NOVEMBER 1979

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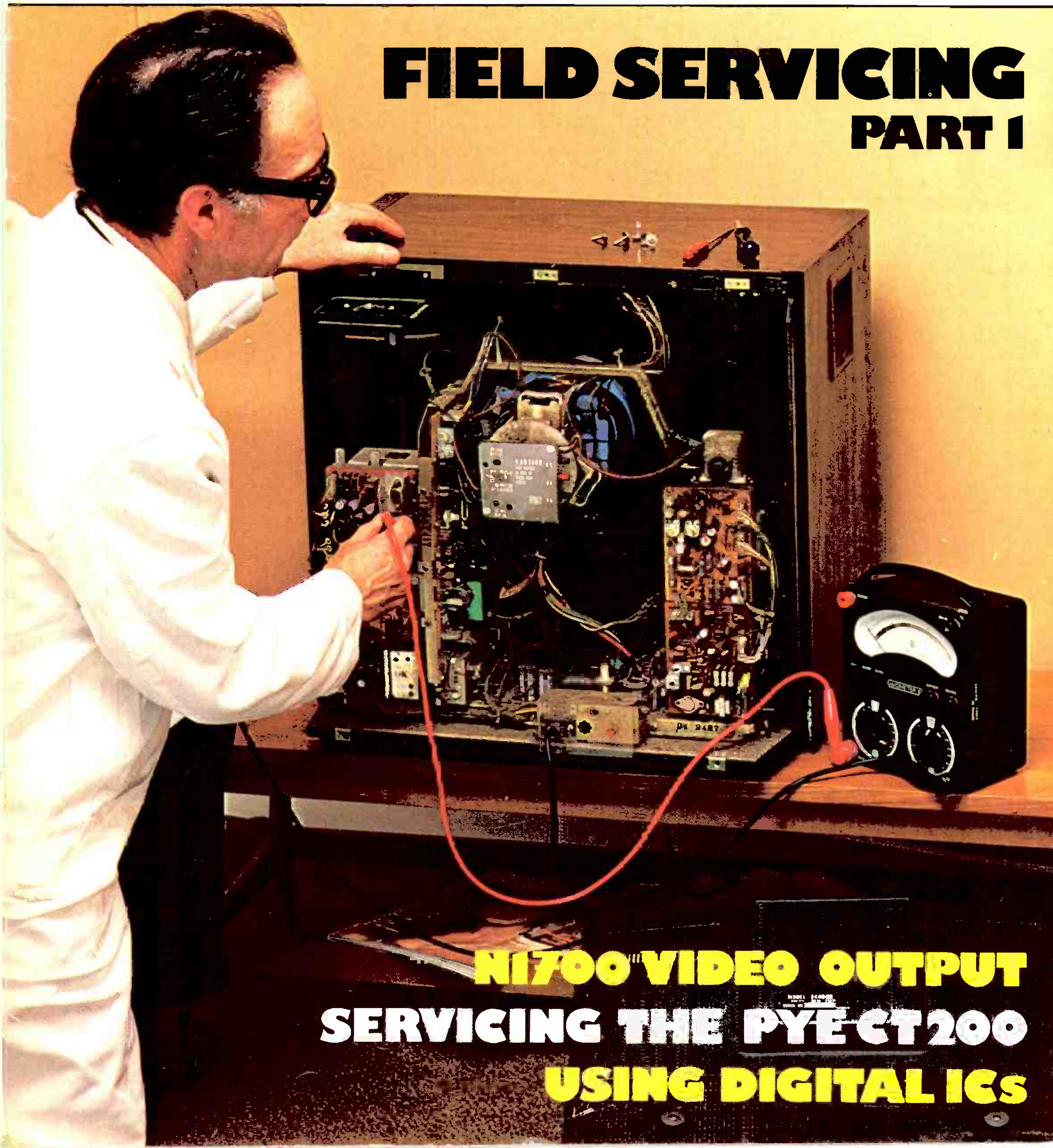
TELEVISION

SERVICING-VIDEO-CONSTRUCTION-DEVELOPMENTS



FIELD SERVICING
PART 1

N1700 VIDEO OUTPUT
SERVICING THE PYE CT200
USING DIGITAL ICs

TELEVISION

November 1979

Vol. 30, No. 1
Issue 349

CORRESPONDENCE
All correspondence regarding advertisements should be addressed to the Advertisement Manager, "Television", King's Reach Tower, Stamford Street, London SE1 9LS. Editorial correspondence should be addressed to "Television", IPC Magazines Ltd., Lavington House, Lavington Street, London SE1 0PF.

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this month

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AD162	0.40
AD161 } AD162 }	1.30
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BC125	0.12
BC126	0.09
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BC137	0.12
BC138	0.21
BC139	0.21
BC140	0.24
BC141	0.22
BC142	0.19
BC143	0.19
BC147	0.07
BC148	0.07
BC149	0.07
BC153	0.12
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BF197	0.10
BF198	0.11
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BF217	0.12
BF218	0.12
BF219	0.12
BF220	0.12
BF222	0.12
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OC75	0.35
OC76	0.35
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OC78	0.13
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Grundig 3000/3010 Saba 2705/3715 Telefunken 709/710/717/2000	6.80
Korting	6.80

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Philips	—	—	40	40	40
Thorn	55	—	60	45	65
Korting	—	—	55	—	60
Pye Mechanical	40	—	40	40	40
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Mono

Bush 161	60p
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TELEVISION

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QUARTZ LCD 5 Function

Hours, mins, secs., month, date, auto calender, back-light, quality metal bracelet.

£6.65

Guaranteed same day despatch.
Very slim, only 6mm thick.

M1

SOLAR QUARTZ LCD 5 Function

Genuine solar panel with battery back-up. Hours, mins., secs., day, date. Fully adjustable bracelet. Back-light. Only 7mm thick.

£8.65

Guaranteed same day despatch.

M2

QUARTZ LCD 11 Function SLIM CHRONO

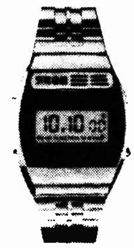
6 digit, 11 functions.
Hours, mins., secs., day, date, day of week.
1/100th, 1/10th, secs., 10X secs., mins.
Split and lap modes.
Back-light, auto calendar.
Only 8mm thick.
Stainless steel bracelet and back.
Adjustable bracelet.
Metac Price

£10.65 Thousands sold!
Guaranteed same day despatch.

M3

QUARTZ LCD ALARM 7 Function

Hours, mins., secs., month, date, day.
6 digits, 3 flags plus continuous display of day and date or seconds. Back-light
Only 9mm thick.



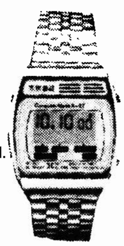
£12.65

Guaranteed same day dispatch.

M4

MULTI ALARM 6 Digits 10 Functions

- Hours, mins., secs.
- Months, date, day.
- Basic alarm.
- Memory date alarm.
- Timer alarm with dual.
- Time and 10 country zone.
- Back-light.
- 8mm thick.

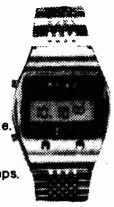


£18.65

M5

FRONT-BUTTON Alarm Chrono Dual Time

6 digits, 5 flags,
22 functions.
Constant display of hours and mins., plus optional seconds or date display.
AM/PM indication, month, date.
Continuous display of day.
Stop-watch to 12 hours 59·9 secs., in 1/10 second steps.
Split and lap timing modes.
Dual time zones.
Only 8mm thick.
Back-light. Fully adjustable open bracelet.



£22.65

Guaranteed same day dispatch

M6

SOLAR QUARTZ LCD Chronograph with Alarm Dual Time Zone Facility

6 digits, 5 flags.
22 functions.
Solar panel with battery back-up.
6 basic functions.
Stop-watch to 12 hours 59 9 secs., in 1/10 sec., steps.
Split and lap timing modes.
Dual time zones.
Alarm. 9mm thick. Back-light.
Fully adjustable bracelet.

£27.95

M7

ALARM CHRONO with 9 world time zones

- 6 digits, 5 flags.
- 6 basic functions.
- 8 further time zones.
- Count-down alarm.
- Stop-watch to 12 hours 59·9 secs. in 1/10 sec. steps.
- Split and timing modes.
- Alarm.
- 9 mm thick.
- Back-light.
- Fully adjustable bracelet.

£29.65

M8

SOLAR QUARTZ LCD Chronograph

Powered from solar panel with battery back-up.
6 digit, 11 functions.
Hours, mins., secs., day, date, day of week.
1/100th, 1/10th, secs., 10X secs., mins.
Split and lap modes.
Back-light, auto calendar. Only 8mm thick.
Stainless steel bracelet and back.
Adjustable bracelet.
Metac Price

£13.65

Guaranteed same day despatch.

M9

QUARTZ LCD Ladies Day Watch

Only 25 × 20mm and 6mm thick.
Hours, minutes, seconds, day, date, backlight and auto calendar.
Elegant metal bracelet in silver or gold fully adjustable to suit very slim wrists.
State colour preference.

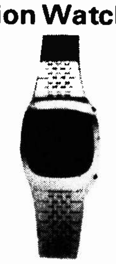
£9.95

Guaranteed same day despatch.

M15

QUARTZ LCD Ladies Fashion Watch

Elegant bracelet in bronze/gold finish or silver colour.
Hours, mins, secs, day, date, backlight and auto calendar. Adjustable for the slimmest of wrists.
State colour preference.



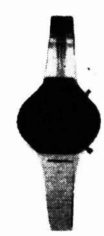
£14.95

Guaranteed same day despatch

M17

QUARTZ LCD Ladies Cocktail Watch

Highly functional watch which also suits those special occasions.
Beautifully designed with a very thin bracelet which retains strength as well as elegance.
Hours, mins, secs, day, date, backlight and autocalendar.
Bracelet fully adjustable to suit slim wrists.
State gold or silver finish.

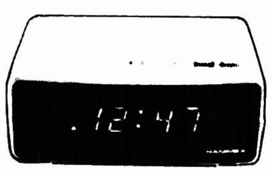


£19.95

Guaranteed same day despatch

M18

HANIMEX Electronic LED Alarm Clock



Features and Specification
Hour minute display Large LED display with p m and alarm on indicator 24 Hours alarm with on off control Display flashing for power loss indication Repeatable 9 minute snooze Display bright dim modes control Size 5 15" x 3 93" x 2 36" (131mm x 11mm x 60mm) Weight 1 43 lbs (0 65 kg)
AC power 220V.

£10.20 Thousands sold!

Mains operated.

Guaranteed same day despatch

M13

EXECUTIVE ALARM WATCH

6 Functions plus Alarm:
Conference signal,
5 minute snooze alarm.
Conference signal sounds 4 secs., before main alarm to give advance warning and an option to cancel.
Snooze sounds 5 mins., after main alarm and is always preceeded by the conference signal.

£14.95

M60

MACY QUARTZ ANALOGUE

Automatic Calendar
Day and Date
infinite bracelet.
This mans watch has elegance as well as the robust appearance provided by a watch with traditional features. Accuracy is provided by a quartz crystal powered by a long life miniature battery.

£24.95

M21

Metac price breakthrough for an Alarm Chronograph with Dual Time only

£18.95

OUTSTANDING FEATURES

- **DUAL TIME.** Local time always visible and you can set and recall any other time zone (such as GMT). Also has a light for night viewing.
- **CALENDAR FUNCTIONS** include the date and day in each time zone.
- **CHRONOGRAPH/STOPWATCH** displays up to 12 hours, 59 minutes, and 59.9 seconds.
- On command, stopwatch display freezes to show intermediate (split/lap) time while stopwatch continues to run. Can also switch to and from timekeeping and stopwatch modes without affecting either's operation.
- **ALARM** can be set to anytime within a 24 hour period. At the designated time, a pleasant, but effective buzzer sounds to remind or awaken you!

Guaranteed same day dispatch.

M16

HOW TO ORDER

Payment can be made by sending cheque, postal order, Barclay, Access or American Express card numbers. Write your name, address and order details clearly, enclose 40 pence per single item for post and packing or the amount stated in the advert. All products carry 1 year written guarantee and full money-back 10 day reassurance. Battery fitting and electronic calibration service is available to customers at any Metac shop. All prices include VAT currently at 15%.

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Trade enquiries – send for a complete list of prices for all the goods advertised plus many more not shown also minimum order details.
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SINGLE STANDARD T.V.'s FROM **£20** + **VAT**

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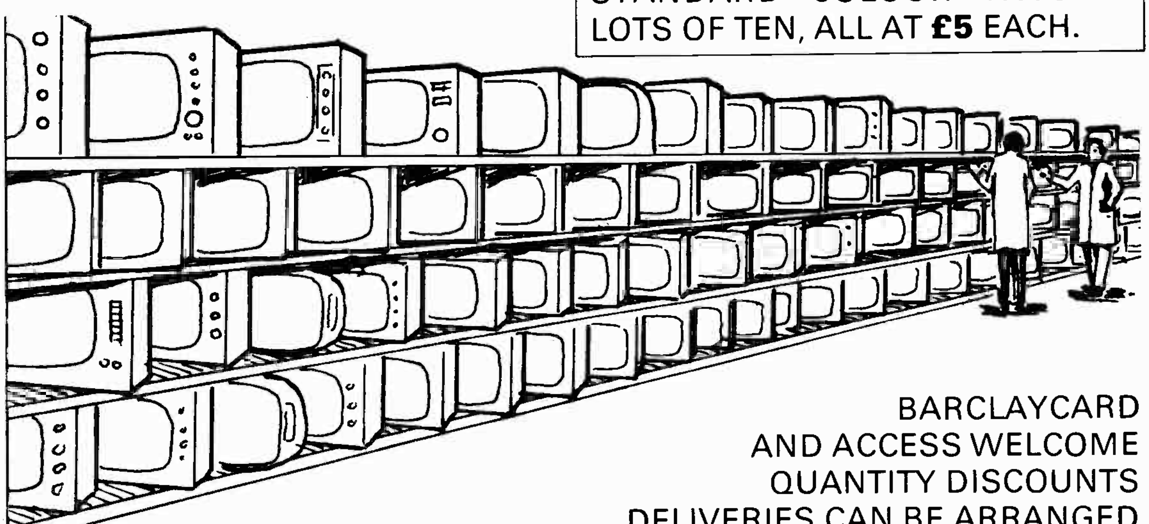

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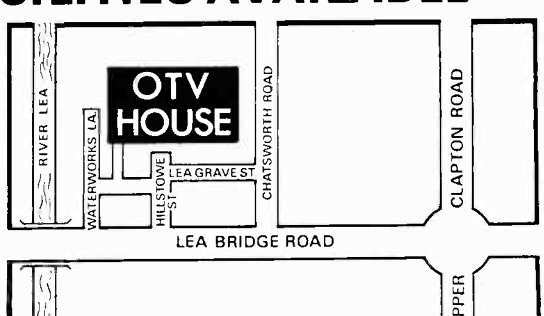


We specialise in Export

Enquiries invited from the Middle East and Third World Countries.

TELEVISION

What to do with ITV-2

In the past we have supported the idea of setting up a separate, independent authority – the OBA, as recommended by the Annan Committee – to run the UK's fourth TV network. The problem with that idea was always how it would have been financed, a point on which the Annan Committee was rather vague. Be that as it may, the idea died along with the last government, the present government promising in the Queen's Speech to set up TV4 under the control of the IBA, with finance provided through advertising. The danger of this of course is yet more of the same, with the new network striving to achieve maximum audience ratings. Not an inspiring prospect, but one appealing to the advertising industry which has more prospective advertising than can be fitted into the present single commercial network.

The comments on ITV-2 made by the Home Secretary, William Whitelaw, during a speech at the opening of the Royal Television Society's recent convention are most reassuring therefore. TV4 will not it seems be allowed to become "just ITV-2". In running TV4, the IBA will be charged with preventing the two commercial channels engaging in a battle for high ratings, and also with preventing the present Big Five ITV companies from dominating the new network.

These are strong words, and in enlarging upon the "strict safeguards" mentioned in the Queen's Speech Mr. Whitelaw spelt out clearly what the government expects of the new service. We quote: "The IBA will be expected to develop a distinctive service . . . (which) should be designed to give new opportunities to creative people in British TV and add new and greater satisfaction . . . for the viewer. It will be expected to make arrangements for the largest practicable proportion of programmes . . . to be supplied by organisations and persons other than the companies contracted to provide programmes on ITV-1." To ensure this, the new network should have its own controller and its own income. The IBA will be expected to ensure "that the budget for the fourth network is adequate to achieve the sort of service described," while this finance would not necessarily be determined by the revenue obtained from advertisements shown on the network," implying that the IBA will be able to use revenue from ITV-1 to finance ITV-2.

This could lead to something very close to what the Annan Committee proposed, and a worthwhile addition to the present services. Let's hope that the expectations Mr. Whitelaw has raised will in due course be met.

European Shivers

As 1980 approaches, the economic outlook is far from reassuring. The seventies have not turned out to be a particularly successful decade economically, and we seem far indeed from the optimism of the late fifties (remember "you've never had it so good"?) and sixties. The end of the era of cheap fuel played a major part in this of course, but one feels that an important contributory factor has been the lack of any significant new industrial developments to act as economic stimulants in the way that electronics and chemicals did in the sixties.

Against this sombre background, the European TV industry is also faced with excess capacity and, with the ending of the PAL patent restrictions, growing competition from Japan. This is the likely reason for some of the interesting company realignments announced in recent months. Earlier this year France's largest setmaker, Thomson-Brandt, took a majority shareholding in one of the largest German setmakers, NordMende. More recently the continent's largest electronics concern, Philips, set up a joint operation with Grundig, which holds a substantial share of the German market. Close technical ties between the two companies had already been established, in particular with the joint development of the V2000 VCR system. Another interesting tie up is that between Italy's largest setmaker Zanussi and Hitachi, who have entered into an agreement for marketing and technical co-operation in all their manufacturing fields.

There has also been rationalisation in colour tube manufacturing, with the announcement that Thomson-Brandt and AEG-Telefunken are to set up a joint subsidiary to be known as Europacolour. Thomson-Brandt's tubes are produced by Videocolour, which was set up jointly with RCA in 1971 and holds about 20 per cent of the European market: Telefunken tubes have been made under a Philips licence which is due to expire.

One can't help but feel that further mergers and realignments amongst the still rather fragmented European domestic electronics manufacturers are to be expected.

OCTOBER COVER

Our cover last month featured the latest *Television* colour receiver, photographed using a fish-eye lens, in a special case made of Perspex. The use of this material results in a very smart cabinet, but working with Perspex is not recommended unless you have experience and the necessary equipment.

Teletopics

CHANGES AT SINCLAIR

News about changes at Sinclair Radionics, which manufactured test equipment, pocket calculators and the Microvision pocket TV set and is owned by the NEB, seems to have leaked out in dribs and drabs. First came the report, mentioned in these pages a couple of months ago, that a new pocket TV set with a flat-screen c.r.t. had been developed and that production of the 2in. Microvision Model TV1B, which uses a conventional electrostatically-deflected instrument tube, had ceased. Next came an announcement that Binatone International Ltd. had taken over Sinclair's calculator and TV interests, which had been operating at a loss.

The picture that eventually emerged was a three-way split up of Sinclair Radionics' interests, though there are several complications in the final arrangements. The three-way split divides up the profitable instrument division, which remains with the NEB as Sinclair Electronics Ltd., a subsidiary of the holding company Sinclair Radionics Ltd.; the pocket calculator and Microvision TV1 interests, which have been bought by Binatone International Ltd.; and Sinclair Research Ltd., which will continue development work on the flat-screen pocket TV receiver project and will also work on other development projects. Complications on the flat-screen TV side arise in that Sinclair Research will develop the receiver under subcontract to Sinclair Radionics which is in turn under contract to the NRDC. The NRDC has already provided £300,000 for the project, and is committed to a total of over £500,000. It's understood that the NEB and Sinclair Radionics are seeking partners to take on manufacture of the flat-screen tube and assembly and marketing of the sets. Mullard has been suggested as a possible partner on the tube side. Work on the project is continuing, but it's unlikely that the flat-screened set will be launched before Christmas 1982.

Binatone, which exports its products to over 50 countries and is said to be the largest privately owned UK electronics company, is to start production of the TV1 at its Wembley headquarters while seeking a Departmnent of Industry grant to build a factory for the purpose in Tyneside. The advantage to Binatone is that by promoting the Microvision TV1 alongside its numerous other products, which include TV games, clock radios and music centres, marketing costs can be kept down. There are likely to be three versions, the UK only TV1B, the TV1C for the US market and the TV1D for Europe. The original multi-standard TV1 was discontinued by Sinclair Radionics in 1978.

Clive Sinclair, who founded Sinclair Radionics in July 1961, also owns Science of Cambridge Ltd. which may take on the marketing of products developed by Sinclair Research. Just to confuse the situation further, Sinclair Research is hoping to obtain a contract to develop a new pocket TV set using a conventional tube.

VIDEO DEVELOPMENTS

Europe's largest annual domestic electronics exhibition, the Berlin Radio and Television Show, is the obvious place in Europe to launch new products and preview new developments. True to form, several new video systems put in an appearance there this year. Toshiba's fixed-head VCR, which we described in *Teletopics* last month, was on show and the long-awaited BASF system was also displayed. There are significant differences between these two LVR (longitudinal video recording) systems however. The Toshiba system uses an endless loop of ½in. (12·7mm.) tape with 220 tracks on it to give an hour's playing time. In the BASF system on the other hand the tape moves to and fro between a take-up spool in the recorder and the spool in the cassette: the tape is 8mm. wide, and carries 72 tracks. The 114 × 116 × 17mm. BASF cassette has a maximum playing time of 180 minutes, but will also be available in 60 and 120 minute versions. When we first mentioned the BASF LVR system in the September 1977 *Teletopics* it was reported that the aim was to have the machine on the market by Christmas 1979. BASF don't seem to be far off target – a UK version is expected to be launched in about a year's time. The simplified mechanics of these systems would seem to offer advantages, though considerably higher tape speeds are involved. BASF claim an improved frequency response compared to helical-scan systems, and both BASF and Toshiba point out the advantage of high-speed tape duplication.

Also on view was Grundig's first video disc player. This pre-production machine is based on the Philips system.

INTERNATIONAL PRESTEL

The PO is to carry out an international trial of its Prestel system, involving users in the UK and up to six other countries – Australia, W. Germany, Holland, Sweden, Switzerland and the USA. A wide variety of up-to-the-minute business information from many parts of the world will be made available to those taking part, the aim being to assess whether a full international Prestel service would be a viable proposition.

TUBELESS CTV

Toshiba is understood to have developed a successful flat-screen colour display system employing a liquid crystal matrix. Initial sets will be in small screen sizes and are planned for introduction in about a year's time. The main problem with this type of display is understood to be achieving adequate definition due to the writing speed attainable.

DR ELECTRONICS EXTEND RANGE

Several interesting additions have been made to the range of solid-state replacement modules produced by DR Electronics. In addition to the PL802/T replacement for the PL802 luminance output pentode, mentioned in these pages before, there is now a replacement CDA panel for use in Pye group hybrid colour receivers, an i.f. selectivity/gain module for use in Pye solid-state colour chassis (713, 725, 731 etc.), also a.c. and d.c. replacement motor speed control modules for use in Hoover washing machines. DR's products are sold mainly through wholesalers, including Belvoir Components, Lloyd Electronics, S.E.M.E. Ltd., Swansea Aerials Ltd., Cooper Electronics (Dublin), Pinnacle Electronics Ltd., Vision Spares (Dublin) and J.A.T.A. DR Electronics' address is 5 Bradgate Lane, Asfordby, Melton Mowbray, Leicestershire.

The i.f. selectivity/gain module consists of a Plessey SW153 SWAF to define the bandwidth, driven by a BF197 transistor and followed by a two-transistor (BF196/BF197) amplifier to provide the gain. The CDA panel has several different features from the LEDCo panel reviewed in our June issue. In particular the colour-difference outputs are a.c. coupled to the c.r.t. grids, which are clamped at 80V. DR Electronics say this system avoids colour drift and makes setting up particularly simple, with only the green and blue presets to balance if necessary.

GREECE CHOOSES SECAM

Greece is to be the twenty fourth country to adopt the French SECAM colour system – an initial £9 million pound contract for the supply of equipment has now been signed. It's understood that the particularly mountainous Greek terrain played a part in the decision to adopt SECAM. A separate agreement has been reached between French and Greek setmakers for the production of 20,000 colour receivers annually.

NEOSID SMALL ORDERS

Neosid Ltd., a major supplier of ferrite components, coil assemblies and plastics coil formers for both professional and consumer electronics use, has established a mail order department to assist constructors and service engineers to obtain these items in small quantities. A broad selection of the company's products is included in the small order catalogue, which is available from Neosid Small Orders, PO Box 86, Welwyn Garden City, Herts AL7 1AS (please enclose stamped, addressed envelope). The range includes ferrite components such as beads, screw cores, rods, E, I and U cores, coil assemblies, plastic formers and trimming tools.

PRERECORDED VIDEO TAPES

One thing that could boost the sale of VCRs would be the availability of prerecorded tapes of well known feature films. Magnetic Video Ltd. has now jumped in to fill this role, with an initial range of 27 films including *Soldier Blue, The Sound of Music, Blue Hawaii* and *The African Queen,* on both VHS and Betamax format cassettes. The recommended price for a two-hour film on tape is £29·96 including VAT, and Magnetic Video say they have many more titles to follow.

AUSTRALIAN SATELLITE TV

As mentioned before, Australia is planning to use Satellite transmissions in order to reach the remote outback areas of the continent. The latest news is that a Canadian satellite is to be used to carry out a series of tests. Television programmes – and telephone calls – will be beamed from Ottowa via the Canadian Hermes satellite to 47 test sites in New South Wales and Queensland. The satellite is being moved to a position off the west coast of Canada so that it "sees" Ottowa and the eastern Australian states at the same time.

CEEFAX SUBTITLING AIDS THE DEAF

The BBC has carried out experimental programme transmissions using a subtitling system designed to help deaf viewers to follow programmes. The subtitles were transmitted as part of the BBC's teletext system (Ceefax) and can be received on a normal teletext-equipped TV receiver. The Ceefax system includes provision of a subtitling control bit which, when "set", indicates that the associated Ceefax page is to be displayed in the form of a boxed caption superimposed on the picture.

Experience with foreign film subtitling has shown that the timing of subtitles must be accurate to within four television pictures (four film frames), i.e. one sixth of a second. Since a full teletext page can take up to a quarter of a second to transmit, when subtitles are included it will often be necessary to break into the transmission of a normal data page to synchronise the subtitles with the picture. The BBC's Ceefax transmission equipment at the Television Centre has been designed to make this possible. Interrupting the transmission of the normal Ceefax data pages to insert subtitle pages increases the overall magazine transmission time, but the effect is minimal – transmission of a two-row subtitle every second increases the overall magazine transmission time by less than 5%

The BBC's computer subtitling system, which is normally used for subtitling foreign films, holds the subtitles in a floppy disc store. They are read out to an electronic character generator under time-code control. To use the system with Ceefax, the data from the floppy disc is "reformatted" and fed to the Ceefax computer-video terminal. The BBC has also devised a caption system which can be used where only a limited number of subtitles are required in a programme. Neither system is suitable for use with live broadcasts of unscripted programmes. The BBC is working with Leicester Polytechnic however on a project aimed at exploiting the Palantype system of mechanical shorthand so that subtitles can be generated and transmitted almost instantaneously – the BBC has designed an electric Palantype keyboard, whose output is transcribed by the Polytechnic's computer, giving a quality of script which shows great promise.

The IBA has been working on similar arrangements (don't the two of them always?), in conjunction with Southampton University.

STATION OPENINGS

The following relay stations are now in operation.

Bishop's Castle (Salop) BBC-1 ch. 39, BBC-2 ch. 45, ATV ch. 49. Receiving aerial group B.

Bleachgreen (Cumbria) BBC-1 ch. 57, Border Television ch. 60, BBC-2 ch. 63. Receiving aerial group C/D.

Briton Ferry (West Glamorgan) BBC-2 ch. 40, HTV Wales ch. 43, BBC Wales ch. 46. Receiving aerial group B.

Church Stretton (Salop) ATV ch. 41, BBC-2 ch. 44, BBC-1 ch. 51. Receiving aerial group B.

Kirkcudbright (Dumfries and Galloway) BBC-1 ch. 21, Border Television ch. 24, BBC-2 ch. 27. Receiving aerial group A.

Pencader (Dyfed) HTV Wales ch. 23, BBC-2 ch. 26, BBC Wales ch. 33. Receiving aerial group A.

Rothbury (Northumberland) BBC-1 ch. 55, BBC-2 ch. 62, Tyne Tees Television ch. 65. Receiving aerial group C/D.

Skipton (Yorkshire) BBC-1 ch. 21, Yorkshire Television ch. 24, BBC-2 ch. 27. Receiving aerial group A.

Storeton (Liverpool and Birkenhead) BBC-1 ch. 22, Granada Television ch. 25, BBC-2 ch. 28. Receiving aerial group A.

West Brunton (Wensleydale) BBC-1 ch. 40, Tyne Tees Television ch. 43, BBC-2 ch. 46. Receiving aerial group B.

All the above transmissions are vertically polarised.

Letters

IMPROVED AGC

There are still a lot of dual-standard sets around capable of giving excellent performance – especially in areas where there's a strong signal. Their main shortcoming is the use of mean-level a.g.c., which alters the gain with variations in picture content despite the signal amplitude remaining constant. As is well known, a sync-tip a.g.c. system gives much better performance during scenes that are darker or lighter than average.

Mean-level a.g.c. was the only economical way of handling both 405- and 625-line signals. Nowadays 405-line reception is required in only a very few areas. In most areas a dual-standard set can be left in the 625-line position permanently and modifications can be made to improve the 625-line reception. It's very easy to change the a.g.c. circuit to a sync-tip one – which operates on the principle that the sync tip represents maximum signal amplitude.

Details will vary from chassis to chassis of course. The example given here is the chassis used in the Pye 11U series of all-valve sets produced over the period 1963-5 – there was a vast number of models bearing many brand names.

The original a.g.c. arrangement is shown in Fig. 1. The negative voltage at the grid of the triode sync separator V9B was used as the a.g.c. potential, filtered by R94/C44/R40/C14 – diode V8 provides overload action on 625-lines, conducting when the d.c. component of the rectified video signal exceeds the a.g.c. voltage and thus supplementing the mean-level a.g.c. action.

The original a.g.c. circuit can be disabled simply by removing R21 and R40. The sync-tip circuit shown in Fig. 2 can be built up on a tagstrip mounted very close to L15 (except for R4 which should be close to C14). If the alternative circuit shown in Fig. 3 is used, remove V8 and C28 instead of R21. The preset potentiometer R1 now acts as a preset contrast control. Set it for a slightly overmodulated picture with the manual contrast control at maximum (a higher setting gives rise to more buzz, due to intermodulation in the video amplifier). These sets are slightly unusual in using a high-level manual contrast control in the anode circuit of the video output pentode incidentally.

The sync-tip circuit couldn't be simpler. Diode D1 acts as a peak rectifier, charging C1 on the sync pulses. It doesn't discharge significantly through the large-value resistor R3 before the next pulse arrives. The video signal input is about 3V peak-to-peak.

I. L. Heynemann,
London NW1.

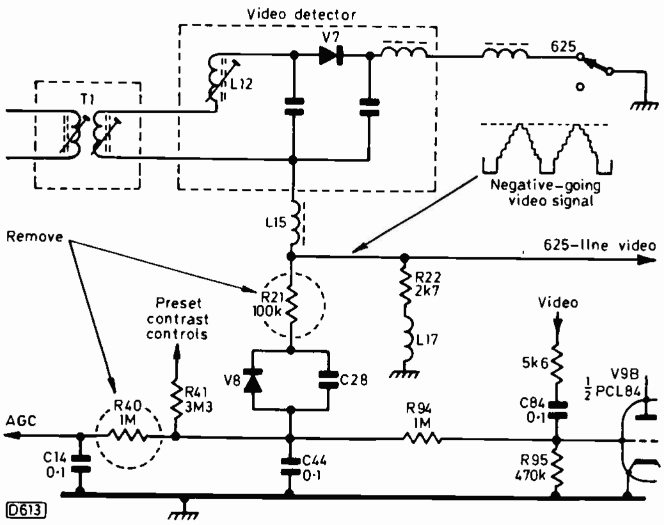


Fig. 1: The original mean-level a.g.c. circuit used in the Pye 11U series receivers. Removing R40 disconnects the controlled stages from the existing a.g.c. circuit; removing R21 or V8 and C28 eliminates unnecessary loading on the video detector diode V7.

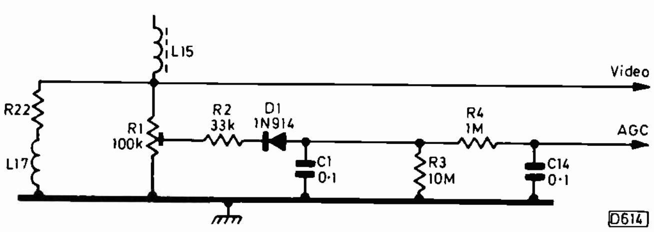


Fig. 2: Suggested sync-tip a.g.c. circuit for use in the Pye 11U series. Except for R21 and R40, the original a.g.c. circuit components can be left in place.

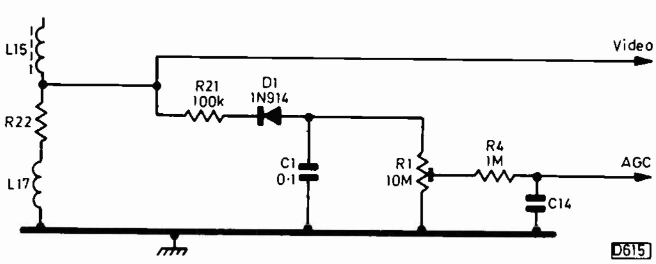


Fig. 3: Suggested alternative circuit. In this case leave R21 in place and disconnect V8 and C28.

THORN 1600 CHASSIS

When servicing the Thorn 1600 chassis, engineers should always check the condition of R157 (39Ω) which is part of the mains dropper. If R157 is open-circuit, the voltage regulator is inoperative. The set will still function, with slight overscan, but the condition will lead to eventual failure of a major component. Since the fault is not obvious to the viewer, can you suggest an over-voltage protection circuit that could be incorporated?

Peter Crosby,
Oldham, Lancs.

Editorial note: When R157 is open-circuit, the 29V supply to the field output stage rises to about 36V. RS Components have an over-voltage protection i.c. (stock no. 307-890) which operates in conjunction with a crowbar thyristor and can be adjusted over the range 2·6-45V. This could possibly be used, though we've not tried it. Anyone else care to comment on this problem?

SERVICING HEADACHES

A couple of servicing problems have caused me headaches recently. The first fault was on a Pye colour set fitted with the 697 chassis. The verticals over the top three-four inches of the screen were slightly bent to the right. The field locking was excellent, and the line lock very good except when a fast moving object such as a tennis or football moved rapidly across the screen – the whole raster would then shimmer. Otherwise both timebases were o.k. All likely culprits in the

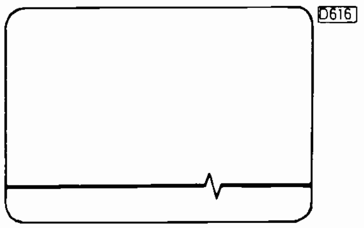
flywheel sync/line oscillator circuits were replaced, but the fault persisted. I then decided to take a look at the sync separator circuit, which is on the i.f. panel. It turned out that the high-value (4·7MΩ) bias resistor R33 between the base of the sync separator transistor and the 205V line had gone open-circuit.

The other fault was on a Thorn 1500 chassis which displayed a perfect picture except that approximately two inches from the bottom of the raster two or three lines were paired, with a peculiar small kink which looked like a triangular pulse about three-quarters of the way along the paired lines (see Fig. 4). The culprit turned out to be C37 (64μF) which couples the video signal to the base of the video output transistor. It seemed all right on test however, charging up perfectly via an Avo 8 on the times 100 range – a nice, smooth steady climb to 10MΩ or thereabouts.

D. Hewitt,
Havant, Hants.

Editorial note: The high-value resistor is included in the sync separator's base circuit to ensure that it's driven to saturation by the sync pulses. The trouble given by the video coupling electrolytic capacitor could possibly be due

Fig. 4: Unusual fault condition experienced on the Thorn 1500 chassis. Linearity otherwise perfect.



to its inductance – or has anyone any other ideas on this one?

PYE SOLID-STATE COLOUR CHASSIS

Further to Mike Phelan's comments on the Pye large-screen solid-state colour chassis (731 etc.), I've found that a leaky field output transistor (VT688) can cause a very rapid reduction of the scan down to two-three inches, with a linear scan. If the field scan reduces in this way, check the field output transistor's heatsink: if the temperature is high, the transistor is suspect.

S. J. Humphreys,
Welwyn, Herts.

Don't Ask Why

Les Lawry-Johns

WHEN women start asking questions, they never stop. Take the other night for instance.

"Why is it warmer in the summer than in the winter?"

Now I'm not going to be taken in by a simple question like that. There just has to be something behind it. But I thought I'd play along.

"Because the earth tilts and we see more of the sun up this end. In other words, it comes up earlier and goes down later and they see less of it down South America way, until it's our winter and then it's their turn to see more of it and we see less, you see."

"When do we start seeing less of it?"

"Oh about the middle of June or something – you know, the longest day."

"Well, if we see less of it after that, why does it always seem warmer two months later, in August?"

"Er, well, you see, by then the sun has warmed up the places which were cold when it arrived. So whichever way the wind blows, it's always warm until these places start cooling down again. Say in September, when it starts getting a bit nippy. Something to do with Arctic Terns so they say."

"So the best time to buy a new coat is in the Autumn then, say about now?" I might have known. So I thought it was my turn to ask silly questions and during the day, instead of concentrating on the work, I was trying to dream up something daft.

It's All Yellow

It was a Thorn 8500 chassis with the complaint of "previously changing colours, now all yellow" (i.e. no blue). So naturally we leapt at the blue output stage to see whether the voltages there could tell us anything. They couldn't. The base, emitter and collector readings were more like those in the red and green stages than they were themselves . . . well, you know what I mean. They couldn't be faulted. So we leapt where we should have leapt in the first place, to the tube base, and checked the first anodes. If anything, the blue first anode was slightly higher than the other two. Check the cathodes we said, and did. Instead of being high, the blue cathode voltage was slightly low, which should have meant more blue on the screen.

My mistake of course was not looking in the mirror when I took the readings. But I had my glasses off to peer closely at the meter, and when I put them back on to look up the test prod was no longer on the blue cathode.

To my befuddled mind it now seemed that the tube had lost emission on the blue gun, so I bunged on the tube tester. Not too good it said, but not too bad either. About the same as the green and red guns. What more do you want?

I was rapidly getting fed up, and when my honey bunny asked what I wanted for lunch I snapped nastily "a turkey egg".

This was it, the daft question I'd wanted since last night. "Don't be silly" she said. "Whoever heard of a turkey egg for lunch?"

"I'll have it tonight then."

"Don't be stupid, you can't buy turkey eggs."

"Why not? There are millions of turkeys around doing nothing until some bank holiday – except gobbling food and making funny noises."

"Well I've never seen them for sale. You deserve beans on toast."

So back we went to the 8500 and its missing blue. This time I happened to look in the mirror as I took the voltage readings on the cathodes. Red o.k., green o.k., blue slightly low and the screen became blue and remained so until the meter prod was removed.

Moving back to the output transistors, the blue collector was correct and the meter made no difference. Obviously the choke between the collector and the tube's cathode was open-circuit. It wasn't. But there was no continuity from the choke to connector 7/3 which takes the blue drive to the tube. My bleary eyes couldn't see any crack in the print, but a jump lead restored normal working.

Voltage readings can be misleading if you don't look in the mirror at the same time to see the effect of the meter on the circuit. The trouble with looking in the mirror of course is that you stand a chance of seeing yourself peering over the top of the set. Then you know just how dozy you look when you're trying to concentrate. Not a pretty sight.

More on the Pye Hybrids

Every time we look round there seems to be a Pye 691, 693 or 697 needing attention. One caught me nicely the other day. It came in for "wrong colour". This was putting it mildly. The grey scale seemed reasonable enough, but when the colour was turned on it was horrible beyond description.

Checking the PCL84 colour-difference output valves didn't produce much joy, although one was definitely low-emission – and leaky to boot. A check on the 12kΩ pentode anode load resistors then revealed that two of the three were open-circuit, which was a promising start. We were out of 12kΩ wirewounds of course as I'd forgotten to order any, but as we seemed to have plenty of other values we decided to fit three 10kΩ resistors and see what the picture then looked like.

At first sight it didn't seem too bad, but when the colour was turned up much the newsreader's face turned green and looked decidedly sick due to a horrible hum bar. So we checked the earthing of the panel, screening of leads, and everything except the right thing of course. We had already checked for the presence of clamp pulses at the yellow plug on the CDA panel – only briefly, in view of the fair grey scale. In the end we took a closer look at the d.c. clamping, and found that although the pulses were arriving at the yellow plug there was a poor contact between the socket and the series capacitor C372, thus leaving the triodes virtually unclamped. With the clamping restored, we could turn up the colour and only maximum contrast would produce hum bars of any mention.

Another Silly Question

We had to call on Mrs. Allnutty whose Doric was dicey (no raster). The line output stage was overheating, and this proved to be a faulty tripler. Whilst we were struggling to fit the new one, Mrs. Allnutty carried on with her decorating and was engaged in mixing paint, or rather was preparing to mix some. She had a fine tin of white satin gloss which she tipped into a large tin. As she did this, she chatted.

"I'm not keen on brilliant white paint. I much prefer a touch of colour, and I do like a very delicate green tint in the white to contrast with the Avacado. Trouble is, I'm right out of green paint. Do you think this emulsion will mix in all right?"

You could have knocked me down with a feather. Mix emulsion with paint?

"You can't do that Mrs. Allnutty. They just won't mix, and if they do they'll separate afterwards. Oil and water you see."

"What do you mean, separate afterwards?" Mrs. Allnutty asked in a worried voice.

"Well, if you painted that door with it, the white would go to the top and the green would go to the bottom, so you'd have a two toned door."

"That sounds a bit daft to me" said Mrs. Allnutty. "I painted the door and skirting in the other room with it yesterday, and it's still all right."

"It might be all right now Mrs. A" I explained, being an expert on telling my wife how she should decorate our own place. "You wait until er, well, you wait. They don't call me Lowery for nothing you know."

"Well I'm going to mix it, and I'm going to paint the woodwork in here with it like I did in the other room, whatever you say."

She did. And it looks all right.

A New Servicing Hazard

Jeff phoned the other day to acquaint me with a hideous new aspect that's entered upon the servicing scene. You know how touch tuner channel selectors and their attendant circuitry can often present problems due in some part to the high impedances involved? Obviously any additional conductive material will do the circuitry no good at all.

Apparently Jeff had a Thorn 9000 in for service which included fitting a new tube. The job finished, the set was placed on the lowest storage rack to await collection. His dog inspected the various sets and finding that the 9000 carried a challenging smell he naturally cocked his leg and sprayed the touch tuner, then with a sniff trotted off without telling Jeff.

Some time later the set was put on the bench for a predelivery check. The full horror of what had happened burst on Jeff as soon as he saw the front of the tuner selectors. Needless to say they were totally inoperative. Thinking that it was just a matter of cleaning the sensors and drying out, Jeff merely kicked the dog and told him not to hiss over the sets anymore or he would be seen to. Alas a thorough cleaning of the touch tuner panel resulted in no improvement at all. The internal works had received a lethal dose of whatever it is that spells doom to touchy components and printed panels. No amount of cleaning and drying out restored reliable selection, and Jeff had no option but to replace all affected parts.

Particularly beware of ladies with two small dogs on leads. We know only too well that they attempt to outdo each other against any vertical surface in a strange place, and our shop is certainly a strange place. Fortunately there were no touch tuners around at the time. The fact that she had recently purchased a new unit audio and a colour set from us saved the dogs from our wrath. When I had occasion to call at their home recently I resisted the temptation to . . .

Too Fast, too Slow

A Ferguson studio something or the other music centre came in with the complaint that the records played too fast and the tapes too slow, with the weird result that records could be taped reasonably but the radio recordings were hopelessly wrong, records sounded like the Chipmunks and prerecorded cassettes of Maria Callas sounded like Paul Robeson.

Being used to funny things and people, we were not disturbed and immediately dealt with the record fault by clearing off the rubber deposit on the motor spindle. This restored its original diameter. The cassette section however was a different kettle of fish (why fish?).

We noticed that when fast forward or rewind was selected, it started at high speed and then slowed and stopped. A meter showed that the motor voltage fell to zero, although the input to the motor control board remained constant. So we attacked the control board, in the wrong way of course as is our wont or natural bent you might say. Hang on a second. We are not naturally bent, I didn't mean that of course, I mean we usually do things wrong because logic is not one of our strong points. Our strong points are muddle, chaos and panic, in that order.

So we checked the three transistors cold and of course they read right. We then did it right and set the thing going. When it slowed we sprayed each transistor with freezer, and when one received a cooling draft the speed immediately increased. Replacing this restored normal operation.

In other words, a job which should have been done in ten minutes took an hour. Maria Callas now sounded like Maria Callas and on record Jim Reeves sounded like, well, Jim Reeves. I'm not keen on servicing these things: TVs seem so straightforward from a handling point of view.

Bear with Us

One of the nice things about running a personal business is that you deal directly with the customer and the customer deals directly with you (never mind about Laura Lovitt, we're not going into that . . . I mean, we need not discuss our flights of imagination just now). Although this is not always a good thing, in the main it is.

One unexpected facet is that we often receive small gifts as tokens of appreciation – bunches of flowers, pot plants, vegetables in season, the odd bottle of Bell's and lots of other nice things, quite often from people we thought we had upset or who had upset us, which all goes to prove that the milk of human kindness should be spread out even to those you can't stand the sight of at first. However, we received something recently which really shook us, and not only us, but the dog and cat as well.

To be honest I must say that this was from someone in the family, so perhaps it doesn't qualify as from a "customer". It was an enormous teddy bear, over 4ft. tall and 3ft wide (paw to paw), with a head perhaps too large for the body – the sort of thing most people like and most females love (why?). This could not be said for our cat and dog however. The cat took one look, arched her back with every hair extended, spat in defiance and then fled for dear life. Ben came in to see what all the fuss was about and was confronted with an enormous head a few inches away from him as he skidded to a halt. He looked away as if the bear wasn't there, which we took to be a gesture of submission, and slowly slunk away.

Thus our brave animals proved their worth when confronted by Ted, and instead of threatening them with the vet we've now only to say the magic word Ted to obtain instant obedience or at least their temporary absence. Which brings us back to our daily work.

Caught Again

We had a Thorn 3500 that lead us a merry dance the other day. The report was that it had suffered from the "twitters" for some time, the twittering being audible while visually the effect was of corrugated verticals. Someone had been in to fix it and had left it free from the twitters, but within a day or two the whole thing had gone off, the cut-out popping out as soon as the set was switched on. So we collected it and started.

There were no apparent shorts, so we started by unhooking the tripler. The set then came on and stopped on for a while, during which time we checked the 30V line and then the 60V line which read more like 70V. Before we could do anything else, several things seemed to happen at once, with some smoke and the cut-out coming to the rescue as my reactions are so slow that they cannot be relied on to switch a set off quickly.

The 15Ω resistor in series with the chopper looked sick, while the chopper transistor itself was short-circuit. These items were replaced and the supply lines checked for shorts. The line output transistor was a dead short, and was also replaced. Just to be sure, we wound back the set e.h.t. control so that the 60V line would be under this. The set then functioned up to a point, but the line timebase was still taking too much current – measured by checking the voltage across the beam limiter sensing resistor R907 which was very hot though of the right value.

We eventually changed the e.h.t. transformer, which had shorted turns, only to find that the restoration of full timebase working resulted in severe arcing in the field timebase panel at C434 which is in the c.r.t. grid bias circuit. This resulted in the loss of three transistors and one diode. To cut a very long story short, this transpired to be due to our accidentally moving a capacitor in the line output section up against a tag on the e.h.t. transformer when the latter was replaced.

After this harrowing and self-inflicted experience, we set up the supply lines correctly, noting that the original twittery whistle had returned. We then considered connecting the original tripler, but decided to do this with caution. Rather than clipping the pulse lead on, we left the set on and advanced the clip to it. There was a vicious arc of flame when it got near. So out went the tripler.

With a new one fitted we had a fair picture, but it was marred by the corrugated effect whenever the brightness was turned down. We also noted that it got worse when the 60V line was reduced, and faded away when the 60V line was increased to an unacceptable level. This then was how it had been "cured" by the someone who advertised his services by only a phone number – by setting the 60V line too high. Apart from my bungling with the capacitor against the transformer tags, the "cure" had resulted in the loss of a lot of expensive bits and pieces.

So now we had to find the cause of the twitter and silence it. Something nagged in the back of my atrocious memory. This was a known fault. Surely not the core of a coil? No it wasn't. Check here, there and almost everywhere. Something started saying 0·01, 0·01 in the back of my mind. C631 in the chopper driver transistor's collector damping network was changed and the twitter stopped. Of course! We'd had the same trouble some years ago, but I'd forgotten it so easily. Why don't I jot these things down? Even if I did, I'd probably lose the thing I jotted them down on.

And Yet Again

It was inevitable that the next set would be a similar model (3000 chassis) with corrugated verticals that came and went. A fool to the last, we immediately whipped out the power pack and in a trice had fitted a new 0·01μF capacitor in the C631 position. With a leer of self-confidence, the power pack was replaced in another trice and the set switched on . . . the raster was still rippled of course. We shone a light on the decoder board and there was the core from L502 (h.t. supply choke in the line timebase) just lying there doing nothing – not even shorting anything out. A dab of adhesive and back it went and away went the ripple, hopefully never to return. Why didn't I do that first?

Servicing in the Field

Part 1

George Wilding

FEW vocations can be as demanding technically as that of the TV service engineer, especially if you work for a retailer or specialist repair business. You can be called upon to repair anything from an old all-valve, v.h.f.-only monochrome set to the latest imported solid-state colour receiver which may employ a new and unusual power supply arrangement, remote control and what have you. On top of this, when confronted with one of these latest pieces of electronic wizardry in the customer's home you will be expected to make an instant diagnosis and put whatever's wrong right with a deft adjustment or at most replacement of one or two small components ... In truth it might take you some time even to find out which stage is which.

If you fish out a service manual and start to study it, even to check up on expected voltages, you'll be thought to be an inexperienced upstart with no real experience of TV sets. After all, "when the set went off next door leaving a white line across the screen the man fixed it in minutes." The present fault may be "only very minor, because the set works fine for about an hour then the colours go funny."

If you persuade the customer that the set requires bench attention, he'll probably expect it to be away for some days and will be quite happy with the use of a loan set. But once you've got the back off in the living room, you're expected to get cracking.

So it pays to give some thought to the best fault-finding procedure to adopt in the field. After many years of practice and experience, I'd say that the following three factors summarise the best approach. First, carefully observe all symptoms, and check for any damaged or overheating components – spotting a discoloured resistor can often save hours of time spent checking voltages etc. Secondly, make the fewest possible simple tests to prove or disprove the operation of suspect sections of the receiver. Finally, check possible faults in order of probability, keeping all service action, in particular component snipping and transistor changing, to the absolute minimum. Servicing efficiency is determined by how few tests are required to trace the faulty component(s).

So what to do? We'll concentrate on older models, since these are the ones most likely to require attention.

No Results

One of the most common faults is a "dead" set, i.e. no sound or raster. Let's say the set is an all valve or hybrid one. First note whether there's any abnormality at switch on – mains switches, whether linked to the volume control or separate, frequently go open-circuit in one or both poles. This is particularly so with earlier Bush/Murphy monochrome sets.

Secondly note whether the valves light up. If not, either no a.c. is reaching the set or there's a break in the heater supply. Don't waste time checking the mains plug fuse. If there's been a short across the mains input, the set's internal mains fuse will have blown. Again, if this is not readily accessible, don't waste time looking for it – it may well be all right, and in any case it's simpler to make a d.c. continuity check across relevant points. If it can be seen however and has a blackened interior – due to a severe short – you'll probably find that the mains filter capacitor is short-circuit or that there's a heater-cathode short in the boost rectifier or line output pentode. On replacing the fuse, if the resistance across the mains input is just less than the ohmmeter's zero reading the filter capacitor is almost certainly short-circuit. If some resistance is recorded however the boost diode or line output pentode is more likely to be at fault. Mains filter capacitors can sometimes fool one by breaking down when subject to the mains voltage but not when checked by the meter's low test voltage: if in doubt therefore, disconnect it.

A dead short in the mains rectifier's reservoir capacitor or across the rectifier itself will also blow the mains fuse of course, but these are rare occurrences. H.T. shorts usually develop in a circuit fed from the h.t. reservoir capacitor via a resistor, which if of the fusible type may have sprung open to show you conveniently where the fault lies. If not, look for a heat damaged or burnt component. This could well be the screen grid feed resistor of a pentode valve which has an internal short-circuit between its screen grid and the control grid or cathode.

A short-circuit in the line output stage can also blow the mains fuse, though it's more likely to have open-circuited the h.t. feed to the line output stage, giving the "no results" or "sound, no raster" symptoms depending on the circuitry used in the particular model. We'll return to this fault later, but as a quick check to eliminate the line output stage before switching on after replacing the fuse, measure the resistance from the top cap of the boost diode to chassis. A reading of at least 200kΩ should be obtained.

If there's no d.c. continuity reading across the mains plug in either direction – check with the meter connected both ways in case there's a diode in the heater circuit – first ensure that there is d.c. continuity between one of the leads from the plug and chassis, with the mains switch on. This should be the neutral lead of course, but many a mains plug is incorrectly wired. If there's no continuity from either lead to chassis, there's either a break in the appropriate lead or the switch's neutral contacts are failing to make.

Assuming that there's d.c. continuity on the neutral side, place one ohmmeter lead on the live mains plug pin and the other on the highest voltage mains dropper tag or the fuseholder – whichever is most accessible. The odds are that the fuse will be intact, and that moving along the dropper will reveal that one of the sections is open-circuit.

In some sets there's a surge limiting thermistor whose connections may have come away: this is most easily checked simply by putting a little pressure on the thermistor, which may then completely disintegrate.

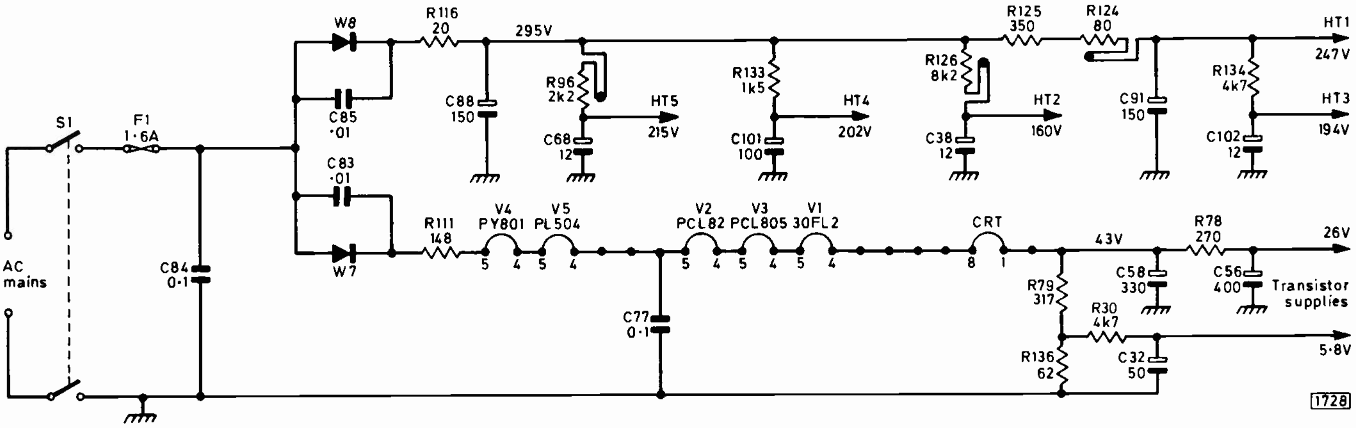


Fig. 1: Typical monochrome receiver power supply circuitry (Thorn 1500 chassis). A short-circuit mains filter capacitor (C84) or h.t. rectifier (W8) will blow the mains fuse F1. An h.t. short-circuit will result in an open-circuit h.t. feed resistor, e.g. a short-circuit in the line output stage will open the fusible resistor R124. The surge limiter R116 open-circuit will give the valves alight, no sound or vision symptom. R111 open-circuit will give the no results symptom, but with h.t. present. W7 is the heater chain dropper diode. Note that the transistor supplies are derived from the earthy end of the heater chain (across R79/R136). When R79 goes open-circuit, the 26V rail rises to 40-50V, causing damage to the transistors in the i.f. strip if the set is left on.

Open-circuit Heater Chain

An open-circuit valve heater (very high or infinite resistance reading across the mains input) is uncommon, and when it does occur is almost always due to a valve with a high-voltage heater, such as the boost rectifier, line output valve or a triode/output pentode valve. Valves with 6·3V heaters, i.e. Mullard and similar types with E as the first letter in their type numbers, hardly ever develop an open-circuit heater.

If you find that the heater chain is open-circuit after replacing the chassis incidentally, connect the ohmmeter across the input and wobble each valve in turn in its holder. The almost certain but frustrating to find cause of the trouble will probably be a badly contacting valveholder, shown up by slightly moving the relevant valve, or alternatively a print fault.

In most cases however an open-circuit heater chain is caused by an open-circuit dropper resistor or dropper section. Unless you have the circuit, which shows the correct resistor value, the best procedure to adopt is to scrape away carefully the insulation from the centre of the open-circuit resistance winding and measure the resistance value from this point to the tag at the end of the intact half of the winding. Doubling this value and adding a percentage to compensate for the wide scrape area should give you a reasonably accurate starting value for fitting a test substitute.

Presence of the correct heater current is best checked by measuring the voltage across the tube's heater. This should be 6·3V with a.c. feed and about 4V when a rectifier diode is included in series with the feed.

While shunting the open-circuit section of a dropper is a convenient way of getting a set going again, in some cases this can't be done satisfactorily. In Bush/Murphy monochrome sets for example the multi-section dropper is mounted at the bottom of the power panel, on the print side. A replacement section would have to be mounted on the component side – but the rising heat can affect the nearby high-voltage boost capacitors with disasterous results (the insulation of all non-conductors falls dramatically with rising temperature). For these models therefore it's essential to fit a complete dropper. These components are not expensive, so it's worth carrying as wide a range as possible.

So much for monochrome receiver heater chains. Due to the absence of dropper resistors in hybrid colour receivers, an open-circuit heater chain is rare in these. The most common cause where this trouble is found is a faulty valveholder or print soldering connection, especially where the PL509 line output valve or PY500 boost diode is mounted horizontally, as in Pye/Ekco and ITT receivers.

No HT

When the heaters light up but there's no sound or raster, then the h.t. supply must be missing. Assuming that a.c. is reaching the h.t. rectifier and that the latter is not open-circuit (which would be most unusual), either the h.t. fuse (if fitted) or a fusible resistor or surge limiting resistor in the h.t. supply is open-circuit. Surge limiters often go open-circuit as a result of prolonged service, but fusible resistors and fuses rarely open unless a short-circuit has caused an excessive current flow. The usual cause of this is a fault in the line output stage – usually a heater-cathode short in the boost rectifier, a short-circuit line output transformer tuning capacitor (an 8-12kV type with a value of something around 50-200pF), a short-circuit boost capacitor or lack of drive to the grid of the line output valve. As previously mentioned, the resistance measured from the top cap of the boost diode to chassis should be at least 200kΩ.

A short-circuit line output transformer tuning capacitor can always be identified by its blackened appearance. In many sets, whether the boost capacitor is short-circuit can be checked by seeing whether voltage remains on the anode of the line output output valve when the boost diode's top cap (cathode connection) is removed. This effect can also be caused by an inter-winding short in the line output transformer in a few sets, particularly the Philips Style 70 series of dual-standard monochrome models, but in at least 90% of cases it's the boost capacitor that's at fault. Where the boost capacitor is returned to chassis instead of to the h.t. line, the boost diode will probably have been damaged in addition to a fuse or fusible resistor opening (where the boost capacitor is returned to h.t. and is short-circuit the fuse probably won't blow, giving the h.t. but no e.h.t. symptom).

Even if the set is strange to you and you don't have the service manual with you, the boost capacitor can be readily recognised: it will be in the region of 0·1-0·47μF, with a working voltage rating of 1kV. As a result, it will be about an inch in diameter. Possibly the high failure rate of these capacitors is due to the fact that they are mounted close to the line output stage valves, which dissipate a lot of heat.

Complete loss of h.t. in hybrid monochrome and colour sets is thus a simple matter to cure, since the h.t. supply is a simple arrangement consisting of a half-wave rectifier plus smoothing. Sound may still be present if the h.t. feeds to the sound circuits and timebases are separate.

Hum

Unless there's a fault in the set that causes excess current to be drawn, low h.t. voltage accompanied by an increased hum level indicates a low capacitance h.t. reservoir capacitor. Near normal h.t., but with a high hum level, poor field lock, impaired definition and in severe cases a visible hum bar indicates loss of capacitance in the smoothing electrolytics.

Thermal Cut-outs

While the usual method of protection against excessive current demand in the receiver is to use fuses and fusible resistors, one occasionally encounters a thermal cut-out. The one used in Rediffusion/Doric hybrid colour sets is resettable, and operates if either the mains current or the line output valve's cathode current is excessive, breaking the live mains connection to the set. To reset the cut-out, press in and release the button. The cut-out used in GEC hybrid colour sets is connected in series with the line output valve's cathode, removing the supply to the stage when it goes open-circuit as a result of excess current. This gives the no e.h.t. symptom of course, to which we must turn next. Note that cut-outs can themselves be faulty.

No EHT

Perhaps the most common fault with receivers of all types is sound but no raster. This can be due to loss of c.r.t. first anode voltage, or incorrect cathode/grid voltages. The usual cause however is zero or inadequate e.h.t.

We'll take monochrome sets first. The first check should be to see whether you can obtain the usual small arc at the anode of the line output valve – if the anode is beginning to glow visibly red however first change the line oscillator valve. If the line output valve is abnormally cool, try another in case it has very low emission or an internal screen grid or cathode disconnection – if there's an anode disconnection, the screen grid winding in the valve will visibly glow due to its taking several times its normal current, while if the control grid is disconnected the valve will grossly overheat due to lack of bias.

If a replacement valve fails to produce a normal arc at the anode, check that there is ample screen grid voltage. Depending on the siting of the valve and its accessibility, this check can be made with the valve in place or removed. With it removed the voltage recorded should be virtually the h.t. rail voltage instead of the working screen grid voltage of course.

Inability to obtain a normal arc from the pentode's anode, with a known good valve and the screen grid and drive voltages present, could be due to several possibilities. Let's assume for the time being however that such an arc can be obtained, but there's no e.h.t. The next step is to hold the tip of the screwdriver blade just under the top cap cover of the e.h.t. rectifier. This should produce both corona discharge and a really good long arc. Changing the rectifier will usually restore the e.h.t. and picture.

If the arc obtained at the rectifier's anode is little larger than at the pentode's anode however there's either a short across the rectifier's heater, thus overloading the line output transformer, or the transformer's e.h.t. overwinding has shorting turns, preventing it from providing the normal transformer action. If removing the rectifier results in a bigger than usual arc at its anode cap, then clearly the rectifier itself is at fault and a replacement will restore results.

On occasions you may get a very good arc from the anode cap of a known good rectifier, but only the slightest of sparks from the e.h.t. lead to the tube, the cause being an open-circuit connection to the rectifier's heater inside its insulated valveholder. On still rarer occasions you may find that removing the anode cap from the tube shows that there's ample e.h.t. there, but there's still no e.h.t. when the anode cap is replaced. This means that there's a heavy leak within the tube.

When a tripler is used instead of an e.h.t. rectifier valve, the snap-on connection point is equivalent to the valve's anode, but the pulse waveform supplied to this point will be very much less. Tripler failure in monochrome sets is usually due to breakdown of the stick rectifiers. This produces a characteristic odour. If on the other hand one of the capacitors in the tripler goes short-circuit, the resultant heavy loading on the line output transformer will give the impression that this rather than the tripler is at fault.

Remember that two different types of e.h.t. multiplier are used in the Thorn 1500 chassis, a doubler which gives 15kV and is coded with a pink or green sticker, and a tripler giving 20kV and having a white sticker. It's possible to fit the wrong type: when the 15kV type is fitted in a 20kV chassis the picture is too big, while using a 20kV type in a 15kV chassis produces the opposite effect, often accompanied by an occasional spark over from the tray to the adjacent electrolytic can.

Colour Sets

When dealing with sound but no raster in a hybrid colour set, the first move should again be to check for the presence of a pulse waveform (spark) at the anode of the line output valve. If this is normal, check at the feed point to the tripler. Adequate tripler input but no output usually means that the tripler is defective, but missing c.r.t. first anode voltages, excessive cathode voltages or inadequate grid voltages caused by a fault in the clamping circuitry in the colour-difference output stages will also black out the screen. As with monochrome receivers however the probability is that the cause of the blank screen is zero or inadequate e.h.t.

This can be indirectly checked by shorting together the grid and cathode pins of any one of the c.r.t.'s guns to remove the bias: if the e.h.t. and first anode voltages are present, this will produce an all red, green or blue raster as the case may be. The red gun pins are probably easiest to use for this purpose – cathode pin 2, grid pin 3 and first anode pin 4, all well away from the high voltage which should be present at the focus pin 9.

If you want to prove positively that e.h.t. is being applied to the tube's final anode and you don't have a pukka probe, the quickest and safest thing to do is to disconnect the anode cap, position it firmly so that it is well clear of earthed points etc., and note the corona. Alternatively, strip about ¾in. from the end of a short piece of stiff e.h.t. cable, coat with solder and shape it into about three-quarters of a circle: push this under the anode connector, and note the corona at the other end.

Naturally such testing should be limited to the shortest possible amount of time, and in fact ample evidence that e.h.t. is present will be provided well before the valves have even warmed up fully. Remember too that the tube's capacitance can hold a considerable charge for a long time after the set has been switched off!

In practice the line output transformers of hybrid colour sets only rarely break down (the most frequent offender

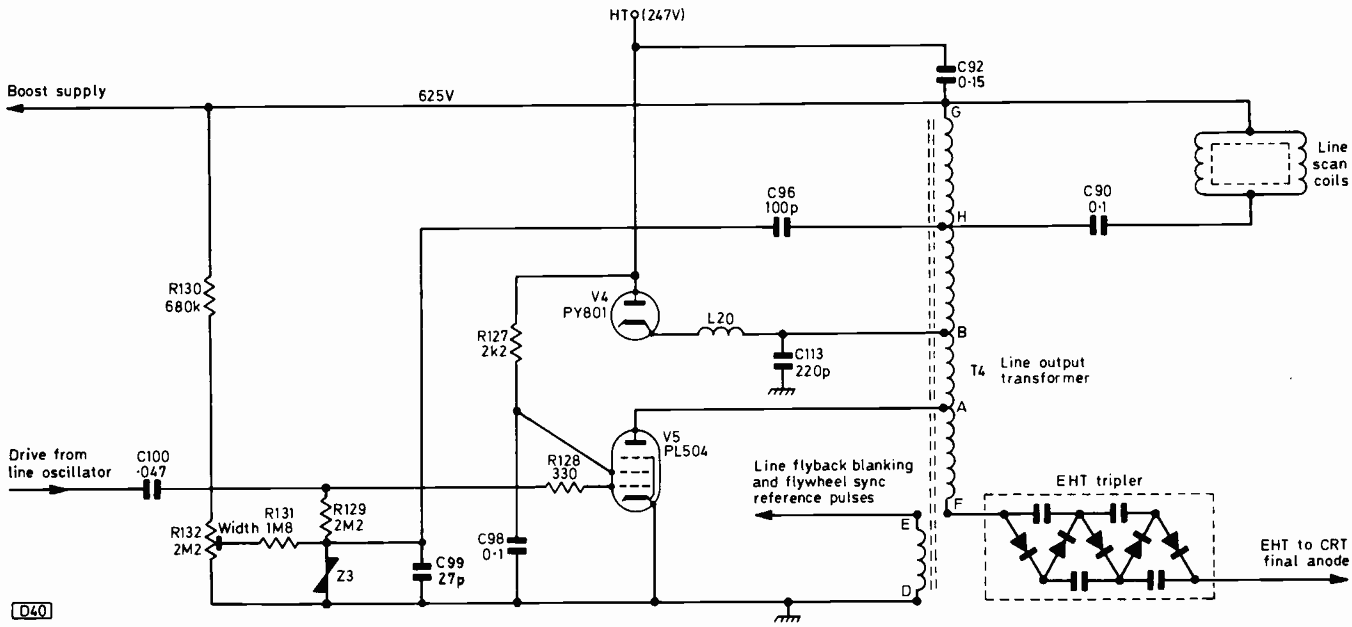


Fig. 2: Typical monochrome receiver line output stage (Thorn 1500 chassis, 20kV version). Check the line output transformer tuning capacitor C113 if a resistance check from the cathode of the boost diode to chassis reveals a short-circuit. This would open R124 (see Fig. 1). The boost capacitor C92 is returned to the h.t. rail and will thus give the sound, no raster symptom when it goes short-circuit.

being the Pye chassis), boost capacitors and 8 or 12kV ceramic tuning capacitors (and the first anode supply reservoir capacitor in the Pye chassis) giving the most trouble. The ITT chassis are particularly prone to tuning capacitor failure. Never replace 8kV disc types with the tubular varieties – they always break down. Use 12kV types wherever possible. It's important to use exact value

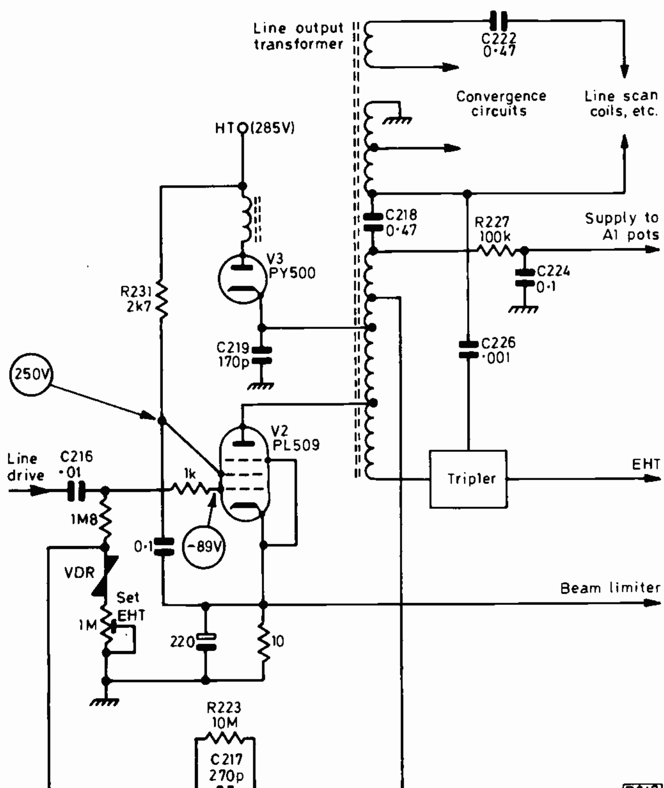


Fig. 3: Simplified circuit of the line output stage used in Pye hybrid colour chassis. This time the boost capacitor (C218) is returned to chassis. There is no h.t. fuse in this chassis, nor any fusible resistors in the h.t. supply. As a result, a short-circuit in C219, C218 or C224 will blow the mains fuse.

replacements. Apart from causing reduced or excessive width, incorrect value transformer tuning capacitors can lead to excessive flyback pulse amplitude with possibly damaging effects upon the transformer and the tripler.

As with monochrome receivers, the line scan coils very rarely give trouble. When they do develop shorted turns, the symptom is much more likely to be readily recognisable raster distortion rather than loss of e.h.t.

Lack of Width

Particularly in monochrome receivers, lack of width is usually caused by a major increase in the value of one of the high-value resistors in the width circuit which biases the control grid of the line output valve. The quickest way to check suspects, which will typically be 4·7MΩ, 8·2MΩ or even 10MΩ, is to shunt them with the meter (20kΩ/V) switched to the 250V or 500V range – it will then be equivalent to a 5MΩ or 10MΩ resistor. Even without a manual, it should be easy to spot these resistors in the v.d.r. circuit. If shunting one of them with the meter set to a range giving a comparable resistance value greatly increases the width, the resistor is almost certainly at fault. Even if the resistor hasn't increased in value, shunting it with the meter will increase the width to some slight extent of course, but a marked increase in width is a sure indication of value change, which will be confirmed by fitting a replacement. In Decca hybrid sets (10 and 30 chassis) check R453 (330kΩ) which tends to fall in value.

On occasion, insufficient width can be due to the line generator valve producing an output pulse of insufficient amplitude or incorrect shape. If a new valve fails to cure the trouble, the working voltages in the stage will be found to be below normal.

Field Timebase Faults

Valve field timebase circuits in monochrome receivers are responsible for almost as many service calls as the line timebase circuits, though they are usually much easier and inexpensive to put right. The valve field timebase circuits used in hybrid colour receivers on the other hand are very reliable.

Probably the most common complaint is intermittent or complete field collapse due to a defective PCL805 field timebase valve: if the horizontal white line displayed has some curvature to it however, resembling a flattened sinewave, then the scan coils are probably disconnected at a plug and socket or the miniature v.d.r. in series with them is open-circuit.

The next most common complaint is possibly weak field hold, the oscillator valve (again probably the PCL805) being the first suspect. Should a replacement fail to effect a cure, the interlace diode feeding the sync pulses to the stage, impaired h.t. smoothing, or inadequate video output valve or sync separator screen grid decoupling must be considered. Check too for discoloured resistors around the video output stage – being carbon types and passing considerable current, they often change value in older sets. This alters the stage's d.c. conditions, usually showing up as distortion of the sync pulses. If the resistors are unblemished, they can be taken to be of the correct value.

In many old ITT monochrome sets weak or non-existent field lock is often due to R63 (330kΩ) going high resistance or open-circuit. This resistor feeds the sync separator's screen grid and the field sync pulse amplifier's anode. Even when it's open-circuit, depriving the sync separator of screen grid voltage, the line hold remains good!

Other causes of weak field sync are a slightly soft i.f. amplifier valve of the EF183/EF184 type, inadequate decoupling of a transistor i.f. stage or strip, or a faulty a.g.c. circuit. When the timebase causes of weak field sync in a hybrid set have been eliminated and suspicion falls on the transistor i.f. and/or video stages the problem, unless a replacement panel is to hand, really becomes a bench job.

In ITT hybrid colour receivers the OA91 interlace diode D46 is worth bearing in mind: it quite often goes short-circuit to give complete loss of field sync, or open-circuit to give no field scan.

If the base of the raster is cramped, first try a new field output valve. If this doesn't correct the fault, check its cathode bias resistor and/or decoupling electrolytic, either of which may have fallen in value. Very often the valve and its cathode bias resistor must be replaced, a fault in one accentuating the deterioration of the other. Top compression can be due to an increase in the value of the cathode bias resistor. In cases of poor linearity, try the presets and if these are in order suspect a component in the feedback loop: if the resistors are unblemished, there is probably a leaky capacitor. Excessive picture size with bad linearity in many Philips hybrid monochrome sets is due to the negative feedback winding on the field output transformer going open-circuit.

A common fault is insufficient height, and in 90% of cases it's due to increase in the value of one of the high-value resistors in series with the height control. This leads to inadequate voltage at the anode of the field oscillator triode. The feed is from the boost rail, and the offending resistor is sometimes in the line timebase section of the receiver. In ITT many monochrome receivers a sudden reduction in height to about two-thirds of the screen is often due to C134 (0·1μF) going short-circuit: the result is that the height circuit is fed from the h.t. instead of the boost supply.

Next Month

So much then for those basic power supply and timebase faults which should be easily dealt with in the field. In the next instalment we'll take a look at the signal side of things.

Video and Audio Out from the Philips N1700 VCR

David K. Matthewson, B.Sc., Ph.D., and Ian Howarth

REGULAR readers of this magazine will know that students are often taken on in my workshop to give them industrial training experience. One of the present batch has been coming up with some very bright ideas. His latest suggestion was that we add video and audio output facilities to the Philips N1700 VCR. This machine is intended of domestic use, and provides an output at u.h.f. to feed the aerial socket of an ordinary TV set.

We use several of these VCRs for recording long runs of Open University programmes over the weekends, copying the programmes required on to other tapes for the local OU group (yes, we do have a recording licence!). Better quality can obviously be obtained by copying or editing at video levels than at u.h.f., so this modification makes good sense. It also enables the VCR to be used with a video monitor, so that the best possible qualilty picture is displayed. The sound can be fed to a separate amplifier for use in a large room etc.

So, after putting our heads together, here's the design we came up with (see Figs. 1 and 2). The audio circuit is quite straightforward, consisting of a simple emitter-follower (Tr4) giving an output of about 1V into 10kΩ. The video side is rather more of a problem, since it must provide 1V into 75Ω (the standard level for TV equipment). There's no suitable point in the N1700 to tap off the required signal, hence the use of a two-transistor amplifier (Tr1-2) with an emitter-follower output stage (Tr3).

The amplifiers require a 12V supply. This, along with the sound and vision signals, can be taken from panel 51 of the VCR – the 12V from pin 3 of socket L1, and 0V from pin 4 of socket L3 or any convenient point on the earth print. The video feed to the amplifier is taken from point M1 and the audio from pin 1 of socket L1.

As we had several of these VCRs to modify, a PCB was designed. This is shown full-size in Figs. 3 and 4. We leave it to the individual to decide upon the type of output sockets to use. Note however that if BNC and DIN sockets are used suitable holes are already provided in the rear of the case. There's plenty of room inside the VCR to fit the PCB, though some minor metal work may be required in order to provide suitable mounting brackets.

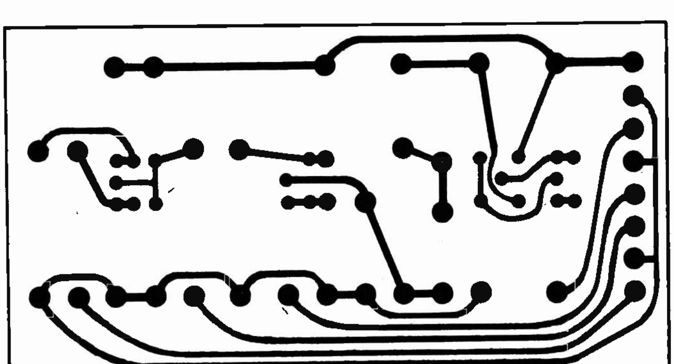


Fig. 4: Full size board layout.

Finally, though the video circuit was designed for use with the N1700 it can be employed wherever an amplifier with a gain of two and an output at 75Ω is required.■

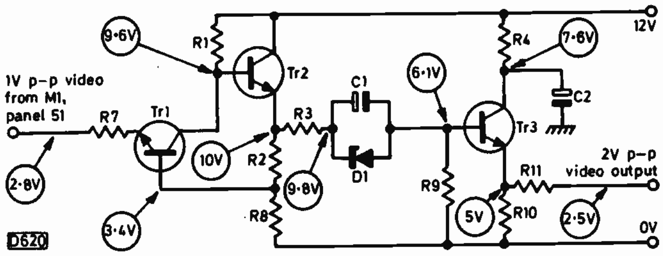


Fig. 1: The video out amplifier.

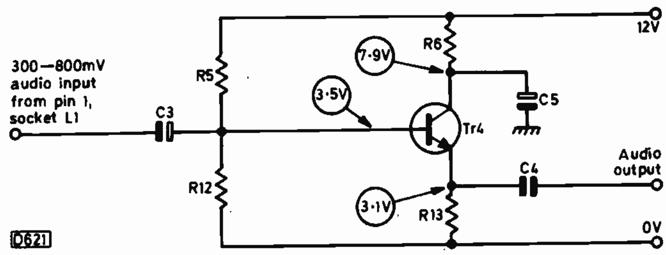


Fig. 2: The audio out amplifier.

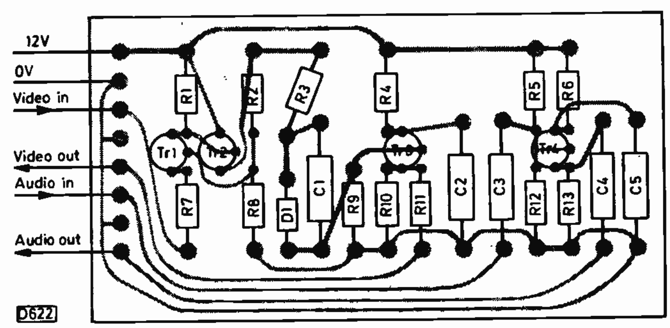


Fig. 3: Component layout on the board.

★ Components list

Resistors:		**Capacitors:**	
R1	3·9kΩ	C1	47μF
R2	470Ω	C2	220μF
R3	68Ω	C3	22μF
R4	100Ω	C4	22μF
R5	39kΩ	C5	22μF
R6	1·8kΩ	All 16V electrolytic	
R7	330Ω		
R8	270Ω	**Semiconductor devices:**	
R9	2·2kΩ		
R10	2·2kΩ	Tr1	BC109
R11	68Ω	Tr2	BC109
R12	22kΩ	Tr3	BC109
R13	1·8kΩ	Tr4	BC109
All ¼W carbon film		D1	BZY88 4V7

Of TTL and CMOS Gates and Cabbages and Kings . . .

Part 1

Andrew Parr, B.Sc., C.Eng., M.I.E.E.

EARLY in 1965 I was given a 7400 TTL chip by my employers and told to find out what it could do. The chip lasted just two days before I managed to destroy it. This started a love/hate relationship with digital logic that's lasted to the present day.

Digital logic is now established in most fields of electronics, and television engineering is a particularly fruitful source of applications. The "Language of Logic" series in the October to December issues of *Television* 1978 provided an introduction to the basic ideas of digital circuits. This article is a follow up, giving practical details of the two most popular logic families, TTL and CMOS.

TTL LOGIC

In the early 1960s the space race was in full flight and it was becoming obvious that electronics would play a vital part in any (hopefully hypothetical) future war. This lead to a sudden burst of frontier pushing and, along with Teflon saucepans, the world was presented with TTL. Incidentally, it has been said that two things gave the USA their lead in military electronics: TTL and the management tool called Critical Path Analysis. That's another story however.

TTL emerged commercially in 1964, introduced by a small firm called Texas Instruments. Although logic chips (RTL and DTL) had been around for some time, the performance of TTL was so vastly superior that it swept aside all alternative techniques and rapidly became an industry standard. It still holds that position, which is a tribute to the original design.

Basic NAND Gate Circuit

With the adverts and the history lesson over, we can look at a TTL gate and see what makes it tick. Fig. 1 shows the circuit of a typical TTL gate. At first sight the multiple emitter transistor looks odd, but this is really a shorthand way of drawing the multiple transistors shown in Fig. 2. The circuit is actually quite a good model for anyone who wants to experiment with the innards of a TTL gate.

With both inputs high, current flows through the base-collector junctions of TR1a/b, turning on TR2 and hence TR4. To appreciate this, consider the diode analogy shown in Fig. 3. The output goes to 0V therefore. With any one input low, TR1 acts as a transistor, pulling the base of TR2 down to 0V. TR2 turns off, and TR3 acts as an emitter-follower taking the output high.

Thus with both inputs high, we get a low output; with one input low, we get a high output. The circuit is thus a positive NAND gate.

The output stage is particularly interesting. The so called totem-pole output gives active drive with either a 1 (high) or 0 (low) output. When logic circuitry is being driven at speed, the main constraint is stray capacitance: the active output allows capacitive outputs to be driven with ease.

Table 1: TTL Characteristics.

Type	*Code*	*Power consumption*	*Propagation delay*	*Speed*
Low power	L	1 mW	33nS	3MHz
Standard	–	10 mW	10nS	35MHz
High speed	H	22 mW	6nS	50MHz
Low-power Schottky	LS	2 mW	9nS	45MHz
Standard Schottky	S	19 mW	3nS	125MHz

Logic Families

TTL is actually a common name for a wide range of TTL type gates, the circuit shown in Fig. 1 being the "standard" gate. The main features of a logic system are usually considered to be: (a) speed; (b) power consumption; (c) noise immunity; and (d) simplicity in use.

As mentioned above, stray capacitance is the major restriction on speed. To increase speed, it's necessary to reduce the value of the resistances in the circuit. This increases the power consumption. Initially, TTL was made available in three versions – low power, standard and high speed. Improved techniques have enabled Schottky diodes to be used in the circuit, and as a result two more types have been added. The speed of a gate is defined as the propagation delay, which is the time a signal takes to go from a gate's input to its output. The characteristics of the five TTL families can best be summarised as shown in Table 1.

Which type of gate you choose depends on the application, but the standard series is adequate for most circuits (it's also the cheapest!).

TTL is specified by a multipart code as follows:

(a) Manufacturer's code. SN is Texas Instruments.
(b) Specification. 74 is industrial, 0° to 70°C; 54 is Military −55°C to +125°C.
(c) Type code as in Table 1.
(d) Device reference: 04 is an inverter, 00 is a quad NAND gate etc.
(e) Package. N = plastic dual in line.

Work out then what a device coded SN74LS04N is.

TTL in Use

TTL runs on a 5V supply rail, and this is subject to a tight tolerance of ±0·25V. The supply can rise to 7V before damage will occur, but operation at this voltage is neither recommended or guaranteed.

The nominal value of a "1" output is 3·3V, and in this state the gate can provide a current drive ("source") of 0·5mA. The nominal value of a "0" is 0·25V, and it can draw ("sink") 16mA. This high drive capability allows simple interface circuits to be used when TTL is connected to the

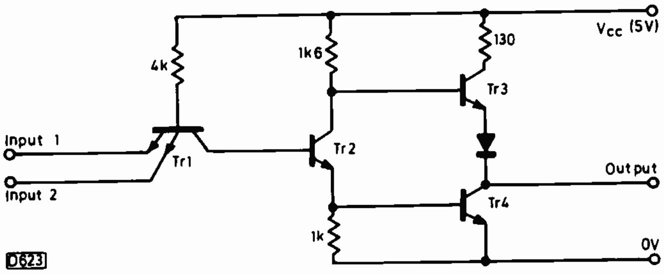


Fig. 1: Standard TTL gate circuit.

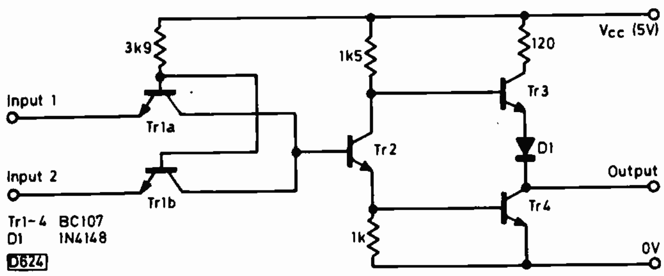


Fig. 2: Discrete component version of the TTL gate.

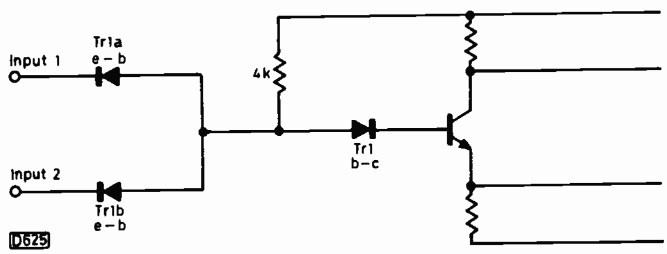


Fig. 3: Diode analogy of the action of Tr1 in Fig. 1.

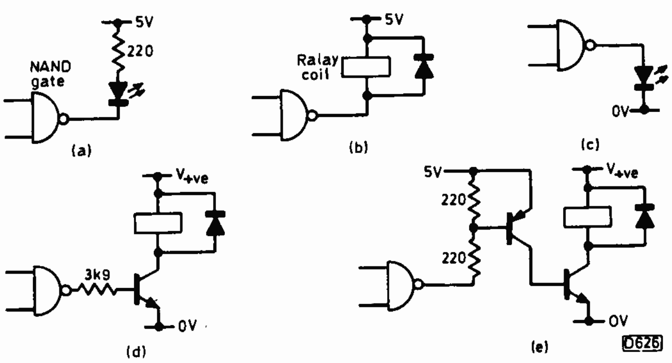


Fig. 4: Interfacing between a TTL gate and an external device. (a) Driving a LED. (b) Direct drive to a reed relay. (c) Alternative LED drive. (d) Driving a high-voltage relay. (e) Driving high current loads.

outside world. Examples are shown in Fig. 4.

TTL is relatively bullet proof, and in my experience will stand having its output shorted to either supply rail for extended periods without harm. There are however several ways of killing the gates.

The first is to let the supply go over 7V. If you are using large amounts of TTL, don't use a simple series regulator which could fail. Use an i.c. regulator or a commercial supply with an over voltage trip. Running TTL on an adjustable supply is asking for trouble – that's how I killed my first gate back in 1965.

The second foolproof method of killing a gate is to take the inputs outside the supply rails. This causes breakdown of the substrate, but is a problem only when you are mixing TTL with circuits operating with higher voltage supplies.

A common problem with all digital systems is noise. This causes memory devices to set, counters to count and monostables to fire – all at the most inconvenient moments.

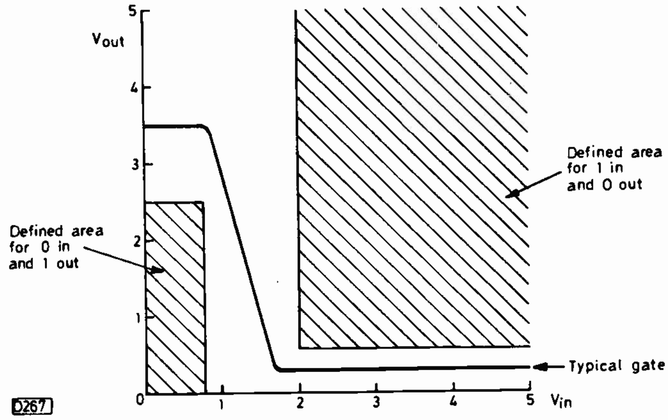


Fig. 5: TTL gate transfer characteristic.

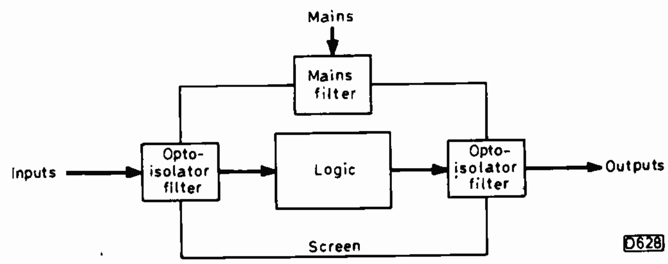


Fig. 6: Last ditch screening to eliminate external noise.

Noise can come from several sources: (a) supply born external (e.g. your deep freeze thermostat); (b) supply born internal, due to current spikes; (c) crosstalk between parallel lines; (d) reflections in long lines.

Before describing these and how to deal with them, we must define noise immunity. We have stated that a typical value for 1 is 3·3V and for 0 0·25V. We must define the lowest possible worse case 1 and the highest possible worse case 0. These are, respectively, 2·4V and 0·4V. We next establish how high we can take a 0 input without the corresponding 1 output going below 2·4V. The data sheet gives the value of 0·8V. If the maximum conceivable 0 level is 0·4V but it can rise to 0·8V we have 0·4V of noise immunity.

Similarly, the lowest value of a 1 is 2·4V, but an input can go down to 2V before the corresponding 0 output rises above 0·4V. Thus at the 1 level we also have 0·4V noise immunity.

The transfer characteristic is shown on Fig. 5.

A noise immunity of 0·4V does not sound a lot, but there are two points two remember. First this is an absolute worst case, with the worst gate at the minimum power supply voltage driving the maximum load. Secondly, the power required to switch the gate is quite large, as the TTL gate is a low-impedance device.

Dealing with Noise

Taking our four sources of noise, how can we deal with them? The first, external noise, is a question of filtering the mains and in extreme cases putting the whole circuit in a Mumetal screen as shown in Fig. 6. Opto-isolators should be used for the inputs and outputs.

The second source, internally generated noise, is interesting. As a TTL gate switches, for a brief time both TR3 and TR4 in Fig. 1 are on together. This causes a large current pulse on the supply. The pulse has very sharp edges, thus generating large transient voltages across the inductance of the supply leads.

Computer manufacturers use multilayer boards, with a

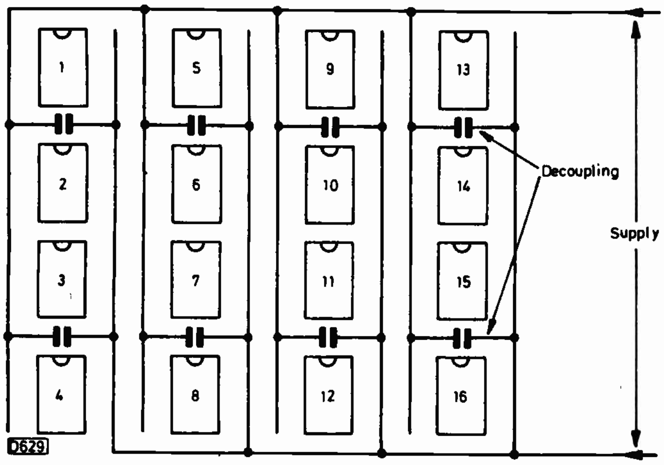


Fig. 7: Supply arrangements with TTL – a typical general-purpose PCB layout.

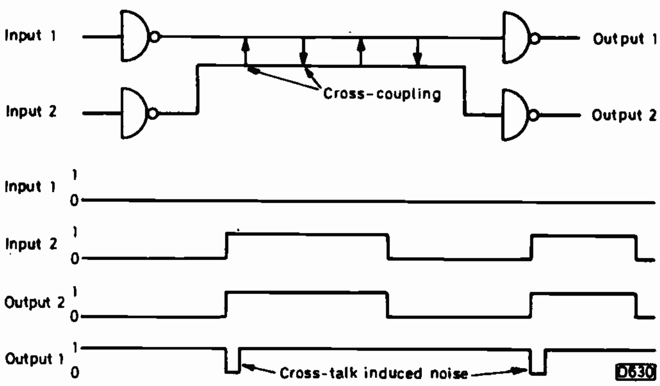


Fig. 8: Crosstalk due to coupling between adjacent tracks.

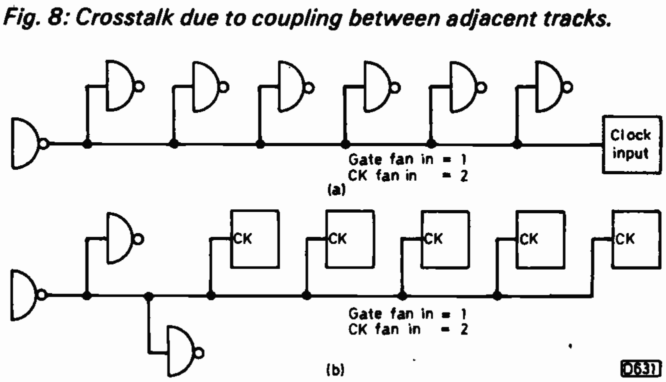


Fig. 9: Fan out and fan in. (a) An allowable configuration – the gate at the left has a fan out of 10, driving a total fan in of 8. (b) Non-allowable configuration. The gate, with its fan out of 10, is linked to 12 fan ins.

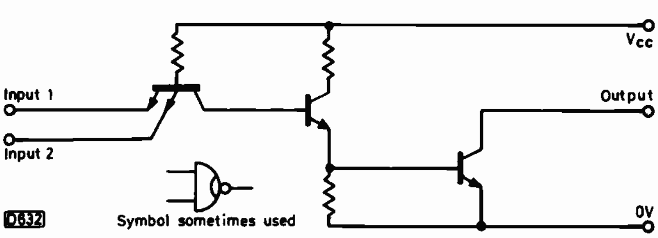


Fig. 10: Open-collector gate circuit.

sheet for the supply and another for 0V. This is not feasible for us poor cost conscious individuals, but we can overcome the problem with a sensible supply layout and liberal use of decoupling capacitors. Fig. 7 shows a commonly used general purpose board.

Manufacturers recommend the use of one 0·01μF disc ceramic for every five i.c.s. I'm a pessimist and use one

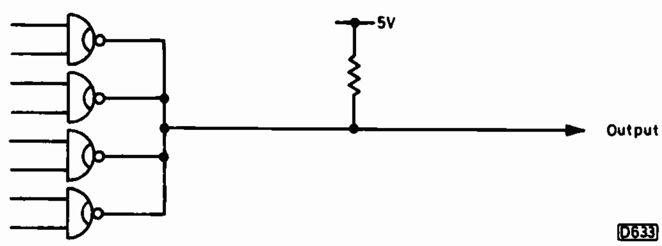


Fig. 11: Use of open-collector gates to provide the "wired-OR" logic function.

0·01μF for every two simple i.c.s and for every i.c. that's vulnerable to noise, such as a memory, counter, etc.

The last two sources (crosstalk and reflection) have similar causes. The waveform edges in TTL are very fast, typically a nS or so. At this speed the edge time is faster than the time taken for the signal to travel along a wire more than a foot (sorry, 30cm) in length.

Crosstalk is coupling between one pair of gates and another (see Fig. 8). Its cure is simply not to run wires close together for runs longer than 30cm or so.

Reflections arise because the interconnecting wires behave like a transmission line – and all TV engineers know that transmission lines need terminating. Normal interconnecting wires have a characteristic impedance of around 300 – 600Ω, and need a corresponding terminating resistor. This is beyond the capabilities of normal gates, but special line driver i.c.s are available. The rule is: keep line length below 60cm for normal gates; above this use line drivers and terminate the lines.

Fan in/Fan out

There's a practical limit to the number of gate inputs a gate can drive. A TTL output is defined as having a fan out – usually ten unit loads. An input is defined as having a fan in, usually one unit load although some clock inputs are higher. To see if a gate can drive the inputs you want, total all the fan in loads and check that it comes to less than the output fan out. Fig. 9(a) is thus allowable (fan out 10, fan in 8), but Fig. 9(b) is not (fan out 10, fan in 12).

Unused Inputs

Unused gate inputs present a problem. They can be left floating, but are then prone to noise. The recommended solutions are: to tie them to the supply rail via a 1kΩ resistor; to tie them to a logical 1 defined by two resistors across the supply rail; or finally to parallel inputs. Spare inputs on OR type gates should of course be tied to 0V or connected in parallel.

Open-collector Gates

Some TTL gates have the totem pole output replaced by a single transistor, as shown in Fig. 10. These gates are called "open-collector gates", and are usually designed so that the collectors can be taken to a high voltage such as 15V or 24V. This makes them suitable for lamp driving etc.

In addition, they can be used to provide a cheap OR function. If several collectors are connected together as shown on Fig. 11, when any output goes to 0 the common line will go to 0. This is known as a "wired-OR". A single resistor is needed to take the line to 1 when all transistors are turned off. Under no circumstances should the outputs of normal totem pole TTL gates be connected together. The wired-OR operation is slower than using a TTL NOR gate.

Servicing Pye Solid-State Colour Receivers

Part 3: 713, 715 and 717 Chassis

Mike Phelan

IN the final instalment in this series we'll deal with the small-screen (18in.) solid-state Pyes, using the 713, 715 and 717 chassis. There is also a Philips version, known as the 570 or A4 chassis. Perhaps the best known model is the Pye CT200, the first all solid-state Pye colour set, which was introduced in late 1972. Other models include the Pye CT200/1 and CT218, the Ekco CT818, the Invicta CT7018 and CT7018/1 and the Philips G18C570. The original version (713 chassis) was fitted with a similar tube to that employed in the Thorn 8000 chassis. It requires a relatively low focus voltage which is derived from the boost rail: a flylead on the tube base provides adjustment, plugging into one of three pins with little variation in the result. The later 715 and 717 (and 570) chassis employ a tube which uses the normal higher focus voltage: this is obtained from the e.h.t. doubler via a focus control on the tube base.

The four main printed panels are held in plastic runners attached to the cabinet base and sides, accessibility being fairly good. The convergence panel is on the right, and can be taken out and placed on top of the set. The top left panel is the decoder, which is virtually identical to the one used in the larger screen models and described last month. Below this is the i.f. panel, which is also much the same as that used in the 725/731 chassis. The large panel at the bottom has on it the power supplies and timebases, some parts of it being a little difficult to get at. When sliding this panel back on its runners, make sure that no leads are trapped behind it – otherwise it will be impossible to replace the back of the set. The latter is held on by the same fixings as were used on the later Pye hybrid sets. They suffer from the same problem, i.e. breaking very easily. Replacements can be glued and screwed to the cabinet with small self-tappers.

Starting again with the power supply, the main differences compared with the larger-screen models are the use of a bridge rectifier prior to the thyristor controlled rectifier, and the use of a BR101 silicon controlled switch instead of a diac to trigger the thyristor. The use of a bridge rectifier means that the chassis is at half-mains potential of course.

The anode of the SCS is fed with a sawtooth waveform

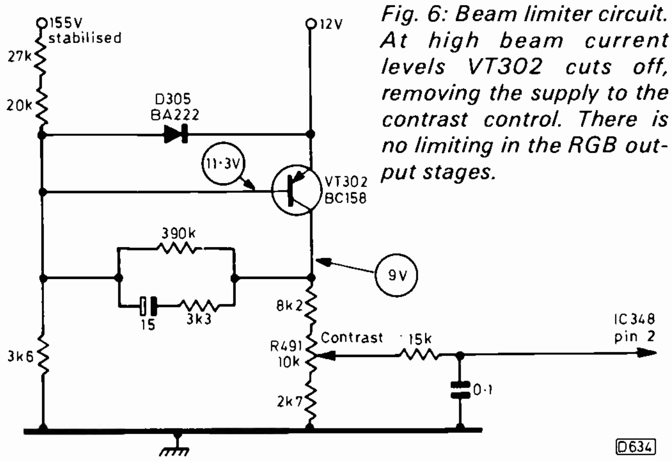


Fig. 6: Beam limiter circuit. At high beam current levels VT302 cuts off, removing the supply to the contrast control. There is no limiting in the RGB output stages.

which is produced by R519/C521. When this reaches the same voltage as the 100Hz half-cycle fed to the anode gate from the junction of R524/R522, the SCS fires, producing a pulse across R533. This is fed to the gate of the thyristor via C532. For over-voltage protection there's a glow switch (537). Should the h.t. rise above a safe value, the gas in the glow switch ionises and the bimetallic contact strips bend, shorting out the h.t. and blowing the mains fuse F526.

When confronted with a blown mains fuse, replace it, switch on and observe the glow switch. If it glows briefly before the fuse blows again, the h.t. is too high. Likely causes are a short-circuit thyristor or the 7·5V zener diode D518 being open-circuit. If the fuse blows instantly without the glow switch operating, check the diodes in the bridge (D503/5/7/9) for leakage. The mains filter capacitor C501 is also not above suspicion.

These sets have a habit of blowing their fuses for no reason at all – both the mains fuse and the h.t. fuse F541 (630mA). A mains fuse that blows at odd times may mean that the h.t. is slightly too high and that the glow switch is striking when the set is warm or when a slight surge occurs on the mains. Note that the mains fuse is the 1·6A one: the 3·15A fuse next to it feeds the degaussing circuit.

Another common fault on this power supply is dry-joints on the filter choke L525. It's worth checking this even if the set is working – if left, dry-joints here rapidly become large holes in the board.

If it seems that the thyristor is not being switched on, but has voltage at its anode, check whether R524 (15kΩ or 10kΩ in earlier production sets) is open-circuit before getting too involved in the power supply circuit. This is the large green or brown resistor on legs near the thyristor, and is often the cause of a dead set.

We've had little trouble with the dropper, but if the 3·5Ω section R544 goes open-circuit the symptoms are misleading. The cathode of the thyristor is then no longer decoupled by C535, so no gate current flows, giving no h.t. at the cathode and leading one to suspect a fault elsewhere in the power supply.

The line timebase is very reliable – the only components that we've ever had to replace are the e.h.t. doubler, the line output transistor (VT654) and the flyback tuning capacitor C656 (0·0024μF or 0·0027μF). Note that there are two types of doubler – one with four and one with five leads, depending on the type of tube fitted.

The field timebase is very simple, using an SCS oscillator (D711) and a class B complementary-symmetry output stage. The output transistor pair VT751/VT754 is the cause of most troubles, either both going short-circuit and blowing F678 or one or other of them going intermittently open-circuit. Be sure to replace the insulating washer under VT751 when repairing this part of the set. The driver transistor VT741 (BC337) occasionally plays up, usually giving a very non-linear field scan. The only electrolytic that has occasionally given trouble is C732 (4·7μF). Symptoms have been poor linearity and spasmodic height/linearity variations.

There are two extra adjustments in the field timebase,

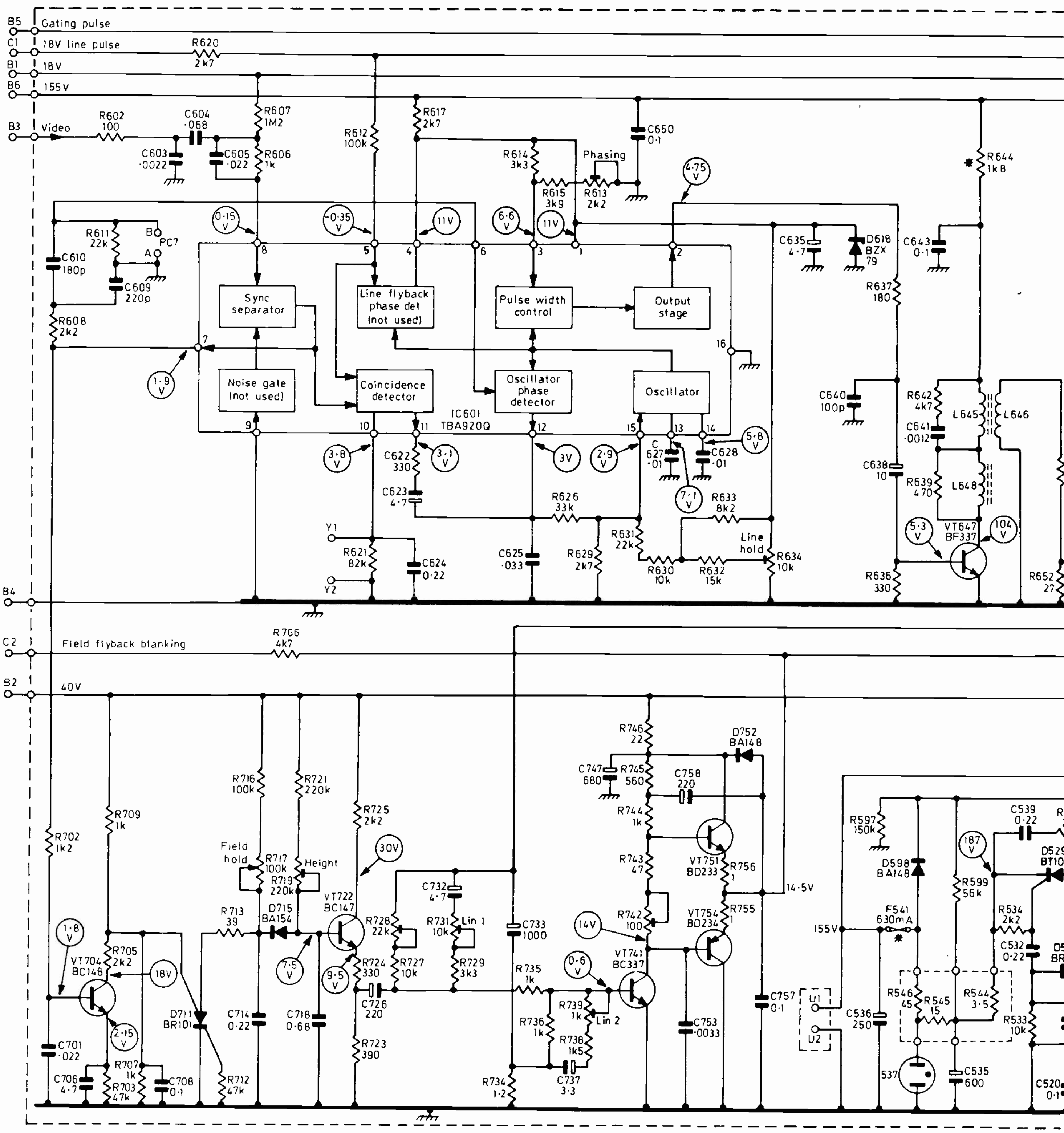


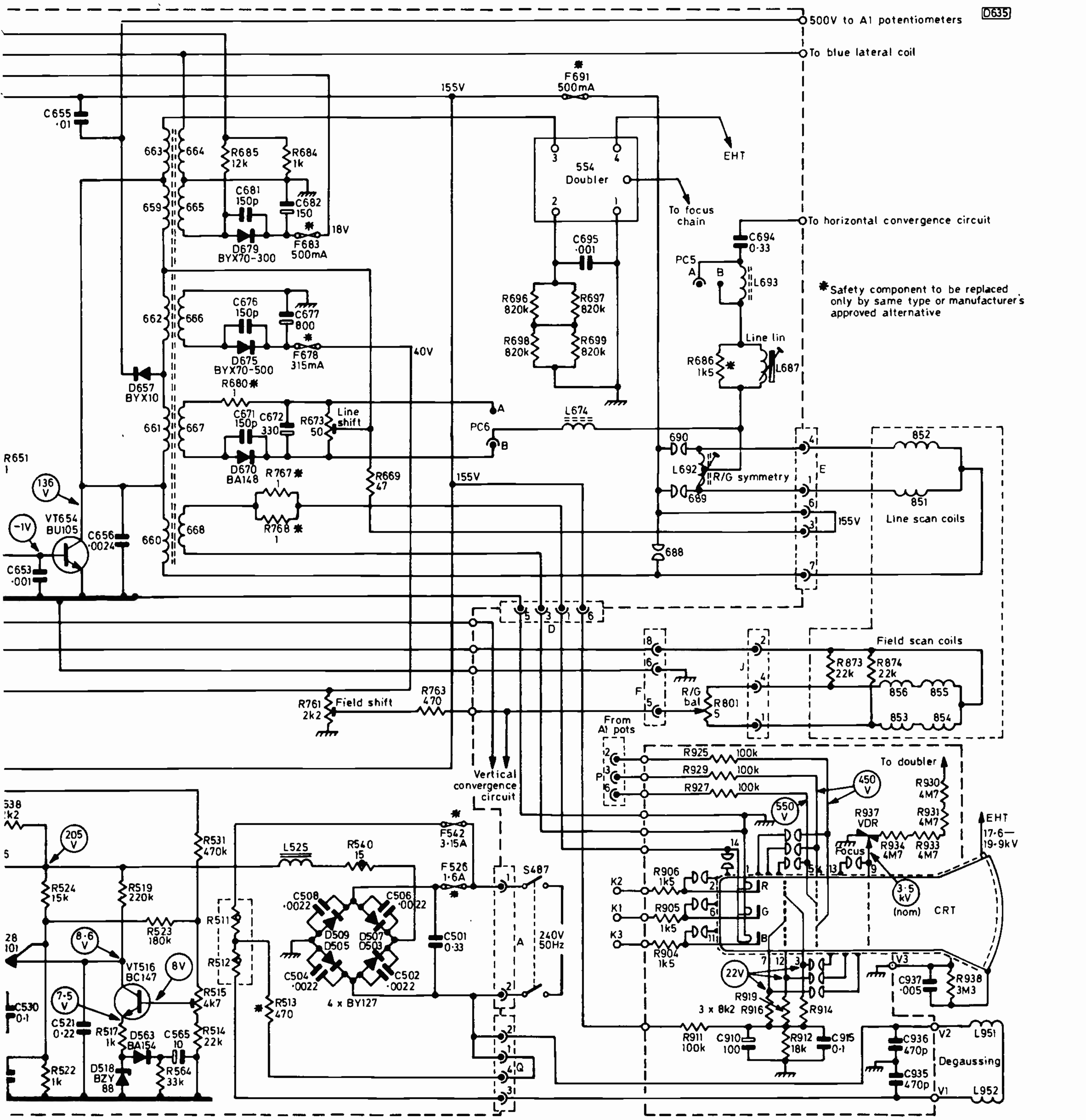
Fig. 7: Power supply and timebase circuits, Pye 715 and 717 chassis.

and these must not be altered indiscriminately. They are the mid-point setting control R728 and the output stage bias control R742. Both settings should be checked after replacing any components in the driver or output stages. Set R728 for 14·5V at the junction of R755 and R756. R742 should be turned fully anti-clockwise, then turned slowly clockwise until the bright line in the centre of the field scan *just* disappears. The line is caused by crossover distortion, as in an audio amplifier.

Some of the tuning push-buttons fitted to these sets give rise to a fair amount of trouble. They can be repaired in the same way as those of the Pye sets mentioned last month.

The tuner/i.f. panel is almost the same as that used in the bigger bretheren, but a 12V filter transistor (VT210) is incorporated. This is also employed as a beam current limiter – in addition to the one (VT302 and associated components) that operates on the contrast control. The rest of the panel is more or less the same as that of the 731 series, and suffers from the same faults – the main one again being dry-joints in the i.f. module.

The decoder is also basically the same as that used in the 731 chassis, but there are one or two differences. There's no switch for turning off the luminance, and the beam current limiter (see Fig. 6) senses the fall in the l.t. supply – this is



The 713 chassis has a different focus arrangement (see text).

obtained from D679/C682 in the line output stage, via the 12V active filter just mentioned – caused by rising beam current. The arrangement is similar to that used in the Philips G8 chassis.

Decoder faults are much the same as in the 731 etc., but there's one that usually catches the unwary. The symptoms are a very smeary picture with no h.f. content and possibly loss of chroma as well. The cause is that either R325 (set gating) on the decoder panel or R613 (line phase) on the timebase panel requires adjustment.

The RGB output transistors VT431/447/463 and the thick-film resistor unit R428A-F contribute to the list of decoder faults, the latter usually altering in value rather than going completely open-circuit. Note that earlier and later decoder panels are *not* interchangeable, as the components in the brightness control circuit have different values.

Intermittent colour on ITV only can sometimes be cured by adding a 100pF capacitor (with the leads as short as possible) between pin 14 of IC408 (TBA990Q) and chassis to sharpen up the bistable trigger and the burst gate pulses.

One fault which we seem to meet frequently on these sets is intermittent luminance. The reason is dry-joints on either C299 (68μF) which couples the video signal to IC348 (TBA560CQ) or the luminance delay line (L292). ■

Long-Distance Television

Roger Bunney

CONTRARY to expectations, Sporadic E signal propagation during August was extremely active. Unlike June/July, the openings didn't last long but nevertheless gave a selection of signals from most countries in Europe. A well established high pressure system at the end of the month (from about the 26th on) started to provide enhanced tropospheric propagation – the weather consisted of the characteristic clear, cloudless days and nights, with early morning mist/fog. My log for the period, omitting MS (meteor scatter) signals, is as follows:

3/8/79	YLE (Finland) ch. E2.
5/8/79	MTV (Hungary) R1.
6/8/79	Switzerland E2.
7/8/79	TSS (USSR) R1, 2; SR (Sweden) E2.
9/8/79	RAI (Italy) IA; unidentified R1 signal; Gwelo, Rhodesia E2 (see later).
11/8/79	CST (Czechoslovakia) R1; MTV R1; ORF (Austria) E2a; unidentified R1 signals. A long SpE opening.
12/8/79	CST R1, 2; many unidentified R1/2 signals. Another prolonged but bitty SpE day. The period 1300-1400 produced an unusual fluttery SpE signal – not unlike MS variations.
14/8/79	TSS R1, 2; TVP (Poland) R1 – the signal reached 800μV straight from a dipole!; SR E2; DFF (East Germany) E4; RAI IB.
19/8/79	MTV R1; several unidentified signals.
21/8/79	TSS R1; TVP R1, 2 (strong signals again); DFF E4.
27/8/79	TSS R1, 2; SR E2, 4; YLE E2.

One point noted was that DFF have a new identification across their electronic pattern. Reception of Gwelo, Rhodesia was initiated by Hugh Cocks (E. Sussex) who phoned at 1800 to report very strong signals. With careful tuning I could resolve only weak video however. David Martin (Shaftesbury) was active at the time but nothing at all was visible there! It seems that this early evening TE (transequatorial skip) type signal is only just reaching the south coast. Hugh lives inland from Hastings, on high ground with a clear take-off to the sea some ten miles away. My own location is on low ground, with the Isle of Wight (and its two ranges of high hills) in the way. David Martin is similarly thirty miles from the open sea. Thus when TE is just making it, only south coast DXers will benefit.

Clive Athowe has recently returned from a visit to the United States (see later). He also noted the new DFF identification, and is the first DXer in the UK to receive the new RTL (Luxembourg) ch. E27 transmitter (625 lines with negative video) – congratulations! He comments that the YLE-2 ch. E2 Fubk card has no concentric circle, though the YLE-1 card does include this feature.

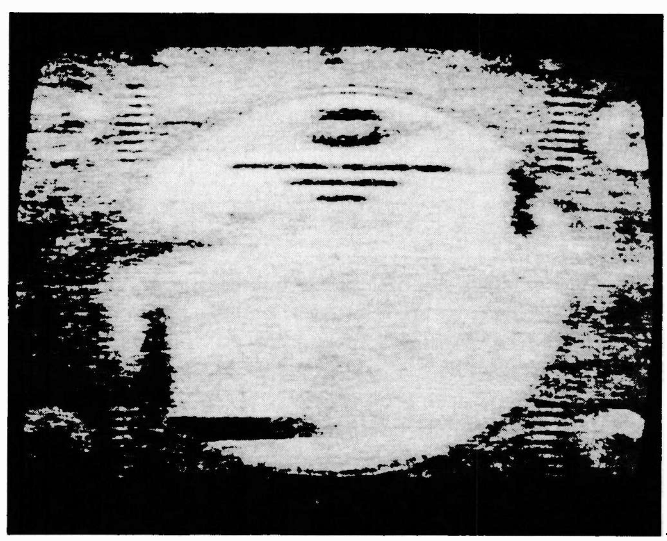
Last month I mentioned another Ryn Muntjewerff "first", reception in Holland of RTA (Algeria) ch. E5 via SpE. Fortunately his photograph of the female announcer came out well (see illustration – note the local Dutch ch. E5 floating signal in the background). I also reported last month suspected reception of Gabon ch. E3 – by T. van Dalen in Holland. The photograph of this suspected reception shows a test card similar to the old Czechoslovakian one with the light background (see *Guide to World-wide Television Test Cards*). This reception was at 1000 GMT on June 29th. Any suggestions?

A final comment on August reception. Ray Davies (Norwich) reports receiving a Jordanian ch. E3 signal on the 5th, from 1730-1745, with Arabic news. At fade out (1745) Ray returned to ch. E2 and received ten minutes of programme and credits from Gwelo!

DX Photos

Prints of off-screen photographs returned from the processors seldom seem to do justice to one's DX reception. This is due to the use of mass production printing techniques which employ a system not unlike mean-level a.g.c. – o.k. for Aunt Flo on the beach, but not for a PM5544

Ryn Muntjewerff's reception of Algerian TV ch. E5 via SpE in Holland.



Could this be Gabon ch. E3? Test card received by T. van Dalen in Holland.

pattern with "JTV Amman" identification! Hand printing from the labs can also (from my experience) prove a disappointment due to incorrect framing etc. If you know of a DXer/film expert you're fortunate. Gareth Price has recommended Paul Godfrey of John Wells Photo and Audio Ltd., 44 London Road North, Lowestoft, Suffolk (tel. 3742) who he says can work wonders with doubtful exposures. Being a radio amateur as well, he understands what DX-TV is all about and can, I'm assured, deal with most shots that come along. Developing is 75p, with hand printing for a 5 × 3½ shot at 23p, postage 20p extra – these prices were before the latest increases in postal charges however, so send an s.a.e. for latest details.

Automated DX

In the June issue of the WTFDA magazine *VHF/UHF Digest* Peter Sawatzky of Guelph, Ontario describes an automated set-up for f.m. DXing. Though this column is concerned with TV DXing only, some of the techniques used give food for thought. The system monitors the 100 allocated f.m. channels in the 88-108MHz spectrum over a 24-hour period. Digital information corresponding to the channels in the f.m. band is loaded, via toggle switches, into a memory which, via a digital-to-analogue converter, controls a varicap tuner. The entire f.m. band is scanned once every five seconds. During this process digital signals corresponding to the a.g.c. levels across the band, i.e. whether or not signals are present, are stored in another 100 locations in the memory. The system compares the a.g.c. levels with another set of data signals already programmed into the memory. When the off-air a.g.c. exceeds the programmed level, scanning stops for a predetermined period of time while a tape recorder records what the system has decided is a DX signal! The frequency can also be noted on the tape, though this part of the system has not so far been brought into operation.

The system is reported to work well with SpE signals, but has shortcomings with MS and tropospheric signals. A Mk. II system based on an Intel 8085 microcomputer is being developed to overcome these shortcomings. The tuner is part of a Heathkit AJ15 receiver. As the system operates on a 24-hour basis seven days a week, no opening is missed.

Whilst the system works well for US radio signals, I feel that in Europe the lack of radio and TV signal identifications for much of the time would be a decided drawback. A UK system could perhaps recover VITS information to give a form of identification, but unfortunately many a truly exotic DX signal does not include VITS, while distortion with F2 propagation could be destructive of such information.

Nevertheless, full marks to Peter! Such a system would be ideal for ionospheric research, but strikes me as being not quite in the spirit of true DXing. Any comments?

New Aerial System

I've recently been testing a new stacked bowtie wideband u.h.f. aerial system. The gain, particularly in groups B and C/D, is most encouraging compared to other versions I've used in the past. Comparative tests of the new Vorta system and a similar stacked bowtie array at both Romsey and Shaftesbury have shown that whilst the group A gain is similar there's a 2dB lift at the h.f. end of group B and a peak improvement of 3dB in group C/D. I also noted a 2dB improvement in the front-back ratio, though the forward lobe is similar and quite broad. Individual measurements were made at two different locations in order to confirm the

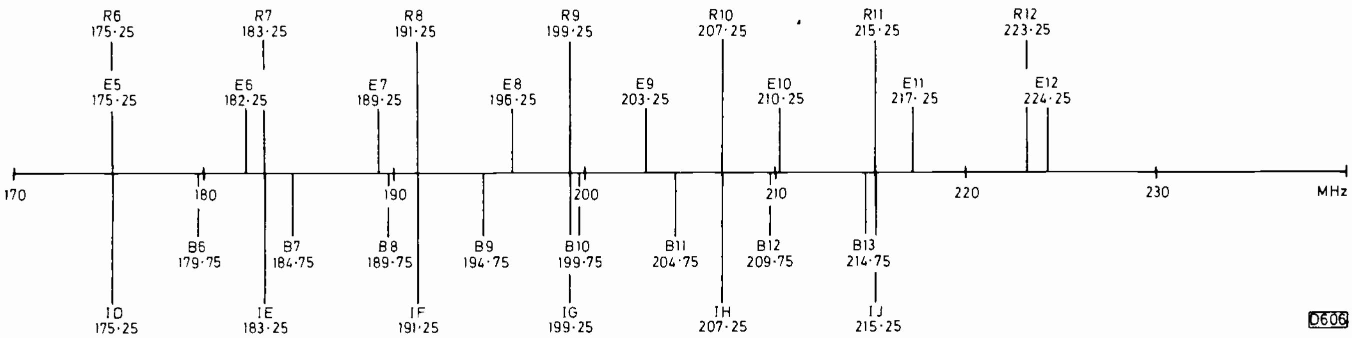


Fig. 1: European Band III vision carrier frequencies. The R channels are used in East Europe, with 6·5MHz sound/vision spacing (system D); the E channels in West Europe with 5·5MHz sound/vision spacing (system B); the I channels in Eire with 6MHz sound/vision spacing (system I); and the B channels in the UK with 3·5MHz sound/vision spacing (system A). System A has 405 lines and positive vision modulation, all the other systems 625 lines with negative vision modulation.

results and check with different signals.

The reason for the improved performance is uncertain, since the new Vorta array is if anything slightly smaller than the other similar one. Matching into 75Ω from the Vorta's balanced system is done by a small ferrite-loaded transformer – the other system uses tuned lines etched on a PCB. Personally I suspect that the improvement is entirely due to the method of matching. The Vorta aerial is known as the Duplex DX4/4 and is "competitively" priced – though at the time of writing I don't have an exact price.

From our Correspondents . . .

Brian Fitch sends us the following Swiss Solar Observatory sunspot predictions: July 153, August 155, September 154, October 152, November 150, December 148. So it would seem that August was the peak in the current cycle.

Robert Copeman (Sydney, Australia) reports more potential DX fields to explore. During 1980 additional u.h.f. stations will be opened at King's Cross (ATN ch. 46, TCN 49, TEN 52) and North Head (ATN 47, TCN 50, TEN 53), with a new Ethnic Television station on ch. 29.

While Clive Athowe was staying in New Jersey, twenty miles from New York, he didn't see a single test card! – all the stations were on air before he rose. Many of the available channels are occupied, and in the f.m. band there's a station every 100kHz. Many householders use rotor systems.

P. Layton (Deal, Kent) reports remarkable success at u.h.f. using a Stolle multiple-director wideband aerial and amplifier (plus rotor). Many Dutch and Belgian u.h.f. signals are "regular".

Jim Cook (Newcastle) has received many Russian signals since erecting an Antiference combined Band I/III MH308 array. A good catch was the Italian free station NCT on ch. E3, with a tuning caption displaying a reclining lady of the *Sun* page 3 variety!

Feedback from John Lannigan (Gainsborough) on the subject of planning permission. When he applied for permission to erect aerials on an 18ft. alloy mast at the rear of his house he was asked to provide exact specifications of each aerial and the method of fixing etc. When permission was granted it was with the proviso that the specification given be followed exactly and preferably erected by a professional engineer. This seems to contradict my suggestion that it's best to be vague about the aerials, merely stating something like "domestic u.h.f. aerial". The aerials are as follows incidentally: from the top down, a five-element 144MHz array, an 18-element array for amateur TV at 430MHz – both using a rotor – a group B Antiference XG aerial, an 18-element group C/D aerial facing north east, a three-element f.m. aerial, a 10-element group A aerial for Belmont, and a group B array from Emley Moor.

DX-TV for the Beginner – 3

Band III covers 164-230MHz. In the UK it's used for the IBA's 405-line transmitters – rumour has it that some of these now operate at reduced power in the interests of conserving the remaining stock of spare valves, which are now impossible to obtain. Long-distance television reception in Band III is mainly due to tropospheric signal propagation, i.e. is dependent on weather conditions – see remarks in the September column. From time to time there are reports of SpE reception in Band III, but this is relatively unusual. Somewhat more frequent are reports of meteor shower reception in Band III – we'll go into this type of signal propagation in a later article.

There's considerable scope for good tropospheric reception in Band III: UK enthusiasts have logged many stations in Sweden, the Iron Curtain countries, Austria and down into Spain. During a good tropospheric opening there will normally be both Band III and u.h.f. signals. Sometimes results in Band III will be better, while at other times the u.h.f. signals will be stronger. Those living in the north east of the UK have limited scope unfortunately due to the intervening terrain – generally, distant UK and Irish stations will be the only ones to put in an appearance.

A prime requirement for a Band III aerial is a good gain/bandwidth product. Though there's not much call for v.h.f. aerials in the UK today, some companies still produce a selection for either single channel or broadband operation. Antiference and Jaybeam make several wideband Band III systems for fringe reception, with a forward gain of 11dB for an eleven-element version. Antiference have several arrays with multiple-element reflector assemblies, giving improved front-back ratio. Premier Industries (Cheltenham) also make several narrow and wideband Band III aerials. A narrow-band aerial should be used where optimum performance at a given frequency is required, e.g. if you wish to receive a particular distant channel regularly, or for MS work on a particular channel. For DX purposes in general however an efficient wideband aerial is the most cost effective solution. Whereas in Band I there are SpE, F2 or MS signals most days, in Band III and at u.h.f. there are long periods when things are dead. It's possible that in a bad year only a couple of good openings may occur, so a general-purpose wideband aerial is the wisest choice. The same thinking applies at u.h.f., especially as installation costs rise with increasing frequency.

When designing an aerial system from scratch on a limited budget, I'd suggest starting off with a Band I aerial, then adding a wideband u.h.f. array with preamplifier, and finally a Band III aerial. From personal experience at my particular location I'd say that the use of good, low-loss coaxial feeder makes the use of a Band III masthead amplifier unnecessary – in a built up area, the amplifier will tend to aggravate interference problems. If on the other hand the location is free of interference from ignition systems, thermostats etc. then by all means use an amplifier.

As with u.h.f. aerials, a Band III aerial must be mounted as high as possible and clear of obstructions. When stacking the aerials on the mast therefore the u.h.f. one will be at the summit, with the Band III aerial beneath it, at least 3ft. away, and lower down the Band I aerial, again with the same spacing. Point all aerials in the same direction, since if propagation from say the east is good at u.h.f. it follows that Band III propagation from the same direction will probably be enhanced.

To start with, concentrate Band III effort on tropospheric reception – attempts at MS reception using the wideband i.f. strip employed in an unmodified receiver will be discouraging because of the weak signals involved and the high noise/low gain of the strip. With experience, you will find it possible to reduce the bandwidth of the i.f. strip, achieving higher gain with improved selectivity. This allows very weak signals that would be masked by noise in an unmodified receiver to be displayed.

Fig. 1 shows the Band III channels in use in western and eastern Europe, including Eire and UK carrier frequencies which can be used for marker purposes. French allocations have been excluded since the receiver used is unlikely to be able to resolve positive-going video signals, let alone 819 lines.

Having briefly covered Band III reception and aerials, there remains the problem of supporting the aerials. Unlike Band I where one can if necessary mount the aerial in the roof space, u.h.f. and Band III aerials should be erected as high as possible in the open. A 30ft. mast with a means of rotation can be erected for only a few pounds (with rotation by hand). The subject was covered in some detail by Garry Smith and Keith Hamer in the March 1978 issue of *Television*. The average house is some 30ft. high, so that a wall bracket/mast combination at the apex of an end wall, or fixed by means of a substantial chimney lashing, will give a height of about 35ft., which is adequate for TV-DX operations.

Finally, having changed my aerials twice a year on average over the past 16 years and encountered most of the problems associated with DXing, I'd be happy to advise newcomers on proposed structures and/or equipment – but please enclose an s.a.e.

Colour Receiver Options 2: Adding Remote Control

Luke Theodossiou

IF you add this month's remote control only option to your basic receiver, you'll have sixteen functions which you can control from your armchair. These functions are as follows: choice of any one of eight preselected stations; volume adjustment up or down; brightness adjustment up or down; adjustment of colour saturation levels up or down plus a "normalise" command; and full set switch-off. We've decided to use a commercial remote control transmitter (ITT) rather than a DIY unit, since the commercial variety looks a little more attractive. The circuit diagram is shown in Fig. 1.

Briefly, the transmitter operates as follows. When a button is pressed, two address pins on the SAA1024 are grounded. Which two pins out of eleven depends on the command required. Thirty "channels" are available with this system, though in our application only sixteen are used. These input signals from the keypad are then converted into five-bit words in the i.c., and are applied to a variable-frequency divider which generates the correct frequency from the 4·43MHz crystal-controlled oscillator for driving the ultrasonic transducer.

The receiver circuit is shown in Fig. 2. The signal is picked up by the ultrasonic transducer, which is connected across terminals 1 and 2 of connector A. It's then amplified by Tr1, Tr2 and Tr3, and fed to pin 15 of the SAA1130. Frequency selective feedback is applied from the emitter of Tr3 to the base of Tr2 to reduce the gain of the amplifier at frequencies outside the wanted range.

The SAA1130 measures the frequency of the incoming signal by counting the number of cycles during a fixed interval determined by the 4·43MHz crystal. All commands are converted into a coded five-bit output signal. A block diagram of the SAA1130 is shown in Fig. 3. It contains a 4·43MHz oscillator which provides all the necessary timing signals. Decoding is achieved by counting the number of cycles present in the ultrasonic signal.

The channel information is stored in the "programme store" and comes out at pins 13, 14, 6 and 7. The code is shown in Table 1.

When "high" the voltage is around +18V and is potted down to +5V by resistors before being supplied to IC2, a 1-of-10 decoder. In our application only the first eight channels are used. Each of the outputs drives a transistor switch (Tr6-Tr13) which has a helical multiturn potentiometer as its collector load. The wipers of these pots are connected to a buffer via hold-off diodes.

The analogue control signals (brightness, colour and volume) come out of the SAA1130 at pins 2, 3 and 4 in the form of 17·5kHz squarewaves, whose duty factor is variable in 62 steps between 1:62 and 62:1. The signal is integrated by capacitors on the signals board of the receiver: this results in a d.c. voltage whose amplitude is proportional to the required control level. On switch on or when the "ideal" button is pressed, the duty factor is 32:31. The potentiometers VR1, VR2 and VR3 are set to correspond to a "normal" picture and volume setting. The i.c. takes 8·5 seconds to sweep the entire range of control.

The mains-off circuit drives a triac (SCR1) which activates the solenoid of the on-off switch. Unlike a "standby" condition, this method actually isolates the set from the mains. We consider it an important safety feature.

On switch on, the SAA1130 goes into "standby" mode. Tr5 with its associated components hold pin 5 positive for a sufficient period to enable normal operation.

Table 1: Programme code

Programme number	*Code* PA	PB	PC	PD
1	L	L	L	L
2	H	L	L	L
3	L	H	L	L
4	H	H	L	L
5	L	L	H	L
6	H	L	H	L
7	L	H	H	L
8	H	H	H	L
9	L	L	L	H
10	H	L	L	H
11	L	H	L	H
12	H	H	L	H
13	L	L	H	H
14	H	L	H	H
15	L	H	H	H
16	H	H	H	H

L = low, H = high.

Construction

The complete circuit is built on a single p.c.b., reference number D066. The copper print pattern is shown in Fig. 4, while Fig. 5 shows the component locations. The only component which is not on the board is the ultrasonic receiver capsule, which has to be mounted on the front of the cabinet and connected to the interface board (at A1 and A2) by a length of screened cable. The remaining connections are listed in Table 2.

Table 2.

B1	—	A5 on signals board
B2	—	A6 on signals board
B3	—	A9 on signals board
B4	—	A12 on signals board
B5	—	A18 on signals board
C1	—	F2 on PSU board
C2	—	F1 on PSU board
C3	—	F4 on PSU board

In addition, the mains switch solenoid cell is connected to E1 and E2 on the power supply board.

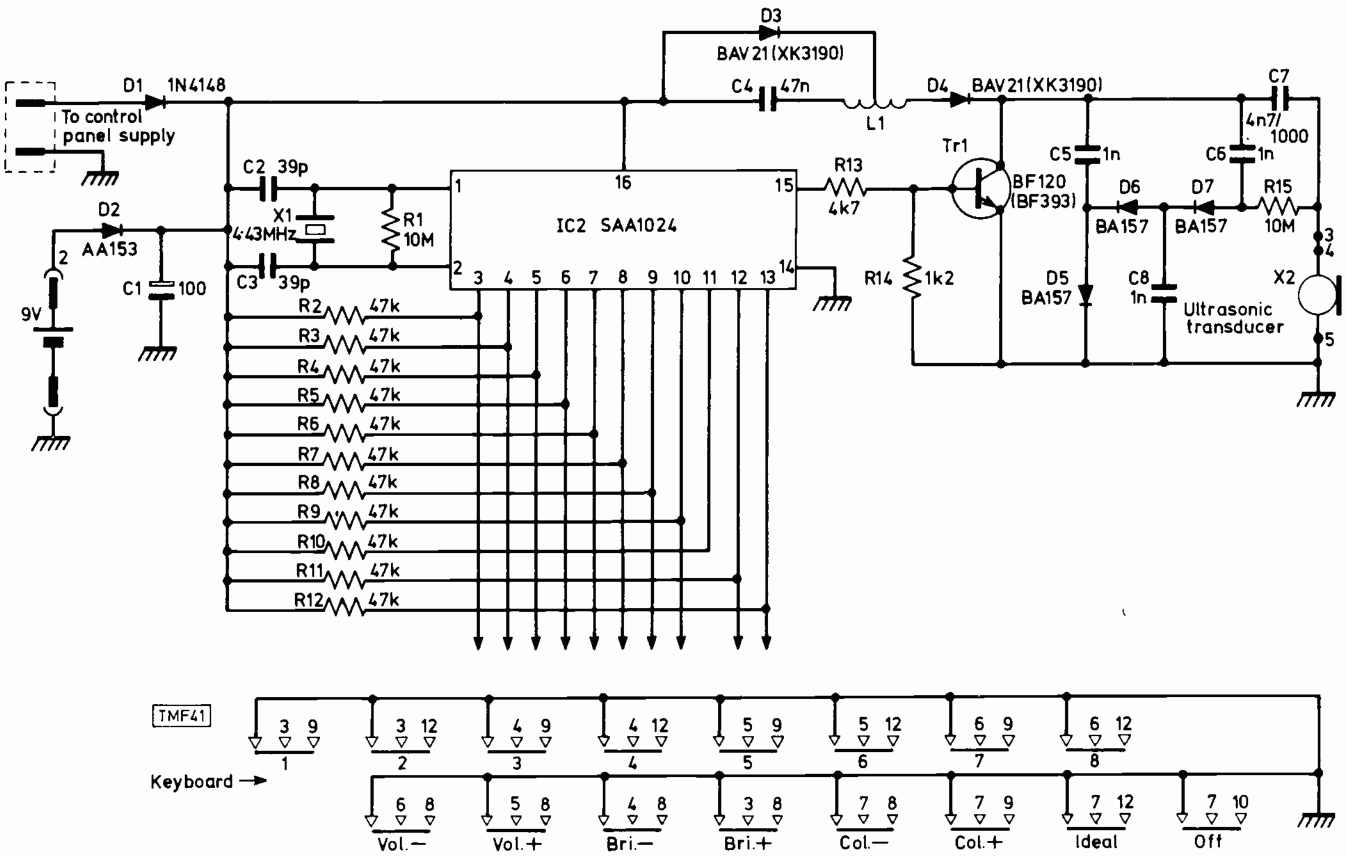


Fig. 1: Complete circuit diagram of ITT remote control transmitter. Note that the plug labelled "to control panel supply" is not used in our application.

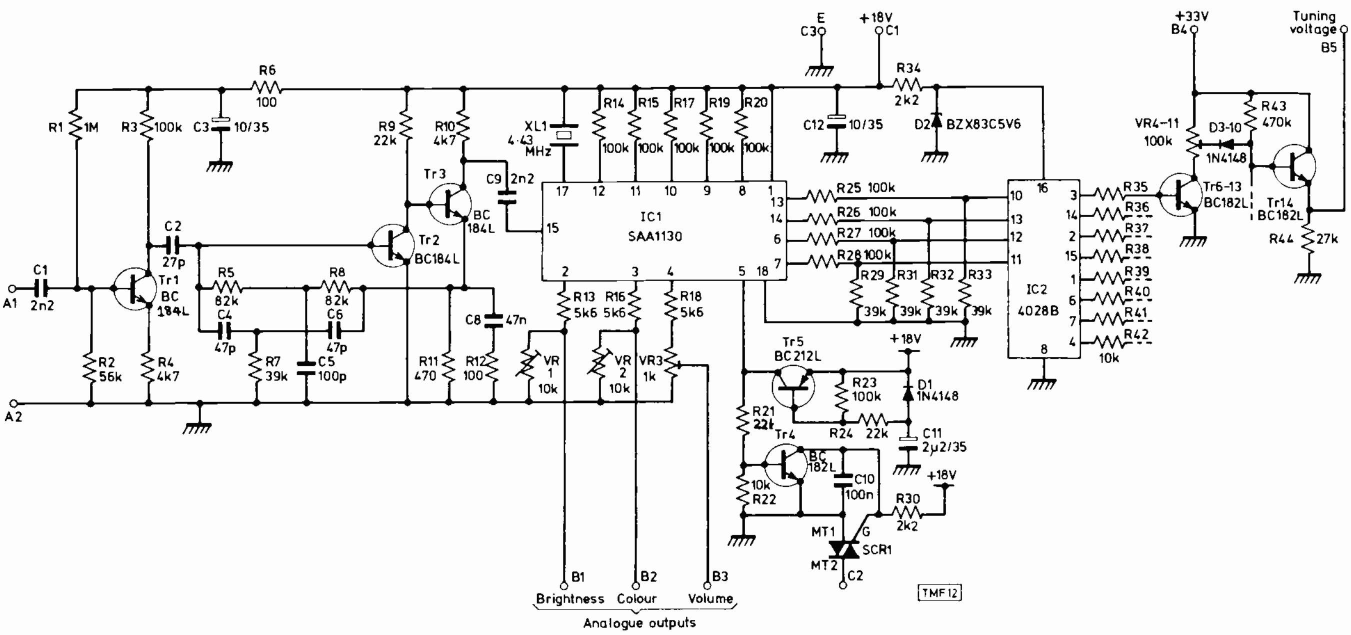


Fig. 2: Circuit diagram of interface board.

Setting Up and Faultfinding

Setting up merely involves switching the receiver on (it will automatically select channel no. 1) and tuning in VR4 to the local station. Then select channel 2 on the remote control transmitter, adjust VR5, and so on.

Next adjust VR1, VR2 and VR3 (without having touched any of these analogue controls on the transmitter) for what you feel is an "ideal" picture and a comfortable listening level. This is the picture and sound you will now obtain on switch on or when pressing the "ideal" button on the transmitter. Note that you will have to press the "off" button on the transmitter for a few seconds before it's activated, due to a built-in delay circuit which prevents inadvertent operation.

Faultfinding is straightforward. If the unit fails to respond to any commands from the transmitter, first of all

★ Components list

Capacitors:

C1	2n2 ceramic plate
C2	27p ceramic plate
C3	10/35V tantalum bead
C4	47p ceramic plate
C5	100p ceramic plate
C6	47p ceramic plate
C7	not used
C8	47n polyester
C9	2n2 ceramic plate
C10	100n polyester
C11	2μ2/35V tantalum bead
C12	10/35V tantalum bead

Semiconductors:

D1	1N4148
D2	BZX83 C5V6
D3-D10	1N4148
Tr1-Tr3	BC184L
Tr4	BC182L
Tr5	BC212L
Tr6-Tr14	BC182L
IC1	SAA1130
IC2	4028B
SCR1	TR1400-0·35 triac (RS Components stock no. 262-028)

Resistors:

		R22	10k
		R23	100k
R1	1M	R24	22k
R2	56k	R25	100k
R3	100k	R26	100k
R4	4k7	R27	100k
R5	82k	R28	100k
R6	100	R29	39k
R7	39k	R30	2k2
R8	82k	R31	39k
R9	22k	R32	39k
R10	4k7	R33	39k
R11	470	R34	2k2
R12	100	R35	10k
R13	5k6	R36	10k
R14	100k	R37	10k
R15	100k	R38	10k
R16	5k6	R39	10k
R17	100k	R40	10k
R18	5k6	R41	10k
R19	100k	R42	10k
R20	100k	R43	470k
R21	22k	R44	27k

VR1	10k	subminiature horizontal presets
VR2	10k	subminiature horizontal presets
VR3	1k	subminiature horizontal presets
VR4-VR11	100K	20 turn helical tuning potentiometers

Miscellaneous:

Ultrasonic receiving transducer	RS Components stock no. 307-367
Remote control transmitter	ITT Consumer Products type CMC33 (stock no. 16-4-99)
P.c.b.	Readers PCB Services reference no. D066
XL1	4·43MHz crystal
Molex 0·2in. connectors	

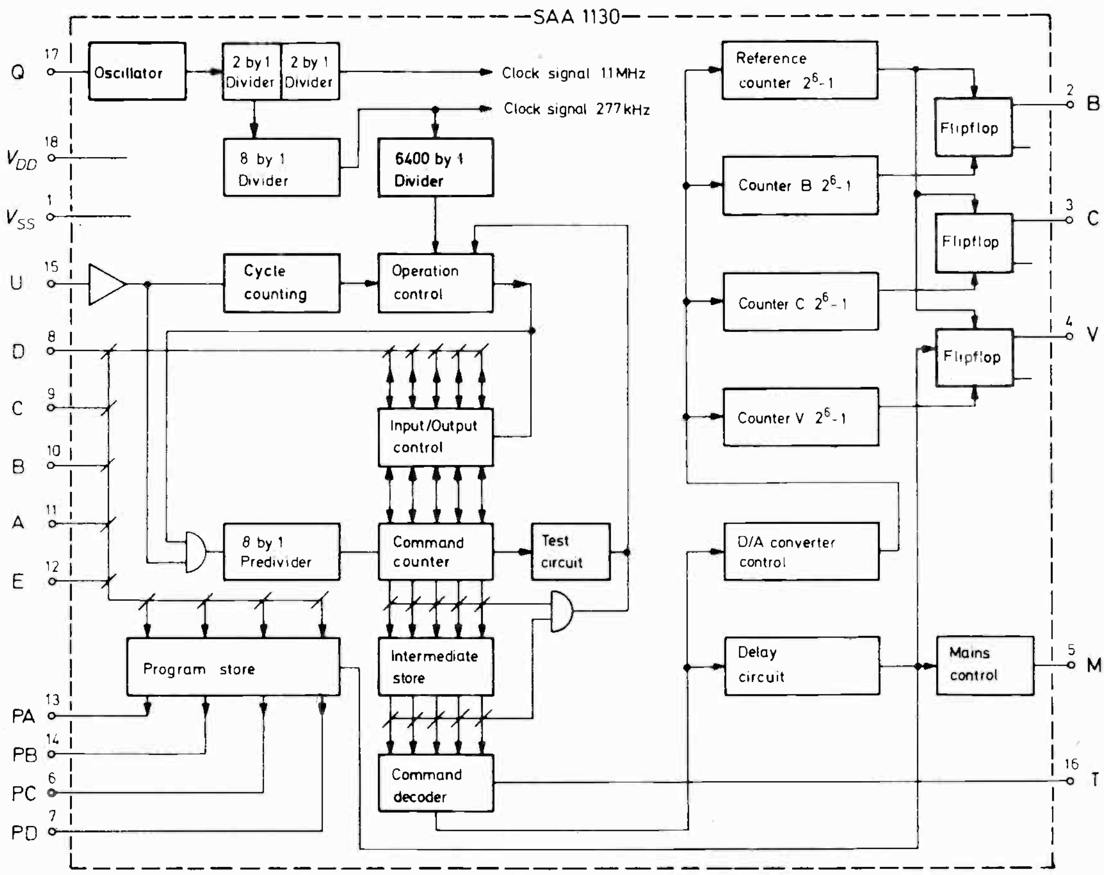


Fig. 3: Block diagram of the SAA1130.

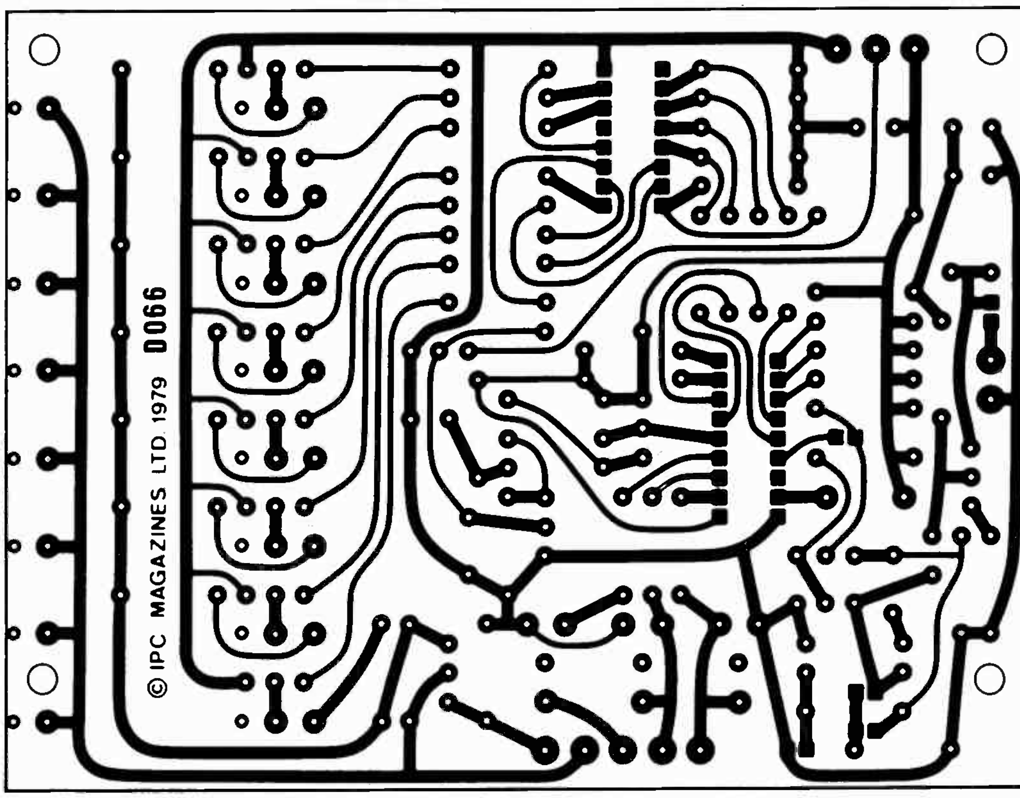


Fig. 4: Copper print pattern for interface board ref. D066.

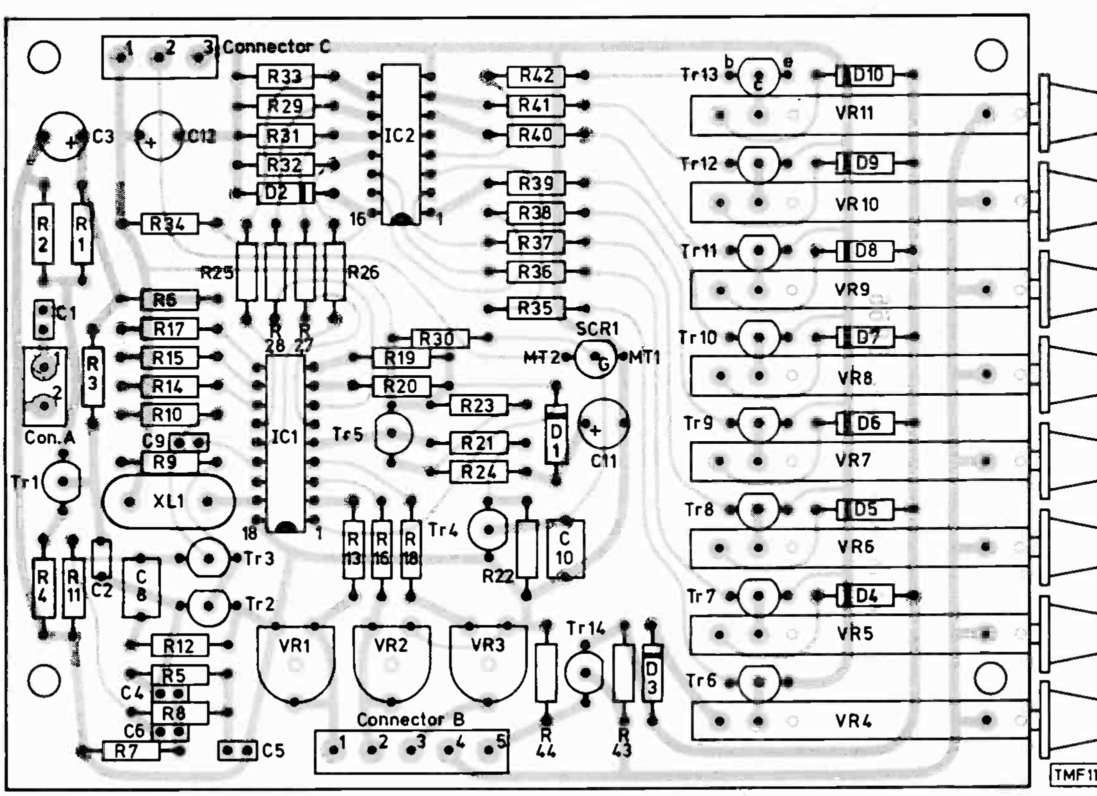


Fig. 5: Component location diagram.

check the battery in the transmitter. If this is in order, check with a scope (while pressing say a channel button on the transmitter) that a signal is present at the collector of Tr3. If all is well, suspect the SAA1130. If the unit fails to change channels but otherwise operates correctly, switch off – then switch on again to reset channel 1, and check the voltages on pins 13, 14, 6 and 7 of IC1 (see Table 1). If they are correct and respond when changing to another channel, then it's probably IC2 which is at fault, though Tr14 or the connections to the signal board may also be responsible.

TV Servicing: Beginners Start Here . . .

Part 26

S. Simon

IN the last two instalments we've described colour tube drive circuits and the faults they give rise to. These are basically excess or lack of one or more colour(s), brightness faults or maybe shading across the screen. There are other types of colour fault however. No or intermittent colour, unlocked colour (colour bars across the screen), green faces or Hanover bars for example. These are due to faults in the decoder (though missing pulses from the line timebase can be responsible for some of these faults) and will have to wait till we get around to that part of the colour receiver. Another group of faults consists of patchy colour or misregistered colour, i.e. the blue, green and red components of the picture are not correctly superimposed, giving rise to medal ribbon effects when really bad. These are due to purity and convergence problems, and are next on the agenda. We'll take convergence first.

In the not too distant future convergence will not be a problem to worry about. This is because the present generation of colour tubes, with their in-line guns and striped phosphor screens, are self-converging.

Mounting the guns horizontally in line reduces the need for convergence, while designing the scan coils to predistort the three beams removes the need for anything other than maybe a couple of factory preset adjustments. For the moment however most of the colour sets you'll have to deal with will be fitted with the older generation of colour tubes. These have the three guns mounted in the neck of the tube in a triangular configuration (or delta arrangement as it's called) – see Fig. 1. As a result, the three rasters produced will, without correction, tend to be as shown in Fig. 2. The required correction is provided by the convergence system, and by considering Fig. 2 you'll see why incorrect convergence will result in misregistration of the three primary colours on the screen.

How is convergence achieved then? A little thought suggests that placing a magnet over each gun will result in the beams being deflected inwards. If the three magnets are carefully adjusted, the three beams can be brought into registration, i.e. converged, at a point in the centre of the screen. This takes care of the centre area, but still leaves severe problems when the beams are deflected towards the edges and corners of the screen.

Centre convergence is called *static* (i.e. beams undeflected) *convergence*. Permanent magnets can be and generally are used for this purpose. Alternatively we can employ a coil wound on a soft iron core, passing through the coil a current(d.c.) preset by a variable resistor, i.e. using an electromagnet instead of a permanent magnet to produce the same effect. Coils and presets were favoured by some continental set designers.

Let's stick with permanent magnets however and bring up the next point. If the blue gun is mounted at the apex of the triangle, two magnets will be required to converge the blue beam with the other two beams – see Fig. 3 – one to move it vertically so that it's brought to the same vertical position as the other two beams, and the other to move it laterally so that its horizontal position coincides with the other two beams. The red and green beams are simply moved radially until they coincide. In practice the two magnets make it easy to adjust the static blue convergence, but red and green are not so easy to converge. They have to be done first therefore (switch off the blue gun).

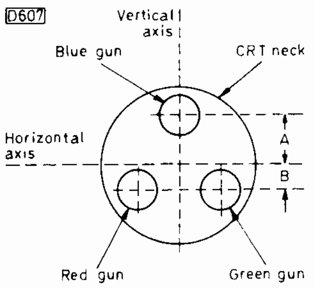
Once the red and green images have been accurately overlaid at the centre of the screen by means of the red and blue static convergence magnets, it's a simple matter to converge the blue beam so that blue falls on top of red and green (yellow) to give white. While the blue vertical static magnet shares the same convergence housing with the others, the blue lateral magnet is mounted on a clamp on the neck of the tube towards the rear (see Fig. 4). It must obviously be aligned with the blue gun. This is at the top in most sets, at the bottom in some (e.g. the Thorn 3000/3500 chassis), depending on which way up the tube is put in – we'll assume that it's at the top, which means that the e.h.t. cavity connector is at the top of the cabinet and not at the bottom. If the blue lateral magnet is rotated or allowed to rotate on the tube neck it will influence the red and green beams as well – you'll have enough trouble without letting this happen!

Having achieved good centre convergence, a lot more correction is required to produce good convergence in the outer areas of the screen. We can't use permanent magnets for this purpose, because the amount of convergence correction required varies as the beams travel across the screen and up and down. We have to employ coils fed with varying current waveforms so that the correction can be varied as required while the scans progress. We can combine sawtooth and sinewave current waveforms to achieve the desired results, varying their amplitudes and proportions by means of a group of preset controls – the *dynamic convergence* controls. By carefully adjusting the controls to tailor the waveforms, we can converge the three (red, green and blue) rasters into one with no distracting fringeing to the images (except maybe in the corners). The waveforms required will be at line and field frequency, and can thus be obtained from the two timebases, with the shaping effected by the coils, presets, capacitors and a few other bits and pieces which you will mostly find mounted on the convergence panel.

Purity

We've talked about converging the three beams at the screen. This is not quite accurate. Colour tubes employ a metal screen (the shadowmask) which is mounted just behind the screen and serves to ensure that when everything is set up correctly the beams fall on the colour dots (stripes in more recent tubes) of the correct colour phosphor. The point at which the beams converge is the shadowmask, not the screen itself. This introduces a further complication.

Suppose the beams are accurately converged but, after passing through the mask, they fall partially on dots/stripes of the wrong colour? We'll get incorrect colours



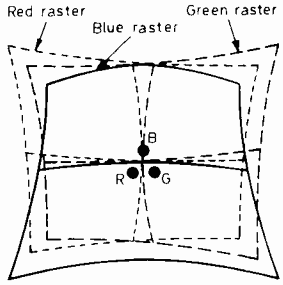


Fig. 1 (left): Arrangement of the electron guns in the neck of a delta-gun tube. Note that distance A along the vertical axis is roughly twice distance B, so that a greater current is required in the blue dynamic convergence coils than in the red and green coils.
Fig. 2 (right): Without convergence correction, the three rasters produced by the three guns in a delta-gun tube take on the approximate shapes shown here.

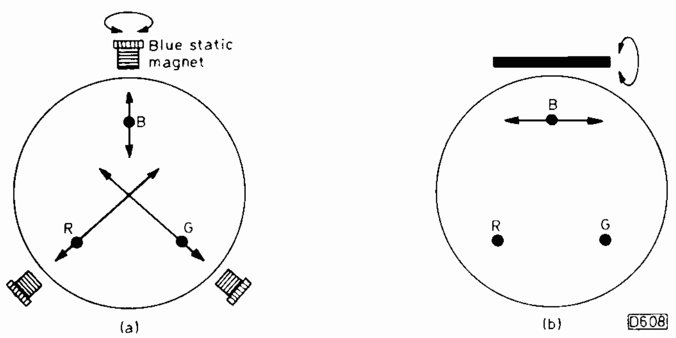


Fig. 3: Radial movements (a) of the three beams, under the influence of adjustable permanent magnets, to converge the beams at the centre of the screen (static convergence). (b) The blue beam requires horizontal as well as radial movement in order to align it with the red and green beams.

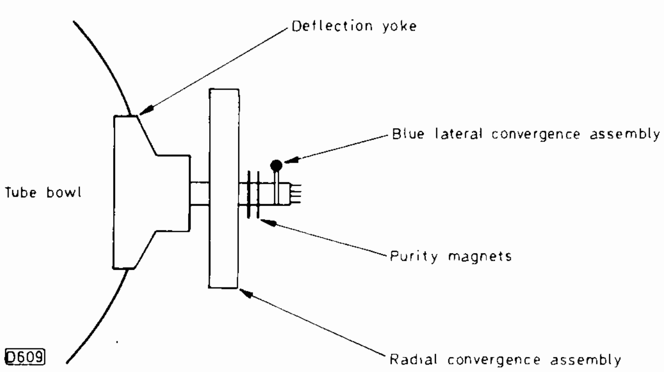


Fig. 4: Positions of the various correction assemblies on the neck of a delta-gun shadowmask tube.

of course – in practice a patchy colour effect. We can't move the shadowmask of course, so to get correct beam "pass through", i.e. *colour purity*, correction is carried out at the gun assembly end of the tube. This means yet more magnets (two) mounted on the neck of the tube. They take the form of rings which can be rotated relatively to each other – much the same as with the picture shift rings used in a monochrome set. The action of the magnets is to rotate the beams slightly to ensure that the beams pass through the shadowmask apertures accurately and then strike the appropriate phosphors.

It may be thought that all these magnets will react with each other to some extent. Indeed they do. And we are not finished yet. The position of the scan coils on the tube neck has a profound effect on beam landing, which is why they have to be moved along the tube neck in addition to the more obvious rotational adjustment to correct for any tilt. All this interaction may appear to be somewhat frightening, and up to a point it is. If the convergence and tube neck components have been seriously tampered with (and we all encounter this from time to time) a lot of patience and a degree of expertise is called for to regain an acceptable display. What to do?

The first move should be to get the purity right. This can be done in several ways and we all have our pet method. One can have all three guns in operation, and examine the plain white raster for signs of colour patches that shouldn't be there. Or one can switch off two of the guns and examine the colour of the remaining raster (say red). If there are patches of incorrect colour (anything other than red), loosen the plastic wing nuts at either side of the deflection coils and pull them back. Then rotate the purity rings in relation to each other until the centre of the screen is pure red. Next move the scan coils forward to spread the correct red out to the edges. After this, check the separate green and blue rasters and ensure that the purity is correct, readjusting if necessary until the required purity is obtained. When purity has been achieved, the convergence can be tackled: don't try convergence first, because resetting the purity magnets will affect the convergence.

Static Convergence Adjustment

As previously mentioned, red and green static convergence should be done first, aiming for perfect overlay at the centre of the screen – preferrably using a pattern of squares from a crosshatch generator or the crosses of test card F. Don't be too fussy at this stage, even though we said "perfect overlay", since if adjustments to the dynamic convergence controls are required these will affect the centre registration. If you are very lucky, only small adjustments will be required to produce an acceptable picture. Once the red and green have been centred up, switch on the blue gun and see how far out the blue static convergence is. The static blue magnet moves the blue image up and down, the blue lateral magnet moving it horizontally. So this is a very quick adjustment.

At this point it's a good idea to check the purity again, to see whether the static convergence adjustments have produced any purity errors. If so, do it all again.

Dynamic Convergence

After this has been done one tackles the far more involved business of dynamic convergence. This calls for some explanation.

Different setmakers have used different convergence arrangements. This means that unless one is handling only a limited range of models difficulties can arise for even the experienced engineer. On some chassis a card covering the convergence board shows the intended effect of each control. This is of course most helpful. On other chassis the controls may be given only a circuit reference number, so that the revelant manual is required in order to find out what they are supposed to do.

Convergence Circuit Faults

Let's, as we've done in some past instalments, take the circuit used in the Pye 691 chassis as an example (see Fig. 5). Before doing so however we must make one point clear. If the set has not been interferenced with and the convergence suddenly becomes wrong although it was previously right, no attempt should be made to reconverge

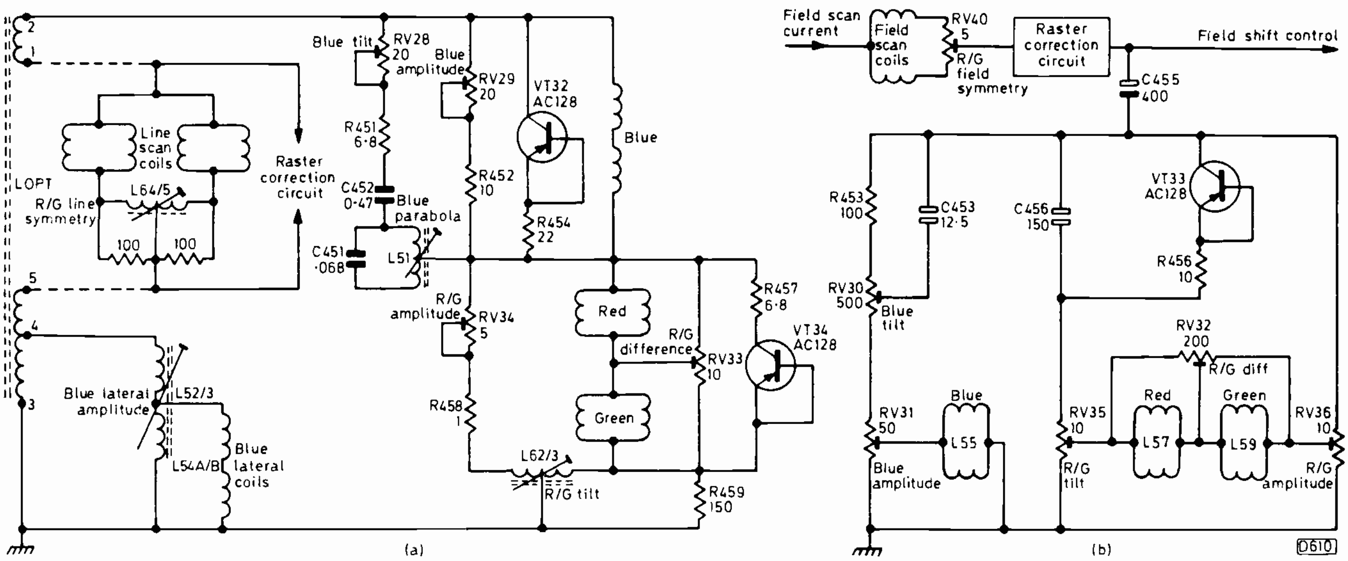


Fig. 5: The line (a) and field (b) convergence circuitry used in Pye hybrid colour sets. The line convergence circuitry is connected in series with the line scan coils via windings 3-5 and 1-2 on the line output transformer.

using the controls unless only one control on the board is suspect, i.e. the exercise is not to reconverge the set but to locate a faulty preset which may have been damaged by heat. Such presets often carry or are asked to carry more current than their wattage rating warrants, or are run near the maximum, which leads to overheating and eventual damage to the track and wiper. The appearance or "feel" often identifies the suspect: by feel we mean that slight adjustment is difficult and feels "grindy".

Some convergence circuit paths are shunted by fairly high value wirewound resistors which can go open-circuit, leaving diodes and/or presets carrying a load for which they are unsuited. As a result several components may be found damaged, with perhaps a burnt board to add to the confusion. The moral here is that if a component is found damaged, be it a preset control or fixed resistor, check the official circuit diagram to see whether the original cause could have been failure of a shunt component or circuit path. Convergence circuitry usually involves several parallel (shunt) paths, and an ohmmeter is of dubious value unless the components to be measured are isolated from the rest for this purpose.

The convergence panel used in the Pye 691 chassis uses three transistors connected as diodes (bases and emitters connected together) plus a number of low value resistors and presets, coils and so on. If a low value resistor is suspected, disconnect one end from the board in order to be able to check for certain whether or not it's open-circuit. With care, a faulty component can be identified and replaced, restoring normal convergence, whereas if an attempt at reconvergence is made with the faulty component still in circuit not only will acceptable convergence be unobtainable but the whole lengthy procedure will have to be repeated when the faulty component is eventually located and replaced. This can mean hours of frustration.

Typical Circuitry

What sort of current flows through the convergence coils, and where is it obtained? Remember that we are not talking now about centre convergence but about bending the three beams vertically and horizontally at the top, bottom and sides of the screen and whilst they are being deflected. This calls for a fair amount of current. More in fact for the blue beam since if you look at Fig. 1 carefully you'll observe that the blue gun is farther from the centre along the vertical axis than the other two guns.

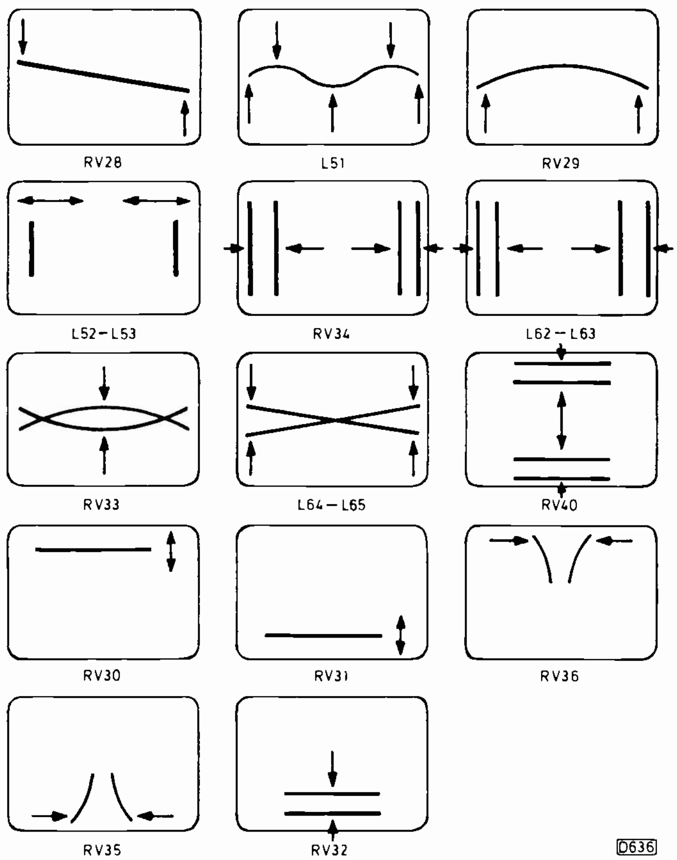


Fig. 6: The effects produced by the various convergence controls in the circuit shown in Fig. 5.

The following short account describes how dynamic convergence is achieved in the 691 chassis. Since we need currents which vary along the horizontal and vertical axes, we can use line and field frequency sawtooth waveforms obtained from the currents flowing in the respective deflection circuits. We can in fact use the currents flowing in the deflection coils, by wiring the convergence circuits in series with them, tapping off the required amount of current (say one tenth) and shunting the rest away (hence the heat problems previously mentioned).

Since the red and green guns are equally spaced at either side of the vertical axis, they'll require equal but opposite

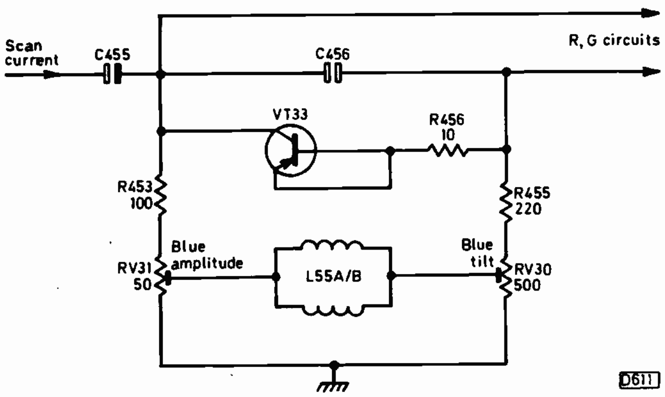


Fig. 7: Modified blue vertical convergence circuit used in later versions of the Pye hybrid chassis.

correction. The correction current will be only about half that required by the blue beam's convergence coils. About 200mA peak-to-peak is required for the red and green horizontal (line frequency) convergence coils and about 400mA peak-to-peak for the blue. The actual current flowing in the convergence coils depends on the amount of correction required: where the convergence is naturally good – at the centre of the screen – no correction current is required. As the distance travelled by the beams becomes greater, so does the possible convergence error and therefore a greater correction is required.

Since the blue gun is mounted centrally, a parabolic convergence waveform is required to give horizontal correction. The line scan current is of sawtooth form: the inductance of the convergence coils tends to alter this to a parabolic form, but nowhere near enough. A capacitor in series with a fixed and a variable resistor are wired across the blue horizontal convergence coils therefore (C452, R451 and the blue tilt control RV28). This alone is still not enough however, additional shaping being required to prevent the blue raster drooping alarmingly at the extreme sides of the screen. The correction required is provided by the parallel connected components C451/L51, the coil being labelled blue parabola. See Fig. 6.

These components affect the shape of the current waveform but not its amplitude. To adjust this, the shunt preset control RV29 (with series resistor R452) are incorporated in the circuit. RV29 is labelled blue amplitude of course. This resistive path shunts away the required amount of power, and can thus change an upward curl at the edges relative to the centre into a downward droop. So that the centre convergence (static) is not upset by this variation at the sides, VT32 is added connected as a clamp diode.

It's quite common for trouble to develop in this particular circuit – it will often be found that the blue horizontal lines cannot be converged with the red and green lines at the left and right-hand sides (droop). The items to check carefully are RV29 and its series resistor R452, and VT32 with its series resistor R454. These are wirewound resistors. The coils and capacitors are rarely at fault.

We've already referred to the need for separate blue lateral convergence – carried out by the separate magnet clamped on the tube neck at the rear. Dynamic blue lateral correction is also required – so that the sides of the blue raster can be adjusted independently. For this purpose a sawtooth current is passed through a small coil wound on the magnet, thus explaining the two leads that go to it. The effect produced can be reversed by swapping over the leads or push-on connectors, and adjusted by means of L52/3.

To summarise so far, we've seen that we can move the edges (left and right-hand sides) of the blue raster up and down and in and out relative to the red and green rasters. The operation has also to be done with the red and green rasters, but as the two guns are in line with one another only a single set of controls is required so that the rasters can be moved relatively to each other. Once again there's a clamp diode (transistor VT34), with a series resistor, to keep the centre convergence steady. The R/G amplitude and tilt controls (RV34 and L62-3) enable the red and green rasters to be brought into registration at the sides. The R/G difference control RV33 removes bowing of the red and green horizontals while L64-5 enables the red and green horizontals to be tilted to remove the crossover effect.

This then is a condensed version of what horizontal convergence is all about: coils of wire associated with static magnets, and timed/shaped currents. This is only the half of it however. What's necessary to achieve correct registration at the sides is also necessary to get the top and bottom right. So we have more convergence coils, this time wired in series with the field scan coils.

In effect, we break the field scan current return path and insert some wirewound resistors of the variable slider type to enable us to tap off the required field frequency sawtooth voltages that push the necessary currents through L57 (red), L59 (green) and L55 (blue). RV40 varies the current flowing in each half of the field scan coils, and is labelled field (frame actually) symmetry. R453 is in series with two variable controls RV30 (blue tilt) and RV31 (blue amplitude). Similarly we have two variables for red and green, RV36 and RV35. The red and green vertical convergence coils are connected to the sliders of the R/G tilt and amplitude controls, with an additional control RV32 wired across them to vary the current in one with respect to the other.

Due to the inductance of all these coils, the sawtooth waveforms are changed into graceful parabolic curves to enable us to raise and lower and straighten up the images. A modification to the blue vertical convergence circuit (see Fig. 7) made it more like the red/green arrangement, and this is more likely to be met in practice.

Degaussing

Now for another complication. We've previously pointed out that patches of incorrect colour will be present if the purity is not accurate. To this end it's essential that the shadowmask itself is free of magnetism. Any large metal surface can easily become magnetised, and the shadowmask is no exception.

To prevent this, coils (called *degaussing coils*) are fitted around the tube bowl (they are actually mounted on the degaussing shield – something you won't find with later types of tube). Each time the set is switched on, a high

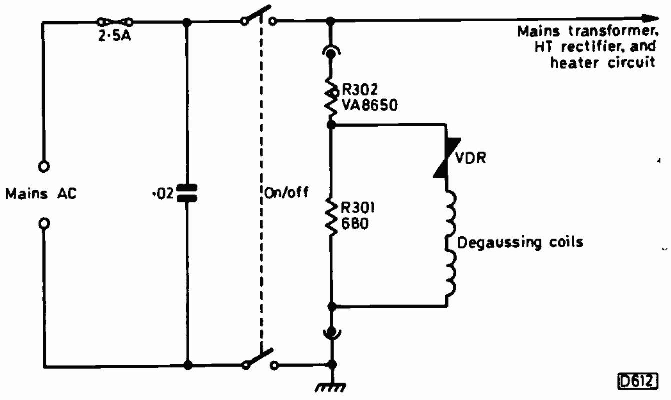


Fig. 8: The tube degaussing (demagnetising) circuit used in Pye hybrid colour receivers.

current (a.c.) is passed through the coils to demagnetise the shadowmask and the associated metalwork. The presence of the positive temperature coefficient resistor (thermistor) R302 (see Fig. 8) ensures that the current rapidly decays to virtually zero.

If patches of impurity are evident, the connections to this circuit are more likely to be at fault than one of the components themselves. In some chassis however a thermistor which is liable to disintegrate is used, and this is a possibility you may have to check. This is especially the case with the double-thermistor used in hybrid GEC colour chassis for example.

Hints on Convergence Adjustments

Having discussed the circuitry involved and what it does, we need only a few hints on using the controls. We can't provide a rigid convergence routine because there really isn't one. There's no substitute for practice, and it's an education to see a hopelessly misconverged test card or crosshatch pattern quickly corrected by an experienced person. If there's a pretty coloured card over the controls to illustrate the effect of each, there's little to be added except to warn that some interaction is to be expected. Static convergence for central beam registration should be carried out first, but one must return to this several times to correct any static misconvergence introduced as a result of adjusting the dynamic convergence controls. If there's no picture guide, the controls will be labelled R/G diff, Blue amp etc. or will simply have circuit reference numbers which will have to be checked with the appropriate service manual.

The basic idea is to start by getting the centre right (approximately) with the static magnets. First switch the blue gun off (by means of the relevant first anode switch) and converge red and green into a single yellow. Then switch the blue gun on. Raise and lower the blue beam by means of the blue static magnet, then bring the blue into horizontal convergence, using the blue lateral magnet, to obtain white.

Switch off the blue gun again and look at the top and bottom to see how far the R/G vertical controls are out of adjustment. If difficulty is experienced in getting good results, aim instead for the same error all the way down the centre vertical lines, appreciating that the static R and G magnets produce an opposite angular movement – try to cater for this. Switch on the blue gun, and recheck the blue static convergence now you've adjusted the R/G vertical controls.

Having done this a few times, you should start to get the feel of each control. When a respectable vertical registration of the three rasters has been achieved, note the positions of the horizontal convergence controls (R/G amplitude, R/G difference, R/G tilt and the corresponding blue controls). Adjust the R/G amplitude control to converge the left-hand verticals, and the R/G tilt control to bring the right side to a nice yellow if separate red and green verticals can be seen. If the red and green horizontal lines cross over, straighten them up with the R/G line symmetry control, and again reset the static convergence if necessary.

Remember that the vertical (field/frame) convergence controls adjust the top and bottom verticals down the centre line, and the top and bottom horizontals (R/G frame difference and R/G frame symmetry for the horizontals, R/G frame amplitude and R/G frame tilt for the verticals). The line controls adjust the sides.

If we've had one recurring trouble with convergence of the 691 chassis, it's been with the shape of the "blue droop" at both sides. If the horizontal blue amplitude control RV29 has no effect, the 10Ω series resistor R452 will be found open-circuit.

Your PROBLEMS solved

Requests for advice in dealing with servicing problems must be accompanied by a 50p postal order (made out to IPC Magazines Ltd.), the query coupon from page 45 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.

DECCA 30 CHASSIS

Is there any way of increasing the effect of the pincushion phase coil L404 on this chassis? At optimum adjustment there is still a dip in the lines at the top centre of the screen, while the sides of the raster tilt outwards slightly from the bottom to the top.

We have often found that better control over the pincushion correction can be achieved by replacing the 10Ω resistor R481 with a 25Ω or 50Ω potentiometer. Adjusting such a potentiometer in conjunction with L404 may well clear your trouble.

SONY KV1800UB

When a camera switches to a new shot with more than a minimal amount of red content in it the whole screen suffuses with red/orange, taking about five-fifteen seconds before the colour balance returns to normal. The fault occurs only at the red end of the spectrum, and is not affected by the a.f.c. action.

This is an unusual fault. It would seem that either a transistor in the red video channel is leaky, or that the R – Y chrominance amplifier is going unstable. The transistors in the red channel are Q159/Q160/Q165. Oscillation in the R – Y chrominance amplifier circuit could be due to failure of the collector supply decoupling capacitor C407 (0·01μF) or leakage in the emitter decoupling capacitors C404 (10μF) or C405 (0·047μF). If you are very unlucky, the tube could have interelectrode leakage in its red gun.

THORN 1500 CHASSIS

The picture on this set is very good, but is slightly dark even with the brightness at maximum. Is there any way of increasing the brightness level?

First make sure that R115 (3·9MΩ) which feeds the tube's first anode has not increased in value, and that its decoupling capacitor C82 (0·01μF) is not leaky. If these components are in order, the brightness can be increased by adding a high-value resistor between pin 2 (control grid) of the c.r.t. and the h.t. line.

GRUNDIG 5011

The picture size sometimes judders for short periods, and on one occasion the cutout operated. A one inch foldover is present – though not always – on the left-hand side of the screen. There are also very prominent Hanover bars. Attempts at readjustment seem to have no effect on these.

We suggest a careful check on the joints in the line oscillator section and around the wound components in the line output stage. The judder could be due to R509, R508 or R507 which set the bias conditions in the width circuit. Check also R504 and Di504, which are in series with the width control transductor. When these points have been cleared, set up the line hold control R426 ("Z"). Hanover bars are uncommon on these Grundig sets. The TBA510 and TAA 630 i.c.s in the decoder are suspect if the fault cannot be cleared by adjusting controls LZ and DV in the delay line circuit.

SONY KV1810UB

Every three to four months this set blows the chopper device Q603 on the power supply board and the line output device Q510 on the timebase board. The set works normally after replacing these devices (type SG6533), then the same thing happens three-four months later.

This is a nasty, expensive habit your set has acquired! We have it on good authority that the sync/timebase oscillator i.c. IC501 (CX104A) or the main smoothing electrolytic C606 (120μF) can be responsible, and have also known it to be due to the line flyback tuning capacitor C542 (0·018μF, 1·5kV).

GEC C2110 SERIES

The main trouble with this set is high e.h.t. With the set h.t. control set correctly, i.e. for 190V at the junction of R58/R59, the e.h.t. is 27kV. If the h.t. is set to reduce the e.h.t. to 25kV the voltages throughout the set are low, giving poor contrast, width etc. With the e.h.t. at 27kV there's defocusing on peak whites, while at 25kV there's smearing etc. There's also a loud caption buzz.

This is clearly an early model – the resistors in the h.t. supply were rearranged in later production. If the e.h.t. is high with P701 set for the correct h.t. voltage and 40V at the emitter of the line output transistor, it's likely that the flyback tuning capacitor C52 is faulty. It should be replaced with the correct type from GEC. Replacing C119 (220μF) which decouples the 12V supply to the TCA270 in the i.f. strip should cure the smearing, while fitting an extra 470μF capacitor across C187 on the sound board should overcome the caption buzz.

THORN 8800 CHASSIS

This set, which I recently acquired, has obviously been operating in a damp environment. When I first switched on there was no raster, due to the e.h.t. lead to the tube shorting to earth – the insulation had broken down. I managed to cut off four inches and remade the connection to the tube, and also replaced the focus potentiometer (full of green mould!), but there are now random flashes across the tube face when a programme is being broadcast. I can't see any signs of arcing around the e.h.t. section however.

In view of the conditions under which it has been operating, we feel that a new e.h.t. stick should be fitted to start with. This may cure the problem, but if not it could be that corrosion has attacked the signals panel. If so, washing it with methylated spirit may do the trick.

ITT CVC30

There's excessive sibilance on sound, but only on BBC-1, the other two channels being perfect. The picture quality is excellent on all three channels.

Very slight adjustment of the quadrature coil L312 adjacent to the TBA120S intercarrier sound i.c. (IC302) will clear this trouble.

DECCA CTV25

This old colour set gives excellent results except for limited colour and an unsynchronised PAL switch. Tuning for maximum ident signal at the emitter of the ident emitter-follower Tr603 with the ident coil L602, the burst coil and VR602 (discriminator balance) produces a signal of about 7V peak-to-peak and about 8·5V across the colour-killer reservoir capacitor C609. This gives reasonable but intermittent colour, but the PAL switch runs unsynchronised – in fact it seems to favour green faces! Reducing the amplitude of the ident signal results in correct PAL switching but loss of colour.

You don't seem to have enough ident signal. There should be about 10V peak-peak at the emitter of Tr603, with L602 adjusted for slightly less than maximum ident signal. We'd suggest you check by substitution the two electrolytics in the ident circuit, C611 and C614, both 10μF. The ident should be improved by replacing the ident diode D604 – use an OA91 – and its coupling capacitor C615 (0·22μF).

THORN 2000 CHASSIS

When this set comes on the picture and sound are good. It takes up to half an hour for this to happen however, and afterwards it sometimes goes off again for a second, leaving a dim raster. The picture and sound come on gradually. The picture appears in monochrome at first, then the colour gradually comes up. The signals always return gradually following the occasional dim raster.

As all signals are involved it seems that either a supply line is going intermittent (monitor the 30V lines with a meter during the fault) or there's a fault in the i.f. or a.g.c. sections of the set. For the latter possibility, start by checking the voltage across the a.g.c. decoupler C56 in the i.f. strip. This should be about 12-14V with a strong signal. If the a.g.c. line is working correctly, check voltages in the i.f. strip. If not, check back to the a.g.c. stages VT9/10: the electrolytics C54/5 (both 50μF) could be playing up.

KÖRTING 51765

The raster on this set flashes white two or three times then stays white, with the picture in the background and prominent flyback lines. The brightness control has no effect on the white screen.

The trouble is often due to heater-cathode leakage in the tube in these sets. To check this, measure the three cathode voltages on the tube base. If these are low, remove the tube base and see whether the voltages on the base return to normal. If so, the tube is almost certainly at fault, and fitting a 6·3V heater isolating transformer will overcome the problem. If the tube is not at fault, check the two transistors (luminance output) on the right side of the tube base and the associated voltages.

THORN 8800 CHASSIS

This set has been troubled with the same problems from new. The symptoms are that the red content of the picture changes to mauve, followed by total loss of colour, and when changing channels the picture appears in monochrome for three-four seconds before colour appears. Adjusting the set oscillator frequency control R210 and trimmer C188, both associated with IC5, seems to make no difference. IC5 (SC9506/TBA395) has been replaced.

Some batches of TBA395 i.c.s were suspect for thermal effects, but since this item has been replaced and the symptoms remain it seems clear of suspicion. We suggest you replace the crystal and the two electrolytics C186 (6·8μF) and C187 (1μF) associated with R210. It's not beyond possibility that the following SN76227 demodulator/PAL switch/matrixing i.c. (IC4) is faulty.

TELETON TA12

Picture wobble on this portable has got worse. There's a white hum bar on the screen but no hum on sound, and at most times the field is unlockable.

Despite the absence of hum on sound, it would seem that there is excessive 50Hz ripple on the supply. This is probably due to failure of one of the rectifier diodes D601/2 connected to the mains transformer, or to loss of capacitance in the associated reservoir capacitor C603 (2,200μF, 25V).

SONY TV9-90UB

The trouble on this monochrome portable is white streaking across the whole screen from any very black picture content, and black streaking from very white picture content. The fault is present on v.h.f. only, u.h.f. operation being all right.

This sounds like a form of i.f. instability. We suggest you check the small ceramic decoupling capacitors such as C324, C337 and C332 in the i.f. strip, and if necessary the electrolytics – C314, C333 and C334. It's possible, though unlikely, that the v.h.f. tuner or the video output transistor Q503 could be responsible.

THORN 2000 CHASSIS

This set has given several years trouble free viewing. It's now developed the following fault however. Every few minutes the colours unlock, forming not so much Hanover blinds as Venetian blinds. The trouble can be temporarily cured by pushing lightly on the push-button tuner for the particular station. The tuner has been repaired, so I assume it's a decoder fault.

Decoder problems with the 2000 chassis are quite rare. From your description, it seems that the reference oscillator is drifting off lock. Suspect components are the electrolytics C3 and C7 (both 4μF) in the burst gate/amplifier circuit, the OA91 diodes (W1-4) in the burst detector circuit, the BC107 d.c. amplifier transistor VT3, and the crystal. Since these components are inexpensive, we'd replace the lot then adjust R13 (detector balance) and R15 (oscillator frequency) as described in the manual.

THORN 1591 CHASSIS

The original trouble with this set was field collapse, the cause being traced to VT16. The original transistor had no marking however, other than a couple of dots, and is marked on the circuit as type TVT15. None of this means much to me, but I found that the set could be got working again by fitting a BC147 in this position. The only trouble now is field judder, mostly at the bottom of the picture. I've checked the height and linearity controls, and both are in order. Could the transistor I fitted be responsible?

VT16 is the field linearity amplifier and TVT15 is a Thorn classification, which includes types BC149, BC208B, BC183LB, BC183LC and BC349B. The BC149 is probably most readily available. We suggest you fit one of the approved devices then, if the fault persists, check the field output coupling capacitor C78 (1,000μF) and its connections and if necessary the output transistors VT19/VT20. If C70 is 0·002μF, change it to 0·01μF.

JVC 7170GB

The problem with this set is that the picture moves to the right, then line sync is lost. The fault rights itself after a while. The field hold is in order and can be adjusted on a normal picture.

Suspect components are the flywheel line sync discriminator diodes D01 and D02 (type 1N34A), and the electrolytics in this part of the circuit, C06 ($4\cdot7\mu$F) and C07 (47μF). The line oscillator transistor TR03 is another possibility. There's a rather unusual stage that inverts and shapes the waveform fed back from the line output transformer to the flywheel sync discriminator circuit. The transistor involved (TR02) and the coupling capacitor C13 (1μF) are further suspects. Check D01/2 first though.

GEC C2110 SERIES

When the picture first appears, there's a bright horizontal band, about ¾in. deep, at the bottom. This disappears after a couple of minutes. The picture is then normal except that the very lowest of captions are half lost below the bottom of the screen. This later fault was apparent before the bright band first started to appear.

The bright band is foldover when the field timebase first comes into operation, and the general problem seems to be lack of field linearity. Make sure that the field output stage mid-point voltage control P454 is correctly set, then check the thermistor TH451 (VA1034) in the output stage emitter bias network and the field charging capacitors C457 (47μF) and C458 (22μF).

TEST CASE

203

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

We took in part exchange a console Decca colour receiver fitted with the later version of the CTV25 series chassis. Although there was no raster, the set was in astonishingly good condition for its age – a nice clean chassis, and a good quality audio section. We decided therefore to correct the line timebase fault, run over the chassis generally, and place the set on the market at a fair price.

The line output stage fault was simply a short-circuit boost capacitor. This was replaced, and as we'd had trouble with the high-voltage capacitors in the line output stage in these sets we decided to go the whole hog and replace all dubious looking components in this area. Following these replacements and complete readjustment of the video, chroma, timebase and convergence sections the results were really very good. Although the tube was the original one, the picture was quite bright with good colour, free from any blurring or colour imbalance over the full range of the grey scale.

The set was put on the market and was bought by a young couple who had only recently married and taken up residence on a new housing estate. Having little spare cash, they were delighted to have acquired such a handsome set at a low price, particularly in view of the good quality sound. This latter feature was particularly appreciated by the young man, who was a hi-fi enthusiast. Less than a week later however they were back in the shop, all apologetic but obviously very concerned. "The set's working fine" they reported, "but we can't keep it on for long because of the ringing it causes in our ears."

This was a new one on us, so we despatched our trusted senior technician, who had been in the business since the days of 9in. Marconiphone sets, to see what was going on. After spending a few hours (yes!) listening with the couple he reported that he couldn't understand the problem since the sound seemed excellent to him, with no ringing, yet the set was obviously causing the couple distress.

Have you any idea what the trouble was? See next month for the answer and another case in the series.

SOLUTION TO TEST CASE 202
– page 661 last month –

You will recall that the problem was no raster on a set fitted with the Pye hybrid colour chassis, and that after extensive tests it was discovered that all three tube guns were excessively biased, with low grid voltages. Now a triode is used as a clamp in each grid circuit, the cathodes of the three clamp triodes being connected together and returned to the clamp voltage source. A fault common to all three clamps would suggest trouble somewhere in the common cathode circuit therefore.

The three cathodes are returned to chassis via R397 ($8\cdot2k\Omega$), which forms a potential divider with R393. The latter is also $8\cdot2k\Omega$, and the voltage at the junction of these two resistors – the clamp voltage – is smoothed by a 4μF electrolytic (C371). If the clamp voltage falls, the voltages at the three c.r.t. grids will also fall, thus reducing the brightness of the picture – to black out if the voltage falls sufficiently. Possible causes of low voltage would be C371 leaky or short-circuit, R393 high in value or open-circuit, or loss of the supply to R393 (via R389, decoupled by another 4μF capacitor, C367). The fault was eventually traced to R393 having increased significantly in value.

QUERY COUPON

Available until 19th November, 1979. One coupon, plus a 50p (inc. VAT) postal order, must accompany EACH PROBLEM sent in accordance with the notice on page 43.

TELEVISION NOV. 1979

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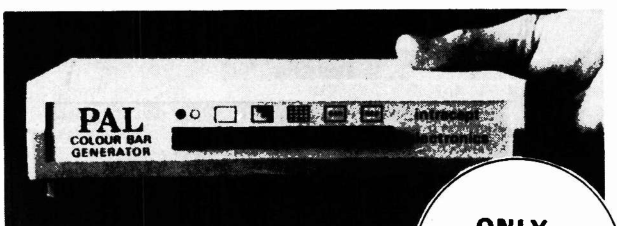

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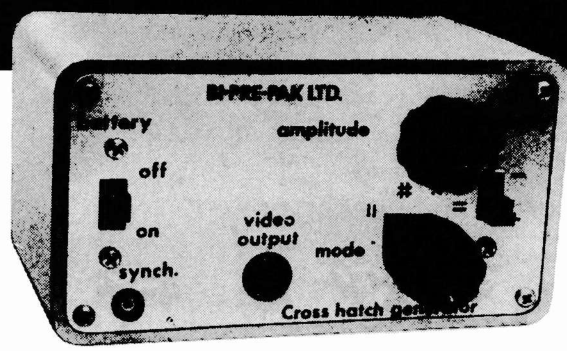

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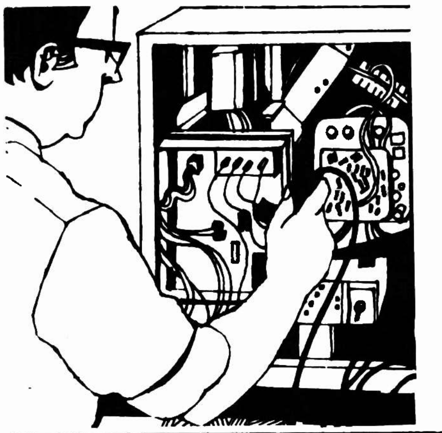

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ECC85	51p	EY86/87	52p	PCF200	£1.83	PL508	£1.80
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ECL80	82p	KT66	£3.58	PCH200	£1.23	PY500A	£1.63
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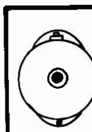

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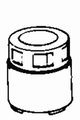

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