoid this situation however. David Benyon describes the phenomenon and what to do to provide protection

Lightning Protection

In the June issue there was a mention of a Pace digibox struck by lightning. It was another case of damage to equipment via a telephone line. I can speak from experience about this, as a similar thing happened to me some years ago. But nowadays I happily surf the net while lightning flashes all around and other people's modems are popping off like flashbulbs.

The Problem

During an electrical (thunder) storm vast discharge currents occur. They take the form of an electric arc (lightning), and are accompanied by intense electromagnetic radiation pulses. The field strengths of these lightning-induced electromagnetic pulses (LEMPs) are quite remarkable. For example a college lecturer friend of mine recalled the time when he performed an involuntary re-enactment of Sir Oliver Lodge's experiment. What happened was most curious.

Brian had been using his umbrella in the normal way, except that his thumb was vertical and spaced a millimetre or so from the metal shaft – the umbrella had a plastic handle. There was a sudden flash of lightning, and simultaneously a spark jumped from the shaft to Brian's thumb. Now, when a voltage of this magnitude can be induced in a man and his umbrella, just think what a mile of telephone cable can manage!

The telephone installation at my present property was carried out when I moved there about twenty years ago. As the engineer who did the work was about sixty, I naturally assumed that he knew his job and that there was no need to check his work. Wrong! I subsequently bought a fax machine, along with a rather expensive fax/phone automatic switch box. All seemed well until an electrical storm produced a loud report from the router-box (there was a clap of thunder about a second later). When I checked the telephone installation I discovered that although a pair of lightning arresters had been fitted they were useless because there was no earth connection (see Fig. 1).

The telephone company has been unhelpful to put it mildly. Reference to various books has shown that the need for lightning arresters has been acknowledged since before World War II. In fact the term 'lightning arrester' was coined in 1860.

When I took the matter up with some 'engineers' I was told "there's not much done on overheads (cables) these days, so we don't bother with earth rods; anyway it doesn't need earthing because there's a connection to a big copper plate at the telephone exchange". Hmm. You just can't get the right kind of staff any more, can you?

Practical Measures

I made an earth rod of 22mm copper pipe, about 5ft long, sunk in a predrilled hole. A Kango Model 950 roto-hammer with a 1in. diameter masonry drill, and several Mason Master size W extension bars, were used to penetrate the foundation and the clayey, stony ground. A substantial wire (6mm^2 cross-section minimum) was used to connect the earth

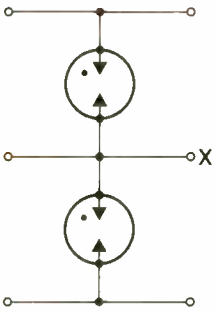


Fig. 1: A telco lightning-arrester box circuit. If terminal X is not earthed there will be no protection against LEMPs.

rod to the lightning arresters. Sharp bends were avoided to minimise self-inductance.

That's the first line of defence. Further protection has been provided by constructing a longitudinal stop coil. This was done by winding telephone extension cable on an old transformer core. Being in push-pull, the signal currents are unaffected. LEMPs, being in push-push, are impeded.

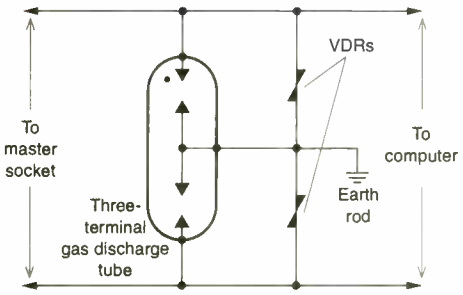
Another lightning arrester (GDT style 14A, Farnell reference 453-432, though mine came from Greenweld) is fitted at the telephone socket used to feed the computer's modem, see Fig. 2. As there is some doubt as to whether or not these gas-gaps are wholly reliable, I also fitted Philips VDRs (Farnell part no. 319-016). The centre tap of these protectors is connected to another earth rod, this time using 10mm^2 cable.

When the installation is in a hot, dry country where earth rods have a high resistance, the second earth rod should be bonded to the mains earth. This is called protective multiple earthing (PME). PME has the great advantage that the earth path for the nuisance current is metallic. Several kA can be absorbed before the voltage rating of the opto-isolator in the modem is exceeded.

Results

The component costs were extremely modest and the results so far have been excellent. Though the VDR capacitance is about 100pF, the 44k modem speed is regularly achieved.

It is now possible to purchase ready-made mains/phone distribution boards with VDRs across the mains and also, presumably, between the mains earth and the phone line. A surge rating of 13·5kA is claimed. The cost of about £50 may seem on the high side, but they soon pay for themselves in cutting repair bills.



Finally, may I just remind you all that the VDR in the LJU series of master sockets is virtually useless. It's a single VDR that is connected across the telephone pair. When a LEMP occurs and both telephone-pair conductors rise to say 10-20kV, the VDR is not interested. What will happen in this event is that the 10kV will jump the opto-isolators in the fax machine or modem and find its way to earth via your expensive silicon. ■

Fig. 2: Customer's extension socket, modified. A three-terminal gas-discharge tube and two Philips VDRs were added. Connect the common point to an earthing rod via cable of adequate thickness, say 10mm^2.

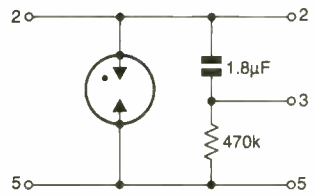


Fig. 3: This PSTN mastering circuit provides no protection against LEMPs.

WHAT A LIFE

Customers and their equipment, the difficulty with today's barbers, and an unusual overheating power supply problem. Donald Bullock's servicing commentary

I'm in the doghouse again, and Greeneyes' spoilt little dog Flash is living the life of Riley. I had knocked up a Mark 2 version of my electric shock machine and installed it at the doorway of my writing hut in the garden. This provides a rich current flow from the step to anything that's making it wet.

Flash let me know, in his own special way, that it was quite effective. He did a few backward somersaults then shot off at 80 m.p.h., yelping his delight. Greeneyes mistook this for a sign of his displeasure.

"You're a wicked sadist" she informed me coldly as she scooped up the mutt. Then, to the dog, "come on to mammy, Flashey Washey."

After that she stopped speaking to me, which was unfortunate as I badly needed a haircut and Greeneyes has been my barber for years.

A day or two later I thought I'd call a truce, mainly because it had turned hot and my straggly hair was annoying me. But she turned on her heels and went off to fondle the dog. I wandered back to the workshop just in time to run into Mrs Gabber.

No Light

"Ah, Mr Blower" she gushed. "What's the matter with your hair? Now, you won't believe this, you simply won't. You won't believe it."

I stopped and looked at her. She seemed reasonably intact.

"My light's gone out" she said.

I believed her.

"It's my Ferguson video recorder" she added. "I disconnected it from the mains supply to clean the room and when I plugged it in again it was dead. No clock display, no nothing. What else could I do? Anyway four hours later the clock was back on again. Ah, I thought, it's all right now. I won't have to take it to that Mr Blarney's place and have to pay him a lot of money to repair it. And what do you think happened next?"

I shook my head and looked blank.

She brought her face close to mine. "It went off again Mr Bullfinch" she said.

I fetched the machine, which turned out to be a Model FV71LV, from her car. Paul had a look at it and found that it worked all right, except for the clock. When he checked its DC supply he found that it was low, which led him to CP41. This 10V electrolytic smoothing capacitor had fallen in value from 220µF to 35µF. A replacement restored the clock display.

When she called to collect it, Mrs Gabber eyed me closely. "There's a good unisex hairdressers just behind Grubbs Foodstore Mr Butcher" she said.

When she'd gone I looked in the mirror and decided to slip out to a barber. The last time I visited one I paid a shilling. It wasn't a high price for a chap whose pride was at stake.

The first one I came to was full of women and kids, in addition to a few trendy-looking saps in trousers. So I tried another – and another. They were all the same. And some had women barbers.

I went back and made some telephone enquiries. "You won't find an old-fashioned men's barber" I was told, "we're all unisex hairdressers these days. Have to move with the times you know."

Stuck in Standby

Not knowing what to do I went to the workshop, where Steven was talking to a tiny man with a strong Irish accent. He'd brought in his colour set.

"Name's Amstrad" he said, "and the set's a Murphy."

Steven looked at the set. "Seems to be an Amstrad" he said.

"Ha, then it would be me who's Murphy."

"What's the trouble?" Steven asked.

"Dunno" the man said. "I tink I'll take an Aspirin when I get home."

The set was a Model CTV3121N, about twenty months old. It was stuck in standby. Steven put it on the bench and, after carrying out some checks, found that there was trouble in the line output stage. Some further tests showed that the line output transformer was the cause of the fault. A replacement is available from CPC at £20.32 plus VAT. The part number came as a surprise: AM604200000280! We ordered one which turned up next day. It looked different physically from the original, but fitting it cured the fault.

Repent

Mr Cantor has the sharpest and shiniest red face I've ever seen. He came in with a Goodmans TV set and, while I was booking it in, put a leaflet over the job card.

"Repent" it proclaimed.

I looked up at Cantor, who smiled. "It's never too late" he said.

"If you know about a filthy little dog, that's not so" I replied. Then I tapped his set, which was a Model 2032. "We'll try to have it ready tomorrow" I said.

There were signs of burning in the line output transformer area. I feared the worst, but the cause was the 330pF, 2kV tuning capacitor C444.

Next day he was back to collect the set. Before he left he smiled and leant towards me.

"What shall it profit a man if he gains the whole world and looses his soul?" he asked.

Shortly afterwards Mr Murphy was back for his set. This time he had his wife with him. They were delighted with the picture their set displayed and paid the bill in cash – with an extra fiver for Steven.

"It's never been as good" Mr Murphy said. Then he leant towards me. "I don't like to say this, sorr, but you could do with a haircut."

A Philips FL1.6

When he'd gone I looked in the mirror again. "It's either a haircut or a cheap violin for me" I muttered. But my thoughts were interrupted by the arrival of Mr Crust. He struggled in a with a 25in. Philips set, Model 25ML8500/05B (FL1.6 chassis).

"It's a very high quality receiver" Crust told us, "but it's dead."

He was certainly right about the

specification. It's a digital scan set that operates at a field frequency of 100Hz. The 3·15A mains fuse was open-circuit, and we soon found that the BUT12AF chopper transistor Tr7216 was short-circuit. There were several dry-joints in the line output stage, and these had no doubt contributed to its failure. After carefully resoldering each one and fitting a new transistor we switched on and were rewarded with an excellent picture.

A day or two later another of these sets came in with the same fault.

When Mr Crust came to collect his set I tried to keep a low profile – I didn't want more comments about my hair. He didn't make any, but I had the feeling that he studied it a bit.

At the Barber's

I simply had to get it trimmed and decided to phone around in the next town.

"I'm looking for an, er, mature type of barber. One with a little corner shop and a few older men sunk into a few old-fashioned chairs" I said to one likely sounding hairdresser.

"I've been here thirty years" the barber said soberly, "just pop in and you'll get the haircut you want from me or my assistant."

I sped off and found the shop to be as I'd hoped. He was chatting to his customers in the way I'd expect. "Want anything for the weekend, sir?" I was delighted.

As my turn came I sat in the chair and the barber flung his cloth over me. Then he slipped on his jacket and walked out. Two or three women came in and sat on the chairs, and a young lady in a smock came through a door at the back of the shop. She smiled at me.

"Just a light trim is it, love?" she asked.

"Would you be good enough to cut my hair?" I asked gently.

She nodded and went off to get the scissors. I kicked the dog's bone away and gave it a good clout.

I was cornered. All I could do was nod. She threw a jug of water over my hair, took a curly pink comb and a pair of nail scissors out of her pocket and started to comb and snip and pat my hair. Not at all what I wanted.

"What's your job dear?" she asked, "is that your used car place at the top of the road?"

"No" I declared, "I'm a television engineer."

"Our set needs a panel thing" she continued, "have you got one that would do? It's a brownish set, about this big."

She drew a big square in the air with her scissors.

"We got 'im from Jaspers, only he's a rogue. Charged us five pounds last time it went wrong. My boyfriend said it was just a loose wire. You've a lot of rogues in your trade, 'aven't you? Course we don't watch it much."

After an age of this sort of thing she said it was done. I looked in her mirror. My hair seemed the same to me, only wet.

"Five pounds seventy five" she said. I went dizzy but paid up, then ran out.

The car mirror confirmed that I still needed a haircut. On my way home I popped into our butcher's shop.

Return

When I got back I looked for Greeneyes, who eyed me coldly.

"I've behaved very badly" I declared, "treated Flashey Washey very badly. Devil must have got into me. Promise I'll never do it again.

I opened the newspaper parcel and a huge bone fell out. The dog went for it and wagged its tail. Greeneyes gave me a warm smile.

"Would you be good enough to cut my hair?" I asked gently.

She nodded and went off to get the scissors. I kicked the dog's bone away and gave it a good clout.

Power Supply Problem

I've mentioned before that when we are in Spain we receive BBC Radio 2, 3 and 4 via satellite. The signals are fed to a low-power FM transmitter that enables us to hear the broadcasts anywhere in the house or garden using an ordinary VHF radio receiver.

Various regulator units that I tried out for powering the transmitter were not as stable as they might have been. I finally settled on a fairly rugged one from CPC, order code PW00140. It's an extremely stable unit that can deliver 1·2A at 14·4V, which is far in excess of what's required. I considered this to be just as well, as the transmitter is in continuous use.

The other day I was surprised to find that the power pack had become very hot and was giving off a strong smell of burning. Yet the transmitter was still working normally, with its usual current consumption. I switched the power supply off and placed it near an open window to cool down. A few hours later I tried it again, leaving it in the same position.

This time it ran coolly all day. So I came to the conclusion that it was OK, though I couldn't account for the earlier overheating. I then returned it to its previous position by the satellite receiver.

A few hours later I noticed the burning smell again, and found that the power supply was hot. I also established that it ran coolly when placed elsewhere. I was forced to the conclusion that the overheating had to do with the power pack's position. It had run coolly for ages in one position: what had changed?

Then Greeneyes came in and switched on Jimmy Young. I noticed how much better my substantial, powerful new loudspeakers reproduced that unusual voice. That was it: my new speakers! One of them was only inches away from the power supply.

I soon confirmed that the proximity of the speaker was the cause of the overheating. Presumably its bulkier and more powerful magnet inhibited the alternating flux changes in the core of the power pack's transformer, encouraging its primary winding to work harder and, in the process, overheat. ■

TELETOPICS

Digital Progress

According to a new report from Strategy Analytics by the end of this year some 56 million homes around the world will be equipped to receive digital TV. The report forecasts 222 million digital TV households by 2005. So far the UK has gone farthest along this path, with almost 30 per cent of homes expected to have gone digital by the end of the year, followed by the USA at 24 per cent then France and Spain at 15 per cent. The report estimates that at the end of 1999 34·4 million homes around the world were equipped for digital TV, 77 per cent via satellite (direct-to-home), 21 per cent via cable and two per cent via a terrestrial TV service.

Competition from satellite TV operators is forcing a rapid roll-out of cable digital TV services, particularly in the USA. By 2005 cable is expected to have become the leading provider of digital TV services worldwide, with 55 per cent of the market.

Last year consumers installed over 17 million digital set-top boxes to give access to the new services: this year's global set-top box sales are forecast to reach 28 million units, rising to nearly 92m a year by 2005.

Leading digital TV operators such as TPS in France, Open in the UK and Teledanmark in Denmark are already offering interactive and on-line services, such as e-mail, home shopping and banking, and games, providing competition for PC-based ISPs (internet service providers).

In the USA America Online has launched an interactive cable TV service, AOLTV. Users pay about $250 for a Philips-manufactured set-top box, with wireless keyboard and remote control. The subscription for existing AOL users is $14.95. An electronic programme guide is central to the AOLTV offering: it brings channels together by category, such as news and sport, enabling viewers to find what they want more easily. Connection to the internet is by dialling up. By early next year the STBs are expected to incorporate TiVo technology, with recording, picture freeze and image replay. AOL has reached a joint development agreement with TiVo and could end up with a 30 per cent stake. Similar plans for "personal TV" have been announced by a group consisting of Microsoft, DirectTV and Thomson Multimedia.

In the UK TiVo is linked with BSkyB. Its PVRs (personal video recorders) are due for release this autumn: the first ones will be manufactured by Thomson Multimedia.

Sky News has launched an interactive TV news service called Sky News Active for its digital satellite TV subscribers. It enables viewers to select the items they require. Access is via the red button on the remote control unit. This leads to a menu of options.

ONdigital has reached agreement with the French company Netgem on the launch of its internet service, which is due later this year. Netgem will provide the technology, which will initially involve the use of an ONdigital internet box, about the size of a large paperback book, that's connected to the ONdigital STB and telephone line. A full specification for the box and name for the service have still to be agreed. They will initially be available to ONdigital subscribers only. The Netgem technology will give fast, simple internet access with instant page reconfiguring to suit TV display.

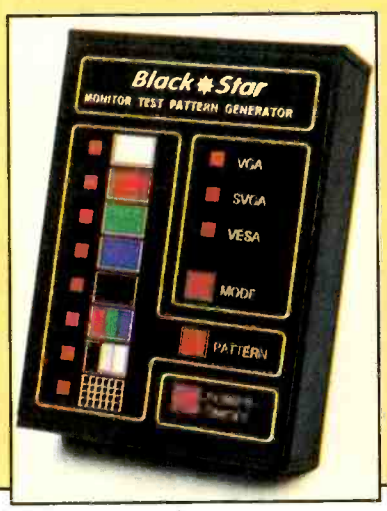
Pace will be demonstrating its Home Gateway technology at September's International Broadcasting Convention in Amsterdam. Visitors will see the set-top box become a gateway for a networked home. Demonstrations will include Shopping Mate, a hand-held device that enables goods to be scanned to create a shopping list that can be transmitted to the STB via a wireless link.

Four of the top UK tour operators, Thomson, Airtours, First Choice and Cosmos, have signed up to use Telewest's digital cable TV service. The TV Job Shop is to be launched via SkyDigital this autumn: it's described as the world's first digital TV recruitment channel. Invest TV has signed a five-year deal with SDN, which runs DTT multiplex A, to broadcast the Simply Money channel. It will be available as a free-to-air service via ONdigital set-top boxes.

Oftel has decreed that SkyDigital's interactive TV technology should be made available openly, on the basis that Sky has a dominant position in the market. The ruling will be reviewed in the first half of next year.

This new portable monitor test-pattern generator has been introduced by Black Star Instruments. The battery-operated, simple to use instrument measures 40 x 105 x 150mm, weighs just 0·5g and is particularly handy for field service work.

There are three timing modes, VGA (640 x 480 pixels, 31·5kHz line frequency, 60Hz frame rate), SVGA (800 x 600 pixels, 35·3kHz line and 56Hz frame scanning), and VESA (1,024 x 768 pixels with 48·4kHz and 60Hz scanning). All modes are non-interlaced. The eight test patterns are white, red purity, green purity, blue purity, black, colour bars, grey scale and crosshatch. Outputs are RGB at 75Ω, 0·7V peak-to-peak. There are negative-going line and frame sync pulse outputs and TTL levels are also provided. Connection is via a standard 15-way VGA connector.



Power is from a 9V PP3 battery or an optional external DC supply (9V, 150mA). An optional carrying case is available. Cost is £165 plus VAT. For further details contact Black Star Instruments, 2 Glebe Road, Huntingdon, Cambridgeshire PE18 7DX. Phone 01480 412 451, fax 01480 450 409.

Thomson Multimedia to Expand

The French consumer electronics group Thomson Multimedia has announced plans to raise at least $1bn to fund an expansion programme. The aim is to become the world leader in entertainment products and interactive services. At present Thomson Multimedia is the world's fourth largest consumer electronics manufacturer. Three years ago it underwent a major restructuring. Group brands include RCA, which has a 20 per cent share of the US TV/video market.

The move has been backed by the French finance ministry, which has a 51·7 per cent controlling stake.

Video News

Macrovision has launched a new Copy Protection Detect feature that allows DV recorders and other digital-based set-top devices that accept analogue inputs to include Macrovision's copy protection technology. The Copy Protection Detect feature maintains end-to-end protection of programme material from the analogue input though the digital processing to the analogue output. Philips Semiconductors' video decoder products will include the technology as a complement to its family of digital video encoders.

The detection circuit can determine whether an incoming analogue video programme has been encoded by a copyright owner using Macrovision's copy protection process. The detection result is tracked within the product, and used to re-encode the analogue video output with Macrovision copy protection to match the original. With hard-disk products the feature can be used help prevent permanent copies being recorded.

Hitachi is to launch the world's first DVD-RAM camcorder, Model DZ-MV100, in Japan in late summer. It will store on a 4·7Gbyte DVD-RAM disc up to an hour of high-quality video (30 minutes per side) at a fixed rate of 6Mbits/sec, or two hours of video in the standard mode at a 3Mbits/sec rate. The discs will be compatible with 4·7Gbyte DVD-RAM drives and VCRs. Other features include a 1·1 million pixel CCD imager, 12x optical zoom and 48x digital zoom. The DZ-MV100 is due for launch in the UK in October.

Sony is to launch a Digital Mavica camera, Model MVC-CD1000, that uses CD-R discs. The 6cm discs have a 156Mbytes capacity that enables them to store over 1,000 JPEG still pictures or up to six minutes of MPEG-1 video. They can be played by a PC equipped with a CD-ROM drive and suitable software.

Hitachi is to launch its first Digital 8 camcorder, Model VM-D865LE, in August. Features include a 22x optical zoom, a 500x digital zoom and a variety of digital picture effects.

Digital Teletext

With the end of analogue TV transmissions a not-too-distant prospect, the two UK teletext services, Ceefax (BBC) and Teletext (previously called Oracle, now run by media group DMG Trust), are being reformatted. BBC Digital Text is already available to ONdigital subscribers and should be available via cable networks within a few months. The digital spectrum has about twice the capacity of analogue services for teletext, enabling the service to be improved with faster navigation and the inclusion of photographs. By the time analogue transmissions end, teletext pages may look little different from web ones.

Teletext has a holiday/flight booking portal under consideration.

This new MPEG transport data stream generator from Yokogawa has been introduced for use with multimedia systems and digital TV. The VT3000 provides reliable and reusable MPEG data streams for testing signal-to-air interfaces including the latest generation of set-top boxes.

The instrument can capture and record transport stream data on an internal hard disk, via a DVB parallel port, and play back up to three independent channels of data simultaneously. Each channel is provided with its own individual clock, which facilitates multiplexing tests.

For further information contact Yokogawa Martron Ltd., Wellington Road, High Wycombe, Bucks HP12 3PR. Phone 01494 459 200, fax 01494 535 002.

Recycling Directive

The European Commission has drawn up proposals on the disposal of used electrical goods, ranging from toy trains to mainframe computers. Manufacturers would have to take back and recycle a set proportion of each item's weight. In the case of toys this would be fifty per cent, rising to 75 per cent for large household appliances such as refrigerators. The Commission also seeks to ban the use of the heavy metals lead, mercury, cadmium and hexavalent chromium, with exemptions for specific purposes.

It's not clear who would bear the cost of these pollution-control measures, which could be made retrospective. In the end both consumers and manufacturers will face extra costs. Similar measures to tackle old cars were agreed in May.

According to the Commission, in 1988 six million tons of waste electrical and electronic equipment were generated in Europe, representing four per cent of municipal waste.

If the Commission's directive on electrical goods recycling is approved by member states collectively and the European parliament, individual governments will have eighteen months to introduce laws based on the directive. At present it looks as if implementation will be introduced later in the decade, with recycling targets in 2006 and heavy metals prohibitions in 2008.

NEC's new PlasmaSync 42in. 16:9 aspect ratio display monitor, Model 42MP1, has new phosphor protection, a programmable timer and on-board audio functions. Resolution is 853 x 480 pixels and the unit is just 89mm thick. A digital zoom function enables any part of the image to be enlarged to nine times the original size. The advanced conversion processing circuit provides compatibility with a wide range of input resolutions so that even charts and diagrams with fine detail appear sharp. A motion-adapted 3D progressive-scan converter provides high-quality reproduction of moving images. The cinema mode uses a process called 2-3 pull-down to recognise film-source signals from a DVD player. Progressive scanning conversion then produces clear, vivid reproduction.

The monitor is available at £7,500 plus VAT. For more information on this and other NEC products contact the NEC customer helpdesk on 020 8993 8111.

It's sometimes difficult to know whether intermittent TV set failure is caused by a power supply or line output stage fault. Checks can be wasteful in terms of time and components. The unit described in this article, designed by Keith Cummins, provides protection during a soak test then indicates the basic cause of the trouble when the fault appears

TV Protection Test Set

The difficulties caused by intermittent failure of a TV set's power supply or line output stage often come up in *Television*. One may fail and damage the other. The problem is to decide where the original fault lies. We all know how frustrating it can be to replace several obviously defective components, run the receiver on test and then, maybe after several hours or possibly several days (perhaps back in the customer's home), have an 'action replay' of the original problem. With this sort of situation time, expense and possibly customer goodwill all come into the equation. Wouldn't it be nice, I thought, if there was a test box that could both prevent repeated blow-ups and assist with the fault diagnosis? I decided to see what could be done at a realistic price. After several 'on-paper' versions I built the unit described in this article.

Basic Arrangement

The test box is connected between the receiver's power supply and line output stage. Fig. 1 shows the basic scheme. The output from the power supply is connected to a voltage sensor, a clamp diode and an auxiliary power supply. Emitter-follower Tr1 receives at its collector the output from the power supply plus an extra voltage provided by the auxiliary power supply. Tr1's base is fed via a ballast lamp, its base voltage being clamped at the receiver's power supply output voltage plus 0·7V by D1. As a result the output at Tr1's emitter, which feeds the line output stage, is the same as the output from the receiver's power supply.

If the voltage sensor detects an excessive output voltage from the power supply it fires thyristor Thy1. Tr1's base voltage is then reduced to a little over 0V. There is therefore no feed to the line output stage, the ballast lamp providing a load for the receiver's power supply.

If the current sensor detects excessive current, the relay contact closes shorting together Tr1's base and emitter. Being without bias, it switches off. The line output stage is now fed via the ballast lamp, which limits the current. With a greatly reduced input voltage, the line output stage shouldn't blow up. But there should be sufficient voltage to enable fault diagnosis to proceed. This is akin to using a variac to reduce the voltage applied to an audio amplifier, so that fault diagnosis can be undertaken without damage.

It might sound expensive to employ an auxiliary power supply, but in practice a suitable unit can be purchased from Sendz Components for just £2. This stand-alone unit needs no modification apart from changing the mains plug from a Continental type to our standard 13A type. It provides +12V and +24V via a three-pin DIN plug. The test unit is therefore fitted with a three-pin DIN socket at the rear. All other connections are made via terminals on the front panel, which also carries the voltage and current sensor adjustment controls, the

input on/off and voltage trip reset switch, the output on/off and current trip reset switch, the protection on/off switch and LEDs to indicate power on, protection on and current trip in operation. A red lens in front of the ballast lamp enables the lamp to be observed.

Complete Circuit

Fig. 2 shows the complete circuit of the unit. Before providing a description of its operation, I should point out that the auxiliary supply's 0V line (socket SK1, pin 2) is connected to the output from the TV set's power supply, which I have called +Vin. As a result the auxiliary supply's 12V output becomes +Vin +12V, likewise its 24V output becomes +Vin +24V, both relative to the test unit's 0V line.

I'll start with RLA, which is a 24V relay with four sets of changeover contacts. Only three are used. When the protection facility is switched off, or there is no input from the auxiliary power supply, RLA is not energised and the test unit's input and output terminals are connected together: the unit is thus 'transparent', i.e. it acts just like a piece of wire. Operation of the test unit can be called up only by energising RLA. This ensures that the auxiliary supply is available before +Vin is applied to the protection circuits. These operate over the range 50-180V (input), with a current protection range of less than 100mA to 1A. The upper voltage is limited by the dissipation in Tr2.

When SW1 is closed, 24V is applied to the coil of RLA which operates. The input and output terminals of the test unit are then connected to the protection circuits. At the same time R1 and D1 are connected. D1 lights to confirm that the relay has operated. This is preferable to connecting the LED to SW1 because, if the relay was faulty, it is possible that D1 would light, giving the impression that protection is being provided when it isn't.

The +12V and +24V supplies are available whenever the auxiliary supply is con-

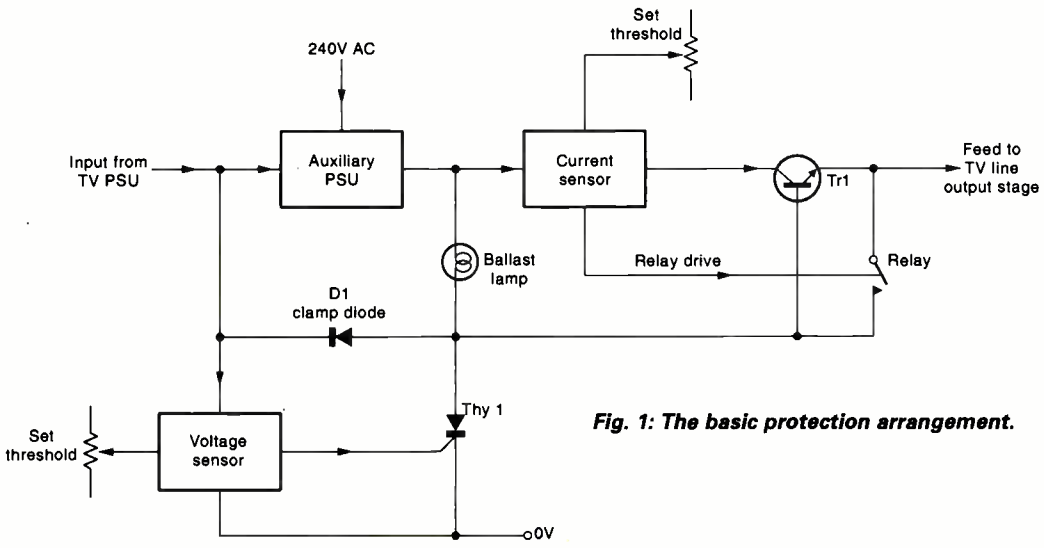


Fig. 1: The basic protection arrangement.

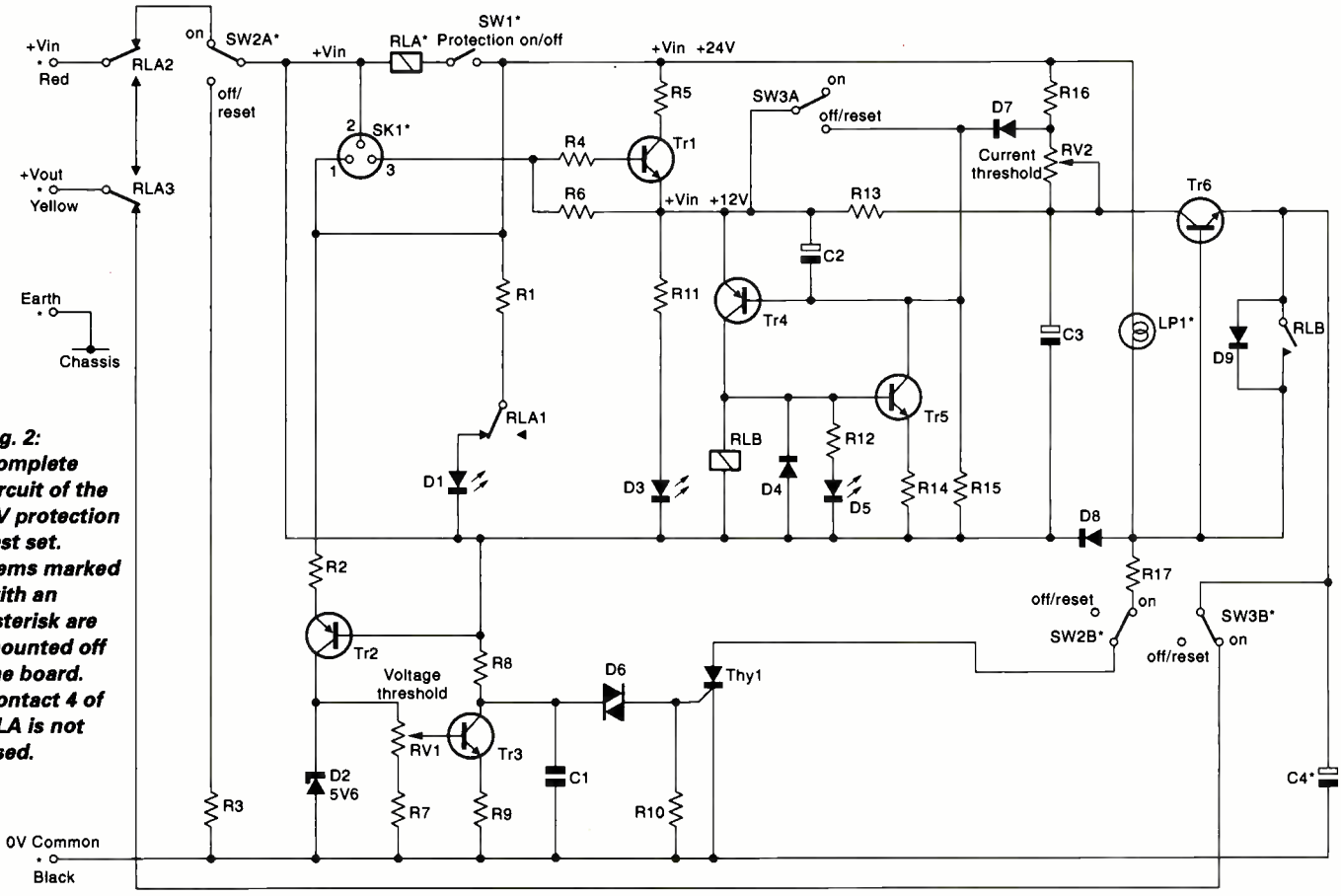


Fig. 2: Complete circuit of the TV protection test set. Items marked with an asterisk are mounted off the board. Contact 4 of RLA is not used.

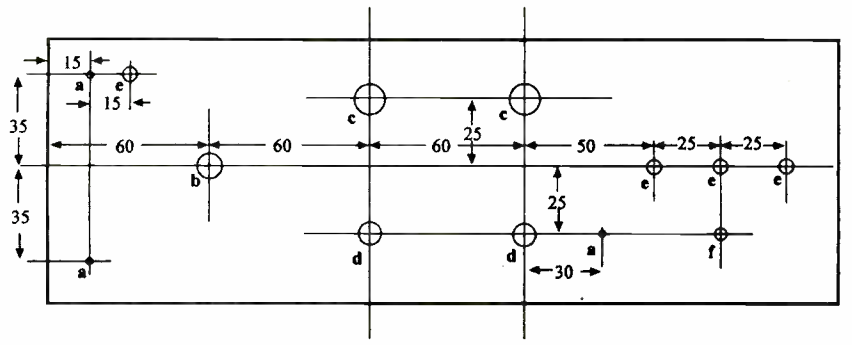


Fig. 3: Drilling details for the front panel. All dimensions in mm. Holes a 3mm for LEDs, b 10mm viewing hole for ballast lamp, c 12mm holes for input and output on/off switches, d 9mm holes for threshold control potentiometers, e 6mm holes for miniature toggle switch and input/output/0V terminals, f 5mm hole for case earthing terminal.

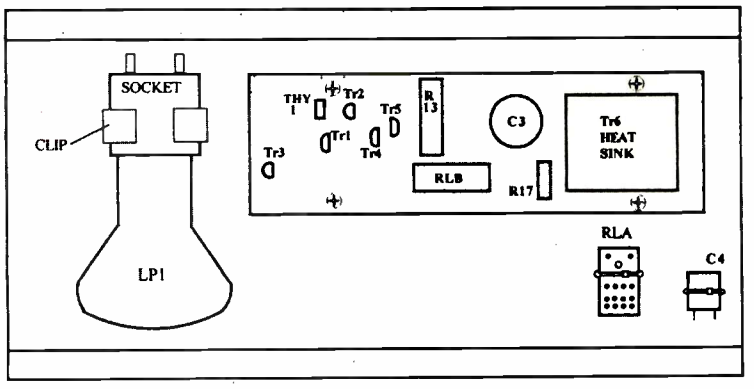


Fig. 4: Suggested layout of components on the stripboard and base plate. Connect the negative terminal of C4 directly to the black 0V terminal.

nected. 24V comes in via pin 1 of SK1 and 12V via pin 3. The 12V supply passes via R6, after which it is referred to as +Vin +12V. We'll deal with what Tr1 does later. The 'power' LED D3 is fed via R11, and remains on whenever the auxiliary supply is available, irrespective of switch positions.

The collector of Tr6 is fed via R13 and decoupled by C3, which prevents gulps of current at line frequency affecting the +Vin +12V supply. R13 also provides current sensing: we'll return to this function and how current limiting is triggered later.

Ballast lamp LP1 is a 240V, 40W R63 reflector type, which is small and convenient. Its resistance when cold is about 100Ω. Under normal operating conditions, with nearly 24V across it, the resistance rises to 400Ω, providing a potential maximum of 60mA base current for Tr6. D8 clamps Tr6's base voltage at 0·7V above +Vin. Tr6's emitter is therefore at +Vin give or take 100mV.

Current Limiting

As previously mentioned, R13 senses the output current. As this increases, so does the voltage across R13. Tr4 drives RLB to provide protection in the event of excessive current demand. Tr4's emitter is connected to the input side of R13 while its base is connected via D7 and RV2 (current limit threshold) to the output side.

Suppose for the moment that RV2 is out-of-circuit, i.e. its slider is at the D7 anode end. This is the position of maximum sensitivity, i.e. minimum current is needed to trip the circuit. In this position, the anode of D7 is connected directly to R13. A small current drain via R15 develops about 0·6V across D7 and, with minimum current through R13, Tr4 is biased just short of switching on. As the current through R13 increases, the voltage developed across it becomes sufficient to switch Tr4 on. This energises RLB and also switches Tr5 on, feeding current to Tr4's base. The circuit thus latches on, with RLB permanently energised. D5 lights, giving visual indication that the current trip has operated. RLB's contact closes, shorting the base and emitter of Tr6 which turns off. Current via R13 ceases, but as the circuit has latched RLB remains energised. The load is now fed from +Vin +24V via LP1, whose resistance increases as it lights up, limiting the load current.

When SW3B is switched from on to off the load is disconnected. At the same time SW3A short-circuits the base and emitter of Tr4. The latching circuit is reset and RLB is de-energised. D4 clamps the over-swing voltage across RLB's coil to a safe value as it de-energises. Note that RLB is a reed relay. At first sight it might not appear to be adequate for this application, but when RLB closes it has to short out only 0·7V and when it opens the high-current condition has been cleared by opening SW3B. So it receives quite kind treatment in what superficially appears to be a demanding situation. C2 is included to prevent a 'spike' inadvertently triggering the latching circuit.

RV2 provides current-limit threshold adjustment. As the in-circuit value of RV2 is increased, current via R16 and D7 increases the reverse bias at the base of Tr4. Thus a greater voltage has to be developed across R13 to switch Tr4 on. The range of control is from under 100mA to just over 1A.

Aux PS Ratings

The auxiliary power supply has current ratings of 600mA at 12V and 250mA at 24V. It will cope with an overload, but a little help may be needed with the 600mA rating. When the current drawn from the 12V supply exceeds 600mA, 0·6V is developed across R6. This voltage is applied to the base of Tr1 via R4. Tr1 is thus switched on, with the result that current is drawn from the 24V supply via R5. This resistor helps to reduce the dissipation in Tr1, which is rated at 1·5W.

The 24V supply can cope with the extra load while LP1 is not alight. When either the current or the voltage trip operates, LP1 lights. But as Tr6 is switched off, the current through R6 is small and Tr1 does not switch on. This leaves the 24V supply fully available in series with the +Vin supply to feed the lamp.

The Voltage Trip

The last major part of the circuit is the over-voltage trip. This calls for a stable reference voltage, which is provided as follows. Tr2 is a constant-current source: the voltage across R2 is a constant 23·3V, and this determines the current. The collector of Tr2 feeds this constant current to zener diode D2, which in turn provides a constant 5·6V. The current is constant over the range of input voltages specified. The dissipation in Tr2 increases linearly with voltage, which is much better than using a resistor to feed D2 – the current would not be constant, and the dissipation would increase as the square of the voltage! Obviously the stability provided by the zener diode is much better with a constant-current feed. In addition the choice of 5·6V was not arbitrary: at this voltage the temperature coefficient of the zener diode is nearly zero.

This stable reference voltage is applied to RV1 and R7. RV1 sets the voltage at the base of Tr3 and hence the current through this transistor and its emitter resistor R9. Tr3 is another constant-current device, but in this case the constant current is determined by the setting of RV1. It follows that for any given constant current the voltage developed across R8 will also be constant. Thus any change in +Vin will appear, without attenuation, at the collector of Tr3,

RV1 is normally adjusted to set Tr3's col-

lector voltage just below the 32V avalanche threshold of diac D6. An increase in +Vin will switch D6 on, applying the charge held by C1 to the gate of Thy1 which then fires. The voltage at the base of Tr6 is reduced, via switch contact SW2B and R17. Energy stored by the output decoupling capacitor C4 or external circuitry is returned to 0V via D9, the current-limiter R17, SW2B and Thy1. D9 also protects the base-emitter junction of Tr6 from reverse voltage.

With the base of Tr6 now being at close to 0V, the unit's load is effectively disconnected and energy from the TV set's power supply is dissipated in LP1. Switching SW2 to off disconnects the TV set's power supply and connects the unit's internal +Vin rail to 0V via R3. The other half of SW2 disconnects the anode of Thy1, a 'belt-and-braces' approach to ensuring that this device resets.

Construction

The unit is built into a cabinet that's 300mm wide, 100mm high and 150mm deep. This provides an uncluttered front panel layout with a sensible amount of working space inside. A 185 x 60mm stripboard panel to hold the components is mounted on stand-off pillars. It's located 25mm from the rear of the box and 10mm from the right-hand edge. The cabinet has a flat bottom chassis plate that can be drilled to enable the stripboard and other components to be assembled before being finally screwed into position. The circuit diagram (Fig. 2) indicates the components that are not mounted on the stripboard panel.

The first task is to drill the case. Fig. 3 shows the details. Mark the case lightly with a soft pencil so that the marks can be easily rubbed out later. Drill pilot holes (I suggest 2mm), with the box overhanging the edge of the bench and a piece of wood to protect the bench. The drill will then hit the wood after penetrating the steel, but this will prevent the drill chuck smashing into the box and scuffing the paintwork. Then, using the appropriate-sized drills, enlarge the holes as required. Clean off swarf and rub out the pencil markings. By exercising care at this stage you can avoid damage to the paint because of drill jumping or, even worse, breaking. Finally, cut the rear hole for the three-pin DIN socket, on the centre line and 50mm from the right-hand edge. Use the socket as a template to mark the securing screw positions, then drill 3mm holes to take M3 screws.

After all that effort and care it's a good morale-booster at this point to fit all the components in their respective holes. It really does look as if you are getting somewhere at this stage. Secure the LEDs in position with a spot of Araldite, and stick the red lens *inside* the box, with its flat face looking through the hole, again using Araldite. As there's plenty of overlap, it's simple to apply the Araldite without it oozing out through the hole in the panel.

When these items have been fitted you can locate the lamp and drill its fixings in the base plate – I used a Terry clip to grip the lampholder. You will see from the illustrations that C4 and RLA are also mounted separately on the base plate, immediately behind the input/output terminals. This ensures that AC circulating current paths are kept as short as possible. C4 is held by a cable tie that's passed through two 2mm holes drilled in the base plate. RLA is mounted 'on its head', secured to the base plate with a double-sided sticky pad then firmly held in position by a cable tie as with C4. RLA's terminals are all thus readily accessible for soldering.

You can now position the blank stripboard, cut to size, on the base plate. Mark the corners with pencil and decide where the fixings will be. I decided on one hole in from the long edges and twelve holes in from the short edges. Use a pencil to mark these positions on the board, then drill an M3 hole straight through both the board and base plate in each of the four fixing positions. This way you don't have to measure anything and the board is bound to fit exactly – provided you don't let it move from the marked corner positions. If you are worried about this, put a bolt through the first hole as soon as you've drilled it, secure the bolt with a nut, then drill the diagonally opposite corner and fit another nut and bolt. The board cannot move while you drill the two remaining holes.

Remove the stripboard and fit the components. Layout is not critical, but be sure to isolate all tracks that will come into contact with supporting pillars. This design isolates the case from everything else, for reasons I'll explain when we come to the operating instructions. Fit terminal pins at all points where connections to off-board components are required. Mount Tr6 on its heatsink, and ensure that all high-wattage resistors are spaced away from the board. Make sure that all the track cuts are complete, without any sneaky bits of track shorting across. The same applies to whiskers of solder. An eyepiece is good for checking on this. When you are satisfied that all is well, mount the board in position.

The interconnections can now be made. Apart from the lampholder, everything is accessible to enable wires to be soldered into position. By leaving a sensible amount of slack in the connecting leads, it's possible to unscrew the board and manoeuvre it a bit if you find, later, that something doesn't work. When all has been proved well, cable ties can be used to tidy up the leads. The internal layout is shown in Fig. 4.

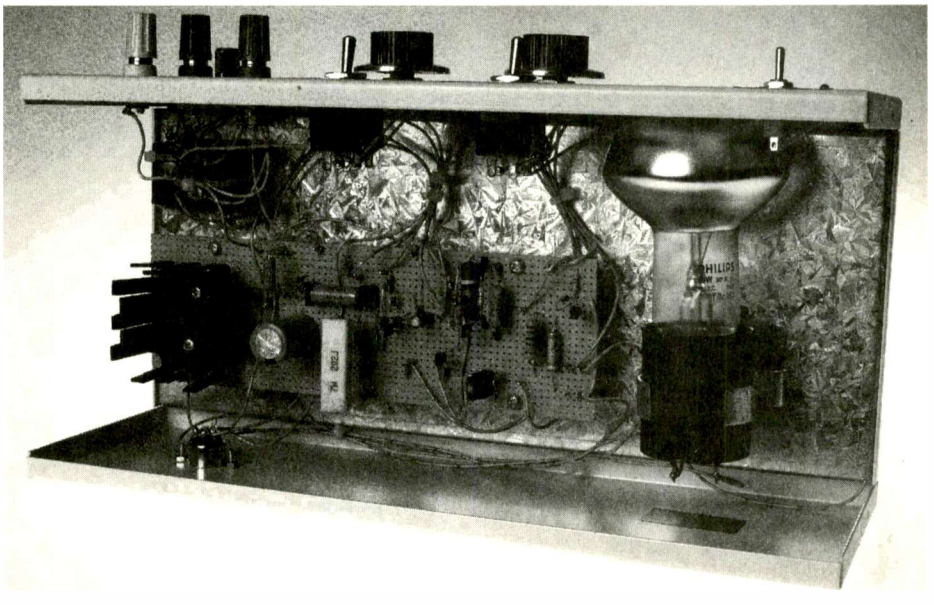
If you have a labelling machine the job can be made to look really professional. Fit labels and the knobs, with 0 at the top when the potentiometers are fully anticlockwise. See photograph for labelling.

Once everything has been given a thorough check, including a resistance check to prove that the case is isolated from everything else except the earth terminal, it's time to change the mains plug on the auxiliary power supply and plug the supply into the test set's DIN socket. When you plug into the mains supply the power LED D3 should light. When the protection on/off switch SW1 is operated the protection light D1 should turn on and off and you should be able to hear RLA click in and out. Measure the +12V and +24V supplies relative to +Vin, and ensure that power is getting to the right places.

Testing

Full testing can then be carried out. Ideally, a DC supply of about 100V is a good start. If you don't have one, you can hook up a temporary arrangement as shown in Fig. 5. In this arrangement a variac feeds an isolating transformer that's connected to a bridge rectifier and reservoir capacitor. The arrangement provides a variable DC source. Use a 100W bulb as the load and a meter to monitor the applied voltage.

The test procedure is as follows:



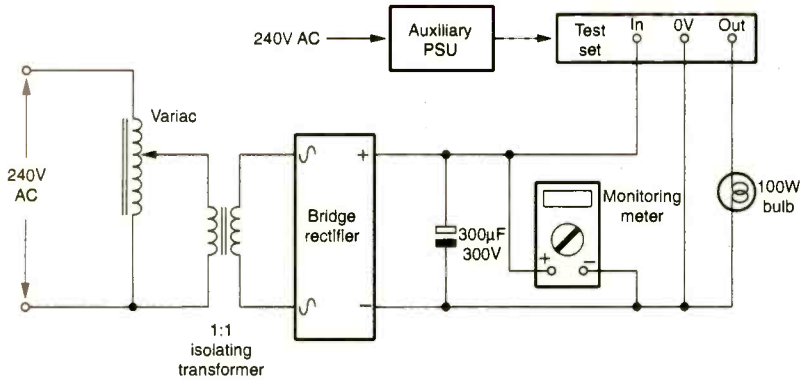


Fig. 5: Hook-up for carrying out the initial test procedure.

(1) Power the unit from its auxiliary supply. The power LED should come on.

(2) Set SW1 to the off (unit transparent) position.

(3) Increase the output from the variac to provide 100V. The 100W bulb should light dimly.

(4) Turn both threshold controls fully anticlockwise and set the input and output toggle switches SW2/3 to their off positions.

(5) Switch SW2 to on, then SW3 to on. The 100W load lamp should light again.

(6) Rotate the voltage threshold control RV1 slowly clockwise. A point will be found where the load lamp goes out and the unit's internal protection lamp LP1 comes on.

(7) Back off RV1. Switch SW2 off and on again to reset the trip. The load lamp should light again.

(8) Increase the voltage from the variac. The protection should trigger.

(9) Return RV1 to its fully anticlockwise position and reset the voltage trip (SW2). The load lamp should light.

(10) Rotate the current threshold control RV2 slowly clockwise. A point should be found where the load lamp dims considerably and the internal protection lamp and current trip LED light.

(11) Increase the current threshold. Turn SW3 off and on again to reset the trip. Set the trip threshold just short of the tripping point.

(12) Increase the voltage from the variac. The increased current should operate the current trip.

Use

Once the unit has passed its test, it can be used for its design purpose. To protect TV receiver circuitry, the feed from the receiver's power supply to its line output stage has to be disconnected and temporary connections made from the power supply output to the test set input and from the test set output to the receiver's line output stage. 0V at the test set is connected to 0V (chassis negative) in the TV receiver. If considered important, the test set chassis earth can be connected to true earth. This might be considered more rather than less hazardous however, since it introduces an earthed body in the vicinity of the TV set. This is a moot point: there are arguments in favour of either approach.

Setting up the test run involves adjustments as previously described, so that the voltage and current trip thresholds are set just short of the triggering points. The whole set-up can then be left running on soak test, with the assurance that should the power supply output increase the line output stage will be disconnected, while if the latter demands excessive current a series current limiter will be applied. ■

Parts list

Resistors

R1 2·2kΩ
R2 6·8kΩ
R3 10kΩ
R4 22Ω
R5 33Ω 2·5W 5%
R6 1Ω 2·5W 5%
R7 1kΩ
R8 100kΩ 2W 1% metal film
R9 2·2kΩ
R10 10kΩ
R11 1kΩ
R12 1kΩ
R13 2·2Ω 7W 5%
R14 2·7kΩ
R15 47kΩ
R16 4·7kΩ
R17 4·7Ω 2·5W 5%

All 300mW 5% unless otherwise specified

RV1 10kΩ lin (VP95)
RV2 1kΩ lin (VP93)

Cut shafts back to 9mm

Capacitors

C1 22nF 100V 10% polyester
C2 10µF 10V electrolytic
C3 2,200µF, 16V electrolytic
C4 47µF 450V electrolytic (AU58)

Semiconductor devices

D1 3mm red LED
D2 5·6V zener diode
D3 3mm red LED
D4 1N4148
D5 3mm red LED
D6 DB3 diac
D7 1N4148
D8 1N4004
D9 1N4002

Thy1 CF106M

Tr1 ZTX650
Tr2 MPSA92
Tr3 MPSA42
Tr4 ZTX550
Tr5 ZTX450
Tr6 MJE13005 (UJ26)

Lamp

LP1 40W 240V R63

Relays

RLA 24V 4P c/o (JG70M)
RLB 12V 1kΩ reed (JH13P)

Switches

SW1 Min toggle SP c/o (FH04)
SW2 Toggle DP c/o (FH39)
SW3 Toggle DP c/o (FH39)

Power supply

HP9011 with 12V and 24V DC outputs From Sendz Components

Miscellaneous

Blue case 238 (XY49)

Terminals, 1 red (HF07H), 1 black (HF02C) 1 yellow (HF09K), 1 earth (JL99H)

Vaned heatsink (JX21)

2 NK2 knobs (RX01)

3-pin DIN socket (HH32)

Labels, equipment wire, stripboard, nuts and bolts, pillars, Terry clip for lampholder, ES lampholder for LP1, plastic red lens (FA95D), terminal pins for stripboard, sleeving, cable ties, BA plugtop with 3A fuse

Numbers in brackets are Maplin Electronics' part numbers

'Electronics, Electrical & Mathematics Principles V6'

If you are looking for an easy and enjoyable way of studying or improving your knowledge of electronics then this is the software for you.

CD-ROM

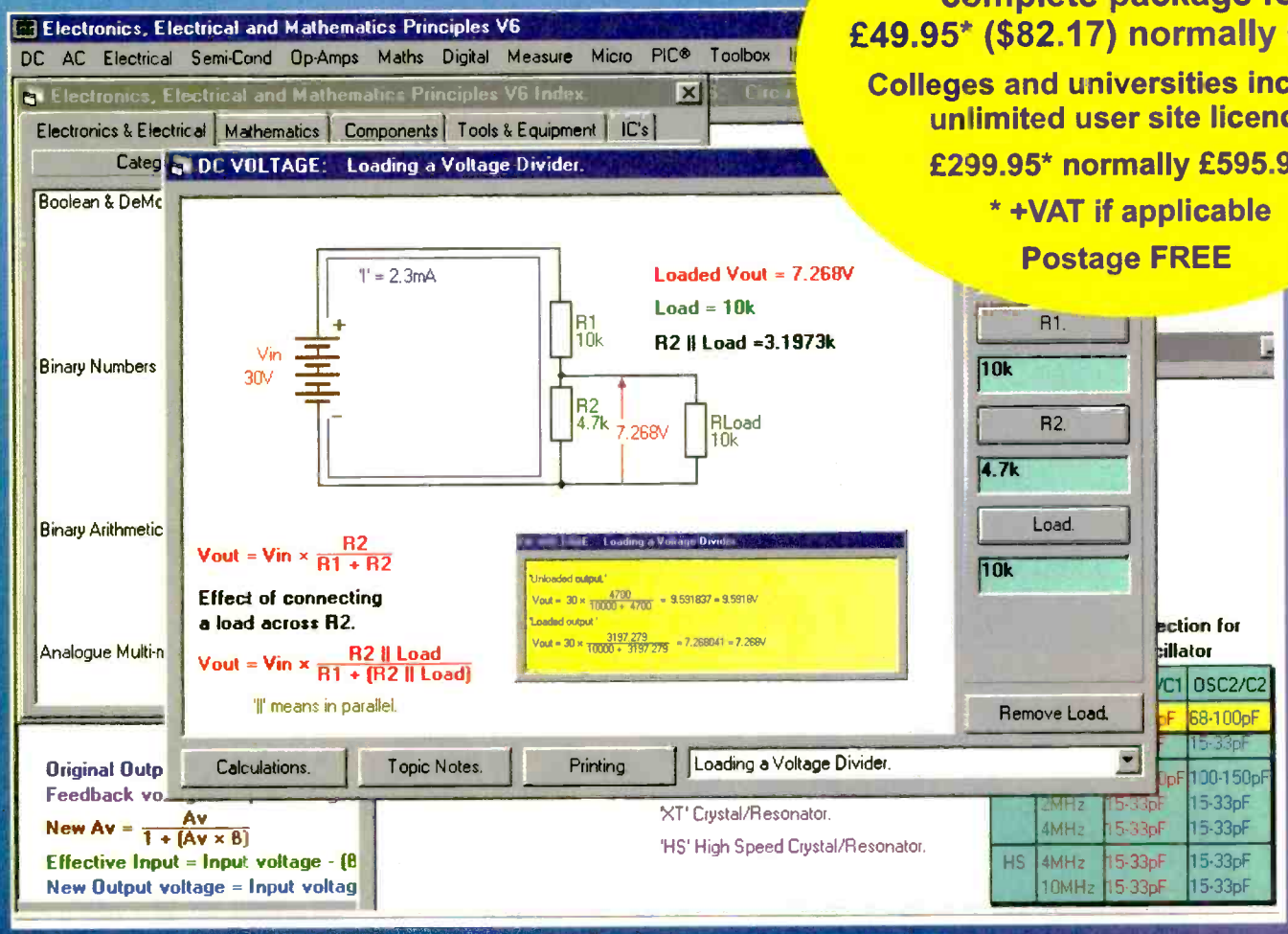
Students and Hobbyists the complete package for £49.95* ($82.17) normally £99.95*

Colleges and universities including unlimited user site licence.

£299.95* normally £595.95*

*** +VAT if applicable**

Postage FREE



Features.

Analogue.
Digital.
Electrical.
Microprocessors.
PIC Microcontrollers.
Mathematics.
Electronics Toolbox.
Components and Equipment Dictionary.
Fully interactive graphics, graphs and calculations.
Single page colour printing.

Full Windows integration.
Explanatory text.
Hundreds of Electronics & Maths formulae with worked examples using your inputs.
All calculations are shown.
Default values on startup.
Easy to use, no prior knowledge assumed.
Comprehensive menu and indexing.
Covers college courses from entry to university level.

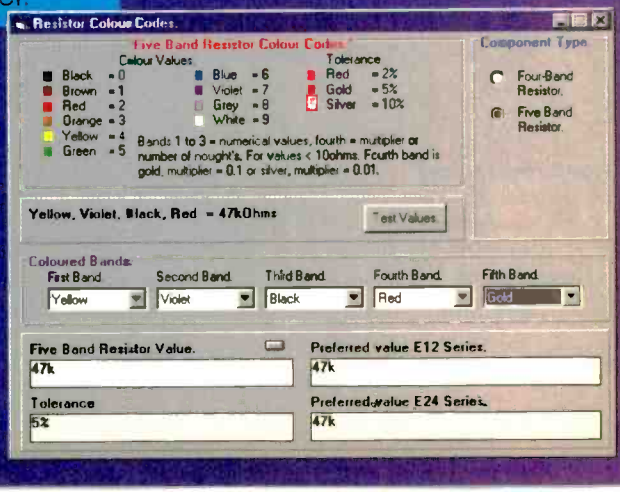
"Electronics Principles is a well thought out and comprehensive program that is also easy to install and stable in operation. It can be wholeheartedly recommended."
Robert Penfold. Everyday Practical Electronics magazine.

www.eptsoft.com

Please telephone or visit our web site for a list of over 900 topics from Ohm's Law to PIC' microcontrollers.

eptsoft limited. Pump House, Lockram Lane, Witham, Essex. UK. CM8 2BJ.
Tel: 01376 514008. Fax: 0870 0509660 info@eptsoft.com

Switch, Delta, Visa and MasterCard payments accepted - please give card number and expiry date.
Cheques and P.O. made payable to eptsoft limited.



Cyril Bateman explains how to spot electrolytic capacitors that are going to fail, first by looking at the circuit diagram, and reveals why measuring a capacitor's capacitance will not necessarily tell you whether or not it has failed

Why do electrolytics fail?

Recently, I refurbished an elderly Hewlett-Packard test instrument. Because of its age, I replaced its 43 aluminium electrolytics. All were dated 1974 or 1975.

Only two of these components failed to meet their specification when tested on a bridge. This is confirmation that, when used correctly, electrolytic capacitors have an exceptional service life.

Why then do some capacitors fail so quickly? Ignoring the most obvious reasons – excessive ambient temperature, over-voltage, too high a ripple current or reversed connection – most early aluminium electrolytic capacitor failures occur because the cathode foil has become reverse biased internally and 'formed-up'.

Internal cathode reverse bias

This reverse-bias effect is not easily seen using an oscilloscope, unless you have specially made capacitors that allow measurement of the electrolyte voltage. It can be simulated though, using the equivalent circuit of **Fig. 1**.

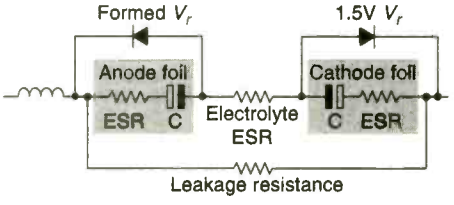


Fig. 1. Equivalent circuit of a polarised aluminium electrolytic capacitor.

The anode and cathode foil diodes can be represented by the 'default' diode in PSpice. For the diagram, I used 'BV=1.5' to represent the un-formed cathode foil diode and the capacitor's rated voltage for the anode foil diode, **Fig. 1**.

Both anode and cathode foils exhibit capacitance with the electrolyte and are connected in series internally, back to back. When a capacitor is charged or discharged, charge transfer between the anode and cathode foils develops a voltage between the anode foil and the electrolyte. Similarly, a voltage is also developed between the electrolyte and cathode foil. These voltages depend on each foil's capacitance value, **Fig. 2**.

Under normal positive anode bias voltages, the cathode voltage is slightly negative with respect to the electrolyte. When the capacitor is discharged, charge transfer develops a cathode voltage which is positive to the electrolyte. The cathode is now internally reverse biased, relative to normal operation.

This transfer of charge may cause the cathode foil voltage to approach or exceed that sustainable by the cathode foil's naturally occurring oxide film. Considerable leakage current then flows between cathode foil and electrolyte, with consequent cathode foil oxide growth[1].

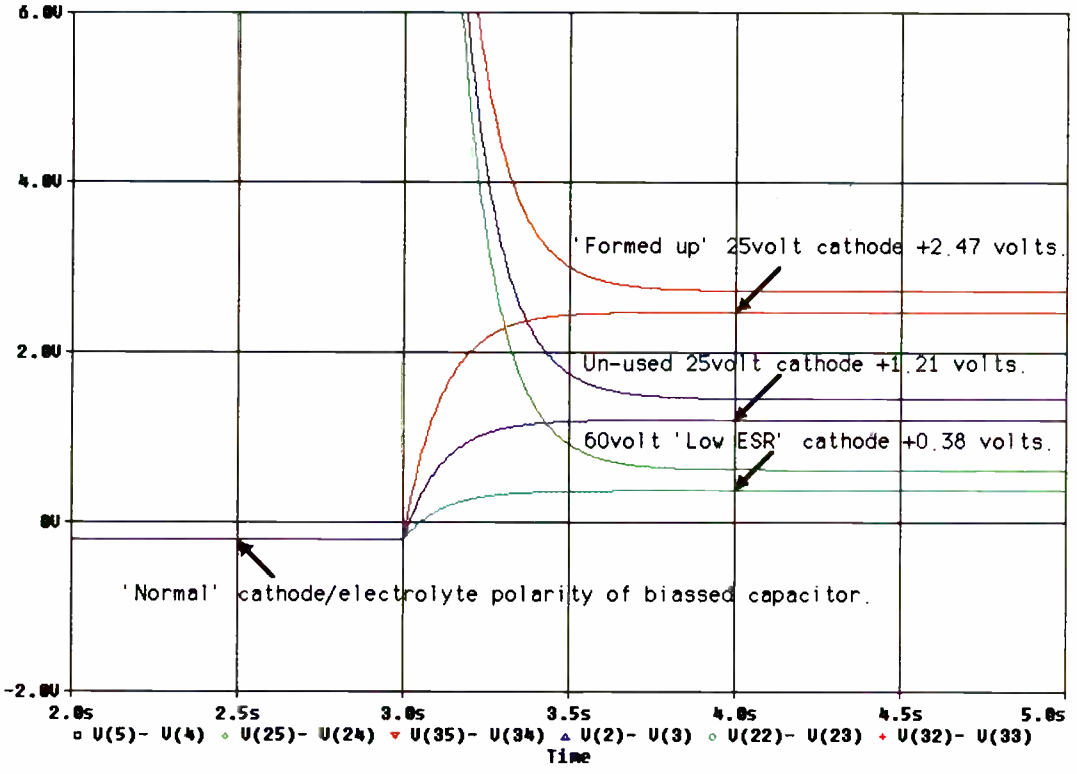


Fig. 2. Simulations of capacitors charged to 25V, then discharged via a 10Ω resistor, demonstrate how the cathode foil's voltage becomes positive with respect to the electrolyte. With positive anode bias voltage, the cathode voltage stabilises slightly below that of the electrolyte. With similar anode and cathode foil CV product, blue trace, the cathode foil charges to a positive voltage, compared to the electrolyte. When the cathode foil CV exceeds the anode's, green trace, a much lower voltage develops. The cathode of the red trace has 'formed up' and is now only half its original capacitance value.

Once started, this oxide growth induces a runaway condition. With repeated capacitor discharge, the reducing cathode capacitance develops ever higher voltages. Cathode-foil oxide growth, cathode voltage, ESR, tanδ and leakage currents all increase until the capacitor or equipment fails.

Repetitive crash discharging, as needed for photoflash, requires a specially constructed capacitor. While photoflash presents an extreme case, many circuit applications use electrolytic capacitors to couple irregular waveforms, without ensuring adequate bias voltage[1].

Frequently, a capacitor in parallel with a resistor is used to couple the drive current into a switching transistor. My satellite receiver originally used a 1µF electrolytic, paralleled by a 1kΩ resistor, to drive the base of a BUT11A transistor. This capacitor failed very quickly, destroying the power supply. A 1µF polyester film capacitor provided a permanent remedy.

Similarly my TV used a 220µF 25V capacitor, paralleled by a 12Ω resistor, to drive the base of its BU508 line output transistor. After only four years service, this TV exhibited an underscanning display.

The plot (**Fig. 3**) shows the forward and reverse leakage current/voltage curves of the 220µF 25V capacitor removed from my TV in 1995, when the display no longer filled the screen.

This damaged capacitor had changed dramatically. Its capacitance was still within tolerance, but the cathode foil had 'formed up', reducing cathode capacitance to 30% of its original value.

All similar circuit arrangements merit careful scrutiny and choice of replacement capacitor.

Causes of rapid failure

Capacitor anodes are made using super pure aluminium. Cathodes are deliberately made using lesser purity foils, to discourage cathode formation under the normal charge/discharge cycles when equipment is switched on or off.

Capacitors described as charge/discharge proof according to CECC 30 300 will have been approval tested,

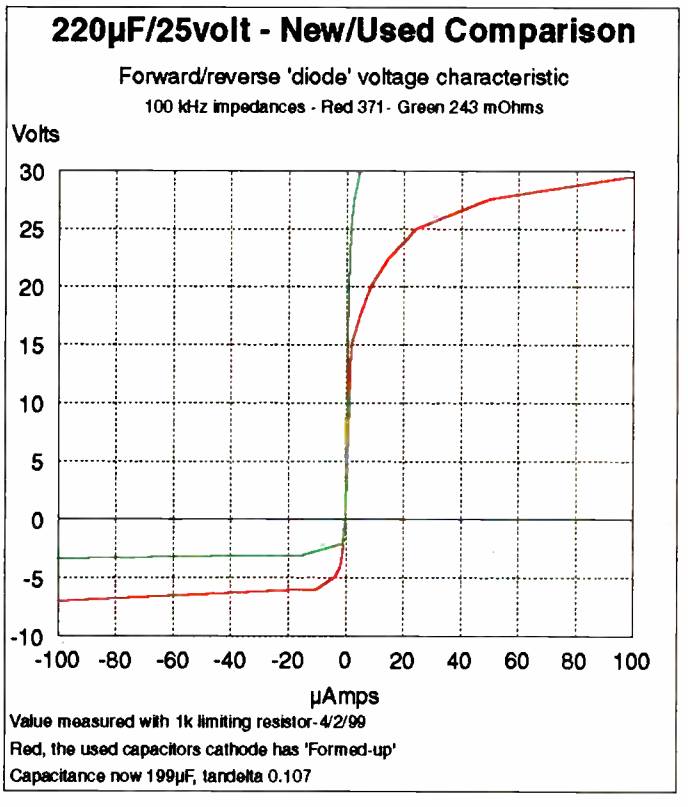


Fig. 3. The red curve shows degraded forward leakage and increased reverse voltage sustain of a capacitor that has suffered from internal reversed cathode bias. Its cathode foil has clearly 'formed up'. Capacitance at 100Hz has reduced to 199µF, but is still in tolerance. Cathode capacitance of this worn-out component is 30% of its initial value. Tanδ has increased to 0.107. The green curve provides comparison with a similar unused capacitor, having 218µF and a tanδ of only 0.044, a 2.4:1 ratio of tanδ. The 100kHz impedances were 371 and 243mΩ, a ratio of only 1.5:1. Clearly tanδ is the more sensitive test.

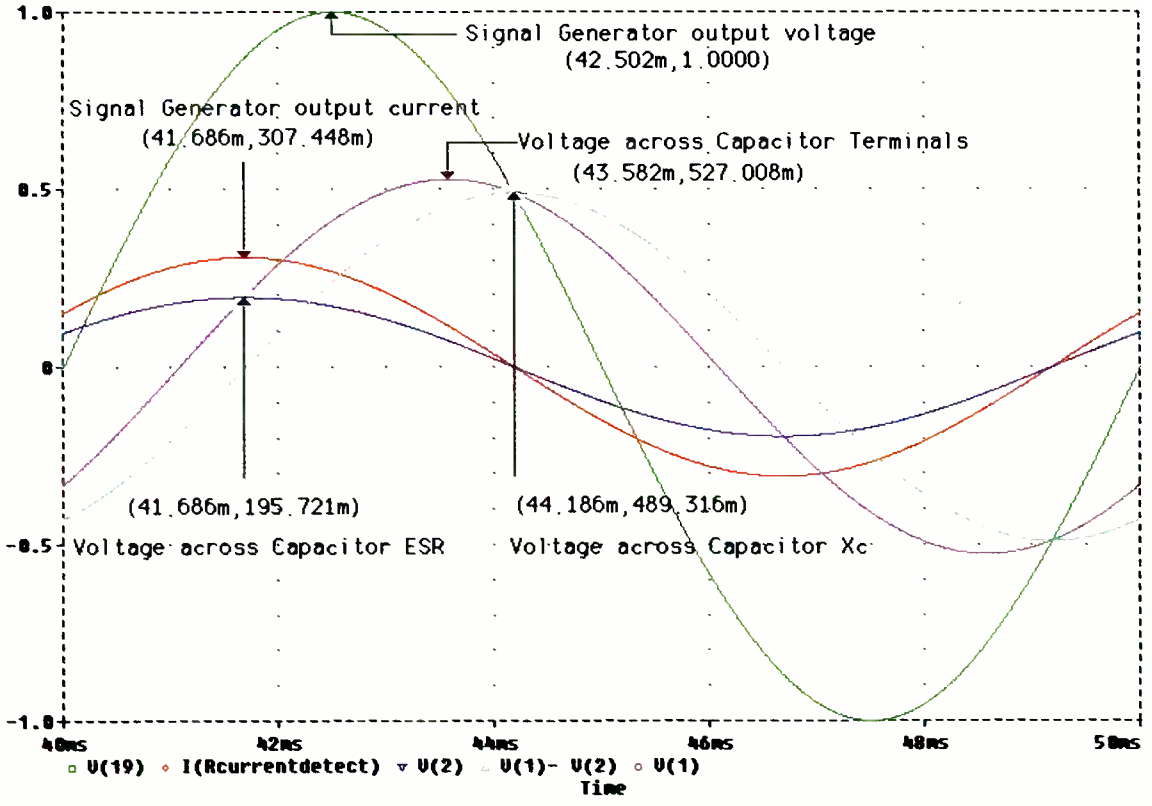


Fig. 4. PSpice simulation showing voltages and currents of a 1000μF capacitor with a tanδ of 0.4. Notice how the peaks of the voltage waveform for the capacitor's ESR coincide exactly with the generator's current waveform. The peaks of the capacitor X_C voltage waveform are separated by exactly 90° phase. Similar simulations confirmed these relationships hold over the range of tanδ. The generator voltage/current phases however vary widely, depending on the capacitor's ESR and the generator's source resistance.

using a time constant of 100ms, and having a construction that can survive 1 million switch-on or off, cycles.

When a capacitor is reverse biased, internally or externally, abnormal amounts of oxygen from the electrolyte are consumed in the capacitor's attempt to grow dielectric oxide on the cathode foil. The consequent excess free hydrogen can force electrolyte past the capacitor seals. Hydrogen collecting at the anode foil degrades the dielectric oxide, increasing the forward leakage current when re-biased correctly. The cathode foil can 'form up' reducing its capacitance.

Cathode foil capacitance value reduces, leakage current, ESR and tanδ all increase, until the capacitor or the equipment fails.

Anode foil is considerably more expensive than cathode foil. To meet the charge/discharge requirements and minimise costs, aluminium electrolytic capacitor designers ensure the CV product of the cathode exceeds that of the anode. This maximises the available capacitance at minimum cost.

To avoid cathode formation of capacitors used in circuits that could cause internal cathode reverse bias, the CV product of the cathode foil should be increased. The best solution is to use a bi-polar capacitor. Alternately a low ESR capacitor of higher voltage than required for the circuit voltages might be suitable.

Low ESR capacitors are made using higher surface gain cathode foils with more conductive paper and electrolyte than standard capacitors. This cathode foil provides more capacitance, hence cathode CV product, for the same foil area.

Choosing a higher working voltage capacitor increases both foil's area. Decreasing ESR and increasing working voltage together will provide a much improved service life.

In-circuit capacitor diagnosis

Having removed a suspect capacitor from a circuit board, measuring its tanδ using a bridge will confirm whether or not the device has failed[2]. When pressed for time though, it is easier, quicker and much cheaper, simply to remove and replace all suspect capacitors. But this usually means throwing away a large proportion of good capacitors.

Can this situation be improved?

Measuring a board-mounted capacitor poses three main problems. To avoid false readings, the test voltage must be sufficiently low that adjacent semiconductor junctions are not turned on. Measurement times must be much less than needed to remove and replace a suspect capacitor. The test result should be unambiguous, needing little or no interpretation.

Measurement of capacitance is of little help. As with my TV, most failed aluminium electrolytic capacitors still have acceptable capacitance.

At present, a few commercial in-circuit impedance testers, often incorrectly called ESR meters, are available. Impedance is easily measured, simply by comparing the voltage drop across the capacitor with that of a known resistor subject to the same test current.

In comparison, ESR is a difficult parameter to measure. It can be properly measured only by separating the capacitor's reactive and resistive vectors. These maintain a 90° phase difference from each other. To eliminate the inductance and resistance of the test leads, a four-wire measuring method should be used.

At the typical 100kHz test frequency used by some commercial two-wire impedance/ESR meters, the resistance and inductance of these leads can exceed that of the capacitor being measured. While test lead resistance can be corrected when calibrating the meter, lead inductance, which usually greatly exceeds that of the capacitor being measured, is more difficult.

Test-lead inductance, added to that of the capacitor being measured, significantly lowers the self-resonance frequency of the test capacitor, such that the capacitor/test lead combination now measures as an inductive reactance, resulting in measurement errors.

A capacitor's impedance, |Z|, comprises the vector sum of its ESR and its capacitive/inductive reactances. At low frequency, capacitor self-inductance matters little, but as

frequency increases, ultimately every capacitor becomes a DC-blocking inductive reactance. Its impedance then increases rapidly with frequency.

$$|Z| = \sqrt{ESR^2 + \left(X_{C(s)} - X_{L(s)}\right)^2}$$

where,

$$X_{L(s)} = 2\pi F\left(L_s + L_l\right)$$

and,

$$X_{C(s)} = \frac{1}{2\pi F C_s}$$

Here, X_C is capacitive reactance and X_L the inductive reactance. At any given frequency, the term $X_{C(s)}$–$X_{L(s)}$ can be simplified to $\pm jX_s$ giving the fundamental vector capacitor equation for impedance, $|Z| = ESR_s \pm jX_s$. Test lead inductance is L_l while capacitor self inductance is L_s.

Many writers on this topic assume that capacitive reactance at 100kHz is so small that impedance is equal to ESR. This is not correct. Many larger electrolytics – especially axial types – will be above resonance, hence inductive.

At 100kHz, a theoretical 1µF capacitor has a reactance of around 1.6Ω. A practical electrolytic capacitor's reactance will be considerably higher, as illustrated in Fig. 3 last month.

A two-wire measurement of impedance/ESR at 100kHz cannot distinguish between an extremely good low ESR capacitor and a short-circuit.

Some impedance/ESR meters have a preset good/bad buzzer which can confuse when measuring the smaller value electrolytic capacitors[3]. These are the most frequent types – hence failures – found on circuit boards. Often the value and voltage of the capacitor being measured is not visible, making judgement more difficult.

Because of the range of impedances to be found, an 'impedance/ ESR' meter's results require interpretation and comparison against known good capacitors. With 100kHz impedance values ranging from 0.01Ω to 24Ω for unused electrolytic capacitors, it is clearly not possible to define a single good/bad impedance value. All measurements used four-wire methods, **Table 1**.

Compared to these impedance variations, the tanδ of good capacitors at 100Hz is a reasonably constant value. Tanδ of typical commercial aluminium electrolytic capacitors ranges from a low of 0.02 to a high of 0.3 for very large low-voltage parts.

Philips' capacitor data handbook requires general-purpose capacitors, subjected to endurance testing, to have tanδ ≤1.5 times catalogue limits or 0.4, whichever is larger[4].

As a general guide, tanδ for typical good board mounted capacitors should be less than 0.1. Medium sized capacitors having a tanδ of ≥0.2 should be replaced to ensure reliability, **Table 2**.

A tanδ measurement discriminates absolutely between an extremely good low ESR capacitor and a short-circuit. The short-circuit will measure as an extremely high tanδ while the good capacitor will measure as having an extremely low tanδ.

Does in-circuit tanδ measurement have any particular disadvantages? If two or more electrolytic capacitors are connected by low impedances, or a capacitor has a low value shunt resistor, the measured tanδ will reflect these combined values – not just the measured capacitor. This is no bad thing, since with these combinations the tanδ measurement fails safe, indicating a bad capacitor to be replaced, rather than hiding any potential problem.

Using Internet and various trade publications, I was unable to locate a suitable low cost in-circuit tanδ meter, so I decided to design and build one to supplement my conventional capacitor bridges. But how might this be done?

Frequency effects

One extremely common mistake is to consider that a capacitor's ESR is fixed.

Electrolytically-formed aluminium oxide is a low-loss dielectric, changing little with frequency*. Expressed as the equivalent series loss, its contribution to ESR reduces with increasing frequency. The resistances of the metal foils, and the electrolyte/paper combination, tend to increase, but more slowly, with frequency.

Dominated at low frequencies by the tanδ of the oxide system, the capacitor's measured ESR initially reduces almost linearly with frequency. As frequency increases further, resistances of the metal foils and the electrolyte/paper combination then dominate, slowing the reduction of ESR.

As the capacitor approaches its self-resonance frequency, ESR and impedance become almost equal. Above self-resonance, ESR increases with frequency, as you can see from Fig. 3 of last month's article.

* *Reference Data for Radio Engineers*, Newnes, Oxford.

Table 1a). Typical impedances measured at 100kHz – low capacitance values.

Capacitor	1µF	2.2µF	4.7µF	10µF	22µF	47µF	100µF
50V bipolar Al.	4.0Ω	3.2Ω	1.4Ω	0.9Ω	0.35Ω	0.3Ω	0.22Ω
63V polar Al.	4.3Ω	3.5Ω	1.8Ω	1.4Ω	0.5Ω	0.4Ω	0.28Ω
450V polar Al.	24Ω	11Ω	5Ω	3.8Ω	1.5Ω	1.0Ω	

Table 1b). Typical impedances measured at 100kHz – high capacitance values.

Capacitor	1000µF	2200µF	4700µF	10 000µF
25V polar Al.	0.090Ω	0.07Ω	0.045Ω	0.022Ω
63V polar Al.	0.050Ω	0.025Ω	0.015Ω	0.010Ω

Table 2a). Typical tanδ values of new stock capacitors measured at 100Hz – low capacitance values.

Capacitor	1µF	2.2µF	4.7µF	10µF	22µF	47µF	100µF
50V bipolar Al.	0.05	0.05	0.05	0.05	0.05	0.05	0.06
63V polar Al.	0.04	0.04	0.035	0.035	0.035	0.045	0.04
450V polar Al.	0.1	0.1	0.08	0.05	0.05	0.05	

Table 2b). Typical tanδ values of new stock capacitors measured at 100Hz – high capacitance values.

Capacitor	1000µF	2200µF	4700µF	10 000µF
25V polar Al.	0.06	0.075	0.09	0.1
63V polar Al.	0.03	0.05	0.06	0.07

Measuring tanδ

Using PSpice, I plotted the waveforms simulating an electrolytic capacitor with a tanδ of 0.4, representative of a failed capacitor. These demonstrate the difficulty in measuring tanδ or true ESR compared to the easy measurement of impedance.

While the vectors representing the capacitor's ESR and reactance remain separated by 90°, their phase relationship to the signal generator's voltage varies according to source impedance and test capacitor tanδ, **Fig. 4**.

This PSpice simulation confirmed the signal generator's current, hence voltage and current waveforms of the capacitor's ESR do remain in phase. Simulation also confirmed that the voltage waveform for the capacitor's reactance is delayed by exactly 90° from that of the capacitor's through current.

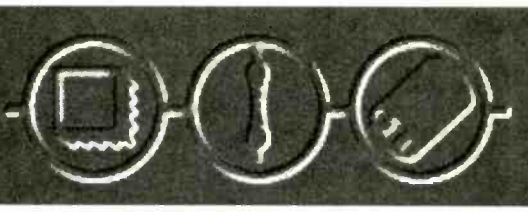
Encouraged by these PSpice analyses, I determined to investigate the design of a suitable in-circuit tanδ tester. Its design proved rather more difficult than I at first expected, but I have succeeded in designing and implementing an easy-to-use tanδ in-circuit tester. It will be described in my next article. ■

References

1. Understanding capacitors, C. Bateman, *Electronics World*, August 1998.
2. Understanding capacitors, C. Bateman, *Electronics World*, June 1998.
3. Bateman, C, 'Understanding capacitors', *Electronics World*, July 1998
4. Data Handbook – Electrolytic Capacitors, Philips Components.

Grandata Ltd

distributor of electronic components



Line Output Transformers

Part No	Code	Price
ALBA		
3714002	LOT02	800p
043714002J	LOT02	800p
43700000	LOT02	800p
AMSTRAD		
3714002	LOT02	800p
043714002J	LOT02	800p
43700000	LOT02	800p
FERGUSON		
06 D-3-084-001	LOT23	1050p
06 D-3-087-001	LOT23	1050p
HINARI		
3714002	LOT02	800p
043714002J	LOT02	800p
43700000	LOT02	800p
HITACHI		
2424593	LOT44	900p
2433751	LOT01	1050p
2433752	LOT01	1050p
2433891	LOT23	1050p
2433893	LOT23	1050p
2433952	LOT33	800p

Part No	Code	Price
HITACHI continued		
2434141	LOT33	800p
2434274	LOT44	900p
2434393	LOT405	1800p
2434593	LOT44	900p
2435006	LOT401	1500p
2436201	LOT90	850p
2433891H	LOT23	1050p
MATSUI		
3714002	LOT02	800p
043714002J	LOT02	800p
43700000	LOT02	800p
7140021	LOT02	800p
MITSUBISHI		
731003	LOT51	1300p
334 P 18506	LOT51	1300p
ORION		
3714002	LOT02	800p
043714002J	LOT02	800p
43700000	LOT02	800p
PANASONIC		
TLF 14512 F	LOT39	1500p

Part No	Code	Price
PANASONIC continued		
TLF 14520 F	LOT40	1500p
TLF 14521 F	LOT39	1500p
TLF 14567 F	LOT39	1500p
TLF 14568 F	LOT40	1500p
TLF 14584 F	LOT41	1550p
TLF 14586 F	LOT42	1500p
PHILIPS		
3119 108 31260	LOT90	800p
3119 198 62930	LOT57	1000p
3122 138 36920	LOT57	1000p
3122 138 36922	LOT57	1000p
3122 138 36923	LOT57	1000p
3122 138 37620	LOT90	850p
3139 128 30400	LOT90	850p
4812 140 10369	LOT90	850p
4812 140 10421	LOT90	850p
4822 140 10274	LOT123	1100p
4822 140 10306	LOT57	1000p
4822 140 10381	LOT128	1100p
4822 140 10384	LOT127	1550p
AT 2076 / 10	LOT57	1000p

Part No	Code	Price
SAISHO		
3714002	LOT02	800p
043714002J	LOT02	800p
43700000	LOT02	800p
7140021	LOT02	800p
SHARP		
RTRNF 1220 CEZZ	LOT39	1500p
SONY		
1-439-332-41	LOT100	1200p
1-439-332-42	LOT101	1200p
1-439-332-52	LOT100	1200p
1-439-387-11 LOT311	1200p	
1-439-387-21	LOT311	1200p
TOSHIBA		
2433751	LOT01	1050p
23236098	LOT288	1200p
23236198	LOT288	1200p
23236255	LOT289	1100p
23236425	LOT288	1200p

Many many more LOPT's in Stock... Please ring for ones not listed

105°c Radial Electrolytic Capacitors

VALUE	CODE	PRICE	PER PACK
10 volts			
470uF	CAP29	120p	10
16 volts			
330uF	CAP30	175p	10
470uF	CAP31	175p	10
680uF	CAP32	210p	5
1000uF	CAP33	210p	10
2200uF	CAP34	525p	10
3300uF	CAP35	500p	5
4700uF	CAP36	610p	10
25 volts			
10uF	CAP37	45p	10
22uF	CAP38	45p	10
47uF	CAP39	48p	5
100uF	CAP40	70p	10
150uF	CAP41	95p	5
220uF	CAP42	120p	10
330uF	CAP43	140p	5
470uF	CAP44	190p	10
680uF	CAP45	315p	5
1000uF	CAP46	365p	10
1500uF	CAP47	390p	5
2200uF	CAP48	200p	2
3300uF	CAP49	220p	2
4700uF	CAP50	365p	2
6800uF	CAP51	390p	2
35 volts			
10uF	CAP52	50p	10
22uF	CAP53	45p	10
33uF	CAP54	50p	5
47uF	CAP55	85p	10
100uF	CAP56	85p	10
150uF	CAP57	95p	5
220uF	CAP58	145p	5

VALUE	CODE	PRICE	PER PACK
35 volts continued.....			
680uF	CAP59	650p	10
1000uF	CAP60	435p	10
2200uF	CAP61	245p	2
3300uF	CAP62	1000p	5
50 volts			
10uF	CAP63	50p	10
22uF	CAP64	70p	10
47uF	CAP65	85p	10
100uF	CAP66	85p	10
220uF	CAP67	175p	10
330uF	CAP68	245p	10
470uF	CAP69	435p	10
680uF	CAP70	490p	5
1000uF	CAP71	525p	10
2200uF	CAP72	325p	2
63 volts			
0.47uF	CAP73	35p	10
1uF	CAP74	35p	10
2.2uF	CAP75	35p	10
3.3uF	CAP76	50p	10
4.7uF	CAP77	35p	10
10uF	CAP78	50p	10
15uF	CAP79	95p	5
22uF	CAP80	75p	10
33uF	CAP81	85p	10
47uF	CAP82	95p	10
68uF	CAP83	130p	5
100uF	CAP84	120p	10
150uF	CAP85	280p	5
220uF	CAP86	280p	10
330uF	CAP87	400p	10
470uF	CAP88	525p	10
680uF	CAP89	500p	10

VALUE	CODE	PRICE	PER PACK
63 volts continued.....			
1000uF	CAP90	540p	5
100 volts			
0.47uF	CAP91	50p	5
1uF	CAP92	85p	10
1.5uF	CAP93	70p	5
2.2uF	CAP94	50p	5
3.3uF	CAP95	50p	5
4.7uF	CAP96	50p	5
10uF	CAP97	95p	10
22uF	CAP98	105p	10
33uF	CAP99	155p	5
47uF	CAP100	175p	10
100uF	CAP101	210p	10
220uF	CAP102	600p	5
470uF	CAP103	600p	5
250 volts			
3M3	CAP104	175p	10
10uF	CAP105	260p	10
47uF	CAP106	435p	10
400 volts			
1uF	CAP107	215p	5
2.2uF	CAP108	225p	5
4.7uF	CAP109	315p	5
10uF	CAP110	400p	5
22uF	CAP111	250p	2
47uF	CAP112	350p	2
450 volts			
1uF	CAP113	280p	5
2.2uF	CAP114	320p	5
4.7uF	CAP115	495p	5
10uF	CAP116	550p	5
22uF	CAP117	415p	2

CD Pick Ups

Part No	Price
KSS 152 A	£13.00
KSS 210 A	£10.50
KSS 210 B	£15.00
KSS 240 A	£20.00
KSS 213 B	£11.50
KSS 213 C	£11.50
OPTIMA 6 S	£11.50
OPTIMA 5	£11.50
RCTRTH8151	£20.00
RCTRTH8112	£15.00
CDM12.1	£15.00
CDM12.1 MECH.	£20.00

Pace Digibox Repair Kits / Spares

THIS KIT IS DESIGNED TO REPAIR THE FOLLOWING POWER SUPPLY FAULTS ON THE PACE DIGIBOX 2200:

DEAD PSU **TRIPPING PSU**

IT COMES WITH CLEAR AND CONCISE INSTRUCTION ON HOW TO CARRY OUT THE WORK

Order Code :SATPSU32
Price : £15.00 + vat

THIS KIT IS DESIGNED TO REPAIR THE NO LNB VOLTAGE FAULT ON PACE DIGIBOX 2200

IT COMES WITH CLEAR AND CONCISE INSTRUCTION ON HOW TO CARRY OUT THE WORK

Order Code : SATKIT33
Price : £4.00 + vat

ORIGINAL SKY DIGITAL REMOTE CONTROL

FOR USE WITH SKY DIGI BOX

Order Code : RCSKY1
Price : £16.00 + vat

PACE DIGIBOX 2200 SPARES SERVICE MANUAL

Contains :
Circuit Diagrams
50 plus page Service Manual

Order Code : BOOK07
Price : £ 20.00 (No VAT)

Tel : (020) 8900 2329 Email : grandata.ltd@btinternet.com
Fax : (020) 8903 6126 Website : http://www.grandata.co.uk

Grandata Ltd

distributor of electronic components

Remote Controls

Universal Preprogrammed Remote Control

Preprogrammed to cover all major Brands of TV , Video , Satellites and CD Players .

Replaces upto 8 different remote controls

With teletext & fastext functions

Order Code : RC9
Price : £10 + vat

Bulk Prices

5 pieces £45 + vat
12 pieces £96 + vat
24 pieces £168 + vat

Magician Sky Digital Remote Control

Operates all SKY digital TV box functions
Operates combinations of TV , VCR & Cable/Satellite systems
Covers 1000's of brands
Teletext and fastext functions
Backlit device indicator keys
Order Code : MAGICIAN4
Price : £10 + vat

We also stock replacement remote controls for 5,000 different models at very competetive prices, contact us for all our remote control requirements . Many of our remote control prices have been reduced.....Please call us for our latest prices

Universal Brand Replacement Remote Controls

Brand for Brand Replacement
Codeless set-up
Teletext and Fastext
Pre-Programmed for the latest models
Replaces broken and lost remotes

Brand	Order Code
Panasonic TV	RCUNI01M
Sony TV	RCUNI02M
Philips TV	RCUNI03M
Hitachi TV	RCUNI04
Mitsubishi TV	RCUNI05
Nokia TV	RCUNI06
Samsung TV	RCUNI07
Toshiba TV	RCUNI08
Ferguson TV	RCUNI09
Grundig TV	RCUNI10
Goodmans/Alba/Bush TV	RCUNI13M
Matsui/Hinaril/Orion TV	RCUNI14M
Satellite	RCUNI17

Price : £7.50 + vat

Accessories / Tools

SLx4.....4 Way Aerial Amplifier

.....the first choice for the professional aerial installer

Now Available !!

SLX2 (2 way) £8.00 + vat
SLX6 (6 way) £18.50 + vat
SLX8 (8 way) £20.00 +vat

* Designed for TV , Satellite and FM Receivers
* 10.5db Gain on all ports
* Isolation between outputs > 22db
* Seperate UHF/VHF inputs
* Noise figure < 4db
* Digital Compatible
* Frequency Range UHF 471-863 Mhz VHF 47-230 Mhz
* CE and EMC Test Certified

Order Code : SLX4 Price : £13 + vat

SOLDER SEAL KIT

DON'T CRIMP IT....SOLDER IT !!!

FOR QUICK AND SAFE CABLE CONNECTION SOLDERING , GLUEING AND SHRINKING WITH A HOT AIR GUN ALL IN ONE ACTION

HOT AIR GUN WITH PIEZO ELECTRONIC IGNITION

USES LIGHTER GAS

BLOWS HOT AIR UPTO 650C

ORDER CODE: TOOL53
PRICE : £13.00 + VAT

HOT AIR GUN

FLAMELESS...ONLY HOT AIR

IDEAL FOR THE FOLLOWING :

SHRINKING TUBES

SOLDER SEALS

HEATING AND DRYING

HOBBY & MODELLING

BENDING PLASTICS

SMD SOLDERING

BLOWS HOT AIR UPTO 650C

ORDER CODE : TOOL54
PRICE : £7.50 + VAT

We stock over 650 different video heads covering over 2500 different models for the following makes :

AIWA, AKAI, ALBA, AMSTRAD, BAIRD, BLAUPUNKT, DAEWOO, DECCA, FERGUSON, FISHER, FUNAI, GEC, GOLDSTAR GRANADA, GRUNDIG, HINARI , HITACHI , JVC , LUXOR , MATSUI ,MITSUBISHI ORION , PANASONIC , PHILIPS SAISHO , SAMSUNG , SANYO , SHARP , SONY , TOSHIBA...AND MANY MANY MORE

This advert is just a selection of our stock.

We also stock the following :

Full Range of Video Spares	Full Range of Satellite Spares	Multimeters
Full Range of TV Spares	Scart and Phono cables	Service Aids
Transistors	Linear IC's	Computer IC's

Japanese Transistors..2SA,2SB...etc & much much more !!!!!

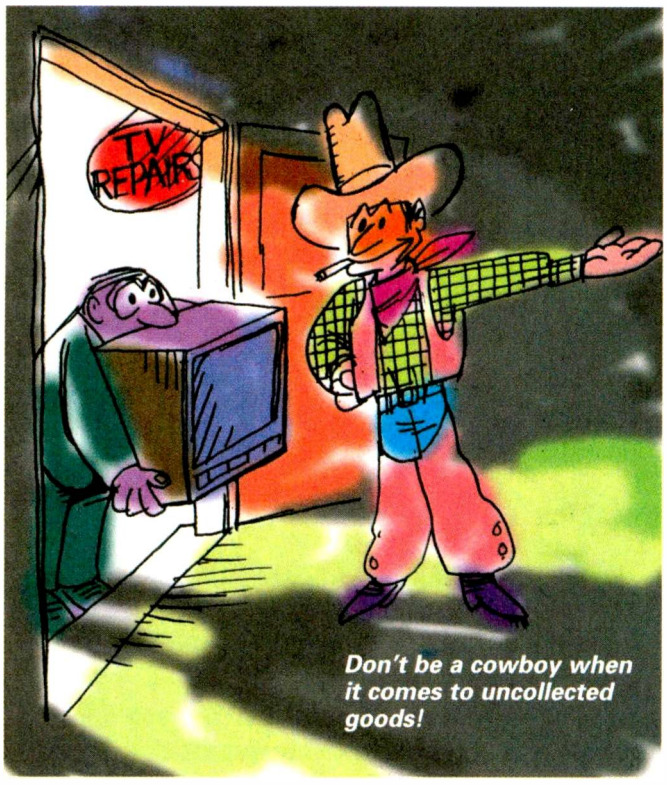
All at very competitive prices !!

Please contact us if you cannot find the part you are looking for.

* Please add £1 p+p and VAT to all orders
* All components are brand new
* We accept payment by Access , Switch , Visa , Cheque and Postal Order
* All prices quoted are subject to availabilty and may be changed without prior notice

K.P. House , Unit 15 , Pop In Commercial Centre , Southway , Wembley , Middlesex . HA9 0HB England

Tel : (020) 8900 2329 Email : grandata.ltd@btinternet.com
Fax : (020) 8903 6126 Website : http://www.grandata.co.uk



Don't be a cowboy when it comes to uncollected goods!

Uncollected Goods

It's quite common for something to be left for repair then not be collected. What can you do? Can you dispose of it, and after how long? Jack Armstrong provides advice on the problem

A frequent question that arises in our trade is "can I dispose of this video/TV which the customer left with me six months ago and hasn't collected?" The question is covered in law by the "Disposal of Uncollected Goods – The Torts (Interference with Goods) Act 1977". In this article I'll try to explain how problems of this nature can be minimised. There are, first, some actions that you must take for disposal to be an option:

(1) Write down the equipment owner's full name, address, post code and telephone numbers. It's a good idea to copy these on to a card that you can fix firmly to the underside of the equipment. I've been to lots of repair shops that use a Post-it note or a piece of paper held with a centimetre of tape. This is totally useless: it will fall off and walk out of the door on someone's shoe! Use card, and tape it securely with a strong adhesive tape.

(2) If you are at all organised you will also keep a separate record of the above details in a book or a computer, together with the make, model and serial number of the equipment, a description of the symptoms, a record of communications with the customer, the estimate, parts that have been fitted and so on. This is not essential, but might keep you out of court if there is a dispute. It takes only seconds to do this, and has the added advantage that you can refer back if you get a similar fault in the future.

(3) Have a standard sheet that explains your terms and conditions for repairs and give a copy of it to the customer. If you can make this a two-part copy, on which the customer writes the make and model, his/her name and address and his/her signature, so much the better – the signature will prove that the customer had sight of it. Your terms and conditions should include a note that goods still uncollected after a reasonable period following notification will be sold or otherwise disposed of.

Collection

Now assume that the repair has been completed, or the customer has refused your estimate, and that you want him/her to collect the goods. Provided you have left the customer in no doubt that he/she must collect the goods, and that there is no dispute over the repair or payment, you are entitled to sell the goods should they remain uncollected. But before doing so, you must satisfy two conditions:

(1) You must deliver to the owner of the goods written notice of his/her obligation to collect the goods; details of the goods to be collected and the address at which they are held; your name and address; and details of any sum of money owing in respect of the goods at the time the notice is sent. This notice may be delivered direct to the owner, left at his proper address, or posted (the proper address of an owner of goods is the registered office or principle office in the case of a body corporate, or the last known address of the owner in any other case).

(2) If the above does not lead to collection of the goods, the second condition laid down in the Act must be satisfied before the goods can be sold. You must now send to the owner of the goods, by recorded-delivery post or registered letter, notice of your intention to sell the goods and the date of the intended sale if they remain uncollected; details of the goods to be sold and your address at which they are held; your name and address; and details of any sum of money owing at the time the notice is sent.

The period between the issue of the second notice and the date of the intended sale must be sufficient for the owner to reclaim the goods. If any money is owed to you the period must be at least three months.

The above two notices may be combined if sent by recorded delivery post or registered letter, but a "reasonable period" must still be allowed for collection. The customer might innocently have gone on an extended holiday and forgotten to tell you. You must not punish him/her for a genuine oversight.

Where you have taken reasonable steps to trace the owner of the goods in order to issue the necessary notices but have been unable to do so, you are entitled to proceed as if the notice has been served.

Where there is a dispute pending about the goods, e.g. whether the repair has been properly carried out, it is not valid to issue any notice until the dispute has been settled.

Disputes

If there is a dispute, you would be wise to get advice from your local Trading Standards Office. They

have the ability to be helpful – as well as the power to put you out of business! Consult them whenever necessary and they will look after you. Don't wait until the customer complains to them: get there first.

It's a good idea to contact them right now, because you never know when a customer might make a complaint. If the Trading Standards officers already know you and understand that you care about doing things correctly, they will be much more likely to support you in any future dispute.

Sale

At the appointed date you may, if the goods have not been collected, sell them by any means at your disposal. You should keep a record of any money made as proceeds of the sale, and the original owner is entitled to a proportion of that money – less your costs, which may include travelling expenses, a portion for insurance while the goods were in storage, repair costs (if not in dispute), etc. If you simply dispose of the goods at the local tip, be prepared to justify your action by keeping a record of the date, the estimated value of the equipment, and the cost of disposal.

Avoiding Disputes

Most disputes arise because the customer feels that he/she is not getting good value for his/her hard-earned cash. To avoid disputes, it's best to find out a customer's expectations from the start.

"How much have you been quoted elsewhere?" is a good question to start off with. This wheedles out the cheapskates who shop around for the lowest quote. If I am told a ludicrous figure, I decline the job – politely. If the customer insists that he/she has not had an estimate, you can follow up with "how much are you expecting to pay?" Sometimes you may be pleasantly surprised to find that the customer expects to pay a fair rate for the job. Sometimes you won't.

You need to be a good judge of character. Most repairers lose out because they are interested in only the technical challenge of the repair. I've even seen them launch into a detailed technical description of the repair while the customer stands with a glassy stare and a bemused smile. This is pointless.

The most technical I get is when I ask a customer "how much do you know about the phase demodulation method of extracting the colour burst signal?" This is bullshit, and the customer usually replies "erm?" Or I might ask about the function of the posistor in a degaussing circuit. The reply would be the same.

You can follow up with "OK, if you don't mind me asking, how much do you earn an hour?" Usually the customer doesn't mind boasting about this, so you can reply "great, well I charge only half that amount for doing this work that you can't do yourself. It's a skilled job that requires special equipment and years of training, so you are getting a real bargain and it will probably cost at least £20 (or whatever) less than a new one".

Choose your words carefully here. The object is not to put the customer down but to convince him that he's getting an amazingly good bargain.

Practice this type of conversation. It will make you more profit than anything else. Get the customer on your side. Show your ESR meter to him without going into technical detail. Mention that the 'cowboy repairers' don't have expensive equipment.

Although you should keep your own records of repairs and the parts fitted, you should never put such specific information on an invoice. If it takes you three hours to track down a dry-joint and a faulty capacitor, the customer will not be impressed by an itemised bill for "parts 10p, labour £64.80". Far better to write say "repaired fault that caused a rolling picture and no audio". Then you can't be accused of overcharging, or have to prove that you fitted whatever new parts you say you fitted. In addition, should the job bounce back with the comment "still the same fault", it's much easier for you to point out that a "blue screen with audio" is definitely not the same thing as a "rolling picture and no audio". Stick to what you actually see and hear. That way you avoid technical discussions and the customer understands what you are saying and usually accepts it. It's also easier to show that you fixed the reported symptom.

This brings us to another point: if the reported symptom is different from the symptom you see or hear, put it down in writing and discuss it with the customer before you do anything.

Intermittent Faults

Intermittent faults are the worst cause of disputes. A customer brought me a satellite receiver and said "it scrambles the picture for two seconds every three weeks". I tested it for an hour without seeing a fault, so I gave it back. Don't get involved in impossible tasks. If you saw the fault but are not certain whether you fixed it, be honest with the customer. Charge a reasonable fee but be prepared to give a refund if the symptom recurs.

Never offer a technical explanation such as "dry-joints". We all understand what these are, and why it can take three days to find a defective joint (or think we have), but the customer doesn't. Don't try to educate him. At worst he'll be embarrassed, while at best he'll understand perfectly and question why it took so long to fix such a simple thing as a bad connection! Call it an intermittent component failure. If the customer asks "which component", simply swing into the "how much do you know about phase shift demodulation?" routine.

Advertising

Be very careful about advertising. If you have advertised "free collection and delivery" you can't expect the customer to collect his goods from your shop. In fact if you advertise "free" anything you are inviting problems. I know a trader who landed in trouble because he charged the customer a "tuning fee" after he went to a "free call out" expecting to take the receiver straight back to his workshop. Instead, the customer asked him to tune in the TV, video and satellite receiver. You might agree that it was fair of him to charge for half an hour's work, but the Trading Standards authority ruled differently. He had not warned the customer *before* his arrival that a charge might be made, therefore he could not charge. Legalistic, but there you are.

I advertise "local call out", which leaves me free to either decline politely any request to drive a long distance or quote a price for the time and mileage involved. It also allows me to charge for a call out if I feel I need to – and I often do.

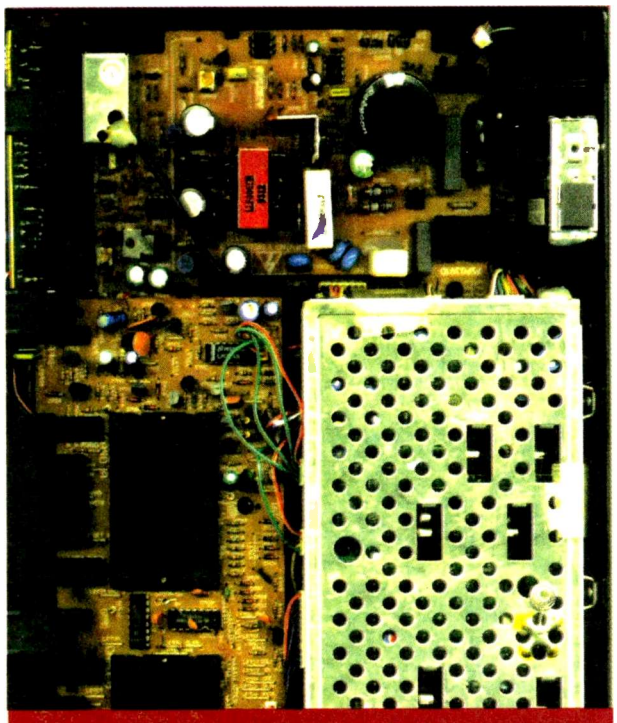
Data Protection

Note that if you keep details about specific customers on a computer in the UK you may be committing an offence if you do not register with the Data Protection Register. For details phone 01625 545 745.

Disclaimer

These notes are intended as a guide, not as a legal document. I am not qualified to provide legal advice, so please do consult your local Trading Standards office. ■

Satellite WORKSHOP



Jack Armstrong

Digital Amstrads

I was rummaging in the depths of a Pace MSS500 satellite receiver when the telephone rang. I should have expected it: the phone only ever rings when I'm busy! You can bet your life that if I finish a job then wait for the phone to ring it won't oblige until I start another repair job. I think it can tell when I have a screwdriver in one hand, pliers in the other and screws between my teeth.

"Hello!" (spitting out screws.)

"Is that Mr Armstrong?"

"Yes, Mrs Gumption." I recognised the voice.

"Oh good. You can help me. The Sky just went funny and they told me I have to boot it. Only my arms aren't long enough, so I wondered if yours are?"

Over the years I've learnt that it is a waste of time trying to make sense of anything a customer tells me over the phone, so I arranged to call on her on my way home.

When I arrived I was ushered into a room where an Amstrad DRX100 BSkyB digital receiver was nestling on a cushion on top of a Sharp VCR. The television receiver was displaying a blue screen with the words "no satellite signal is being received" on it.

"They said that to boot it I had to switch it off at the wall then hold that 'backup' button while I switched it back on."

I took the cup of tea that was being thrust towards me.

"Only what with my arthur eyetus and the extension cable being thirty feet long, and I can't see without my glasses . . ."

I thought she was about to cry, so I comforted her by patting her head and agreeing that she would indeed have needed much longer arms – long enough to reach the other room, where the extension cable was plugged into an ancient 15A round-pin socket that had no switch.

I did the next-best thing, which was to unplug the receiver from the extension cable, hold the button and push the plug back in. After a few seconds the front panel lit up like a Christmas tree. I then released the button.

Twenty minutes and a second cup of tea later, the receiver still hadn't downloaded the software from the satellite. So I checked the signal from the LNB. My meter produced a good reading when the 22kHz tone was switched on. I suggested to Mrs Gumption that she should phone Sky again and ask them to get the receiver repaired, since it was clearly faulty.

The following day I heard from Mrs Gumption again.

"Oh dear, they want to send a hengineer to check the box."

"But I did that yesterday."

"They say it has to be done by a real hengineer. Their hengineers all get three weeks' training."

"Well I never. So when is this 'hengineer' coming?"

"He isn't. They said it would be three weeks and they would charge me £50 for the man to visit because the box isn't insured. I could buy a new one for £300, or I could wait for them to test the box for another £50 and see if it could be repaired. So it's going to cost at least £100, Mr Armstrong. I said some rude words and they put the phone down. Can you fix it for me?"

A week ago I would have politely said no, but a mailshot from MCES had informed me that the company can repair and upgrade a DRX100's tuner for only £25 plus VAT. So I collected the receiver and tested it again in the workshop.

The 'signal' and 'quality' indicator bars on the TV screen were wandering up and down in a random fashion. The LNB supply was present, and the 22kHz tone was on, but the "no satellite signal" message remained stubbornly on the screen. I removed the top cover, then the rear panel, in order to reach the PCB. There are two versions of the DRX100, which is made by Samsung – the 4.7 and 5.0. Both have the same tuner, type TBDE381119A, which is manufactured by Forward Electronics Co. Ltd. in Taiwan.

It's not too difficult to unsolder the tuner from the plated-through board. So I removed it, packed it in anti-static bubble-wrap and sent it off to Manchester with my cheque. Four days later it came back. When I'd refitted it in the receiver, I was rewarded with perfect pictures and sound. It's worth mentioning that a comparison between an original tuner and a repaired one shows that MCES not only repairs the tuner but also changes components to improve the sensitivity and stability. So here's an excellent service. It enabled me to carry out the repair for far less than others had quoted.

Since then I've had two more DRX100 receivers for repair. A refurbished tuner cured one but not the other. This one seems to have a faulty microcontroller chip, so I'll send it to Horizon Satellites in Basingstoke (01256 841 860) who seem to be well equipped to deal with this type of job.

I've been told that the capacitors in the power supply can fail, but I've not come across this myself.

While I had the DRX100 on the bench I had a poke around with my old 20MHz oscilloscope. It's totally inadequate for this type of work of course – the tuner's output looks like 400mV of noise – but it did show

the difference between 'signal' and 'no signal'. Unfortunately I got the same results with the LNB disconnected as I did with a faulty tuner.

Test point TP101 is worth a look: it's connected to pin 5 of the tuner. With a picture on the TV screen there's about 1·65V DC at here. With a signal from the wrong satellite and no picture the reading is 2V, with intermittent pulsing to zero. With no LNB connected or a faulty tuner the reading is 5V with intermittent pulsing to zero.

Tuner pins 7 (left end of R125) and 8 (left end of C121) show what appears to be the tuner's baseband output, at around 400mV.

A Digital Grundig

A Grundig GDS200 arrived in the workshop by international carrier. On test, it powered up with the red LED coming on then going off again (is this normal?): pressing the standby button turned it on. It then displayed the messages "searching for listings" followed by "no signal . . ."

With an LNB connected, the LNB voltage 'on' and 22kHz tone 'on', the signal and quality bar indications were both at zero. Always check these settings, because the first thing the owner does when the picture goes off is to change every menu setting he can find!

Anyway, I decided that this was another job I didn't want to tackle, so I got in touch with Genserve who arranged to collect, repair and return it. The phone number is 0800 298 6117.

A Digital Pace

A Pace BSkyB 2300 was brought to me by a local dealer to "look at".

"It's just the card reader" he said, "the receiver works perfectly for an hour, then displays a message telling you that the card is faulty."

Unfortunately he hadn't brought the card. Since every card is authorised for a specific Sky digibox, this could be a problem. But when I tried my own subscription card I found that it worked perfectly on TV channels 4 and 5. That would do for soak testing.

Two hours later the receiver was displaying the "faulty card" message. But the card worked perfectly in my own Pace BSkyB 2200 receiver. As an experiment, I removed the whole double-deck card reader assembly from a scrap board and swapped it over with the one in the 2300 that displayed the fault. This is not a job for the faint-hearted. The plated-through holes hang on to solder like leaches to blood. Even my Weller desoldering station was struggling. Unfortunately the receiver produced exactly the same symptoms with the replacement assembly fitted.

I next tried hot air to trigger the fault and freezer spray to cure it. This treatment suggested a problem with U1100 (TDA8004T) or U203 (LVC04A). But fitting replacements didn't help one bit. The only other components in the area affected by heat and cold were some zero-Ω links and the PCB itself. The soldering to the links appeared to be OK, although one of the ceramic chips might have had an invisible crack. There might have been a cracked PCB track. If so, I knew I wasn't going to locate it. It's early days for digital receiver servicing, and I know when to give up before I damage something. This one is going to Pace for repair by someone with the right equipment.

[redacted]

Jack Armstrong is willing to try to sort out readers' satellite TV receiver problems by e-mail. You can reach him via the internet web site at:

http://www.ukstay.com/jack

If you have no internet access you can write to him c/o Television, Room L514, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Please enclose two first-class stamps.

Test Case 452

Most VCR repair work is relatively easy these days, especially with older models whose habits and failings are well known. Sometimes however something that can puzzle even the most experienced technician comes along. A Panasonic NVJ40 recorder presented us with a fault of this type.

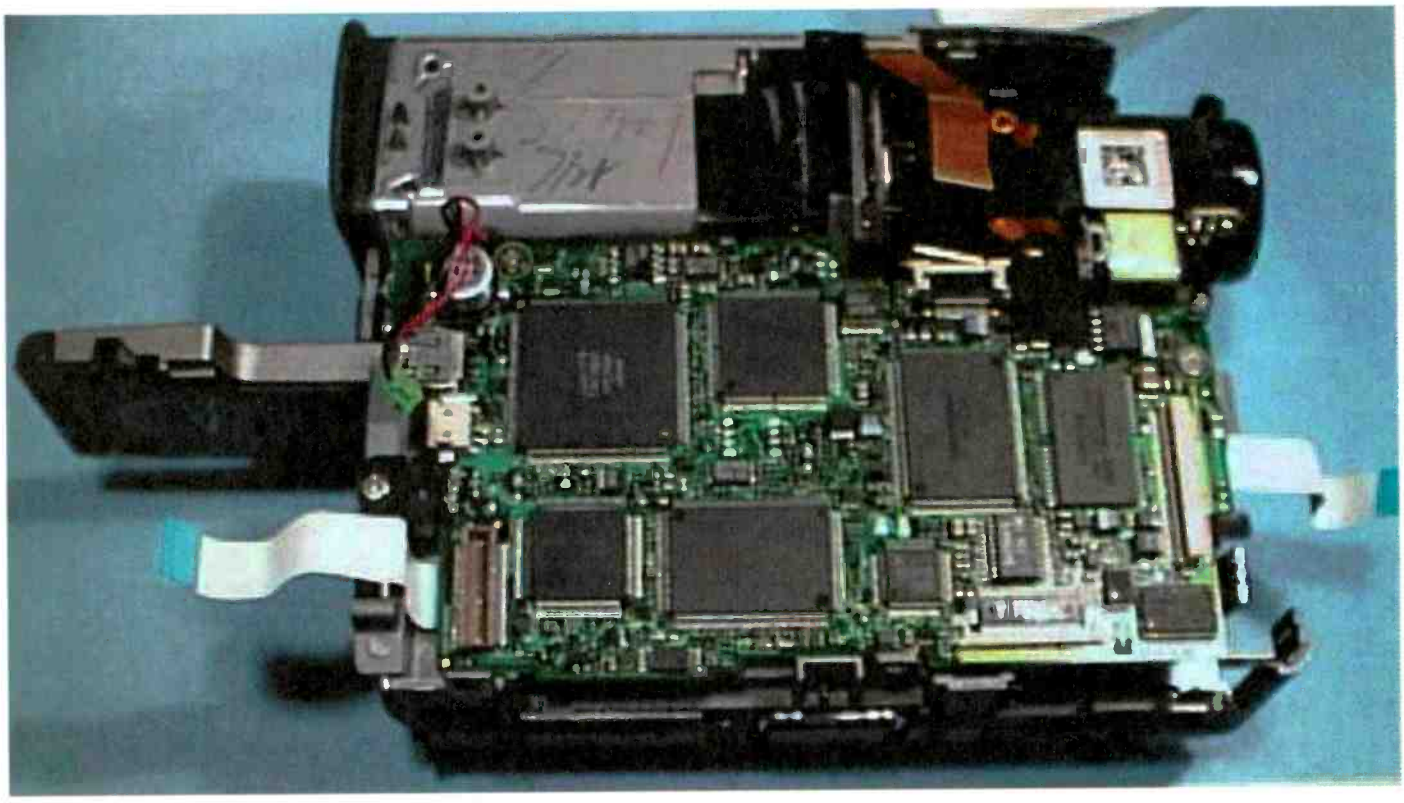
The reported fault was no picture in the cue (search forward) mode. This was confirmed on test. There were no problems with either playback or record, and all was well in the review (search backward) mode. But when the fast-forward key was pressed during playback the picture, after a second or two, broke up into lines and then become a jumbled 'hash' – similar to the effect of dirty or blocked video heads. At this point the drum started to make a whirring noise, and it was plain that it was rotating too fast. When its speed was reduced by applying pressure with a finger there was some semblance of a picture, though it was very broken up. Why did the drum sped up in cue only?

When he looked carefully at the tape path in the cue mode TechnoCrat, who had been given the job, noticed that the tape was very much higher than normal where it passed the audio/control/erase head: the lower edge of the tape was almost clear of the control-track section of the head. TechnoCrat decided that the pinch roller was worn, a reasonable enough conclusion. He obtained a new one from the stores and fitted it, but this failed to cure the problem. As before, the tape rode up in the cue mode even though its position was correct in the playback and review modes. Anyway, why should the speed of the drum increase when the tape path was incorrect?

It was all very difficult to understand. Where was Sage when TC needed him? In fact Sage was out on a field job, installing a projection TV set in a customer's house. But he had his mobile phone with him – a mixed blessing as far as Sage was concerned! He answered it however and listened to TechnoCrat's description of his trouble with this old Panasonic machine. The upshot was that TC was told to pull out the plug from the ACE head assembly. He might then get a surprise.

A bemused TC went back to the machine, pulled the plug from the ACE head connector and did indeed get a surprise. Even though the tape still rode high in the cue mode, the drum's speed remained normal and the on-screen picture was line-locked. There was however a great deal more mistracking in this mode than the normal few bars caused by track crossing. TC then reconnected the ACE head, selected the cue mode and, with great difficulty, deflected the tape path downwards, using a tilted screwdriver shaft, so that the control pulses at the lower edge could be picked up. Once the tape was in this position the drum speed, after a second or two, returned to normal.

TechnoCrat tried hard to figure out why the tape should be deflected from its normal path across the face of the ACE head, but every idea he had foundered on the fact that only the cue mode was affected. It was not until Sage returned that the mystery was solved. So where was the culprit? For the answer, turn to page 630.



What is DVC?

In this second instalment in his new series Steve Beeching, I.Eng. describes the Digital Video Cassette (DVC) tape format and the pulses used for system control

DVC signals are recorded on the tape as helical tracks. This is similar to the VHS system, but twelve tracks are required to record one TV frame compared with two tracks for VHS.

The recorded signal consists of tracking data, audio data, video data and sub-code data. With the additional gaps provided (G1-G3), data run-ins and margins, the total amount of data per track is about 139·5kbits. Fig. 1 shows the track layout. For a single TV frame consisting of twelve tracks, the data total is some 1·674Mbits. At the TV rate of 25 frames/sec, the serial data stream to/from a video data head is 41·85Mbits/sec. During playback a data-locked PLL, operating at 41·85MHz, recovers the data – in a similar manner to CD playback. The top and bottom edges of the tape are reserved for later use and are designated optional tracks 1 and 2. We can forget about them for the time being.

As with all domestic videotape systems, a head first comes into contact with the tape at the bottom edge then scans across the tape helically from bottom right to top left, finally leaving the tape at its top edge. The angle of the digital video track is 9·1668°, its effective length being about 33mm. There is no audio/control track head nor a full erase head. Erasure of previously recorded data is accomplished by the record data drive, which is at a sufficiently high level to record the new data and erase the old.

There are three tracking frequencies, f0, f1 and f2, which are in digital form not analogue as with the Video 8mm format. The frequencies are f0 = 0 (no signal), f1 = 465kHz and f2 = 697·5kHz. When processed during playback, these provide a tri-state tracking signal for the tape servo.

Track layout

The ITI (Integrated Tracking Information) at the start of each track (see Fig. 1) is a system data segment that contains information on track pitch, also insert edit information. This information enables the CPU to determine the tape speed, SP or LP. The Start Sync Block Area (SSA) signal in the ITI section of the tape indicates the playback position of the video, audio and sub-code data. This is done by measuring a constant delay timing period after reading the SSA information recorded with the data. It's not too dissimilar to the way in which a field sync pulse is used to indicate the start of an analogue picture with standard VHS playback.

The following 'gap', G1, is provided to separate the ITI from the audio data. It is

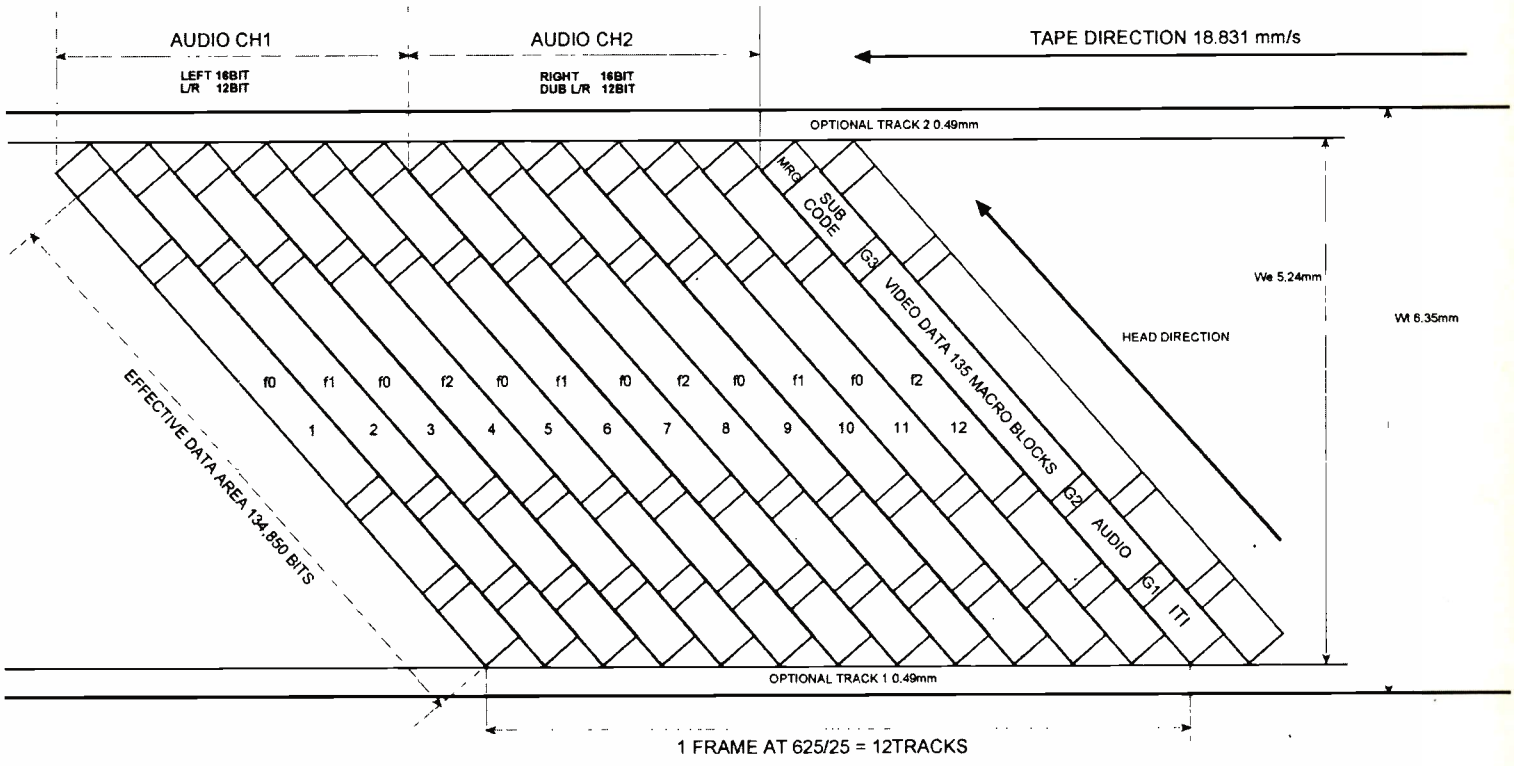


Fig. 1: The DVC helical-track layout.

not blank, as the playback PLL has to be kept running.

The audio data section comes next – there's an audio option that allows for post-record dubbing. Either of three stereo sampling frequencies can be selected: 48kHz, 44·1kHz (the same as with CD, and for playback only) or 32kHz. The highest quality is naturally provided at 48kHz, with 16-bit linear sampling for two-channel working. Each channel is data compressed and is spread over twelve tracks, six for Ch. 1 and six for Ch. 2 in a twin-track stereo mode.

32kHz, 12-bit non-linear sampling is used for four-channel operation. Tape tracks 1-6 are allocated to stereo tracks 1 and 2. Tracks 7-12 carry stereo tracks 3 and 4: these two tracks can be post-dubbed. The audio section of the track accommodates a total of 10·5kbits.

After gap G2 we come to the video data section, which has a data allocation of almost 112kbits. 135 macro blocks of data are recorded in this section. Next comes gap G3, then the sub-code section which has a capacity of 1·2kbits. It contains the time and date information for the recording tape counter and the 'time code', i.e. Min:Sec:Frame (as in 25 frames/second). Each video frame is time-coded for accurate editing. An overlap margin area (MRG) follows the sub-code section. This is included for change-over switching between heads.

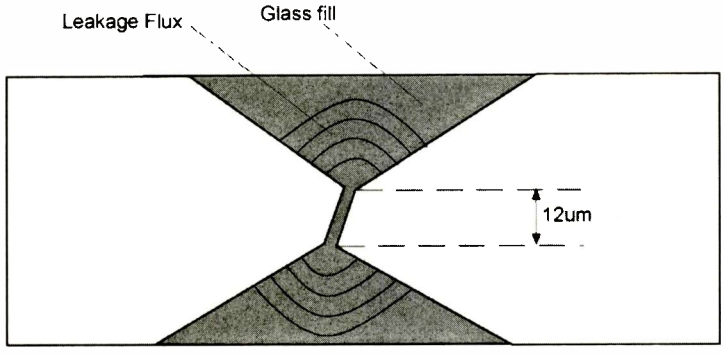


Fig. 2: The SP head, with 12µm gap and V construction.

The Heads

Each standard video/data head has a 12µm-length gap, see Fig. 2. This is just over the width of the track. In addition there's approximately 2µm of leakage (fringing) flux at each side of the head slot, giving the head tip an effective width of 16µm – see Fig. 3. During playback the extra width is used to bridge the track being replayed (10µm) so that tracking pilot data from the adjacent tracks can be picked up. This yields the Automatic Tracking Frequencies (ATF) required for the tape servo system.

The tape speed is such that in the record mode the centre line of each subsequent recorded track is displaced by 10µm with respect to the previous track. As a result the extra 12µm of head width over-records each previous track while the 2µm of fringing flux reduces the tracks even further, to leave an 8µm wide magnetic track, see Fig. 4.

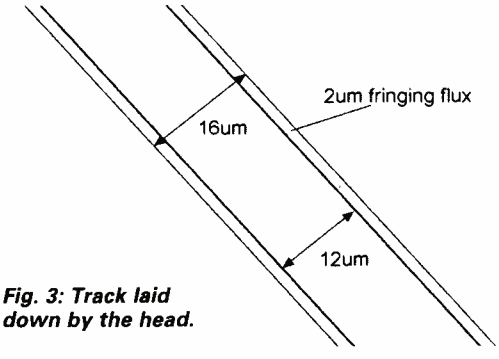


Fig. 3: Track laid down by the head.

At the start of a recording the first track laid down is 12µm wide. The next track is shifted along by 10µm, determined by the tape speed, so that the extra track width initially recorded is over-recorded. Thus tracks that are effectively 10µm wide are laid down on the tape. Because of the fringing flux another 2µm is over-recorded, not fully but

enough to reduce the effective track width to about 8-8·5µm. This does not give rise to any problems: the playback error rate is probably higher than it would be if the full 10µm width was used, but the stability of the tracking system is increased.

In the track recording sequence diagram, Fig. 4, the tape is travelling from right to left, viewed from the virtual centre of the head drum.

LP system

The benefit of a 12µm head with an additional 2µm of fringing flux to enable the ATF system to function is compromised when the mechanism is an SP/LP type. These mechanisms use a head of later design, with the fringe flux reduced to a very low level. If the fringing flux was left at 2µm it would cause problems for LP working.

In the DVC LP mode the tape speed is reduced to two thirds of the standard speed, not half as with analogue systems. The track width is thus reduced to two thirds of standard, from 10µm to 6·67µm. If the original head construction was used for LP operation, with 2µm of fringing flux, the effective track width would be reduced to 4·67µm. This would reduce the data level and result in an unacceptable data error rate.

To overcome the problem the head tip is in parallel form as opposed to the 'V' form of the initial design, see Fig. 5. This virtually eliminates the fringing flux. With the V-shaped gap there are large areas of supporting ferrite at either side of the tip which is very robust. The later parallel type does not have this support, so extra glass fill is incorporated to maintain head durability and mechanical robustness.

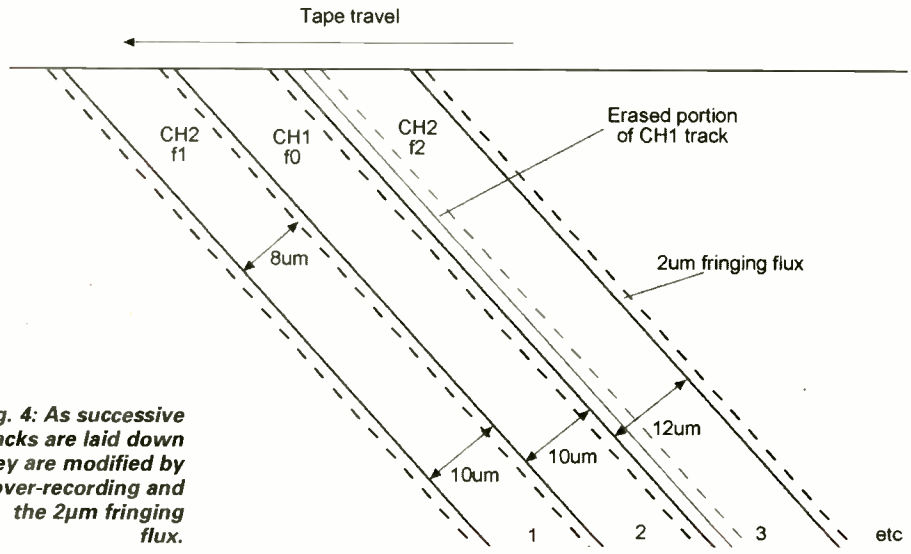


Fig. 4: As successive tracks are laid down they are modified by over-recording and the 2µm fringing flux.

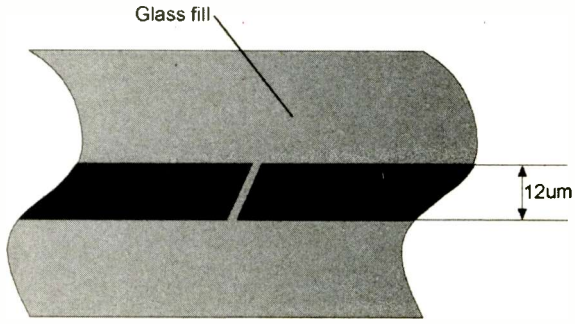
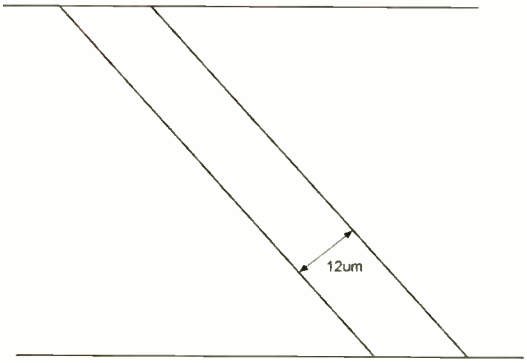


Fig. 5: The SP/LP head, with parallel instead of V-shaped tip.



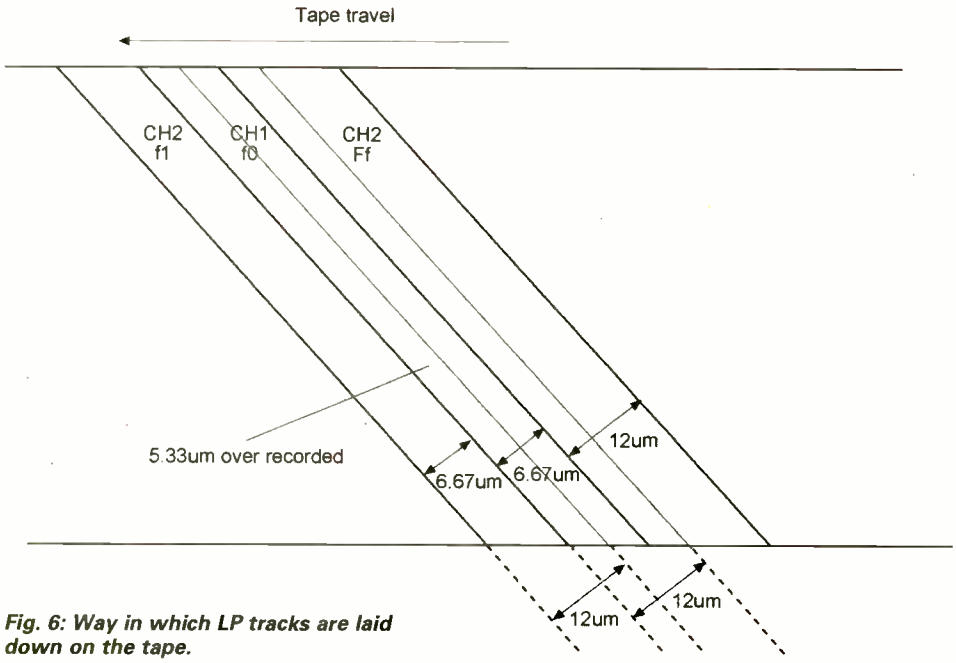


Fig. 6: Way in which LP tracks are laid down on the tape.

SP/LP tracks

The first track laid down by this later type of head is 12µm. In the SP mode subsequent tracks are laid down 10µm apart, each extra 2µm being over-recorded but without the effect of the fringing flux. There is less overlap to pick up the tracking signals from the adjacent tracks: compensation is provided by means of additional ATF pilot frequency amplification.

In the LP mode the first track laid down is again 12µm wide. The tape speed is now 12·554mm/sec and the track displacement is reduced from 10µm to 6·67µm. So 5·33µm of each previous 12µm track width is over-recorded – see Fig. 6. As there is no fringing flux there is no further reduction in track width. This maintains an adequate data pick-up level and error rate.

Note that the newer type of head

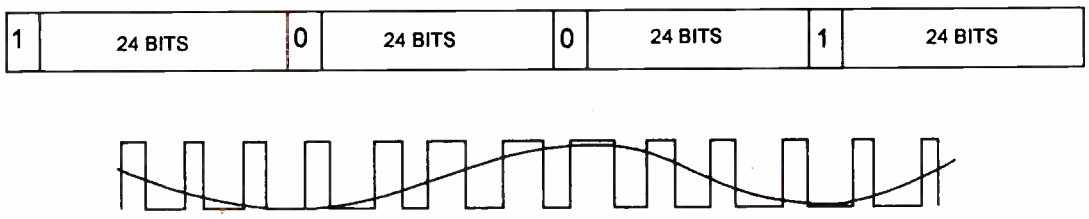


Fig. 7: The ATF pilot signals are inserted by adding an extra digit to the basic 24-bit data packets. Filtering makes the AC component of the signal available.

cannot be fitted to SP-only models as a replacement. To do so would result in reduced ATF signal pick up in the playback mode and, as the ATF amplifier would provide insufficient gain, there would be poor and erratic tracking. Head drum assemblies differ between SP and SP/LP models and are not interchangeable.

Timing

As mentioned earlier there are three tracking frequencies, though f0 = 0Hz = no signal; f1 and f2 are generated by division from the recorded serial data rate, so there is correlation between them. The recorded data rate is 41·85MHz. This is divided by 90 to give f1 (465kHz) and by 60 to give f2 (697·5kHz.).

The pilot signals are not added to the data as separate frequencies during the recording process. Instead, they are created by modifying the data stream. The 8-bit data is arranged in groups of 24 and an extra bit it then added, so that there are 25 bits (this is called 24/25 conversion, see Fig. 7). The extra bit is either 0 or 1, and is changed from one to the other at the pilot signal rate. A product of this is that the DSV (Digital Sum Variation) varies with the pilot frequency. As the DSV is the DC component of the data stream, it can be used to add and extract the pilot signals, which will appear as an AC component of the DSV.

If the additional bits consisted of a series of ones, the average value of DSV would rise: with a series of zeros the value would fall. When the series of ones and zeros changes at the pilot-frequency rate, the DSV can be extracted during playback and the tracking AC components can be filtered out.

With an analogue machine the drum flip-flop is the main timing pulse: it's the heartbeat of the system. In a digital video recorder a single timing IC provides many clock pulse lines, and the clocks are phase synchronised. Digital video processing is controlled by the Frame Rate Pulse (FRP), which has to be synchronised with the clock pulses and the head-switching signal HID (Head Indication Data). HID is high for the Ch. 1 head and low for the Ch.2 head. See Fig. 8.

With two video/data heads and six revolutions of the drum (12 data tracks) per frame, the head speed is 9,000 r.p.m., or 150revs/sec. The HID period is thus 6·666. . . ms (3·333ms/track), or 150Hz compared with a VHS machine's 25Hz.

Tracking signal control, pilot signal and tracking timing pulses are generated from the FRP and HID pulses in the DCI (Digital Channel Coding IC), with an 18MHz clock. A switching signal called the TSR (Tracking Signal Reference) is developed from the FRP and HID pulses – it's almost identical to the HID signal. TSR is used as an HID signal for pilot frequency and head relationship control.

It's important that the servo system starts the first track, 0, at the rising edge of an FRP pulse, see the timing diagram Fig. 8. This ensures correct 'framing' of the video data tracks. Two pilot frame pulses are available to determine the start of a playback frame and the first track: only one, PFO, is used with PAL. It corresponds to a start in the pilot frequency sequence f0, f1.

The DCI chip generates three more sets of timing pulses: TRP0, TRP1 and TRP2. The combined binary logic of these signifies which number video track (1-12) the Ch. 1 head plays back at any given time. Table 1 shows the logic conditions.

Another signal, called the TREB (Tracking Error Bit), is used to control the capstan motor phase and maintain accurate automatic tracking. It's a tri-state waveform with three levels, at 2·4V, 1·5V and 0·6V, and is developed by filtering the playback data from the video heads, using the DSV calculation to recover the pilot signals f0, f1 and f2.

With perfect playback tracking TREB is high at 2·4V when the Ch. 2 head plays back an f2 track. When it plays back an f1 track TREB is low at 0·6V. When the Ch. 1 head is correctly centred on an f0 track it picks up equal quantities of f1 and f2 from adjacent tracks as crosstalk: these cancel out to leave TREB at the 1·5V level. See Fig. 9.

When the head tracking is in advance, the Ch. 1 head is off-centre and picks up more of the f1 pilot signal than f2: there is an imbalance in

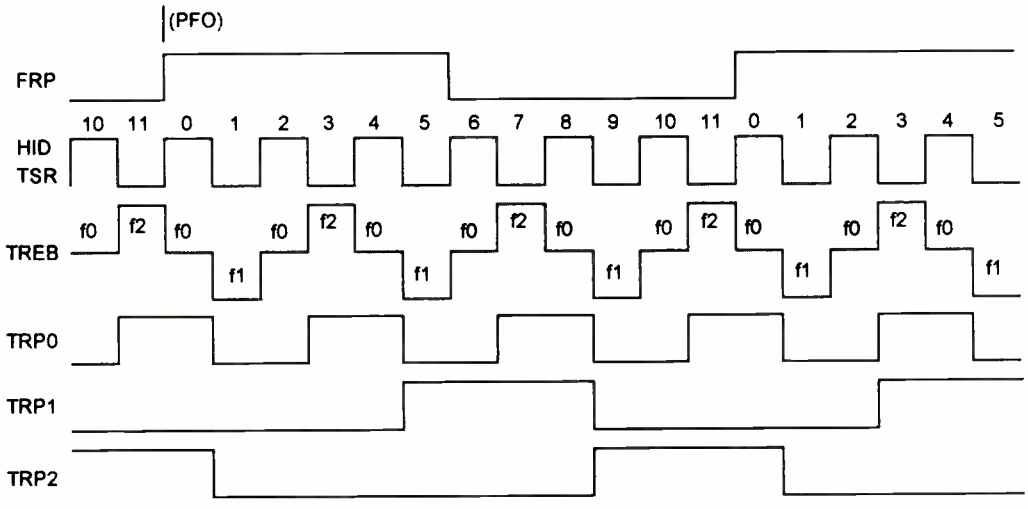


Fig. 8: Pulse timing diagram.

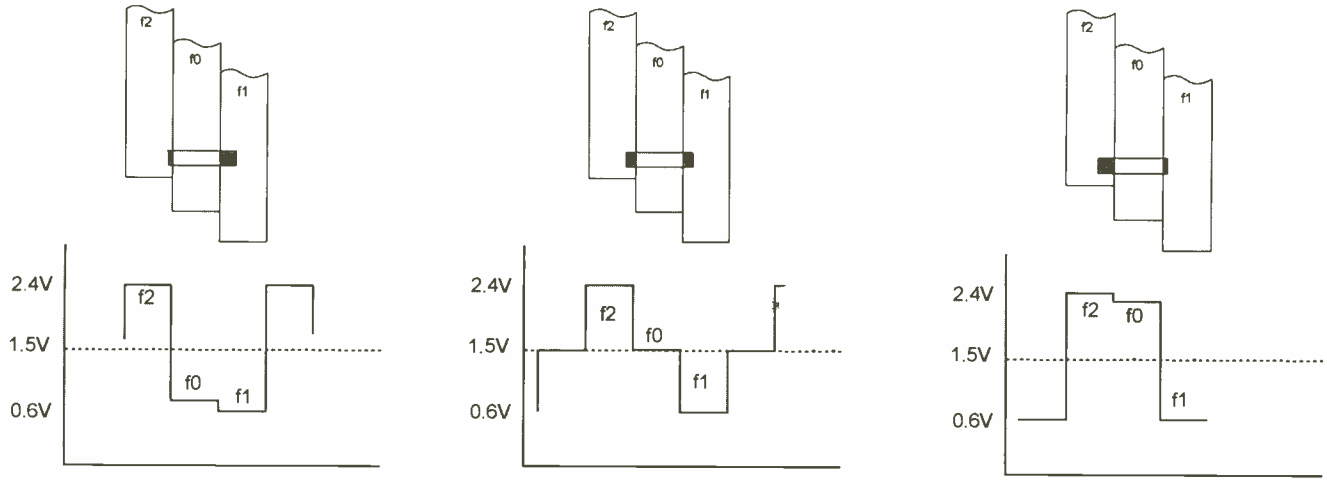


Fig. 9: How head tracking is controlled by the TREB signal. Head tracking in advance left, head tracking correct centre, head tracking retarded right.

Table 1: Logic conditions for Ch. 1 tracks.

Ch. 1 track/PFO	*TRP0*	*TRP1*	*TRP2*
0	1	0	1
2	0	0	0
4	1	0	0
6	0	1	0
8	1	1	0
10	0	0	1

the f0 track crosstalk and the TREB signal on that track is low at almost 0·6V. The Ch. 2 head f2 and f1 outputs remain the same.

When the head tracking is retarded, the Ch. 1 f0 imbalance favours the f2 pilot frequency and the TREB signal is at 2·4V. Again the Ch. 2 f2 and f1 outputs remain the same

The average value of the TREB waveform is integrated to produce a varying phase-error signal that's used to correct the capstan motor phase. The servo aims to maintain the TREB signal at 1·5V for Ch. 1 (f0 track) playback.

Capstan speed is set by the 897Hz FG signal. This keeps the speed constant within the control range of the phase-control system.

If the Ch. 1 head is dirty, the playback picture is blanked as the servo loses lock and mutes. If the Ch. 2 head is dirty there will be alternate bands of pixel blocks or black lines on the playback picture. ■

VCR Clinic

Reports from
Pete Gurney, LCGI
Kevin Green, TMIIE
Roger F. White, TMIIE
and John Coombes

Sony SLV720B

This centre-deck machine refused to accept a tape and powered down when an attempt was made to load one. A check on the supply rails revealed that the MTR 12V supply was missing. The 2SB733 regulator transistor Q602 had a visible crack through it, and the surrounding board was discoloured. As a check on the resistance of the motor supply showed that everything seemed to be OK, I assumed that the transistor had suffered over a period of time before it died, hence the board discoloration.

I fitted a replacement transistor and powered the VCR. The MTR 12V supply was now present, but when a tape was inserted it immediately died with the transistor again splitting in half. It was difficult to locate the cause of the trouble, as no low-resistance paths were present. The 12V rail has a convenient link however, next to Q602. I removed it and fitted a 10Ω resistor to reduce the current flow. Q602 was again replaced and a tape was inserted.

The voltage on the motor side of the added resistor immediately fell to nearly zero, but this time the regulator transistor survived. Unfortunately the MTR 12V rail feeds three motors, capstan, drum and loading. They are all inaccessible when the deck is mated to the PCB. To establish which motor was causing the trouble I had to disconnect each one in turn, reassemble the deck, and load a tape to check for the presence of the 12V supply. The culprit was eventually found to be the capstan motor. Although it showed no measurable shorts, a replacement cured the fault.

It's advisable to shop around for these motors, as the price seems to vary by as much as £30. **P.G.**

Sanyo TLS924

Intermittent shut-down was the complaint with this time-lapse machine. It has a built-in self-diagnosis system, which at least gives a clue as to the probable area in which the fault lies. In this case the error code was E3, which indicates failure of the capstan motor to rotate. These motors rarely give trouble because of an electrical problem, and the cause of the fault was quickly traced to the upper capstan bearings. These have a habit of seizing up intermittently as they disintegrate.

A good check on the state of the upper bearings is to attempt to move the capstan motor shaft from side to side. In this case I found that there was about an eighth of an inch of movement. Replacement bearings are available from Sanyo agents Charles Hyde and Son, under part no. 11930HP. Fitting replacements and a 1,000 hour service kit completed the repair. **P.G.**

Panasonic NVSD400

There was no video or audio at either the scart connector or the RF output. When I took the machine apart I found coins of the realm rolling around under the PCB. After many checks the cause of the trouble was found to be the failure of a couple of surface-mounted components, Q3003 and R3028. **K.G.**

Akai VS485

The capstan motor wouldn't rotate in play but was OK in the fast forward and search modes. It's fed from the 12V supply for normal playback/record but has a higher supply for FF and rewind. The cause of the fault was traced to diode D206, which is by socket WP201 on the main PCB. **R.F.W.**

Hitachi VTF250

I had two of these machines with the same fault in a single week. Capstan motor operation was very weak. The 14V supply was low because C12 and C13 were faulty. **R.F.W.**

Sanyo VHR774

The complaint was poor rewind, so I ordered and fitted new belts and a mecha state switch. The fault was still present of course. I eventually discovered that a small piece of plastic was massing from the chassis moulding under the take-up spool. It's part of the mechanism that selects clutch or direct drive to the spools – so the machine was trying to rewind via the take-up clutch. As a full repair would have been uneconomic, I glued a small piece of plastic in place with epoxy. Fortunately this worked. **R.F.W.**

Sony SLVE220UB

Intermittent cutting out is a complaint you can get with this machine. It can be very intermittent indeed. The cause is circuit protector PR501, which goes high-resistance. A replacement will restore normal operation. **J.C.**

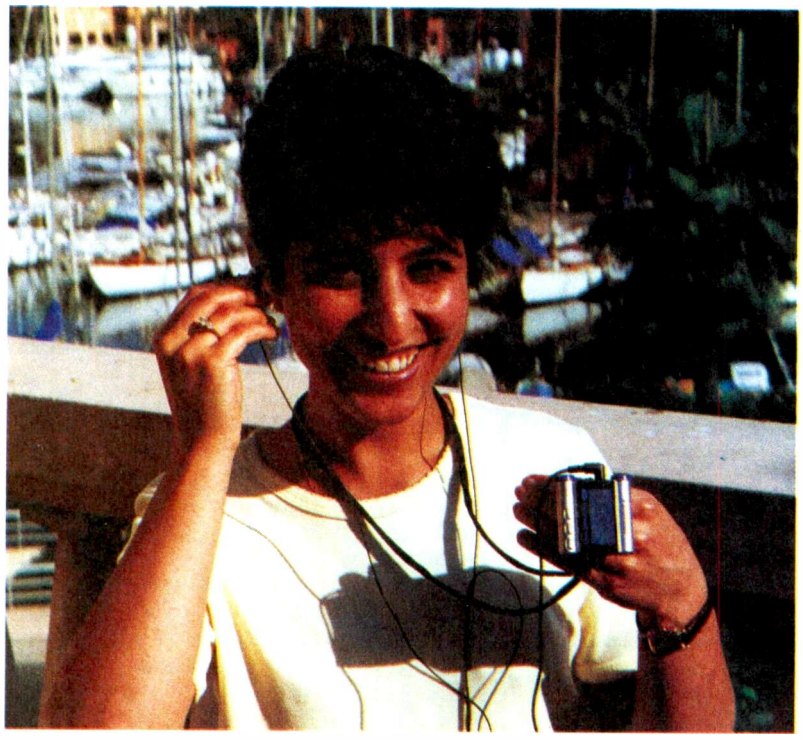
Toshiba V729B

If the playback picture is marred by dots and dashes, check the brass earth spring at the back of the deck. To prove the point, clean the spring and increase its tension. This should restore correct playback.

Toshiba has a modification kit however. This involves soldering a link from deck earth to the spring (see page 411, May issue of *Television*). It eliminates the fault completely. **J.C.**

At the Panasonic and Technics Seminars

The latest technology from Panasonic and Technics, world leaders in the consumer electronics industry, was presented at a joint seminar earlier this year. George Cole was there to report



The above photo (top of column) shows the first Panasonic SD card audio player.

During May Panasonic and Technics held a joint seminar in Monaco, where the companies' latest technologies were unveiled to the technical press. A number of interesting developments were presented, including integrated digital TV receivers (IDTVs), DVD-Audio, DVD-RAM, the SD Memory Card and an extension to the VHS PAL format.

Television

The T[tau] range of TV sets, first launched in 1998, now consists of 27 models, including projection TV sets and the use of a plasma display panel in some receivers. A new chassis that incorporates many new technologies has been introduced. These include Advanced 100Hz Super Digital Scan, which is enhanced by motion estimation. Advanced Progressive Scanning displays the lines in sequence as complete frames instead of interlaced field by field. There are several new digital picture enhancement features, including a new advanced dynamic sharpness control, improved Advanced Artificial Intelligence which maintains high contrast while controlling the focus and sharpness, and an improved digital comb filter to avoid the moiré effect sometimes produced by fine lines and check patterns.

Other new features include PIP (picture in picture), which displays a small picture from another source such as a VCR while the main programme (TV channel or from DVD) is being watched; POP (picture out of picture) which displays the main picture at reduced size with the other image in a separate border at the right-hand side of the screen; PAT (picture and text) which displays teletext on the right-hand side of the screen and the main picture to the left; PAP (picture and picture) which uses two tuners to display two TV channels side by side; Strobe which uses the remote-control unit's strobe function to display a series of pictures in quick succession; and a new channel search which enables you to see all available TV channels circling a central, currently viewed channel display. The teletext text level has been upped from 1.5 to 2.5, increasing the palette from 8 to 32 colours.

The new chassis consumes only 0·5W when in standby. Sound performance is improved by the use of Panasonic's AFB (acoustic feedback) technology. This uses microphones to monitor the sound output from the speakers, providing feedback to the AFB circuitry to compensate for any inconsistency in speaker performance.

Panasonic is to launch two digital terrestrial IDTV sets, Models TX32DT2 and TX28DT2, for terrestrial free-to-air reception. They include MHEG5 teletext, DVB subtitle displays and twin smart-card slots. A DSM-CC on-air download facility provides data file transfer across an open system. The digital and analogue tuners are permanently active, enabling the viewer to record a digital programme, with the digital tuner locked to prevent accidental change, while watching analogue programmes. An external modem is an option.

Multimedia Home Platform

Panasonic, Philips and Sony are promoting the MHP (Multimedia Home Platform) standard, which has been established by the European DVB Project. The idea is to have a single system that can handle a variety of applications from different service providers. MHP uses a Java machine and APIs inside the set-top box. There are three 'profiles' that correspond to different uses. The simplest is the Enhanced Broadcasting Profile, which provides complex EPGs and limited interactivity. The Interactive Profile provides increased interactivity and more sophisticated applications, while the Internet Profile adds internet operation via the MHP box.

MHP offers an upgrade path from systems such as Mediahighway and OpenTV to full MHP implementation. This means that for a time proprietary and MHP applications will have to run on some boxes with a series of plug-ins (to enable MHP applications to run on an OpenTV box

and vice versa for example). Version 1.0 of the MHP standard was recently established, and Germany looks as if it will be the first country to use the system for broadcasting with its FUN (Free Universe Network) service. This brings together a number of broadcasters, including public-service networks like ZDF and ARD, to offer free-to-air digital TV.

Panasonic says that the first stage of MHP implementation will see FUN set-top boxes that offer enhanced broadcasting services, followed by boxes capable of providing interactive operation for applications such as home shopping, banking and e-mail, the final stage being set-top boxes that provide full internet access.

MHP sounds like an excellent idea. But many existing set-top boxes don't have sufficient on-board memory to be able to handle Java-based applications, and whether pay-TV operators will be happy with a system that allows their customers to switch services without having to change the set-top box remains to be seen.

The Panasonic Model TX32DT2 IDTV receiver.

DVD-Audio

At last year's seminar Eddie Esaki, Panasonic's general manager of overseas sales and marketing, talked about the forthcoming launch of DVD-Audio, due by Christmas 1999. But the launch was delayed when a Norwegian hacker cracked the DVD copy protection system known as CSS (Content Scrambling System). The launch had to be postponed while a more powerful encryption system was developed.

Toshiba and Matsushita, who developed the original CSS system, brought Intel and IBM into the development of the new system. This was originally called CSS 2 and was initially intended for DVD-Audio. It was complete by the end of last year. The decision was then taken to use it for all DVD formats and give it a new name. Two names in fact, CPRM (Copy Protection for Recordable Media) and CPPM (Copy Protection for Prerecorded Media). The complete system is known as 4C, reflecting its development by four companies, and is designed for other formats as well such as the SD Memory Card (see later).

DVD-Audio offers much better performance than today's audio CD format. The latter uses pulse-code modulation, analogue audio signal sampling at 44·1kHz and 16-bit resolution. The system was developed over twenty years ago, and digital technology has moved on since then. DVD-Audio also uses PCM, but offers a series of sampling frequencies and quantisation levels that extend up to 192kHz/24 bits. It also provides a frequency response up to 96kHz and a dynamic range of 144dB. Other features include two- to six-channel audio and multimedia use – text, pictures and video, the latter conforming to the DVD-Video standard.

The first DVD-Audio players from the companies will be the Technics DVD-A10, priced at about £830, and the Panasonic DVD-A7 at about £670. Technics is to launch a DVD-Audio micro system, Model DVD-HDA710, at about £830 in October. There will also be an optional multi-channel amplifier and speaker system, plus DVD-Audio ready amplifiers, speakers and receivers. All DVD-audio players are Universal DVD players that can also play audio CDs and DVD-Video discs. Today's DVD-Video players will not be able to read DVD-Audio discs however – though they will be able to play the video content on a DVD-Audio disc.

The DVD-A10 incorporates a Digital Remaster Processing (DRP) system that Technics claims will improve the sound quality with audio CDs. It works by using a digital signal processor to create a high-range signal above 20kHz: this virtually natural harmonic structure is added to the original recorded data, thereby extending the effective frequency response into the ultra-high range.

There were no details of DVD-Audio software pricing, support or availability.

DVD-RAM

Although the DVD-Video format has become the fastest-ever selling consumer electronics launch, with sales eclipsing even colour TV, VHS and audio CD at the same stage in the cycle, many consumers are waiting for recordable DVD to arrive. Several recordable (or, to be more precise, rewritable) formats have been developed, including the DVD+RW format from Sony and Philips, the MV (Multimedia Video) disc from NEC, DVD-RW from Pioneer and DVD-RAM, whose supporters include Panasonic, Hitachi and Toshiba. Only the latter two are official DVD formats. Panasonic says that DVD-RAM offers a number of benefits that include a high writing speed (2·16Mbits/sec), quick random access and high reliability (the discs are stored in a protective caddy).

The DVD-RAM format has been available in the PC market for a couple of years, with the first discs providing a storage capacity of 2·6Gbytes. Since then discs with a storage capacity of 4·7Gbytes have been developed: these are being used for the consumer version of DVD-RAM.

Panasonic launched the first domestic DVD recorder based on DVD-RAM technology, Model DMR-E10, in Japan at the end of June. It can store up to an hour of studio-quality video or up to four hours of better than VHS-quality video on the disc – users can select the picture quality by varying the recording bit rate. Table 1 shows the various recording modes available. The highest picture quality (XP) has a data rate of about 10Mbits/sec: in the LP mode the data rate is about a quarter of this. The automatic bit-rate adjustment system selects the recording bit rate in accordance with the disc storage capacity available.

The DMR-E10 was demonstrated at Monaco. It has a Disc Navigation system that provides a series of thumbprint images for quick and easy access. The Play List function makes it possible to set mark-in and mark-out points for direct playback of a particular scene. It's also possible to create a list of selected scenes for playback – Play List offers up to 99 lists and 999 scenes.

The Technics DVD-A10 DVD-Audio player also incorporates a DRM system to improve the sound quality with audio CDs.

The Panasonic Model NV-FJ760B VCR offers EP operation, 60sec rewind, Tape Library indexing and subtitle recording amongst other features.

The DMR-E10 is priced at the equivalent of about £1,600 in Japan. Blank discs are about £18 each. The DVD-RAM recorder will probably reach Europe early next year.

VCRs

Panasonic showed the NV-F360 and NV-F3710, the first European VHS VCRs to provide Extended Play (EP) recording, which gives a three-fold increase in playback time. It enables up to twelve hours of video recording to be stored on an E240 tape. Panasonic says EP is great for recording programmes while you are away on holiday, or sports events.

Although EP recording is a new feature with domestic European decks (VCRs made for security systems offer many hours of recording on a single cassette) it has a long history. The first NTSC VHS recorders offered three recording speeds, 3·3cm/sec (SP), 1·67cm/sec (LP) and 1·1cm/sec (EP). But when VHS first came to the PAL markets the machines had a single speed, 2·34cm/sec.

Then, in 1983, Hitachi launched the VT17, the first LP VHS machine to be made available in the UK. For LP operation the tape speed is reduced to 1·17cm/sec. LP and EP recording works by laying down narrower tracks on the tape. The standard VHS video track is 49µm, LP tracks being 24·5µm wide. In the EP mode the tape speed is 0·78cm/sec and the track width just 16·3µm. The first LP VCRs were four-head machines, with two SP and two LP heads. Nowadays however most VCRs use a single pair of dual video heads for both SP and LP. Panasonic's EP recorders are six-head machines: there are four video heads plus two for VHS Hi-Fi.

Panasonic released details of its EP recorders several days before JVC officially announced the new specification. An EP machine has SP, LP and EP modes, which means that an E180 cassette can be used to store three, six or nine hours while an E240 cassette gives four, eight or twelve hours' recording time.

A number of factors have made EP recording possible: video enhancement techniques such as digital noise reduction, timebase correctors, improved head and tape performance and greater drum assembly precision. The EP mode applies to both VHS and S-VHS formats and uses the same signal processing as the LP mode. According to Panasonic users do not have to buy special-formulation tapes, e.g. high grade, for EP recording.

Table 2 lists track configuration details for VHS/S-VHS PAL recording modes.

Linear and hi-fi audio recording are both possible with EP but, unlike LP, line sync pulse alignment is maintained. This means that there is no skew distortion in the trick-play modes like picture search. Panasonic demonstrated this: with LP picture search colour was lost, but with EP search it was maintained.

Panasonic has incorporated EP with two top-end VHS recorders, both of which incorporate the company's Tape Library recording index system (which can store data on up to 600 programmes), 60sec Jet rewind, Intro-Jet Scan (which in the cue mode plays the first ten seconds of each programme) and subtitle recording. Models NV-FJ760B and NV-FJ710B also include Auto SP/LP change, which automatically switches to the LP mode if there is insufficient tape recording time in the SP mode.

Panasonic also showed the NV-D2000 Digital Video (DV) recorder, which is described as a "Digital Network Station". It's a digital editing machine that uses MiniDV cassettes and is designed for editing programmes from various sources, including PCs, VCRs and camcorders. It can convert signals from analogue sources such as VHS, S-VHS, Video 8 and Hi-8 to digital format, with most functions usable via a wireless editing controller. The NV-D2000 does not incorporate a TV tuner but can be linked to an external tuner.

The edit deck can be connected to four VCRs and four analogue video units at the same time, enabling images from both analogue and digital tapes to be recorded on a single DV tape. It has a mass of connectors for the various applications, including an 8mm LANC control terminal and an RS232 port for connection to a PC using Windows 98 or 95. The inclusion of AD and DA video converters enables users to transfer their analogue collections to the

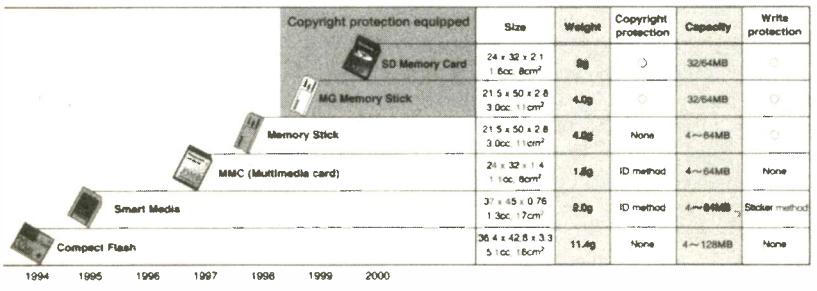


Fig. 1: Flash memory card evolution.

Table 1: DVD-RAM recording modes.

Mode	*Data rate (Mbits/sec)*	*Quality*	*Recording time (hours)*
XP	10	Studio	1
SP	5	Better than S-VHS	2
LP	2·5	Better than VHS	4
FR	2·5-10	Varies	1-4

Notes: Based on single-sided 4·7Gbyte disc. The FR mode provides automatic bit-rate adjustment for exact recording time.

Table 2: VHS/S-VHS recording modes.

Parameter	*SP*	*LP*	*EP*
Tape speed (mm/sec)	23·39	11·70	7·80
Track width (µm)	49	24·5	16·3
AC head position (mm)	79·244	79·248	79·25

digital format. Other features include a timebase corrector, time-code editing and audio mixing.

Camcorders

Panasonic's new digital camcorder range includes Models NV-DS25B, NV-DS150B, NV-DS15B and NV-DS12B. All have 0-lux Night View, which enables black-and-white images to be recorded under low-light conditions, also a motion sensor that records a moving object then stops automatically ten seconds after the cessation of motion – this is done to conserve tape battery power. The NV-DS25B has an 8MB MultiMediaCard memory that can store up to 200 images: by using a card adaptor, the images can be transferred to a PC or a suitably-equipped printer.

The NV-DX100 is, according to Panasonic, the world's smallest and lightest three-CCD model. But the prize for the overall smallest camcorder goes to the NV-EX3 which weighs 400g (without battery and tape) and has a volume of 350cc.

Models NV-VS4/VS7 and RZ7 are S-VHS-C camcorders that include Super VHS-ET technology – this makes it possible to make S-VHS recordings on VHS tape.

The SD Memory Card

Although tapes and optical discs are at present the most cost-effective recording media they are being challenged by both hard disk technology and memory cards. One survey, from Technology System Research, forecasts that world demand for memory cards will explode during the next few years as more and more devices use the technology. The current memory card market is dominated by the SmartMedia and CompactFlash formats, but a new generation of intelligent memory cards has been developed, most notably Sony's Memory Stick and the SD (Secure Digital) Memory Card developed by Panasonic, SanDisk and Toshiba. Fig. 1 shows the evolution of the flash memory card, with details of size, weight, capacity and copyright protection systems. Flash memory cards retain their contents when the power is switched off, and are thus closer to hard disks than RAM memory, which is volatile.

The SD Memory Card is designed for use in a wide range of devices and is backed by almost a hundred companies that include Microsoft, EMI, Samsung, Sharp, JVC, Hitachi, Canon and RealNetworks. Panasonic sees SD as being suitable for the storage of a wide range of content, including music, movies, games, software, maps, photos and electronic books (e-books).

The SD card is about the size of a postage stamp and can include copy protection, making it ideal for audio applications – Panasonic launched two SD audio products in Japan at the end of June. Fig. 2 shows the basic design of the SD Memory Card. The misinsertion prevention rails (one at each side) ensure correct insertion in a device, while the write protection switch can be used to protect the contents from accidental overwriting. There are nine pins, which are protected by terminal guards. Pins 1, 7, 8 and 9 are used for data, pin 2 for commands, pin 4 for power and pin 5 for the clock line: pins 3 and 6 provide earth connections.

Fig. 3 shows the SD Memory Card format layers. The physical layer at the bottom protects the contents. The file system layer (ISO9293) is above this, while the application layer at the top can include video, audio or other data. There's also a security layer which stores the copy protection system. This uses a series of keys. Both the host and the SD card are authenticated by use of unique keys. Any copyright-protected content is encrypted using a unique key which is downloaded into the card memory, enabling decryption to take place.

The existing SD Memory Card can work at data speeds up to 2Mbits/sec and provides a maximum storage capacity of 64Mbytes. This makes it suitable for such applications as music and sill video images. SD cards with faster read/write speeds (over 10Mbits/sec) are due to be launched next year, while larger cards offering up to 1Gbyte capacity are expected to be available within five years. According to Panasonic, by the end of next year some SD cards will be able to store about nine minutes of MPEG-2 video (running at a data rate of 4Mbits/sec), with the capacity reaching 36 minutes in about 2004. Fig. 4 illustrates the projected development.

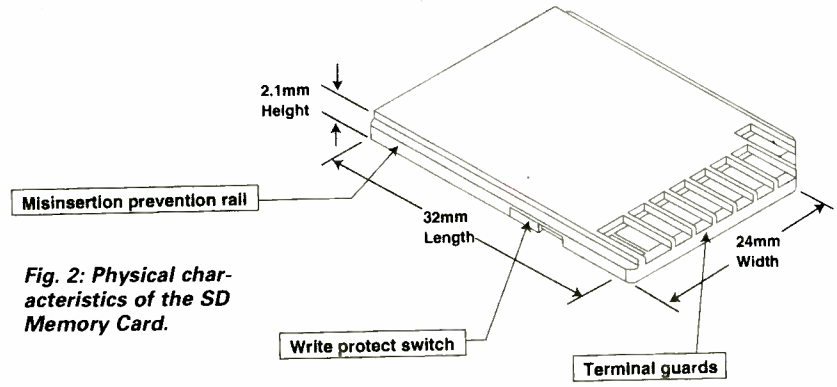


Fig. 2: Physical characteristics of the SD Memory Card.

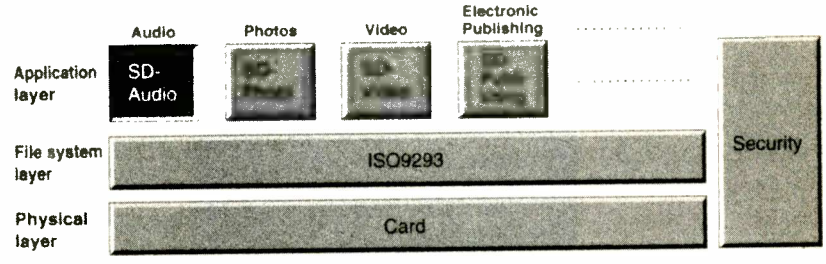


Fig. 3: SD Memory Card format layers.

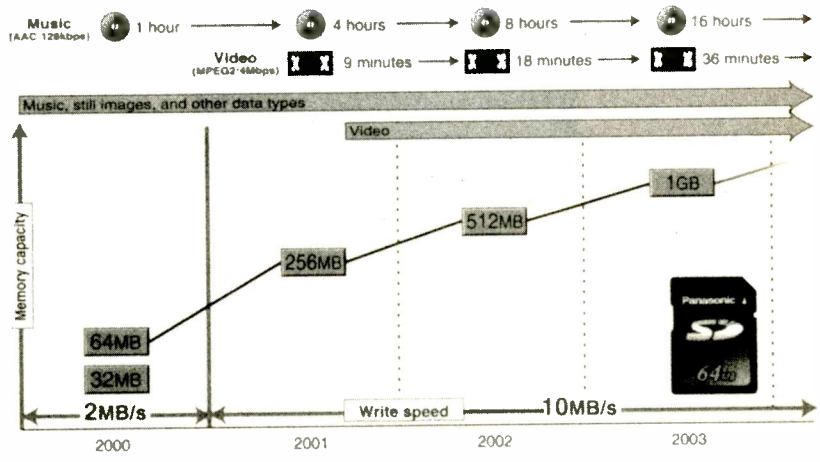


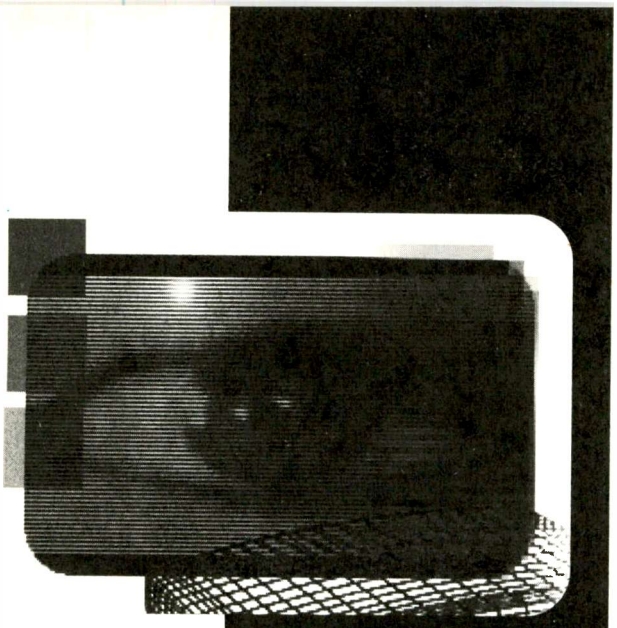
Fig. 4: Projected development of the SD Memory Card.

Panasonic showed the first SD Card audio players (see heading photograph). The Advanced Audio Coding (AAC) compression system used is based on MPEG-2. It offers better sound quality than MP3, which is based on MPEG-1. I tried out several SD audio players and was impressed with the clarity provided. An SD Card can store up to 64 minutes of hi-fi sound, using a data rate of 128kbits/sec, or 129 minutes of lower-quality audio at a data rate of 96kbits/sec.

SD Card audio players are supplied with SD-Jukebox recording and library software which is used for transferring music from a PC to the player. Music is transferred via a Universal Serial Bus (USB) connection.

Panasonic sees SD as heralding a new trend to 'wearable audio', and Eddie Esaki hosted an unusual 'fashion show' with models wearing SD audio card products in the form of wrist watches and neck pendants! ■

Acknowledgement
Many thanks to all the Panasonic and Technics product and marketing managers who attended this year's seminar for their help.



TV Fault Finding

Reports from
Adrian Spriddell
Denis Foley
Gerald Smith
Bob McClenning
Glyn Dickinson
Russ Phillips
David Smith
Steve Leatherbarrow
and Bob Longhurst

Sony KVM2151U (BE2 chassis)

The complaint was colour dropping out. We noticed the effect only occasionally over a period of several days, and finally managed to tie it down to a line twitch that presumably upset the burst gating. A close look at the PCB revealed numerous print cracks around component legs. So a blanket resoldering operation in the line timebase and power supply areas was carried out. This cleared the fault. **A.S.**

Finlux 5025

The TDA1521 sound output chip ICp1 had failed. A replacement restored sound, but when the volume was turned up to no more than a moderate level the chip would be driven to clipping. Ra73 (0·1Ω) in the 30V supply circuit had risen in value. **A.S.**

Philips 14GR2520 (G90AE chassis)

This set came back after I'd cured the dead-set symptom – the original problem had been no output from the power supply because the SFOR5D43 thyristor Thy6670 was short-circuit. This time the set wouldn't go into standby. I hadn't checked as fully as I should, because this second fault must obviously have been caused by the first one.

When the remote control unit's standby button was pressed, the LED on the set went from green to orange instead of red. Pin 41 of the microcontroller chip IC7220 goes low for standby. This change, via Tr7671, turns on Thy6670, the thyristor I had already replaced. When Thy6670 switches on it should increase the voltage across C2660 to 14V – during normal operation the voltage across this capacitor is approximately 8V. At 14V, which is fed to the optocoupler via D6653, the set goes to standby. The 8V was not increasing as it should because D6669 (BAS32) was short-circuit. A new diode cured the fault. **D.F.**

Hitachi C2114R

This set was dead. I found that the BUT12AF chopper transistor Q903, the CNX82A optocoupler IC901 and the P6KE130A over-voltage protection diode ZD952 were all faulty. They appeared to have been replaced before. The customer denied any knowledge of a previous repair – "it's my mother's" was all the help I could get from him. Suspecting that I might end up with the same problem as my predecessor, I went a little further and discovered that R951 (39kΩ, 0·5W 5 per cent) in the HT sensing potential divider network was faulty. I fitted a replacement then, with a little adjustment, obtained the correct 112V HT voltage. But the set was still dead.

I've not been able to work out exactly what happens, but if the line output stage doesn't start at switch on the 9V supply is disabled. As a result the TDA8361 IF, colour decoder and timebase generator chip IC201 ceases to produce a line drive output. If you connect a scope to pin 37, you can see the line drive pulses appear momentarily. The line output stage wouldn't work because it was being damped by the TA8427K field output chip IC601, which was faulty.

Once a replacement had been fitted there was sound and a picture. But the picture was displaced to the right. This was a phase-shift condition, likely to be caused by a fault in the pulse feedback between the line output stage and IC201.

Checks in the feedback path showed that the clipper diode D704, which is connected to chassis, was leaky. But when a replacement was fitted the picture disappeared! It seemed a shame to give up after getting so far. There was still a raster, so perhaps it was something to do with replacing D704. In fact there are two clipper diodes. The other one, D703, is connected to the 9V rail. When this second one had been replaced there was a normal picture. The diodes are both type 1N4531.

Another of those jobs with which it's impossible to charge for all the time and effort you have to spend on it! **D.F.**

Philips 28CL6770/25Z (FL1.10 chassis)

The set would come on in standby and sometimes went to standby when changing channels. This is usually a sign that the protection circuit is coming into operation. I noticed that the screen was being over-scanned: the height and width were both excessive. A check on the HT voltage showed that it was high, at 156V instead of 141V, approximately 10 per cent above the specified figure.

The circuit diagram shows the control module as a grey box that's available as part of the power supply repair kit. HT sampling is at pin 8L40. R3374 is mounted on the module in series with this pin. It' a small (0·25W?) resistor, and on test

I found that it had changed in value by 10 per cent, from 75kΩ to 82kΩ. A replacement restored the HT to 141V, after a tweak on the preset, curing the fault symptoms. **D.F.**

Finlux 3000 Series Chassis

This set wouldn't come out of standby from cold. The standby LED just flickered and went out. Once the electrolytic capacitors Cu7 and Cu8 in the power supply had been replaced the set worked normally. Cu7 is the reservoir capacitor for the supply to the TDA4601D chip and Cu8 the chopper transistor's base drive coupling capacitor. Both are 100µF, 35V. **G.S.**

Brion Vega 25BST219

This set had no sound. The picture was OK and the on-screen display worked, but there was no volume bar. The NVM3060 memory chip CI1 was corrupt – a replacement restored the sound and full OSD. **G.S.**

Grundig CUC2030 Chassis

There were horizontal black-and-white lines across the screen and the set wouldn't tune in. The lines were present even with a video input via the scart connector. It was as if the standard was wrong or there was no sync. After a lot of checking the cause was traced to the sound MSP chip, which was corrupting the data lines. When the data lines to this chip were disconnected the set could be tuned in and the picture was OK. A new MSP chip put matters right. **G.S.**

Hitachi CT1709

This portable produced a snowy display and wouldn't tune in. On making some checks I found that the tuner's VT supply was missing. Replacement of the 33V zener diode ZD002 and its 12kΩ feed resistor R044, which was open-circuit, restored the tuning and picture. **G.S.**

Nokia 6364UKSFN

The Nicam sound crackled. There was normal sound once the MSP2400 sound processor IC had been replaced and the EEPROM values had been reset. **G.S.**

Samsung CI5052X (P68 chassis)

If the HT output from the power supply is high, before you try replacing the SDH209B chopper control chip IC801 replace C852 (470µF, 16V). This may well bring the HT back to within its normal voltage range, enabling it to be set at 125V. C852 is the reservoir capacitor for the supply to IC801. **B.McC.**

Decca DBS9892C

We've had a couple of these oldish Nicam sets with the same fault – intermittent operation. The cause of the fault is not easy to spot: remove the scart PCB from the Nicam and main panels (one tag soldered) and you will find a dry-joint at the far left and the far right pins of the connector. When the joints fail completely the set will be dead, as the LT is looped through this panel. The audio PCB also suffers from dry-joints. The result is audio "thumping". **G.D.**

Samsung CI6837AN (Z68 chassis)

Odd symptoms but fortunately an easy cure. The screen was filled with 'space invader' (remember them?!) style white dots that curved in at the sides and flipped in and out at the centre of a blank raster. There was also no sound. It seemed a good idea to check the 5V and 12V supplies, which were very low because of a poor connection at the 15V feed link wire to the regulators. **G.D.**

Goodmans Compact 110

These Samsung-based sets suffer from power supply trouble. If one of them comes in dead, inspect the electrolytics in the field output stage. If they are bulging, throw the set away: the HT will have gone high, overrunning everything. If they are OK, use an external 12V supply to power the set. If it works, strip the power supply down and remove any black glue from the PCB, especially at the snubber network where the 39Ω, 5W resistor can fail because the glue has damaged the PCB. The chopper transistor usually survives. Then replace the two 180kΩ start-up resistors, using histab components, and check that the 47µF capacitors are 105°C types and are in good condition. Use the best type you can find for replacement. Then look for a new speaker, as you will have broken the wires going to the old one . . . **G.D.**

ITT Compact D2 Chassis

This set was brought in because of field faults. Easy, there were dry-joints at the field output IC. The customer also complained about poor sound. There was no Nicam sound, and the FM sound was buzzing. Access is not good, so I decided to inspect the sound IF section. Replacing C242 (0·47µF) and C244 (47µF) in the IF can brought good sound without any realignment. There was still no Nicam sound, but the customer decided that he didn't want this fault repaired. **G.D.**

Pioneer SD28AV1

The standby LED flickered and the remote-control unit wouldn't bring the set out of standby. Checks revealed that the 5V output from the 7805 regulator chip IC722 was unsteady. The cause was a short-circuit at pin 27 of the microcontroller chip IC1451, which is socketed. **R.P.**

Hitachi C2558TN (G8Q chassis)

The channel number was displayed but there was no EHT. Voltage checks showed that the 12V supply was low at about 5V. The cause was found to be C933 (2,200µF, 25V) which is the reservoir capacitor for the feed to the 12V regulator. **R.P.**

Samsung CI5913 and CI6813 (U88MT chassis)

Proceed as follows if C560 (2·2µF, 250V), which smooths the HT supply on the CRT base panel, has failed. Change C410 (may be shown as C401 on the PCB and the circuit diagram) from 220µF, 100V to 47µF, 250V, and connect its negative pin to chassis. It's the reservoir capacitor for the HT supply to the RGB output stages. Change C416, which smooths the supply to the line output stage, from 2·2µF, 250V to 47µF, 250V. If R415 (0·47Ω, 0·5W) is fitted, check whether it's open-circuit. If so replace it. This is official Samsung information. **R.P.**

B&O MX3500

This set suffered from crackling sound, very similar to Nicam dropout, which stopped after about 25-30 minutes. A long, hard look with a magnifying glass and a strong bench light revealed dry-joints at the audio output chips IC3 and IC4. They are on PCB10, the bottom board. **R.P.**

Pioneer SD28AV1 (ITT/Nokia D-E FST chassis)

There was no HT output from the power supply, which worked all right in standby and when loaded with a light bulb. The TDA3654 field output chip IC401 was shorting the 26V supply, which is derived from pin 8 of the line output transformer. **R.P.**

Panasonic TX21T1 (Alpha 2 chassis)

This set suffered from intermittent fuse blowing. Every so often the mains fuse F801 would shatter. Once

it had been replaced the set would work for ages before providing a repeat performance. The cause of the trouble was the mains bridge rectifier's reservoir capacitor C807 (100µF, 400V). **D.S.**

Mitsubishi CT21A2STX (Euro 12 chassis)

This set was brought in because of field collapse. Before fitting a new TDA8178S field output chip (IC451) it is worth replacing C956 (1,000µF, 35V), the reservoir capacitor for the 28V supply, and C452 (220µF, 35V), the flyback boost capacitor. It is also a good idea to check the HT voltage, which should be about 120V. Do this before fitting the new IC, or by lifting one end of R976. Excessive voltage is usually caused by C906 (47µF, 50V), C909 (2·2µF, 50V) and the two 3V zener diodes D907 and D908 (both type RD3.0FB1).

A modification kit (Mitsubishi Mod. kit 2) is available from Grandata. This is three times cheaper than the TDA8178S chip and is easy to fit. **D.S.**

Ferguson D14R (TX805 chassis)

This set was dead and in a sorry state. The mains fuse was blackened, and the S2000AF chopper/line output transistor TP10 was short-circuit. With this chassis it's always best to check DP50 (ZPU150), the over-voltage protection diode across the 103V supply (from pin 5 of the LOPT to chassis). In this set it laid unmarked, mounted vertically, on RX05 and wire link JP26, just to the left of the A1 potentiometer on the LOPT – if one of us engineers fitted components like that we'd be called cowboys.

If DP50 is short-circuit or leaky, a thorough check needs to be carried out. Replace the following components: DP10 (BYV38), RP92 (0·68Ω fusible), DP90 (BA157), DP21 (2·7V zener diode) and CP08 (100µF, 35V).

I didn't gamble. After fitting a new LOPT I was rewarded with a working set. So much for the built-in protection circuits. And why fit the power switch on the back? **D.S.**

Mitsubishi CT25A4STX (Euro 12 chassis)

This set tripped when switched on – it was in the over-voltage mode. A previous engineer had replaced various capacitors in the power supply, using low-ESR 105°C types. He had also replaced the RD3·0FB1 zener diode D907 in the chopper transistor's base drive circuit. When I tested it however the replacement proved to be leaky. A further replacement brought excellent results. **D.S.**

Hitachi C2524TZ (G7PS chassis)

This set required a new line output transformer. The part number on it is 2436771. Be careful when ordering. If you order an HR type, the correct one is HR7832, not HR7600 as shown in one catalogue. It's also wise to check the value of R909 (39kΩ). When it goes high the HT rises. It's best to replace this resistor as a matter of course. **D.S.**

Ferguson D68N (ICC9 chassis)

There was no line or field sync. The cause was TX07 (BC848B), which is a surface-mounted device. **D.S.**

Cathay 3501B

The picture displayed by this set was of reduced width. The cause was traced to dry-joints at the line driver transistor Q110. There was normal scanning once it had been resoldered. **D.S.**

Soudwave CTV1405R

This set was dead though the power supply was OK. The cause of the trouble was the line driver transformer, whose primary winding was open-circuit. **D.S.**

Panasonic TX25MD1 (Euro 2 chassis)

We've had very few faults with this chassis. With this set however there were flyback lines at the top of the scan. The fault was very random and was eventually traced to D456 (MA2160B), which is associated with the field flyback boost voltage generator circuit. **S.L.**

Goodmans 256NS (Philips L6 series chassis)

This Philips based set was dead but whistled. The cause was traced to C2912, a blue disc capacitor (2·2nF, 2kV) near the line output transformer. It was leaky. According to the back cover the chassis was type L6.3: the chassis itself was labelled L6.2! **S.L.**

Samsung CI5373T

A dead set with the mains fuse blown is not my favourite repair with these sets. You will almost certainly find that IC801 is short-circuit. Samsung, helpful as ever, has a repair kit. Replace IC801 (SAMSA40100080), ZD801 (SAMS32167401880) and HC801 (SAMSA40100090). Although this will cure the problem, we have experienced repeat failures for which no explanation could be found. Remember this when you provide your repair estimate. **S.L.**

Bush 2857NTX

A change to get one of these sets that wasn't dead! It produced a very poor picture however, lacking crispness. The cause was traced to R433 (150kΩ) in the beam-limiter circuit. It had changed value. **S.L.**

Osaki P148T

This set apparently went off with a pop. When I switched it on a slight noise, not unlike a simmering kettle, came from the line output stage. There was about 10V at the collector of the line output transistor, but it wasn't hot. A check at the cathode of the HT rectifier D812 also produced a reading of 10V. The 47µF, 160V HT reservoir capacitor C828 was open-circuit. Once a replacement had been fitted the set worked normally. **B.L.**

Matsui 2096T

We've had a couple of dead sets in recently. The BUH5150 line output transistor Q580 was short-circuit in the first one. The cause of its demise was a dry-joint at C576 in the field output stage. With the second one R108 (220kΩ) in the power supply was open-circuit. It's connected to pin 3 of the TDA4605 chopper control chip. **B.L.**

Samsung CI5322T

When this set was switched on the standby LED glowed for a few seconds then flicked off. Voltage checks showed that the outputs on the secondary side of the power supply came up then decayed. The culprit was C817, which when tested read 40µF instead of 100µF. **B.L.**

Mitsubishi CT21M1TX

From a cold switch on the picture was generally unstable, with wavery lines that flickered across the screen, while the only sound output was hum. Scope checks showed that there was ripple on all the outputs from the power supply. The culprit proved to be C905 (470µF, 25V) on the primary side of the circuit. As I didn't have the circuit diagram I had to rely on freezing and heating suspect capacitors to locate the faulty one. **B.L.**

Bush 2866NTX

There was no 33V tuning supply because R124 (15kΩ, 1W) was open-circuit. It's shown as 12kΩ in the circuit diagram. **B.L.**

HELP WANTED

The help wanted column is intended to assist readers who require a part, circuit etc. that's not generally available. Requests are published at the discretion of the editor. Send them to the editorial department – do not write to or phone the advertisement department about this feature.

Wanted: By Video 2000 enthusiast, any parts/panels for Philips V2000 series machines, in particular for Model VR2334 and microcontroller chip M5M8050L-552P or INS8050-6. Tel./fax 01489 576 579 or e-mail keith@portset.co.uk

Wanted: Main board or the M50439-563SP microcontroller chip for the Mitsubishi Euro 4Z or Euro 6 chassis (Model CT2155). Please phone Mervyn Quilter on 01752 702 247 or e-mail mervynquilter@aol.com

Wanted: For the Ferguson 3C03 camcorder, the small black plastic lever that opens the lid of the cassette when you insert it, or a complete cassette carrier assembly. John Woodgate, 3 Bramfield Road East, Rayleigh, Essex SS6 8RG. Phone 01268 747 839.

Wanted: LOPT for the Mitsubishi TV Model CT3701TX. Telephone Peter Hale on 01633 266 563 (Newport, Gwent).

For disposal: Back copies of *Television* from 1983 to1990. Please write to R. Flitcroft, 14 Routledge Walk, Blackley, Manchester M9 1DT.

Wanted: Help with a Goodmans One Ten A tuner-amplifier Model 12123. Some of the transistors to be replaced (type 2N3702) have a colour band on them, top to bottom, red-white-green. What does this colour band indicate and what should I specify when ordering? Also, can anyone suggest an equivalent for the BFT39 transistor. K.D. Benson, 6 Pant Cadifor, Pant, Merthyr Tydfil, Mid Glamorgan CF48 2DD. Phone/fax 01685 371 423.

Wanted: Brown goods sales brochures, shop display items etc. pre 1980. Early CTV sets sought, especially dual-standard, plus in particular a Decca 60 series CTV. I am also interested in 405-line sets, radios etc. My aim is to preserve products that illustrate the evolution of our industry for future educational and entertainment purposes and exhibitions. Phone Peter H. Dolman on 01380 828 524 (day) or 01380 828 148 (evenings). Or email dolmanav@hotmail.com

Wanted: A Loewe TV chassis, Model Profi S28 64457. Good price paid. Phone Peter Ward on 01425 475 445 (Ringwood, Hants).

For disposal: *Television* magazines from 1977 to 1997. Every issue in good condition. Plus several other electronics magazines. Best offer considered. Phone B. Mistry on 020 8422 0728 or 020 8997 2646 (Greenford, Middx) or e-mail b.mistry@lineone.net

Wanted: I need to replace a transistor in a Bush VCR Model 3401. The markings on it are A114 TSD. So far I have had no luck in trying to obtain one as it seems to be obsolete. Can anyone suggest an alternative? F. Quinn, 6 Princess Avenue, Blackhill, Consett, Co. Durham DH8 0LG.

For disposal: Capacitor Wizard surplus to requirements, in full working order with manual. £50 post paid in UK. Also have, free on request, working remote control units for the Beolink 1000 and Pye 20DV2. Please phone David Martin on 01279 506 212.

Wanted: For the Toshiba Model V880MS/880MC VCR, a tuner unit type H001/EC432A, IF module Z090/STD-MS1, picture IF second UB01 or a main PCB from a scrap machine. And for a Matsui VP9505 VCR a front-loading cassette mechanism (working) or parts to fix the right-hand side cassette lift – broken gear and spring assembly (white). Phone or fax 00 34 96 671 9902. R. Peters, Bloque Bravo No. 6 Casa 3, Pueblo Bravo, 03170 Rojales, Alicente, Spain.

For disposal: A quantity of *Trader* service sheets, Thorn CTV manuals from the 3500 to the ICC5 chassis, Philips/Pye CTV manuals from the 693 to the K35 chassis, various Amstrad/Fidelity CTV and VCR manuals and a Sony colour TV manual compilation up to 20in. Phone Phil Marrison on 01283 790 747 (Alrewas, Staffs) or e-mail PhilipG@pgmarrison.freeserve.co.uk

Wanted: Circuit diagram for the Alba Model CTV4889. J. Clarke, Macaulay Ward, Ashworth Hospital, Parkbourn, Maghull, Liverpool L31 1HW.

Wanted: Remote control unit, AV lead and user manual for the Philips CDi370 portable CDi player. Phone Andie Wilkes on 01926 404 935 (day) or 0121 605 0720 (evenings), or e-mail andie@wilkes123.freeserve.co.uk

Wanted/for disposal: Require C9, C20, C30, C40, HF100 Betamax VCRs to help keep the format going! Have the following VHS VCRs for disposal: Philips VR6291, Akai VS767, Saisho 3400 – suitable for spares/repair. Alan Stubbings, 7 Church Road, Saxilby, Lincoln LN1 2HH. Phone 01522 702 601 (evenings/weekends).

Terrestrial and satellite TV reception. News on terrestrial and orbital transmission changes. How DAB is being implemented in Europe and the USA. Roger Bunney reports

DX and Satellite Reception

This year's season for Sporadic E signal propagation/reception started at the end of May, with a mass of signals that were mostly received along a north/south path in the UK. As a further bonus for DXers, warm weather produced a lift in tropospheric propagation over the weekend of May 13th, with reception from central Europe along the east coast. But the main news has been the return of SpE. Here's the log:

10/5/00	RAI (Italy) ch. IA.
13/5/00	Ch. R1 signal, source unidentified.
14/5/00	RAI IA; RTL Club (Hungary) R1.
16/5/00	RAI IA; TVE (Spain) E2; RTP (Portugal) E3; C+ (France) L2.
19/5/00	Russia R1.
20/5/00	RAI IA.
21/5/00	TVE E4.
27/5/00	RAI IA; Video (Italy) E2; TVE E2-4; CRO (Croatia) E4; TVR (Romania) R2, 3; Nova (Czech Republic) R2; RTS (Albania) IC; also an Arabic E2 signal at 1625 – E2 signals from both Syria and Iran were seen that afternoon. Plus unidentified signals.
28/5/00	JTV (Jordan) E2; RAI IA, B; Video E2; TVE E2-4.
29/5/00	RTP E2, 3; TVE E2-4.
30/5/00	NRK (Norway) E2-4; SVT (Sweden) E2-4; TVE E3.
31/5/00	SVT E2-4; NRK E2-4; CRO E4; C+ L2-4; RAI IA, B; TVE E2-4.

Jordanian test pattern received as a digital signal via Hot Bird at 13°E.

There was no SpE reception on June 1st.

It was a good though late start to the season, and hopefully the active conditions will continue. Keep a check on the ch. A2/E3 spectrum during late July, from around 2000 hours, as this is the time of the year when you can get transatlantic SpE reception.

In a previous column I mentioned the BDXC report that Lazlo Kozari had received a ch. R2 signal from Hungary, with colour bars that had a gold headman profile at the top right-hand corner, followed by Arabic-like captions including 'TYPKME6AWN' (possibly Cyrillic). The latter has now been identified as Turkmenbashi, which is in Turkmenistan. The transmitter likely to have been Krasnodar near the Black Sea. This means that the reception was over a distance of some 2,700km. There was also a report that Ian Roberts in South Africa had received F2 signals from the north – Hungary ch. R1, Bantiger (Switzerland) E2, Madrid E2, Portugal E2 and three German E2 transmitters, all identified by using a scanner to check the frequency offsets: the MUF reached 55MHz, with regular transequatorial propagation from the Mediterranean, Iberia and Croatia.

The aurora in early April produced many reports of sightings but few of RF reception. Reporting in *Six News*, Chris Deacon, G4IFX (Farnham, Surrey) described the phenomenon as "the whole northern half of the sky blood red, with a greenish-white glow rising above the northern horizon and rays shooting upwards: the display continued for at least two hours". When he checked the 50MHz amateur band he found that there were strong signal reflections from the NE and NW. A check outdoors then revealed "two particularly bright red blobs in the sky", both of which corresponded to the directions of his reception. Here in Romsey, some 35 miles from Farnham, an elevated white glow could be seen, increasing and

decreasing in intensity. I'd never seen the like before.

Satellite Sightings

At least three SNG trucks came to Romsey to cover the by-election on May 4th. Sky was uplinking at 11·621GHz, and SIS-26 and UKI-257 were also active after midnight. As dawn came the local BBC-South SNG truck arrived in the Market Place and aligned its aerials with Eutelsat II F3 (36°E) – the 11·098GHz downlink signal was too weak to be locked here with my 1·2m dish. RTV UKI-511 Sky News covered the Inner London elections on that day. ITN-9MHz at 11·074GHz was also in operation.

It has become apparent that many uplink trucks are now equipped for MPEG-2 4:2:2 encoding (instead of 4:2:0), a more robust and higher-quality standard that ordinary MPEG-2 receivers cannot display. Roy Carmen however has found that his RSD ODM302-CI receiver will provide short-duration picture lock-up with a 4:2:2 signal. I scoured the MediaCast Satellite Show in mid-May, but could find no receiver other than specialised ones intended for broadcaster use (and costing mega-bucks) that's able handle this standard. A Dutch black-box eventually overcame the problem of the EBU's SIS transmissions, providing good pictures and audio. Hopefully someone will come up with a solution to the 4:2:2 problem.

There was wide coverage of the Festival de Cannes 2000 during the week that started on the 15th. Roy Carmen found Telecom 2C (3°E) in action at 12·548 and 12·712GHz H with many symbol rates including 6,289. The digital multiplex I found was at 12·550GHz V (SR 27,500, FEC 3/4). It was in action throughout the week with service identifications FTR/F52/Canal 1 (or 2 etc.) across the four channels. Most were being used by the French networks, but Canal 4 was an NTSC feed for N. America. The BT TES 26 uplink truck gave us 'Fenetre sur Cannes 2000' via NSS K (21·5°W) at 11·550GHz H (SR 5,632, FEC 3/4). A few days later 'BT TES 28 G00152 Cannes' provided a PAL news feed via Goonhilly and NSS K at 0700 hours. This was at 11·559GHz H (5,632, 3/4). While on the theme of transmissions from France, can anyone tell me what 'CIP PARIS' is? The caption, on colour bars, was seen via Telecom 2B/D (5°W) on May 19th at 1840: it was an analogue transmission at 11·575GHz H, with sound at 6·60/7·20MHz.

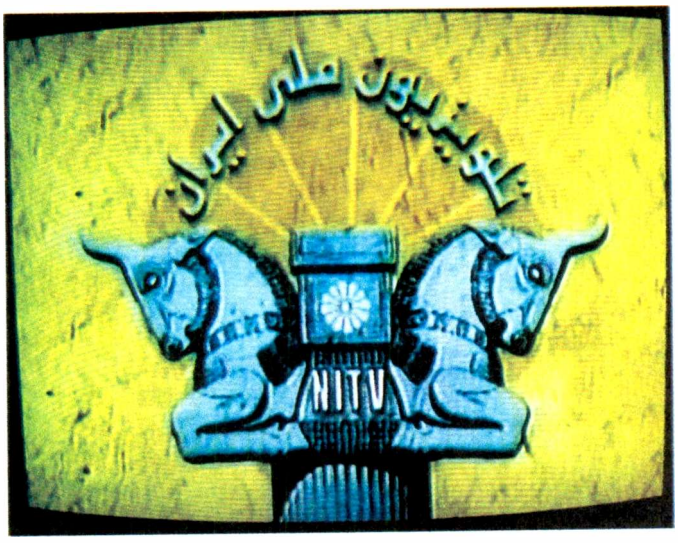
Disaster struck the Dutch town of Enschede on May 13th, when a fireworks warehouse exploded. As it's on the border, most of the SNG trucks that rapidly appeared came from German broadcasters. Kopernikus DFS-2 became very active, with one analogue and several digital feeds. The latter were at 11·588, 12·572 and 12·589GHz, all with SR 6,111 and FEC 3/4.

A new digital multiplex started in mid-May via Turksat 1 (42°E). Details are 11·080GHz H, SR 30,000, FEC 3/4. There are several W. European channels including Sky News, CNBC Europe. MTV (UK version) and a couple of RAI (Italian) channels.

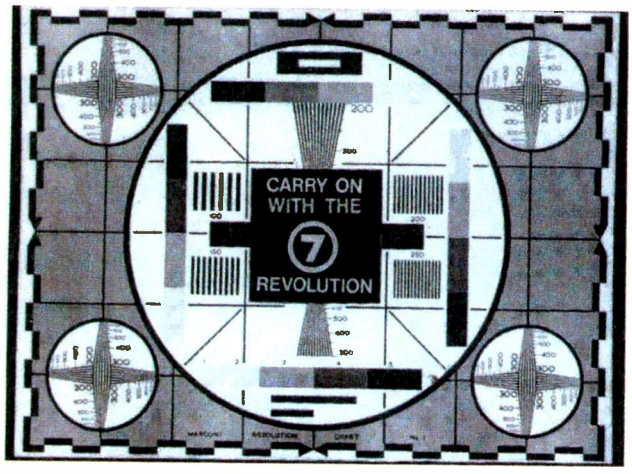
I had several good catches during the month. At 1830 on May 12th the BBC UKI-234 Scottish SNG truck provided an item on holiday charges for the local news programme. This was via Eutelsat II F3 (36°E) at 11·580GHz H (5,632, 3/4). HRT-Zagreb fired up its uplink truck SNG CRO-1 on May 14th after a very long absence. This was for an open-air military dedication or memorial service at Bleiburg. The analogue transmission was at 11·550GHz H (audio 6·60/7·20MHz) via Kopernikus DFS-2 (28·5°E). Alerted by Stefan Hagedorn's internet news letter, I checked Sirius at 13°W – an old satellite in a new position – and found analogue colour bars with the Sirius ident inlaid. This was at 11·782GHz H (though reported as RHC, the signal peaked at H). Over a period of hours the signal slowly sank into sparklies. On the following day the test card was noise-free. This suggests that the satellite is in a very lazy inclined orbit. You don't see sparklies with digital of course. The most dramatic 'DX' reception however was via Arabsat 2B (30·5°E) on May 11th at 2100. A celebratory dance against a wall of banners that announced 'Somalia Peace Conference' appeared in the sparklies at 4·076GHz (LHC), with an inlaid RTD logo. It eventually faded to an ident slide showing docks and the caption 'Dhammaad'. I was unable to find any port of this name in my Atlas but eventually identified RTD as Radiodiffusion-Television Djibouti. A varied month!

Terrestrial News

UK: The government is considering ways of accelerating the move from analogue to digital TV. The original plan was to close down analogue terrestrial UHF TV between 2007-2010, but thought is being given to bringing the date forward to 2005. Lots of spectrum space would then be available for sale to other users. But whereas satellite and ONdigital viewers are happy to pay for extra services, the majority of UK viewers still watch analogue TV and would not want to buy a digital box to continue their viewing.



This impressive station identification was also received via Hot Bird. NITV is National Iranian Television.



As an experiment, Robert Copeman (Australia) recently sent me several test card pictures via e-mail. My printer is mono only, but the results were excellent. This is the Marconi test card used by HSV-7 (Melbourne) in 1972.

The Radiocommunications Agency has licensed TELE2 (UK) Ltd. to use parts of the 4GHz band for fixed-wireless access (FWA), initially in Leicester, Nottingham, Bradford and Leeds. FWA services will consist of high-capacity internet and data links via fixed point-to-point circuits and are expected to spread across the UK rapidly. The 4GHz band is currently used for fixed microwave links and C-band satellite downlinks. The former is more likely to lead to co-frequency interference problems.

RSL station TV 12 (Isle of Wight) is now transmitting Sky News at 1200, 1700 and 2200 hours, also the Sky News Sunrise programme at 0700-0800. The latter is followed by the Island Sunrise programme at 0800. This is the first time that Sky has been retransmitted terrestrially in the UK. TV 12 also transmits QVC and Bloomberg at various times during the day/night. Check ch. 54 during the next tropospheric lift.

European digital TV: YLE's planning (Finland) for the introduction of digital TV, to run in parallel with the existing analogue services, is at an advanced stage. Four DTT channels are expected to be on-air by mid-September, with YLE producing a 24-hour news/educational/cultural channel and a Swedish-language service.

The Dutch broadcasting company Nozema has selected Thomcast to supply 36 UHF transmitters for the start of the DTT services. By this winter six main transmitter sites should be equipped to broadcast five digital multiplexes each. These sites are at Hilversum, Haarlem, Almere, Wormer and two in the Amsterdam region.

The Americas: Brazil has confirmed that the COFDM modulation system will be used for DTT rather than the FCC favoured 8VSB system. The country may not adopt the European DVB standard. The Japanese ISDN system will be considered when it has been finalised. Argentina is considering COFDM.

50MHz Amateur band: With the closure of RTE's ch. IB Maghera transmitter, the Irish 50MHz allocation has been increased from 50-50·5MHz to 50-52MHz. Cable companies have been told to improve technical specifications over the next five years, after which amateurs will have automatic access to the 50MHz band.

The Kingdom of Bhutan has authorised the use of the 50MHz band by amateurs, and Taiwan is to allow transmissions at up to 600W.

My thanks to *Six News* for this information.

TV-DX Tuner

There is to be another production run of the D100 TVDX tuner. It's an integrated full-band tuning system that covers 45-250MHz plus the UHF spectrum to 860MHz, with a fully variable (not switched) IF bandwidth, IF/RF gain controls (plus an AGC loop), coarse/fine tuning, an FM radio output for TV sound and an optional Band I varicap notch filter. A variable IF bandwidth helps to lift weaker signals from the noise and reduces adjacent-channel interference – essential for positive DXing these days.

The tuner is housed in a plastic box (metal front and rear) that measures approximately 7in. wide, 3·75in. high and 4·75in. deep. Power is taken from an external 13A plug PSU. Output is at the UHF channel of your choice. You just tune the D100 for DX reception and feed the single-channel UHF output to your TV set. Cost is about £140-£150. For further details apply to HS Publications, 7 Epping Close, Derby DE22 4HR – please include a stamped, addressed envelope.

Orbital News

SES Astra has done a deal with Eutelsat, leasing six 72MHz bandwidth Eurobird transponders within the range 11·20-11·45GHz to supplement Astra 2A/B/C capacity at 28·2°E. Eurobird is to be launched early next spring and will take up orbital position at 28·5°E.

Eutelsat's W4 Ku-band satellite is now in orbit at 36°E. It provides extensive coverage of Russia via a high-power fixed beam, with 19 transponders, and coverage of sub-Saharan Africa via one fixed and one steerable beam, each with six transponders. The Russian transponders will be used for direct-to-home digital broadcasting by the media group Media Most. The African transponders will be used for a range of services, in particular digital pay TV and broadband internet access for a major client. W4 is in the same orbital position as Sesat, which has 18 Ku-band transponders for business-to-business services and provides coverage across Europe, North Africa, the Middle East and the Indian subcontinent.

New SkyDigital channels continue to be announced. The latest are The Baby Channel, which is due to start in March 2001, Artsworld due later this year and The Medical Channel which is now on-air (ch. 902). CNNI is to open a fifth regional channel, covering South Asia, via PAS-4 at 68·5°E.

The EBU has concluded successful tests of its new simple, standard scrambling system for digital SNG operation. The Basic Interoperable Scrambling System (BISS) is expected to be given ITU approval later this year. It will, unfortunately, present another barrier to sat-zapping enthusiasts. We are already faced with the loss of many OB links because of the use of MPEG-2 4:2:2.

The Scandinavian telecomms group Telia has agreed with Eutelsat to launch a digital service via W3 at 7°E. Multimedia services including radio, TV and data will be offered across Europe, the Middle East and the nearer parts of Russia. CNCB Europe is to start a local-language service, CNCB Nordic, for Scandinavia. Business and financial news will be provided by CNBC's Copenhagen bureau.

Motorola is planning to 'de-orbit' the Iridium LEO fleet of 66 satellites – there were too few subscribers to the phone service. It would be the most expensive firework show ever.

DAB

The end of 405-line TV transmissions in Band III left a vast stretch of frequencies available for other uses. In Europe, including the UK, the ch. E12 end was assigned to digital audio broadcasting (DAB). The BBC has been transmitting digital audio since 1995, using 1·5MHz-wide channels that incorporate several services on a multiplex basis. Many of its analogue radio services have been duplicated in this way. More recently several commercial radio stations have

come on air. In view of the cost of receivers there can be few listeners at present. But those few are enthusiastic about what they hear.

DAB tuner prices range upwards from £500 for the Panasonic GT1000, or a little less for a PC DAB card. The improvement in relation to the existing high-quality FM radio service is questionable. Do we rally need the service? It just seems to be that everything is going digital.

The USA is committed to maintaining its analogue FM band however. The intention there is to incorporate DAB within the existing Band II (88·5-108MHz). Two groups, Lucent Digital Radio (New Jersey) and USA Digital Radio (Columbia, Maryland), have been carrying out research into methods of inserting digital transmissions within the existing FM radio channels. These 200kHz wide channels have a guard band at each end, which is where the DAB signals can be inserted, see Fig. 1. The technique is known as in-band on-channel transmission (IBOC).

Once the user has tuned to the centre frequency of the FM channel, the digital information at each side is present within the receiver's IF bandwidth. It can be extracted by filtering and fed to a digital demodulator. There is a problem however when multipath reception causes destructive interference. To overcome this, the Lucent system separates the data into four time-shifted 32kbit streams. The loss of some of this data degrades reception but does not prevent it. At 128kbits, CD-quality sound is provided. The USADR system transmits the same data in both guard bands, arguing that one should be OK most of the time. If, in extreme conditions, both fail the system reverts to analogue reception. The National Radio Systems Committee of the FCC is to evaluate the two systems: DAB is expected to start in the USA by 2002. The IF bandpass filtering will need to be good – a flat response across 200kHz with a steep drop-off at each side.

I would like to hear from any reader who listens to DAB in this country: any comments would be welcome.

Some of the above information was obtained from the May 2000 issue of the Benelux DX Club bulletin.

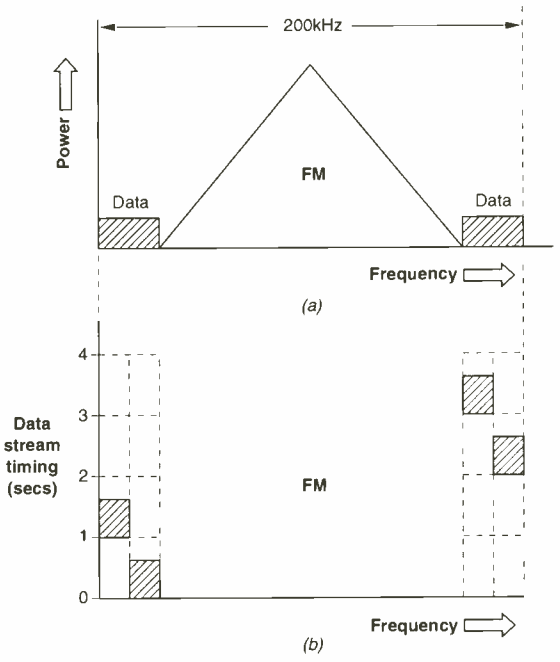
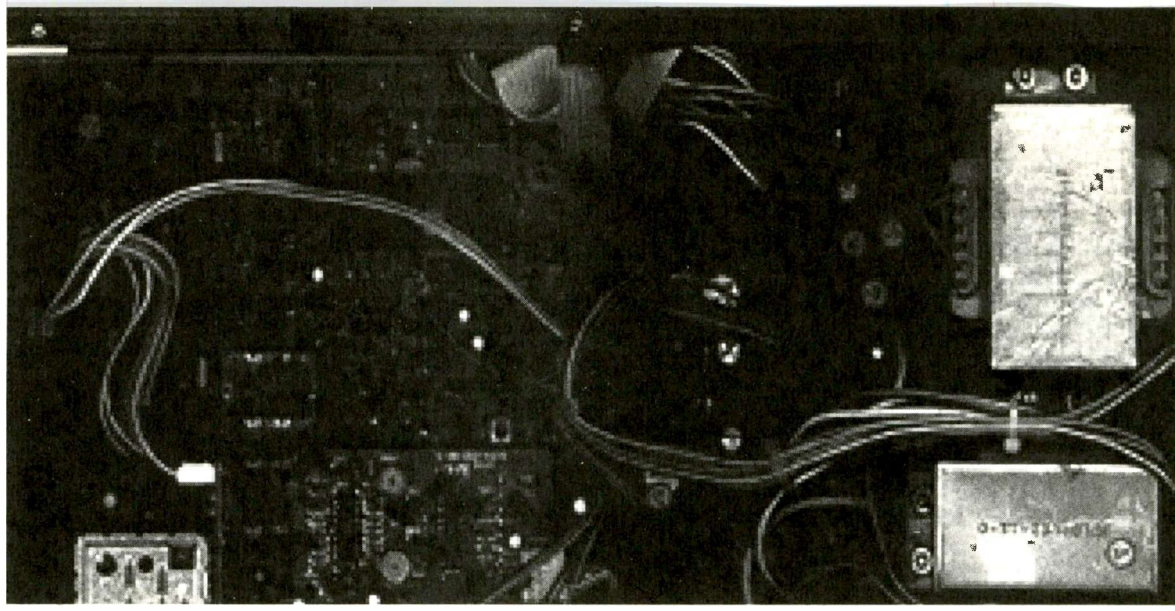


Fig. 1: How digital and analogue FM radio are combined in the USA. (a) The digital audio data is inserted in the guard bands at each side of the analogue FM channel. (b) To reduce the effects of multipath interference, the Lucent system splits the audio data into four time-shifted streams as shown.



Satellite Notebook

Reports from Hugh Cocks and Pete Haylor

LNB Trouble

Mr Lindquist had been receiving the encrypted Swedish TV European service (SVT Europa) from the Sirius satellite at 5·2°E for a couple of years without any trouble at all. Recently however he phoned to tell us that he was getting intermittent reception with picture break-up. His Nokia 9600S digital satellite receiver occasionally produced a no-signal message.

Fortunately the signal began to deteriorate just after my arrival at the house – this type of fault can be reluctant to appear when you want to see its effect! An analogue Pace receiver was also in use, normally for the free-to-air Astra stations, with the input from another dish. As a test however I pressed it into service with Sirius by tuning in the "Welcome to Sirius 2" test pattern at around 11·740GHz (horizontal polarisation). This is a useful aid to finding the satellite. The signal was perfectly normal and showed no sign of the intermittent degradation experienced with the digital one. I checked the alignment of the 90cm dish used for Sirius and found that it was spot on.

When I called up the Nokia receiver's advanced channel search menu the red signal-quality bar maintained a high deflection. This is an indication of the tuner AGC voltage, so at least the level of the IF input from the LNB was constant. There are two ways of checking the quality of the digital signal being fed to the Nokia receiver.

The first is to use the red-menu facility. With the remote control unit, press *radio* then *99* then *radio* again and then *menu*, quickly. Within a second or so the red menus should appear at the left-hand side of the screen. Select option eight, the receiver set-up menu. "Select frequency integer?" is then displayed at the top of the screen. Press the button below *OK* on the remote control unit until "select indicate RS errors" appears. Press *OK*. The channel name at the front of the box should change to a left-hand side number between 40 and 150 and a right-hand number which is normally 0. Exit from the red menus as quickly as possible by pressing the left-hand button beside *OK*. This returns you to the receiver set-up menu. Return to normal receiver operation by pressing the remote-control unit's *TV*, *radio* and again *TV* buttons in quick succession.

The other way to obtain the same error display reading is to call up the blue service menus. Go to installation and highlight system settings. Press *1*, *2*, *3* and *4* rapidly on the remote-control unit, highlight "test functions" and press *OK*. The test-functions menu should be displayed. Highlight "signal quality indication" then change 'off' to 'on' by using the remote-control unit's *volume* button. Press the *TV* button twice to return to normal use rapidly. The same number display should be seen at the front of the receiver.

The left-hand number is approximately the carrier-to-noise ratio multiplied by ten. So if 105 is seen this means 10·5dB. It's updated every second and varies a little – naturally enough it drops rapidly in a rainstorm! The right-hand number normally stays at 0, but if the signal becomes weak or there's another problem it rises each time the resampling process takes place, each second, to a maximum of 999.

The carrier-to-noise ratio with normal reception was about 10dB, with no errors present. When the picture started to break up the carrier-to-noise ratio rapidly dropped to about 5dB with high errors indicated. There was no more degradation when a new LNB had been installed. The carrier-to-noise ratio had increased by 2dB, and under clear sky conditions the error indication was steady at around 122.

To return the receiver to the normal channel identification display at the front panel, go to standby then switch back on again. It isn't necessary to enter the service menus again. **H.C.**

DAB Interference

We've yet to encounter digital terrestrial TV interference with VCR and satellite receiver UHF output channels here in Portugal. I understand that in Iberia as a whole digital transmissions will use only chs. 60-69, which in this part of the world are little used for analogue transmissions, so DTT interference problems shouldn't present any difficulties here. Digital Audio Broadcasting (DAB) tests are now taking place however, and recently I had my first experience of DAB interference.

The customer uses a standalone Band III modulator to distribute the video signal from a security camera around the house. Channel selection from E5 to E12 (175-224MHz) is by means of dip switches. The incoming terrestrial and satellite TV signals are fed to the unit in the usual way, the entire output then being sent around the house. The modulator is of Far Eastern manufacture and has fairly good filtering at UHF, so the third harmonic of the fundamental Band III signal is weak, minimising interference with the UHF signals looped through the unit.

He recently called us to report that the camera signal had become very snowy. All other signals remained OK. After some initial confusion I found, by unplugging the RF input to the unit, that the camera signal became clear again. The modulator had been set to ch. 12, i.e. approximately 223-230MHz. The previous week, DAB radio tests had started from the same site as the local Band III TV transmission. They were in the 224-226MHz range, hence the interference problem.

In most parts of Europe where VHF is still used for TV transmissions ch. 12 is being withdrawn and reallocated to DAB. Resetting the modulator's output to ch. 10 (210-217MHz) provided a complete cure. **H.C.**

Sky Digibox

The complaint was two movie channels missing. On screen the signal strength was shown as 60 per cent, the signal quality as 40 per cent and the lock indicator as OK. A check at the dish showed that there were no horizontally-polarised signals and that with vertically-polarised signals the best reading was 22. Once a new dish and LNB had been fitted the horizontal and vertical readings were 87 and 91 respectively. This is the second fault I've had with a Cambridge LNB as part of a system over a year old. **P.H.**

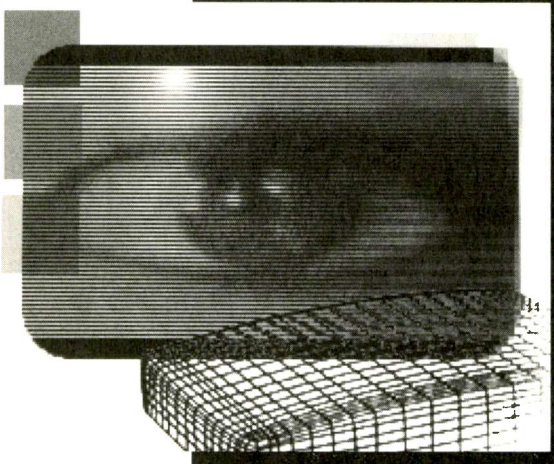
Digital/analogue Installations

It's becoming popular to have a digital and an analogue receiver with a single dish and not bother to subscribe to SkyDigital. There are a lot of free signals from various satellites. But it's becoming a nightmare to set up the receivers to work in all modes. The installation I had to carry out recently involved a Humax digital and a Manhattan analogue receiver. Reception from 19·2°E and 13°E by both receivers was required.

I had to connect the two signal feeds to a DC switch controlled by the 12V switching output from the Manhattan receiver, with the output from the switch going to the Humax receiver then looped through to the Manhattan receiver's input. This way, when the digital receiver was in use the Manhattan's switching output controlled the choice of satellite. When the Humax receiver was switched off, the signal passed to the Manhattan receiver with satellite choice from its 12V switching output as before. **P.H.**

Quickies

Pace MSS500: The picture would drift sideways and go to black-and-white. C208 was open-circuit.
BT SVS260: This set went to stand-by when switched on. The 5V supply rectifier diodes D405/6 (1N4002) were leaky.
Pace MSS300: There were lines on the picture. C221 was open-circuit.
Echostar SR90: When this receiver was switched on the display flashed then went off. Q802 was open-circuit.
Pace PRD900: There was no sound or vision. The cause was open-circuit print between Q18 and Q20.
Pace MSS508IP: When going from one satellite to another the motorised system moved in short bursts. C216 (1,000µF, 63V) was leaky. **P.H.**



Monitors

Reports from Colin McCormick and Ian Field

Compaq 171FS

There was no screen display. The fault cleared as soon as the cover was removed, and returned when it was refitted. The rear of the cabinet has some foam that rests on the metal screen of the tube base PCB. Pressure here made the display come and go. The cause of the trouble was a dry-joint on the tube socket.

Geometry and grey-scale setting up are not obvious with these monitors, as there are no on-screen menus. I worked the following out by experimentation. The front panel buttons only seem to do size and position. Press the inset 'function' key, then 'contrast down'. The power LED will flash once slowly. The rest of the keys provide adjustment of the highlights. Press 'function' then 'contrast up' to adjust the lowlights. The LED will flash twice slowly. Press 'function' then 'brightness down'. The LED flashes three times. The horizontal position keys can then be used to set the EW pincushion correction. To get out of each sub-menu, press 'function' again. If you get into a complete mess, 'reset' will restore the default settings.

Model 151FS is similar. **C.McC.**

Dell VC5EN

The customer hadn't bothered to write out a job card since someone had already written "scrap" across the top of the cabinet. I was hoping for a nice easy job – replace the BUH715 line output transistor and optimise the flyback tuning. But it was obvious that things were not going to be so simple when the monitor powered up and produced a magenta display. Since these monitors often suffer from invisible solder fatigue on the CRT base panel, a lot of time was wasted on resoldering here. Flexing the cable seemed to affect the fault but was inconclusive. An easy answer to this was close at hand: there was a scrap VC5EN with a broken CRT in the stock room.

I salvaged the signal cable from the scrap monitor and fitted it to the one under repair. It now produced a cyan display with no frame lock and intermittent line lock! As both cables were in poor condition, I decided to rig up a continuity tester that would pass only a good conductor and finish off one that was weak or intermittent. It consisted of a 12V 7Ah dryfit battery (Nicad D-cell) and an H4 headlamp bulb with both filaments wired in parallel. This will pass a current of just over 8A, which is rather too much for continuous operation of the cable being tested but, when applied just long enough and disconnected before undue heating takes place, would prove that a conductor is good. An intermittent or part frayed conductor will fail instantly and permanently, thus eliminating any cable likely to fail prematurely in service.

The original cable's green signal conductor was open-circuit. The intended replacement had open-circuit red signal and V sync conductors: the H-sync conductor lit the bulb for a split second before it too died. There wasn't another VC5EN cable in the scrap pile. The nearest one I could find was from a Tulip-badged Philips chassis. To my surprise, the Philips PCB connector fitted the pin header on the VC5EN's CRT base. It was easy enough to unclip the individual pin receptacles from the connector body and rearrange them to match the VC5EN pinout. Unfortunately the Tulip/Philips cable has a superfluous mounting bush where the VC5EN cable is secured with a P-clip. The mounting bush is not easy to remove – it's best not to attempt this without a full pack of fresh scalpel blades and a well-stocked first-aid kit ready to hand!

The end result was a working monitor. So beware: the signal cable is suspect with these monitors. The situation could probably also arise with the 15in. FST tube version. **I.F.**

MOSFETs

A few months back Donald Bullock mentioned that the STP6NA60F1 was "hard to get". The first point to note is that the 6N60 part of the number is generic. With this family of MOSFETs the 6 is the drain current rating (6A), the N means that it's an n-channel device (P would indicate p-channel), while 60 is one tenth of the drain-source voltage rating, which in this example is 600V. STP is the manufacturer's code, in the same way as SN, CD, MC, HEF etc. with logic ICs. So, broadly speaking, any MOSFET with 6N60 in the number will have the same basic specification.

The difficulty arises in obtaining the insulated version. I think it's the F in the number that indicates this. The 2SK1117 is identical to the non-insulated 6N60 and the 2SK1118 is the same as the 6N60AF1 insulated type. With non-insulated MOSFETs, the BUK438-800 (6·6A, 800V), BUK457-600B (7·1A, 600V) and BUZ91A (8A, 600V) all equal or exceed the required specification. Suitable alternatives for insulated TO220 MOSFETs could be the 2SK1365 at 7A, 1kV (ISO3P case) if space permits, the 2SK2740 at 7A, 600V or the 2SK2843 at 10A, 600V.

An important point to watch when replacing a non-insulated MOSFET with an insulated type is that the insulated types have typically less than half the wattage dissipation rating of a non-insulated type. For example the non-insulated 2SK1117 has a total power rating

of 100W while the 2SK1118 (ISOTO220) has a total power rating of 45W. Similar ratings apply with non-insulated and insulated versions of the 6N60. Before using one type instead of the other, it would be wise to compare the °C/W thermal resistance for both types and compare that of a TO220 plus insulating washer with that of an ISOTO220. The uninsulated TO220 with good mounting practice, a good-quality mounting washer and oxide-filled silicone heatsink compound is probably the better of the two.

One thing I would not be so keen to try, as I've heard that others do, is to replace an insulated-gate bipolar transistor (IGBT) such as an IRFBC40 series device with an ordinary MOSFET such as a 2SK1118. IGBTs are designed to provide the high current density/ low collector-emitter saturation current characteristic of a bipolar transistor while being free from the charge-carrier storage that occurs at the base-emitter junction, limiting the maximum power switching speed. I await with interest how certain engineers come unstuck with this substitution. **I.F.**

Nokia/Salocomp D1728/TCO

Of all the turnkey manufacturers, this is probably my least favourite. These monitors are well-known for damage to the sheet-metal chassis. The PCB is mounted on brass 'captive-nut pillars'. If the monitor is placed down on the desk anything less than carefully, the pillars push through the PCB. I've seen several with fault symptoms that suggest LOPT failure. But in each case, knowing that the estimate would be refused, I've been unable to confirm the diagnosis.

This unit had a different symptom. It powered up with a picture that fluctuated wildly left to right – anywhere but centre. This settled down in less than a minute, after which no amount of flexing, tapping or prodding would bring the symptom back. I decided to carry out a more thorough inspection and clean the deposits of exhaust particulates from around the EHT connections. Those around the anode cap produced a hard, black stain on the cleaning cloth when cleaned off with strong solvent. I didn't see the fault thereafter. My theory is that the deposits around the anode cap produced a leakage path that rapidly dried any humidity when the EHT came up. I think that cleaning around the anode cap had been all that was required. **I.F.**

Hitachi CM620ET

The job card said "no picture", but when the monitor was powered a display appeared and no amount of prodding or poking would make it go away! After giving the soldering on the main PCB a brief look over, I decided to remove the tube base screening and have a look there. A couple of the CRT base pins had barely visible fracture rings, and the same condition was present at the small IC with narrow-pitch pins. I defluxed the CRT base panel then continued the examination with a bright light and magnifier. More fatigued solder joints were seen.

Because of this I felt that a much more thorough inspection of the main PCB was required. This showed that someone else had already had a go, mostly around the front panel microcontroller chip. The amount of solder on many of the joints was excessive. Whoever had attempted reworking the PCB had made the common mistake of simply adding more solder for the flux it contained without making any effort to ensure that the connections had been improved.
The first task was to remove the surplus solder. Slightly oxidised tracks or component pins can be dealt with by gently agitating the joint: rub the tip of the iron against the side of the component lead. A flux such as RS555-869 is useful to avoid wasting solder just for the flux core.

Although the soldering is a prime suspect with the reported symptom, I noticed that on certain parts of the main PCB some of the component number legends had been included in the etch-resist screen print. As a result, the track-side component numbers were in copper, and one or two were dangerously close to bridging adjacent tracks.

This chassis uses separate scan and EHT output devices, the EHT one being a MOSFET. When I followed the gate track back to the pair of complementary emitter-follower driver transistors I came across just such a potential short. Even with a magnifier it was impossible to see whether there was a gap between this sliver of copper and either of the two adjacent tracks, but as the monitor would run (most of the time!) there had to be one. Carefully skimming the copper sliver away with the tip of a scalpel blade eliminated this danger once and for all. Although I didn't follow the adjacent track, it came from another identical driver pair and looked as if it went to the 2SJ306 B+ PWM transistor that serves the BU2520AF scan output transistor.

Another, unrelated point I noticed was that the holes for the 2SJ306 don't line up with the heatsink. Thus when the mounting screw is tightened the device distorts and its case can crack. Fortunately I found a sintered ceramic TO220 washer of just the right thickness to cure this problem. The alternative is to remove the device and preform the leads before refitting it. **I.F**

AOC Spectrum 5VLV

The complaint was simply "smokes"! The monitor didn't produce any smoke in the default DOS start-up mode. But, starting from cold, there was no red, which appeared a few seconds later. The first suspect was C939 (1,000µF, 16V). Its ESR was actually very good, but since the 6·3V rail it smooths also supplies the LED in the regulation optocoupler, I fitted a very low-ESR HF electrolytic as a replacement with a 1µF polycarbonate capacitor in parallel as an added precaution.

During my overall inspection I noticed a small area of charred PCB between Q412 and Q407. The IRF630 transistor between these two positions was in a very sorry state, and the Q number on the board couldn't be read. As an area of PCB (almost one square cm) had to be filed away, the replacement had better ventilation than its predecessor! I decided that a small screw-on heatsink wouldn't be a bad idea however.

While looking for a possible cause, I discovered a heat-degraded solder joint at one end of C425. The affected joint is partly obscured by a nylon support pillar and could easily have been missed. Whether this dry-joint was the actual cause of the trouble is not certain, but the capacitor is part of the same circuit.

Once the monitor had been checked for correct operation in all possible modes, attention was turned to the condition of the CRT. Since the 6·3V supply smoothing capacitor I'd replaced had not actually been faulty, there was no chance of CRT recovery as a result of this move. So to complete the repair a full grey-scale balance was carried out. **I.F.**

WEB SERVICE

Amstrad

http://www.amstrad.co.uk

http://web.ukonline.co.uk/clifflawson

Amstrad now has its own official web site covering current products. For information on older products the Cliff Lawson web site is essential viewing.

All Tech Tips

http://www.skyeinteractive.net/techtips/

Another US technical tips site which deals with subjects related to repair of the whole range of consumer electronic items. The site is being updated and plans to include current repair articles, books on repair, schematics and links to manufacturers technical repair sites. There's also a chat room.

Anatekcorp

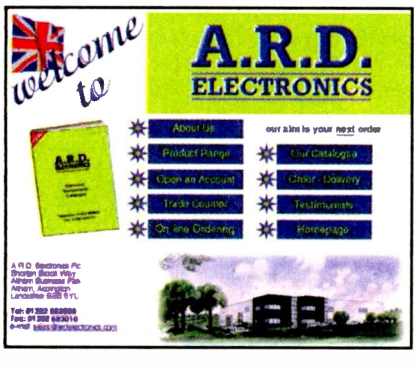
http://www.anatekcorp.com/

A US site selling computer databases of fault reports and schematics, but it has some interesting articles for free download - you can even submit your own. There's a technicians forum but you have pay $60/year to be a member.

A.R.D. Electronics Plc

http:/www.ardelectronics.com

A.R.D.'s Website details all the information you need to know about this new and exciting electronic component distributor. It shows how to: open an account (credit or cash), obtain a trade catalogue and place orders (both online and direct)



Baird 30 Line Recordings

http://www.dfm.dircon.co.uk

For history buffs and the curious here's a fascinating site containing early TV recordings and their background.

BBC

http://www.bbc.co.uk/info/reception

http://www.bbc.co.uk/enginfo

If you need any help with your reception go to this site – both of the addresses point here. There's special advice for people with loft installations, and caravaners and boating enthusiasts.

Darren Meldrum's Home Page

http://www.meldrum.co.uk/mhp/index2.html

This excellent site is dedicated to television especially the bits in-between – the announcements, idents and, for the nostalgic among you, the Test Cards. It also contains some useful links to other sites (as do many other sites).

Doknet Service manuals

http://www.doknet.com

This Dutch site says it has 350,000 service manuals and 1 million service parts.
You interogate the data base by filling out an order form, with the "request" box ticked, and then wait for an email to arrive back on your computer. However,
an on-line index would be useful and maybe on-line downloading of the manuals.

Electronic Repair Tips

http://elmswood.guernsey.net/index.html

Here's growing source of free repair tips shared by visitors to the site. You can search by manufacturer or type of equipment. A short description of the fault is given and you can click for further details. However, my only criticism is that when you click to go back from a fault you seem to lose your original results list.

ICHE

http://www.iche.com

See Bill's problem page which is a forum for enginers and technicians to post their problems, tips, advice etc to. All submissions are at Bill's discretion.

MB21

http://www.mb21.co.uk/index.html

Another enjoyable site with a "telenostalgia" section about the technical aspects of television. There's also a section on transmitter sites, teletext "then and now", and a "rough guide" to widescreen television

Newsgroups

uk.tech.broadcast

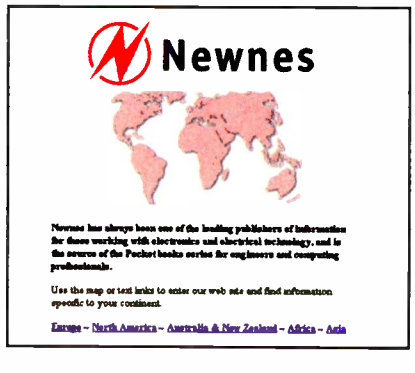
uk.tech.digital-tv

uk.tech.tv.sky

If you have never got into newsgroups then these are worth a look.
You"subscribe" (free of charge) to a newsgroup through your e-mail software (eg. Outlook Express). If it's not obvious how to do it then check out the help section on your Internet Service Provider's front page. Newsgroups are like notice boards where subscribers can send an Email to be viewed by everyone else.They are generally a source of help and advice, with plenty of humour too! Maybe there should be a TV engineer specific newsgroup called "uk.tv.engineers". Any thoughts? (thanks to Iain Dobie for this information)

Newnes

http://www.newnespress.com

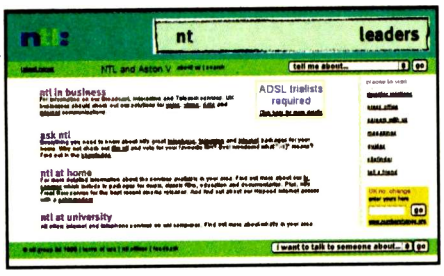


Check out this site for the latest book titles on TV & Video Servicing and Technology and their famous Pocket Book series. You can shop on-line and also register for an Email service to tell you when relevant new titles are published.

NTL

http://www.ntl.co.uk

Go to this site for information on NTL's Broadcast, Interactive and Telecom services, including packages for home



area by area. There's also a useful transmitter site map and database, giving locations and information. The site also contains useful documents, which describe digital TV, interactive TV and digital Radio. There's also a useful contacts list.

M.C.E.S.

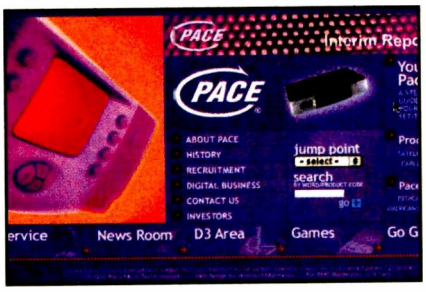
http://www.mces.co,uk

The MCES site gives details of our range of service including Tuners, Video Heads, RF & IF Modules plus latest prices and special offers.

Pace

http://www.pace.co.uk/trade/index.htm

The Pace site has a product finder. On servicing, there is a restricted access area for Pace retailers and service partners. If you are a member of the trade and you deal with Pace products you can apply for access by following the instructions. The free access area contains some useful Frequently Asked



Questions and links to other useful sites such as the Lyngemark Satellite Chart at http://www.lyngsat.com.

Philips

http://www.philips.com

http://www.semiconductors.com/products/

Take a look at the impressive Philips home page which leads to a product listing and detailed information. Perhaps more useful to the technician is the semiconductor data "tree" where data sheets can be downloaded on all Philips integrated circuits.

Servicing Advice

http://www.repairfaq.org/REPAIR/F_Repair.html

Here are some frequently asked questions about servicing consumer electronic equipment, with a US bias. But there's some good material on monitors and CD players and CD-ROM drives. (thanks to David Edwards for this information)

Satcure

http://www.netcentral.co.uk

Packed with frequently asked questions (FAQ) about common faults and cures for faulty satellite receivers and decoders. Repair kits, upgrade kits, spare parts, surplus components plus links to other satellite information sites. Also audiophile components, electronic hobby kits, dolls house and model railway electrical stuff, a beginners' electronics course and lots of other information that will keep you occupied for days! The entire web site is also available on CD for just a £5 note.

Taxan

http://www.taxan.com

http://www.valuevision.co.uk

Look here for information on Taxan monitors and their new Valuevision range, with information on servicing, spares and latest software drivers.

Texas Instruments

http://www.ti.com

Data is also available from Texas Instruments where you can quickly search their site for the information you need. Quality Electrical Direct http://www.qed-uk.com Here's a new retail site with a very interesting feature - not only can you purchase from a huge range of consumer goods but you can also request price information on your mobile phone. For example, you could be looking around your local branch of Dixons and see something you want. You can then send a message to QED via the Short Message Service (SMS) on your mobile phone to request a price and delivery from QED. The information is send back to your phone including how many they have in stock. It will be interesting to see if this new E-commerce approach succeeds.

Timecast

http://realguide.real.com/stations/

Television of the future? This site contains listings of TV and Radio stations available on the Internet. There are quite a few TV stations of US origin available to watch. The video quality isn't very good at the moment, but this is sure to improve. There are also some fixed cameras positioning in locations ranging from game park, high streets and people's houses - not exactly captive viewing! But an interesting thought - are PCs and TVs going to eventually "get married"?

Transmitter Alignment Programme

http://www.tvtap.mcmail.com

This site contains the timetable of work on the TV Transmitter Adjustment Programme or TAP. The programme's aim was reported earlier in Teletopics, but briefly it is to maintain existing analogue services as work progresses on digital television UK "to fulfil official regulatory licence requirements". When transmitters are being worked on there are local messages.

Televes

http://www.televes.com/ingles/ingles.htm

Televes website was launched as an

easier way to keep in contact with our World-wide Network of Subsidiaries and Clients. This site is constantly updated with useful information/news plus you can download info on our range: TV Aerials & accessories, Domestic and Distribution amplifiers, Systems Equipment for DTT and Analogue TV, Meters and much more.

UK Electrical Direct

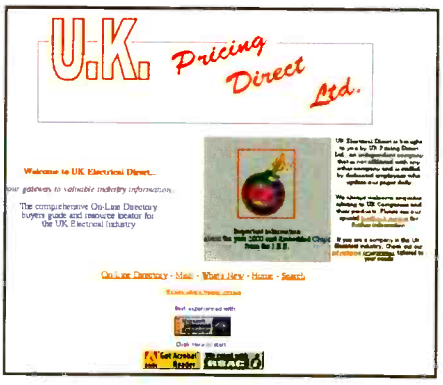
http://www.uked.com

For a comprehensive on-line directory, buyers guide and resource locator for the UK Electrical Industry look at this site. Many of the companies listed have links to their own web sites, making this a one-stop shop for a huge amount of information.

UK Mailing List Group

http://www.egroups.com/list/uktvrepair

Following on from the newsgroup discussion last month there is a UK Email group for TV technicians where you can send an Email to everyone in the group. There's just over 30 people in the group at present. For more details and how to register look at the egroup home page. Just a general comment though - you do have to be careful who you give your Email address to so that you can avoid "spamming" - that is getting lots of unwanted Email about dubious Russian site (amongst others).



Reed Connect

http://www.reedconnect.net/

Another free internet access site, this time from Reed Business Information.

However the site possesses a useful UK People and Business Finder, with an e-mail search. There's also business news and local information, and some good links to directory sites.

Repairworld

http://www.repairworld.com

Repairworld is a sophisticated US based fault report database which is updated bi-weekly. It operates on a subscription basis and describes itself as an "affordable solution for all technicians". There is apparently no minimum number of months for which you have to subscribe. You can see some samples of the material for free, monitors, VCR, DVD and Camcorders being of particular relevance to UK users. The site even provides a "chat room" where you can talk via your keyboard to others "in the room".

Put your web address in front of 21 000 electronics enthusiasts and experts.
Television **acknowledges your company's need to promote its web site, which is why we are now dedicating pages in every issue to announce your WEB ADDRESS.**
This gives other readers the opportunity to look up your company's name, to find your web address and to browse the magazine page to find new sites.

We understand that cost is an important factor, as web sites are an added drain on budgets. But we are sure you will agree that the following rates make all the difference:

FOR 12 ISSUES:
Lineage only will cost £150 for a full year, just £12.50 per month.
This includes your company's name, web address and a 25-word description.
Lineage with colour screen shot costs £350 for a full year, which equates to just £29.17 per month.
This price includes the above mentioned information, plus a 3cm screen shot of your site, which we can produce if required.

To take up this offer or for more information ring:

Pat Bunce on 020 8652 8339
or fax on 020 8652 3981.
or e-mail: pat.bunce@rbi.co.uk

Company name		Web address		

AUDIO FAULTS

Reports from
Mike Leach
Paul Smith
Martyn Davis
Kevin Green, TMIIE
Ian Bowden and
Maurice Kerry

Panasonic SA-HD52 midi system

If you get one of these machines that shows classic faulty laser symptoms, such as cutting out and stopping after just one or two tracks, always try replacing the regulator chips on the regulator board first. They get very hot and break down after a short while, giving the impression that there's a laser fault. **M.L.**

Samsung MAX555

I've had several of these midi units with the same fault: the CD section would intermittently fail to recognise that a disc has been inserted. I noticed that in the fault condition the laser lens didn't move and was therefore not focusing on the disc. In every case removing the heatsink from IC9258, resoldering the IC's pins and the adjacent transistor Q1501, then replacing the heatsink with compound added cured the problem. **P.S.**

Goodmans S2750

We had two of these systems in recently. The first one wouldn't play CDs. The laser was continually trying to focus, and at the same time the sled moved backwards and forwards. Meter checks showed that all the voltages on the CD PCB were low. They are derived from a separate winding on the mains transformer, via two in-line 2·2Ω resistors. Fortunately these were the cause of the problem: both had gone high in value.

The second system produced low, distorted sound. An oscilloscope used to trace the signal path showed that the inputs at pins 3 and 14 of the TC9153AP volume IC on the front panel were OK but the outputs at pins 4 and 11 were severly clipped. A new chip restored normal sound. **P.S.**

Sanyo MCD-S735F

There was no audio output from this little hi-fi system. I suspected the LA4597 audio output chip IC108, as there was audio at its input pins 2 and 6 but no output at pins 10 and 12. A replacement made no difference however. The cause of the fault was R277 (22Ω), which was open-circuit. It was holding IC108 in audio mute. **M.D.**

JVC MX-D401T

The customer complained that this equipment was dead. He was right. When I started to check I found that Q904 (2SB1375) had gone open-circuit, also resistors R902 and R904. There was very heavy ripple at C902 (2,200μF, 25V) which also needed to be replaced. By this time the unit was making a slow recovery, but was far from cured.

Further checks showed that R924 was open-circuit. Once this resistor had been replaced the unit came to life, but as yet with no sound. The final problem was caused by another open-circuit resistor, R958 in the amplifier circuit. Bingo! – and time for a large brandy. **K.G.**

Technics SLP1200

The complaint with this CD player was "poor playability". These players are normally very good, not producing any audible dropouts with the Toshiba error disc.

I checked the RF level and servo adjustments and found that they were fine. I did however notice that when trying the PLL adjustment there wasn't a definite window where the blips in the audio were reduced or eliminated. This led me to suspect the PLL hybrid chip IC301. Correct operation was restored when a replacement had been fitted. I obtained it from a scrap SLP110. **I.B.**

Aiwa CXN999 Mk II 4ZG-1 CD mechanism

When a CD was inserted there was no lens focus movement or disc rotation. Checks showed that the 7·5V supply was low at 3·8V. The cause was C301, an 0·1μF chip capacitor, which produced a leakage reading of 370Ω. A replacement restored CD operation. **M.K.**

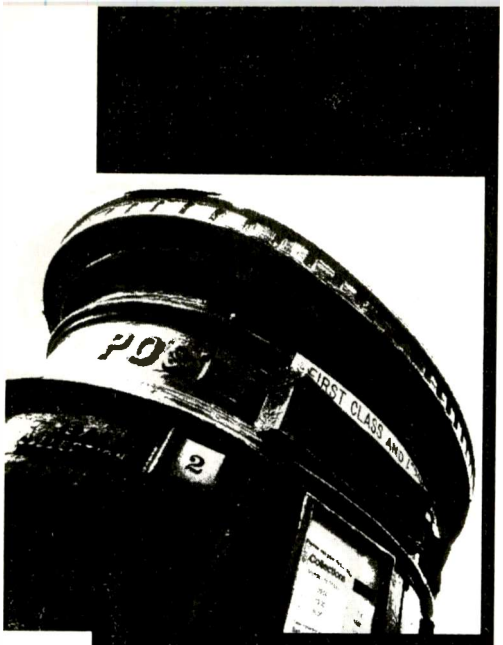
Technics SE-CA1080

There was intermittent loss of the audio output. I found that the symptom could be instigated by tapping the board. A scope check at pin 6 of IC501 in the fault condition showed that there was no AC here – pin 6 is the power detection input, and is an AC signal from one pole of relay RL701. This relay has two poles, which feed the bridge rectifier diodes D701-704 for the +B and –B supplies. One pole was faulty, going open-circuit intermittently. **M.K.**

Aiwa NSXD858

The volume up/down and tray loading motors didn't operate. Volume can be remotely controlled, while the tray is opened and closed by a key on the front panel. The motors have four drive transistors each, for forward and reverse operation. Q202-209 are controlled by the TC4094B chip IC201, which is in turn controlled by data from the microcontroller chip IC1.

The supply to Q202-209 and IC201 should be 5V. A check showed that it was 12V! The supply comes from the main panel via the 2SD2005Q lo-sat transistor Q107, which was short-circuit. A replacement cured the fault, and IC201 seemed to be undamaged. **M.K.**



Letters

We welcome letters from our readers and try to publish as many as we can. You can send them typed, handwritten, or on disc. Address them to the Letters Editor, Room L514, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

VideoPlus, Channel 6

There seems to be a problem with VideoPlus and some older VCRs. I have a Philips VR6547 which was bought in 1995. Since the beginning of the year it has been rejecting VideoPlus codes that are longer than six digits. Because of this it's now impossible to use VideoPlus to record programmes that have irregular start and end times. And as Channel 5 codes all have seven digits or more, these cannot be used either. Incidentally the VCR is unusual in having the VideoPlus circuitry in the remote control unit, with an LCD panel: most VCRs have the circuitry within the recorder itself and use an on-screen display.

It could be that because of memory constraints with the remote control chip the VideoPlus codes for the year 2000 onwards were pruned down. Or maybe there's some other explanation. Can anyone comment on this?

I have tried several of the longer VideoPlus codes with a Sanyo VHR775. This machine is of about the same age as the Philips one but has an on-screen display. At present it accepts all seven- and eight-digit codes.

On another subject altogether, RSL-TV, the Oxford Channel (also known as Channel 6) has been broadcasting from the Oxford transmitter on channel 47 since last summer. It claims to have been the first station of its kind, but I have seen no mention of it in *Television*. I live about nineteen miles from the transmitter, which is actually at Beckley, and can pick up a very snowy picture with occasional interference from S4C Wenvoe. I suppose that Welsh viewers would complain if Channel 6 used a higher power.

To start with there were two half-hour programmes daily on a one-hour loop. Last autumn this was changed to a 45-minute daily magazine programme followed by a What's On diary, again on a one-hour loop. Subject matter includes local history, local entertainment, film reviews, local current affairs, sport, gardening, food, etc.

Simon Pearson,
Chipping Norton, Oxon.

Tube Rejuvenation

I was very interested to read Derek Minns' letter (June) concerning his apparent lack of success in rejuvenating Sony Trinitron tubes. In contrast (pun intended), I have often found that these tubes are more responsive to the prospect of a second childhood than some of their conventional cousins.

I have a workhorse B&K 467 tester/rejuvenator dating from 1984. Apart from a crop of dry-joints worthy of the best B&O receiver, it has done well and recouped its cost many times. The problem with some Sony tubes is the style of base connector, including an extra, isolated pin for h-stat convergence correction. Rather than take on the difficult and probably expensive task of tracing and obtaining suitable bases, I decided to produce my own USB (Universal Sony Base!) by cannibalising a twelve-way adaptor plug from an old and redundant B&K base adaptor assembly, removing the original base and extending the leads to about 100mm in length. Using other base adaptors as a guide, I identified and installed the three cathode leads, plus g1, A1, focus and heater connections, then soldered to the ends, and heatshrink-sleeved, socket inserts (obtained from an old connector) of suitable diameter to push-fit on the tube base pins.

Fortunately Sony tube pin connections are usually printed on the base PCB and, after unplugging the tube, it's not too fiddly to push the individual socket inserts on to the appropriate pins. I have found that careful processing of Trinitron tubes can produce rewarding and lasting results, and have several happy reconditioned Sony owner witnesses!

Long experience with the 467 has taught me that the most effective and lasting reactivation of any tube is often achieved by releasing the appropriate reactivate button after the first one or two meter 'kicks', rather than waiting for the needle to drop to the yellow area as stated in the instructions. If the subsequent emission reading is poor or worse than before, the same cautious procedure can be repeated. This is more likely to achieve that elusive reactivation 'peak' between residual cathode contamination and total destruction of the emissive surface.

If only they'd invent something as effective for us TV engineers . . .

Chris Avis, RadioVision (Exeter), Exeter, Devon.

Purity Problem

Last year I bought a new widescreen TV receiver, a Panasonic Model TXW28R4, and after a few weeks noticed that there was some colour impurity – a blue tint at the top left-hand corner of the screen and a red tint at the top right corner. The store's contract service engineer said he couldn't see this. The service manager subsequently called and admitted that it was present, but said it was inevitable with the widescreen format. He degaussed the screen, which appeared to improve matters, but within a few days the impurity was as before. The store then replaced the set, but at switch the same impurity was present.

At this stage I began to suspect that the problem might be caused by local influences, particularly the receiver's position. I originally had two Studiocraft speakers approximately 1-2m either side of the set,

but these were removed at an early stage in an attempt to cure the problem. The only other possibilities I can think of are my VCR, which is beneath the set, and the electric mains supply meter in the cellar below. Could these affect the purity of the display. Am I perhaps being too finicky in expecting near perfect colour purity?
A. Gardner,
Sheffield.

DESCO

After reading the letters from Michael Maurice, Brian McPherson, David Naylor and Trevor Parker on the registration of service firms and cowboy repairs I would like to add to the debate.

I have strong views on registration, having been in the electronics servicing industry for some 47 years, served a recognised apprenticeship, and gained both Radio and Television Servicing certificates awarded by the former RTEB and the National Certificate. I've also been on countless manufacturers' service courses, am an amateur radio enthusiast, and a Fellow of the Institute of Incorporated Engineers.

In 1990, after being told that a particular DIY guy was a 5-star qualified caravan repair man, I asked myself what I had got to prove to the public that I was any more qualified to repair a TV set than the man in the shed or the fellow who worked off his kitchen table?

I presented my views to the Radio, Electrical and Television Retailers Association, but no one wanted to know (I also tried, in 1996, to get the organisation to incorporate 'electronics' in its title, again without success).

In 1997, as president of the association, I had the pleasure of helping to organise and introduce the first RETRA service conference. There was overwhelming enthusiasm amongst the engineers and technicians present to be appreciated, recognised and registered, as happens in some other countries. Brian McPherson, also a past president or RETRA, will by now have made a presentation about registration at the RETRA service conference at Solihull (July 5th).

For my part, having seen the need to register service and repair centres, my firm recently founded DESCOE – Domestic Electronic Service Centres of Excellence. It was launched on April 17th by my Member of Parliament, on the occasion of the opening of our new service workshop. We have the backing of our MP, and the details have been lodged with the DTI. Our local Trading Standards Office and Health and Safety officers are delighted. The criteria have been seen by qualified assessors, and advice from the Electronics Examination Board was incorporated. Major manufacturers have shown interest. Sony is very supportive, and Panasonic has expressed interest.

DESCO works on the basis that you self-assess to a 3-star level the services you claim to be professionally capable of carrying out. This is contained in a mission statement that notes special skills and exclusions. To achieve a 4- or 5-star rating a professional assessor must be appointed. There must, of course, be some cost.

There are repair people who claim they know it all with no formal training at all, but I believe that most technicians have had some training which has cost somebody money. So £50 for registration and even £500 for assessment could be considered good value for money, especially as it promotes a repair and maintenance business.

I believe that one day, when certain laws are changed or amended, all service industries – including builders and the motor trade – will have to be able to demonstrate technical competence, so that the consumer is given a fair deal and a safe repair is guaranteed.

A trade association is obviously the right organisation to start and administer a scheme. But if RETRA is unable to manage it DESCO, which is now in place, is the answer.
Chris Keeble, I.Eng., FIIE,
Sound and Vision Electronics, Frinton-on-Sea, Essex CO13 0AU.

PCB Repairs

I have followed the article and correspondence about PCB repairs with interest, and mainly agree with the letter from Denis Mott – except on the repair of burnt parts. The letter from Pete Roberts described his treatment, which he seems to consider satisfactory, as does D. Benyon. I beg to differ from them however. The use of epoxy resin, especially if not filled to saturation with an inert material, constitutes a lowering of the PCB's flammability, though the risk is small if the job is carried out carefully. D. Benyon has the right idea, but I doubt whether he tested the flammability of his 'putty'.

As an experiment, I repaired a sample piece of PCB with four different fillings, then tested them for flammability. The board seemed to be Paxolin, as I think it was called when I was in the RAF as a radio fitter fifty years ago. When heated with a naked flame to about 400°C it will ignite, but self-extinguishes when removed from the flame. The fillings were as follows:

(1) Quick-set epoxy (Bond it, Brighouse, West Yorkshire) made to a putty using talcum powder. Talc is inert – it does not decompose until about 850°C and is still a good electrical/fire insulator! It is much less hazardous to use than fibreglass, and is easily drilled after setting if required.

(2) As **(1)** but excess talc to resin by adding enough lighter fluid to the talc to enable a teaspoonful to be made into a paste with an 8mm sized blob of mixed resin. (Lighter fuel is a good non-toxic cleanser/solvent, though highly flammable.)

(3) Milliput standard-grade, ready-filled epoxy repair putty (Dolgellau, mid Wales, sold in model shops at about £3 for two component rolls each about 50g).

(4) Auto body filler (Stevens Polymers, Sandbach, Cheshire, £4.50 for about a third of a litre). This is polyester-resin based.

All were left for about 14 hours before testing. Each was then heated at the interface using a small spirit lamp, with a 10mm high flame, until ignition occurred.

Filling **(1)** caught fire before the PCB, in about five seconds; **(2)** ignited at the same time as the PCB (about ten seconds), as did **(3)**. The most fire-resistant was **(4)**, and I assume that polyester-based putty is less flammable than epoxy. It is also far cheaper and easier to use, though it does not seem to be as tough or strong as Milliput. The latter has a maximum recommended temperature rating of 130°C, while an old leaflet for 'Plastic Padding' says 200°C.

I have written the above as I am concerned about D. Benyon's repair of a PCB that sounds as if it had nearly ignited, and that his repair could in the long term become a potential fire risk.

On a different subject, I have been testing the conductivity of pencils – over the years various contributors have suggested the use of pencil lead to repair printed contacts/membrane switches on keyboards etc. I followed this practice with various degrees of success, then discovered that the conductance of pencil lead various enormously. Apparently the lead is made from graphite/carbon black/clay and fired at a low temperature to harden.

Virtually all B pencils will restore a membrane switch to some extent, but for a good repair a W.H. Smith Professional 5B is outstanding. A strip about 10mm long by 1m has a resistance of about 2kΩ, compared to over 2MΩ for the best B grade.
Mike Cooper, M.I.M.,
St. Austell, Cornwall.

Answer to Test Case 452

– see page 601 –

The most misleading symptom, at least as far as TechnoCrat was concerned, with the faulty Panasonic NVJ40 VCR was the fact that the drum speed changed in the cue mode. In fact it's a 'quirk' of the servo system used in this and similar Panasonic models: when the off-tape control pulses are absent or disordered with the ACE head still in circuit, there is fast and erratic rotation of the drum. If in doubt, pull out the plug and see!

So the on-screen effect was something of a red herring, the real problem being that the tape rode up in the vicinity of the ACE head – this was the cause of the very poor tracking in the cue mode.

When Sage took the job over he found that the tape tension during its passage towards the ACE head was very high in the cue mode. It was also higher than normal (though this produced no ill effects) in the other modes. At the supply side the back-tension was more or less normal. The cause of the excessive tension was a worn lower drum, with excessive friction at its surface. Unfortunately the only cure is a new lower drum assembly.

The cost of this was more than the customer was prepared to pay. He paid for the trial and the sentence, and said he would continue to use the machine but not in the cue mode. It had served him well enough.

NEXT MONTH IN TELEVISION

AF Power Monitor

Ian Rees originally made up this simple piece of equipment for repairing car radios. It then had a dummy aerial and a built-in 12V power supply. The monitor is now used for hi-fi and TV applications. Many modern TV sets have high-power stereo amplifiers and speakers incorporated in the back cover. They become especially tedious once the back cover has been removed for servicing access, and running without speakers is not a good idea. This unit provides correct loading and other benefits.

The Grundig Arganto IDTV Receiver

Eventually the set-top box will disappear, superseded by the integrated digital TV set. Several IDTV models have already appeared, but have yet to sell in quantity. Ian Martin decided to try one out. He reports on its operation, features, connectivity and performance.

DVC Video Part 3

In the next instalment Steve Beeching describes the basic signal processing carried out in a digital camcorder.

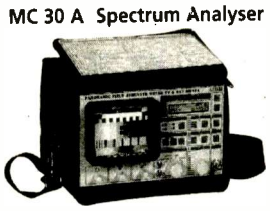
BEAB Changes

Consumer Electronics Standard EN60065:1998, on safety testing, will come into operation in 2002. It involves some major changes, particularly with repsect to equipment flammability.

Published on the third Wednesday of each month by Reed Business Information Ltd., Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. **Filmsetting** by JJ Typographics Limited, Unit 4, Baron Court, Chandlers Way, Temple Farm Industrial Estate, Southend-on-Sea, Essex SS2 5SE. **Printed** in England by Polestar (Colchester) Ltd., Newcomen Way, Severalls Industrial Park, Colchester, Essex CO4 4TG. **Distributed** by MarketForce (UK) Ltd., 247 Tottenham Court Road, London W1P 0AU (0171 261 7704). **Sole Agents** for Australia and New Zealand, Gordon and Gotch (Asia) Ltd.; South Africa, Central News Agency Ltd.

PERIFELEC

MC 30 A Spectrum Analyser



- Synthesized satellite cable and TV field strength meter with panoramic reception on 14 cm (5,5") screen and digital carriers measurement.
- Complete microprocessor and IspLSI logic control.
- Continuous frequencies from 46 to 860 MHz and from 920 to 2150 MHz on 4 bands.
- Selectable 4, 1 and 0,2 MHz spectrum band-width, picture measurement 1 MHz.
- Display of picture of selected synthesized channel.
- FM (Radio) L/L', B/G, I, D/K/K', M/N TV standards and Ku and C satellite standards.
- Possibility of 32 programs memorized per frequency band.
- Display (2 Lines of 16 characters).
- Range of measurement of signal strength from 20 to 120 dBµV, manual or automatic attenuator.
- Battery life about 1 hour 20 minutes, weight 5,8 Kg.

- Display of full-band and 4 possible expanded spectrums.
- Channels and frequency plans of cable and TV standards memorized.
- Frequency, signal strength in dBµV or bargraph, displayed on a digital display (2 lines of 16 characters).
- Voltage of remote power supply in 14v or 18v and 22 KHz in satellite + DiSEq C™ v1.2 switching.

The panoramic field strength meter MC30A combines in one instrument all the functions necessary for installing and checking TV or satellite reception, both analogue and digital. The visualization of the spectrum and the picture allows the carrying out of all the necessary adjustments with this one instrument. The high technology used in the MC30A allows a range of possibilities unheard of in a instrument in this price category.

SADELTA

Due to its weight and size, the TC-402 A/D is the ideal instrument for the installation of FM and terrestrial TV aerials as well as CATV systems.

- Peak detection.
- Built in loudspeaker for AM and FM reception.
- Frequency indication with 4 digit LCD display.
- Analogue and digital measurement.
- Multi-turn potentiometer to enable tuning.
- Weight including batteries: 1,9 Kg.

TC 402 A/D

TC 80 A/D

The TC 80 A/D has been designed for the reception of TV Satellite systems.

- Analogue and digital measurement.
- Full Band Frequency Sweep.
- Switchable 14 v or 18 v LNB-power supply + 22 KHz tone switching
- Rechargeable 12 v / 2,6 Ah battery.
- Weight including batteries: 3,3 Kg.

The TC80 A/D has been designed to aid the installation of analogue and digital satellite systems. This high quality meter has video and audio output via scart socket on rear and video only via BNC socket on front panel. The built in speaker delivers demodulated audio from any analogue satellite signals.

Full catalogue of meters available, please phone for details.

COASTAL AERIAL SUPPLIES

Unit X2, Rudford Industrial Estate, Ford, Arundel BN18 0BD
Telephone: 01903 723726 Fax: 01903 725322 Mobile: 0976 241505

Sole Import Distributors

BSMART (CRAWLEY) LTD

Largest selection of

MAJOR MANUFACTURERS NEW "B" GRADE PRODUCTS

T.V. VIDEO AUDIO MICROWAVE OVENS

Contact Fred Bean

BSMART (CRAWLEY) LTD.
10/11 LLOYDS COURT, MANOR ROYAL,
CRAWLEY, SUSSEX RH10 2QX
Tel (01293) 618000
Fax (01293) 400133

Setbacks

Technical Specification		
Reference	5371	5372
Inputs(2)	UHF/FM	UHF/FM
Outputs	6 (+1)	7 (+1)
Gain UHF	10 (+24)	10 (+24)
Noise Figure	2.5dB	
Line Power	12Vdc	
Output	89dBµV	

Features
- Ideal for digital installations
- Low noise figure
- F connectors
- Fully shielded

Technical Specification			
Reference	8130	8131	8132
Gain (dB) out 1	23	17	7.5
Gain (dB) out 2	-	15	7.5
Gain (dB) out 3	-	-	12
Gain (dB) out 4	-	-	16
Outputs	1	2	4
Input	1		
Noise Figure	=< 3.5dB		

Features
- Design for individual installations
- Proven reliability and performance
- IEC connectors
- CE conforms with EN55013, EN55082-1, EN60065

Technical Specification			
Reference	4381	4382	4383
Ampl.band(MHz)		5-380/470-860	
VHF Gain (dB)	26	13	1 3 0 5
UHF Gain (dB)	30	20	23 9 15
Var. gain VHF (dB)	>20	>20	>20
Var. gain UHF(dB)	>15	>15	>15
Max.output level (dBµV)	99	88	90 76 82
Noise Figure (dB)	<2.8dB	<2.8db	<2.8db

Features
- High output level/Low noise figure
- UHF and VHF variable attenuator (0-20 dB)
- IEC connectors
- Fully shielded

All these products are available from UK's main distributors and wholesalers

Televés

Televés UK Ltd Tel. 01633 875821 Fax 01633 866311
televes.uk@televes.com **www.televes.com**

LA ELECTRONICS

WHOLESALE DISTRIBUTORS OF DOMESTIC ELECTRONIC APPLIANCES

Unit 15 Marks Hall Margaret Roding Dunmow Essex CM6 1QT
Telephone: 01245 231684 Facsimile: 01245 231862

NEW B GRADE STOCK AT BELOW TRADE PRICE

Large **WIDE SCREEN** 16 x 9 Format Televisions *from* **£450**

Large **REAR PROJECTION** Televisions 52" *from* **£1,500**

We also carry a Large selection of televisions and videos all at below trade price.

36cm portables ..... *from* **£60.00**
51cm televisions nicam ..... *from* **£150.00**
59cm televisions nicam ..... *from* **£180.00**
68cm televisions nicam ..... *from* **£200.00**
78cm televisions nicam ..... *from* **£450.00**
95cm televisions nicam ..... *from* **£800.00**
Videos 2 head mono ..... *from* **£65.00**
Videos 4 head nicam ..... *from* **£70.00**
Videos 6 head hi-fi nicam ..... *from* **£110.00**
36cm combined TV and video ... *from* **£150.00**
dvd players ..... *from* **£150.00**

LARGE QUANTITY DISCOUNTS AVAILABLE

25cm televisions with DC 12/24 volt suitable for caravans – mobile homes – cars – kitchen use *from* **£120**

– ALL PRODUCTS ARE FULLY GUARANTEED –

YOU WILL NOT GET A BETTER DEAL ANYWHERE

We stock a great many other items in the TV and Video range so if you don't see what you are looking for, give us a call, *we will save you pounds.*

Visitors by appointment only

WILTSGROVE LTD

28/29 River Street, Digbeth, Birmingham B5 5SA
Tel : 0121 772 2733 Fax : 0121 766 6100
e-mail : sales@wiltsgrove.co.uk

CORDLESS 'B' Grade PHONE

- User friendly MMI
- Memory Dialling
- Tone Dial switchover
- Register recall
- Key tone On/Off
- Baby call
- Handset lock
- Incoming call priority
- Call transfer
- Call time display
- Paging handset feat.
- Different ring tones

Phones are supplied in original packaging

SPR-5100 Cordless Phone **£29.99**

AIWA Hifi - Brand New

with 12 months G'tee

Model : LCX137KS Only **£54.99** each

DVD PLAYERS

REC800 - £149.99
(Multi-Region DVD Player in a Satin Gold finish, with Remote control & Audio/Video leads)

REC600 - £139.99
(Multi-Region DVD Player in a Black finish, with Remote control & Audio/Video leads)

SONY DVP325 - £169.99
(UK Region 2 DVD Player in a Black finish)

GRADED STOCK

Jamo SPEAKER RANGE

JAMO D-165	£37.99	each
CORNET 165	£34.99	each
STUDIO 170	£69.99	Per Pair
SURROUND 160..	£39.99	Per Pair

with 12 months G'tee

Only **£94.99** each

Model : NSXSZ20KS

SONY

SLVE-70 VCR - **£109.99**
with 12 months guarantee

GRADED VCR's IN THE BOX FROM ONLY £34.99

WHITE GOODS

NOW IN STOCK
RING FOR DETAILS

TELEVISION BARGAINS

GRADED STOCK IN THE BOX - AS GOOD AS NEW

ALL SETS ARE IN WORKING CONDITION

Description	1+	5+
14" CTV R/C	£42.50	£39.99
14" Text R/C	£49.99	£44.99
20" Text R/C	£54.99	£49.99
21" CTV NICAM	£74.99	£69.99
28" CTV NICAM	£119.99	£109.99
28" Widescreen	£169.99	£159.99

QUANTITY DISCOUNTS AVAILABLE !

JAPANESE GRADED STOCK

Televisions & Video's available from only **£59.99**

Panasonic 4 Speaker Surround Package

Surround sound speaker package. Power : 15W

Contents :
- 2 x Front Speakers
- 2 x Rear Speakers
- 2 x Front connector wire
- 2 x Rear connector wire

Package Price : **£29.99**

CDTV50

5" COMBINED PORTABLE TV/CD PLAYER

Amstrad

1+ Only **£34.99** each
5+ **£29.99** each

GRADED STOCK

- 5" Black & white TV
- Top loading CD player
- Repeat play
- MW/FM stereo radio
- 20 track programmable CD
- Skip mode

SPARES AVAILABLE FOR THE FOLLOWING BRANDS :

AWIA, ALBA/BUSH, GOLDSTAR, FERGUSON, LG, TOSHIBA, THOMSON, HITACHI, JVC, DAEWOO, HINARI, NIKKAI, BEKO, SANYO, TATUNG, THORN, SONY, PHILIPS, PANASONIC, DECCA, PYE, GEC, CROWN, SAMSUNG, MITSUBISHI, GOODMANS, GRANADA, GRUNDIG, NOKIA, FIDELITY, ITT, MATSUI & MORE.....

TRADE ONLY. Offers subject to change without prior notice. Items Subject to Availability, Carriage and V.A.T.

Freefax Orderline : 0500 55 05 05

Service Link

No other consumer magazine in the country can reach so effectively those readers who are wholly engaged in the television and affiliated electronics industries. They have a need to know of your products and services.

PHONE 020-8652 8339 **FAX 020-8652 3981**

The prepaid rate for semi-display setting is £15.00 per single column centimetre (minimum 4 cm). Classified advertisements £2.00 per word (minimum 20 words), box number £22.00 extra. All prices plus 171/2% VAT. All cheques, postal orders etc., to be made payable to Reed Business Information. Advertisements, together with remittance, should be sent to Television Classified, 12th Floor, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

SERVICE MANUAL LIBRARY

£5 loan fee any Service Manual or keep for £10 (even if priced £50 or more). Lifetime membership £99. FREE Manual listing dozens of 1000's of models audio, tv, video, etc. cross referenced to correct manufacturer's chassis (£9.95 on its own). We trade other manuals so that members can get new manuals for only the cost of postage.

Phone 01357 440280 (fax 440384) for full details or write to:
INFOTECH, Midlinbank Farm, Ryelands, Strathaven, Lanarks ML10 6RD. World's largest stock of Service Manuals (TV VCR Combis, Test Eqpt, Audio, CD, Satellite, Dom Eq) Complete Repair Data (Not the few faults offered everywhere else) & Technical Literature. ***Any items asked - free quote - free gift with every order during 2000.***

SPECIAL OFFER UNTIL END OF APRIL 2000

Any 20 full service manuals from stock (1 at a time or in any quantity you wish) only £199 including 1st class post. Includes those priced at £50/£60!!!
Includes FREE Data Reference Manual.

100's of offers and prices FREE on request

Practical Radio Repairs for £2 (free with any other order)

Any of the famous McCourt or Tunbridge TV Repair Manuals for only £5 each - all for £29 post free till end 2000.
Any 10 complete VCR chassis fault/repair manuals from our list for only £25 - with all circuits £49.99

ACCESS, CONNECT, DELTA, EUROCARD, MASTERCARD, SOLO, SWITCH, VISA, etc.

£2.50 postage any non-free order.

SERVICE MANUALS

Thousands of models available
For most UK European, Far East and USA makes

Service manual prices

B/W TV	– £6	CTV/VCP	– £10
VCR	– £15	Camcord	– POA

Service sheets/circuits also available for some models
+data for satellite, audio and camera

**** 50+ CTV PSU Circs Compilation (A4) – £10 ****
**** 50+ VCR PSU Circs Compilation (A4) – £10 ****

Payment by Cheque/PO only please
Add £2 P/P etc, to order total. Do not add any VAT.

D-TEC
PO BOX 1171, FERNDOWN, DORSET BH22 9YG
Tel: 01202 870656

Engineers Service Data

Got a difficult fault & need help? We specialise in fault information (Since 1985)

Brand New release: Edition 24 Fault Index books.

Now Available Edition 24 of the Television Magazine Index Covers **over 14,000 Television, Video, Satellite, Camcorder & Monitor faults,** Large easy to read **A4 format** The latest addition to a **highly acclaimed & recommended series.** In daily use in workshops around the world !!
ISBN 1 898394 32 6 ***Edition 24: (2 book set) £14.75***

Brand New: Fault indexes on disk - Version 2.0

Latest faults together with ***all data*** from ***all*** previous versions, Covering a **MASSIVE 23,500 !! Television, Video, Camcorder, Satellite, CD & Monitor faults** listed in 20 years of Television.
Version 2.0: Indexes on Disk - PRICE HELD £17.50
Low cost updates are available for all Book & Disk fault indexes.

OFFER EXTENDED: Kwik Tips Fault Database

A valuable service resource for workshops large or small, **Kwik Tips Version 1.1** is our ***LARGEST FAULTS & REMEDIES database EVER,*** Compiled from **over 20,000 !! Entries** & covering **1,435 Chassis & Models,** This concisely Edited **TV & VIDEO REPAIR DATABASE** will easily pay for itself with just one repair.
Kwik Tips on disk: OFFER ENDS SOON! £22.95

Make your service data & manuals work harder.

Avoid buying circuits you already own, Apply same repair to many models **Best Selling *3rd Edition*** of the **Cross reference** guides containing **7,500 ENTRIES** covering **TV Models to Chassis and Television, Monitor, Video, Camcorder & Satellite Equivalents.** comprehensive **A4** book.
ISBN 1 898394 29 6 ***3rd Edition Equivalents £6.95***

E.C.S. (Est 1985)
Technical Publishing

316, Upton Road,
Noctorum, Wirral,
Merseyside. CH43 9RW
Tel / Fax 0151 522 0053

Please add £1.95 P & P to total (Europe £2.95, r.o.w please enquire).

NEW FAX BACK SERVICE NOW AVAILABLE
TEL/FAX A.T.V. on
0114 285 4254

SAT/CTV Circuits	£5.00
VCR Circuits	£7.00
CTV Manuals	£10.50
VCR Manuals	£14.50

(P/P add £2.50 to each order)
419 LANGSETT ROAD, SHEFFIELD S6 2LL

VISA MasterCard

Fryerns

Service Information **FES** Circuit Diagrams

TV's, VCR's
SATELLITE
AUDIO & HI-FI
Most Models Covered

Prices are from £4.00 + £2.50 P/P
1 item – total £6.50 inc
2 items – total £10.50 inc
3 items – total £14.50 inc
4 items – total £18.50 inc

Payment by credit card or Postal Order for next day delivery.
Cheques to clear.
Tel/Fax 01206 211570

VISA MasterCard

2 The Lodge
Easthorpe Green
Marks Tey, Colchester
CO6 1HA

CLASSIFIED TEL:0181 652 8339

REPAIRS

LINEAGE

AVO MULTIMETER Model 8, £45.00. 500 volt megers £30.00. Prices plus VAT and p. & p. Send SAE for lists of surplus instruments and scopes etc. A. C. Electronics, 17 Apleton Grove, Leeds LS9 9EN. Tel: 0113 249 6048.

PRIVATE RETAILER has excellent part exchange colour televisions and videos to clear. Tel 01494 814317.

MISCELLANEOUS

SPARES & COMPONENTS

PROPERTY

CLASSIFIED TEL:0181 652 8339

TEMPO

COMPUTERS • MULTIMEDIA
TV • VIDEO • HI-FI • DOMESTIC APPLIANCES

Due to our continued expansion we are looking for experienced engineers to service our wide range of leading brand products.

Bench Engineer (Brown Goods)

Based at our Tottenham Service Division

You must be organised, conscientious, with good communication skills. Technical qualifications are not essential, but applicants must have a good technical aptitude.

Tempo is already one of the top 5 electrical retailers in the country and with huge expansion plans. Secure your future with a company that's going places, by sending your CV to:

Chris Cartey, Tempo Ltd, Unit 3, Lockwood Industrial Estate, Millmead Road, Tottenham, London N17 9QP

or telephone either Chris or Mahendra Patel on 020 8365 1906 for further information.

DON'T SIGN ON THE DOTTED LINE UNTIL YOU TALK TO TEMPO

CHANNEL YOUR SKILLS IN A NEW DIRECTION

TV Service Field Engineers **Locations: Nationwide**

Taylor Nelson Sofres is one of the world's leading market information organisations, with some 7,500 employees in over 40 countries. We have one of the most dynamic records of growth and profitability of companies listed on the London Stock Exchange. Our success is based on the excellence of our people and their ability to deliver innovative solutions to major brand leading, blue chip clients.

Due to the continued growth of the *Television Research Division* we are looking to recruit additional Service Engineers to operate throughout the UK. Your main role will be to install and maintain TV monitoring equipment in domestic households.

You will need to have knowledge and experience of TV and VCR technology. Additional training will be provided by specialists at our London Headquarters. Applicants must be qualified to at least City & Guilds 224 or equivalent, have a service oriented background, good communication skills and the determination to achieve high standards of delivery. A full driving licence is essential.

The positions are available for full-time staff on a fixed term, or a sub-contract basis.

If you have the background and experience for this role and would like to be part of a growing team, then please send your CV and a covering letter (with current salary details) to Millie Jones, Human Resources Executive, Taylor Nelson Sofres, Westgate, London, W5 1UA or
Fax: 020 8967 4170
Closing date: 28th July 2000
Website: www.tnsofres.com

TAYLOR NELSON SOFRES TV RESEARCH

CINEMA ENGINEER

A rare vacancy exists for a fit, youthful person with electrical and electro-mechanical skills. London based with some field work required.

We work with a wide ranging group of clients in film, theatre and specialist venues. Great package and never a dull moment for the right person.

Applications by fax, or email.
Email: job@fproj.com
Fax: 020 8488 8300

EXPERIENCED ENGINEERS

Bench or Field

for either TV, VCR, Audio or Camcorder.
Excellent Salary.
Modern workshop.
Staff discounts.

Please send CV to:
'A' One Digital Domain
Unit 2B,
Aberconway Road,
Morden, Surrey
SM4 5LN

Telephone
0208 543 8888

Are you urgently looking for:

TECHNICIANS
BENCH ENGINEERS
FIELD SERVICE ENGINEERS, etc.

Then why not let Television Magazine help you find the right person that you are looking for.

Call Pat Bunce on
020 8652 8339
020 8652 3981 (Fax)
E-mail
PatBunce@rbi.co.uk

TWO ENGINEERS

Required for busy expanding Service Company.

One TV/VCR Engineer
One Camera Engineer

Both minimum 5 years experience. Qualified to C&G 224. Knowledge of Sony product would be an advantage. Both positions come with competitive salary and pension scheme.

Apply in writing to:
S. Thomas Service Manager,
1532 Coventry Swan Centre,
Yardley,
Birmingham B26 1AD

EXPERIENCED FIELD/BENCH ENGINEER

required by small family business

A good knowledge of all makes of TV, VCR, Audio equipment repair essential Please apply in writing with CV and current salary.

Ticehurst Ltd
39 High Street, Heathfield,
East Sussex
Telephone: 01435 862222

CLASSIFIED TEL:0181 652 8339

What are you aiming for?

If you really want to sharpen your brown or white goods know-how - start aiming higher! We certainly are, with a target of achieving '100% Customer Satisfaction' in After-Sales Service. It's a key element of Comet's future strategy, which is why we're currently looking to expand our team of customer-focused engineers.

Whilst we have opportunities nationwide, we are particularly interested in receiving applications from the South East of England, for:

Field Engineers - Brown & White Goods
Workshop Engineers

South East & Nationwide **£Competitive + Benefits**

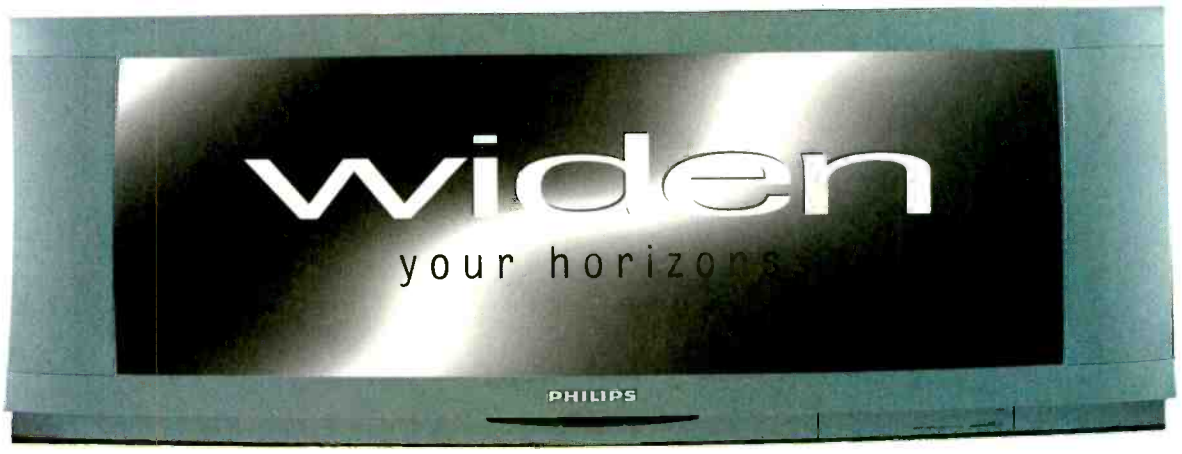
Utilising previous experience in the service and repair of brown or white goods electrical retail products, you'll also be keen to contribute as a valued member of our Customer Service Team. Turn your engineering skills to a wide range of equipment, brown or white - either way, you'll put the customer first and in return Comet will give you all the technical training and management support to make your mark. And due to the Company's progressive expansion programme, the sky's the limit for career development!

In addition to an excellent basic salary, Comet provide a host of benefits including Kingfisher pension scheme, fully expensed Company Vehicle and, after a qualifying period, share save scheme and private health insurance. Furthermore, you'll be entitled to staff discounts at other Kingfisher Group companies including - B&Q, Superdrug and Woolworths.

Fire away - Write, enclosing a brief career history, to:

Laura Cunningham, HR Department, Comet Group plc, Unit 5, City Park Industrial Estate, Gelderd Road, Leeds LS12 6DR

COMET



WORKSHOP ENGINEERS

ATTRACTIVE SALARY + BENEFITS **RUGBY & SURROUNDING AREAS**

Here at ScottishPower we know a thing or two about customer care. Hopefully, you do too. We're growing fast because we put the customer first - a formula that's proven a huge success. This is your chance to expand your skills, working for one of the UK's leading electrical retailers.

Right now, we're looking for skilled Workshop Engineers, qualified to City & Guilds 224 or equivalent with experience of repairing brown goods. In this job, it's all about getting it right first time and minimising inconvenience for the customer - and that's where you come in. You'll enjoy solving problems and gaining a real sense of achievement at seeing a job well done.

We offer all the training and support you need to help your career advance, and if your skills need updating, we offer support there too - including full back-up from the manufacturers, plus competitive benefits. All we ask in return is enthusiasm and a flexible approach.

Please write, with your CV, stating current salary details to: Mark Perrier, Recruitment & Training Manager, ScottishPower, California Drive, Whitwood Industrial Estate, Castleford, West Yorkshire WF10 5QX. Or telephone 01977 605295 or E-mail:mark.perrier@scottishpower.com

ScottishPower
"We can't help but help."

MAINTENANCE ENGINEERS

Charter Broadcast is one of the UK's leading broadcast equipment hire companies providing dry hire and turn key installations for the world's leading television programme makers. Due to the recent expansion of our base service department we are currently looking for domestic TV and video bench engineers to join our team based at Borehamwood in Hertfordshire.

The ideal candidates will be qualified to at least C&G 224 with at least five years experience as a TV and Video bench engineer and be able to fault find to component level on a range of products including colour television, vcr and camcorders. You will have an interest in New Technology such as digital television and DVD and will be self motivated with the ability to work, at times, unsupervised. Computer literacy would also be an advantage as most of our high-end broadcast equipment is software driven.

If you feel you have the necessary experience and would like to join our friendly team please send your CV to:

Trevor Smith, Charter Broadcast Ltd
Unit 4 Elstree Distribution Park, Elstree Way, Borehamwood, WD6 1RU
E-mail: trevor@charter.co.uk

VIDEO TECHS

FIELD SERVICE ENGINEERS

Throughout London

As one of the UK's largest independent consumer electronics service companies, we are looking to recruit qualified and experienced field service engineers to join our existing team. You should be qualified to C&G 224 or equivalent, and be able to repair to component level.

Full training, company vehicle and an attractive salary package will be provided, together with excellent career prospects in one of the fastest growing companies in the industry.

Please apply in writing, enclosing your current CV to :-

Alex Peacock, Operations Manager, Video Techs,
5 Kimpton Road, Sutton, Surrey, SM3 9QP

INVESTOR IN PEOPLE

ADVERTISERS' INDEX

CLASSIFIED TEL:0181 652 8339

Special Offer Sale – 20 Remote Controls £20.00 (mixed all well known brands)

FERGUSON ICC 7 HAND SET £3.00

FERGUSON VIDEO

FV90 LV HAND SET £3.00
FV80 LV HAND SET £3.00
FERGUSON
BATTERY CONVERTER TA606 £15.00
24V DC/240V AC £15.00
BENCH POWER SUPPLY VARIABLE
0-30V 3A-TWIN METERS P/P £5.00 ea £50.00
BRIDGE RECTIFIERS 10 FOR £1.00
BURGLAR ALARM KIT full description £7.00
CAMCORDER-UNIVERSAL BATTERY 9.6V – 1400MA FOR JVC-PANASONIC-PHILIPS £5.00
CAMCORDER-RIPOD SHOULDER POD £3.00
CAPACITORS:-
1IN/2KV, 2NZ/2KV, 4NZ/4KV EACH 15p
5N6/2KV, 6N2/2KV, 9N1/2KV EACH 15p
35V-22UF, 50V-4 7UF, 50V-100UF EACH 25p
AA BATTERIES 1.5 VOLT
STC ALKALINE 10p
DESOLDER PUMP £2.00
DIGITAL CAPACITANCE METER CMC200
200PF-20MF £28.00
FILTERS – 455 & 480 EACH 10p
GAS SOLDER IRON-PORTASOL HOBBY £10.00
INFRA RED DETECTOR
WIDE/SHORT ANGLE WITH RELAY £5.00
INFRA RED RECEIVER-MATSUMI MINIATURE £1.00
MILLI VOLTMETER-ELECTRONIC-LEADER
LMV-181A 40V A/C IN-IMV F/S £5 P&P £5.00
IMV-300V CALIBRATED – COST £225.00 £5 P&P
COLOUR TV BATTERY
CONVERTER IN 24VDC TO 240V OUT £15.00
MODULATOR-TUNABLE SATELLITE-TV £1.00
PANEL-IK2-FM2211 STEREO £5.00
PANEL-CVC80-POWER £5.00
POSITOR 18 2 PIN 20p
POSITOR-2322 662 98012 50p
POWER SUPPLY –
12V DC & 24V DC-REGULATED £2.00
POWER SUPPLY-REGULATED 3-12V 500MA £5.00
PSU AC 12V 500MA £1.50
PSU AC 9V 1A £1.50
QUARTZ HALOGEN –
500W 200V FOR OUTDOOR LAMPS £1.00
R.S. SAFE BLOC £5.00
RELAYS-SUB MINIATURE 25p
SATELLITE TUNER UNIT – 2427611
. . . BASE BAND/VIDEO OUT £3.00
SCART TO 4 PHONO LEADS 1.5M £3.00
SCART TO 6 PHONO LEADS £3.00
SCART TO "D" PLUG £1.00
SCART TO SCART LEADS –
ALL PINS CONNECTED – 1.5 METRES £2.00
SOUND 5.5MHZ MPM 1000T £1.00
SOUND 6.0MHZ MPM 1040 £1.00
TRANSFORMER-RS ENCAPSULATED MAINS
0-120V-0-120V PRI 0-9V-0-9V SEC £1.00
TRIPLER KT3/K30 £4.00
TRIPLER – UNIVERSAL £5.00

AMSTRAD

HEAD AND DRUM – 6000 £12.00
HEAD AND DRUM – NICAM £12.00
PANEL-CLOCK DISPLAY – 8.900 £5.00
PLASTIC FRONT WITH FLAP – 8.900 £3.00
POWER SUPPLY-VS1000-VS1100 £5.00
POWER SUPPLY, LONG OR SHORT CHASSIS 1991/1992 MODELS £3.00
POWER SUPPLY – SWITCH MODE – DOUBLE DECKER £5.00
20 OFF MIXED NOKIA ITT
SALORA FINLEX SERVICE MANUAL £10.00 POST 4.00
MAINS ADAPTOR 12V AT 500 M/A
NEGATIVE CENTRE £1.00
NEGATIVE CENTRE £1.00
POSITOR EQV 98009 – SALE PRICE 25p

FERGUSON

ADAPTOR – VPT – TEXT – VA354 £2.00
AC MAINS & BATTERY-VA365 P/P £3.00 ea
CAMCORDER BATTERY, HIGH CAPACITY 9.6V 1800MA-VA310 £3.00
CAMCORDER BATTERY CHARGER
9.6 VOLTS VAZ65 EACH £6.00
CAMCORDER CAR ADAPTOR CHARGER – AND BATTERY-VA308 £5.00
CAMCORDER LENS 2 OFF –
TELE-CONVERSION LENS x1.4 & x0.7 £1.00

CARDIOID CAMERA MICROPHONE-VA SUPER 218 TELESCOPIC BOOM & STAND £5.00
CHASSIS-TX80-NEW-NO TUNER P/P £5.00ea £15.00
CHOKE-MAINS INPUT-TX9-TX10 £4.00
CHROME BOARD-ICCS
I/Cs U4647TKF OR HA11498 £6.00
DECK AND CAPSTAN MOTOR:-
FV61LV, FV62LV, FV67LV, FV68LV EACH £30.00
FV70B, FV71LV, FV72LV, FV74LVX EACH £30.00
FV77HV £30.00
FV31R £12.00
HEAD AND DRUM
MODULATOR-SATELLITE-T1040-SRD3/4 £2.00
PANEL-10 MIXED FROM TX9 TO ICC5 £20.00
PANEL-DECODER-ICC5 £5.00
PANEL-FRONT-TX100 £4.00
PANEL-IF-TX9, TX10 £4.00
PANEL-REMOTE AND POWER SUPPLY
FV31R DISPLAY P/P £2.00ea £5.00
PANEL-REMOTE-TX9, TX10 EACH £5.00
PANEL-REMOTE-TX10-540/01 £5.00
PANEL-REMOTE-TX10, WITH BATTERY AND 4 I/Cs – 1544-033C £7.00
PANEL-REMOTE TX90 –
139.001 I/Cs M293B1 AND MS1000 £10.00
PANEL-REMOTE TX100
I/C M293B1-SAA5012 £5.00
PANEL-REMOTE TX100
WITH STAND-BY BATTERY AND I/Cs £5.00
PANEL-T228B TEXT
FOR TX89, TX98, TX99, TX100 £6.00
PANEL-TX90 THORN FRONT, – – 8 BUTTONS 01M4-515-002 £5.00
PANEL-TUBE BASE-ICC5 £5.00
PANEL-TUBE-BASE-TX89, TX98, TX99 £5.00
PANEL-TUNING 1509G-TX9, TX10 £5.00
POWER SUPPLY 12V-3A
FOR VIDEOSTAR CAMERA PP3 £4.00
PUSH BUTTON UNIT-TX85, TX86 – 8 BUTTONS £5.00
RECEIVER – INFRA-RED – ICSL486-TX100 50p
TRANSFORMERS-SWITCH MODE:-
TX85, TX86, TX89 EACH £4.00
TX100 £5.00
473190-00, 40153000 EACH £5.00
ICC5 3112-338 326842 £4.00

HITACHI

DECODER-TELETEXT PC232A5 – ISSUE 4 £15.00
HEAD AND DRUM – 620E £12.00
MAINS SWITCH WITH STAND-BY £50p
MODULATOR No 5587881 £5.00
OSCILLOSCOPE 20MHZ DOUBLE BEAM – V212 £188.00
PANEL-TELETEXT G8P – ISSUE 6 £10.00
PANEL-TELETEXT PC315-11 – ISSUE 7 £15.00
PANEL-TEXT-VT753E £20.00
POWER SUPPLY TV SWITCH MODE
STR 4211 ISSUE 10 £8.00
POWER SUPPLY VIDEO SWITCH MODE VTM312ELM £10.00
THICK, FILM-HM9204A £3.50

HOSIDEN

TUBE BASE – MIXED 10 for £1.00
AA Batteries made by STC Group of Companies 10p each

ITT

IF MODULES:-
5827-01-51, 5827-03-51 EACH £3.00
5828-04-10, 5829-02-58 EACH £3.00
5929-03-41 EACH £3.00
TELETEXT CONVERSION KIT £3.00
CORE 2 90° ITT TEXT PANEL £3.00

1996/7 MATSUI

VIDEO DECK COMPLETE P/P £5.00ea £16.00

MATSUI – ORION

DECKS WITH HEADS –
D1096 VXA110 VP 9401 £16.00
HEAD-VSR1500 = ORION D2096 £5.00
PANEL-MAIN-VSR 1500 P/P £5.00ea £3.00
POWER SUPPLY-VSR 1500 £5.00
POWER SUPPLY & REG – TYPE STK 5343-VP9501 £8.00
POWER SUPPLY-SWITCH MODE-1500 £3.50

PHILIPS

DECODER-TEXT-K40-KT3 £6.00
IF PANEL FOR CP90-CP110 £5.00

TEXAS

NICAM BOARDS MK II £3.00

SAMSUNG TECU5983 VA24A
VHF-Tuner with Aerial Socket
Fit most new TV's £5

35-VICK DESOLDERING BRAID 1.5 meter
Size AA (2), Size AB (3), Size BB (4) £1

5 VIDEO HEADS *FOR* £20
Amstrad 6000, Amstrad 8900. Heads & Drum

FERGUSON NICAM MODULE III
Art No 989 591-E00 £5

L.O.P.T.

36061, 36162, 36362, 36383, 36481
36482, 36761, 36831, 36832
36943, 36962
2432211, 2432351, 2432491, 2432851
2432871, 2432981, 2432984
2433952, 2434141, 2434393
2434451, 2434492
2435016, 2435062
2435064, 2435085, 2435121
2435372, 2435701, 2436773
2436792, 2436795, 2436797, 3216001
243066, 243063
3220029, 3714016, 47003481
AT2076/78, AT2076/88, AT2078/25
AT2077/81
DST81N243/472593-00
DST85B235/47328700 & /40153200
DST88N234/400086AD, &/47805200L
DST88N234/47320041, &/47317590
DST186N243/473058-00
TFB3035D, TFB3069D, TFB4023AD
TFB4039AD, TFB4066AD

ALL LOPTS £5.00

FERGUSON
TX9
TX10
TX85, TX86
TX89, TX98, TX99
Y260781
FSTY260482
LOPT RED SPOT
LOPT WHITE SPOT & YELLOW SPOT

PANASONIC
TC2203, TLF 1456B
TLF1457B, TLF701/6

TOSHIBA
TFB 3035D, TFB 4023AD, TFB 4032BD
TFB 4038AD, TFB 4110AD
TFB 3089D, TFB 4088AD

VIDEO DECKS

AIWA 1500
MATSUI VXA 1100
MATSUI 1500
ORION D1094
ORION D1096
ORION D2096 ETC
ES POST WITH HEADS
EACH £20.00
CAPSTAIN MOTOR FOR ABOVE DECKS £15.00
AND HAND SETS £3.00
4 HEAD DECK FOR 1500 £20.00
20 HIGH VOLTAGE CAPS 1500V – 2000V MIXED £1.00
VIDEO PATTERN GENERATOR MODEL T9535 240V
MAINS SMALL £5.00
PAL TV ADAPTOR – RGB IN UFH OUT £5.00
MOTOR 12V 10p

HANDSETS

AMSTRAD
4600 £3.0
4700 £5.00
6000 £15.00
6800 £4.00
UNIVERSAL £3.00

DECCA
NICAM LCD £4.00

FERGUSON
BSB £1.50
FV41R/3V59, FV41R/FV42 – FV51-52 £10.00
ICC5 £7.00
IK2000, IK7000 EACH £4.00
SRD2, SRD3, SRD4 EACH £1.00
T780 £2.00
TV/SATELLITE WITH FST £3.00

HITACHI
CPT2158 (NO REPLACEMENT) £5.00
VIDEO RM933E VIDEO PLUS £30.00

MATSUI
1500 £5.00
VSR 1500 £4.00
VX3000 £3.00
3000/ORION – TV AND VIDEO £2.00
RC = PACE 900, FERGUSON, SONY, GRUNDIG £5.00

MITSUBISHI
RM35 – VIDEO £5.00

NOKIA
RC202 £4.00
VP9401
D1096
VXA1100
AND VIDEO PLUS

ORION
TV AND VIDEO £2.00
VIDEO WITH LCD – 1992/93 MODELS £5.00

PANASONIC
EUR51142 £10.00
TC1632, TC1642, TC2232 EACH £8.00
TX2034, TX2044, TX2200, TX2234 EACH £8.00
TX2244, TX2300, TX2636, TX3300 EACH £8.00
RC201 – TV – REPLACES TNZ1411/2

PERDIO
PV 1188 £3.00

PHILIPS
NEW TYPE UNIVERSAL £8.00 (3 in 1)
RC4001

SAMSUNG
HANDSETS, TV & VIDEO – 12 TYPES EACH £3.00

SANYO
UNIVERSAL VIDEO £3.00

SIEMENS
TV/VIDEO – 1994 MODEL £5.00

THORN
9000, 9600, TX9, TX10, TX1000
TEXT AND NON-TEXT EACH £10.00
CPT1408T, CPT2176, CPTZ178 EACH £5.00
CPT2476, CPT2478 EACH £5.00
TEXT, REPLACES PHILIPS KT3, K30, K4 ETC U/V £8.00
PHILIPS 3 IN 1 HAND SET £8.00
FERGUSON WITH TEXT IKZ
CHASSIS P/P £5.00 £10.00
TX86 CHASSIS P/P £4.00 £10.00
ORION AND MATSUI CARRIAGE 1500 TYPE D1096 ETC £6.00
SANYO LOPT P/P £2.00 4 FOR £5.00
240V ADAPTOR 9V AC 1A £1.00

COMPLETE REPAIR KIT, CLUTCH AND PINCH ROLLER, IDLER D2906 £7.00

TUNERS

IF TERC8-022A TBJZA-00ZA-ALPS £3.00
SATELLITE SXT2302180968 £3.00
SATELLITE
WITH BASE BAND MIN SXT2302234 £4.00
SMALL UNF/VHF £3.50
VHF/UHF – TEKE4-112A £4.00
4944
U321, U341, U342, U343, U344, U411, U412, U944 £2 EACH
U743, 7744

AMSTRAD
UE33-BO1 £3.00
MRF7-7E33
MATSUI ORION VIDEO TUNER IF £5.00

FERGUSON
IF2105-RE £5.00
MTP2011-AP00 £5.00
UHF – ICC5 £5.00
VHF – ICC5 £5.00
TX85, TX86, TX89, TX90 EACH £4.00
TX98, T99, TX100 EACH £4.00

ORION
1500 – UE33 BO9 £4.00

PANASONIC
SMALL UHF/VHF £3.00

FERGUSON
DOUBLE SIDE NICAM £10
ICC5 NICAM SINGLE BOARD ICC5 £10

SHARP
TUNER AND IF 1810587 PA1 UK £3.00

TATUNG
UNIVERSAL 205 OR EQUIVALENT WITH AERIAL SOCKET £3.00

MOTORS

HITACHI
CAPSTAN 150E £3.00

MATSUI
CAPSTAN I/C NO. M56730 ASP £15.00
2 TYPES 1995 TO 1997 MODELS MATSUI VIDEO DECKS WITH CAPSTAN MOTOR AND HEAD P/P £5.00 £20.00

MITSUMI
MOD MRF7-UF32 £5.00
MOD TMUG3-103A £5.00

MITSUBISHI
CAPSTAN-HSE41-I/C M51782ASP £2.00

Treble A Batteries12 for £1

7805	20p	2SD1432	£1.00	BU204	60p	BUT11AF	50p	BYW29/50	15p	HD6140425J	50p				
7806	20p	2SD1453	£1.00	BU205	75p	BUT12A	20p	BYW95	10p	HD6140815	£1.00				
7809	20p	2SD1576	£1.00	BU206	£1.00	BUT13	£1.00	BYW95C	10p	HE4528BP	15p				
7812	20p	2SD1577	£2.00	BU207	£1.00	BUT18AF	£1.00	BYW562A 100V	8p	HEF4029BP	20p				
7812F	20p	2SD180T03	15p	BU208	80p	BUT71/800	15p	BYX10	10p	HEF4093	20p				
2SC940	£1.00	2SD1878	£1.00	BU208A	£1.50	BUW11	40p	BYX38/300	25p	HGA1124A	50p				
2SC3795	£1.00	2SK1460	£1.00	BU208D	90p	BUW84	60p	BYX55/350	10p	HM6264					
2SC3973B	£1.00	2SK1464	£1.00	BU222	£1.00	BUX39	£1.00	BYX55/600	10p	ALP-15	£3.50				
2SC4313	£5.00	2SC4891		BU326	£1.00	BUX84	50p	BYX71/60	20p	IK7ST 6931 B1	£3.00				
2SC4589		1500V/15A	£2.00	BU407	40p	BUX84AF	50p	BYZ106	10p	IN5401	3p				
10A/1500V	£2.00	AN5521	£1.00	BU508A	90p	BUY49	20p	BZW-C110	5p	IR106A	10p				
2SC7350	15p	AN5551	£1.00	BU508AF	£1.00	BY187	5p	BZW83-C20	3p	L298N	£4.00				
2SD200	£1.00	AN5831	£2.00	BU508D	80p	BY208-800	8p	CA3123Q	50p	LA7830	£1.00				
2SD401	40p	BC550C	20p	BU508DF	£1.00	BY228	15p	CD4555BE	20p	LA7831	£1.00				
2SD716	£1.00	BDV648	50p	BU705	£1.00	BY229	6p	CLE871A	£5.00	M708 AB1	£1.50				
2SD787	30p	BDV658	50p	BU801	50p	BY255	5p	FE3B	4p	M708 LB1	£1.50				
2SD789	30p	BF8695	20p	BU806A	£1.00	BY299-200	15p	HA1140	£1.00	M37204ECSP	£1.00				
2SD820	£1.00	BF870	20p	BU807	50p	BY299-800	30p	HA1185	£1.00	M58658P	£1.00				
2SD868	75p	BFW41	15p	BU808DFI	£1.00	BYT71-800	15p	HA1196	50p	MN650	£1.00				
2SD880	30p	BT Phone Batterys	£1	BU824	50p	BYV19-30	15p	HA11485ANT	£1.50	S13522V	£1.00				
2SD1264	50p	BU105/04	80p	BU826	£1.00	BYV28-200	15p	HA118041NT	£1.50	SAA1061	£3.00				
2SD1266	£1.00	BU108	£1.00	BUK444/800	£2.00	BYV95B	10p	HA513385PI	£2.00	SAA3018	£1.00				
2SD1398	£1.00	BU124	50p	BUK445/600	£2.00	BYV95C	12p	HA513385P3	£2.00	SAA5010	£2.00				
2SD1415	£1.00	BU126	80p	BUK454/600	£1.00	BYV96D	10p	HCF4520	50p	SAA5231					
2SD1427	£1.00	BU180A	65p	BUT11	50p	BYW20-08-9	£1.00	HCF4520BE	50p	(TEXT)	£2.00				

No accounts — No Credit Cards

SENDZ COMPONENTS

63 BISHOPSTEIGNTON, SHOEBURYNESS, ESSEX SS3 8AF.

Tel: 01702 338894 Fax: 01702 338805

Specific P/P charges are PER ITEM • For UK addresses add P/P to order then 17.5% VAT to total. This applies to EC unless VAT No. is given • Exports – P/P at cost • Postal Order/Cheque with order. Unless otherwise specified add £1.70 P/P to SMALL ORDERS + Additional P/P for HEAVIER GOODS. Technical information by telephone only • Government/School Orders on official headings. Callers to shop – 212 London Road, Southend-on-Sea. Open Saturday Only 10-12noon – 2-5pm.

PLEASE ADD 17.5% VAT TO BOTH THE GOODS TOTAL AND P/P CHARGE

TOTAL CONTROL

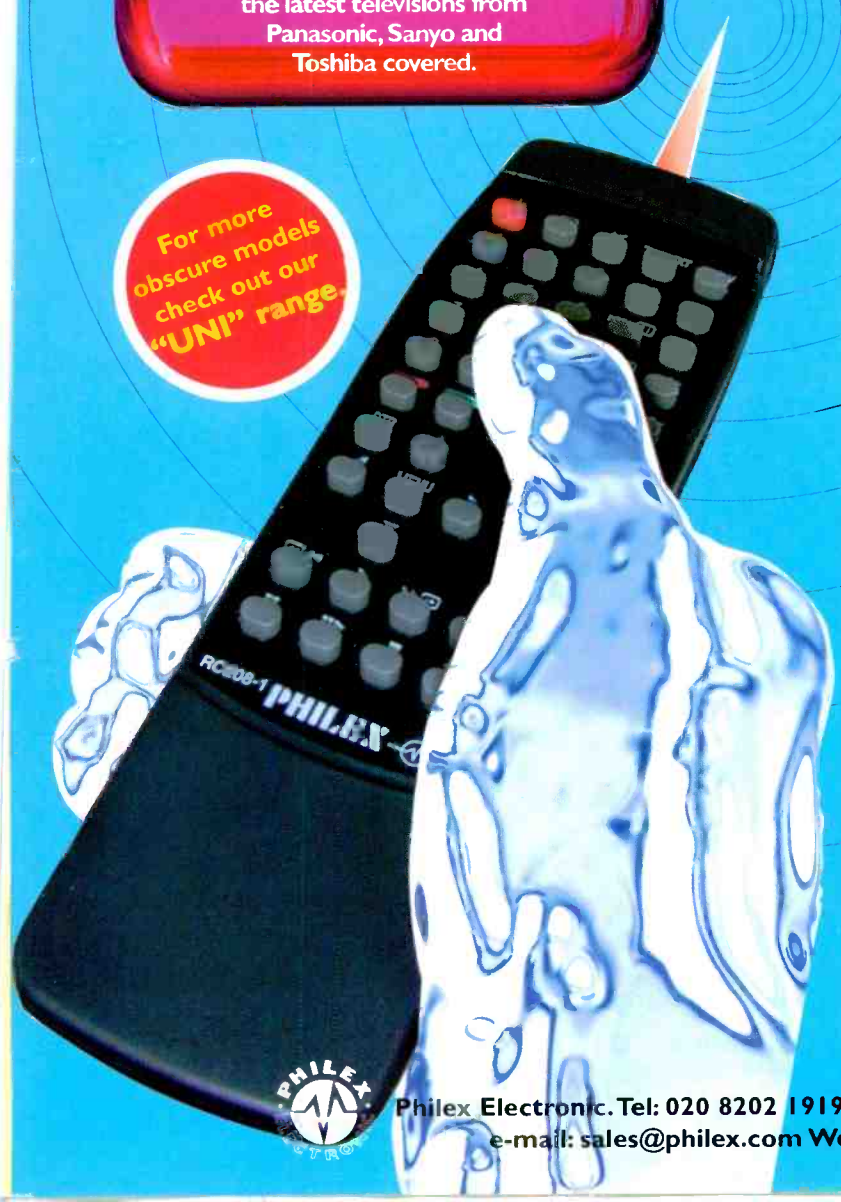
With PHILEX Replacement Remotes

Philex stock one of the widest ranges of Replacement Remote Controls for those who want all the same key functions as their original remote control but for a fraction of the manufacturer's price.

The range is constantly being updated to cover the latest TVs, VCRs and satellite receivers and currently covers hundreds of brands and thousands of models both new and old.

Our newest Replacement Remote Controls have got the latest televisions from Panasonic, Sanyo and Toshiba covered.

For more obscure models check out our "UNI" range.



RC210-1
Replacement TV remote control for Panasonic TNQ8E0432, TNQ8E0421, TNQ8E04281, TNQ8E0441 & TNQ1410. Covers a wide range of models from the TC, TX & TXC series

RC211-1
Replacement TV remote control for Panasonic TNQ8E0461
Models: TC14S1R, TC21S3T/S1R/S1T, TX14S1T/S2T, TX21S1RC/S1T/S1TC

RC212-1
Replacement TV remote control for Panasonic 02280227
Covers a wide range of models from the TX21, TX25, TX28 & TX29 series

RC898-1
Replacement TV remote control for Sanyo JKYB
Models:
14M1/M1T/M2/M2T/M3/M3T/MT1, C14EA95/A/B/

RC956-1
Replacement TV remote control for Toshiba 23120340
Model: 2505DBT/DDT, 2805DB/DBT/DDT, 3409DB/DBT, CT9493 & CT9511

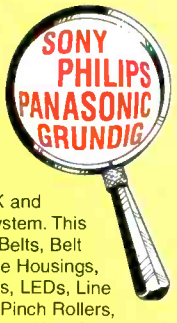
RC957-1
Replacement TV remote control for Toshiba
Model: 1400RBO/TB/TBT/TBW, 1510TB/BT/TBW, 156T9BT/BW, 2100TB/TBT, 2101TB/TB5/TBG/TBT/TBZ, 2102TB/TBZ, 2103TB5/TBG, 2500TB/TBT, 2501TB/TBZ, CT9241, CT9462, CT9463, CT9481, CT9526

RC958-1
Replacement TV remote control for Toshiba
Models: 150R6B/R6BK/R6BZ, 155R8B/R8BZ, 175T9/T9B/T9BT, 210R6B/R6BZ/RBZ/T6B/T6BZ, 215T8B, 255R7B/R7BK/R8B/T7B/T7BK/T8B, 258R7B/R7BW/T7B/T7BK/T7BW, 259D9B/D9BZ, 289T6B, 3297TB/T7B, 349P9B, C258T7B, also many models from CT9175-CT9420 series

Philex Electronic. Tel: 020 8202 1919 / 07000 PHILEX Fax: 020 8202 0015
e-mail: sales@philex.com Website: http://www.philex.com

Look at these *Extra Specials*

"Find-A-Part" Service



The A.R.D. "Find-A-Part" service is a new concept designed to quickly help you find the right part at the right price.
We have taken the entire König database of every compatible part sold in the UK and stored it onto our computer system. This has created a huge library of Belts, Belt Kits, Capstan Motors, Cassette Housings, Clutches, Gears, Idlers, Lamps, LEDs, Line Output Transformers, Motors, Pinch Rollers, Pulleys, Remote Controls, Repair Kits, Sensors, Service Kits, Switches, Tension Bands and Video Heads covering virtually every Manufacturer of consumer electronics Brown Goods.
This database is linked to a special Search Engine which means that you can quote Manufacturers Names, Original Model References, Konig Part Numbers or just Key Descriptive words and our experienced team of sales operators will be able to find the correct compatible part in a flash.
Don't delay, give the new "Find-A-Part" system a try and see how much money you can save by buying quality compatible components at very competetive prices, without the need to search through endless Cross Reference pages.

Manufacturers | Model Reference | Part Number | Description

Ask for your FREE 600 Page user friendly Trade catalogue NOW

It has comprehensive technical information with pictures to help in product identification.

All products are clearly and logically presented to make the items easy to find.

We have a highly trained and caring staff and perfect systems to try and make every contact with A.R.D. Electronics a pleasurable and problem free experience.

Offers expire August 31st 2000

4-Way Extension Leads With Neon Indicators

- Sealed screw case for added safety
- Neon indicator located in top left hand corner
- 2 metre length 13 Amp cable
- Fully wired and fitted with an approved 13 Amp plug
- Cable grommet attached to the socket board for added protection
- Available with the socket board unfused or fused with the fuse holder conveniently located on the front of the board for ease of fuse change

Technical Information

Current Rating.....13 Amps, 250 Vac
Lead Length.....2 metres
Approvals / Recognitions.....BS1363/A

Description	Order Code	Offer Price
Unfused Version	210-00439-56	2.25
Fused Version	210-00442-56	2.49

Single Output Digital Universal Gold LNB by CAMBRIDGE

- High performance single output LNB.
- Integrated electronic polarisation selection.
- Compatible with existing satellite receivers.
- Digital set top box compatible.

Please contact our technical department for full specifications.

Order Code	Offer Price
340-00129-56	11.99

All price exclude VAT.

Inifiniti CDR-74i Compax CD-R disks by Mdea

- 680MB, 74Minutes capacity.
- A premier grade protective seated multispeed CD recordable disk.
- A polycarbonate disk with stable organic blue dyestuff storage layer, Silver reflective layer (superior to Gold) and protective coating against the impact of normal handling (dust, scratches etc.).
- Compatible with all types of CD-R writers and CD-ROM drives.
- Guaranteed up to 8X write speed.
- Guaranteed archival life span of more than 100 years.
- 25 disks supplied in a clear shrink film overwrap, with polycarbonate protective pseudo CD's at each end of the stack to ensure media integrity.
- This packaging is ideal for duplicators. You can store 10 times as many disks in the same shelf space.

25 disks per pack.

Order Code	Offer Price/Pack
180-00114-56	13.95

Compatible Remote Control

Features
- Modern, yet extremely robust housing
- Rubber Keypad
- Reverse Polarity Protection
- CE Approved
- Hardwearing etched printing
- 100% Testing
- Manufactured in China

Type	Replaces
RC400/HL	Philips RC5991, 218-20831

ISO9002

ISOQAR QUALITY ASSURED FIRM ISO9002 | UKAS QUALITY MANAGEMENT 026

Certificate Number 2152/99

EASY ORDERING

Open a Trade Account today or pay by Credit Card.

We accept VISA MasterCard SWITCH BACs

A.R.D. ELECTRONICS

'Our aim is your next order'

Warehouse at Altham

FREE DELIVERY ON ALL ORDERS OVER £20

A.R.D. Electronics Plc, Shorten Brook Way, Altham Business Park, Altham, Accrington, BB5 5YL e-mail: sales@ardelectronics.com

Tel: 01282 683000 Fax: 01282 683010

Trade Website: www.ardelectronics.com