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TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

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Diode Pack***



**Ten Years of VHS Video
Add-on FM Tuner for VCRs
TV Fault Finding • DX-TV
Satellite TV Up-date
Microwave Signal Devices
VCR Clinic • Vintage TV**

MANOR SUPPLIES

MKV PAL COLOUR TEST GENERATOR FOR DOMESTIC TV & VCR.

TEST DEMONSTRATIONS AT 172 WEST END LANE



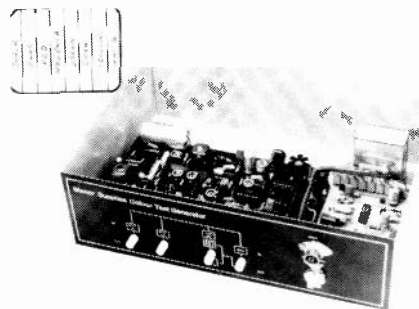
- ★ 40 different patterns and variations.
- ★ Fully interlaced sync pulses with correct picture blanking.
- ★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
- ★ Chequerboard.
- ★ Mono outputs with border castellations, cross hatch, grey scale, vertical lines, horizontal lines and dots.
- ★ UHF modulator output plugs straight into receiver aerial socket.
- ★ Additional video output for CCTV & VCR.
- ★ Facilities for sound output.
- ★ Easy to build kit, standard parts. Only 2 adjustments. No special test equipment required.
- ★ Mains operated with stabilised power supply.
- ★ All kits fully guaranteed with back-up service.
- ★ Also available with VHF Modulator.

Price of Kit **£70.00**
 Case (10"×6"×2 1/4") app. **£8.60**
 Optional Sound Module (6MHz or 5.5MHz) **£3.90**
 Built & Tested in Case including Sound Module **£108.00**

SPECIAL TEST REPORT 'TELEVISION' DEC. 1982

Post/Packing £2.80
 Add VAT 15% TO ALL PRICES

PAL COLOUR BAR GENERATOR (Mk4)



- ★ Output at UHF, applied to receiver aerial socket.
- ★ In addition to colour bars R-Y, B-Y etc.
- ★ Cross-hatch, grey scale, peak white and black level.
- ★ Push button controls, battery or mains operated.
- ★ Simple design, only five i.c.s on colour bar P.C.B.
- ★ Backup service available.

PRICE OF MK 4 COLOUR BAR GENERATOR KIT **£30.00**. CASE **£8.60**. BATT HOLDERS **£4.20**. MAINS SUPPLY KIT **£4.20** (Combined P&P **£2.80**).

MK 4 (BATTERY) BUILT & TESTED **£58.00** + **£2.80** P & P.
 MK 4 (MAINS) BUILT & TESTED **£68.00** + **£2.80** P & P.
 VHF MODULATOR (CH 1 to 4) FOR OVERSEAS **£5.75**.
 EASILY ADAPTED FOR VIDEO OUTPUT & C.C.T.V.

ADD VAT 15%

TELETEXT DECODER PANELS (TESTED)
 Mullard VM6101 **£30.00**, Philips KT3, K30 **£30.00**, p.p. **£2.30**

PHILIPS G11 PRESTEL TELETEXT UNIT includes Mullard VM6230 Teletext Decoder, 6330 panel, plus Line Coupler and Interface **£30.00**, p.p. **£2.80**

TV SERVICE SPARES

BACKED BY TWENTY YEARS EXPERIENCE & STAFF OF TECHNICAL EXPERTS

LOPTS, TRIPLERS, PANELS, TUNERS, SELECTORS ETC.
PHILIPS KT3 PANELS (non text) tested, exchange Decoder **£10.00**, Sound, Frame, Power, RGB **£7.50** each p.p. **£1.50**.
THORN TX9 PANELS Complete & tested **£28.00** Exchange. (Shop only).
THORN 8000 TO 8800 Panels tested exchange. Power **£7.80** p.p. **£1.50**. Frame **£10.00** p.p. **£2.30**.
THORN TX9, TX10 Facia Control Panel Incl Infra Red Remote Receiver **£8.50** p.p. **£2.00**.
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THORN 8800, 9800 Touch Tune Facia Unit **£3.50** p.p. **£1.50**.
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 TX9, TX10 Infra red (Non-Text) **£18.00**; TX9, TX10 Infra red Teletext **£21.50**, p.p. **£1.20**. Others available.
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 TX Remote panel 1509G (incl. UAA1008A & Battery) **£5.00** p.p. **£1.80**.
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GEC 20AX Line Time Base **£18.00** p.p. **£2.00**.
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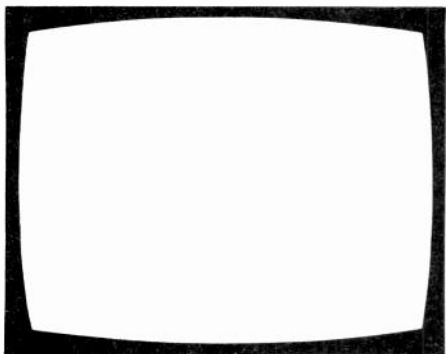
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TELEVISION

May
1988

Vol. 38, No. 7
Issue 451

On sale April 20th

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BACK NUMBERS

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INDEXES

Indexes to Vols. 35 and 36 are available at 80p each from the Editorial Office (address above).

QUERIES

We regret that we cannot answer technical queries over the telephone nor supply service sheets. We will endeavour to assist readers who have queries relating to articles published in *Television*, but we cannot offer advice on modifications to our published designs nor comment on alternative ways of using them. Correspondents should enclose a stamped addressed envelope. Requests for advice on dealing with servicing problems should be directed to our Queries Service. For details see our regular feature "Service Bureau". Send to the address given above (see "correspondence").

this month

- 493 Leader**
- 494 Add-on FM Tuner for VCRs** *Peter Marlow, B.Sc., C.Eng.*
A single-chip f.m. receiver to add a radio programme recording facility to VCRs without this feature. With complete constructional details.
- 499 A Guide to Microwave Techniques, Part 2** *Andrew J. Heron*
How microwaves are launched in and extracted from waveguides and various waveguide components.
- 502 Thanks a Million** *Les Lawry-Johns*
Solution to that Grundig problem and various other troublesome sets.
- 503 Resurrecting a Dead Siemens** *Colin Boggis*
The set needed a new line output transformer, which is a mite expensive. The solution, which could apply to other sets, was to use a TX10 focus unit.
- 504 Teletopics**
News, comment and developments.
- 506 VCR Clinic**
Reports from Eugene Trundle, Phil H. Ireland, Alfred Damp, Steve Beeching, T. Eng., J.P. Cleak, Rana S. Narwan, Dave Dulson, Malcolm George and Philip Blundell, Eng. Tech.
- 508 A Low-cost TVRO Installation, Part 3** *Roger Bunney*
This concluding instalment describes a method of providing easy elevation adjustment.
- 510 Ten Years of VHS Video** *Eugene Trundle*
It's ten years since the first JVC VHS machines started to appear in the UK. A review of the video decade, seen mainly from the servicing angle.
- 514 Satellite TV Up-date** *Harold Peters*
The current situation as the ascent of Astra and the UK DBS satellite looms closer.
- 515 Next Month in Television**
- 516 TV Fault Finding**
Reports from Philip Blundell, Eng. Tech., Aled Roberts, J.R. Armagh, G. Hewins, Ian Bowden, Roger Burchett and Nick Beer.
- 518 Vintage TV: Early Cable Techniques** *Chas E. Miller*
A look back to the days of cable converters and branded terminal units twenty seven years ago.
- 522 Long-distance Television** *Roger Bunney*
Reports on DX conditions and reception and news from abroad. Plus a note on v.h.f./u.h.f. duplexing with a masthead u.h.f. amplifier.
- 524 Letters**
- 527 Service Bureau**
- 528 Test Case 305**

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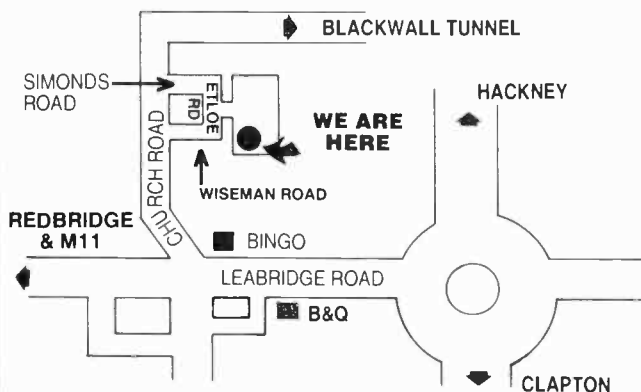
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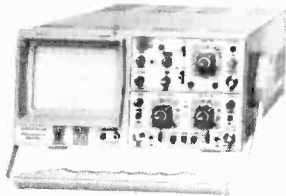
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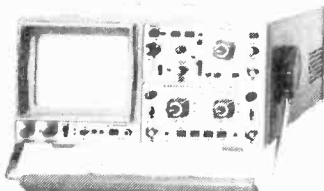


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 - Sens. Ch1, Ch2 2mV/cm
 - Time Base 0.25/cm - 20ns/cm
 - Trigger DC-40MHz AC, DC, HF, LF, (TV Frame)
 - Active TV Sync. Sep
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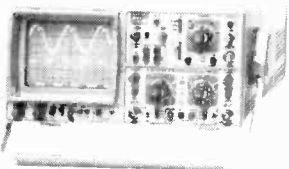
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 - Sens. Ch1, Ch2 1mV/cm
 - Delay Line
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 - Delayed Sweep 100ns - 0.1s
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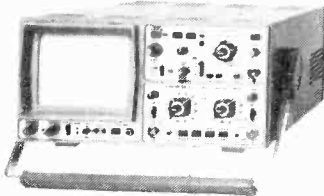
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 - Calibrator
 - Plus many more features



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- SPECIFICATION**
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 - Delay Line
 - Delayed Sweep 100ns - 0.1s
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 - Overscan LED indicators
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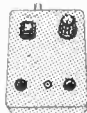
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TELEVISION

Fifty Years of Change

The history of economic activity is full of surprises. In particular, companies come and go and size is no guarantee of longevity. Take the *Financial Times* Ordinary Share Index which was started just over fifty years ago, in 1935, to provide a guide to the state of the market, based on the price of thirty active and leading shares. Of the original thirty bastions of UK industry, only six remain in the present Index. The electrical/electronics industry was represented by two firms back in 1935, GEC and EMI. GEC remains there; EMI is also present, as a constituent part of Thorn EMI. Plessey has since joined the ranks as a third representative of the electronics industry. What happened to the 24 firms no longer listed? They haven't just fizzled away, though some look distinctly shadowy in their present form. Several disappeared during the early post-war period of nationalisation, while others changed their identity during the take-over era that got going in the sixties – when some would say that the main focus of business attention moved from manufacturing to shuffling paper around in major deals, to the detriment of investment in and the development of industry.

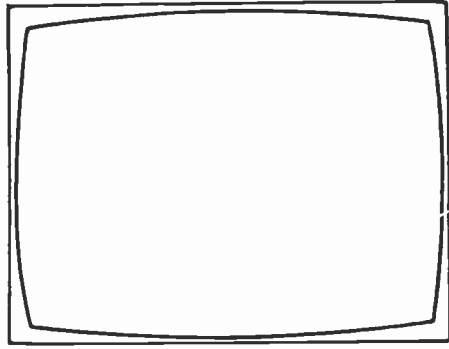
Being a well-known and apparently firmly established business is of itself no guide to continuing success. In Europe, such firms as BMW, Volkswagen and Olivetti are amongst those that have teetered on the brink of economic collapse at various times. Perhaps we shouldn't labour the subject of Rover which, as Austin Motor, was one of the original FT30. It seems to have been on the verge of collapse for as long as one can recall, and would surely have gone under had it not been for the effect this would have had on employment in and the continuation of the UK's manufacturing base.

With the exception of EMI in 1935 and Thorn EMI today the consumer electronics industry has never attained the status of representation in the FT30. It is, perhaps, rather surprising that EMI made it in 1935, but then it has never been purely an electronics company and could have been selected for its promise as a sunrise industry. Formed through an amalgamation with Columbia in the tough days of the early thirties depression, EMI has always been large in the recorded music business. By the time that Thorn acquired it EMI had become primarily an entertainment-based operation (Thorn first sold off the hotels!). Thorn itself has largely moved out of manufacturing, and what consumer electronics manufacturing capability remains in the UK is largely by courtesy of Japanese enterprises.

Just thirty years ago there were many well-known UK electronics goods manufacturers that looked as though they were here to stay. One thinks for example of Bush, Cossor, Ekco, McMichael, Murphy, Pye and Ultra. Many had been doing quite well. Most had expanded to meet the call for electronic equipment during the war. Then the post-war period in the UK, with full employment, produced boom conditions. There was a shortage of goods and almost anything that could be produced sold – it was a sellers' market of the sort we've not seen in many a year. It's a sad fact that these enterprises never developed in the way that their Japanese counterparts did in the seventies, and that South Korean firms now seem to be doing. As an example of the latter, Daewoo started in business in 1967 with \$9k, five employees and an order for a small shipment of cheap shirts. Now it's active in a wide range of fields from heavy industry to consumer electronics, taking in cars and aerospace and with sales in 1986 of over \$10b. It is considering setting up a VCR plant in Wales. Korean firms have expanded in the context of a protected domestic market, active government support and a harsh labour regime, but even so the pace of expansion has been breathtaking.

Some of those older UK names are still around as brands used by others. It's always a bit surprising to think that a brand name can be more firmly established and have a far longer life than the firm that originally created it. The life span, as independent operations, of many of those early firms was in fact quite short, starting off in the twenties or thirties and selling out in the fifties or sixties. They never became really large-scale manufacturers. Maybe the climate and opportunities of the times were against it. Remember that the rise of the Japanese electronics industry came in the semiconductor era, by which time many well-known UK firms had pulled out.

Japanese industry also succeeded because it took a global view. The competitive nature of the consumer electronics industry in recent decades has meant that small-scale operations, with their inevitably high unit costs, have not been able to survive unless they've found and exploited a specialist niche. It's not been possible to profit from UK manufacture for the UK market for many years. In fact it's difficult to see how it has been possible to make a profit out of any UK consumer electronics activity in recent years. Dixons, Currys, Comet, Rumbelows and the rental organisations have managed it however, largely through placing bulk orders direct with manufacturers, a system that appears to have been pioneered by Currys and was subsequently developed by this firm and others with the shift to own-brand merchandise. It has also to be said that low wages played a part. The low rewards on the servicing side have been highlighted in our letters pages on a number of occasions. The rewards have not been good on the retail side either, the result all too often being that assistants know little about the goods they are selling. Now it seems that even the retail side is going ex-growth. Until, it has been suggested, something to compare in its impact with the VCR comes along to rekindle consumer interest. Perhaps satellite TV will fulfil this role. Perhaps . . .



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John A. Reddihough

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COVER PHOTO

The two VCRs shown in our cover photo this month represent the advance in VCR development from 1978 to the present time. The original JVC Model HR3300EK is shown at the top. At the bottom is the JVC Model HRD530EK, a top-of-the-range machine with dual-speed operation, Hi-Fi sound and a NICAM decoder for stereo sound transmissions. See article on page 510.

HELD OVER

Due to time problems Part 5 of our series "Practical Computer Programming" will appear in our next issue.

Add-on FM Tuner for VCRs

Peter Marlow, B.Sc., C.Eng.

It's handy to be able to use a VCR to record radio as well as TV programmes. The advantages compared to use of a conventional audio cassette are the tape length and the VCR's accurate timer. Digital sound recording interfaces are available for this purpose at a price, and some of the top-of-the-range VCRs have this facility already built in. Most VCRs however require a simple interface unit to make them operate in a sound-only mode. The interface works by supplying a blanked (black) TV display with the sound signal. A suitable design was described in the November 1987 issue of *Television* – the VCR sound recording interface. It will accept an audio input from a hi-fi tuner or a portable radio. To save tying up the hi-fi for this purpose however I decided to develop a simple radio tuner specifically for this application. The tuner does of course have other uses.

Preliminary research showed that an f.m. tuner would have to be used – if the TV set is on during the recording session its line output stage will interfere with long- and medium-wave reception. This eliminated the neatest solutions – to use the Ferranti ZN414Z or ZN416E t.r.f. receiver chips! Research also revealed that a mono signal would be adequate: the majority of stereo VCRs already have a sound only record facility built in. A check on commercially available f.m. tuner modules brought to light the Larsholt 7254 mono tuner module which is available from Cirkit. At a price of £30 however it seemed to be a little on the expensive side for this application.

The solution chosen is the use of the Philips/Signetics TDA7000 i.c. which is described by its manufacturers as a complete mono f.m. radio on a chip. The fact that it can be used to produce a compact unit and its low price make it ideal.

The TDA7000 requires only one external LC tuned circuit, for the local oscillator: setting up is very easy. It has an i.f. of 70kHz with an internal two-stage active filter and a unique correlation muting circuit to suppress spurious signals. The maximum i.f. swing is compressed to $\pm 15\text{kHz}$ by using a frequency locked loop (FLL) to control the local oscillator. The combined action of the muting circuit and the FLL loop also suppresses image frequencies.

Because of the local oscillator's low r.f. level and the low i.f., radiation from the TDA7000 is negligible. The total current consumption is 8mA, making the chip ideal for use in battery-operated equipment. The r.f. input is 1.5-110MHz, which invites other applications such as six metre amateur radio reception.

Design Details

A block diagram of the chip, along with the external components suggested in the application report, is shown in Fig. 1. There are quite a lot of miniature ceramic capacitors – semiconductor technology will soon put all these on the chip. L2 and C22 are required only for band-stop attenuation of high-level a.m. or TV signals, and are thus not needed for UK operation.

The application report circuit was taken as a starting point. There were several additional design features I

wanted to implement. First, varicap diode instead of variable capacitance tuning would be desirable, the idea being to have preset station selection. Secondly, a buffered local oscillator output could drive a frequency display. Thirdly it would be desirable to have direct connection to the VCR sound recording interface unit to reduce the number of leads required and make use of a common power source – a second connector links all the signals to the VCR. Fourthly, for neatness the design should fit into the same sized box as the VCR sound interface unit (the two could of course be accommodated in a common enclosure).

Components list

IC1	TDA7000*	R1	22k
REG	78L05	R2,3	47k
Tr1	BC178	R4	10k
Tr2	BC109	R5,9,10	2k2
D1	BB109B*	R6	4k7
LED	CQY85 red 3mm	R7	220 Ω
L1	50nH, Toko S18*†	R8	270 Ω
VR1-4	100k cermet multi-turn (20t), e.g. RS162-265	R11	75 Ω
		All	1/4W CFR

† screening can optional

C1	1 μ 50V min radial electrolytic
C2	1n8 ceramic plate crimped
C3,17	100n ceramic block
C4,15,18,19	220p ceramic plate crimped
C5	10 μ 50V min radial electrolytic
C6	180p ceramic plate crimped
C7,10,25	10n ceramic plate crimped
C8	150n ceramic block
C9	22n ceramic plate crimped
C11	18p ceramic plate crimped
C12,21	3n3 ceramic plate crimped
C13	2p7 ceramic plate crimped
C14	1n ceramic plate crimped
C16,22	330p ceramic plate crimped
C20	150p ceramic plate crimped
C23	0.22 μ 100V film
C24	0.47 μ 100V film
PL1,4,6,7	2-pin header + crimp connector housing
PL2,3	5-way 240° DIN PCB Socket, e.g. RS473-284
PL5	4-pin header + crimp connector housing
SK1	Flush coaxial socket
SW1	Single-pole 5-way rotary switch
Case	120 × 65 × 40mm. Verobox 65-2518H
	Potentiometer panel mounting bushes (RS545-222), PCB, knob.

Parts marked * are available as a package for £7.40 from VIP Ltd., 32 Charlton Lane, Cheltenham, Gloucestershire GL53 9DX (telephone 0242 581 383). The price includes VAT and postage. VIP Ltd. can supply other parts on request and can also still supply parts and the PCB for the VCR sound interface unit (*Television* November 1987).

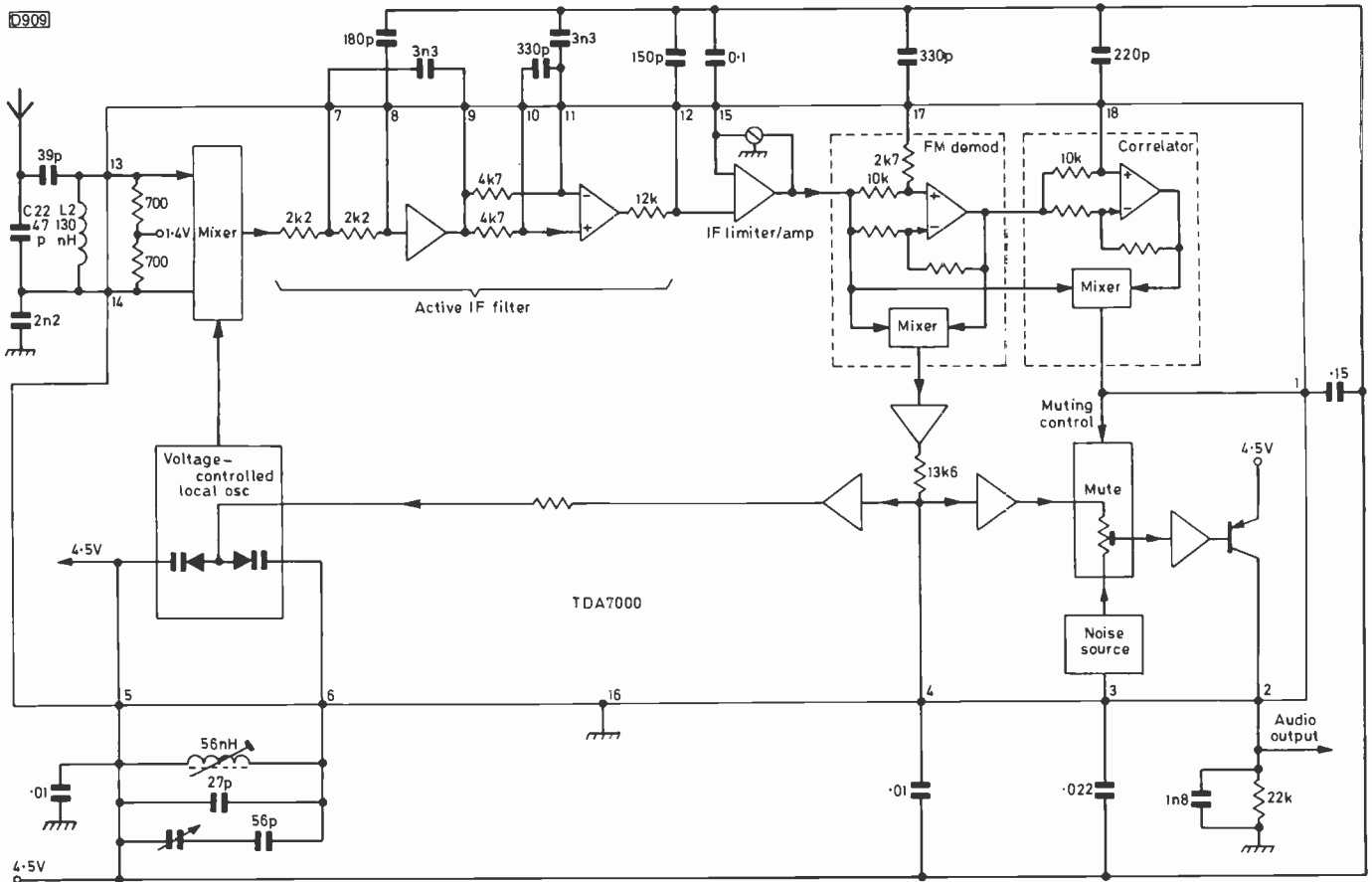


Fig. 1: TDA7000 block diagram and suggested external circuitry.

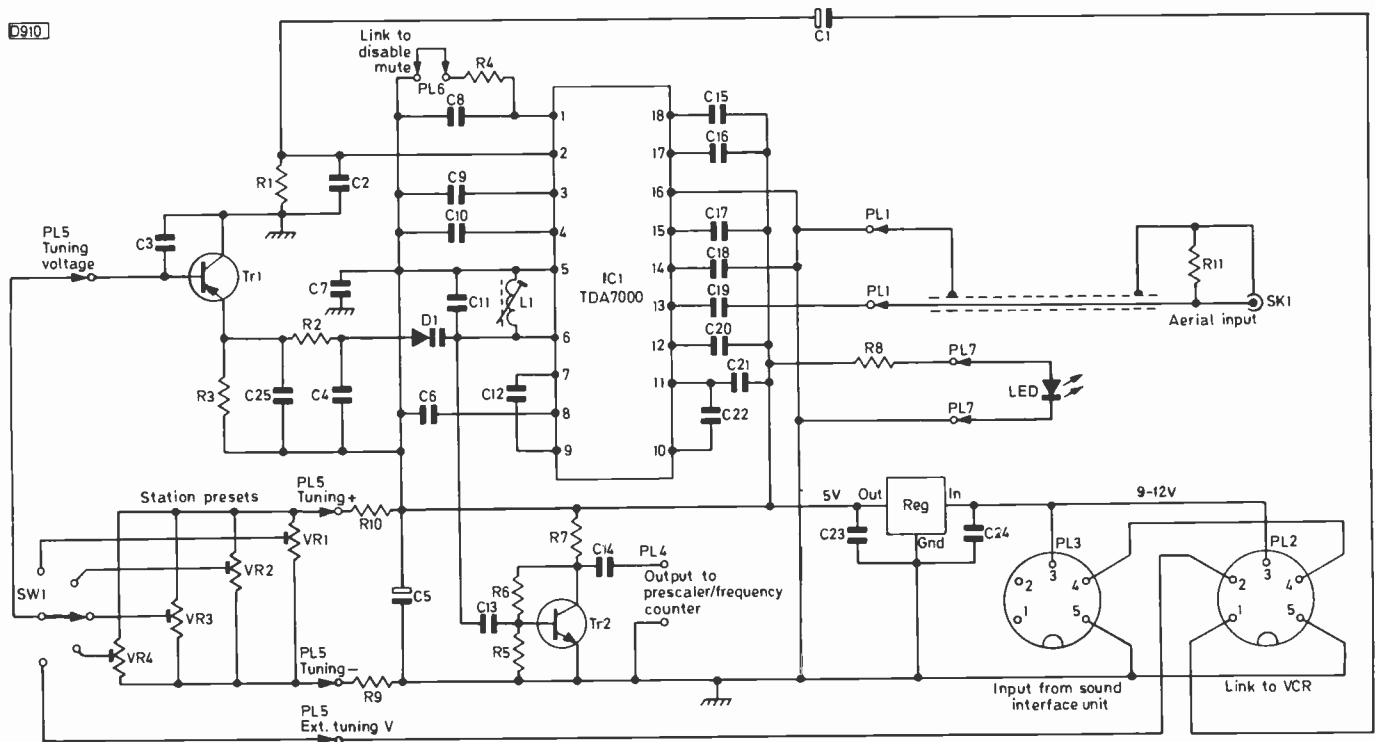


Fig. 2: Complete circuit of the VCR add-on f.m. tuner.

The full circuit of the add-on unit is shown in Fig. 2. The design follows the application report circuit except that tuning is controlled by varicap diode D1. Switch SW1 selects the tuning voltage from one of four preset potentiometers (VR1-4) or an external source. It's then buffered by Tr1, which is connected as an emitter-

follower, before being used to bias D1. R9 and R10 set the tuning range. The suggested values (2.2kΩ) provide tuning across the complete f.m. broadcast band.

PL6 can be shorted to disable the muting circuit - this connection could be brought out to a front panel switch if required. Tr2 is the local oscillator signal amplifier, incor-

Fig. 3 (right): PCB print pattern, 1:1 scale. Use standard 1/16in. fibreglass, single-sided.

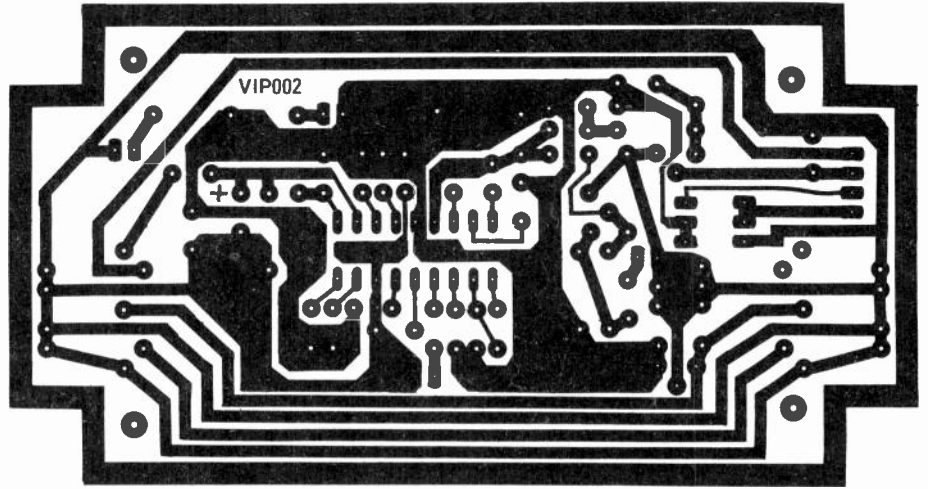


Fig. 4 (below): Board drilling diagram. All holes 0.8mm except A 1.2mm and B 3mm. Cut around the inside of the black border line.

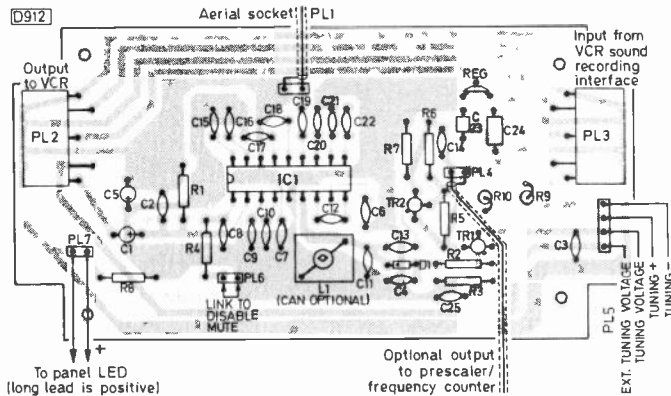
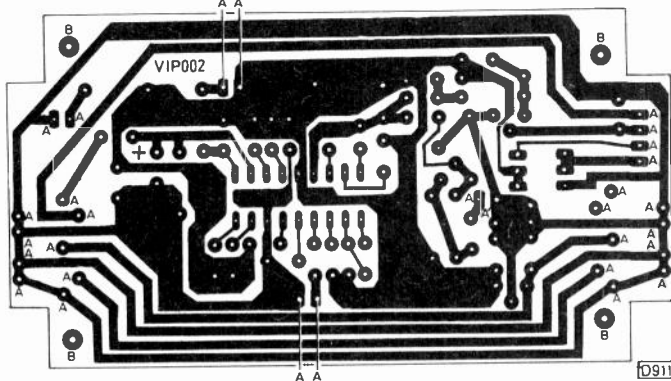


Fig. 5: PCB component layout diagram.

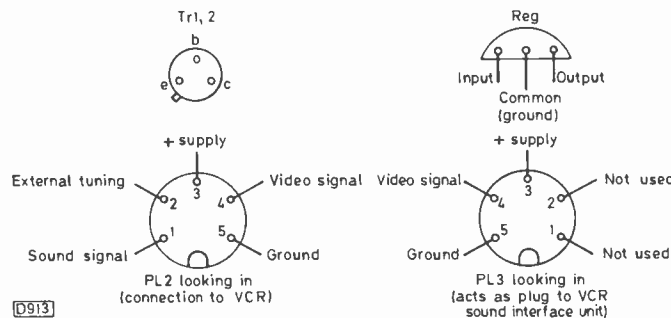


Fig. 6: Pin details.

ported to allow a prescaler/frequency counter to be connected for accurate tuning. Note that the output frequency is 70kHz below the incoming signal. If you don't require this feature, leave Tr2, C13, C14, R5, R6 and R7 off the board.

The TDA7000 is powered via a 5V regulator which

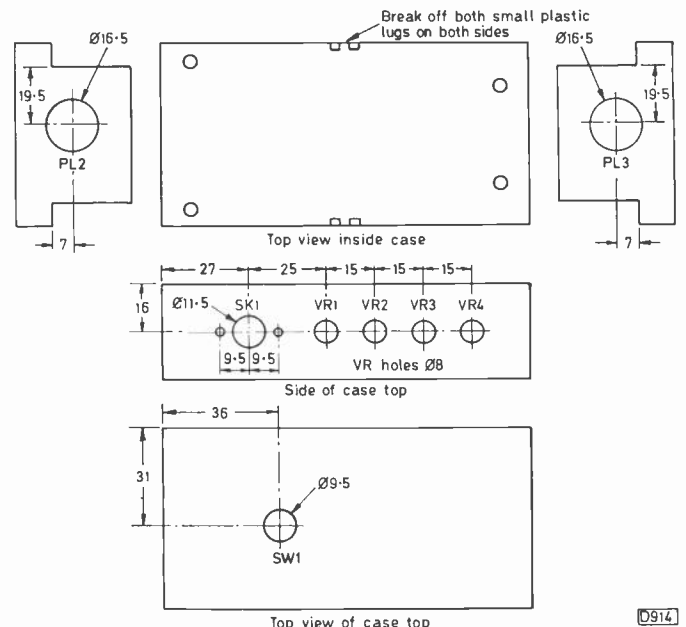


Fig. 7: Case drilling details (not to scale). All dimensions are in mm.

allows a wide range of input voltages to be used. A 4.5V battery could be used directly, but as it runs down the tuning will alter. In any case there's a small temperature effect on the preset tuning.

The two connectors PL2 and PL3 link the tuner to the VCR and the VCR sound interface unit respectively. PL3 is wired for one-to-one connection with the sound interface unit. This is best implemented by soldering back-to-back the pins from two five-way 240° DIN plugs, with the bodies discarded. Power is supplied from the sound interface unit or from the VCR via a Beta camera lead (see November 1987 article).

Construction and Setting Up

PCB details and the component layout are shown in Figs. 3-5. Pin out details are shown in Fig. 6. A single-sided PCB can be used, but the layout is slightly critical. Common-sense rules concerning the need for short leads in the r.f. circuits apply here. Case drilling should be straightforward: a diagram is shown in Fig. 7.

Setting up is simple. First, connect the tuner to the VCR sound interface unit. Switch on and check that the

— continued on page 509

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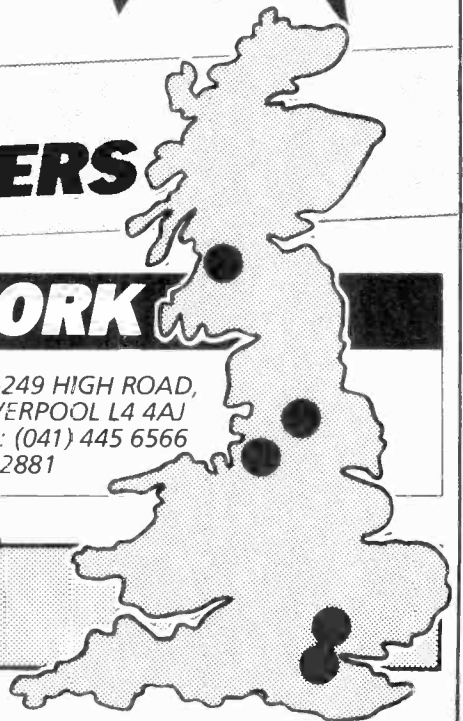
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RECEIVER K3 Tex Front Panels with I.C.s (SAA3027P/SAB3013/HO448328) £5.00	TUNER 75p
G8 100K Pots on Panel & Lead for 6 Push Button Unit £2.00	GEC 20AX POWER SUPPLY Mark 2 £10.00
K30 Mains Switch remote £1.00	THORN 9000 4.7m 400V 40p
K35 Mains Switch remote 75p	12 VOLT BATTERY PACK Nicad A.A. £5.00
K35 Aerial Socket and Plug in Lead to Tuner £1.50	G8 TUNER V/CAP on Panel £3.50
KT3-K30 Slider Pots 4.7ku 20p each	G8 SPEAKER 75p
LARGE Foacs Pots. Fits Pye, GEC, ITT, Decca 75p	9,000 SPEAKER £1.00
G8 Power Supply Panel £4.00	THORN 9000 Sound OP Panel £30p
EX DECCA 80-100 Decoder £5.00	ONE I.C. K35 Decoder £7.00
EX DECCA 80-100 Frame £5.00	K30 IF/K35 IF £2.00
THORN 8000-8500-8800 Decoder £6.00	THORN Lopt 8500-8800 £4.00
GLASS BEADS Diodes 200w/1.2A 25 for £1.00	TX9 THORN Tuner Panel with I.C.S Pots £3.00
G11 IF Panel £8.00	THORN CHASSIS 1600-1700 Series Mono £10.00
G11 Decoder Panel £8.00	THORN 1600 Rec- & Anode Cap 50p
JVC HEADS 3155 £20	KT3-K30 Slider Pots 4.7k £1.00 for 10
G11 Condenser 470/250V ITT £2.00	K35 20 Turn Pots 6p each
G9 Power Panel £3.50	HITACHI & GEC 20k Pots 20 for £1.00
G8 Line Panel £12.00	KT3 K30 Speaker 30p
G8 Transductor £1.25	K30 Push Button Switch 6 Way £1.00
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G8 Con/Panel New Back Type £4.00	K35 12 way Push Button Unit £1.50
KT4-KT3-K30 Handset Replacement £12.00	K35 L.O.P.T. Split Diode £6.00
HT520 METER 20,000 Fuse Diode Protector Logic Test Facility £15.90	RANK T20 Front Panel £6.00
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9000 SERIES Decoder 01 929 014 080 Thorn £5.00	6 off LED DISPLAYS, Mixed £1.00
LATEST VIDEO For Latest Philips, GEC, Pye and Hitachi Front panel with memory chip and push button and pots and LED's £6.00 NEW	HAND SET TESTER, Infra Red £8.00
20AX GEC LOPT Panel with Split Diode £4.00	AERIAL SPLITTER with filter £1.00
RANK T20 Focus Pot 75p	UNI DIRECTIONAL Dynamic Microphone £2.00
RANK 718 Focus Pot £1.00	20 TURN POTS with Band Switch 10p
26" LOPT Split Diode 2432301 £8.00	PUSH BUTTON Mains Switch with Screw Holes Fixing 4 for £1
16" LOPT Split Diode 2433481 £6.00	PYE 731 Line Trans £3.50
Ex Panel Split Diodes 2432871/2432981 £5	PYE 731 New Power Supply £4.00
Split Diode 2433752 £6	800v DIODES at 3 amps. Glass Beads 6p each, 20 for £1.00
T703A LOPT Transformer Rank with Focus Pots and Diode £3.00	KT3 Line Output Transformer £5.00
HITACHI Mains Switch 50p	9000 THORN Front Panel with POTS & Push Buttons £4.00
HITACHI AE Socket 30p	THORN 8500 Time Base £3.00
-1 CONDENSER Axial Leads 450 A/C 1200 D/C 15p	7 SEG DISPLAYS 4 Bank Display, Z-6042T 50p
MAINS TRANSFORMER 240v in/200v/8v £1.00	SPLIT DIODE FBS1245AR £5.00
GREEN FLAT, NEC, LED's 3p each 100 for £2	PHILIPS KT3 4R7 W.W. Resistor 15 for £1.00
15V015V 1 Amp Print Type £1	PHILIPS FOR PICK UP HEAD GP422/GP2211 £1.50
12+12V 2.8VA Print 1"x1" 75p	GEC TEXT PANEL PC895A7
8+8V 1 Amp Print 75p	
ET596 UHF V/CAP Tuner, small £2.50	
FIDELITY Panels with I.C. £1.00	
FIDELITY LOPT Split Diode AT2076/80 £3.00	
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LINE TRANSFORMER Philips TX 12" and 14" Portable £12.00	
WANDER PHONES Key Pad and Hand Set, No Case £1.00	
TV AERIAL AMPS 1 way £9.00; 2 way £11.00; 3 way £15.00; 4 way £40.00; 6 way £50.00	

2432211 2432301 2432461 2432491 2432871 2432981 2432984 2433212 2433581 2433751 2433452 TX100 THORN 2433952 K4 L.O.P.T.	<h3>SPLIT-DIODE</h3> £6 EACH	33651 36072 36362 36383 36482 36761 36831 36832 36833 36921/79 36922/79	<h3>L.O.P.T.</h3> <h3>SPLIT DIODE</h3> <h3>PHILIPS</h3> £5 EACH	<h3>TRANSFORMERS</h3> 3112-338-30942 3112-338-30633 3111-268-30050 3112-138-98094	AT2036/00 AT2076/55 AT2048/11 AT2076/71T AT2055 AT2080/15 AT2076/35 RCO ST CT3325 AT2076/38 OT2041 AT2076/51	<h3>£10 EACH</h3>
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A Guide to Microwave Techniques

Part 2

Andrew J. Heron

So far we have described how a TEM wave can be propagated along a waveguide. But how can a TEM wave be established in a waveguide in the first place?

Waveguide Launchers

In general terms a wave is launched into a waveguide by setting up an electromagnetic field which resembles that of the desired mode (TE₁₀ etc.). This can be achieved by placing a probe, which is essentially a small aerial, inside the waveguide. Fig. 11 illustrates this. The probe is arranged so as to produce E-field radiation, and also to lie in the direction of the desired E-field strength. In its most basic form the probe can consist of the inner conductor of a coaxial cable, inserted through a hole in the guide so that it protrudes to the required extent. The TEM wave will travel along this conductor until it reaches the end and will then radiate almost equally in all directions relative to the end of the conductor. The radiated TEM wave strikes a waveguide boundary and is then reflected between two boundaries in the manner described last month.

Since the probe radiates laterally in both directions a plate is placed across the end of the guide to prevent energy "spilling out": energy radiated in the direction of the end plate is reflected back in the desired direction of propagation. The arrangement shown in Fig. 11 is for the TE₁₀ mode in a rectangular waveguide. For maximum power transfer the probe should be a quarter guide wavelength ($\lambda_g/4$) long, and would be positioned perpendicularly to and midway across the broad waveguide dimension. The distance between the probe and the end plate should also be $\lambda_g/4$.

The field pattern in the immediate vicinity of the probe is very complex, as it contains many modes. Since the guide's dimensions are in this case arranged to support only the TE₁₀ mode of propagation all higher modes will be rapidly attenuated. A few wavelengths along the guide only the desired mode will be present.

This form of launcher often incorporates a bar attached to the end of the probe, parallel to the broad guide dimension, to improve its mechanical rigidity. The additional bar will not significantly influence the process of launching the wave since it is perpendicular to the E field.

There are many forms and variations of launcher but the single probe described is the simplest and most commonly used type. The same probe arrangement can be used to extract the r.f. energy from the guide. The probe is usually connected to a coaxial socket mounted on the guide. Thus the r.f. signal can be coupled by a coaxial line to the associated equipment.

Waveguide Detectors

For communications purposes the r.f. signal is modulated. By placing a waveguide detector at the receiving end of the guide the original modulating information alone can be extracted.

Fig. 12(a) shows a typical waveguide detector. The doorknob transformer is energised by the electromagnetic

wave and thus acts as a detector of electromagnetic energy. A current representing the original modulating information is produced by the crystal detector, which is connected to the inner conductor of the coaxial output socket via the doorknob transformer. The capacitance between the doorknob and the waveguide is such that it acts as a bypass filter for the r.f. carrier. As the frequencies used in waveguide transmission are extremely high, only a small capacitance is required and can easily be obtained. The top section of the socket is designed to form a rejection filter at the carrier frequency.

Thus the signal information is separated from the carrier signal in exactly the same way as with the equivalent, conventional circuit – see Fig. 12(b) – used at lower frequencies.

Waveguide Components

The principles outlined so far allow an r.f. signal to be launched into a waveguide at one end and extracted at the other. Various components can be used to introduce discontinuities in the guide, making waveguides comparable with conventional transmission lines.

The Two-screw Tuner

When a length of waveguide is connected to an aerial the guide's impedance must, for maximum power transfer, i.e. zero mismatch, equal that of the aerial or, more precisely, the aerial feed point. Inserting a screw into the broad dimension of a waveguide is electrically similar to connecting a tuning stub across a transmission line. For a full explanation of the action of such a screw, mathematics

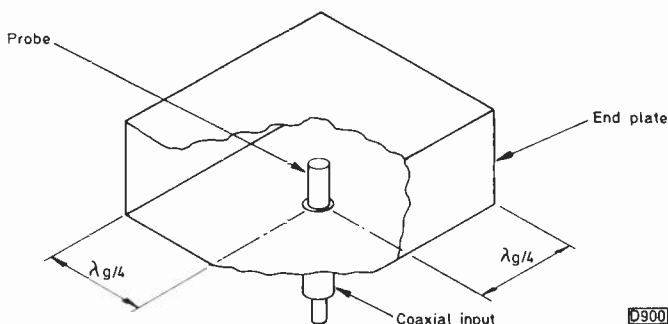


Fig. 11: Launcher probe in a waveguide.

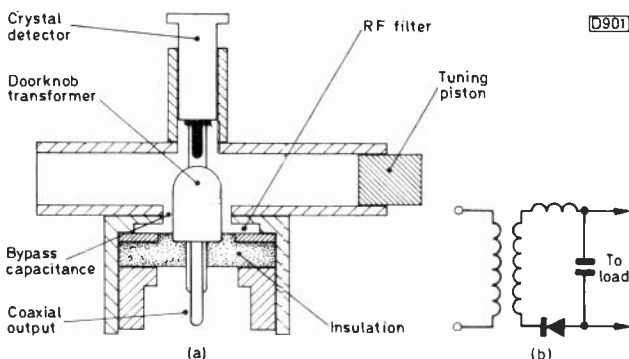


Fig. 12: Waveguide detector (a); equivalent circuit (b).

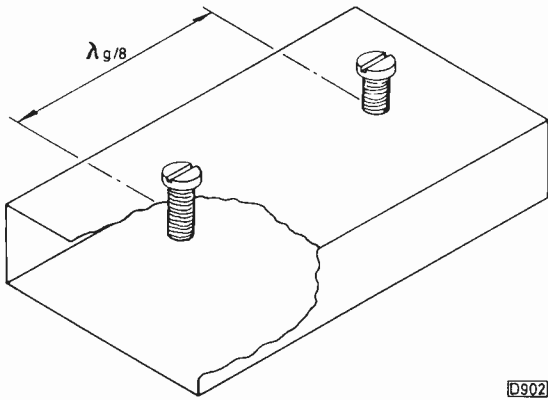


Fig. 13: The two-screw tuner.

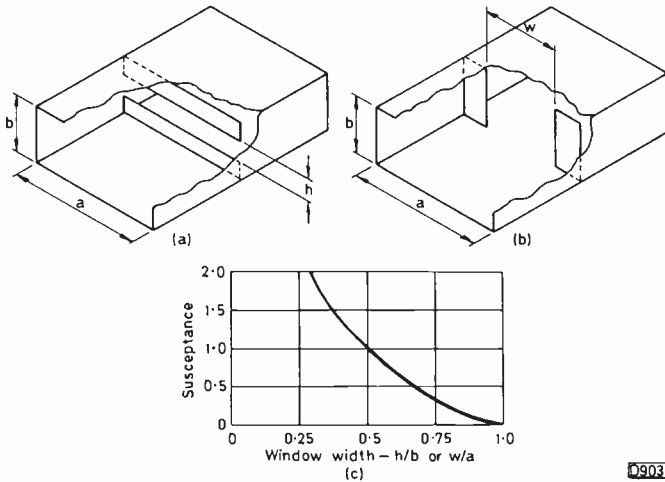


Fig. 14: Iris apertures.

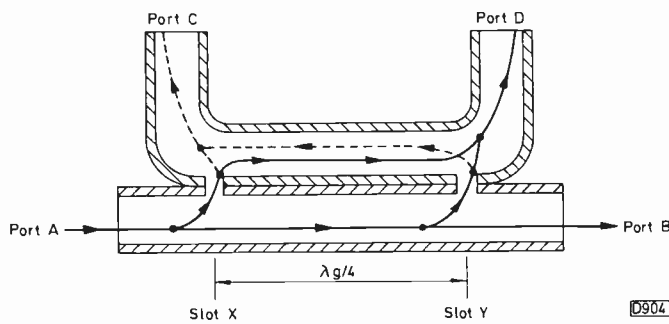


Fig. 15: The directional coupler.

employing complex notation would be required. Suffice it to say that: (1) A screw whose depth of penetration into the waveguide is less than $\lambda_g/4$ will introduce a capacitive susceptance. The latter is defined as the inverse of capacitive reactance. (2) When a screw is inserted by more than $\lambda_g/4$ an inductive susceptance is introduced. Inductive susceptance is the inverse of inductive reactance.

Fig. 13 shows a two-screw tuner: it consists of two screws inserted in the broad dimension of a short length of waveguide, usually $\lambda_g/8$ apart. When considering a mismatch we are concerned with the system's voltage standing wave ratio (VSWR or SWR). The mismatch can be considered as the presence of unwanted reactance in the system. An appropriate susceptance is introduced by inserting both screws a certain distance: since susceptance is the inverse of reactance, the net effect of adjusting the screws is to add a controllable susceptance to cancel the unwanted reactance. In this way the impedance becomes

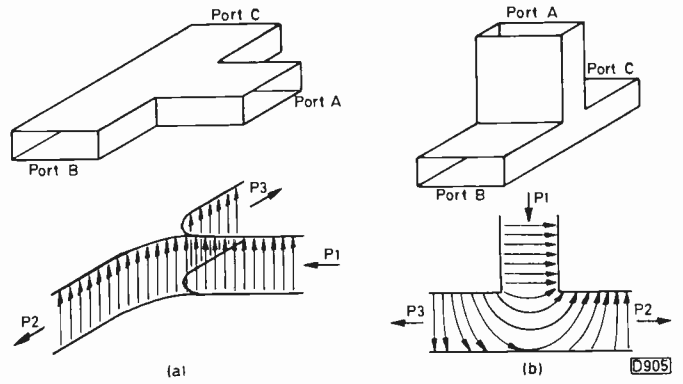


Fig. 16: Tee junctions, (a) shunt, (b) series. For (a) $P_2 + P_3 = P_1$. P_2 and P_3 are in phase. For (b) $P_2 + P_3 = P_1$ but P_2 and P_3 are in opposite phase.

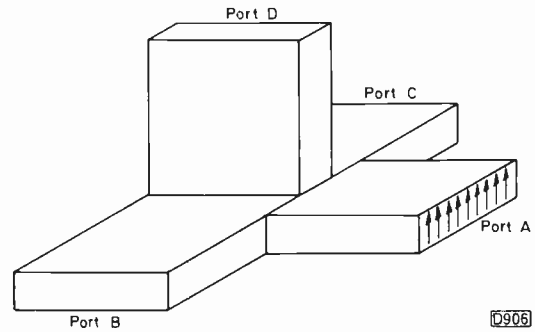


Fig. 17: The hybrid tee.

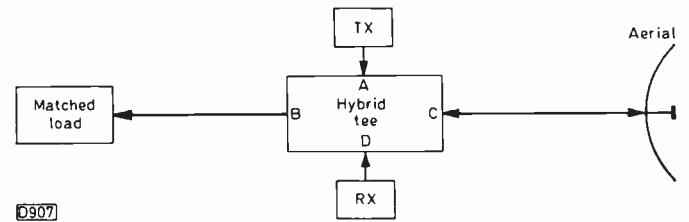


Fig. 18: An important application of the hybrid T - as a T/R (transmit/receive) coupler.

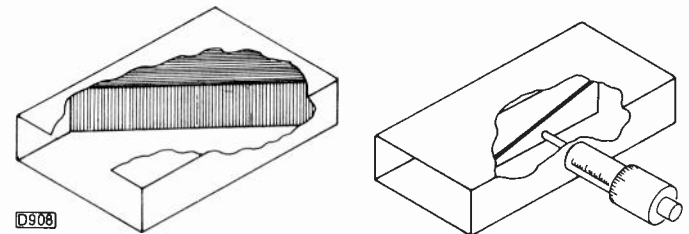


Fig. 19 (left): Waveguide matched load. Fig. 20 (right): Waveguide attenuator.

purely resistive, the condition required in any transmission system for maximum power transfer.

A two-screw tuner will usually provide the matching required. Where a match cannot be achieved in this way a three-screw tuner will correct any mismatch.

Iris Apertures

Another way of introducing a susceptance into a waveguide is to incorporate an iris aperture. This usually takes the form of a pair of thin metal plates parallel with either the broad or narrow guide dimension. The iris operates in a similar manner to a two-screw tuner but generally provides a fixed susceptance value since the

plates are usually fixed to the guide and cannot readily be adjusted.

The majority of waveguide connections introduce a degree of mismatch into the system. Iris apertures are provided as an integral part of a waveguide to correct such mismatches.

Depending on its position within the guide an iris will provide either a capacitive or an inductive discontinuity. With the plates arranged as shown in Fig. 14(a) a discontinuity is introduced across the waveguide's broad dimension. Since this obstructs a section of the E field the iris is capacitive. The same rules apply as with a conventional capacitor. When the distance between the plates is reduced, the capacitance is increased. This reduces the capacitive reactance and increases the capacitive susceptance introduced into the guide by the plates. The magnitude of the susceptance is thus proportional to the distance between the plates. Since a capacitive iris reduces a waveguide's narrow dimension (b) the power level that can be transmitted in the guide is lowered, due to the danger of arcing across the guide. This limits the use of capacitive irises.

With the plates arranged across the narrow dimension of the waveguide, as shown in Fig.14(b), the H field is partially obstructed and the iris is thus inductive.

It will be apparent that a combination of capacitive and inductive apertures can be used to obtain correct matching, in a similar manner to the two-screw tuner.

The Directional Coupler

We may wish to extract a proportion of the signal in the guide, say for measurement purposes. This can be done by introducing a discontinuity in the form of a slot cut in a wall of the guide.

It can be shown that a narrow rectangular slot cut along the centre of the guide's a dimension will be non-radiating. If this slot is moved across the a dimension, towards either of the side walls, the slot will radiate a fraction of the E field: the intensity of the radiation is proportional to the slot's displacement from the centre line. In a similar fashion the power radiated by a slot across the b dimension is proportional to the width of the slot.

Fig. 15 shows two lengths of waveguide, A-B and C-D. Both have two slots, X and Y, cut across the broad dimension at a distance of $\lambda g/4$ apart. If a TE₁₀ wave is launched into the lower guide at port A, so that it propagates in the direction A-B, most of the power will arrive at B. In travelling along the guide however the wave will pass the two slots X and Y, each of which will couple a fraction of the power into waveguide C-D. The power radiated from each slot will divide equally between C and D.

The power radiated from slot X to port D will have the same path length as the power radiated from slot Y to port D. The two powers will therefore be in phase and the resultant power at port D will be the addition of the powers from each slot. As you can see, the power radiated from slot Y to port C has a greater path length than that radiated from slot X to port C. If the distance between the slots is $\lambda g/4$, the path length difference is twice this, i.e. $\lambda g/2$. There is thus a 180° phase difference between the two powers, which will cancel each other to produce zero output at port C. If the wave was being propagated from B to A there would, similarly, be zero output at port D. So what we have here is a directional

coupler.

Where AB is a section of the main transmission path the directional coupler can serve as an indicator of VSWR. This is because the output at port D is proportional to the magnitude of the radiation in the direction of propagation while the output at port C is proportional to the reflected wave.

Coupler Characteristics

The efficiency of such a device is usually described in terms of the following parameters. *Coupling coefficient*, given by $10 \log (PA/PD)$ dB, is the proportion of the main signal that's directed to D. *Through loss*, given by $10 \log (PB/PA)$ dB, is the attenuation of the main signal due to propagation through the coupler. *Directivity*, given by $10 \log (PD/PC)$ dB, is the relationship between the two radiated powers. *Isolation*, given by $10 \log (PA/PC)$ dB, is the efficiency of obtaining zero output at port C.

Since the distance between the two slots is $\lambda g/4$, the coupler is frequency dependent and its performance will deteriorate as the transmitted signal deviates from the design frequency.

The T Junction

Where the power is to be divided between two separate systems a waveguide T junction is generally used. There are two forms, H field (shunt) and E field (series). Their operation is illustrated in Fig. 16: for a perfect junction the outputs at ports B and C will be half the power entering at port A.

The Hybrid T

Fig. 17 shows the hybrid tee, or "magic T" as it's commonly called. It can be considered as a combination of E- and H-field junctions. The properties of the hybrid tee are such that power entering one port is divided equally between two other ports with no power being transferred to the fourth port. If a TE₁₀ wave with its E field in the direction shown enters port A the field will be divided equally between ports B and C. The E field will not propagate in the direction of port D since its direction will not allow this – the E field is parallel to the conducting boundaries and is not zero at these boundaries.

An important application of the hybrid tee is shown in Fig. 18. The transmitted power is at all times disconnected from the receiver while both the transmitter and the receiver are connected to the aerial. The power from the transmitter is divided equally between ports B and C. Port B is terminated with a matched load and will therefore not introduce a mismatch in the transmission path. The power received from the aerial is divided equally between port D (the receiver) and the matched load connected to port B. Thus a single aerial with two feeds via the hybrid tee can be used simultaneously for transmission and reception.

Matched Loads

A matched termination can be used to terminate unused T-junction ports etc. in a transmission system or to simulate a perfectly matched load. The latter application is particularly useful for various measurement procedures, for example to determine the characteristics of directional couplers.

The matched termination must absorb all the power in

the guide and introduce as small a mismatch as possible in doing so. Fig. 19 shows a common form of matched load. It consists of a short length of waveguide with one end closed off with an end plate: a wedge shaped piece of lossy material – usually resin loaded with iron dust – is slid into the guide. The principle is as follows. Microwave energy entering the wedge produces eddy currents within it, due to the iron content. These eddy currents dissipate the microwave energy in the form of heat. The wedge shape is used because the material introduces a discontinuity into the guide: to minimise reflections the discontinuity must be introduced gradually.

The length of the wedge should produce a reduction factor of 100, i.e. an attenuation of -20dB , as the energy passes through it. After passing through the wedge the attenuated energy is reflected by the end plate. It then passes back into the wedge where it will experience a further attenuation of -20dB . Thus the reflected signal emerging from the wedge should be $1/10,000\text{th}$ (-40dB) of the original level.

Waveguide Attenuators

Attenuators are used to reduce the power level in a system. This may for example be necessary to protect a

delicate instrument when taking measurements where the transmitted power is relatively high.

Fig. 20 shows a common form of attenuator. Attenuation is produced by the tapered resistive strip which is inserted into the guide parallel with the narrow dimension. Microwave energy sets up currents in the strip (commonly referred to as a vane), the energy being dissipated as heat. The E field, which the vane obstructs, varies from zero at either sidewall to a maximum at the centre of the broad dimension. Maximum attenuation is thus obtained with the vane in the centre of the guide. The attenuation can be varied by adjusting the position of the vane.

The vane is tapered so that the disturbance it introduces in the guide is gradual, thereby keeping reflections from the vane to a minimum. The micrometer provides precise adjustment and enables the device to be calibrated in decibels accurately.

Practical Devices

Note that the waveguide devices described in this article have been shown in the diagrams in their simplest form. In practice flanges would be included to allow connection between components and the main guide.

Thanks a Million

Les Lawry-Johns

What a lovely lot of readers we do have. There's no doubt about it. For example Cliff Mitchell from Bexleyheath popped in last week and presented me with a bottle of Teacher's. A lovely man who remembered that H.B. doesn't like this brand in her coffee so that I'd have to drink the whole bottle neat. I toasted Cliff several times that evening. Cheers!

As he departed Keith and Alex from Portsmouth popped in. They were on their way to Sendz at Southend to pick up several bits and pieces and presented me with a couple of Thorn triplers. Thanks, lads, they'll come in very handy: I've had to ease up on my ordering recently so as not to upset my bank manager – since I've not been able to think too clearly of late I've not been able to make much money. Keith and Alex also sorted out the battery board of a Philips 10CX1120 that had been puzzling me. Although I had the circuit it didn't show what voltages to expect and I had been too stupid to expect a 110V output from the board. Thanks the pair of you – call in again and rescue me anytime!

The Tandberg

This chap came in and asked me to look at his TV set. I asked him the make. Tandberg he said. I thought it would be of Scandinavian origin, but it had "Made in Scotland" on the back. I removed this and peered at the unfamiliar inside.

He said the picture was distorted. When I switched the set on there was hum on the sound and a severely curved picture, so I accused the main reservoir electrolytic of being open-circuit. I didn't have one with the right pins, so I checked the voltage and fitted a $470\mu\text{F}$, 300V electrolytic inside the cabinet, taped to the cableform that runs under the tube. The resulting picture was lovely and the sound

was clear of hum. I charged a tenner and he went away well pleased.

He came back next day and the new capacitor was a right old mess. I fitted another one and decided to leave the set on test for a while. After an hour I switched it off and left it for ten minutes. Upon switching on again there was a gurgling noise and the new capacitor had once again failed.

To cut a long story short, the switch-mode power supply was not switching on. Without a load the voltage produced by the mains bridge rectifier was excessive, so the reservoir capacitor failed. It transpired that the h.t. preset control was intermittently faulty. A new one, along with a new electrolytic (higher voltage this time, just in case) put things right. The set was tested for a further couple of days before the customer collected it and paid another five pounds.

An ITT CVC9

A friend from the Medway towns brought in an ITT CVC9. He said he didn't have any valves for it so could I fix the set for him? The PY500 boost diode was getting very hot but the PL509 line output valve wasn't. I straight away checked the boost reservoir capacitor, but it was innocent. I checked the PY500 which was also innocent. So was the PL509. When I disconnected the tripler from the line output transformer the PY500 didn't overheat and the sound came on. I stared at the tripler: it shouldn't have caused the PY500 to overheat. Just then I noticed that the beam limiter resistor was cooked. There must have been a leak in the tripler.

Anyway, a new tripler and resistor restored normal operation and a beautiful picture was displayed. The set was a 22in. model. I've never had to replace the tube in one of these in my life. It's a pity that later models didn't have the same tube life span.

More Tripler Trouble

How about that Grundig 2210 that had me by the short and curlies (remember? – last November!). It kept blowing the fuse I'd added in the supply to the line output stage, sometimes after an hour or so, sometimes after a whole

day. The cause of the trouble turned out to be the new tripler that had been fitted a short time earlier.

How did we find out? Well, you'll remember that the set had been given to us. Phil took it home with him and his parents' Grundig needed a new tripler. So he fitted the one

from the 2210. It worked fine for a while, then the cut-out started to trip every now and again. Oh well, as long as we know. Thanks Les Austin (Letters, January) for all your advice on these sets. Sorry it took so long. Some of those resistors had been the wrong value.

Resurrecting a Dead Siemens

Colin Boggis

I was recently given a 22in. Siemens Model FF306 with remote control. The problem was that the thick-film focus and first anode supply unit had flashed over, rendering the entire line output transformer, of which it's a part, useless. The spares agent for these sets is Mastercare, and an enquiry produced the information that replacement line output transformers cost around £60. This explains why I was given the set – with labour, the repair bill would have been around £100. That's a bit steep for a four year old set, even allowing for the fact that it was otherwise in almost new condition.

I decided to see whether it would be possible to resurrect the set for a lot less money. The line output stage circuitry (see Fig. 1) is standard, so I thought that it might be possible to use a Ferguson TX10 focus assembly along with a separate potentiometer for the first anode supply – provided the faulty parts could be safely isolated from the existing line output transformer.

Modifications

Adopting a "go for broke" approach, I simply cut off the top part of the focus assembly (see Fig. 2), using a hacksaw as carefully as I could manage. Having done this I covered the exposed wire ends with epoxy glue to provide insulation.

I then wired in the TX10 focus unit and a first anode potentiometer (see circuit shown in Fig. 3) and crossed my fingers as I switched the set on. It sprang into life, with a healthy crackle as the e.h.t. came up, and after setting the first anode voltage, the grey-scale and focus I was rewarded with a perfect picture.

To check the safety of the epoxy resin insulation I gingerly prodded around the glue with an earthed probe, trying to provoke a response. None came, so I appeared to

have won. The modification cost about £10, a saving on parts of some £50.

After soak testing for a week or so the set developed a "flutter" when switched on from cold. This was traced to a faulty BR303 thyristor in the power control circuitry.

It's six months since I sold the set and there's been no comeback. A lot of TV sets use a similar line output transformer assembly and in suitable cases this TX10 approach might well be worth trying.

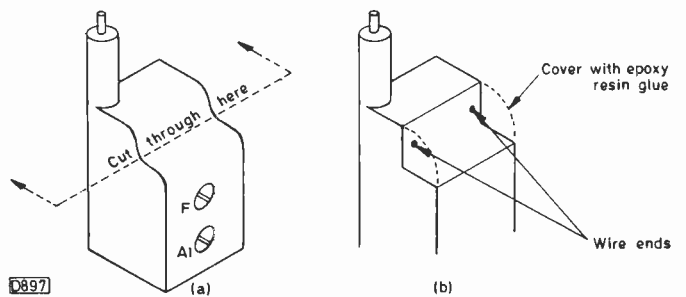


Fig. 2: Where to cut through the focus/A1 section of the line output transformer (a), application of epoxy resin insulation (b).

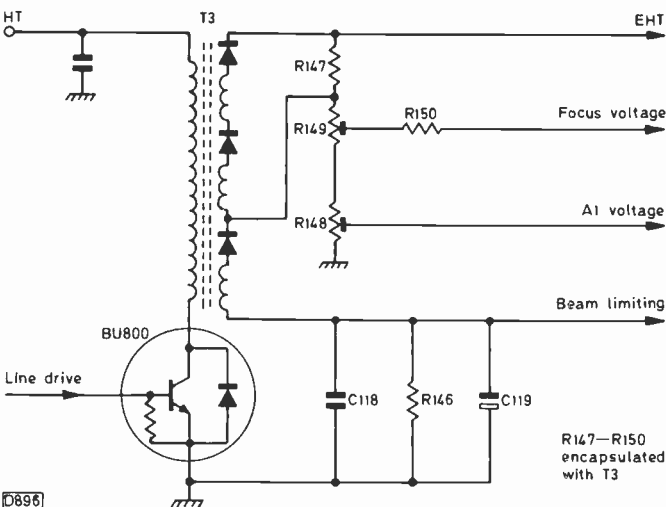


Fig. 1: Original e.h.t., focus and first anode supply circuitry used in the Siemens Model FF306.

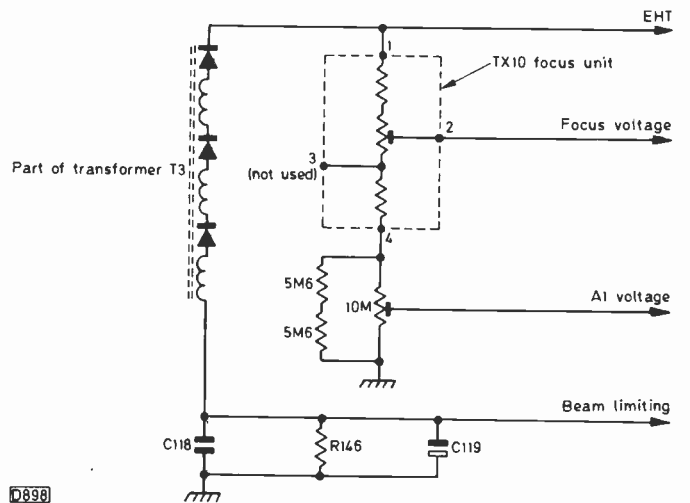


Fig. 3: Modified circuit using the focus unit used in the Ferguson TX10 chassis.

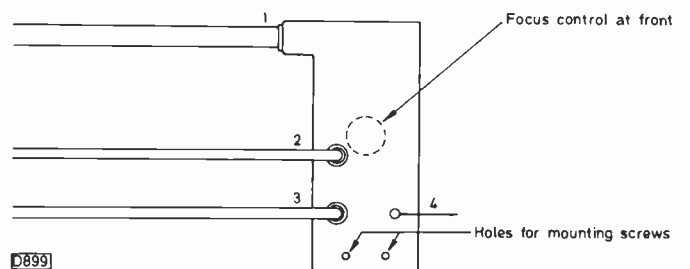


Fig. 4: Connections to the TX10 focus module (rear view).

Teletopics

AGREEMENT REACHED ON HI-BAND 8mm SYSTEM

Sony reports that agreement has been reached by a group of companies on the basic specification, so far NTSC only, for a Super 8mm video format. In addition to Sony the companies involved are Aiwa, Canon, Hitachi, Hitachi Maxell, Fuji, Konica, Matsushita (Panasonic), Sanyo and TDK. The NTSC specification is: peak white f.m. 7.7MHz; sync tip f.m. 5.7MHz; frequency deviation 2MHz; recording current adjusted for optimum at 7MHz; white clip level 220 per cent; dark clip level 90 per cent. The colour and audio specifications remain the same as the standard 8mm format.

A new high-coercivity metal-particle tape is required, a special detection hole in the cassette enabling the machine to identify the tape type automatically. Machines produced to the new standard will be able to play and record in the standard 8mm mode, but Super 8mm recordings will be incompatible with standard 8mm only machines.

The draft Super 8mm specification has been submitted to the Electronic Industries Association of Japan (EIAJ). Super 8mm equipment is not expected to go into production until some time next year and will be marketed in the NTSC countries first.

Sony has also announced the 625/50 specification for the ED Beta system, which was described in our October 1987 issue. Peak white f.m. is 9.3MHz and sync tip f.m. 6.8MHz, giving a frequency deviation of 2.5MHz. The white clip level is 200 per cent and the dark clip level 70 per cent. The horizontal resolution is 500 lines and the wide deviation results in a high signal-to-noise ratio. No launch dates or prices have been announced.

SATELLITE TV

The scheduled launch date for the Astra satellite has been put back to November 1st while the transmitter power level has been increased to 52dBW. The latter means that a 60cm dish will be suitable in southern and eastern England; in the north and west a 75cm dish should be suitable.

British Telecom is to demonstrate a new DBS TV control system this summer. It will be the first of its kind to use the pan-European MAC standard with integrated signal scrambling and subscriber management systems (billing and customer enquiries). The computer software for the system has been developed by British Telecom's Research and Technology Division at Martlesham. The demonstration will be carried out via one of the present low-power satellites and British Telecom is inviting programme providers to participate.

An encryption system for use with D-MAC/D2-MAC to provide for pay-TV services has been agreed between those designing the decoder chip sets and the providers of future services. It's known as Eurocrypt.

Two sets of discussions are taking place on the future of Super Channel, which is owned by fourteen ITV companies and the Virgin Group and was launched in January 1987. The Television Broadcasting Company, a consortium that includes Carlton Communications, Thames Television, London Weekend Television, Dixons and Saatchi and Saatchi, has been seeking a majority stake.

Simultaneously, talks on forming a joint general entertainment channel have been taking place with Rupert Murdoch's Sky Channel. The latter arrangement would release a transponder for the proposed Eurosport channel. Super Channel's loss for the current year is expected to exceed £8m: so far some £46m has been invested in the service.

DBS ENGINEERING CONFERENCE

Speakers from five countries are to deliver papers at the "Direct Broadcast by Satellite" engineering conference, a two-day non-residential event scheduled to take place in the IBA's London Conference Hall on June 16-17th. The conference is being organised by CONCERT, the conference arm of the Society of Electronic and Radio Technicians, in conjunction with the IEE, the IERE, the IEEE, the Royal Television Society, RETRA and the Conference of Aerial Installers. Members of these organisations can attend at the rate of £100 plus VAT for the two days or £50 plus VAT for either day. Charges for others wishing to attend are £120 plus VAT for the two days or £60 plus VAT for either day. The conference will cover the engineering aspects of DBS in some detail – topics listed for inclusion are DBS basics, system installation and related problems, the D-MAC transmission standard, set-top box and interfacing problems, scrambling and conditional access. For further details apply to Janet S. Firmin, CONCERT, 57-61 Newington Causeway, London SE1 6BL (telephone 01-403 2351).

PROSPECTIVE UK TV SERVICES

The results of studies into the feasibility of extra UK TV channels in the low s.h.f. band and at v.h.f. have been announced by the Department of Trade and Industry.

The suggestion for a pay-TV channel at v.h.f. does not appear to be feasible due to interference and coverage problems. Planning a system that would avoid co-channel interference and interference to PMR allocations could result in a coverage of only 30-40 per cent of the population.

An 'MMD (multichannel microwave distribution) service at s.h.f. is considered to be feasible however, providing up to twelve extra channels with a coverage of 70 per cent of the population. How the channels would be used remains to be seen – whether for new national services or as a supplement to cable TV operations.

The earlier proposal to use spare u.h.f. capacity to provide one or two extra national channels, with coverage limited to 50-70 per cent and 50 per cent respectively, is also considered to be feasible.

INDUSTRIAL SCENE

Tatung is to invest £4.6m at its Telford, Shropshire plant, creating an additional 220 jobs. The investment will establish a high-tech manufacturing facility for computer monitors and expand the existing colour television receiver manufacturing facilities. The Department of Trade and Industry has provided a £600,000 grant under the Regional Selective Assistance scheme. It will be the first time that Tatung monitors have been produced outside Taiwan and should reinforce Tatung's position as the world's largest monitor manufacturer.

Mitsubishi is to expand its VCR plant at Livingston, Scotland, creating a further 250 jobs by next year. A manufacturing facility for VCR parts, including head drums, will form part of the expansion. VCR production should increase from 226,000 last year to over 300,000 next year – about three quarters of the output is exported.

South Korea's third largest consumer electronics manufacturer Daewoo intends to establish a £5m VCR plant in Europe. There are good chances that it will be set up in Wales. Production is expected to start at 100,000 machines a year rising to some 300,000 after two years. Much of the production will be for the OEM market – Alba and Sentra are amongst the firms already supplied with VCRs by Daewoo.

Toshiba and Samsung are to set up two joint-venture VCR plants in South Korea, mainly to supply the US market. One will produce complete VCRs and the other VCR kits in chassis form. Some of the latter will be assembled at Toshiba's Tennessee plant in the USA. The new plants will have an initial output capacity of 600,000 units each.

Prestwich Holdings, which bought Bush Radio for £15.5m about two years ago, has announced that it will sell the company if a suitable offer is made. While Bush remains profitable it has been affected by the current squeeze on margins in the consumer electronics market.

SPARES AND SERVICING

Our TV/VCR Spares Guide published last month should have mentioned that Charles Hyde and Son Ltd. of Prospect House, Barmby Road, Pocklington, York YO4 2DP (telephone 075 923 068) is an official spares distributor for Sharp consumer electronic products. We have been sent a copy of Charles Hyde's detailed and very clear spares catalogue. The company is also an officially appointed spares distributor for Philips and Ferguson, and stocks spares for TV sets and VCRs sold by GEC, Hitachi, Sanyo, Sony, Toshiba and other manufacturers.

More than 400 technicians from independent dealers have attended a series of service seminars on the latest ITT TV receivers run by SL Consumer Electronics (UK). The roadshow reinforces the company's continuing commitment to the independents following the recent subcontracting of the service division to its former services and spares management, which trades as Hoopwell Ltd. (see Spares Guide).

The headquarters of the Mitsubishi Electric UK Ltd. Consumer Products Division has moved to Travellers Lane, Hatfield, Herts AL10 8XB (0707 276 100). The Service Department remains at Otterspool Way, Watford for the time being but is due to move to the new site. We will announce the date when this has been decided.

NEW FERGUSON TV CHASSIS

The new Ferguson TX99 chassis has been designed as a replacement for the 90° TX90 chassis in the larger screen sizes. One mechanical change is that the controls are no longer integrated with the single PCB chassis, giving greater flexibility in presentation. Circuit features include a chopper power supply that provides mains isolation, a TDA3301B colour decoder chip with auto grey-scale correction, improved flywheel line sync efficiency and non-interlaced teletext operation. A detailed article on the new chassis will be appearing in a later issue.

VIDEO EQUIPMENT

Sony's first VHS VCR, Model SL-V201, has now been released in the UK. The suggested retail price is around £400. Features include index search, HQ circuitry, noiseless freeze frame, variable slow motion, infra-red remote control and a 365 day/8 event timer. The SL-V201 has been designed to interface with Sony's 8mm video equipment and the RM-E100 edit controller.

For those who want a video playback only machine Tatung has released the TVP1311 to sell at under £200. Features include auto repeat and rewind, shuttle search and freeze frame. One use for which Tatung considers the machine will find a widespread demand is as an economical second domestic video.

Following evaluation by IBA engineers and ITV companies the IBA has agreed to the use, under certain conditions, of a modified version of the JVC VHS camcorder by freelance news cameramen working for regional news programmes. In its basic specification the camcorder does not meet normal broadcast standards, but modification at component level improves the picture to an acceptable standard. Since processing at the studios degrades the picture quality to below that normally achieved by current ENG equipment, limits on operational practice have been agreed between the IBA and the ITV companies, i.e. the first replay is to be made in component signal form to a recognised type of ENG VTR. The idea is that the JVC camcorder can be used by stringers for mute news material.

GRANDATA MOVES TO LARGER PREMISES

Grandata has moved to larger premises at K.P. House, Unit 15, Pop-in Commercial Centre, Southway, Wembley, Middx (telephone 01-900 2329). The mail order operation is being streamlined and the product range expanded.

LATEST FROM GREENWELD

Greenweld (443S Millbrook Road, Southampton SO1 0HX) has released its 1988 Spring Supplement, a 24-page catalogue detailing new lines introduced since publication of the main 88-page catalogue last October. Of interest is a security CCTV system comprising a camera and 12in. monochrome monitor at £199.95. Other additions to the Greenweld range include in-car audio products, several stereo mixers, a range of 8/12/16 channel audio mixers, a couple of video/audio enhancers and a cine/video converter at £18.95 for use with a cine/slide projector and a video camera with micro capability.

TELETEXT RETRO-FIT KITS FROM FERGUSON

Ferguson has introduced a range of kits to convert certain models fitted with the TX100 chassis for teletext operation. It's emphasised that only full remote control receivers can be adapted economically: the kits are for dealer only fitting and full instructions are included – fitting time should not exceed half an hour. Kit TA171 is for use with Models 22D2, 26D2, 51A8, 59B8 and 66B8; kit TA173 for use with Model 51A0; kit TA174 for use with Models 51A2, 59B2, 59D2 and 66B2; and kit TA188 for use with Models 20G2, 22G2 and 26G2.

IN BRIEF

Toshiba has developed a CCD image sensor for high-definition TV systems. The 16.2 x 10.5mm chip produces a two million pixel display. New technology has had to be developed to maintain adequate sensitivity (the smaller the pixel area the less light picked up). . . The Nigerian government has banned the use of satellite TV receiving equipment. Anyone found using a dish will be prosecuted. . . Sony has announced a portable player for 3 and 5in. compact audio discs. Called the Discman, the player measures about 4in. square and weighs just 300g. It's due for UK release in late summer – no price has been fixed.

VCR Clinic

Reports from Eugene Trundle, Alfred Damp, Steve Beeching, T.Eng., Philip Blundell, Eng. Tech., Phil H. Ireland, Dave Dulson, Rana S. Narwan, J.P. Cleak and Malcolm George

Hitachi VT120/130

At switch on the head drum would start to rotate and would then run continuously until the machine was switched off. While this was happening the machine would happily accept a cassette and even load it up. The sensors and the syscon and servo departments were working correctly, but control pin 5 of the drum motor chip IC1651 could not be pulled down. With pin 5 isolated the voltage on it was 5V and we found that over 100mA would flow from this point to chassis. This action didn't stop the motor however! The diagnosis was internal leakage within the chip and a replacement HA13403 solved the problem. **E.T.**

A new fuse and BA6209 restored the machine to normal operation. **E.T.**

Hitachi VT120

Tapes were being crunched during *cassette* loading and unloading because the left-hand tape guide was not fully retracting during the tape unload phase. In fact the loading motor was shutting down prematurely. This was cured by slight adjustment of the mechaposition switch. **E.T.**

Sony CCD-V8

This camcorder would "slow forward" as soon as it was switched on, with or without a cassette being present. No tape loading would take place, and after four or five forward windings the machine would go into the alarm mode with the eject light flashing. It wouldn't eject though – for this you had to dismantle the machine and flip the switch manually.

The problem was due to a leaky start-sensor phototransistor (Q603) on board HS5. We replaced the end sensor too. It was of the same type and probably from the same production batch. **E.T.**

Sanyo VHR3100

The problem with this newish machine was that it wouldn't accept a tape. The cassette LED (infra-red light source for the tape end sensors) was not emitting because the SWD5V line was missing. This comes from the 2SA984 switching transistor Q4001 on the SY-1 board. The transistor was open-circuit at its collector. **E.T.**

Hitachi VT9500

The owner of this machine had been operating it for some time via remote control only – for the very good reason that the front panel control keys didn't work. The only one that did anything was the play button: when pressed, the record and play lights lit and the machine went into the record mode. Checks revealed that the HD38750A53 function control chip IC2003 was receiving the correct supply voltage and that its oscillator section was running. Fitting a new chip cured the problem. **E.T.**

Hitachi VT130

According to the job card the machine couldn't be tuned. In fact the whole receiver section was out of action, though the tuning signal was present and a good tape played back correctly. We found that the not-PB 12V supply was missing due to switching transistor Q504 being open-circuit. A BC328 turned out to be a suitable replacement for the 2SA952. The machine was a later model with an ICPN5 (200mA) protector in the 12V feed to Q504's emitter. This protector had also failed and had to be replaced. Later versions of this model have several changes and modifications which are covered in the Hitachi supplement manual no. 2705E. **E.T.**

Sanyo VHR1100

The reel turntables didn't turn at all: the machine reverted to stop soon after loading and during the unloading process spilled tape all over the front of the deck. We found that fuse F3001 on board SY1 was open-circuit. An ammeter connected in its place showed that a normal few hundred milliamps passed when the forward functions were selected, but the current rose to over 2A when the reel motor was asked to go backwards.

The output section of the BA6209 reel motor drive chip IC3006 consists of a transistor bridge arrangement. One or more of the transistors here must have gone short-circuit.

Panasonic NV830

There was overloading on E-E. It was not the modulator this time as the u.h.f. a.g.c. was ineffective. Replacing the BN5115B i.f. chip cured the problem. **S.B.**

Ferguson 3V29/JVC HR7200

The complaint was of no colour on playback of a prerecorded tape – the machine was o.k. with its own recordings. The fault description proved to be correct. On playing a prerecorded tape and tracing the signal through we found that there was a voltage drop of about 1V across C415, the input to the main converter. On removing the capacitor to fit a replacement one leg fell off. **A.D.**

Ferguson 3V32/JVC HR7655

The complaint with this machine was no clock display. The display came on when the machine was plugged in, but after about half a minute it began to fade and after a minute it was completely out. Voltage checks revealed the absence of a -24V line which was restored when zener diode D233 on the tuner/timer sub power board was replaced. **A.D.**

Hitachi VT63

From the initial recordings we made with this machine it looked as though the heads were faulty. But the customer's complaint was of no recording. Making further recordings proved that the heads were not faulty, as good pictures were obtained. Oscilloscope checks revealed that the video f.m. envelope was varying – and could be varied by applying pressure anywhere on the board. The f.m. signal passes from the chip via a 1kΩ resistor to the f.m. record level preset. The waveform was stable at the chip,

but varied at the other side of the 1k Ω resistor. Various filters were accused, but all proclaimed their innocence. After a lot of pushing and prodding the fault was eventually traced to the preset. It was broken, one leg having snapped close to its body. **A.D.**

General VGX-520

This machine uses the Panasonic NV430 tape deck, so the following fault could apply to either model. The trouble was intermittent tape chewing. When the stop button was pressed during playback the tape would stop but not unload. If the tape was then ejected the loading poles would unload but the tape would not be wound back into the cassette. The cause of the fault was traced to high-resistance contacts in the mode control switch. **A.D.**

Ferguson 3V65

We've had two almost identical cases of the 220 Ω fusible resistor that feeds the 30V regulator being open-circuit. The cause in both cases was severe corrosion and shorting on the underside of the tuner/i.f. panel in the vicinity of IC3. No leaky capacitors were found, and the cabinets showed absolutely no signs of spillage. Strange . . .

Another of these machines displayed a smeary picture in the E-E mode though playback of a test tape was good. Replacing luminance module IC101 cured the fault. **P.H.I.**

Samsung V1-611

The fault with this machine was dead slow front loading and slow lacing followed by immediate unlacing. No loading motor voltages could be found in the manual, but comparison checks with another machine exonerated the electronics. Though the motor felt o.k. in operation fitting a replacement restored full speed loading. **P.H.I.**

Sharp VC8300

The fault with this machine was intermittent loss of sound in the E-E and playback modes. A lot of heating, probing and flexing were necessary before we discovered the dry-joint to be on the mother board where the audio module plugs in. **P.B.**

Marantz MV464

If one of the video heads is low the recordings can be quite good but the auto-tracking appears to go past the optimum setting. Check by connecting the scope to the output of the head amplifier (pin 6 of plug S1) and playing the alignment tape. **P.B.**

VHS Head Drums

Here's a tip if you have trouble with a VHS head drum that's tight on its shaft. Heating it with a hairdryer for a few minutes will expand it sufficiently so that it can be freed. **P.B.**

Fisher FVH-P906

The complaint with this machine was of no playback colour, and a test recording played back on another machine showed that it didn't record colour either. All relevant l.t. rails were correct and d.c. checks at the pins of the i.c.s involved proved inconclusive. Scope checks

revealed that the oscillators were all running, at the correct frequencies, and that while chroma was going into the main processing chip IC203 it wasn't coming out. At this stage of chroma signal processing only two chips are involved, IC203 and IC204. We replaced both in turn and found that IC204, an LC7342, was the culprit. The same chip was responsible on another occasion, with a Model FVH-P907. **D.D.**

Toshiba V9600

We've had to change the loading belt in a number of these ageing machines recently. They seem to load all right but have trouble unloading. The manual suggests removing the loading cam drive assembly to replace the belt, but I prefer a much simpler method. Removing the two screws that hold the cassette lid opener just behind the loading gear gives easy access to the loading belt with a pair of long-nose pliers. You'll find that this is much quicker than removing the drive assembly. **D.D.**

Samsung V1-611

The fault with this machine was no rewind or fast forward, due to a worn out idler unit. Since the machine was a new one the fault could become quite common. **R.S.N.**

Samsung V1-611

This machine would not change channel and we discovered that there was no 12V supply from the power unit. Transistor Q2 and the i.c. stabiliser were both overheating – Q2 feeds the chip, which had no output. Replacing these items restored normal operation. **R.S.N.**

Panasonic NV333 and NV366

The 2SC2671 transistor used in the booster amplifier is a common source of trouble with these machines. Panasonic have issued a repair kit, part no. VVK4059, which consists of a 2SC2671 transistor plus two MA161C diodes and fitting instructions. It costs only a pound or two. **J.P.C.**

Ferguson 3V16/JVC HR3660

An early ex-rental 3V16 came into the workshop the other day. The job ticket said "no colour". We quickly discovered that the machine wouldn't play back a test tape, or record satisfactorily, if the selector switch at the rear was set to auto or colour. The picture provided by a known good tape gave the impression of severe head wear, with no sync. In the switch's monochrome position record and playback were both o.k.

When we removed the bottom cover and hinged open the Y/C panel we could see that liquid spillage had badly affected the area around IC207/8. So we decided to waste no more time. But we all know that needless curiosity has never been the mother of economic viability and I couldn't resist the challenge to find the real cause of the problem.

IC207 on the Y/C panel should receive a sync input from IC1 on the servo panel. This signal was absent. The servo panel in its turn should receive a video input from the emitter-follower transistor X7 on the Y/C board. This signal was also absent.

The input to X7 passes through a low-pass filter, LPF-2, and the previously mentioned liquid had got into the windings and rotted them. Hence no video, no sync and no colour. Nice one, Bob! **M.G.**

A Low-cost TVRO Installation

Part 3

Roger Bunney

Part 1 of this series described a method of providing a patio mounted dish with azimuth adjustment. The remaining outside problem is to provide a means of elevation adjustment.

Standard patio mounts usually have a simple telescopic arrangement at the rear. This enables the dish to be set at the required elevation for reception from a particular satellite, then locked in position by means of a single bolt. My first action to make life easier and avoid having to use a spanner when changing from one satellite to another was to cut a slot across the locking bolt and braze into this slot a large steel washer to provide hand locking. This can be seen in the accompanying photographs. It was hardly the ideal solution, so thought was given to the possibility of providing a hand-operated elevation adjustment system. Visits were paid to various nearby DIY outlets to see whether suitable parts were available. I eventually found some components that could be used to form the basis of an adjustable mechanism at minimal cost.

At my home the skyline to the east is restricted to perhaps 30° above the horizon by warehousing. It's restricted by a similar amount to the west by housing. Telescopic adjustment over some 2.5in. is required at the rear of my dish to move from the Intelsat V satellite at 1°W to the Intelsat V bird at 27.5°W. I can just about see 35°W, so an elevation adjustment range of not more than 4in. is ample. Those more fortunately situated will wish to look towards the horizon at perhaps only 5° up. In this case a greater range of elevation adjustment will be required. More on this later.

UK readers will no doubt be aware of the Black and Decker "Workmate" DIY home bench system. It's fitted with a threaded bolt action controlled by a rotating handle

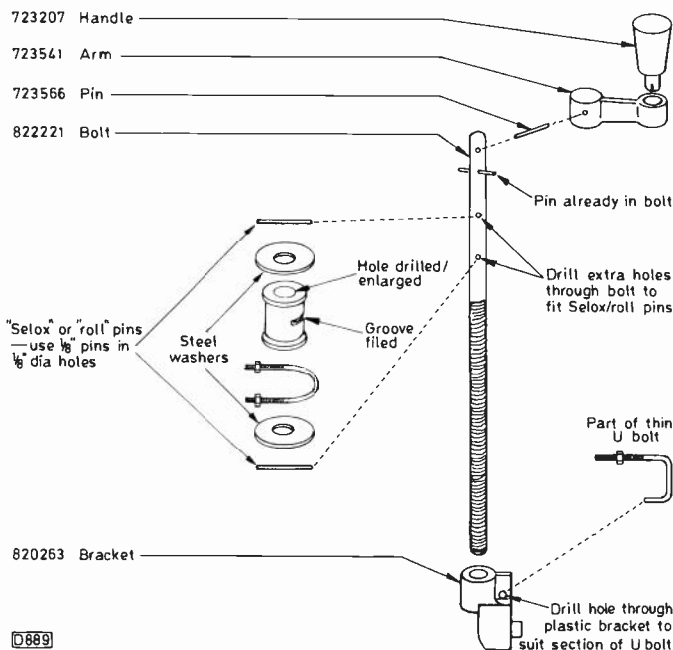


Fig. 1: Method of securing the Black and Decker handle, arm, bolt and bracket — the total length of the bolt is 11in. Black and Decker Workmate spare part numbers are as shown. The approximate cost of the Black and Decker parts is £2.80.

— ideal for our satellite system. Fortunately Black and Decker are able to supply component parts of the system very cheaply as service spares. I obtained the part numbers from the local service depot and put in an order. Four weeks later (the Christmas holiday period intervened) the items arrived.

Seven inches of the total 11in. length of the threaded bolt are threaded, far more than needed at my present location. An examination of the accompanying diagrams and photographs will show how I assembled the system. Two brackets were obtained from a local agricultural depot: I thought these were gate hanging pins but was told that they are for bolting to walls and "to tie things to or hang things from"! They are made of steel, are very strong and cost me only 87p each including VAT. One was bolted to the thicker (upper) part of the telescopic tube by means of a 1.25in. exhaust pipe clamp. The other was similarly bolted to the thinner (lower) section of the telescopic tube. The exhaust pipe clamps cost 62p each.

The rotating bolt with its long screw thread was fixed to the upper bracket through a metal tube that's not unlike a cotton reel bobbin. I was fortunate in finding an alumin-

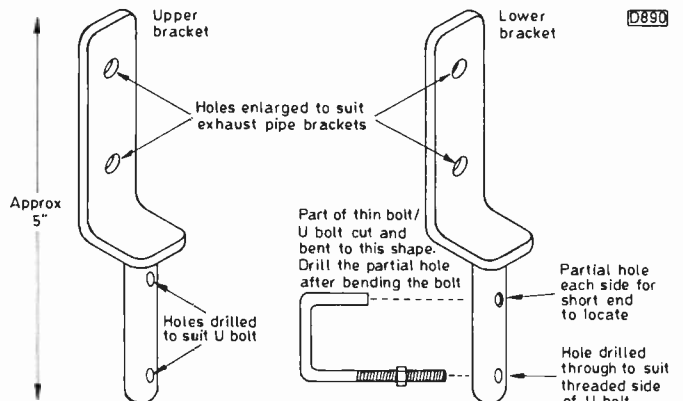


Fig. 2: The agricultural brackets, which cost me 87p each.

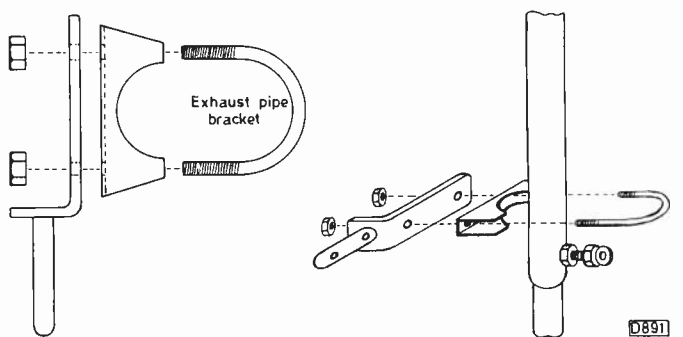
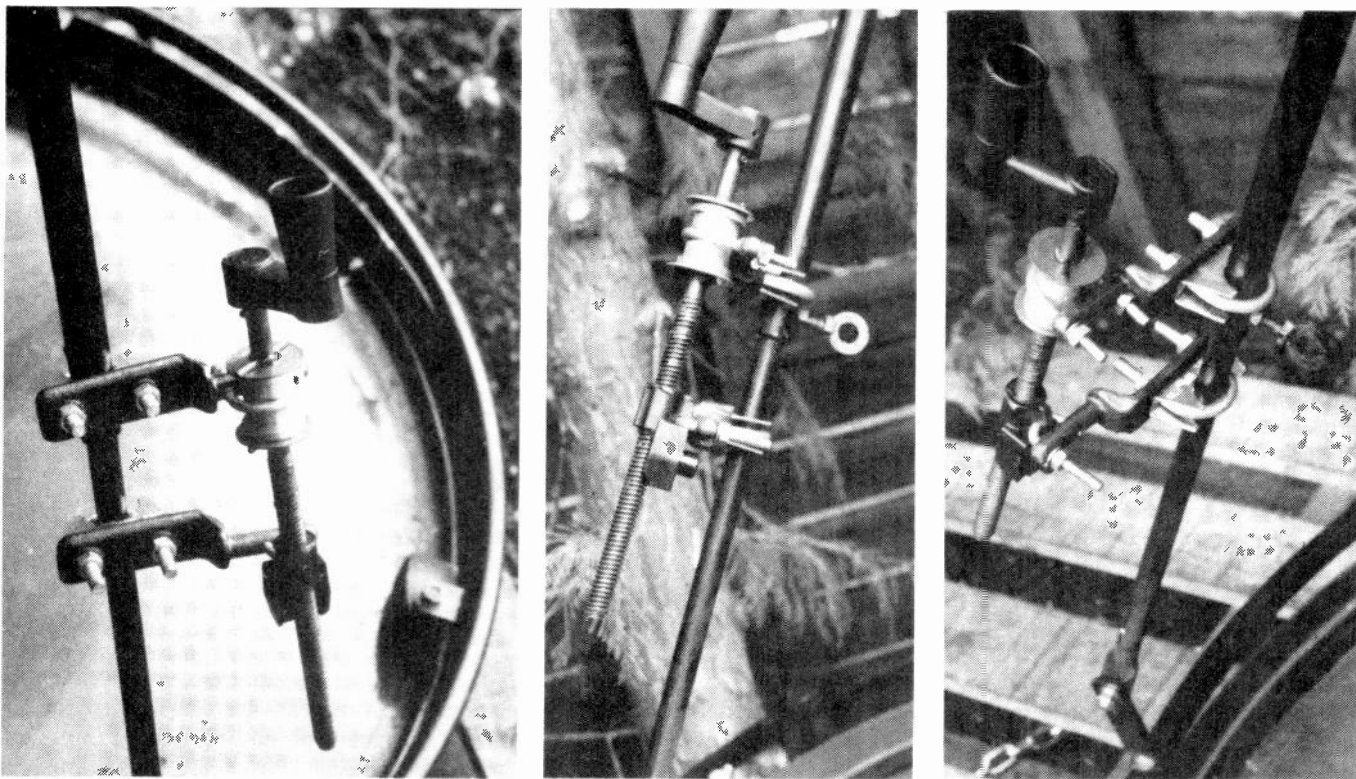


Fig. 3 (left): The two 1.25in. exhaust pipe brackets cost 62p each.

Fig. 4 (right): Method of fixing the exhaust pipe brackets. The upper bracket fits on the larger diameter section of the telescopic tube, adjacent to the former locking bolt. The lower bracket is fixed in similar fashion on the lower section of the telescopic tube. To minimise friction between the thread within the upper cylinder and the lower plastic bracket, ensure that the two exhaust pipe/agricultural brackets are mounted in parallel.



The above photos show the adjustable elevation arrangement from various angles.

ium roller at my place of work. This was drilled out to allow the long bolt to pass through the centre. The bobbin is held in place at each end by steel roll pins which are knocked through: a large steel packing washer at each end, between the pin and the bobbin, ensures minimal friction and once greased will turn relatively easily. The alloy bobbin is clamped to the agricultural bracket with another U bolt – a smaller exhaust clamp could be used for the purpose. File a groove in one side of the bobbin to fit the rounded part of the U bolt and ensure a rigid, non-slipping fit.

The lower bracket assembly is fixed to the long bolt by means of the Black and Decker plastic bracket. It's an unusual looking item that allows a convenient hole to be drilled as shown. A much modified section of thin U bolt was threaded through this hole and bolted to the main agricultural bracket. The bolt is located in a recessed hole in the bracket as shown.

The complete assembly was then carefully bolted to the upper and lower parts of the telescopic arm at the rear of the dish. Take great care that the two brackets and the long bolt are aligned in parallel and are on the same axis. If correct axial alignment is not achieved you'll feel resistance when winding at the highest elevation, i.e. when the brackets are closest together.

If you require adjustment down to the horizon, i.e. an elevation of just a few degrees, an alternative to the long Black and Decker bolt should be sought. Many of the larger DIY outlets stock lengths of studding approaching 0.5in. in diameter. This can be used in conjunction with large nuts, preferably plated – the Black and Decker handle and arm can still be used.

Calibration for various elevation points has not been shown. It should be possible to use the protruding threads on the various U bolts to bolt a metal strip to one U bracket so that it moves alongside its mate on the other U bracket. A reference line on the latter will enable markings to be made on the strip to give very accurate measurements.

The details provided above describe how I achieved variable elevation adjustment in a very basic and simple way at minimal cost. Various parts were scrounged from junk boxes etc. I've no access to welding and other metal working facilities and have had to make the best of this situation, which is probably shared by most other readers. The system devised may look crude but it's effective – and it works!

Black and Decker tell me that they will be happy to provide the items mentioned. Readers should contact their local depot. There's usually a two-three week delay, but the cost is low. Selox or roll pins, U bolts and large washers should be available from a tool or fastener supplier.

We would be happy to publish in the magazine solutions from other readers to the problems associated with satellite TV reception, be they mechanical or electronic.

Add-on FM Tuner

– continued from page 496

supply to the TDA7000 is correct at 5V. Connect the tuner to the VCR and TV set. Find a suitable v.h.f. aerial feed (in good reception areas a piece of wire is good enough). Use SW1 to select one of the tuning potentiometers and turn it to the end of its track – the high-voltage end as measured at the wiper. Turn the core of L1 until Radio 2 is received. Give the core an extra half turn. The basic setting up is now complete.

A word about aerials. The tuner's input is very sensitive and the simplest of aerials will give good results, as will a roof-top aerial with masthead preamplifier. I use a two-foot length of twin mains cable, shorted at the end, connected to a coaxial plug with a 75Ω resistor in series with the centre pin. This works well, even close to a TV receiver. Good listening!

Finally, I am very grateful to Mark Dawson for his help with this project, especially the unusual aerial design.

Ten Years of VHS Video

Eugene Trundle

VHS video cassette recorders first appeared on the UK market in 1978. At that time no one could have anticipated the grip that VCRs were going to get on the public – the British public in particular. During the intervening ten years there has been an explosion in video technology, largely brought about by the competition between manufacturers. The domestic video tape recorder story started long before 1978 however.

Historical Background

As long ago as 1967 Sony was selling open-reel video tape recorders in the UK at prices that just about put them within the domestic electronics sphere. But 1972 saw the real start of domestic video, when Philips introduced the N1500 video cassette recorder. It didn't sell in large numbers and had limited capabilities, but the "VCR" format represented a milestone as the first video recorder system designed specifically for home use. It had most of the basic ingredients that we know so well today: the tape enclosed in a foolproof cassette; automatic threading; helical scanning; and simple controls like those of an audio recorder. Why didn't it catch on? To start with it was relatively expensive, and had a playing time of only an hour. But perhaps more significantly it was introduced during the first great colour boom, when dealers and the public alike were devoting their time and money to the new colour sets. In addition, the tapes were rather expensive.

The appearance of the VCR-LP system in 1976, i.e. the Philips N1700 series of machines, was greeted with no greater enthusiasm or take up. Perhaps many of the same market factors were still present. One of my most vivid memories of this period relates to a stag party where certain tapes were laid on for the entertainment of a local football supporters' club, in the back room of the King's Head. The TV set was there, and beer was stacked by the crateful. The final ingredient, the video machine, was to be provided by your truly. Uproar broke out when it became apparent that the VCR and VCR-LP formats were incompatible! The twittering voices from the loudspeaker, the lines and bars on the screen, and the disgrace of being thrown out – the N1500 after me – are memories that I shall always carry.

By this time however the Japanese manufacturers were busy. After a certain amount of infighting two new formats were finalised and launched in Japan: Sony's Betamax system appeared in April 1975, while JVC's VHS system came along in September 1976. After their initial release in Japan, both systems were soon introduced and marketed in the USA, where the scanning and colour standards and the mains voltage are basically the same as those in Japan. To start with neither format was particularly successful, but sales soon picked up. VHS was supported by the US heavyweight RCA.

PAL/625/50 versions soon became available for use in Europe, where West Germany and the UK seem to have been the initial target markets. The VHS system was supported by Telefunken and NordMende in West Germany and by Thorn-EMI in the UK. In the early days most VCRs in the UK were rented and Thorn's dominance in this market, through Radio Rentals, DER and other rental

chains, soon put the VHS system in the leading position in this country. Though it couldn't be foreseen at the time, this was in effect to seal the fate of the Betamax system, largely because of the software situation – tape libraries wanted to stock just one tape format.

The Early Days

But back to 1978 and the appearance of those first electromechanical wonders in the shops. In my role as Merlin to a lively independent dealership I saw at least as many Beta as VHS machines. The experience of the rental engineers was almost entirely with the VHS system however, and partisan feelings enlivened many a tea break at the local technical college, which we all earnestly attended. In those days the video classes were over subscribed. Now many courses don't even get started for want of support. Ironic, isn't it? As it was to turn out, we didn't have to worry too much about many of the things our lecturer drummed into us. In the fullness of time our anxieties about writing speed, extinction frequency, azimuth angles and folded sidebands came to be replaced by much more immediate problems such as can Mrs. Jenkins pay her bill, will the cat's wee eat any further into this Y/C panel, and will Mr. Murdoch ever master the timer on his machine and stop ringing us up?

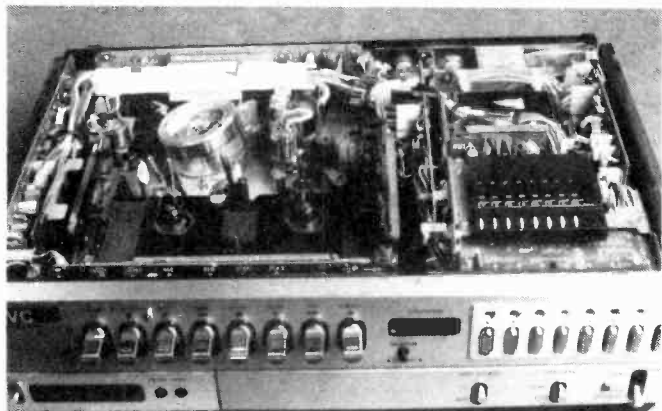
Modifications to TV receiver flywheel sync circuits were a major topic in those days, and the man who could get the time-constant in the TV set right *and* fix the video was a king indeed. He might even command an extra £10 a month on his wages. My service manager at the time, the venerable Cedric Collier, examined the first VCR to arrive in the workshop and decided that it was a mechanical rather than an electrical affair. As such it was to be dealt with by the audio engineer who, it was assumed, would have more experience of this sort of thing. Having had such greatness thrust upon him Dick, our audio man, upped and left, never to be seen again. I gather that his subsequent dealings related mainly to boats and women, and maybe he was wiser than the rest of us. Anyway . . .

Gaining Experience

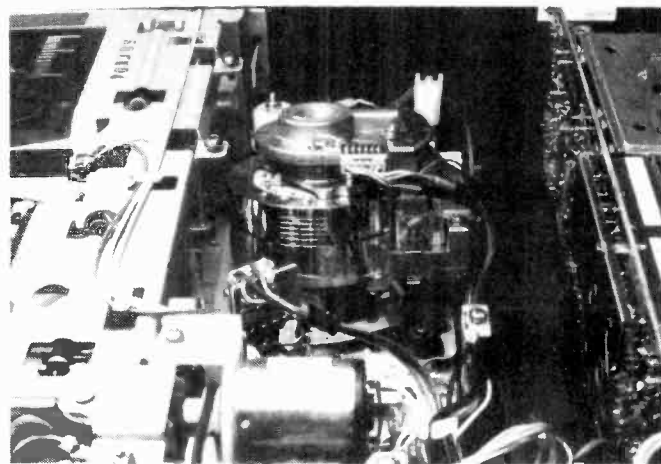
We soon got to know the workings and habits of the piano-key machines, and so did the rental boys, aided by the intensive courses, booklets and so on produced by the rental companies who, at the time, were putting intense effort into staff training. We learnt how to deal with servos, how to twiddle guides, and how to set up the tape path. The Beta tape path was always the more difficult one to deal with, having six crucial guide adjustments – there are only two primary ones with VHS machines.

We also got to know how not to treat the heads! There were some enthusiastic DIY types amongst our customers, and I remember one machine that came in with no heads – both had been broken off in a ham-fisted attempt to clean them, and the lower drum had been damaged by a large screwdriver that had been used to lever up the upper drum – the better to clean the heads perhaps?

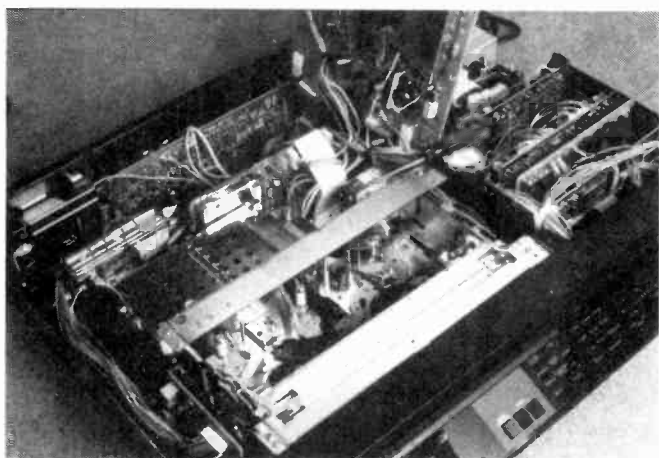
The early Beta machines were larger and heavier than their VHS counterparts, but many (myself included) felt



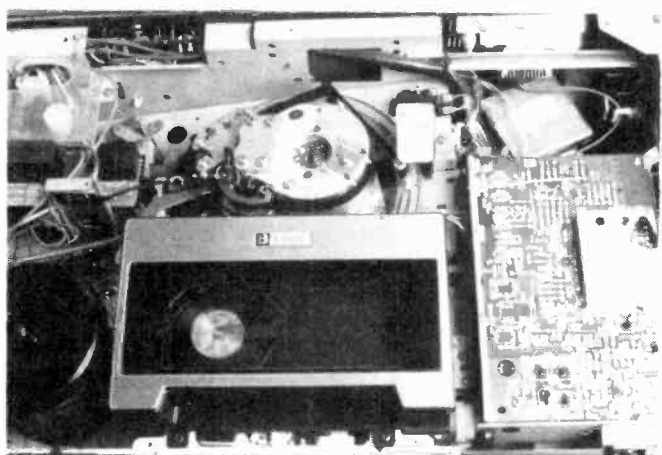
A 1978 interior – the JVC HR3300 with its top cover removed. The machine weighed 13.9kg and its one-event timer had no setting, the recording continuing until the end of the tape was reached.



Hi-Fi sound by Panasonic. This view of the pioneering NV850 deck shows, above the head drum, the rotary transformer for the audio f.m. system.



Ten years on: JVC's top of the range Model HRD550. This slim, light model will record eight programmes over a one year period, has "transmittable" timer setting, full infra-red remote control, dual-speed recording, Hi-Fi sound and a NICAM decoder for broadcast stereo sound.



Also ran: the spacious deck layout of the Sanyo piano-key Beta Model VTC9300. The a.c. motor at the bottom left drives everything on the deck. Many more springs and levers lurk below the deck, amongst the clutches, pulleys and belts that live there.

that they produced a better picture. Some of the original bangers in both formats are still soldiering on – to this day I have a Sanyo VTC9300 in service at home. These robust old-timers in both formats all meet their Waterloo when expensive things like heads and motors wear out and the cost of repair can't be justified. With the exception of the

switches and relay contacts in these early machines the electronics have over the years proved to be incredibly reliable. Solid-state switching is far better, if a little more obscure in its workings.

There are compensations for those working on videos as opposed to tellys – no high voltages to catch you unawares and sizzle your fingers, and they don't attract those layers of filth and dust that the heat and high voltages in a TV set produce – nor do you do your back in carrying them. On the debit side, new sorts of intermittent faults came along to plague us. Many of these are to do with friction surfaces (belts, idlers, etc.) and deck sensors. They are with us still! Perhaps too there is more at stake if the diagnosis is wrong. It's embarrassing to be left with an expensive i.c., head or motor when replacement hasn't cured the problem.

A trick-motion machine, the JVC HR3660, appeared as early as 1979, with still frame, variable-speed slow motion and double-speed playback, a bucket-brigade device being used to provide sound compensation. A harbinger indeed! 1979 also saw the announcement of the Philips-Grundig developed V2000 system with its innovative (for domestic use) dynamic track following and a turn-over cassette.

Into the Eighties

In 1980 the scene changed somewhat, with the introduction of light-touch controlled VCRs. With these a micro-computer in the system control department took the place of the levers, microswitches and mechanical interlocks used in the earlier models. This development lent itself to cordless remote control and front loading. All these features were to be found in a terrifying (to most engineers, anyway) new machine, the JVC HR7700/Ferguson 3V23. This complex ensemble of electronics and mechanics, with chain-driven rolling pin, must have had one of the highest component counts of all time in domestic equipment. It was back to college or to the textbooks to learn about microcomputers, port expanders, insert editing and goodness knows what else.

Another advance at about this time was the introduction of the first portable equipment – the piano-key operated JVC HR4100 and Sony SL3000 recorders and the GS1000, 3V06 and HVC2000 cameras. Suddenly we had to know about pick-up tubes, lenses, optics, sync generators, encoders and so on. I recently renewed my acquaintance with an early video camera when it came in for repair – a JVC GX88. The difference in weight, facilities, performance and power consumption in comparison with modern

cameras and camcorders is staggering. We've come a long way in a relatively short time.

Test Equipment

As more and more video equipment came in for repair we decided that additional test equipment was required. Somewhat shattered by the prices, we nevertheless invested in VHS and Betamax alignment tapes, an eccentricity gauge (still the only one for miles around here!) and back-tension measuring cassettes. These were added to the torque meter, jigs and other bits that we already had.

The alignment tapes were held in great reverence, to the point of being locked in a cupboard. And thereby hangs a tale. After refusing the use of one to a trainee who wanted it to adjust guides a certain senior engineer, not a thousand miles from here, fed the pristine tape into a machine for a final check on the tape path. Having a heavy cold that day he sneezed and, disgusting to relate, showered the head drum. The latter promptly and instantly picked up the hallowed tape and wound around itself several yards of tape, with a terrible rustling and crunching sound, while the pop-eyed engineer stood frozen in amazement. I finally hit the stop button.

Developments

The transition to electronic VCR control was widespread and swift. 1981 saw machines capable of insert and assemble edit, a rapid trend away from top loading, and the intensification of competition between manufacturers and formats.

1982 was a momentous year in which developments came thick and fast. Philips, JVC and Sony reached an agreement in principle on the Video 8 system and format – strange in the light of subsequent events! The VHS-C cassette made its appearance in portable equipment, which in those days consisted of “separates” such as the JVC HRC3, Ferguson 3V33 and the Sharp VC220N. Stereo sound capability was introduced, but on the “lo-fi” longitudinal tracks. And the first VHS machines, such as the JVC HR7650, appeared with a comb filter for luminance crosstalk compensation (the Sony SLC7, released in 1981, had been the first machine to incorporate this feature).

The effects of burning midnight oil amongst the other Japanese manufacturers started to tell in 1983. Panasonic introduced the first VHS machine with Hi-Fi sound, Model NV850, in which the sound problems associated with the use of a relatively slow-speed longitudinal track were finally banished. The sound performance of conventional VHS had been a matter of growing embarrassment to the industry – the previous year's crop of stereo machines had actually emphasised the signal-to-noise ratio shortcomings. Hi-Fi machines followed quickly from JVC, Ferguson and the others. This year also saw the introduction of dual-speed machines, initially the Hitachi VT17. Another alignment tape was needed, and you had to be more careful about setting up the tape path and the tracking, though skirmishes with Hi-Fi machines had taught us to pay more attention to these things anyway . . .

Hitachi also pioneered the solid-state (MOS) image sensor for use with portable equipment. By this time cameras and portable VCRs had become much smaller and lighter – and a damn sight more difficult to repair. Rather than the customer being weighed down physically by his gear, the engineer became morally weighed down in his attempts to service it!

The user's problems were being lightened in other ways as well. Horrifically complicated timer setting procedures were simplified with the introduction of user-friendly microchips. Instant recording, auto-rewind and cordless remote control were becoming commonplace.

1984 was another year of tremendous competition between manufacturers and formats. Sony replied to the VHS Hi-Fi sound challenge by introducing its own version, in the form of the Beta Model SLHF100. In reply to dual-speed VHS machines Grundig introduced an LP version of the V2000 format – Model 2080 had a maximum running time of sixteen hours with a single cassette. But significantly, Grundig started to produce VHS hardware. Philips and Pye also changed from V2000 to VHS, while in the Beta camp Toshiba and NEC changed over to VHS. During the year several nails were thus driven into the V2000 and Beta coffins. The traditional photographic companies like Canon, Konica, Olympus, Polaroid and Kodak were now strongly involved with video, having seen the big inroads it had made into the amateur cine market.

Camcorders

Meanwhile JVC had introduced the first VHS camcorder, Model GRC1, which was marketed by Ferguson as the 3V41. We'd already seen VHS-C (Compact, using the small thirty-minute cassette) in the form of separate VCRs like the HRC3, but the new camcorder had a small head drum. This milestone in miniaturisation had four heads in its little drum, with a long wrap and the high speed of 2,250 r.p.m. The textbooks were confounded – they insisted that the drum must have a diameter of 62mm and rotate at 1,500 r.p.m. This didn't worry us too much because we've not yet had any faults in this area. We just marvel at the excellent compatibility of the system, and know that should we see a picture flicker at a rate of 12.5Hz with one of these machines it will be bad news!

Events of 1985

Some of the earliest piano-key machines were wearing out and being scrapped by 1985: cannibalisation was the order of the day, and large piles of picked-over machinery grew under the benches of the vultures – we've only now cleared this lot out, having called a halt to servicing this type of machine on the basis of old age and infirmity (us as well as the machines!).

In retrospect, 1985 had most to show for the portable video enthusiast and home-editing buff. Two-piece outfits like the JVC HRS10 and Hitachi VT8 came to the fore, and Pioneer launched its MSX video computer, Model PX-7, with genlock. The Japanese developed MSX computer system seems to have gone back into the cupboard however. Panasonic introduced its NVM1 camcorder, with a full-sized cassette to give a long running time: the small drum configuration was retained, with four heads and wondrous switching.

The year saw Sony launch its first 8mm format equipment, with the excellent CCD-V8, giving us a whole new format to learn about – just in case we were getting bored. As never before, the brown goods repair brigade was having to adapt to new technologies and learn new techniques. Flying erase heads, ATF and M/U tape loading: onwards and upwards! By now however the diversity and reliability of consumer electronic equipment, the continual introduction of new models and the relatively small sales of each (especially with the portable gear), meant that many engineers were starting to lose touch with

what was going on in many fields. How many of us know much about the ephemeral Sony Betamovie record-only camcorders, with their 300° tape wrap, single-head drum and incredible time-warp tricks in the scanning and subcarrier departments?

Changes in 1986

1986 saw the official demise of the V2000 format, in announcements from both Philips and Grundig, who had not made any machines of this type for many months. By this time the world-wide population of VHS machines had reached around one hundred million and was growing rapidly. There were times in the workshop when we were so busy we felt we were looking after them all! The Beta format was by now struggling hard against the odds. The Super Beta specification Model SLHF950 was perhaps its final kick. With this specification the luminance f.m. carrier frequency was raised, giving superb picture quality while maintaining reasonable compatibility. But very few were sold.

Meanwhile the picture quality provided by basic VHS was being worked on. The year saw the introduction of the first HQ machines. HQ badges proliferated, but most machines didn't use the full HQ specification. No time was lost in bringing the benefits of HQ to portable gear – the second-generation JVC C-type camcorder Model GRC2 had it.

I believe it was at about this time that there were one or two prosecutions against the proprietors of the burgeoning video libraries. It seemed that some of their soft porn was not soft enough to satisfy the censors, and a hasty clearing out of the shelves took place, based on a list that was circulated to the trade. Our shops, used to dumping any problems on the Service Department, sent us a box of suspect library tapes. Stashed under the bench, these mucky movies did much to enliven the lunch hours – our learning is not confined to electronic technology!

Pace of Progress Quickens

1987 was the year when digitalisation came to the fore. Field stores began to crop up in VCRs, starting with the Hitachi VT250 picture-in-picture machine and a digital still-frame system in the Toshiba DV-80. Remote control systems in which timer programming could be composed on the handset and then transmitted to the machine in one go were becoming common. The alternative bar-code scanner (Panasonic) also made its appearance. Still on the simplified timer-setting theme, Grundig brought out the teletext-programmable Model VS540, though some problems were caused by the twelve-hour clock used by the BBC in presenting its programme schedules!

Sophisticated index search systems also appeared, along with the half-loading technique in which a loop of tape is brought into contact with the control head during fast forward and rewind to facilitate place finding. Flying erase, previously used only in Video 8 "home" machines, appeared for the first time in VHS equipment – in the Panasonic MC-10 camcorder.

At this stage the Betamax format was still hanging on, though with little technical innovation or marketing effort. Many of the older Beta machines were beginning to wear out and, faced with inevitably high quotes for head replacement, most owners opted to scrap their SLCs and VTCs in favour of new VHS machines – leaving me with a rich legacy of used Beta tapes for time-shifting and archiving on my old bangers. VHS was well and truly

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affordable: the lower end of the market had for some time been in the grip of the large retailers' in-house brands, with prices around £250 or even less, and a basic Amstrad machine could be bought for under £300.

The Present

This brings us to the present year. The long-awaited announcement that Sony is finally to get into VHS came early. On every level, from the boardroom to the High Street and in all their major markets, Sony and JVC have been at daggers drawn for as long as I can remember. I've often pictured the workshop car park duel that might occur should their representatives' visits ever coincide – but they haven't, yet! S-VHS should be with us sometime later this year: this new high-definition variant of the format will be a fitting crown to ten years of development.

In Retrospect

These ten years have seen tremendous changes in the trade – from where I'm sitting, anyway. Virtually all the faces in my workshop have changed over the period, and many good engineers are now pursuing different careers altogether. Although the wages, rewards and recognition of engineers have improved (particularly lately) the overall equation does not seem to be an attractive one, even now. Certainly there's been a steady decline in the number of people employed in our business, and it's difficult to foresee a reversal of this trend.

But regardless of what happens in the service trade, VHS will still be with us in ten years' time for sure. By that time we may have entered what has rather ominously been called the post-industrial society. What will that mean?

Satellite TV Up-date

Harold Peters

Each Cable and Satellite TV Exhibition (the latest one was held at the Wembley Exhibition Centre on February 25-28th) has had its own atmosphere. There was a degree of bewilderment when the first one opened, relief when the Cable Act was passed, despair when Challenger was lost and now optimism in anticipation of the launch of the Astra satellite. Many of the trade stands this time displayed "Astra ready" outfits with dishes as small as 65cm, LNBs at affordable prices (the cheapest was £60) and receivers with space for a MAC decoder.

At the Astra stand itself emphasis was being laid on the satellite's sixteen-channel capability – able to provide viewers with everything they could want from one bird. Philips Electronic and Ass. Ind. Ltd. produced a startling demonstration of D2-MAC (not to be confused with D-MAC) on transparent receivers in which the tube seemed to float in a fluorescent frame. At the touch of a button viewers could sample the compact-disc quality of the various multilingual sound accompaniments.

For field and installation engineers there were alignment aids such as Satfinder (U.K.)'s electronic sextant. Once programmed with the azimuth and elevation angle of a wanted bird, LEDs lit up when the objective was pointed in the right direction. The device can be used for site surveying as well as dish positioning. But I do wish they wouldn't demonstrate site surveying on tripods at normal eyeheight: it's what the bottom of the dish will see that matters.

The outside dish farm, the part you usually visit on your way in or out, is always good for a bit of light relief. In 1986 it was a "dustbin lid" dish producing good Music Box through a gap in the giants. Last year it was a huge professional dish being aligned by the good old "up your end a bit Fred" method. This year it was a large motorhome which pointed the way things are going – it had its own 100cm dish on the roof.

Satellite Recap

It dawns on you only when you are well clear of all the "positive thinkers" at the show that with Astra due up this winter and the French TDF-1 satellite due to follow it the TV from space situation by this time next year could be quite a mess. We could have three systems on two bands, with four methods of polarisation and six orbital slots to contend with – not to mention the various methods of scrambling. So if you came away as confused as I did, here's a summary of the situation as it looks today.

Satellite transmission power levels can be divided into three groups: (1) Low at around 20W – used by the current generation of Eutelsat and Intelsat V satellites. (2) Medium, around 40W, promised by Astra. (3) High power, around 200W, the target for DBS broadcasting.

The power level determines the size of dish you need for noise-free reception. It accounts for the existing "north-south divide". Under current building regulations, planning permission is required for dishes wider than 90cm. The present low-power satellites call for 90cm dishes in the south of the UK, 1.5m dishes in the north.

Astra expects a 60cm dish to be adequate in the south

and a 75cm dish in the north, while DBS transponders should produce clean signals over the whole country using simple "dustbin lids".

The wattage available at the satellite is determined by the solar panels. So you can have more medium-power transponders than high-powered ones per satellite. This is why Astra hopes to be able to provide sixteen channels while the DBS satellites provide only four, with one spare.

Systems

Most of today's satellite transmissions use PAL – even the French TV5 has changed over from SECAM now that dual-standard decoders are commonplace. With f.m., PAL can result in sparklies on colour when working near threshold levels. In addition, PAL can be scrambled only at the expense of some bandwidth. MAC is the preferred space transmission system, with its sequential transmission of the chrominance and luminance components of the picture. But which variety of MAC? The variants are all to do with the digital part of the signal. This contains the sound channels, sync information, teletext and various control signals. The situation has moved on since we last reported on this.

C-MAC, which derived maximum use from the system, had a common bit rate with studio digital TV, f.m. for the vision signal and phase-shift keying (PSK) for the digits. For UK use it has been dropped in favour of D-MAC, which is less versatile and uses f.m. for both the vision and the digital information. France and Germany favour the D2-MAC variant. This is less versatile still, but can be fed into their many cable networks without too much processing. BSB, which has the UK DBS franchise, is committed to D-MAC, while Astra still seems to be keeping its options open. The problem for Astra is that there's unlikely to be a sufficient supply of MAC chip sets by the time the satellite is launched – chip sets capable of handling both D-MAC and D2-MAC are still in the development stage.

Bands and Polarisation

Today's low-power satellites use the 10.9-12GHz "cable band" and Astra is due to follow suit. The high-power DBS satellites will use the 12-12.7GHz band. As yet we know of no LNB that can cover these two bands continuously.

Existing signals come with either vertical or horizontal polarisation, just like our terrestrial ones, but with the important difference that the two polarisation modes can be used for the same channel from the same satellite. An example of this is Sky and Super Channel: a polarotor changing from one to the other will give you both at around the half-way point.

The DBS channels will have circular polarisation – the signal spins like a rifle bullet. Clockwise spinners (RHCP) and anticlockwise spinners (LHCP) will be co-sited. Not all polarotors can handle this in their present form, merely collecting both signals at -3dB (half power) when set to any angle.

Orbital Slots

There are enough satellites in service to enable you to check that you've got your polar mount declination angle spot-on. At 60°E, right down in the east, there's an Intelsat V with a handful of German broadcasts. At 13° east there's good old Eutelsat-1 with Sky, Super Channel and others. Eutelsat-4 at 10°E is beginning to add a few more, such as RAI-2. Our UK cable mainstay Intelsat V at 27.5°W

continues to provide Premiere, Children's Channel, Screen Sport and so on.

Astra will be at 19°E, with the French and W. German DBS satellites at 19°W. Our own BSB satellite will be still farther west at 31°W. Note that all these bearings are as seen from the North Pole (where they are below the horizon anyway!), and that from our latitudes the true angles will be slightly less.

Eutelsat-2 at 7°E carries the odd TV channel. Thus in the segment between 19°E and 7°E there are four satellites using common channel allocations (plus the odd offset), with separation as little as 3°. The smaller the dish the wider the beamwidth, so in this segment it's quite possible to pick the wrong bird – we've already done so when aligning with a spectrum analyser. In addition, a dish with a wide beamwidth used with a receiver with poor selectivity could easily result in co-channel interference, something you'd not normally be looking for.

Failures

When the first Russian Gorizont satellite ran out of propellant and developed a vertical wobble we all became aware that faults in space aren't fixed as easily as the ones that our Les reports. To get decent pictures, the dish we use had to be repositioned twice a day. The replacement Gorizont satellite was much better, but failed totally last autumn. So we're back with the "wobbler", awaiting the replacement.

Eutelsat-1 has also had its share of trouble. Two transponders began to lose power and had to be artificially boosted by increasing the strength of the uplink signal. Then SAT-3's transponder on the east spot failed – it was moved to the west spot transponder vacated when Europa closed down.

Around the turn of the year one of the French 12GHz medium-power satellites died, possibly struck by meteoric dust. But the biggest disappointment was the failure of the W. German TV-Sat bird, which was successfully placed in orbit by Ariane last November, to deploy its solar panels fully. This £175m project should have been Western Europe's first high-power DB satellite. It's understood that engineers on the ground are still trying to salvage some use from it before the equinoctial eclipses deplete its power even further. It doesn't look as if it will be possible to use fewer transponders to compensate for the lack of power. The stuck panel appears to be screening the uplink dish. The satellite's twin, the French TDF-1 which is due up this summer, is being looked at closely in view of what happened to TV-Sat.

To Sum Up

From the foregoing it's obvious that no single hook-up is going to cover present and future requirements fully, a situation that's leading users to rent rather than buy. The technology isn't the only problem. Most if not all the present cable-satellite TV channels are being run at a loss. It seems that advertisers are not too happy about the idea of using a medium that reaches different audiences in different countries. From America we hear that satellite TV transmissions have been used to broadcast material that would be unacceptable via terrestrial channels – if the same thing happens here, Mary Whitehouse may have to brush up her Euro-speak . . .

Finally my thanks to A. Sidall who shared with me the effort of covering the exhibition.

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TV Fault Finding

Reports from Philip Blundell, Eng. Tech.,
Aled Roberts, J.R. Armagh, G. Hewins,
Ian Bowden, Roger Burchett and Nick Beer

Fidelity CTV14S

If the set changes channel intermittently of its own accord – in extreme cases it can switch itself to standby or the volume can change – replace the BPW41 infra-red receiver diode, the 100pF coupling capacitor if fitted, and ensure that the screening can is correctly soldered. **P.B.**

Finlandia C22BZ7

This set couldn't get up on cold mornings. A check with the hairdryer and freezer brought us to C726 which was of low capacitance. Although this set was made by Salora, spares are available only from Granada. **P.B.**

Grundig CUC120 Chassis

The set-e.h.t. control R647 can become intermittent with these sets, causing symptoms such as intermittent no sound or vision, varying brightness, or short field output chip life. The symptoms depend on whether the h.t. goes up or down. **P.B.**

Amstrad CTV1401

For weak and distorted sound, check whether R356 (10k Ω) is open-circuit. **P.B.**

ITT CVC1200 Chassis

For low h.t. when the set is first switched on, check whether C701 (10 μ F, 350V) has dried up. **P.B.**

Network NW1210

These monochrome portables are often used as computer monitors, and the owners reduce the picture size so as to be able to see all the text. Unfortunately the field linearity control is in such a position that it's easy to short it out to the chassis support, blowing T302 and T303 (both type BC252) in the process of adjustment. **P.B.**

Plustron TV19

The symptoms with this set were similar to a thermal fault in the i.f. strip. The set would work for fifteen to twenty minutes, then the picture would gradually fade away, leaving a blank white raster with very distorted sound. We eventually traced the cause to an intermittent open-circuit in the line output transformer's a.g.c. pulse winding. The fault was cured by winding a couple of turns of thin insulated wire around the transformer's core to act as a new a.g.c. winding. **A.R.**

Hinari CT4/5

The problems were intermittent loss of sound and intermittent crackling noises. The noises ceased when R601 in the feed to the output stage was removed, but remained with the 6MHz filter Z103 removed. It took a long time to establish that the i.f. area screening can had not been pressed home into the board during manufacture, with the result that the earth path from R118, R119 and R108 via one leg of the can was not continuous between the can

and the main earth rail. The end of the leg made touch contact with a bridge of solder across the land on the PCB track but not proper electrical contact.

The problem with a remote control version was the brightness button jamming in the labelled escutcheon, which is stuck on. To scrape out the square hole with a scalpel meant taking out the front control panels – two, joined together by a rather dodgy silicone rubber splodge and six or seven parlous, fine wire links that overlapped the edges of the boards. Matters were made more difficult by the fact that the extreme ends of the assembly are lodged behind switches. Then I realised that the answer is to take the c.r.t. out and slide the panels up and away once the many screws have been removed. **J.R.A.**

Odd Hum Bar Symptoms

The problem with this Northern Ireland version of the Nikkai remote control 14in. set, Model MG002R, was a faint but irritating hum bar about an inch deep bounded by paired raster lines and floating slowly, but only on the lower frequency channels, up to about 31. There was no problem at channel 32 and above. I've had similar problems in recent months with other sets, and as in each case I fed in a red raster display from the signal generator. This gives a sharply defined image of the symptom.

Plenty of electrolytic decoupling was applied to the tuner's 12V supply and the 80V feed to the 32V tuning voltage regulator, but to no avail. Now the varicap diode tuning line has no decoupling other than the emitter-follower buffer Q700, so I took the handy way out and added 1 μ F directly to the very accessible tuner's tuning voltage pin. This cleared the hum completely, but gave slow channel change due to the charge time involved. Changing to 0.1 μ F just about did it, so 0.22 μ F was used.

Other hum bars, some depending on the use of lower or higher channels, have been experienced with Hitachi, Ferguson and GEC sets. One GEC set had several evenly displayed wide vertical striations. Some of these faults cleared when the a.f.c. was switched in, which is a fair guide to trying 0.1 μ F or 0.2 μ F on the tuning line to the tuner. But the point is that tuners are generally very easy to get at when trying extra decoupling. So with odd-looking decoupling, hum or other bar diseases I recommend always starting with the supplies to the tuner. If the problem appears after major trouble and much ining and outing of panels and small bits it's possible that disturbance of lead dressing has resulted in stray hum pick-up. But it's happened to us without any such disturbance. **J.R.A.**

Salora 1H0/H3 (Non-remote)

The symptoms consisted of a dark bar across the top quarter of the screen combined with picture pulling that varied with drive and picture content. Suspecting some sort of regulation fault I checked the 142V line with a scope. This revealed a 3.5V peak-to-peak rounded sawtooth at field rate, but comparison with another set showed that this was normal. A similar hum was seen on the video signal and was followed right back to the vision demodulator chip – in fact it could also be seen on the i.f.

input to the chip. The cause was traced to hum on the tuning supply, which is derived from the 142V line via a 1k Ω resistor then three 33k Ω , 0.5W resistors in parallel on the front panel, feeding the TDA1057 32V regulator. One of the 33k Ω resistors was open-circuit. **I.B.**

Bang and Olufsen 33XX Series

Thin black lines would intermittently flash across the screen, and occasionally there would be loss of line and field sync. The cause was traced to 1TR11 on the tuner/i.f. panel. It was going leaky intermittently – when leaky its bias altered and the video signal sync pulses were almost cut off. **I.B.**

Salora J Chassis

This set wouldn't start correctly from cold. If it was left to warm up it would start, but when running with the contrast turned up the width would fluctuate with picture content. The cause was CB712 (4.7 μ F, 35V electrolytic) in the base circuit of one of the power supply switching transistors (TB701) going open-circuit. **I.B.**

Rank T20/T22 Chassis

Height almost doubled was traced to a dirty field linearity control, 4RV5. Sound but no raster can occur when one or both of the field output transistors 4VT3/4 fails. TIP41A transistors seem to work all right in these positions. Replace both transistors and balance with 4RV6. **G.H.**

Decca/Tatung 145 Chassis

In the event of no raster with muffled sound and the c.r.t.'s voltages o.k., check R434 (10 Ω fusible) in the supply to the field output stage.

For a very bright raster check R436, another 10 Ω fusible – Tatung say short it out! **G.H.**

Dwektronic Classic

This monochrome portable had been sold by Woolworths. The fault was an intermittently open-circuit mains rectifier diode. When it went open-circuit the output from the regulator fell, giving hum bars and poor sync — the kind of fault that worries an owner no end and results in many a cheap set being consigned to the scrap heap prematurely. It was surprising that the set had ever worked at all, as the mains fuse was rattling around in its holder. Retensioning the holder seemed to be impossible, so I resorted to soldering the fuse in. **R.B.**

Decca 80/Hitachi VT11

I'm sure that some of my customers ought to visit a psychiatrist. This lady actually visited an optician. Her TV set finally blew the mains fuse and we found that the crowbar had operated because the h.t. was dangerously high. Resetting this and refocusing produced a good off-air picture. Cleaning the video heads and pinch wheel, and roughening up the idler with wet and dry, then produced good playback from the VCR. Finally demonstrating the VCR's a.f.c. switch enabled good recordings to be made. All this was cheaper than the pair of spectacles she'd bought — to be fair she'd been told that

she didn't need them. She had heard the idler screeching in rewind, so she doesn't need a hearing aid either! **R.B.**

Rediffusion Mk 3 Chassis

Intermittent brightness variation due to zener diode 2D15 has been mentioned before (see page 750 last September). In that report the diode had gone open-circuit intermittently. I've had a few cases of it going short-circuit, blanking out the raster. This always seems to happen when there's trouble in one of the RGB output stages — the BF393/5 transistors go short-circuit. BF461/5 transistors are supplied as replacements. It would seem prudent to keep some 7.5V zener diodes handy. **R.B.**

Rediffusion Mk 4 Chassis

These have been extremely reliable sets to date. We are now finding that the BU208A line output transistor is beginning to fail. What you find is that 4R2 (470 Ω , fusible) has sprung open due to the start-up circuitry being asked to run the set — unless the owner has switched off as soon as the fault occurred, which in my experience seldom seems to happen. **R.B.**

Thorn 1500/1525 Chassis

The scan-correction capacitor C90 (0.1 μ F) seems to be prone to going short-circuit in later versions of the 1500 chassis (the 1525 is basically a 1500 with a varicap tuner). The result is obvious – a vertical white line on the screen. The earlier 1500s don't seem to suffer from this problem. **R.B.**

Sony KV2766UB

There was a parasitic oscillation at the bottom left-hand corner of the screen, about six inches long and moving at 45° to the centre of the screen. Carefully dressing all suspect leads then tidying and repairing several suspect solder joints in the power supply and line output stage seems to have provided a cure. **N.B.**

Decca/Tatung 120 Chassis

For code control panel faults, e.g. missing display segments, can only select odd (or even) channel numbers, I suggest cleaning all the pins of the four i.c.s on the panel. I've also had several cases of tarnished connectors in the holders. **N.B.**

Bang and Olufsen 4402 (20AX Chassis)

The complaint with this set was no results. C10 and C12 (both 47 μ F, 40V) were, as so often, open-circuit but replacing them failed to restore normal operation. We found that there was a break in the print at the cathode of SCR1. **N.B.**

Grundig TP400TT Remote Control Unit

An interesting one: the remote control unit works twice then stops. The 47 μ F, 8V electrolytic converts itself into a battery! Replacements are very difficult to find as 16V types are too large so that the case won't close. Grundig don't supply the part as they say it never goes! Personally, I've had at least ten fail. **N.B.**

Vintage TV: Early Cable Techniques

Chas E. Miller

Cable television has been established in the UK for well over thirty years. Thus the early receivers are now well into the vintage era. The Bush TM100 receiver (or "terminal unit") that we are going to look at in this article represented the state of the art when it was introduced back in 1961. As this is the first time we've examined a cable TV set in this series some background information will probably be helpful for those readers not familiar with the techniques used.

Rediffusion Systems

Rediffusion Ltd. had introduced sound re-broadcasting networks in a number of cities and towns well before World War Two. In each area, selected radio stations were picked up by a suitably-sited aerial system and receiver in a position well clear of electrical interference. The receiver's output was fed to large amplifiers that delivered high-level a.f. signals to a network of cables around the town. Each subscriber had a simple selector switch and a loudspeaker equipped with a matching transformer and volume control. For the equivalent of a few pence per week the subscriber had the choice of two or three (later more) stations at reasonable quality without any other running costs. The system was most popular in areas where normal reception was difficult and where a local council owned large numbers of buildings and could thus grant the necessary wayleaves for the cables en bloc.

Rediffusion expanded its operations after the war to take in more areas, and in due course set about adding wired television to the networks. Once again a well-sited receiver was used to obtain a clean signal. This was converted down in frequency to between 4.5MHz and 9MHz for distribution via the existing cables. The extra signal was accommodated on the existing a.f. system by using a phantom circuit – this can be achieved by using extra transformers, centre taps and the earth path as shown in Fig. 1. Only the vision signal was handled in this way, the sound being sent out at a.f. in the same way as the radio programmes. The power level of the vision signal was very low compared to that of the audio signals and boosters had to be used to maintain the signal level throughout the network.

When I first became involved with cable TV in the late 1950s ITV had just been added to the network operating in our area. Up to this time the only receivers used had been

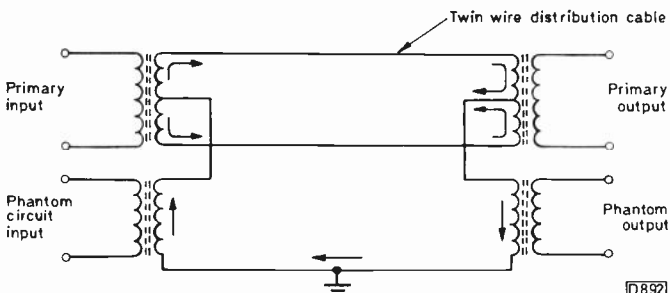


Fig. 1: The phantom circuit technique using a single twin-wire distribution cable. The arrows show the signal current path in the phantom circuit. Instead of using the earth connection, a second twin-wire pair can be used as the return path.

those supplied by Rediffusion itself. Potential subscribers thus had a restricted choice of sets and the full economic potential of the network wasn't achieved.

Cable Converters

As a first step to expand the appeal of wired vision, converters were offered. These made any set suitable for cable operation. Outside contractors were employed to fit the units, and this is where my little concern came in. We bought the converters from Rediffusion at £4.4s.0d. and charged the customer £6.6s.0d., which was not too bad a profit for the period and for the time taken to carry out the installation. There were some incidental advantages as well. Conversion involved removing the entire existing r.f./i.f. section of the receiver, also the audio output stage and loudspeaker. As a result we were soon knee-deep in EF80s and the like, still then in widespread use in ordinary sets and thus having some value. The loudspeakers could be used for all sorts of jobs, notably for car radio installations.

Subscribers paid 3s.9d. (the equivalent of about £2 in today's terms) a week for the two TV programmes and a selection of radio stations. Since ITV and BBC reception in parts of our town was marred by ghosting and low signal levels the cable option proved to be quite popular.

Had it not been frustrated, the pinnacle of my conversion career would have been tackling some 300 sets at a local hospital. This would have left us with about 2,000 EF80s and a lorry-load of speakers. In the event, whichever committee it was that held the purse strings changed its mind at the last moment and opted to instal new sets instead, thereby costing the taxpayer about eight times as much money. We took the loss of the contract philosophically – after all, who wants 2,000 EF80s?

Brand Name Terminal Units

At the beginning of the sixties the choice of cable receivers was broadened by the introduction of well-known brand name sets made specifically to operate on the current Rediffusion system, which was known as TDUK2. The Bush Model TM100 was one of this new breed. It was a 19in., two-station table model resembling the contemporary TV100 series of off-air receivers produced by Bush, but with some quite different circuitry.

With the TDUK2 system the two vision signals were distributed at what were referred to as system frequencies, 4.95MHz and 8.45MHz respectively. The upper sideband only of the first frequency and the lower sideband of the second were used, so that an s.f. strip with a bandwidth of 3.5MHz centred on 6.75MHz was capable of receiving whichever signal was applied to it without the need for any switching other than that carried out at the external Rediffusion selector switch.

Circuitry

Fig. 1 shows the s.f. strip circuit. The selected s.f. signal was applied to the first s.f. amplifier valve V1 (EF80) via the centre-tapped primary of an input transformer per-

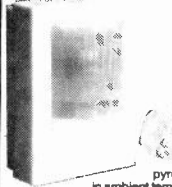
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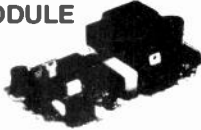


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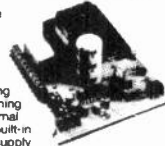
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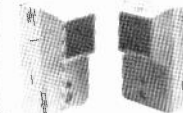
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manently tuned to accept the full bandwidth. V1's bias consisted of a mean-level a.g.c. potential derived from the sync separator circuit in the usual way, plus a potential tapped from the contrast control. Simple tuned-anode coupling was used to pass the signal to the second EF80 s.f. amplifier valve V2, which was operated with fixed bias. Resistance-capacitance coupling was used between the anode of V2 and the OA70 detector diode MR1. There were just two further tuned coils. Because the accompanying sound signal was distributed at a.f., there was no need for any sound traps, which contributed to the simplicity of the tuning arrangements. This time however the traditional standard Bakelite Rediffusion speaker box was banished, a conventional speaker being enclosed in the TV cabinet. A

PCF80) was used in the video amplifier stage. Bush used this valve for the same purpose in its off-air sets, with the triode section employed as a cathode-follower to drive the c.r.t.'s cathode. In the TM100 however the cathode-follower section was used solely to feed the signal to the sync separator stage, the c.r.t. drive being taken from the PCF80's pentode anode.

The timebase and power supply circuitry followed Bush off-air receiver practice of the time.

Due to the impending arrival of BBC-2, the TM100 was to a certain extent obsolescent when introduced. It gave a good account of itself for BBC-1 and ITV however, and remains an interesting example of wired TV technology twenty seven years ago. We didn't need satellites, either!

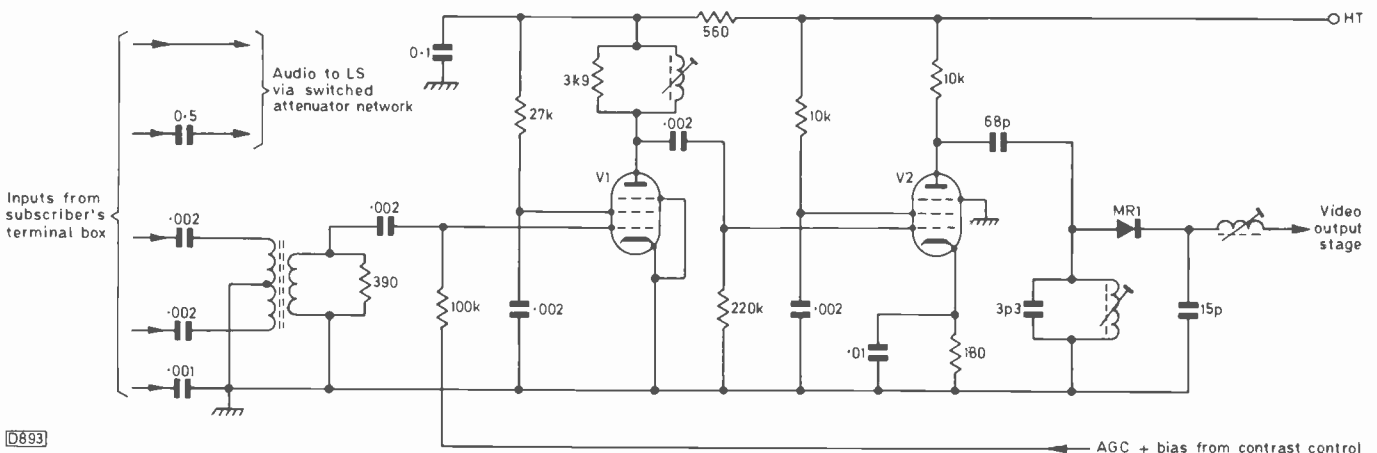


Fig. 2: The s.f. (system frequency) circuit in the Bush Model TM100 used two EF80 amplifier stages followed by an OA70 detector diode. The accompanying sound signal was coupled to the loudspeaker via a capacitor, a switched volume control network and a matching transformer. The rest of the circuitry followed off-air practice.

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Long-distance Television

Roger Bunney

February was a rather quiet month. There was a little of everything to lift the winter spirits, but in rather small measure! Random meteor scatter signals can be seen daily throughout the year of course, but are fleeting (mere pings), weak and largely confined to Band I. Sporadic E signals are rare at this time of the year though short openings do occur: the SpE log for the month is as follows:

- 3/2/88 TVP (Poland) ch. R1; CST (Czechoslovakia) R1; RAI (Italy) IA; +PTT-SRG (Switzerland) E2.
- 6/2/88 TVE (Spain) E2, 3.
- 8/2/88 SVT (SR-1, Sweden) E2; DR (Denmark) E3; YLE-TV1 (Finland) E4.
- 10/2/88 RUV (Iceland) E4.
- 11/2/88 SVT E2; TVE E2, 3.
- 12/2/88 TVE E2, 3.
- 13/2/88 TVE E2, 3.
- 14/2/88 TVE E2, 3, 4.
- 16/2/88 TVE E2, 3.
- 17/2/88 TVE E3.
- 19/2/88 CST R1; TVE E2, 3.

There were fewer loggings reported towards the end of the month, though Roger Fussell at Torpoint continued to note signals from TVE.

There was a tropospheric lift on the 14th, with excellent Band III and u.h.f. signals from France, Belgium and Holland in the south/south-east. A further excellent opening occurred on the 21st, when Band III/u.h.f. signals from West Germany, France, the Benelux countries and Eire were recorded throughout much of the UK. The opening continued through the following day. A new RTE-2 (Eire) station was noted by Simon Harmer (Powys) during this period, on ch. 56 with vertical polarisation.

There was auroral activity on the 6th and 14th, but a more intense period occurred on the 21st with signals identified from SVT on chs. E2-4, YLE chs. E3 and 4 and RUV ch. E4. The auroral conditions continued into the following day and during the evening phase ch. E2 signals from NRK (Norway) were identified.

Interesting to note that during the high-pressure conditions on the 21st a reading of 1,037mb was recorded here at Romsey – rather high!

Several readers have reported reception of Goes ch. E35, with tests for the NOS-3 network occasionally interspersed with Winter Olympics offerings. A Belgian reader comments that care should be taken over La 5, the French terrestrial network which is also available via a French Telecom satellite, and TV5 the French programme transmitted by an ECS-1 downlink and also carried terrestrially by Brussels ch. E56 – the latter service now has the identification “tv5europe”.

Problems arose with the low-cost TVRO installation here when high winds in early February blew over the dish and damaged the feeder at the F plug termination. The resultant short-circuit across the feeder produced a slow cremation in the receiver's power supply and eventually

the primary winding of the mains transformer went open-circuit. This brought to light the fact that it's normal US practice to keep the LNB powered whenever the receiver is connected to the mains supply, even when the receiver itself is switched off. This is done in the interests of frequency and tuning stability, which is sensible enough. Unfortunately, and typical perhaps of the sort of luck I have, the fuse didn't blow and the receiver has had to be replaced.

Here's a tip a reader sent in recently – I quote from his letter. “I discovered that the preset potentiometer identified as VD-Pulse in the service manual for my Hitachi VT8000E VHS VCR and as VS-ADJ on the PCB can be set for zero flicker with moving objects in the still-frame mode when playing back a programme originally shot as cinefilm, though the flicker cannot be eliminated when the programme source is a video camera. This is because film is shot at 25 frames/sec, so consecutive TV fields derived from them are identical.

My thanks to Simon Hamer (Powys), Ian Menzies (Aberdeen), Roger Fussell (Torpoint) and David Moller (Eastbourne) for assisting with the loggings during this rather quiet month.

The IBA Engineering Information Dept., Crawley Court, Winchester, Hants SO21 2QA has published a glossy folder entitled “D-MAC/Packet”. It describes the D-MAC DBS standard in an easy to understand manner and is free to anyone who writes in to the IBA – two second class stamps should be sent to cover postage.

News Items

EBU: The EBU technical centre is to move from 32 Avenue Albert Lancaster, Brussels, to Geneva, alongside the EBU legal section. It seems that high taxation in Belgium precipitated the move.

Finland: Experimental local TV services are expected to start in various parts of the country later this year, funded by the government and in some cases carrying advertisements.

Hungary: MTV-1 is now operating seven days a week. MTV-2 is to transmit a full day programme throughout the week starting next year.

Switzerland: Telecine should by now have started to transmit Canal Plus programming via the ch. E69 outlet.

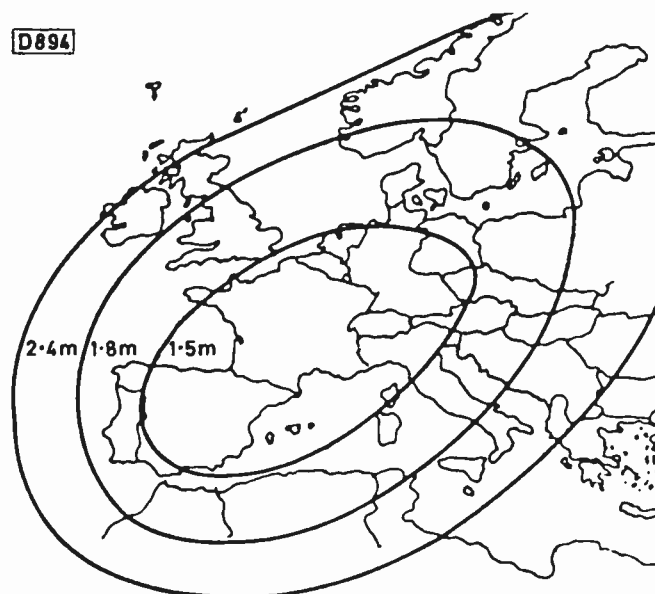


Fig. 1: European coverage of the PAN-AM satellite, courtesy Tele-satellit. For further details see last month.

In Brief: RTL Plus now has on its electronic test pattern the identification "RTL PLUS KOLN" – the main office has moved to Koln in West Germany. The ch. E7 Dudelage transmitter comes on earlier than the satellite service . . . Tele Monte Carlo (TMC) is now transmitting a combination of its own and the French M6 network programming . . . The Moscow first programme now starts at 0330 GMT . . . Colour has been added to The Voice of Kenya Television service . . . The West German Berkenthin (Hamburg) transmitter is now on test on chs. E25 (2kW), E36 (6kW) and E60 (2kW). Ch. E25 is used for RTL Plus and ch. E60 for SAT-1.

Masthead Amplifiers

The masthead amplifier came into its own with the advent of TV transmissions at u.h.f. – in many places signals of entertainment quality would not be obtainable without the use of an amplifier. Noise levels have been gradually reduced in recent years, and the latest u.h.f. amplifiers have noise figures of typically 1.5dB. The Dutch company Schradar has an amplifier with a noise figure of only 1dB.

Problems can arise where u.h.f. and v.h.f. aerials are to be used with a single long download. The v.h.f. signals may not need amplification but a diplexer could introduce too much loss. Then again, it may be difficult to achieve a d.c. pass at u.h.f. with a d.c. block at v.h.f. Another situation is where distribution of v.h.f./f.m. radio signals along with u.h.f. TV is required at several outlets. Des Walsh has been looking into such problems. He has come up with suggestions for diplexing a v.h.f. signal into a masthead amplifier's u.h.f. output (i.e. no amplification at v.h.f.) and for diplexing a v.h.f. feed into a u.h.f. output and providing some amplification for both – see Fig. 2.

Fig. 2(a) shows a typical u.h.f. amplifier output circuit where the unit is powered via the download. The 2.7pF capacitor provides a d.c. block in the signal path while the r.f. choke passes the d.c. and prevents loss of signal via the power supply circuit. Similar arrangements are used at

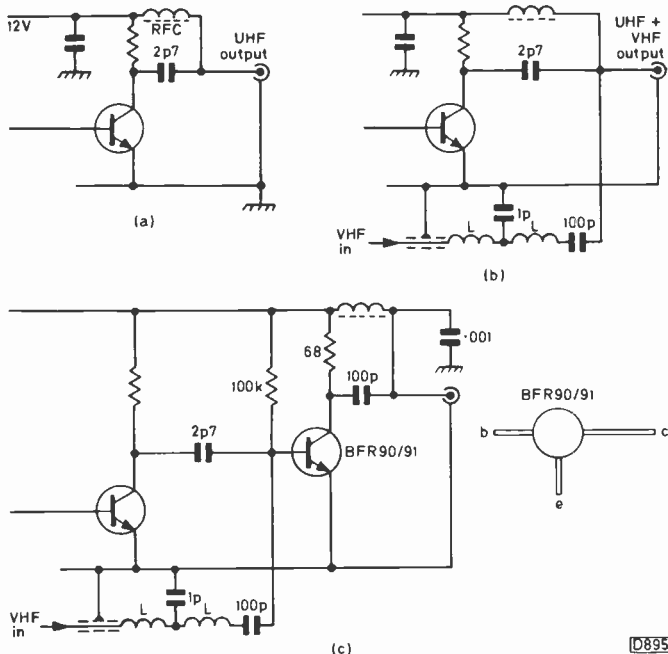


Fig. 2: Typical u.h.f. masthead amplifier output circuit (a); modifications to incorporate v.h.f./u.h.f. diplexing (b); v.h.f./u.h.f. diplexing with an additional stage of amplification (c). The coils marked L consist of 4½ turns, ¼in. diameter.

NEW FROM YOKO MODEL F6/ VHF/UHF SYSTEM B/G/I/L Operation £95.00



Yes, the ubiquitous Yoko 5" black & white TV for reliable VHF/UHF TV/DXing is back — but in an improved version. Model F6 incorporates not only **SYSTEM I** (6MHz sound for UK/Eire/South Africa) but **SYSTEM B/G** (5.5MHz sound for Europe, Middle East, Australasia and other parts) AND **SYSTEM L FRENCH** standard (6.5MHz sound). The 5.5/6MHz sound switching is automatic within the receiver, the 6.5MHz and positive/negative video switch is situated at the rear of the television.

It's restyled too, featuring a sleek black monitor look and with rotary drum continuous band tuning. A telescopic whip antenna is situated at the rear, together with a 75 ohm coaxial aerial input socket.

Versatile 3 way powering for AC Mains, internal batteries or an external 12v DC source (lead supplied), its ideal for the home, mobile, camping/caravanning or that 'DX-pedition' to the local mountain (and we'll supply the aerials if needed!). Completely compatible for use in the UK and throughout the Continent (including FRANCE). It's just the answer for a compact — 5.7(H) × 5.5(W) × 8.6(Deep) inches — high gain and comprehensive TV-DX installation and at a reasonable price.

Stocks of this new receiver have just arrived from the Far East, ready for the new Sporadic E 1988 openings — so don't delay, order today and maximise your loggings this coming season.

YOKO model F6 multistandard VHF/UHF 5" screen TV (System B/G/I/L) £95.00. Carriage UK £4.95; elsewhere POA.

Aerial Techniques, the company that knows the TV-DXing hobby carry a comprehensive range of aerial equipment for every type of installation — and with a huge range of filters, amplifiers, cables, rotators, masts and supporting hardware. Send for our illustrated **Catalogue at 75p**, if it doesn't list what you want, then we can obtain it quickly.

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AERIAL TECHNIQUES (T)
11, Kent Road, Parkstone,
Poole, Dorset, BH12 2EH. Tel: 0202 738232.



the receiver. The two circuits suggested by Des are shown in Fig. 2(b) and (c). The first adds the v.h.f. signal to the u.h.f. output via a filter to prevent u.h.f. signal loss. This feed has its own d.c. block (100pF). In the second circuit amplification by means of a wideband circuit using a BFR90 or BFR91 transistor in the common-emitter mode is provided for both sets of signals. No gain figure is suggested but with care over construction a voltage gain of 10dB should be achieved. Constructional details are not provided — it's assumed that anyone modifying an amplifier would appreciate the precautions necessary at these frequencies.

Des also comments on the subject of interference from high-band v.h.f. PMR and 450-470MHz communications signals. His experience shows that the use of a rejector circuit in series with and as close as possible to the amplifier's input is best. For the high-band PMR rejector the coil should consist of three-five turns of ¼in. diameter, ½in. long (preferably of silver-plated wire), with a 5pF capacitor. For the u.h.f. interference the coil should consist of one-two turns with a 1-2pF capacitor. If care is taken over construction the rejector should provide 25-30dB of attenuation.

Our thanks to Des for this valuable information.

Satellite News

The fault with the Telecom I-B satellite is believed to be in the 30V regulated line: at the time of writing the craft is still out of action. Two Israeli satellites for TV/telecommunications use, named Amos-1 and Amos-2, are to be launched during the next five years. They will provide home satellite TV reception within Israel and

transponders will be available for use by other countries. The Australian AUSSAT operation is still running at a loss, partially because of delays in signing leases for three of the four 30W transponders for the outback services.

The West German and French authorities are considering a joint DBS service from a single satellite, with two French and two German channels, following failure of the West German TV-Sat craft. This could be good news for the French since it seems that difficulty is being experienced in finding users for some of the TDF-1 craft's transponders.

T.S. Nanda Kumar of Madras regularly receives good quality signals from the Soviet u.h.f. TV satellite Ekran at 99°E, on ch. 51. Recently he's noted signals on ch. 54 as well, with the same programming. He wonders whether a second programme service is in the offing. Does anyone have any information on this?

Ian Waller (Lincoln) receives two high-level Eurovision channels from the ECS-4 craft at 10°E. The signals are transmitted at 10.995GHz, with horizontal and vertical polarisation respectively. Unusually, there's intercarrier sound rather than sound in syncs. RTL Plus has appeared at 11.472GHz and RAI at 11.655GHz, both with horizontal polarisation. An interesting signal received from this satellite is a low-level Deutsches Bundespost vision transmission at 11.49GHz with vertical polarisation. ORF (Austria) programmes at 11.59GHz have been received from the ECS craft at 7°E.

DX-TV Potential

The prospects for DX-TV reception continue to increase.

Ireland is to have a third national commercial TV service and in addition there's to be a multi-channel subscription service distributed either by cable or off-air in the low microwave band (2.5GHz). The plans are to have upwards of eleven channels available via cable/MMDS. With the prospects of an MMD service in the UK before long 2.5GHz equipment should become readily available,

though the subscription aspect is a complication. The 2.5GHz band is now commonly used for urban signal distribution in the USA, and cheaply made Taiwan equipment can be bought via mail order etc. in North America.

Meanwhile TV broadcasting in Denmark is in an expansionary phase. Several local TV stations are due to come into use later this year, at u.h.f. Some transmitters for the TV-2 network, also at u.h.f., are already on test. Our thanks to the BDXC for the following information on TV-2, which has an on-air date of late September/early October. Copenhagen West ch. 53 was due to start test transmissions on April 5th. The same site is transmitting DR-1 on ch. 31. Both these u.h.f. transmitters have an e.r.p. of 600kW. The ch. E4 outlet is being kept in use for the time being but is due to close at a later date. Other TV-2 stations are as follows:

Station	Ch.	On test	Area
Abenra	E27	1/7/88	Sonderjylland/ Sydslesvig
Hedensted	E30	15/8/88	Vejle
Videbaek	E40	1/10/88	Ringkobing
Tommerup	E22	15/11/88	Fyn
Svendborg	E32	15/11/88	Fyn
Viborg	E56	1/1/89	Viborg
Thisted	E28	1/1/89	Viborg
Hadsten	E26	15/2/89	Arhus
Nibe	E35	1/4/89	Nordjylland
Tolne	E37	1/4/89	Nordjylland
Varde	E33	15/5/89	Ribe
Jyderup	E33	1/7/89	Vestjylland
Nakskov	E52	15/8/89	Storstrom
Vordingborg	E58	15/8/89	Storstrom
Ro	E56	1/10/89	Bornholm

Note that later dates are approximate.

These additional u.h.f. stations will increase the prospects for DX-TV reception, given the right conditions, but will also increase the possibility of co-channel interference in Sweden and Germany.

Letters

TRADE AND INDUSTRY COMPARED

Recent letters have been particularly interesting, covering a range of subjects from dabbling to service charges and enthusiast repairs etc. I would like to add a few comments.

Perhaps I should first mention my position. Eleven years ago I left the trade to go into industry. This change was made with some trepidation. I'd been a large fish in a small pool, and was going to be a small fish in a large one. Over the intervening years I've managed to progress however, and have ended up in management – a medium fish in a large pool!

The differences between industry and the trade are marked. In industry you don't have to face up to Joe Public with his big mouth and shallow pocket. We work on a limited range of very high-technology products. Mistakes can be horrendously expensive: thus rewards are high, commensurate with the responsibility. We use a lot of specialised equipment, a typical call-out charge being around £80 followed by £50 per hour plus the cost of parts. The interesting thing about this is that I believe the

skills involved and the ingenuity needed are frequently less than those required of skilled personnel in the TV trade. The guys who do our servicing probably couldn't fix a TV set – they seem to be rather frightened of VDUs. They certainly wouldn't be prepared to deal with offensive customers and their kids and pets. The chance of some idiot having got into the equipment before them is remote. But these specialist servicemen are well paid and drive around in unmarked D and E registration Astras and Cavaliers, not beat-up Marinas.

Why did the TV trade get itself into such a state? The problem seems to lie with the inexpensive, mass-produced, high-technology products sold by Dixons and the like. Realistic service charges could end up being greater than the purchase price, unlike the industrial electronics scene where a cheapie personal computer costs £8k or so. Note that the public doesn't mind paying out hundreds on car repairs – because the vehicle cost thousands in the first place. It's a matter of proportion: I guess people don't like any one service charge to be greater than ten per cent of the purchase price.

Am I saying that the trade's on a hiding to nothing? I suppose the answer is yes. I fear that many TV technicians, even the most skilled, end up at the bottom of the heap so far as salaries are concerned. This is brought out by the SERT review of wages and salaries over the years. TV service engineers deserve more, but how are they to

get it? I thought this years ago but couldn't change the system, so I made the effort and got out when an opportunity arose.

Industry has different pressures. There are deadlines to meet, huge sums are involved and tough decisions have to be taken. This aspect worried me to start with, but I got used to it. In return, the rewards in terms of salary, holidays, pension, etc. are better. I doubt whether I could earn more than two thirds of my present salary in the trade.

However, as our esteemed editor said to me on one occasion, "once a TV man always a TV man", and I have to confess my continuing interest in and affection for the trade. This is possibly made more indulgent by the fact that I'm looking from where the grass is greener and don't have to endure the day-to-day rigours. Instead, I take a delight in reading about Les's problems with his sets and customers! This means that I'm a dabbling professional as opposed to the unprofessional dabbler of the kind that drives Peter Goodman and friends crazy. The saying goes that "fools rush in" – B.A. Berry's article in the March issue, with its wisdom and cautionary tone, is timely and apposite. Unprofessional dabblers should read and digest!

Current video technology is way beyond most dabblers' capability of course. They wouldn't achieve much other than add damage and complication to the original fault, which trade personnel are then cursed with having to fix. For the electronics specialist like Mr. Sergeant, who obviously enjoys getting into tellys as well as wellies at the weekend, the situation is rather different. He may not know all the wrinkles, but he's aware of the disciplines involved.

Harold Peters refers to the practical aspects of the magazine. This brings us to the old problem of whom to aim the magazine at? It was originally *Practical Television* of course, aimed at the enthusiast and not very trade orientated. The editor has clearly tried to strike a balance as conditions have changed. The trade now needs a magazine like *Television*, where previously it got by without. *Television* has had to change to survive – the advancing technology has made the hobbyist approach by and large decidedly impractical! I believe that the change has benefitted the trade and those interested outside it. I for one enjoy the way in which the magazine keeps me in touch, and am glad to be able to contribute articles of a practical nature from time to time in the old tradition. The motivation that got me writing in the first place was, you guessed it, not being too well off in the TV trade!

*Keith Cummins,
Holbury, Hants.*

SEPARATING SALES AND SERVICE

As I see it, Steve Beeching got it dead right in his letter in the March issue. The future seems to lie in separating the sales and servicing sides of the trade. It's best for dealers concerned with sales to contract out their servicing needs to separate companies in out of town premises with engineers who can be kept up-dated continually and with all the necessary test equipment and jigs. The only way in which the latter companies can be made financially viable is for them to work for a number of dealers. This approach certainly works here in Devon, and I see no problems in areas with larger populations. The end result is that the dealer can maximise the space available for selling, an essential condition with high town rates, and reduce his wages bill and work load.

If the dealer has all these pluses, what are the disadvan-

tages for him and the advantages to the service company? The dealer obviously has to pay for rental and maintenance contract repairs, as he does at present. He can sell maintenance contracts as at present, agreeing a similar contract between himself and the service company or going direct through an insurance company such as D & G Telesurance. Take an under-guarantee repair which at present must be the biggest headache for a dealer's service department. He sends it to the service contractor who is getting the machines from a number of sources, has the required test equipment and is able to keep his engineers trained to handle the latest sets. He can therefore turn the repair around in a reasonable time while the dealer has no paperwork other than the job card, all labour claim paper work being dealt with by the contractor who, with his more efficient organisation, can do the job within the value of the reimbursement. This is becoming a necessity rather than an option: dealers cannot go on making a loss in their service departments while trying to subsidise under-guarantee repairs through the chargeable ones.

I'm afraid I lose patience with the dabblers who seem to want the best of both worlds. I've nothing against anyone treating it as a hobby and delving into their own equipment, but I get the impression that this is not always the case and that irresponsible work is being done on modern, high-technology TV sets and VCRs. When such equipment comes to us with man-made faults and a request for two bills or an itemised bill it usually means that a dabbler has been at work. When you look at some of the questions in service bureau you cannot believe that they are from genuinely informed people working on their own or a mate's gear: some indicate that the questioner shouldn't be let within a mile of the appliance.

The subject is no longer one that is suited to the DIY approach. Those who want the magazine to teach them how to repair sets should go to the local technical college. If this is too much trouble and they want only their own equipment repaired they should take it to someone qualified to undertake the task.

*Nick Beer,
Bideford, Devon.*

TRADE AND TV INTEREST

I've read with interest recent letters on trade cowboys, enthusiast repairs and so on. Surely the magazine's purpose has always been to encourage an interest in TV electronics? The pleasure in this can be derived from "tinkering" with such equipment and carrying out *sound* repairs. Why, after all, did most engineers come to think of entering the trade in the first place? Because of their interest, possibly stimulated by reading *Television*. I suspect that our magazine would not exist were it not for the large numbers of enthusiasts who purchase it. It's a reflection on the current quality of *Television* that the trade now find it of interest too. Advertisers obviously recognise this.

I entered the trade rather late in life, after spending many years in the electrical contracting industry. During those years I occasionally dabbled with TV, having bought my first copy of *Practical Television* in 1957. A few years ago I decided to become more involved and am now a fully qualified TV and video engineer. I would recommend that real enthusiasts attend meetings and courses with their local amateur radio club and also take advantage of local college education for City and Guilds qualifications.

There will always be bodgers, cowboys and equipment

owners who wire fuses over etc. They can and do create extra work for those who do things correctly. So it's not necessarily a bad thing! I must say that some of the worst workmanship I've seen has been carried out by those in the trade.

One last word of advice to anyone misguided enough even to think of entering this trade – don't! You won't get rich, even slowly!

Dave Mackrill,

St. Leonards-on-sea, East Sussex.

EX-VALVE SET DABBLER REPLIES

My letter to you (January) seems to have created quite a stir! I'd like to clear up a few points. In my younger days I worked on the other side of the fence, in the industrial part of the trade. When my friends asked me about my job I would say that I dabbled about with valves! But I had to pass an exam to get the job, building test gear such as sweep generators, bridges and oscilloscopes – also dusting and sweeping up! For all that I don't count myself above the bloke employed to do the cleaning.

I didn't intend to imply in my last letter that the dabbler should work on someone else's set if it's wanted for regular use. What I had in mind was the old set that auntie passes on to a lad interested in electronics as she's got herself a new one.

But if people have a good background knowledge they should be left to carry on with repair work that might benefit the elderly and unemployed who have little chance of being able to pay for shop repairs. The law should act in the case of those who just make a mess of other people's sets and try to get money for nothing. Mr. Goodman is quite right in this respect. When I mentioned that a large retail outlet employed youngsters to change panels it's a fact. I don't repair sets now so I asked a retailer to deal with a simple case of field collapse. They sent someone who simply swapped the panel.

A club for dabblers could well be a way to help enthusiasts to enjoy their hobby, but wouldn't be suitable as a public repair service. I would see it as a way for those interested to gain experience. It would involve quite a bit of organisation.

Ex-valve set dabbler.

GRUNDIG SPARES

Further to my recent letter on Grundig's new after-sales policy, I should have mentioned that in streamlining their operation to optimise dealer support Grundig have not ignored or neglected non-dealers. They have arranged for spares to be available through Willow Vale of Reading who, as most dealers will be aware, offer an excellent by return service. This is an important point, and I would like to set the record straight.

R.K. Caley,

R.K. Electrics of Ilfracombe.

TEST EQUIPMENT A PROBLEM

I've been an engineer all my life, first in the Navy with radio/radar and all that, then in the TV trade with the Cop, followed by a teaching career in electronics, but am now disabled as a result of an accident. I still have a very active mind however, and to pass the time I do good deeds for needy folk such as pensioners whose antiquated equipment has been turned away by the professionals as uneconomic. I don't bodge, I repair. There must be many

more like me who thoroughly enjoy *Television* and look forward to it each month for the information so much needed by its mortal souls.

Test equipment is a problem. On my disability allowance I can't afford things like scopes, frequency counters and signal generators. Is there anyone in this area who would loan such equipment when required, or for that matter sell redundant equipment at minimal cost? Any information would be helpful and all letters answered.

C.T. Marden, 20 West Street,

Ecton, Northants NN6 0QF.

REPLY FROM MASTERCARE

Two letters concerning Mastercare appeared in your February issue. These call for comment. First it is not true that we don't offer trade account facilities. It depends on turnover. Whilst we are not prepared to open accounts for a turnover of say £100 per annum, we are currently trading on account with a number of companies.

Mr. O'Hagan mentions that he was charged £10 for a circuit photocopy but neglects to mention that a complete technical service manual was included in the price. He also neglected to mention that the price of £90.64 for a set of scan coils included the c.r.t. and carriage.

Mr. Lewis says that parts for Amstrad equipment are available from PV Tubes. These are not supplied by Amstrad and are pattern parts.

*Bryan Magrath, Marketing Manager,
Mastercare, Hemel Hempstead, Herts.*

ON CABINETS

I would like to support Mr. Freeby in his complaint (March letters) about poor quality cabinets. He mentions flimsy plastic. I would put most castors on music centres in this category as well. Incidentally I think a fortune awaits the cabinet maker who provides for a VCR to be housed above the TV set instead of beneath it, so that you don't have to grovel on the floor.

T.A. Carrick,

Newquay, Cornwall.

HELP WANTED

I have been trying for weeks to find a source of spare parts for a Rediffusion Sheerline M3829 stereo cassette deck. Rediffusion have no record of this model and none of the sources they suggested have been able to help. What I specifically need is the play/record switch mounted on the PCB and its mechanical linkage to the front panel record button, also the pinch roller assembly. The unit doesn't seem to be very old so hopefully spares will be available somewhere. Any help would be much appreciated.

D.M. Williamson, Sound and Vision Services,

The Old Wool Market, Quay Street,

Haverfordwest, Dyfed. Telephone: 0437 66945.

FOR DISPOSAL

I have for disposal a Bush Model TV53 405-line TV receiver, plus many spare valves for it and the circuit diagram. If anyone is interested I can be contacted at the address below or on 0942 675 299.

F.C. Bailey, 2 Elmridge,

Leigh, Lancs WN7 1HN.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £1-50 cheque or postal order (made out to IPC Magazines Ltd.), the query coupon and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

GRUNDIG CUC2410 CHASSIS

The problem with this set is no raster. There's e.h.t. and the tube's heaters are alright. Also the sound is o.k. A check at the c.r.t. base board shows that the tube's cathodes are at about 200V.

The absence of the picture is because the high cathode voltages have cut off the tube. This chassis uses automatic black-level correction, the sampling pulses for which enter the RGB module at pin 7. Operation of the black-level clamp is very critical, and the TDA3566 decoder chip will shut down if it sees an incorrect level at this feedback point. The most likely cause of the trouble is leakage in one of the BF421 or BF422 transistors in the RGB output stages. Cold checks on these devices can sometimes be misleading, the only sure test being substitution – or an exchange/replacement c.r.t. base panel.

SHARP VC9300

ITV and Ch. 4 programmes can be recorded and played back but with BBC-1 and -2 the recordings are usually either in monochrome or with intermittent colour. The sound is o.k. and the signal strength good.

This problem is sometimes caused by wide component tolerances. Change C543 to a 5 per cent type., part no. RC-QZA102TAYJ or VCQCSH1HM102J, and C539 to a UJ type, part no. VCCUPA1HJ181J. Then if necessary realign the a.f.c. circuit to get the tuning spot on. If these measures fail to restore reliable operation we see no alternative to realigning the colour-under circuits – reference oscillator, a.f.c. and a.p.c. – as specified in the manual.

PANASONIC TC216G

The fault is seen most clearly when letters or numbers are displayed on the screen. They seem to be scrambled, the dots etc. making up the letters being all over the place so that the words are unreadable. The effect is also shown up with a cross-hatch pattern, where the verticals are affected, with dots at the top of each square – the dots are stationary but their position can be altered by adjusting the brightness or contrast control.

Check the earthing of the c.r.t.'s outer conductive coating – it should be connected to Y1 on the c.r.t. base panel, then to chassis via E on C07. If this is in order suspect the earthing of the tripler, then the tripler itself.

FERGUSON 3V22

During playback of a self-recorded or prerecorded tape the picture exhibits a horizontal "breathing" effect which has a frequency of about 1Hz and an amplitude of a few

centimetres. Along with the picture width variation there's a corresponding cyclical horizontal misregistration of the chroma and luminance information, also a cyclical variation in the colour saturation. The heads have been cleaned and new belts fitted.

The cyclical horizontal picture displacement will be due to either (a) a rhythmic variation in the back tension (look for a slow oscillation of the back-tension lever position) or (b) a slow variation in the head drum speed. The latter is more likely, in which case it could well be that the head drum motor is worn. Before condemning/replacing it check the settings of R52 and R49 on the servo board.

AMSTRAD CTV2200

The d.c. fuse F502 in the power supply had blown and we found that the 2SC3156 chopper transistor Q501 was short-circuit. Unfortunately, replacements keep blowing. We've tried powering up via a variac but the set remains dead until about 100V when the transistor fails. Is there an alternative for the 2SC3156?

The chopper transistor has to be of the specified type and unfortunately substitutes will not work. Check for shorts on the h.t. line, particularly D504, Q802 etc. If no obvious shorts are found, check R506, R507 and R517 in the chopper control circuit before suspecting the μ PC1394C chopper control chip IC501.

FERGUSON 3V30

This machine works normally for a while then develops reduced sound or complete loss of sound with its own recordings. At the same time previously recorded sound can be heard to a greater or lesser extent. The recommended smaller-diameter take-up guide pole has been fitted but has made no difference. We found that the amplitude of the sound bias waveform fell when the fault occurred, and that replacement of the oscillator transistor seemed to cure the problem. The machine has now come back with the same fault however.

We suggest that you check carefully for dry-joints at the pins of the oscillator transformer T1. If everything is in order here, replace all the following capacitors with Ferguson or JVC approved types: C43, C44, C45, C46 and C48. These measures have cured two similar cases that we encountered.

AMSTRAD CTV2200

The surge limiting resistor R501 and the chopper and line output transistors Q501 and Q802 had all failed. Fitting replacements produced a good picture but after ten minutes it started to shrink at the right-hand side. We kept the set going for a week. Sometimes it worked all right but at others the right-hand side of the picture would shrink then expand again. After a week the same two transistors blew.

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cheque or postal order, must accompany EACH PROBLEM sent in accordance with the notice printed above.

TELEVISION MAY 1988

It seems that the line output stage is being heavily overloaded when the picture shrinks. We suggest you check, preferably by substitution, C815 and C862 which are in parallel with the line output transistor, then if necessary C831 and C854 in the scan drive circuit. If the fault persists the likelihood is that the line output transformer T802 is faulty.

SANYO VTC5150

The picture is fine but there's wow on the sound, at around 0.5Hz and noticeable only on music. The voltages on the servo board are all correct and replacing the main chips on this board has made no difference.

We suggest you clean the tape path thoroughly and fit a new pressure roller. If this doesn't clear the fault it's likely that the capstan motor is faulty. This can be due to bearing trouble and is often detectable, preferably with the motor removed, by turning the shaft by hand.

TEST CASE

305

Each month we provide an interesting case of TV/video servicing to exercise your ingenuity. These are not trick questions but are based on actual practical faults.

David the Downtrodden was nearing the end of his day's field service calls. Amongst the last was to be a visit to the owner of a Fidelity CTV14R colour portable. The phoned complaint was of a snowy picture. A glance at the roof aerial on the way to the front door showed that it was still in place and pointing in the right direction. Even so he took a monochrome portable into the house with him to be able to make a quick check on the aerial system. The picture on the screen of the ailing Fidelity CTV14R was quite grainy, whereas that on the little test set was fine. So the fault was in the colour portable.

Removing the back, David found a strange tuner (type UE2-B31F). He didn't have one of these amongst the ELC1043s and U321s in the mobile stores. No bad joints could be found, so out came a bias box of his own invention to check the tuner's a.g.c. operation. Which pin is used for automatic gain control? The circuit diagram and service manual are not very clear on this point, but by a process of elimination he decided that pin 5 must be the one. Connected here, the battery-powered bias source didn't improve the picture at any setting. The set would have to be taken back to the workshop.

When it's turn on the bench came Channel Four was showing a test pattern. As well as the grainy effect, the picture was marred by a slight degree of ghosting, though the ghost was very close to the main image – it was a faint, single “ring” effect. The right sort of tuner wasn't available at the workshop either, so the one in the set was

dismantled and carefully checked for dry-joints and any other physical problems. None were found. The next step was to check the 12V supply to the tuner and i.f. strip, then the voltages around the SL1432 i.f. preamplifier/SAWF driver chip IC4 and the TDA4420 i.f. chip IC5. All voltages were within a few per cent of those specified in the manual.

Although suspicion remained firmly with the tuner, the fact that the i.c.s were in stock led first to the SL1432 being replaced. The picture remained as before. Was it worth trying the i.f. amplifier/demodulator chip? It seemed an unlikely candidate, because faults this far along the signal path don't generally give rise to much noise on the picture. In addition this chip plays no part in supplying the tuner with a.g.c. But the TDA4420 has only eighteen pins, the soldering iron was hot and the desoldering braid was handy. In the new one went. Our theorising was right: the chip is too far downstream signal-wise to cause noise on the picture.

So the tuner was removed and sent off to a well-known rebuilding firm, which quickly despatched an exchange one of the same type. The replacement was fitted with a flourish of the soldering iron. Much consternation ensued – the fault was still there! After much winding of the tuning control potentiometers and rechecking of the a.g.c. department the tuner repair company was accused of sending out a defective unit. In fact both tuners were perfectly all right! What was the real cause of the trouble – a clue is given by the side effect noticed in the workshop? We'll clear up the snow in the next issue!

ANSWER TO TEST CASE 304

— page 449 last month —

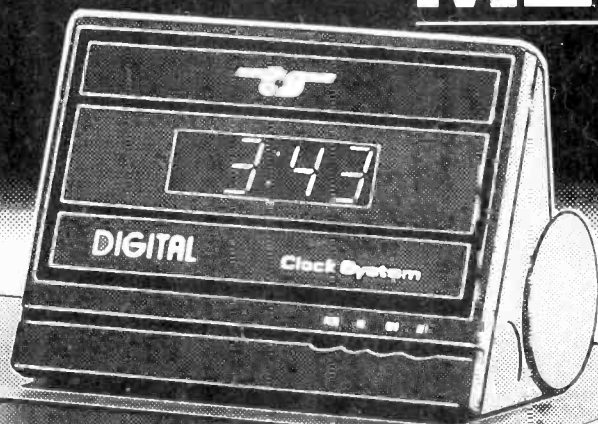
Techno-Supersleuth was in deep trouble with a Ferguson TX10 chassis last month. Despite TS's laudable attempts at diagnosis, which involved replacing two i.c.s and many peripheral components, the vertically-jittering picture would not steady. Much of the diagnostic process had been based on the assumption that there was something wrong with the sync pulses. They were finally exonerated by injecting field sync pulses from a known good set.

This procedure showed up some interesting line and field phase offsets between the four channels available from the local transmitters. With the set-up described, correct vertical and horizontal positioning of the picture was obtained only when the two sets were tuned to the same channel. With sync pulses from one channel and the picture from another some strange and unusual effects were seen. But we digress.

The vertical field jitter effect wasn't coming from the field oscillator or output stages at all. Indeed the problem would have been solved more quickly by considering the vertical shift circuit, which basically consists of a variable resistor that enables a direct current to bypass the field scan coupling capacitor – the amount of this current flowing through the scan coils enables the picture position to be set. The field shift control RV772 was in order, but the scan coupling capacitor C777 (2,200 μ F) was leaky and “talking”.

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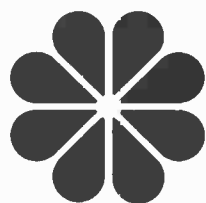
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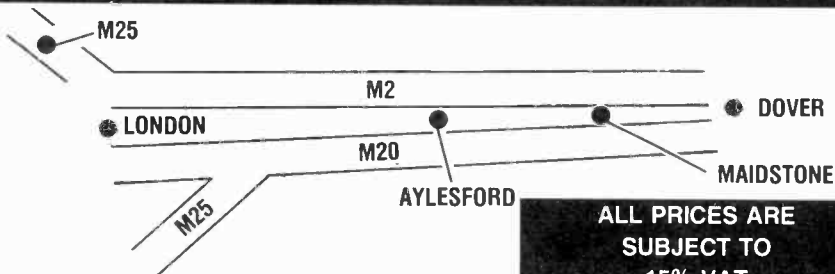
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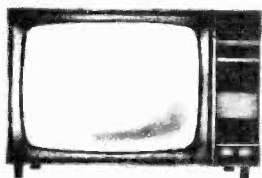
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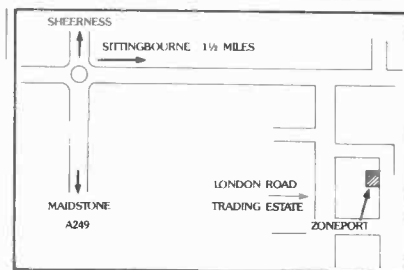
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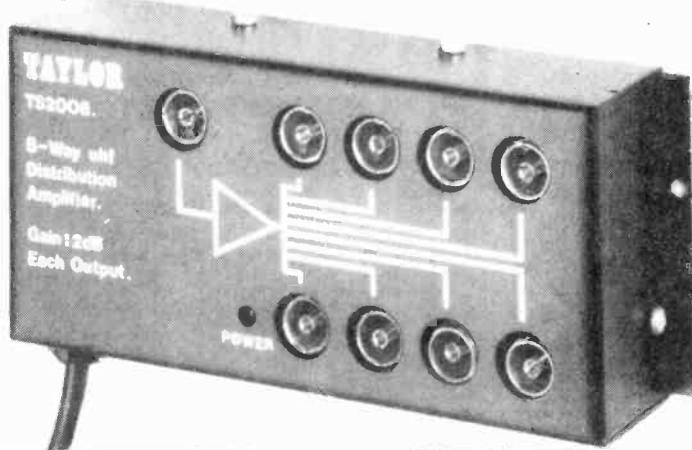
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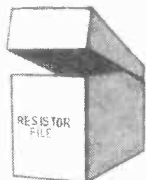
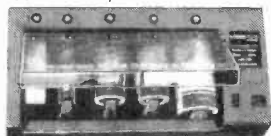
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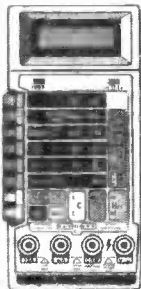


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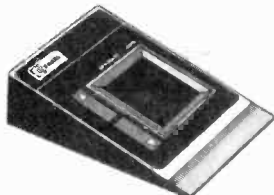
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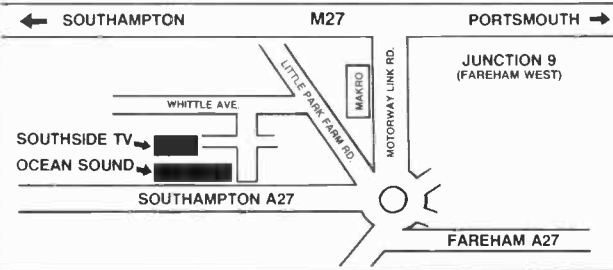
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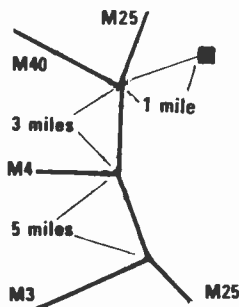
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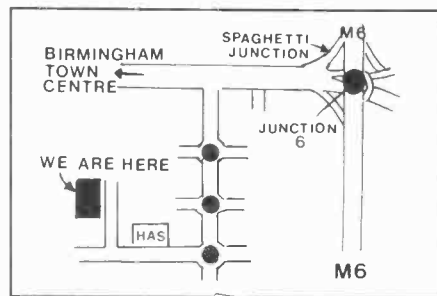
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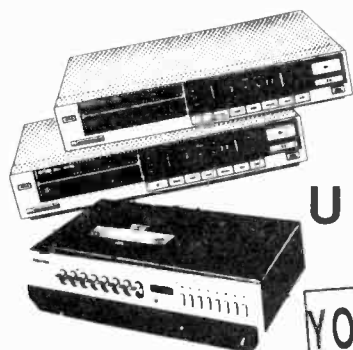
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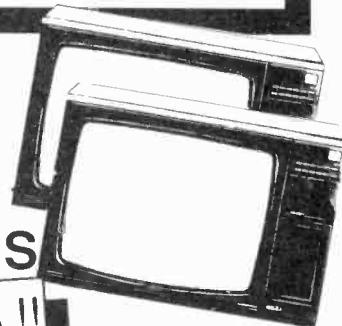


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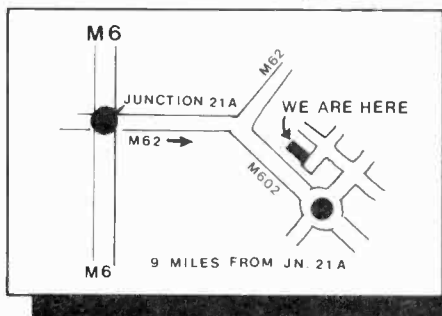


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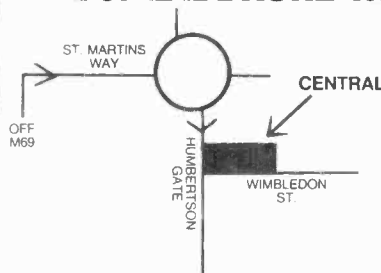
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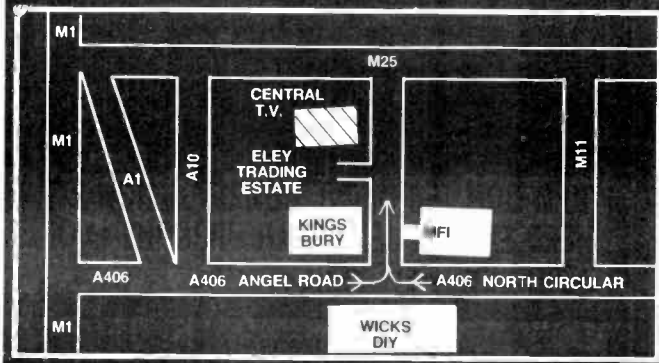


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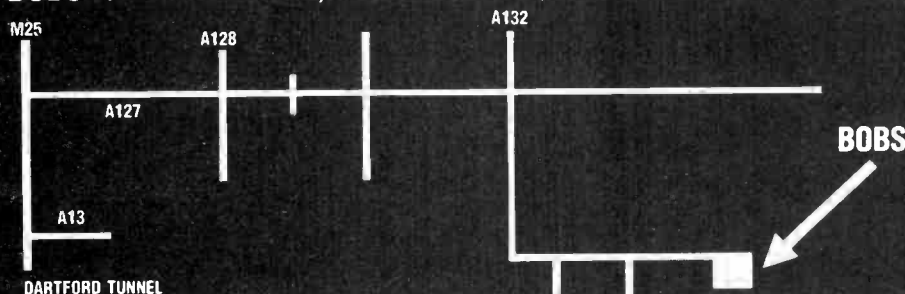
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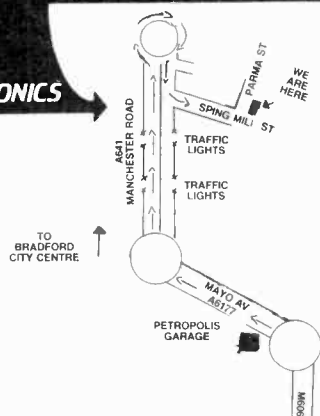
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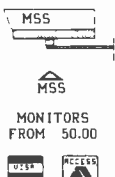


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