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BC108	10
BC109	14
BC109C	14
BC113	13
~~BC116A~~	~~10~~
BC117	14
~~BC125B~~	~~16~~
BC132	25
BC135	15
BC137	19
BC138	26
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BC147	11
~~BC147A~~	~~11~~
BC148	10
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TELEVISION

SERVICING·CONSTRUCTION·COLOUR·DEVELOPMENTS

VOL 25 No 8
ISSUE 296

JUNE 1975

THE NEW TELEVISION

Next month we have a surprise for you: a new, bigger and better *Television* magazine (see page 345 for further details). The page size will be larger, and there will also be more pages. We have been experiencing increasing difficulty in getting all we want into each month's issue of the magazine in its present form. Colour servicing for example calls for the inclusion of more, and more complicated, circuitry. This has been tending to squeeze out some of the other features we feel should be included. But with larger and more pages we consider we will be able to provide the service we aim to give: to keep readers fully up-to-date on all that is happening in the domestic television industry both here and abroad, to provide authoritative articles on servicing the ever more sophisticated equipment that is going to come your way, with plenty of tips on faults encountered, and to maintain a good flow of constructional features.

These improvements involve us in higher costs unfortunately, while rising costs in general—the current inflation—have already put the production of a specialist magazine such as this in considerable jeopardy. The price of paper for example has rocketed. So it is necessary to make another, much regretted increase in our cover price, to 40p.

We wish to be fair to our readers however, by giving better value for this higher price. Hence the increased number of pages, enabling us to deal with more each month and to add extra features, while the increased page size will enable us to present more readably the often complex circuitry you will increasingly have to deal with now that colour sets are the norm and video equipment—cassette recorders, disc players and cameras—are about to take their place alongside the domestic telly set.

This does not mean any radical changes in editorial policy. We shall continue to deal with domestic TV equipment of all types and vintages that are of interest to readers, also the necessary items of test equipment. Regular features will be maintained and added to.

We hope that you will welcome the new *Television* next month. While the magazine as it is at present is well received by its readership we intend to prove that it can be made better all round. Your views as well will be welcome however: if there are things you would like to see covered in greater detail in future, let us know.

L. E. HOWES—*Editor*.

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THE JULY ISSUE WILL BE PUBLISHED ON JUNE 16

TELETOPICS

NEW COLOUR CHASSIS FROM THORN

Information has now been released on no fewer than three new colour chassis from Thorn. First the 8800 series chassis, a version of the 8000/8500 series modified for use with 22in. c.r.t.s. The receiver section—i.f., RGB output and decoder—is similar to the 8500 series except that the panel (PC819) is altered slightly due to the use of a varicap tuner with a.g.c. The new timebase panel (PC650) is also to be used in other 8000 series models. It includes an additional field effect transistor which is used as a buffer stage between the field oscillator and field amplifier/driver stages to prevent line pulses interfering with the operation of the field oscillator: this could occur, causing interlace problems, due to the use of pincushion distortion correction circuitry in the new chassis. The new convergence panel, which includes the transductor pincushion distortion correction circuitry, is fitted into metal brackets at the top of the cabinet: by releasing two clips the panel can be raised so that convergence adjustments can be made from the front of the set.

The second chassis is Thorn's 4000 chassis which has been used in export models for some time. It's for use with 110° delta-gun shadowmask tubes and incorporates active convergence circuitry therefore. The first UK model to be fitted with the chassis is the HMV 2726. This is a luxury 26in. console model with ultrasonic remote control. The chassis uses a single-transistor (BU126) line output stage with tripler and e.h.t. regulator. The latter is connected in series with the emitter of the line output transistor: the sensing point is the c.r.t. first anode voltage which as usual is obtained by rectification from the line output transformer. There are eight i.c.s and considerable use is made of thick-film resistors and modules.

Thorn have now used every possible type of regulated power supply in their colour chassis. The original 2000 chassis employed separate series-transistor regulaters to power the field and line timebases. The 8000/8500/8800 series use thyristor regulated power supply circuits. The 3000/3500 chassis used a series switch-mode (chopper). regulator. In the 4000 chassis a shunt switch-mode regulated supply is used. The basic principle is shown in Fig. 1. The chopper transistor Tr1 is switched on and off at line frequency for a longer or shorter time, as required to provide regulation, by the variable mark-space ratio drive applied to its base. Bridge rectifier D1 charges C1 negatively, and when Tr1 is driven on D2 cuts off and current flows into Tr1's inductive load L. When Tr1 is switched off the voltage across L reverses and D2 conducts, charging its reservoir capacitor C2. Note that the use of a bridge mains rectifier in the 4000 series means that the chassis is always at half mains voltage, a point that must be remembered when servicing. The variable mark-space ratio circuitry in this chassis is incorporated with the line oscillator, flywheel line sync and sync separator in one of the i.c.s.

The cordless remote control system used with the 4000 chassis provides remote channel changing and volume, brightness and saturation control. The transmitter unit consists of a Hartley oscillator which drives a capacitive ultrasonic transducer. The control unit press-buttons connect the 1·5V battery to the oscillator and adjust the tuning over the range of 33·6kHz–44·4kHz, the frequencies used for the various functions being as follows: 33·6kHz channel change; 37·2kHz volume down; 38·4kHz brightness up; 39·6kHz volume up; 40·8kHz brightness down; 42kHz saturation up; 44·4kHz saturation down. A capacitive transducer mounted on the front of the set receives the ultrasonic signals and feeds them to the processing circuits which employ twelve i.c.s and several discrete component stages.

The most interesting chassis however is the 9000 series which has been designed around the new Mazda PIL self-converging colour c.r.t. This tube, which was described in some detail in our June 1973 issue, features horizontal in-line guns, a vertical striped screen with slotted shadowmask, and a precision wound toroidal deflection yoke which is preadjusted and fixed permanently to the c.r.t. The design of the c.r.t./yoke combination means that no dynamic convergence circuitry or adjustments are required. Preset permanent magnets enable purity and static convergence adjustments to be made. Pincushion distortion correction is incorporated and there are five preset adjustments plus the width control in this part of the circuit. The convergence achieved by the tube/yoke assembly is virtually independent of the receiver circuitry: the scan and pincushion adjustments have no effect on either convergence or purity—even the e.h.t. voltage has no effect on convergence so long as the focus voltage remains a constant percentage of the e.h.t. voltage. Seven i.c.s are used in the chassis.

One aim in the design of this chassis has been to reduce the number of transistors required in the high-power handling sections of the receiver. For this purpose a combined line output stage/regulated power supply arrangement has been developed. The unique circuit which Thorn have designed for this chassis has been given the name Syclops—synchronous converter and line output stage. This is now a Thorn Consumer Electronics registered trade name. The basic idea is as follows. The shunt chopper supply circuit shown in Fig. 1 can be rearranged as shown in Fig. 2. Here we have a power transistor being switched at line rate to feed an inductive load, in other words something much

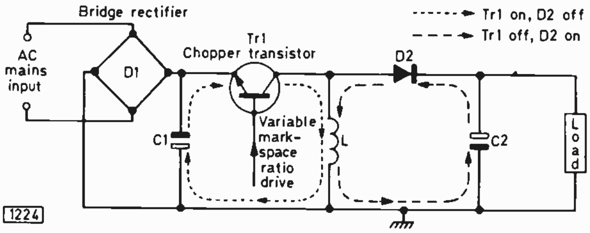

Fig. 1: Basic elements of the shunt switch-mode (chopper) regulated power supply circuit used in the Thorn 4000 110° colour chassis.

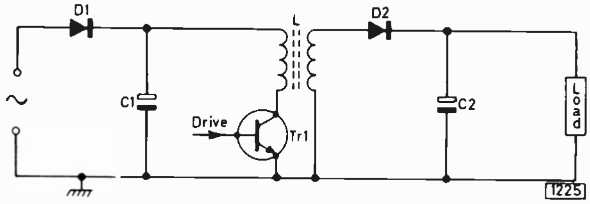

Fig. 2: Alternative arrangement of a shunt switch-mode regulated power supply circuit.

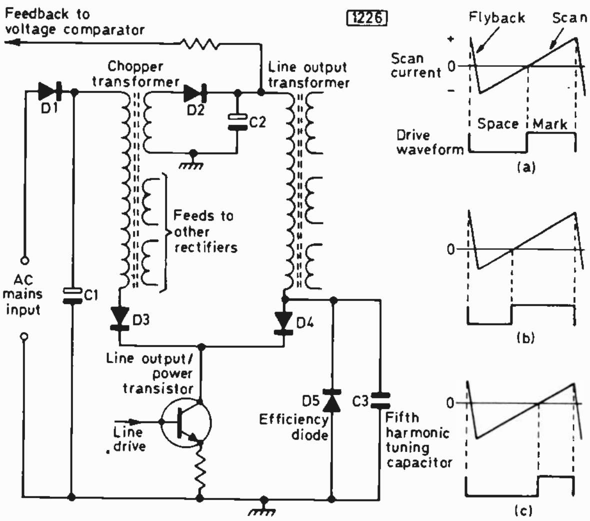

Fig. 3 (left): The Thorn Syclops circuit combines the basic shunt switch-mode regulated power supply and line output circuits as shown here in simplified form.

Fig. 4 (right): Varying the mark-space ratio of the drive waveform in order to regulate the output. (a) Output transistor switched on half way through the scan. The shunt efficiency diode switches off when the output transistor is switched on. (b) Mark-space ratio increased, the output transistor switching on earlier. (c) Mark-space ratio decreased, the output transistor switching on later. The scan current waveform remains the same in each case while the power output varies.

the same as a line output stage. How the two functions are combined in the Syclops circuit is shown in Fig. 3. The line output (Syclops) transistor is driven by a variable mark-space ratio waveform to provide the regulation and is connected as a switch in series with the primary windings of two transformers, the chopper transformer and the line output transformer. Rectifier D1 charges C1 from the mains, current flowing into the primary winding of the chopper transformer when the line output transistor is switched on. D2 rectifies the voltage across the secondary winding, charging C2. When the line output transistor is switched on current also flows via the primary winding of the line output transformer into C2. Feedback from the junction D2/C2 to a voltage comparator stage adjusts the mark-space ratio of the line drive waveform. As usual, the line output transistor (type R2540) conducts during the latter part of the scan, the efficiency diode D5 conducting to provide the initial part of the scan. As Fig. 4 shows, the line output sawtooth current waveform is not affected by altering the line output transistor's switch on time: the power fed into the transformers is. Additional secondary windings on the chopper transformer feed further rectifiers to provide supplies for other parts of the set. The Syclops line/power output stage is protected from excess voltage and current surges by monitoring circuits which under fault conditions operate a trip to remove the drive to the transistor.

The trip circuits which shut Syclops down also remove the supplies to all the receiver circuits in doing so. The line oscillator, Syclops control, line driver and degaussing circuits remain powered. The trip input monitors the field timebase supply and the video line in addition to the Syclops transistor peak collector voltage and power supply collector current. If any of these exceed the safe level the drive to the Syclops is removed and the set turned off for a brief time after which it starts up again. Thus if the fault persists the receiver will continue to trip and recover sequentially until the fault is cleared or the set is switched off.

The i.f./RGB/decoder board used in the 9000 chassis is basically similar to that used in later versions of the 8500 chassis. Some slight differences are necessary in the 9000 chassis due to the use of the PIL tube and a varicap tuner. Since the first anodes of the PIL tube are common there are no separate first anode adjustments for background control. Instead, the d.c. levels at the c.r.t. cathodes must be independently set for correct grey-scale tracking. For this purpose the cascode RGB output stages have bias presets to provide background control in addition to gain preset controls.

Unlike the 8000/8500/8800 chassis, Thorn have reverted to the use of an e.h.t. multiplier in the 9000 chassis.

COMMUNITY TV

Only last March we raised the question as to whether local community TV services distributed via cable had much of a future. This was after news of the severe curtailment of the first such service, run by Greenwich Cablevision, to three hours a week with no professional staff. Since then two of the other four operations, Bristol Channel and Wellingborough, have ceased entirely. These services cost money of course and in the present difficult economic climate all firms are looking for ways of cutting expenditure. Nevertheless the firms that were so anxious to get started in this field could perhaps have done more planning to start with and been prepared to enter into a longer term commitment. The experiences gained so far prove little or nothing except that there are a number of people interested in exploiting the possibilities of local programmes. It looks all too much as if the big boys in cable TV were out to see whether there was the prospect of making a killing out of this new type of service and are coming to the conclusion that there isn't.

COLOUR TV SET HAZARDS

The recall for modification of some 300,000 colour TV sets in the US, ordered by the Bureau of Radiological Health on the basis that the sets could under fault conditions emit X-ray radiation in excess of US government standards, is the largest such operation ever undertaken. None of the sets has been found to have been emitting radiation above the permissible maximum, but it was found that some sets could be made to emit from the c.r.t. faceplate nearly three times the maximum limit under a combination of fault conditions and misadjusted controls. All this makes one wonder. In the early days of colour TV the problem was the e.h.t. stabiliser valve, which had to be shielded therefore. This device has long since been dispensed with in new sets. We are now in the era of solid-state TV chassis and the problem may be thought to have disappeared. Most solid-state chassis however employ a stabilised h.t. line, and a fault in the regulator circuit can result in the h.t. voltage rising considerably. If over-voltage protection isn't built in (or for any reason doesn't work) and the line output stage doesn't cease to operate, the e.h.t. will rise to an excessive figure. So the problem is still potentially with us.

TRADE SCENE

The domestic TV market is still in bad shape, with deliveries of colour sets—both UK made and imported —down 21% in January compared to a year previously and monochrome deliveries down 14%. Colour set imports have roughly halved.

New models nevertheless continue to trickle out. **Pye** have introduced a new 18in. colour set, Model CT218, at £249 recommended retail price (including VAT). This is fitted with the new 715 chassis, a slightly up-dated version of the 713 chassis. **Philips** have introduced a 22in. colour set, Model 556, featuring touch tuning and cordless remote control of channel changing. The set has a suggested selling price of £325 (including VAT) and is fitted with a modified version of the G8 chassis. The simple, relatively low cost remote control system provides sequential channel changes: a mechanical striker mechanism is used in the remote transmitter unit to generate ultrasonic signals at 41·5kHz. A VCR button is included on the control panel. **Scantic** have added a 22in. model to their range. This is fitted with a Toshiba RIS c.r.t. —a 110°, in-line gun type. Model number is 56582.

The Department of Trade is to investigate a claim that Japanese colour TV tubes are being imported at prices that constitute dumping and that this is harming the UK tube industry.

VIDEO

RCA is developing a videodisc system which it hopes to introduce on the US market next year. Philips hopes to launch its videodisc system (see *Television* June 1974) on the US market this autumn. Meanwhile it is understood that the introduction of RCA's Selectavision ½in. magnetic tape videocassette system, originally planned for this year, has been deferred: a new, simpler deck is being developed, with the main aim of doubling the playing time of the casette—to two hours instead of one.

TRANSMITTER OPENINGS

The following relay transmitters are now in operation:
Clyro (Powys): BBC-2 channel 44, BBC-Wales channel 51. Receiving aerial group B.
Oldham North: ITV channel 24 (Granada programmes). Receiving aerial group A.
Tideswell Moor (Derbyshire): ITV channel 60 (Yorkshire Television programmes). Receiving aerial group C/D.
Whalley (Lancashire): BBC-1 (North West) channel 40, ITV (Granada programmes) channel 43, BBC-2 channel 46. Receiving aerial group B.

All these relay transmissions are vertically polarised.

CEEFAX EXTENDED

The BBC has more than doubled the capacity of its Ceefax data transmissions. Experimental Ceefax transmissions started last September and initially 24 pages of news and information were transmitted every day of the week with regular up-dating between 8 a.m. and 6.30 p.m. Now 50 pages are being transmitted. Decca and GEC have announced that their next year's models will include a socket so that a Ceefax module can be added.

SOLID-STATE TV CAMERAS

RCA are to market in Europe next year a range of solid-state TV cameras for hand-held and other applications where small dimensions and low power consumption are important considerations. The heart of the cameras will be RCA's silicon imaging device, sid for short, which has 163,840 picture elements in a 512×320 matrix. Charge coupling is used to provide signal read-out from the device (see article in the October 1974 issue for details of this technique). The cameras will weigh 2½lb and measure $5{\cdot}78 \times 4{\cdot}5 \times 2{\cdot}75$in. The video output obtained can be fed into the aerial socket of a domestic TV set—the versions developed so far operate on the US TV standards. Space is available in the cameras for adding a couple of extra sids to give full colour compatibility. The highest voltage used in the cameras is 16V. Cost of the cameras is understood to be in the range of $3,000–$3,800 depending on the grade of sid fitted.

NEW PRODUCTS

A new, smaller glass delay line for use in colour set decoders has been introduced by ITT. The TAU60 delay line provides approximately 15% space saving compared to the standard TAU40 delay line. ITT say that alternative base pin configurations are available, which may present a problem to service engineers though troubles with chrominance delay lines are virtually unknown.

Mullard have recently introduced a new range of Plumbicon TV camera tubes featuring improved resolution and increased sensitivity. The resolution of the XQ1410 range is better than 700 TV lines and the basic sensitivity typically 400μA per lumen. The tubes are directly interchangeable with the standard XQ1020 range, enabling the performance of equipment to be up-graded.

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Les Lawry-Johns deals with faults experienced on the Philips G6 colour chassis.

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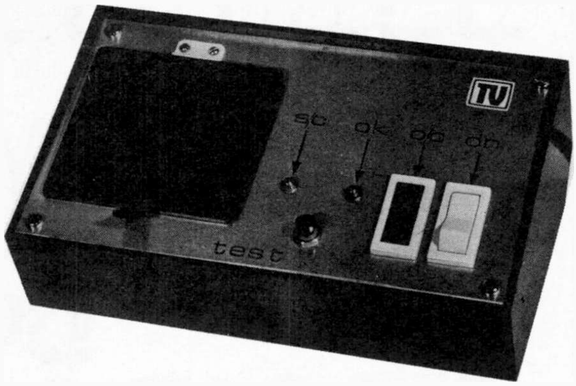
THYRISTOR TESTER

ALAN WILLCOX



WITH thyristors being increasingly widely used in TV receiver power supply and line output circuits, some means of testing these devices should prove to be a useful addition to the workshop. When one starts thinking about a practical thyristor tester, a number of difficulties become immediately apparent. First, because thyristors come in a wide variety of shapes and sizes, finding a suitable method of connection presents a problem. Secondly, the only satisfactory method of testing thyristors involves the application of high voltages and currents which are potentially dangerous.

In the unit to be described, the connection problem was resolved by using flying leads and crocodile clips. In the interests of perpetuating the life of anyone installing a thyristor for test, a safety flap covers these connections: when the flap is raised the power is automatically removed.

Circuit description

The circuit is shown in Fig. 1. The mains transformer T1 is used solely for isolation purposes, allowing the bulk of the circuitry to be earthed via the mains plug.

When the mains switch S1 and the safety switch S2 are closed 250V a.c. is applied to the thyristor, but no current flows until the gate is connected via the "test" switch S3. The neon lamp LP1 has a dual role. First it serves as an indication that power is applied to the test clips. Secondly, if remaining illuminated when S3 is depressed, it indicates that the thyristor is open circuit. If the thyristor is good, current will flow on the negative half-cycles (with respect to earth) when S3 is operated. Current flow is via R1, R2, R4 and D5. This l.e.d. is labelled "O.K.", and when alight signifies that the thyristor is good.

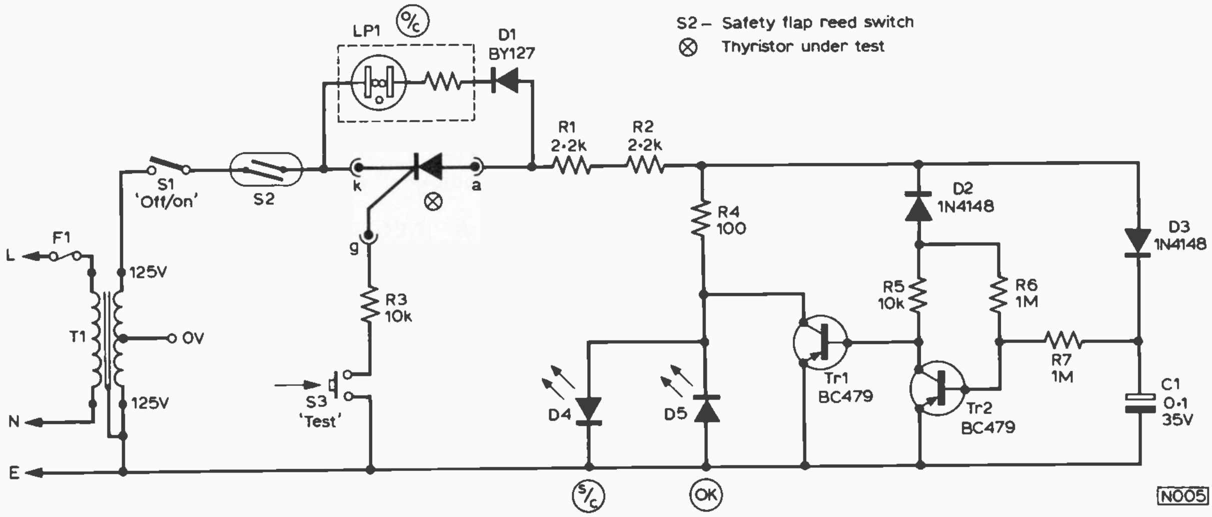
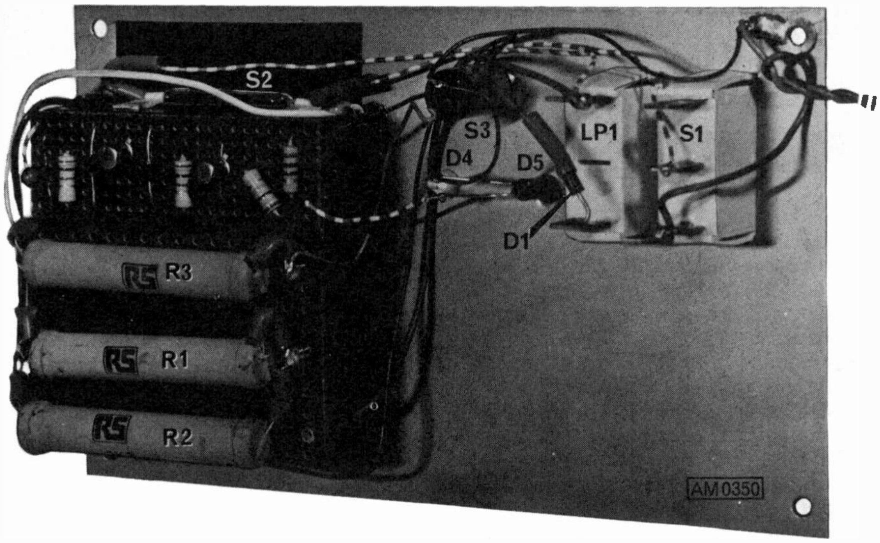


Fig. 1: Circuit diagram of the complete thyristor tester.



In order to clear the mains transformer, the thyristor test compartment must not extend more than 70mm from the left-hand edge of the front panel.

Should the thyristor be short circuit, current will flow also on the positive half-cycles, and so the "Short circuit" indicator D4 will also be illuminated. To give a clear indication under these conditions it is arranged that D5 is extinguished, and it is for this purpose that the rest of the circuit is introduced.

When a good thyristor is in circuit, Tr2 is switched fully on by forward bias via R6 from the 10 volts or so developed across R4. This transistor effectively removes bias from Tr1, which is therefore cut off, allowing D5 to illuminate. If, however, the thyristor is short circuit D3 will conduct on positive half cycles, charging C1 to a steady positive potential of 10V. Current via R7 due to this voltage completely offsets the forward bias via R6, and so Tr2 is cut off. Tr1 is now free to conduct on negative half cycles, so effectively shorting out D5 only.

Construction

The instrument case housing the prototype is just about the smallest that could be used, and some care is therefore required when positioning the components. For the insulated test compartment one half of a plastics box would be suitable, or a container may be built up from paxolin or similar material. The maximum depth, however, should be 20mm (0·8in) otherwise the components mounted on the rear may foul the case bottom. The hinge used on the flap was a nylon type obtained from a model shop. The use of a reed switch to interrupt the power eliminates the possibility of accidental switching, which might occur with a manual type switch. The switch is actuated by a small magnet glued to the plastics lid.

All wiring should be routed so as to leave a clear space above the mains transformer, which must be mounted as far to the right of the case as possible with its lower connection tags resting on the case bottom. No ventilation was considered necessary as the 10W resistors are run well below their rating, and in any case the instrument will be operated only intermittently.

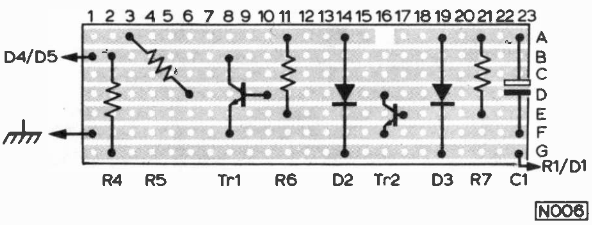


Fig. 2: Layout of the circuit board. Note that this view is inverted compared with photograph above.

Testing

Because of the high voltages applied to the test leads it is wise to test the unit thoroughly once construction has been completed.

First check with an ohmmeter that there is continuity between the earth pin of the mains plug and the front panel. Then, with power applied and the mains switch on, check that the neon is illuminated when the flap is down, and extinguished when it is raised. Finally, check with an a.c. voltmeter that no voltage exists between any of the clips, or between the clips and the front panel. Only when these tests are completed satisfactorily should the instrument be considered safe.

Operation

It is good practice to switch on the mains switch only when the thyristor is connected, and to regard the flap switch as an additional safety precaution.

If the thyristor shows "O.K." before the test button is depressed it has an internal leak causing it to act as a straight rectifier, and should be discarded. If the thyristor is good it will indicate "O.C." until the test

—continued on page 369

LONG-DISTANCE TELEVISION

ROGER BUNNEY

THOUGH the lighter days of spring are with us once again, general reception conditions in the UK still seem to be rather in the dark. I have been unable to log anything of consequence here to indicate an upsurge in Sporadic E activity—indications are usually noted during March and April before the main season starts around the second or third week of May. I nevertheless feel that this lack of activity doesn't mean a poor season ahead, and in fact am reasonably confident in predicting that the season will be slightly better than in 1974. As for the other propagation modes—MS (Meteor Shower/Scatter) and tropospherics—these remain dismally insignificant at present.

The column is being prepared early this month due to production problems at the magazine's offices—the preparations for the changeover to the new style and printing next month—so the log goes up to 21/3/75 only. It reflects the rather dismal conditions, while during the period my activities have been restricted by a bout of 'flu.

3/3/75 WG (West Germany) ch. E3; Switzerland E3—both MS.
4/3/75 DFF (East Germany) E4—MS.
5/3/75 TVP (Poland) R1; TVE (Spain) E2, 4; ORF (Austria) E2a—all MS.
6/3/75 SR (Sweden) E2; TVE E2; RAI (Italy) IB—all MS.
7/3/75 TVE E2, 4; CST (Czechoslovakia) R1—all MS.
10/3/75 WG E2; TVE E4—both MS.
11/3/75 CST R1; TVE E2, 4; WG E2—all MS.
12/3/75 DFF E4; RAI IB; WG E2; TVE E2, 4—all MS.
13/3/75 TVP R1; ORF E2a; SR E2—all MS.
17/3/75 DFF E4—MS.
18/3/75 SR E2; TVP R1—all MS.
20/3/75 MT (Hungary) R1; TVE E2; DFF E4; NRK (Norway) E4; SR E2—all MS.
21/3/75 CST R1; SR E2, 3, 4—all MS.

On two occasions the FUBK test card without identification was observed via MS on ch. R1/E2a. Several other enthusiasts have noted this during the pre-0900 CET period. As yet no one has been able to identify this transmission but I suspect either ORF or CST. I have also observed the PM5544 test card on ch. E4 prior to 0800 CET, again without any clue as to its origin.

Another version of the PM5544 test card has been logged on ch. R1/E2a. This sports a long identification in the lower black rectangle—the first two letters are BR then there is a small gap followed by other letters. Has anyone else seen this? March 3rd also produced the CS U 01 pattern on ch. R1, but with a longer form of identification within the circle. Garry Smith (Derby) logged these last two mystery sightings.

Clive Athowe from his Norwich eyrie has noted further test card changes. In West Germany ZDF is using a new identification "DBP-ZDF", Heissischer Rundfunk-1 has changed its identification from "hr 1 FFMT" to "hr 1 FFTM", while WDR Fernsehen-1 now uses the identification "WDR-TV". All these identifications are on the FUBK card. Clive has commented on the improved tropospherics during February. On the 5th he received the ch. R9 Poznan and ch. R12 Szczecin Band III transmitters. Congratulations!

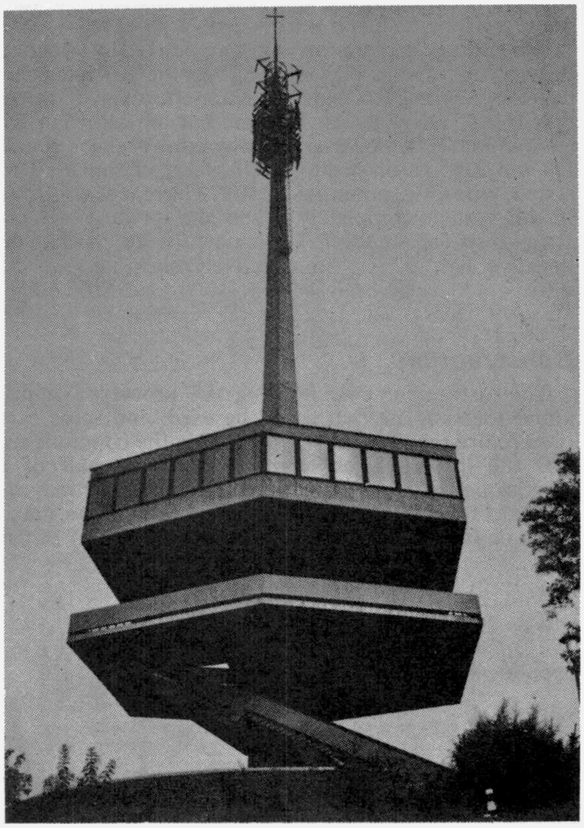
Hetesi Laszlo (Hungary) tells us that the identification on the PM5544 test card used there is now "MTV-1 BUDAPEST". Hetesi has logged Bulgaria ch. R2 Plovdiv on the news—the interesting and distinctive news announcer is featured this month.

A letter from our Dutch TV expert Ryn Muntjewerff indicates that some care must be taken over loggings of JRT (Yugoslavia) since JRT is transmitting programmes to Albania in Albanian, as well as programmes in Hungarian and Russian. For example the caption "Dnevnik na Albanskom Sezikli" has been received on ch. E3: translated this means "News in the Albanian language".

Finally in this short round-up Hugh Cocks reports Brest-3 testing on ch. E24.

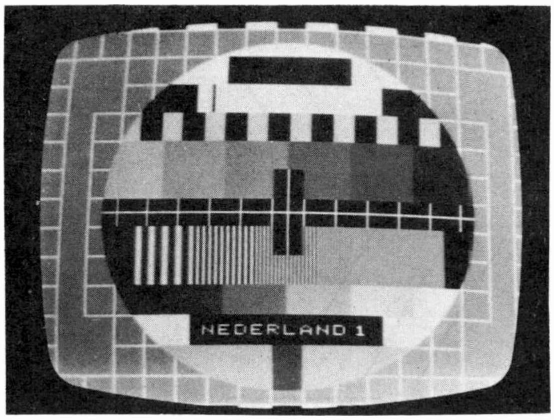
New EBU Listings

West Germany: The Kreuzberg/Rhoen ch. E3 transmitter is now operating with horizontal instead of vertical polarisation. The following transmitters are operating with reduced power: Monschau ch. E21 reduced to 220kW e.r.p.; Amberg ch. E37 reduced to 280kW e.r.p.; Muenster-Baumberge ch. E45 reduced to 190kW e.r.p.; Minden ch. E57 reduced to 320kW e.r.p.; Luedenscheid/Nordehll ch. E60 reduced to

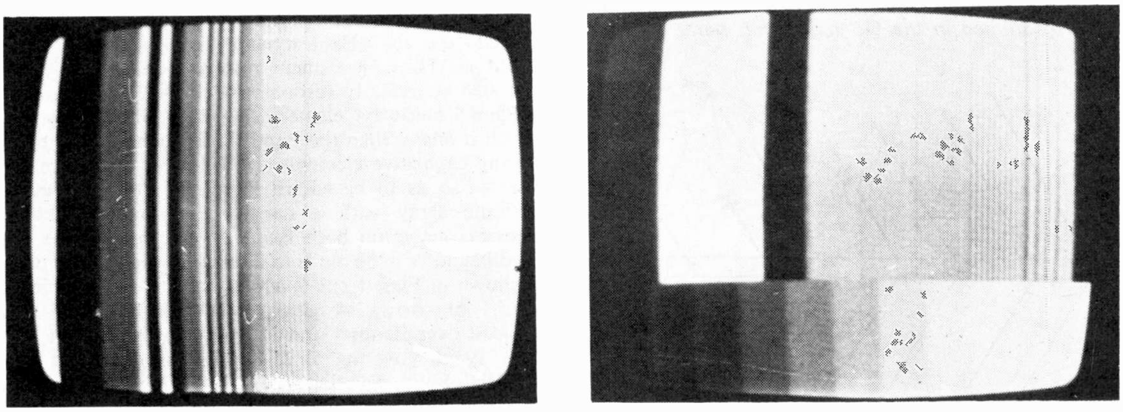


Miskolc (Hungary) MT-1 ch.R9 5kW transmitter. Photo courtesy Ryn Muntjewerff.

Bulgarian TV news announcer, received by Hetesi Laszlo (Hungary) on ch. R2.



New pre-programme test card used by NOS (Holland). Photo courtesy Peter F. Vaarkamp.



Test patterns used by JRT (Yugoslavia). Received by Hetesi Laszlo (Hungary) on ch. E4 from the Psunj transmitter.

150kW. The e.r.p. of the Monschau ch. E50 transmitter has been increased to 330kW. All these transmissions are horizontally polarised.

Belgium: Anlier ch. E60 200kW horizontal. RTB-French.

France: Angers ch. E41 TDF-3 20kW horizontal (south of Le Mans). Bar le Duc-Willeroncourt TDF-2 ch. E48, TDF-3 ch. E54, 200/55kW horizontal (east of Troyes). Morteau TDF-2 ch. E54 20kW horizontal (east of Dijon).

News Items

Finland: Seppo Pirhonen tells us that a third Finnish network is in the planning stage. YLE will be constructing the network on the south and west coasts. Programmes will be mainly in Swedish since that is the language spoken in this area. The network will transmit largely at u.h.f. though a new ch. E4 transmitter will be taken into service. Projected transmitters in Finland are as follows: Vuokatti ch. E4 40kW (late 1975), Vuokatti ch. E56 600kW (late 1975), Kerimaki ch. E55 600kW (summer 1975), Forssa ch. E37 600kW (late 1975), Pihtipudas ch. E32 600kW (late 1976), Kalvia ch. E30 150kW directional (late 1976). Vuokatti is in north Finland some tens of kms east of Kajaani which transmits on ch. E4 and will be taken off the air. I'm sure all readers will wish Seppo and his attractive wife Leena very best wishes for future happiness following their recent marriage.

Italy: In case you didn't see the note on page 328 last month Indesit of Turin have announced a new colour TV system which is understood to be a variant on PAL. The aim is understood to be to resolve the long-standing dispute as to whether the PAL or Secam colour system should be adopted by RAI.

Kuwait: Kuwait television is to go colour using PAL. Marconi have received an order recently to re-equip outside broadcast vehicles for colour operation.

Ireland: The RTE Engineering Information Department has announced that the following transmitters currently transmitting on 405 lines (System A) are to be phased out: Mt. Kippure ch. B7 on December 31st 1975, Truskmore ch. B11 on December 31st 1975, Dublin ch. B3 on June 30th 1976.

Bulgaria: The Bulgarian television service celebrated its fifteenth anniversary last November 7th. The "strongest TV transmitter in the Balkans" will operate from a 300 metre high tower being constructed near Schumen.

East Germany: A new transmitter for DFF-1 is in operation on ch. E36 at Rugen.

Signal Reflections via ARA

In the April column we discussed the possibilities of receiving Moon-bounced TV signals. Another form of signal propagation has now been suggested, in the February issue of *Wireless World* (page 86). The principle is that the heat produced by a high-power long-wave transmitter affects the electron density some 100km above the transmitter. As a result signal scattering—similar to Auroral back-scatter—can occur giving communication over some hundreds of miles at up to and including u.h.f. In the case of Droitwich

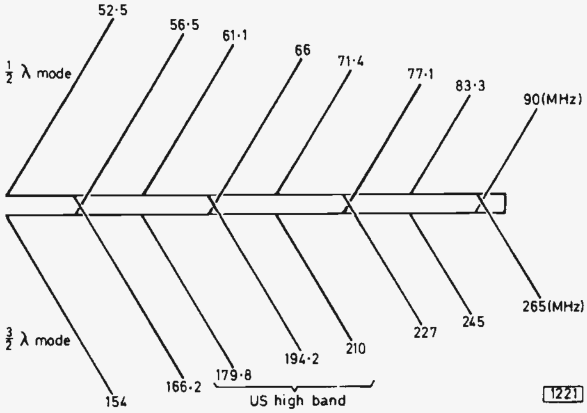


Fig. 1: Basic log-periodic aerial arrangement: each dipole in this example has a half-wave resonance in the US low v.h.f. band while three of the dipoles have a one and a half wave resonance in the US high v.h.f. band.

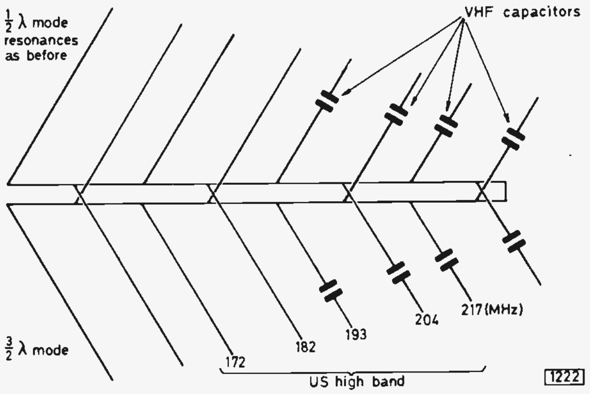


Fig. 2: By adding capacitors of predetermined values at the correct positions along the dipole elements the one and a half wave resonances are reduced. In this example five of the dipoles have a one and a half wave resonance in the US high v.h.f. band.

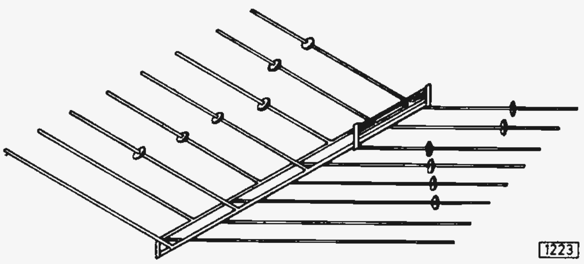


Fig. 3: Basic arrangement of the JFD Model LPV-TV80. This has six dipoles and, at the front, two directors. Four of the dipoles and the two directors are tuned by capacitors to reduce the one and a half wave resonances. This is one of eight models in the range.

the temperature rises by some 45°C. Tests have been conducted in the USA with a 5MW transmitter beamed vertically to raise the electron gas temperature, forcing the gas to expand along the magnetic field and thus give scattering from field-aligned irregularities. The effects occur in both the E and F layers. This could be a new opportunity for DX-TV experiments, certainly for those living relatively close to a high-power long-wave transmitter. The mode of propagation has been called ARA, artificial radio Aurora.

Capacitor Tuned Aerial Elements

Whilst searching through some old TV information recently I came across several North American TV aerial catalogues. In the JFD Company's catalogue interesting details were given on the design of their log-periodic v.h.f./u.h.f. arrays. Although the use of very wideband aerials (in this context Bands I and III, plus u.h.f. as well in certain arrays) has never been advocated for DX-TV work nevertheless the principles of these aerials are of interest and if anyone has experimented with this approach we would be delighted to hear of the results obtained.

Basically, a half-wavelength dipole cut to say 88MHz will also resonate at approximately three times this frequency, i.e. 264MHz. If capacitors are inserted at certain points within the dipole element itself the upper resonance can be shifted—the 264MHz resonance can in fact be altered to 216MHz. Thus an element resonant on ch. A6 (88MHz) can also be made to resonate on ch. A13. To sum this up, a Band I half-wave element also has a 3/2-wave resonance which is *higher* than the Band III frequencies, but by introducing capacitive elements the 3/2-wave resonance can be *lowered* so as to be within Band III. This enables a log-periodic array with a considerably greater number of elements active on both Bands to be produced. A similar modification can be made to director elements. The principle is shown in Figs. 1 and 2 while Fig. 3 shows a typical JFD v.h.f. only array. A gain of 7-9·5dB and 10·5-13dB is claimed over Bands I and III respectively (Band I, i.e. US Low Band, covering 55·25-87·75MHz and Band III, i.e. US High Band, covering 175·75-215·75MHz in this context). The company also produce a series of log-periodics with wideband u.h.f. sections mounted in front of the v.h.f. section. It is interesting to compare this with Anthony Mann's array illustrated in the October 1974 column. Our thanks to the JFD Company for allowing us to make use of their information.

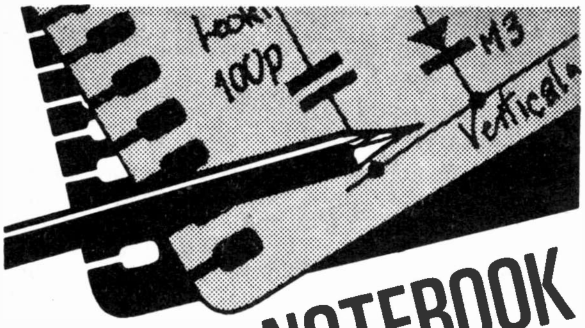
1975 World Radio/TV Handbook

The 1975 edition of the *World Radio and TV Handbook* is now available from booksellers. It contains essential information on transmitters, networks, systems, etc. and is one of the few guides to TV transmitters outside the European broadcasting area. The price is £3.50. Published by World Radio-TV Handbook, Denmark.

Freak Propagation?

Clarke W. Ingram (Pittsburg, USA) recently reported in the WTFDA (Deerfield, Illinois) "DX Scoreboard" column a most unusual phenomenon. Pittsburg received its first large snowfall of the winter on December 1st. At approximately midnight, after the snow had stopped falling, Clarke experienced loss of colour from the local ch. A2 TV station KDKA-2, the colour gradually disappearing until only a monochrome picture could be obtained. On tuning to WTAE-4 ch. A4 he discovered the same process taking place, proceeding through to WJAC-6 and after a time reaching into Band III (US High Band) on WSTV-7. As the colour loss reached Band III so the KDKA-2 Band I ch. A2 colour returned. The phenomenon eventually reached WSTV-9 ch. A9. The Band I channels returned to normal

—continued on page 358



SERVICE NOTEBOOK

G. R. WILDING

Bright Vertical Band

A dual-standard Ekco Model CT102 colour set gave a good picture except for a bright vertical band almost 2in. wide at the centre of the screen. The owner said that this had got progressively worse during the previous few days. New valves made no improvement, the set e.h.t. and beam limiter controls worked normally, as did the brilliance control. The fault was likely to be due to a defect in either the timebase or the luminance output stage, the brilliance control affecting the d.c. restoration at the control grid of this stage. There were no voltage discrepancies anywhere so we decided to check all likely electrolytics. Those in the luminance output stage and brilliance control circuit were tried first, but all proved to be in order. We next tried shunting an equivalent across the cathode coupling electrolytic C213 (1μF) in the PCF802 line oscillator stage. This action cleared the fault.

No Sound or Raster due to LT Fault

The fault report on a model fitted with the ITT CVC5 chassis was that neither sound nor raster were present when the set was switched on though it had worked perfectly up to the time it had been switched off. On switching the set on there was a slight buzz, indicating that the mains supply was reaching the transformer and that the input fuses were therefore intact, while on looking through the back we could see one or two valve heaters glowing. We switched off, removed the back and noted that the wirewound resistors in series with the h.t. feeds were moderately warm. The three pairs of power resistors feeding the collectors of the three RGB output transistors were cold however. The h.t. was pretty well normal so it was clear that the raster was being blanked out because the RGB output transistors were not conducting and in consequence their high collector voltages were biasing the three c.r.t. guns past cut-off. The RGB output transistors are driven by d.c. connected emitter-followers which are fed from a 20V l.t. rail. Absence of current in the output transistors implied lack of drive from the emitter-followers, so attention was turned to the l.t. supply circuit. On checking we found that the 0·5A fuse in series with the a.c. feed from the mains transformer secondary winding to the l.t. bridge rectifier D52d was open-circuit. Further tests showed that the bridge rectifier unit was short-circuit. It was now clear why there was no sound either, since both l.t. rails were inoperative. Before fitting a new bridge rectifier we checked its 500μF reservoir capacitor in case this had been damaged through application of a.c., but the capacitor was in order so it seemed that the l.t. fuse had blown immediately. Normal operation was restored on connecting a new bridge rectifier unit into circuit.

Lack of Height

The picture displayed by a set fitted with the Pye 67 chassis had suddenly reduced to a height of about five inches, though the width was unaffected. The linearity was still quite good and although we did not expect this to cure the trouble a new PCL805 was tried just in case. There was no improvement, so as a first move before starting to check voltages we tried shunting a large-value electrolytic across the pentode cathode decoupler. There was negligible improvement so we next assumed we would find that the anode voltage of the triode section of the valve was low, since the triode section is generally used as the oscillator with its anode fed via high-value resistors from the boost rail. The triode anode voltage turned out to be normal however, as did all the pentode voltages. So we resorted to the circuit diagram, which revealed that the PCL805 triode section is used as a phase splitter in the flywheel line sync circuit, a separate ECC82 being used as a cross-coupled multivibrator field generator. It is one anode of this valve that is fed from the boost rail, via the height control and a 1·2MΩ resistor, and as expected the anode voltage was low due to the 1·2MΩ resistor (R109) going very high resistance.

In other models in the past we have known the triode section of a PCL84, ECL80 or ECC81 to be used for field generation. Where doubt exists and the circuit is not to hand the safest and surest way of finding out is to apply the voltmeter to the anode of the suspected valve: if it is part of the oscillator circuit this action is bound to reduce the height and probably start the picture rolling.

Bluey-Green Picture

The complaint with an oldish dual-standard Bush CTV25 colour receiver was that the picture was "bluey-green". The owner had previously been advised that the red gun was weak and thought that it had now failed completely. The monochrome picture was also strongly tinted towards blue-green, so obviously the cause of the fault was not absence of output from the red colour-difference output stage. The cathode feeds rarely go open-cricuit so number one suspect was the c.r.t.'s red gun first anode voltage. This proved to be about 50V instead of something in the region of 700V. The first anode voltages are fed from the presets to the appropriate pins on the tube base via 1MΩ resistors. We did not suspect the red first anode feed resistor however since the usual cause of zero or low first anode voltage is a short or leak in the associated decoupling capacitor. This was confirmed by connecting the meter across the red first anode decoupling capacitor (9C14, 0·01μF): on unsoldering the capacitor the first anode voltage returned to normal. After replacing it, using a 1kV working voltage type, re-adjusting the three first anode presets and giving the convergence a tweak here and there a very good picture with ample red content was obtained. In view of the owner having been told that the red gun of the tube was low-emission, which was not the case of course, the thought occurs that at the time the faulty capacitor might have had only a slight leak which prevented the red gun first anode voltage reaching the correct potential.

No Picture

Absence of picture on a set fitted with the TCE 1500 chassis was found to be due to the thermal fuse R124 being open-circuit. We resoldered this and as the set warmed up a loud line whistle which was completely unaffected by adjusting the line hold control developed. The PL504 line output valve rapidly overheated, and the fuse then opened again. Fitting new valves in the line timebase made no difference but it was found that by putting pressure on the chassis in the vicinity of the PL504 it ceased to overheat and a picture developed. Further tests showed that when the abnormal line whistle developed there was no voltage on the line drive coupling capacitor C100 in the PL504 control grid circuit, though there was normal voltage at the anode of the line oscillator. A jumper lead was soldered therefore between C100 and the anode of the 30FL2 line oscillator valve (triode section), and this gave normal operation. It would appear that the PL504 went into self-oscillation when lack of drive resulted in only a fraction of the normal grid bias being developed.

Incorrect Colours

The complaint with a Philips set fitted with the G6 single-standard chassis was incorrect colours. Inspection showed that this was due to a deficiency of green. We changed the G−Y PCF200 output/clamp valve V7006 (see Fig. 1), readjusted the G−Y matrix balance and amplitude controls and after giving a final tweak to the other presets a good picture was obtained. A few days later however the owner complained that the colouring had gone back to little better than that before the service call. The first suspect was the 10M Ω clamp triode anode resistor R7241 but this was o.k. and all the voltages in the stage were correct. While making voltage checks however the picture suddenly returned to normal green and it was then found that pressure on the panel just under V7006 would largely restore or remove the G−Y signal. No dry-joints were evident but further testing revealed that the coupling capacitor C7071 in the G−Y matrix circuit was defective. On replacing this and resetting the matrix controls the green content of the picture remained correct.

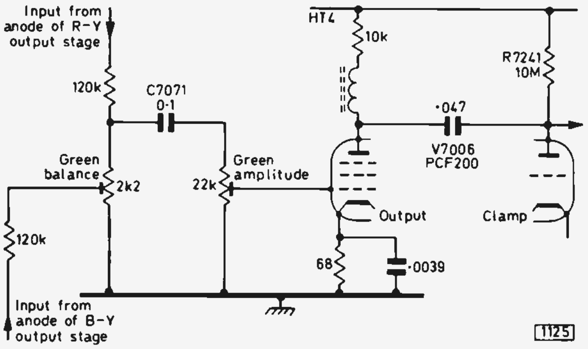


Fig. 1: G−Y matrix circuit, Philips G6 chassis.

Field Linearity Faults

That very common fault cramping at the base of the raster can be caused by a defective output pentode, reduced value cathode bias resistor, dried up electrolytic cathode decoupler or by a slightly leaky control grid coupling capacitor. In sets some years old the thermistor in series with the field scan coils can go high-resistance producing the same fault. On rather rare occasions you may come across cramping at the top of the picture, in which case a component in the field linearity feedback loop will be faulty or the field output transformer primary winding will have shorted turns. Recently however a model fitted with the STC/ITT VC51 chassis came our way with cramping in the centre of the raster. The maximum height available was also considerably reduced, though there was sufficient to fill the screen. New oscillator and output valves failed to produce any improvement and both linearity controls though having a wide range had little effect on the fault. The next step was voltage checking therefore. Starting with the pentode section of the PCL85, we found the anode voltage marginally higher than normal, the cathode voltage marginally lower, but the screen grid voltage considerably reduced at just over 100V instead of 220V. There is no screen grid decoupling capacitor so the defective component was obviously the 1k Ω screen grid feed resistor R97. On replacing it and resetting the linearity presets a very good raster was obtained.

Poor Contrast

The contrast was poor on a Murphy single-standard Model V2415S and it was impossible to completely black out the raster. A new PFL200 video amplifier valve made no improvement and it was then discovered that the c.r.t. cathode voltage was low at about 135V instead of 160–170V. The video output stage is d.c. coupled to the c.r.t. cathode so the trouble was obviously in the video stage. The cathode voltage was low at about half the correct figure of 6V, the screen grid voltage was also low and the screen grid and anode feed resistors were overheating. These conditions indicated insufficient bias and the 320µF electrolytic cathode decoupling capacitor was found to have a heavy leak. After replacing this and the 10k Ω screen grid feed resistor which had markedly fallen in value normal contrast and brightness conditions were obtained.

Dim, Unmodulated Raster

There was sound on both systems on a KB model fitted with the STC/ITT VC51 chassis but only a dim, unmodulated raster. The latter proved to be due to excessive c.r.t. cathode voltage, in turn caused by failure of the PCL84 video output pentode to pass normal current. The relevant circuit is shown in Fig. 1. If the output pentode passes less than normal current the voltage drop across R56 will be less than normal, and since the potential divider (R58, R61) which biases the c.r.t. cathode is fed from this point the cathode voltage will rise. The cause of the fault turned

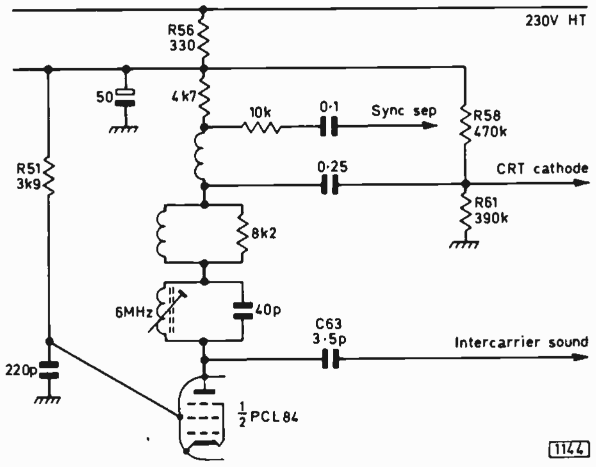


Fig. 2: Video amplifier anode circuit, ITT VC51 chassis. Low current in the PCL84 due to R51 being open-circuit resulted in less than normal voltage drop across R56. This increased the c.r.t. cathode voltage, producing a dim, unmodulated raster, since the potential divider R58/R61 which biases the c.r.t. cathode is fed from R56.

out to be the PCL84's screen grid feed resistor R51 which was open-circuit. A good picture was obtained on replacing this component. The surprising feature of the fault is that the u.h.f. sound, which is tapped from the anode of the PCL84 via C63, was still present at quite fair volume despite negligible current in the valve due to the absence of screen grid voltage. The feed was apparently filtering through via the valve's internal capacitance and the exterior wiring.

Servisol Cures Film Projector!

As most service engineers know all too well, not every job brought to the bench falls in the radio and television category. Recently a film projector came my way because the known good lamp in it wouldn't light. With the lamp fitted we found zero voltage across its filament but when it was removed the normal 8V could be read. Clearly a case of a high-resistance contact somewhere and on putting the meter, in series with a limiter resistor, on one side of the lamp switch a current reading of a fraction of an amp was obtained whilst when the meter was applied to the side of the switch to which the a.c. is fed 10A could be drawn. It was impossible to clean the switch contact without dismantling the multipurpose switch, so a few drops of Servisol were tried. Instant success!

Weak Field Lock

Weak field lock but quite good line lock was the trouble with a set fitted with the Thorn/BRC 1500 chassis. Replacing the 30FL2 sync separator valve and the PCL805 field timebase valve failed to cure the fault and all the voltages in these stages were absolutely normal—as expected in the case of the PCL805 since the linearity and height were perfect. The fault seemed likely to be due to a faulty capacitor therefore and as a first step the 0·022μF capacitor (C74) feeding the field sync pulses to the PCL805 was replaced. This made no difference and after checking various electrolytics and decouplers in this area to no avail attention was directed to the video stage—defects here can often affect the timebase synchronisation by cramping or limiting the sync pulses. The video amplifier transistor's emitter voltage was found to be marginally above the correct figure of 0·9V, possibly due to component tolerances, but its collector voltage was markedly below the correct figure. The resistor values in the stage were normal and the fault was traced to a leak in the base feed electrolytic coupling capacitor C37 (64μF). Replacing this capacitor restored perfect field lock and somewhat improved the picture definition.

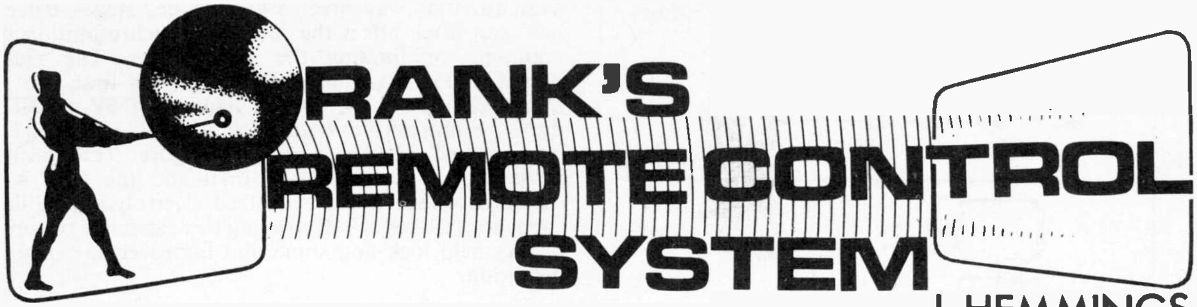
Aerial Connection Faults

After replacing the PCL86 audio valve to cure a case of distorted sound in a set fitted with the STC/ITT VC3 chassis (and checking its cathode bias resistor of course!) the owner complained that v.h.f. reception, usually better than u.h.f. reception in his area, was the worse of the two. Inspection showed a grainy picture with weak contrast, suggesting aerial trouble or a weak r.f. amplifier. On gripping the aerial plug to remove and examine it however the grain improved considerably. Clearly the braiding of the coaxial cable was not connected signalwise to chassis, hand-capacitance doing this to a limited extent. On subsequently examining the v.h.f. aerial socket panel, which slides into a cut-out at the top of the cabinet back, it was found that the 470pF capacitor which earths the outer body of the aerial socket had broken away. Normal results were obtained on resoldering it.

In similar vein we came across a Hitachi colour set recently that had suddenly developed a grainy picture with the verticals showing slight but annoying ringing. The cause was traced to the aerial socket where it was found that the split inner pin had been forced apart, one half having broken off. In consequence the central pin of the aerial plug was making only a capacitive feed to the bent back socket connector. On fitting a new aerial socket a perfect picture was obtained. The slight ringing was presumably the result of input mismatching.

Varying Contrast

There was a good picture on a colour set fitted with the ITT CVC5 chassis but the contrast sometimes varied, increasing then reverting to normal. This suggested a fault in the a.g.c. system which in this chassis is complicated by the fact that the bias from the a.g.c. generator is first applied as reverse bias to the base of the second i.f. transistor, which acts as an a.g.c. d.c. amplifier/inverter forward biasing the base of the first i.f. transistor from its collector circuit. Voltage tests under the fault condition revealed that the collector voltages of both transistors were the same as when the aerial was disconnected. Tests in the a.g.c. generator stage then revealed that the BA145 protection diode in series with its collector had high forward resistance. This diode was replaced and the set given a soak test during which there were no further gain variations. Clearly the diode had been going intermittently open-circuit, stopping the a.g.c. circuit functioning. When testing for any fault in a colour set it pays to automatically replace any suspect diodes even if completely unrelated to the fault under investigation. This guards against subsequent short-term failure and a complaint that other faults develop soon after your service call.



RANK'S REMOTE CONTROL SYSTEM

J. HEMMINGS

THERE is nothing new about TV set remote control systems, which have appeared at various times over the past twenty years. In the days of mechanical tuners however rather a lot of hardware was required. For the remote control of channel changing with a v.h.f. turret tuner for example a turret drive motor plus relays to start and stop it were necessary. Such systems were expensive, cumbersome and inclined to go wrong. We are now in the era of varicap u.h.f. tuners which can be electronically controlled by touch-sensitive arrangements however, and these lend themselves to electronically operated remote control arrangements. By using more complex transmitter units and control channels other functions such as volume and brightness can also be remotely controlled. The control system can be either via a cable or cordless.

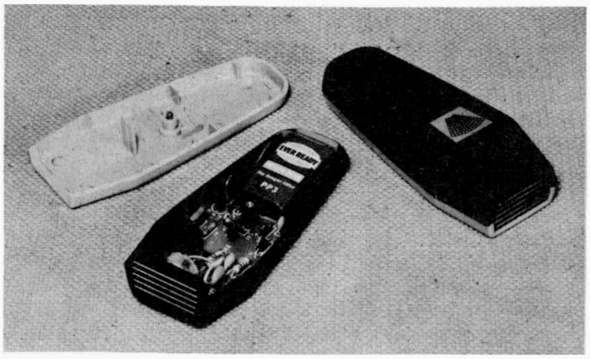
In the latest range of Bush colour receivers—the 18in. Model BC6111, 22in. Model BC6318 and 26in. Model BC6418—Rank have exploited the present possibilities in order to provide a low-cost remote control system which they offer as an integral feature instead of as an optional extra. The system is a cordless one giving sequential channel changing and also sound muting. These are the important features that a remote control system should provide—remote control of such things as brightness and colour should not be necessary with a correctly installed set operating under normal conditions.

The hand-held remote control transmitter unit, shown in the accompanying photograph, is certainly a simple device. Basically it consists of a 40kHz oscillator which drives a capacitive ultrasonic transducer. The circuit is shown in Fig. 1 and it will be seen that the single transistor used, 11VT1, forms part of a straightforward Hartley oscillator circuit. When the spring-loaded remote control pushbutton switch 11SW1 is depressed the oscillator is powered by the 9V battery. A secondary winding on the oscillator transformer 11L1 is tuned by 11C3 and produces a 300V peak-to-peak sinewave signal which is fed to the transducer 11LS1 via 11C6. The transducer also requires a 300V d.c. polarising voltage: this is obtained by feeding the 300V sinewave signal to the half-wave voltage doubling rectifier circuit consisting of 11C4, 11D1, 11D2 and 11C5. The high-value resistor 11R2 prevents the a.c. signal to the transducer being short-circuited by 11C5. Thus whenever the pushbutton is depressed a burst of 40kHz oscillation is transmitted.

The remote control receiver unit in the set is rather more elaborate, using twelve transistors. The receiver channel starts with a capacitive transducer which is built into the front of the set. It is of the same type as that used in the transmitter, but requires a lower polarising voltage (188V). When this transducer receives a short burst of signal, lasting from 0·25 to 1 second, the channel changes, each successive burst changing the channel in sequence. A longer burst of signal, about two-three seconds, mutes the sound, while a further short burst restores the sound without changing channel.

The receiver channel is shown in block diagram form in Fig. 2. The receiving transducer output is first fed to a three-stage amplifier which incorporates high-pass filtering to provide a degree of low-frequency noise immunity. The third stage consists of a differential amplifier with a 40kHz tuned output circuit. Clipper diodes are incorporated between the second and third stages to give as nearly as possible an amplitude limited signal with a 1:1 mark-space ratio: this is done to enable the receiver unit to operate with widely varying signal levels. The detector stage following the amplifier has a time-constant of approximately 10mS to reduce interference from short bursts of spurious signals. The output from the detector is fed to a Schmitt trigger circuit which provides a well-defined squarewave pulse to operate the pulse length discriminator circuit.

The pulse length discriminator is necessary in order to discriminate between short (channel change) and



Photograph showing details of the hand-held ultrasonic remote control transmitter unit.

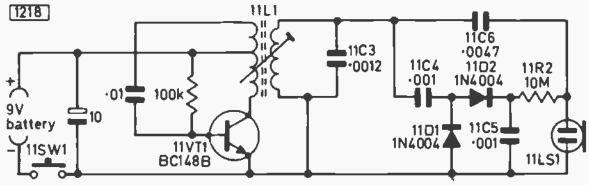


Fig. 1: Circuit of the transmitter unit. Capacitive transducer 11LS1 provides an ultrasonic output at 40kHz.

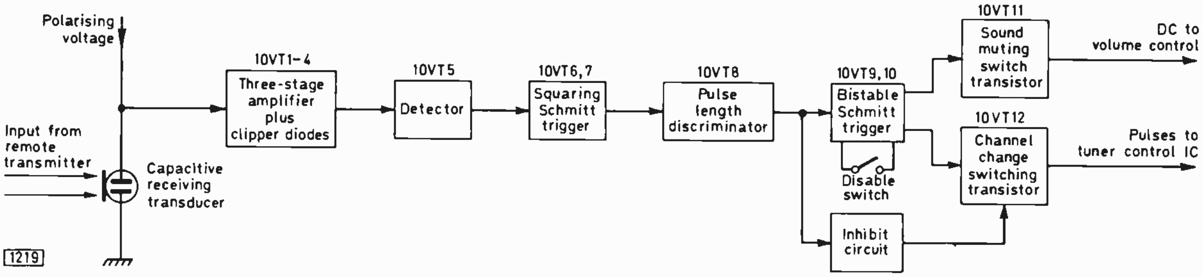


Fig. 2: Block diagram of the remote control receiver channel.

long (sound muting) signals. When a short burst of signal is received this will be differentiated by the circuit, giving positive and negative-going pulses from the front and back edges of the squarewave input. When a longer signal is received however the time-constant of the circuit prevents the trailing edge of the square-wave producing a negative-going pulse. Thus a short burst produces both positive- and negative-going pulses while a long burst produces positive-going pulses only.

The following bistable circuit, a Schmitt trigger type, changes state on receipt of either positive- or negative-going input pulses.

Control Actions

The sound muting switch consists of a transistor which returns the volume control to the supply line when it is conducting, open-circuiting the supply to the volume control when it is not conducting (a d.c. volume control operating in conjunction with an intercarrier sound channel i.c. is used). The sound muting transistor is driven from the collector of the bistable circuit output transistor. A positive pulse at the input to the bistable circuit mutes the sound, while a negative pulse restores it. Thus when a positive pulse only arrives at the bistable input—the condition when a long burst of signal is received—the sound is muted, this condition continuing until a negative pulse derived from a short signal burst appears at the input to the bistable.

The channel change system used in these models is shown in Fig. 3. The heart of the arrangement consists of an Emihus m.o.s.f.e.t. shift-register i.c. that determines which tuning potentiometer output is applied to the varicap tuner unit to tune it. A series of touch

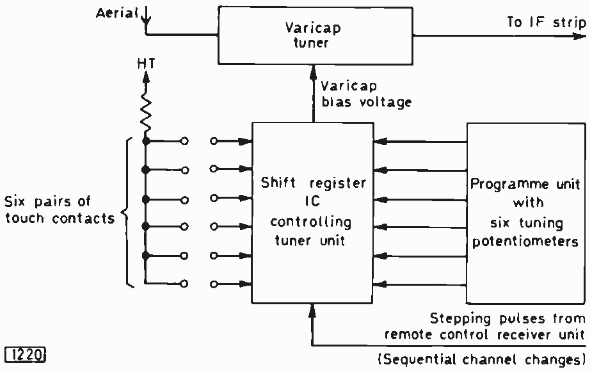


Fig. 3: Method of controlling a varicap tuner using touch-contacts and a shift-register i.c. An extra input to the i.c. enables stepping pulses to be applied to give sequential channel changes

plates switch the i.c. whenever contacted. The i.c. also has a stepping input which is driven by pulses from the remote control receiver unit. Each pulse from the receiver unit steps the shift register to its next position, giving sequential channel changes.

Returning to Fig. 2, the channel change switching transistor 10VT12 in the receiver unit is driven from the emitter of the output transistor in the bistable circuit. As we have just seen, its output pulses are applied to the stepping pulse input pin of the varicap tuner control i.c. 10VT12 is normally non-conducting: a negative pulse at the input to the bistable followed by a positive pulse—obtained from a short channel change signal from the transmitter unit—switches 10VT12 on briefly to provide a negative-going output pulse at its collector. There is no output from 10VT12 when a positive pulse only appears at the input to the bistable since this produces a negative transition at the base of 10VT12 which is an npn transistor held normally non-conducting.

To summarise these conditions: a single positive pulse at the input to the bistable circuit cuts off the sound muting transistor 10TV11 and has no effect on the channel change switching transistor 10VT12; a negative pulse at the input to the bistable restores the sound or produces a channel change. How does the channel change switching transistor distinguish between the commands "channel change" and "restore sound", i.e. why doesn't the channel also change when the sound is restored by a brief burst from the transmitter unit?

To distinguish between these two commands an inhibit circuit is connected between the pulse length discriminator transistor and the base circuit—which contains a time-constant network—of 10VT12. The inhibit arrangement ensures that channel changing cannot occur while the sound is muted and that 10VT12 ignores the effect of the first negative pulse at the bistable input following sound muting.

A disable switch is provided at the front of the set to enable the viewer to over-ride the remote control system. This is useful if interference with which the system cannot cope is experienced. When the switch is closed the bistable circuit input impedance is reduced and the signal pulses are attenuated sufficiently to prevent channel changing, while at the same time a short-circuit is placed across the bistable so that 10VT11 remains conducting and normal sound output is obtained.

All in all Rank have ingeniously exploited the possibilities provided by the latest varicap tuner control techniques to produce an economical remote control system. Certain Murphy models will also feature it: to start with the 22in. Model MC6309 and 26in. Model MC6409. ■

LETTERS

TRADE TEST TRANSMISSIONS

The editorial in your April 1975 issue is a very understandable reaction to the decision that the BBC had to make in connection with trade test transmissions on BBC-2. We were, of course, very well aware that this would cause some hardship to the trade but in a climate where we are required to make very substantial economies, and with the knowledge that any curtailment of our services must inevitably cause inconvenience to some section of the community, this particular service had to suffer.

The BBC-2 network consumes in aggregate more than 5,000 kilowatts of electricity through 150 transmitters and it must, therefore, be seen as an extremely expensive and inefficient signal generator when it is used simply as an item of test equipment for the serviceman. You will be familiar with the fact that the licence fee increase recently granted to us, although reasonable in the present state of the national economy, is still less than we had sought. The BBC does not expect to be exempt from the need for economy and its viewers are clearly entitled to expect that as much as possible of their licence fee will go into programmes: this economy, we believe, will deprive them of virtually nothing.

We conducted a good deal of research into the possible effects upon the trade and had many consultations before taking our decision, which we did in the end with very great regret but a firm conviction that it was right. We have been careful not to curtail test transmissions on Saturdays when we know that a great many sales and rentals are finalised, and we are very well aware that there are occasions when the presence of all three transmissions is important to television aerial contractors and servicemen. Nevertheless, with the appropriate test equipment, which must now be considered a normal part of an adequate tool kit, only a small proportion of visits need be timed to coincide with the morning and afternoon transmissions that we have managed to retain in our schedule. We are sorry that it is a nuisance to the serviceman and we have to invite his co-operation in fitting in his jobs to suit the revised pattern of transmissions.—**C. B. B. Wood** (*Head of Engineering Information Department, British Broadcasting Corporation*).

As a service technician working for a large rental company I wrote to the BBC to point out that it is difficult to set up a colour receiver without a test card and that it is not every company that can afford to equip each engineer with a colour bar/crosshatch generator. They replied to the effect that they do not agree that it is difficult to set up a colour receiver without a test card and that it can be done with suitable test gear in the workshop. Does the BBC really think that we can pick up each set and run it back to the workshop every time we want to adjust the static convergence, height, linearity etc.?

One's heart sinks when on walking into a customer's home and hearing that "the set has no colour" one switches on and finds BBC-1 and ITV both showing schools' programmes or grainy old monochrome films made in the year dot. What can the engineer do apart from over-riding the colour killer to see whether colour grain is produced and working from there? But this is not satisfactory for the engineer or the customer.

I urge other readers of *Television*, especially those in servicing professionally, to complain bitterly to the BBC. A few hundred letters might make them sit up and take note.—**I. C. White** (*Wellingborough*).

SIGNAL STRENGTH METER

I have built the signal strength meter described in your December 1974 and January 1975 issues and made certain modifications to improve its operation. Since these may be of interest to other constructors I am listing them below. (1) Using a 1mA meter I found it necessary to reduce the value of the series resistor R2 to about 2k Ω in order to obtain full deflection (I bridged the original 6·8k Ω resistor with a 4·7k Ω resistor). After doing this VR5 could be adjusted to give an exact full scale reading—adequate signal strength must be available of course.

(2) To improve the sensitivity of the low range I removed D8 and D9 and replaced them with a wire link. Putting one of these diodes in series with the high-sensitivity switch position eliminated the 20% deflection that occurs when the instrument is switched on and there is no signal.

(3) I found it difficult to see the l.e.d. glow in daylight even with a hood fitted. To improve matters I used a 100μA meter (see Fig. 1) to give a definite indication regardless of daylight conditions.

I have housed the entire unit in a wooden box and it has proved to be an invaluable piece of equipment. —**L. E. Fleming** (*Homerton, London*).

Caleb Bradley comments: Certainly do not reduce R2 below 2k Ω or one day a strong signal may wrap the meter needle around the endstop. The meter is fully protected with the original value given.

Deflection when there is no signal could be caused by tuner and i.f. strip noise or by slight instability. The distinction is that as VR5 is adjusted the noise level varies progressively whereas instability causes the needle to swing suddenly. Suppressing the small no signal deflection on the high-sensitivity range by putting a diode in series with the meter will mask very weak signals—this may be no disadvantage of course. The same result can be achieved while keeping a linear scale by reducing the value of R11.

It seems rather extravagant to add a moving-coil meter to do the job of the l.e.d.! Much simpler to add a pushbutton switch across R16: pressing this brightens the l.e.d. considerably with only momentary battery drain.

SERVICE FROM DISCOUNT HOUSES

Vivian Capel in his article on *Colour Receiver Preinstallation Checks* (March) comments that: "The problem is aggravated by discount houses. As a rule they sell sets in the carton, or make only a cursory check to see that a set is working".

McOnomy is the exception. Our colour sets are unpacked, soak tested for at least 24 hours, adjusted where necessary, and installed in the customer's home. Where the customer prefers to take the set with him it is still unpacked and tested, then repacked. If the customer is not satisfied with the set when he connects it up at home we send a fully qualified television engineer to set up the receiver in situ. A lot of

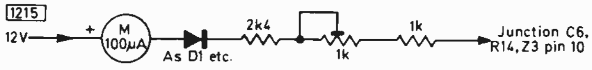


Fig. 1: Vision signal indicator using a 100μA meter. Connections from this meter circuit to the signal strength meter are made via a lead and "Roka" plug and socket so that the l.e.d. is in use when the plug is disconnected.

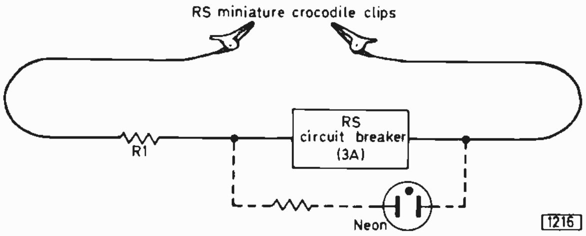


Fig. 2: This simple arrangement saves fuses when testing for short-circuits.

customers ask for the set to be seen boxed with the seal unbroken. We even satisfy this request and still set up the receiver afterwards.

All goods are on show. Television sets and audio equipment are displayed working for customers to try out before buying. We give twelve months' free parts and labour on all television and audio equipment. Colour sets are repaired in the home up to thirty miles from the store without charge by fully equipped City and Guilds Colour Certificate qualified engineers who can attend within a day of receiving a call from a customer.

It seems time for the bad reputation given to discount retailers because of the bad practices of a few to be rectified. Discounters now seem to be the only companies that can still afford to pay for the few good engineers available (those who have not gone off to South Africa). We have to give our customers good service and I consider that we do a darn sight better than some of the "corner shop retailers" who claim to give personal service. And our customers get a large discount to boot!

With regard to the comment in *Teletopics* on minor faults in new receivers I would like to point out that when hundreds of colour sets a week are pre-checked, soak tested and installed these minor faults become major expenses. The manufacturers often give discounts to cover this sort of repair but even though most retailers deal with them they should nevertheless make the manufacturers aware of how much has to be spent on repairs—otherwise we just hide from them the poor workmanship and non-inspection of their goods before delivery.—**P. Wraith, Service Controller, McOnomy Ltd.** (*Kingston-upon-Thames*).

SHORT-CIRCUIT CHECKER

In the event of a short-circuit thyristor or rectifier the 20mm. fuses commonly fitted can make quite a noise, with glass shattering everywhere. The device shown in Fig. 2 can be used when testing to prevent this and indicate whether a short-circuit is still present by tripping out. If a small neon indicator is added across the circuit-breaker this will give further proof by lighting when a short-circuit exists. R1 prevents the maximum short-circuit current (20A) of the RS circuit-breaker being exceeded—a value between 12Ω and 20Ω is suitable.—**Alan Kuhlman** (*Earls Barton, Northants*).

CURRENT

Regarding your leader (February) on electronic and conventional current I have felt strongly on this subject for many years. If it was possible to agree to reverse the use of the terms positive and negative—they were only arbitrarily chosen and have since proved to be the wrong way round—understanding an electric current would be made very much easier. Current is a flow of electrons from where there is a surplus to where there is a deficiency: this could then be correctly defined as being a flow from positive to negative, and we could talk of current flowing from the positive cathode to the negative anode as in fact it does. As it is now one has to bear in mind that the arrows in the symbols for diodes and transistors are always in the direction of the mythical "conventional current".—**R. V. Goode** (*Totland Bay, Isle of Wight*).

Editorial comment: This would indeed make everything much simpler. Such a changeover would probably be impossible to bring about however because of the confusion that would arise with the vast amount of equipment and components already marked positive and negative in accordance with the present convention.

I must confess to be surprised at the views you express in your February leader on the flow of conventional current. Although newcomers to the field of electronics are often puzzled by the two conflicting concepts this is surely no reason for rejecting a perfectly valid theory. In order to standardise on a system of units electric current has been defined as the rate of flow of *positive* charge. Thus if one Coulomb of charge passes along a conductor in one second a current of one Ampere is said to be flowing. The confusion lies in the fact that in the days when the phenomenon of electricity was first being investigated the electron, which is in fact responsible for current flow, was given an arbitrary *negative* charge and thus flows in the cpposite direction to the current which it is carrying. In these days when thermionic devices are rapidly becoming obsolete the problem can be solved simply by forgetting entirely about the presence of electrons. It is easy then to remember that current flows from a point of positive potential to one which is less positive. The present trend seems to be in favour of conventional current and I feel that you may be misleading your readers by adhering to the old concept of electron flow.—**J. Naulls** (*Plymstock, Devon*).

Editorial comment: We stick to our view that it is simplest to concentrate on electrons, with their conventionally negative charge, and certainly don't agree that in thinking about solid-state devices electrons can simply be forgotten—their operation after all depends on the controlled flow of electrons through them.

AN EXPENSIVE FAULT

I recently had the misfortune to encounter the following fault. It may serve as a warning to others. The set was one of the GEC group's dual-standard receivers, a Model 2013. It was brought into the workshop with the report that "it went bang and stopped working". Tests revealed no sign of a short-circuit, but the heater

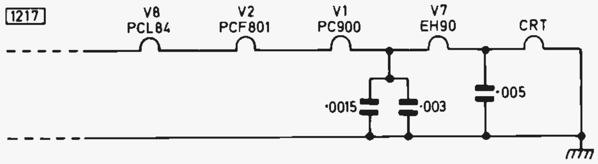


Fig. 3: A rather expensive repair was caused by the audio PCL84 shorting intermittently. This valve is rather notorious for interelectrode shorts.

chain was found to be open-circuit. This was traced to the frequency changer valve (V2, PCF801) in the v.h.f. tuner unit. On fitting a new valve the set performed as new. As we had found no explanation for the "bang" however the set was left running in the corner of the workshop. After about twenty minutes there was a loud bang from the loudspeaker and the picture flared up before going out. Rushing over to switch off I was just in time to notice that the c.r.t. heater was extremely bright. Static tests again failed to reveal any short-circuit, but this time the EH90 (V7) heater was found to be open-circuit. Fig. 3 shows the earthy end section of the heater chain. It seemed that the most likely cause of the trouble was an intermittent short-circuit in the PCL84 audio output valve (V8), probably the screen grid shorting the full h.t. to the heater line. The PCL84 and EH90 were replaced therefore but although the set then worked the picture was very dim and the gain low. To restore the original performance the c.r.t. and both v.h.f. tuner valves had to be replaced. Thus what should have been a simple PCL84 sound output valve replacement turned out to require five new valves and a new 23in. c.r.t. A very expensive fault!—**K. J. Dicks** (*Stoke-sub-Hamdon, Somerset*).

WHISTLING AND SCREECHING

With reference to the sound fault—whistling and screeching—experienced on a Bush Model TV141 (*Your Problems Solved*, March), we have also experienced this problem on a couple of these sets. The symptoms were exactly as described. When the first set came into the workshop we tried all the most likely components, including the valve of course. None of these replacements made any difference whatsoever. It was then noticed that applying freezer almost anywhere around the audio valve would either reduce the whistle or temporarily cure it altogether. We tried most of the things you suggested, then changed the valveholder. Still the fault persisted! The only other possibility seemed to be leakage through the printed panel so we cut away all the paxolin around the triode anode and grid pins, using a very small twist drill. This completely cured the trouble. The second set responded to the same treatment. In neither case was the paxolin panel seriously discoloured—just the usual slightly darker colour around the valveholder. I hope this will assist other readers.—**J. Adams** (*Oxford*).

CORRECTIONS: VARICAP RF MODULATOR

The connection between C26 and C25 in Fig. 2 should be shown broken since pin 10 is used to mount C34.

The input tag to be disconnected and removed, shown at the top right in Fig. 4, is incorrectly labelled "i.f. output"—it is the aerial input tag.

LONG-DISTANCE TELEVISION

—continued from page 350

colour after a time but the Band III channels remained in monochrome until station close down. It seems that the local CATV (communal TV) systems were also affected by the fade out, so it wasn't a fault in Clarke's receiver. Has anyone any explanation for this strange event?

From Our Correspondents . . .

Once again there is unfortunately little space for comments from readers' letters and we must hold over the long reports from our Australian contingent.

G. Wright (Gorleston-on-Sea, Norfolk) lives in an area well known for excellent reception and first discovered the possibilities of DX-TV whilst changing channels on his Sony colour receiver. At the end of February the Dutch first and second chains came in so strongly that they were of similar quality to the local Anglia service! BRT and RTB (Belgium) were also received, though with a little fading, together with some West German transmitters. G. Wright is now improving his installation and we look forward to hearing from him of further successes—his East Anglian location is almost a guarantee of this!

Nigel Hanwell (Stocksbridge, Sheffield) has still been unable to identify positively his suspected reception of Jordan last year. Due to a visit to the USA he missed the July/August Sporadic E season. He comments that "most people I met in the US had colour TV but the quality of the colours displayed was generally rather poor". Nigel's stay was in Chicago which has network stations WBBM-2 (CBS), WMAQ-5 (NBC) and WLS-7 (ABC). WBBM is virtually a 24-hour operation, closing for approximately thirty minutes daily (time depends on the ending of the "late-late" movie). Colour on these stations was poor: it was better on the local channels 26, 32 and 44, and the Public Broadcasting channel A11. The WCIU (ch. 26) programmes are mainly in Spanish and Polish. The WFLD (ch. 32, Kaiser Broadcasting Company) and ch. 44 (mainly sport and Mexican programming) transmitters are atop the Hancock building while the WMAQ transmitter is atop the Sears Tower (the World's tallest building). Most blocks have at least one u.h.f. dish aerial plus rotor to pull in the Milwaukee and South Bends transmitters. People on cable TV systems have a choice of up to 21 programmes. Outside aerials on single houses are mostly log-periodic types covering Bands 1-5.

SERVICING TV RECEIVERS

—continued from page 373

problem ourselves, of the fault "line shake" due to C211 and C212 (single-standard chassis component reference numbers) in the line oscillator circuit. It is recommended that these should be replaced using the best polystyrene or polyester types available.

Finally we have noticed that failure of C226 (0·001µF) in the e.h.t. multiplier circuit is becoming more common, resulting in the first stick in the e.h.t. tray burning out. The 2·5A mains input fuse blows since the PY500 efficiency diode will have been virtually a short-circuit across the h.t. line. So if there is a nasty smell fit a new capacitor, e.h.t. tray and mains fuse, and check the PY500.

NEXT MONTH: PHILIPS G6 CHASSIS

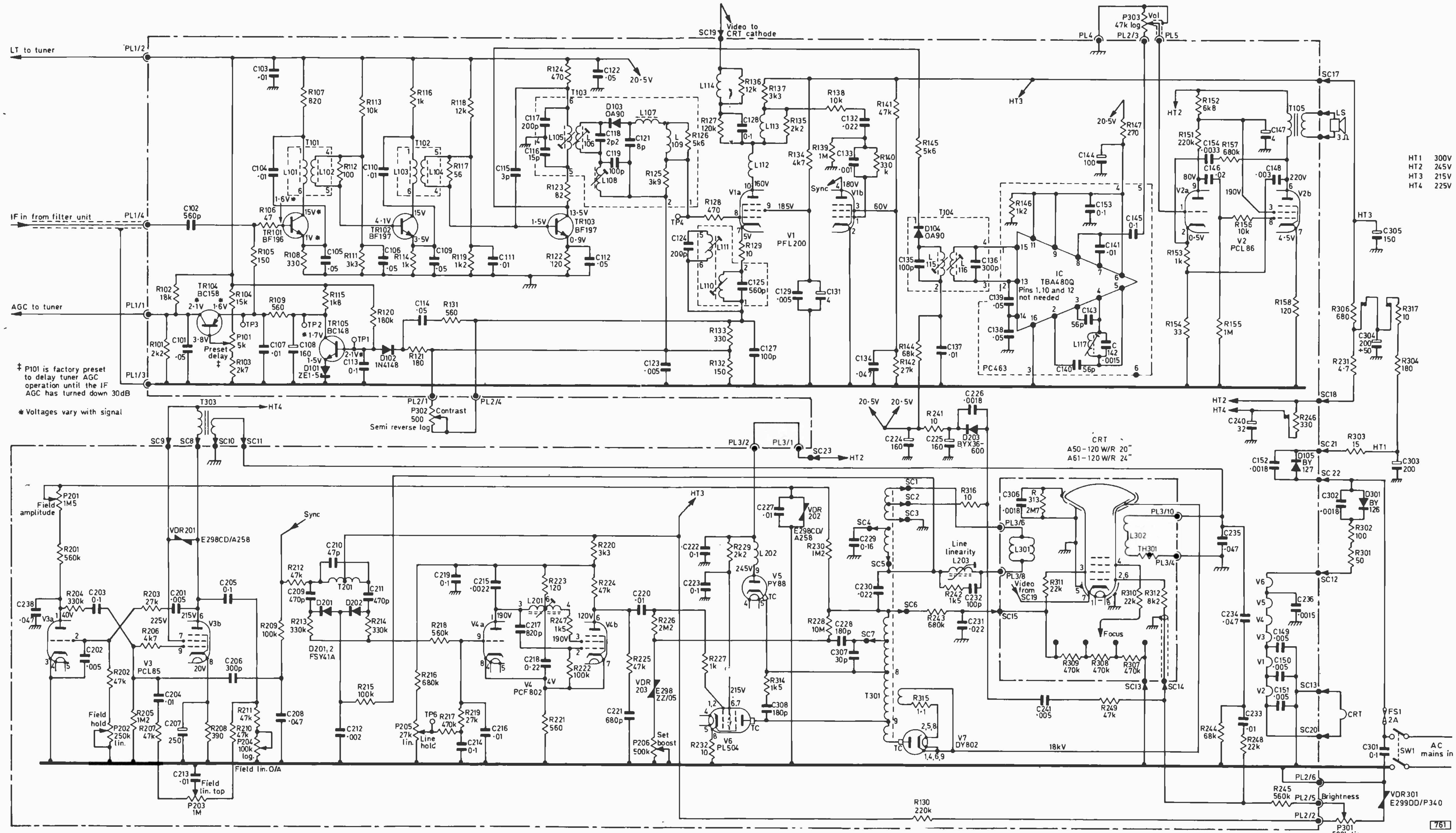


Fig. 1: Basic circuit, GEC Series 1 and 2 chassis (tuner and i.f. filter unit circuits omitted). Note that a number of different intercarrier sound i.c.s have been used during the production run. In some sets an additional 41.5MHz rejector coil assembly is fitted in place of C109 in the emitter circuit of TR102. R232 in the cathode circuit of the PL504 line output valve is added on later models: a ¼W carbon film resistor must be used in this position. The heater decoupling capacitor C236 is omitted in later production. The 1N4005 diode is an approved replacement for rectifier D203 (a fast switching type must be used).

With the later deflection yoke introduced during the production run of the Series 2 chassis the following timebase component value changes will be found: field timebase R201 330kΩ, R205 470kΩ, C213 0.022μF; line timebase R225 56kΩ, C229 0.22μF, C307 total value 60pF (may be two capacitors wired in parallel).

The following changes will be found in the later 3000 series (with varicap tuner): R204 470k Ω, R205 680k Ω, R207 270k Ω. A resistor (R110) is connected in parallel with R102 in the a.g.c. circuit: this was originally 180k Ω but was reduced to 56k Ω to give improved performance.

The operating frequency of multivibrator and blocking oscillator circuits is determined by *RC* networks. These cannot define the frequency precisely. As a result if a flywheel line sync circuit is used with these types of oscillator it must be able to draw the oscillator into synchronisation over a wide frequency range. This means that the time-constant of the flywheel sync filter circuit must be short and in consequence the noise immunity is poor. The frequency stability of a sinewave oscillator on the other hand is very high and in conjunction with a reactance triode only a narrow pull-in range is required from the flywheel sync circuit. A long time-constant filter circuit can be used therefore. The overall result is excellent sync lock with good noise immunity. The preset line hold control P205 sets the basic bias applied to the grid of the triode section of the PCF802.

Line Output Stage

The line drive waveform is shaped by R224, R225 and C221 and fed via C220 and R227 to the control grid of the PL504 line output valve. The junction of C220/R227 is returned to chassis via R226, VDR203 and the set boost control P206. A positive-going line flyback pulse is fed via C228 to the junction of R226 and VDR203. As a result of the non-linear characteristics of the v.d.r. a negative voltage is produced and applied to the control grid of V6 along with the drive voltage. A positive voltage is applied to the circuit via R228 from the boost rail (C230 is the boost reservoir capacitor). P206 sets the bias at V6 control grid.

Any rise or fall in the mains supply voltage will increase or decrease the scan width and the amplitude of the pulses fed back to the v.d.r. An increase in the mains supply will increase the negative bias at V6 control grid, reducing the stage gain and scan width to compensate. The opposite happens when the mains supply falls. The circuit thus acts as a scan width stabiliser, automatically compensating for mains voltage fluctuations.

The rest of the line output stage follows normal practice, with V5 the boost rectifier and V7 the e.h.t. rectifier. A winding on the line output transformer T301 feeds the scan rectifier D203 which produces the l.t. supply for the transistor stages. If D203 has to be replaced a fast-switching type must be used. R316 provides protection by acting as a fuse: if a replacement is required it must be a ¼W carbon film type.

Field Timebase

The field sync pulses are integrated by R209 and C208 and applied to a conventional PCL805 field timebase circuit. Cross-coupling between the triode and pentode sections of the PCL805 results in multivibrator action. The triode section conducts briefly to generate the flyback, discharging the field scan waveform charging capacitor C238. During the scan this charges from the boost rail via R201, the height control P201 and R230. R230 together with VDR202 form a potential divider which stabilises the height. VDR201 across the primary of the field output transformer limits the peak voltage developed across this winding. The field linearity feedback loop consists of C205 etc.

Power Supplies

The back-to-back diodes D301 and D105 are centre fed from the mains input and provide the valve heater and h.t. supplies respectively.

Faults

These chassis have proved very reliable. As in any other set however valves and other components can fail. The following notes concentrate on faults experienced in the timebase sections.

Tackling Field Troubles

When faced with a field timebase fault the first action should be to inspect the printed panel, looking for signs of burning or overheating on the panel around the PCL805 base and also in the associated components, particularly the pentode cathode bias resistor R208. The next step should be to change the valve. This takes only a few seconds and can save a lot of time and trouble that could otherwise be taken up in searching for the cause of an elusive fault. Be sure the replacement valve is new and not one rescued from another set. A rescued valve may work satifactorily for a time but is not to be relied upon. It pays to be ruthless with PCL805 valves: when in doubt throw it out. The modest cost of a new valve is well spent, an investment in reliability.

A faulty PCL805 can cause the following symptoms: collapse of the raster to a single horizontal line across the screen, field roll or jitter, or a small picture with gaps at the top and bottom though usually linear. The latter fault is due to failing emission of course, the power output being reduced so that the screen is no longer filled. A good PCL805 will give 7W output.

Horizontal White Line

Field collapse can be caused by other faults however. In one GEC Model 2047 a replacement valve failed to restore the raster so we brought our Avo meter into use to check pin voltages. There was no voltage at the triode anode pin 1. R201 was normal at 560k Ω but there was no voltage across it. Proceeding along to the height control P201 we found voltage at one end and at the slider: the track was open-circuit where it joined the tag at the other end however. A replacement potentiometer restored the voltage and cleared the fault.

On another set the same fault was traced to a lead to the field scan coils having come adrift. A touch with the soldering iron cured this trouble.

Lack of Height

A small picture with good linearity was the complaint with a 24in. model fitted with the Series 1 chassis. A very low voltage reading was discovered at pin 1 of the PCL805. Note that due to the high value of R201 and P201 combined, over 2M Ω, a meter between pin 1 and chassis will decrease the actual voltage since it will form the bottom leg of a potential divider chain. To minimise this effect the meter must be switched to the highest range that will give a usable reading on the scale—GEC recommend using a 20k Ω/V meter (e.g. Avo Model 8) to obtain the specified reading of 40V. Tracing the voltage back to the boost line we discovered that the voltage at the junction of R230 and VDR202 was low. Voltage-dependent resistors are

FAULT FINDING GUIDE

John Law

GEC SERIES 1&2: TIMEBASES

THE arrangement of the chassis used in large-screen GEC single-standard monochrome receivers marked a complete break from the familiar horizontal printed panel layout which had been used for many years in a succession of dual-standard models. The chassis occupies the bottom half of the cabinet and is of box construction with a vertically mounted printed panel. The screened line output section is on the right-hand side.

Model Numbers

The following models are fitted with the Series 1 chassis: GEC 2047, 2065 and 2082 (all with A50-120W/R 20in. c.r.t.s), 2048, 2066 and 2083 (all with A61-120W/R 24in. c.r.t.s); Sobell 1047 and 1065 (20in.), 1048 and 1066 (24in.). The Series 2 chassis is basically the same except that it uses a different mechanical tuner while the mains dropper (h.t. section) is moved to the right-hand side and the position of the main electrolytic capacitor block is changed slightly. It is used in the following models: GEC 2084 and 2104 (20in.), 2105 (24in.); Sobell 1101 (20in.) and 1102 (24in.). The same basic chassis is used in the subsequent range of GEC models which feature a varicap tuner unit. These are the 3122, 3124 and 3130 (20in.), 3123 and 3125 (24in.).

Modifications

The electrical modifications which should be noted are as follows. In later versions of the Series 2 chassis a new scan coil assembly was introduced. Along with this change other component changes took place to suit the new coils. The modified field and line output transformers and line linearity coil can be used in earlier models without modification, and no changes are required on the printed panel. The later line output transformer (L310004) has an additional tag at the end of the horseshoe cheek, adjacent to SC1 (see Fig. 2). With the earlier scan coil assembly connection SC1 must be used and the extra tag left blank: C307A must not be present, the total C307 capacitance being 30pF. With the later scan coil assembly the original connection SC1 must be left blank and the new tag used, while C307A must be fitted to ensure that the total C307 capacitance is 60pF. Series 2 models incorporating the later scan coil assembly and associated modifications have the suffix B after the model number.

In addition to the varicap tuner the 3000 series models incorporate modifications to meet BEAB approval requirements. These affect the physical nature of certain components rather than their value: it is essential that identical replacements are used. There are also one or two component changes on the printed panel. These are described under Fig. 1.

Technical Features

There are some interesting technical features of these chassis. The vision i.f. stages (TR101-3) are wideband and are preceded by a filter unit attached to the tuner to determine the basic pass band and selectivity of the i.f. section. The filter unit used in varicap tuned models incorporates an additional stage of i.f. amplification (TR151, BF196). There are two transistors in the sync tip a.g.c. circuit, and this in conjunction with the flywheel sync and low-noise tuners ensures a steady locked picture even under weak signal conditions. The intercarrier sound channel consists of an integrated circuit mounted on a small sub-panel. Several i.c.s have been used. The one used in earlier models is the TAA570; later models mainly used the TBA480Q.

A PFL200 (V1) is used as video amplifier and sync separator. Negative-going sync pulses appear across R131 in its cathode circuit and are rectified by D102 to provide the a.g.c. potential. The contrast control P302 operates partly by varying the gain of the video amplifier and partly by controlling the amplitude of the sync pulses fed to D102. C113 acts as reservoir for D102. The a.g.c. amplifier TR105 controls the forward a.g.c. applied to the first i.f. strip transistor TR101 while TR104 acts as a delay mechanism controlling the application of a.g.c. to the tuner unit.

Flywheel Line Sync

The timebases are conventional. T201 in the anode circuit of the sync separator V1b generates antiphase sync pulses which are fed via C209 and C211 to the flywheel sync discriminator diodes D201 and D202. A reference pulse from the line output transformer is integrated by R215 and C212 and fed to the junction of the discriminator diodes. The control voltage obtained depends on the phase relationship between the sync pulses and the reference sawtooth and is fed to the control grid of the triode section of V4. This acts as a variable capacitor, forming part of the line oscillator coil (L201) tuning. The pentode section of V4 is the sinewave line oscillator, the feedback being between the screen grid and control grid via L201 and C217.

normally very reliable and cannot readily be tested except by substitution. In this case however a replacement v.d.r. restored normal voltage and cleared the fault. It is more usual to find that R230 has increased in value, reducing the PCL805 pin 1 voltage and the picture height.

Field Linearity Faults

Over a period of time the pentode cathode decoupling capacitor C207 will dry up and loose capacitance. The negative feedback developed across R208 as a result will caused reduced height plus bottom compression.

In one case visual inspection of the chassis following a complaint of a small picture with bottom cramping revealed a badly charred cathode bias resistor (R208) with its soldered contacts dry and dirty. The panel was cleaned and a new resistor fitted therefore. A burnt cathode bias resistor indicates excessive current flow which in turn suggests heater-cathode leakage in the valve. Consequently before switching the set on a new valve was fitted.

On switching the set on the picture just filled the screen but the bottom still curled up. Adding a 200μF capacitor across the existing decoupler (C207) straightened out the raster, so C207 was removed and checked. Its internal resistance was found to be 600 Ω. It appeared that the heavy current resulting from the heater-cathode leakage in the PCL805 had over-run R208 until it had burnt out: the pentode cathode voltage had then risen to the anode voltage and the low-voltage decoupling capacitor had broken down, developing the approximately 600 Ω internal resistance so that the valve continued to operate though with a high bias voltage. This gave a small raster with bottom cramping since the valve was operating on the wrong part of its characteristic curve.

Line Timebase: No EHT

No raster and no timebase whistle means no line oscillation and no e.h.t. The question is why? There are five valves in the line timebase and any one of them could be the culprit. The problem is to pinpoint the trouble in the shortest time. First, as always, lay down the tools and meter and use your eyes. Are there any telltale signs of burning on the printed panel or any of the components? If not, switch the set on and see that the heaters are alight. If the e.h.t. rectifier does not light up it could be faulty: more likely however either the PL504 (probably) or the PY88 has died.

Watch the screen grid of the PL504: if it glows red but its anode remains cold this suggests screen grid voltage but no anode supply. Since the anode current flows via the boost rectifier this could mean, as happened in a recent case, that the PY88 cathode is disconnected.

Another possibility is that no e.h.t. is due to the boost capacitor C230 being short-circuit. Since in these chassis the boost capacitor is returned via the line linearity coil (L203), the line scan coils (L301) and contacts SC1-SC3 on the line output transformer to chassis V6 will have no h.t. while the PY88 will be very unhappy. Probably the fuse or R303 will be open-circuit.

If all is in order thus far, replace the e.h.t. rectifier valve: a faulty rectifier will kill the e.h.t. and frequently results in the line whistle having an unusual note.

No e.h.t. with the PL504 running cool calls for a

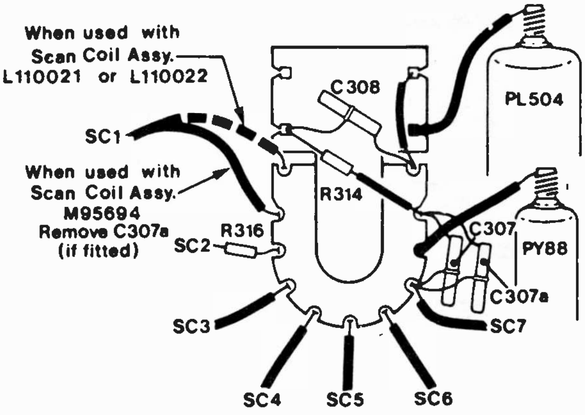


Fig. 2: Connections to the line output transformer. Note differences with later type (see text).

check on its screen grid voltage: the 2·2k Ω 4W feed resistor R229 can go open-circuit.

If on the other hand both the screen grid and anode of the PL504 are glowing excessively there is voltage at both electrodes but excessive current is flowing through the valve. If the set is left running in this condition the PL504, PY88 and the line output transformer will be damaged. The fault is loss of drive to the PL504 and the usual cause is that the line oscillator valve (PCF802) has failed. A defective coupling capacitor (C220) will also remove the drive.

Hold, Width, Striations

A more common fault caused by the PCF802 is loss of hold with the hold control at the end of its track. In cases of poor line hold replace the PCF802 and if necessary check the flywheel sync discriminator diodes D201 and D202.

Lack of width can be caused by the PL504, the PY88, R228 going high-resistance, or the set boost control P206 being faulty. P206 must be replaced if it is found to be defective.

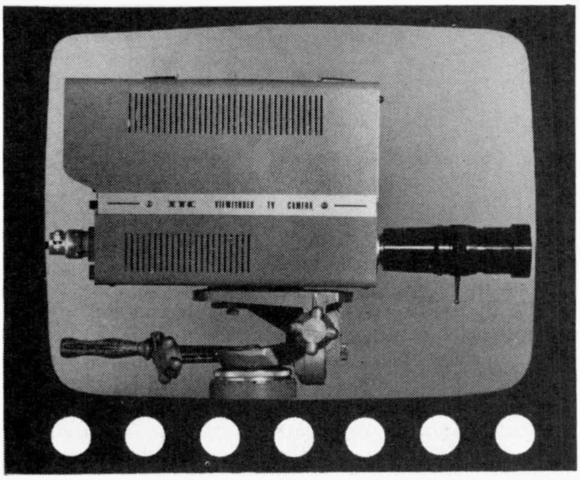
Depending on the deflection coils fitted either a line linearity coil—L203 as shown in the circuit diagram—or a linearity sleeve may be used. In earlier versions the coil is damped by a 1·5k Ω resistor (R242) only—striations on the left-hand side of the screen should direct attention to this resistor. In later versions a 100pF capacitor (C232) is connected in series with the resistor.

Power Supply Tips

There are a couple of points worth noting in connection with the power supplies. First, since the l.t. supply is obtained by scan rectification from a tap on the line output transformer it is most important that the boost voltage is set correctly—for 890V at SC6—otherwise the l.t. rail and the transistor stages will be affected. The first symptom that will be noticed is distorted sound. The other point is that the heater dropper assembly R302/R301 can burn out if the mains lead is draped around it. We have found this to be the case in a few sets and the answer is to replace the assembly *and* move the lead (don't just add insulation).

To date we have had few unusual faults on these chassis. Maybe in time . . .

CCTV



PART 15

Peter Graves

In many respects a monitor for CCTV is very similar to a domestic receiver without its r.f., i.f. or sound stages, though some monitors are equipped to relay programme sound from a studio. The video amplifier input must be suitable for the amplitude and impedance levels of the video signal (1·0V or 1·5V p-p for composite video signals). A switch is often fitted to select internal or external synchronising signals. In the internal position the syncs are stripped from the composite video in the normal way while in the external position syncs (line and field) are supplied separately from the sync input allowing the use of non-composite video inputs (Fig. 1). Most monitors have loop-through inputs on both video and sync to enable other monitors (and equipment such as a video tape recorder) to be driven from the same video feed line.

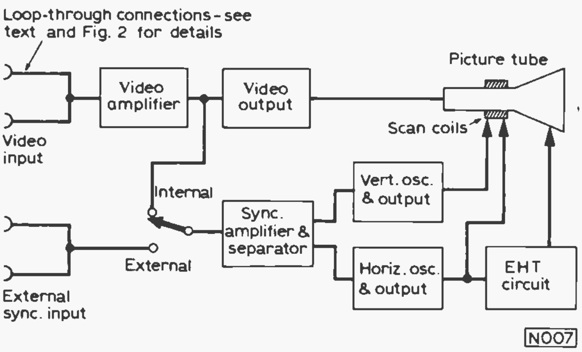


Fig. 1: Basic block diagram of a CCTV monitor.

Loop-through inputs (Fig. 2) are possible because of the high input impedance (compared to the 75 Ω of the coax) of the monitor's video amplifier. The coil between the two coax sockets in Fig. 2 compensates for the discontinuity caused by the break in the coax and keeps the mismatch to a minimum. The input can be terminated, when desired, with a terminating switch which connects in a 75 Ω resistor. Some monitors lack this facility and, if the input must be terminated, a stuffer—a plug containing a 75 Ω resistor—must be inserted into the unused loop-through connector.

T-Junctions

Not all monitors have loop-through connections and, if several monitors are to be used on the same line, a T-piece is used in the single socket. This will cause a slight mismatch which may limit the number of monitors that can be used on the line. Single socket monitors may also have an internal terminating resistor with or without a terminating switch. In the latter case the resistor should be removed to prevent double termination problems.

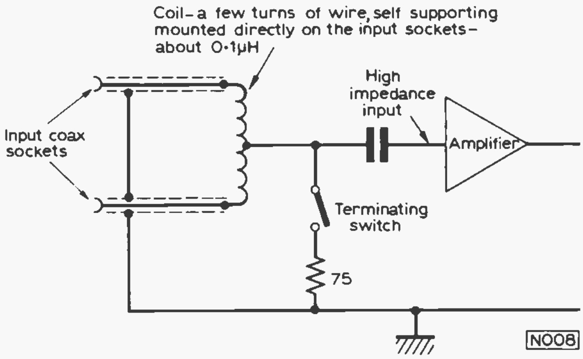


Fig. 2: A loop-through input circuit for video or sync.

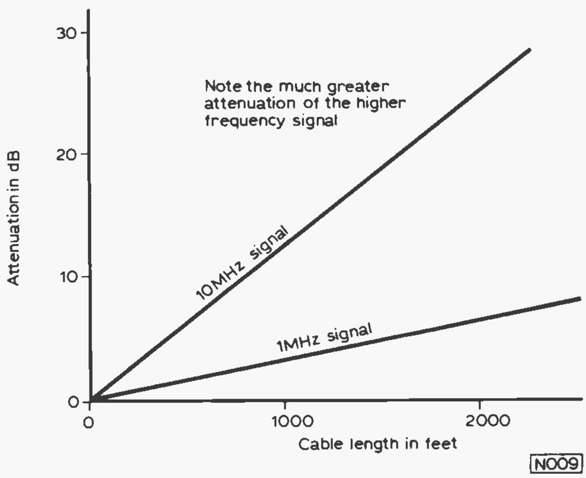


Fig. 3: Typical signal losses in a coaxial cable.

It would seem that any number of monitors (and here we include other equipment that might be fed from a video or sync feed) could be connected to a single feed. In practice the number is limited to about five or six due to the cumulative effects of the slight mismatches caused by the cable connections at each monitor input. These cause ghosting and losses in the cable itself, particularly at the higher frequencies which will affect the fine detail in the picture (Fig. 3). The practical limit depends on the amount of distortion that can be tolerated.

Reflections

To prevent reflections back down the cable, the far end must be correctly terminated with a resistor of value equal to the coax characteristic impedance, connected between the coax inner and outer. Unterminated cables must be avoided. Their presence may be recognised by greater than normal signal amplitudes and sometimes ghosting.

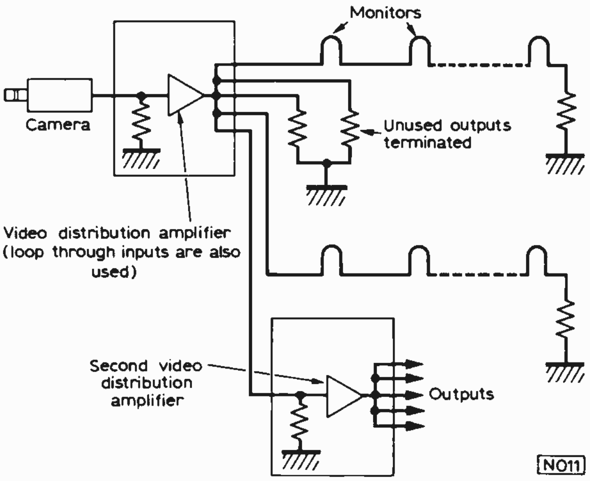


Fig. 5: Using video distribution amplifiers.

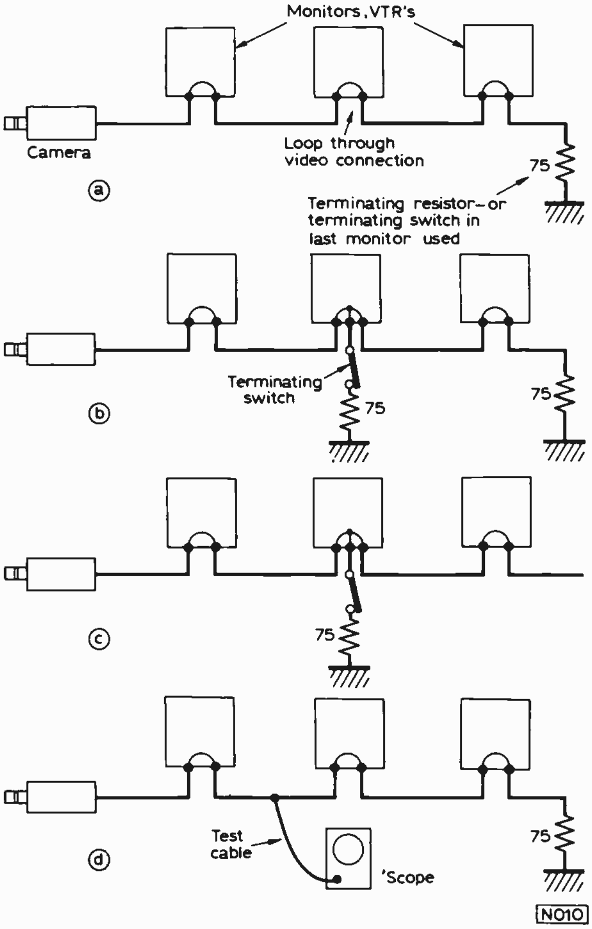


Fig. 4: Video or sync distribution arrangements:
(a) Correct method.
(b) Inadmissible: double termination.
(c) Inadmissible: open circuit length of cable.
(d) Acceptable for temporary use, providing the test cable is kept short.

It is occasionally necessary to use a piece of unterminated cable. as a test lead feeding a 'scope or test monitor. To prevent trouble a maximum cable length of about a metre (three to four feet) is advisable in this case. Fig. 4 shows, in block form, some of the do's and don'ts of connecting monitors together. Similar methods of connection are used for both video and sync pulse distribution cabling.

R.F. distribution

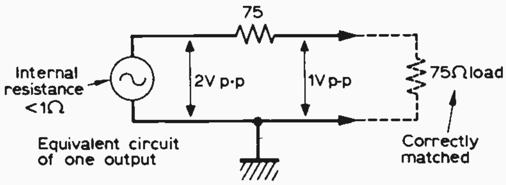
A limitation of five or six monitors is unsatisfactory for many applications. There are two ways of getting round this problem, one being to use an r.f. distribution system. Here the final composite video signal from the studio is fed to a modulator and the modulated r.f. signal is distributed through coaxes—exactly as in a domestic piped TV system—to ordinary domestic receivers, provision also being made to distribute the sound. Although convenient, r.f. distribution introduces losses which may be unacceptable.

Distribution amplifiers

The second way is to distribute the signal as video and to use distribution amplifiers. These take a single input and provide a number of outputs (typically 5 or 6) giving a corresponding increase in the number of feeds that can be taken from a single source. A number of distribution amplifiers can be used to give an almost indefinite final number of monitors (Fig. 5). Again, the upper limit is set by the amount of distortion that can be tolerated.

Both video distribution amplifiers (VDA's) and pulse distribution amplifiers (PDA's) may be encountered, we have already met PDA's in conjunction with the distribution of pulses from sync pulse generators. Basically, a VDA is a power amplifier with a voltage gain of about 1—a small range of gain adjustment is provided to compensate for cable losses—and a low output impedance capable of driving a number of loads. Many PDA's are of the same form, being adapted for the different signal amplitudes (2V p-p for pulses, terminated into 75 Ω) and it is possible to interchange them in an emergency.

The second type of PDA is more than just a simple amplifier, it also regenerates the sync pulses—developing new, squared up pulses from an incoming pulse signal that may have suffered amplitude and frequency distortion. Not suitable for video!



Pulse regeneration

The commonest circuit used for pulse regeneration is the Schmitt trigger (Fig. 6). With no input signal Tr1 is cut off and its collector will be almost at the potential of the h.t. rail. The base potential of Tr2 is determined by the potential divider action of R4 and R5 and Tr2 will be biased hard on. The emitter current of Tr2 flows through the emitter resistor (R3) of Tr1 and the voltage drop across it will keep Tr1 biased off.

This is a stable state of affairs until a positive-going input signal is applied to the base of Tr1. When the input reaches a level known as the threshold voltage, Tr1 will start to turn on and its collector potential will start to drop towards earth. This will reduce the forward bias via R4 to Tr2 and start to turn it off. The resulting drop in Tr2 emitter current will reduce the voltage drop across R3, further increasing the forward bias on Tr1 turning it further on. This in turn drives Tr2 further off and so on. A rapid regenerative action takes place, identical to that in a multivibrator circuit. This action only stops when Tr1 is fully on (bottomed) and Tr2 is fully off (cut off).

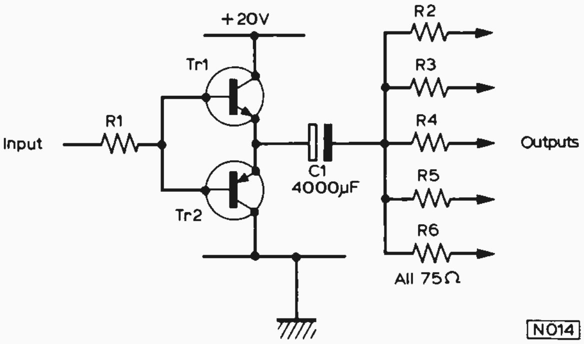


Fig. 8: The complementary pair output stage. Base biasing arrangements for Tr1 and Tr2 have been omitted for simplicity.

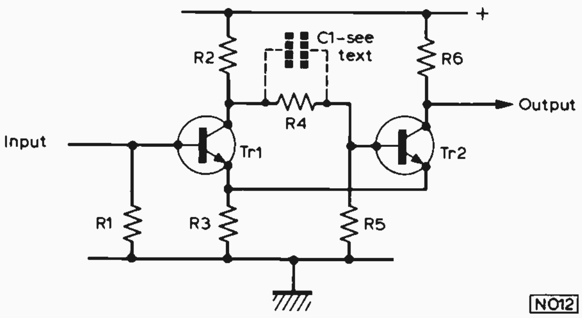


Fig. 6: The Schmitt trigger circuit.

The circuit remains in this state as long as the signal level applied to the base of Tr1 is above the threshold level. When the input voltage drops below this level (at the end of an input pulse) the opposite effect takes place, Tr1 starts to turn off turning Tr2 on and so on. Regenerative switching takes place which returns the circuit to its original state, where it remains until the next input pulse. The waveforms for the circuit input and output are shown in Fig. 7, which illustrates how a ragged input pulse can be squared up.

In practice, R4 is shunted with a small capacitor (C1 in Fig. 6) known as a speed-up capacitor. This compensates for the loss of high frequency components of the signal through the shunting effect of the input capacitance of Tr2. As the frequency rises, the reactance of C1 decreases, coupling more and more signal to Tr2. By suitable choice of components, this increase can be made equal and opposite to the loss due to the input capacitance of Tr2. This provides faster transitions.

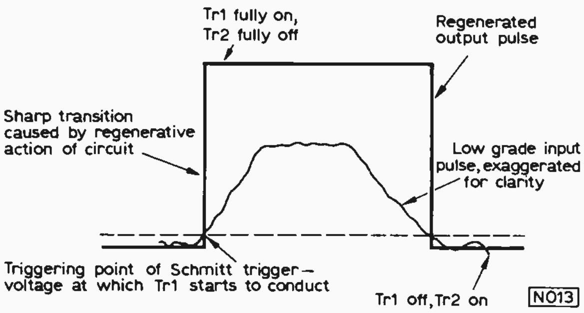


Fig. 7: Action of the Schmitt trigger. This drawing ignores the inherent difference in triggering levels on rising and falling voltages, known as hysteresis.

Output stage

Whatever kind of distribution amplifier is discussed the output stage is usually a complementary pair (Fig. 8). The voltage swing at the output is coupled through a d.c. isolating capacitor with a value of a few thousand microfarads to minimise low-frequency losses.

The output impedance of the circuit is very low (a few ohms down to a fraction of an ohm) and this enables a number of outputs to be taken in parallel, build-up resistors (R2-R6) being used to match the coax impedance. Since the output impedance of the amplifier is so low these resistors are effectively connected between the coax inner and earth, thereby correctly matching the coax cable. These resistors also help to isolate the outputs, preventing interaction between them. To maintain correct output levels, unused sockets should be terminated (as in Fig. 5) with stuffers or, in more permanent installations, with resistors soldered directly across the output sockets. Don't forget to remove them if the output is required, to avoid double terminations.

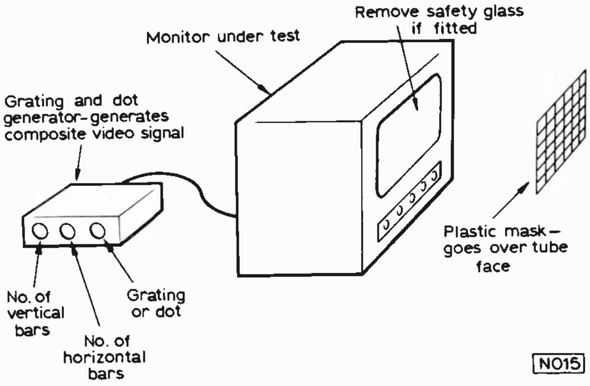


Fig. 9: Setting up the monitor linearity.

Monitor features

Having covered an outline of signal distribution let's return to the monitor. The video amplifier, sync and scan circuit techniques will present no surprises to an engineer used to domestic circuits, particularly in the better grade monitors where the emphasis is on good solid workmanship with standard circuits for high reliability. The major differences are the generally higher bandwidth of the video amplifier (10MHz is typical, 30MHz is not uncommon and higher bandwidths amplifiers are available) and in the use of clamping in the video amplifier to ensure an accurately determined d.c. level—this was covered in detail in last month's article. Flyback circuits are used in the normal way for e.h.t. generation but occasionally a separate e.h.t. unit with its own oscillator and output transformer is used. This prevents the inevitable interaction that occurs between the e.h.t. regulation, line linearity and line amplitude in a combined e.h.t. generator and line output stage. Again, the circuits are straightforward and easy to service.

Screen sizes

Monitors for CCTV are generally smaller than domestic sets, tube sizes of 9, 14 and 17in. (23, 34 and 44cm) are common though bigger sizes are available; a 9in. monitor is a useful test monitor for general servicing. The lower power requirements mean that all solid-state circuitry is commonly used in modern monitors. Special precautions must be taken when such monitors are used under rigorous conditions (such as in steel mills) where the mains supply is "dirty". The large, random voltage spikes from the switching on and off of heavy machinery can play havoc with semiconductors. All-valve monitors are superior in this respect.

Typical ways of overcoming the problem are to use the cleanest mains supply that can be found plus a constant voltage transformer to eliminate some of the spikes and variations in mains voltage. Filters can be used on the mains side and the h.t. rails can be protected with zener diodes whose breakdown voltage is a little higher than the h.t. voltage. If a spike gets onto the h.t. line it will be shunted to earth before it can do any damage. A low value resistor (a few tens of ohms) in series with the diode will restrict the current and prevent fuse blowing. If this sort of trouble is experienced the manufacturer or supplier of the monitor should be asked for advice.

Video adapted receivers

Some manufacturers supply converted domestic receivers as monitors and these go under the general name of video adapted receivers or VAR's. The tuner and i.f. stages are removed and the video and sound stage inputs modified to provide loop-through connections at the correct signal levels and impedances (sound is distributed on a 600 Ω line). The original scan and e.h.t. circuits are retained. A mains isolating transformer must be added, which is unfortunate as it increases the weight of the unit. Difficulties might otherwise arise because of the receiver's live chassis.

There are many CCTV installations where the superior picture quality and linearity of a proper monitor are unnecessary and its extra cost cannot be justified. It is here that the video adapted receiver, which may be only one sixth of the price of a monitor, comes into its own. Incidental advantages of using domestic-based equipment are the wider availability of spares and a tolerance of low-grade sync signals. The author has seen a system using several thousand pounds worth of monitors and a single VAR, both being fed from the same source with a very poor sync signal. The expensive monitors could not be locked yet the VAR gave excellent pictures!

Linearity adjustments

There being no tuner or i.f. circuits to align, the setting up of a CCTV monitor really only involves the scan amplitudes, linearity and position. With domestic receivers the broadcast test card can be relied on to give an accurate circle for setting up. When a camera is used to view a test chart containing a circle and the resulting signal is used to feed a monitor it is not possible to tell whether distorted circles on the monitor display screen are due to the camera, the monitor or a combination of both. Even if the linearity appears alright, there may be equal and opposite errors from the two sources resulting in problems if the monitor is used with another camera.

It is necessary instead to use some form of external reference source of known accuracy, and a grating and dot generator is commonly used for this purpose. This produces an accurately timed, electronically generated, video signal which appears on the monitor display as a white grating. Alternatively, in the dot position, just the intersections of the grating lines can be displayed as white dots. This is sometimes more convenient and less confusing to use. It is also possible to vary the number of horizontal and vertical lines to give a great variety of grating sizes.

We have encountered one use of the grating and dot generator in the setting up of camera linearity by allowing the camera to view a grating test chart and superimposing an electronic grating from the generator on the image from the camera on the monitor screen. By comparing the two gratings the camera linearity can then be set up. Any non-linearity in the monitor can be ignored since both gratings are equally affected.

Monitor linearity

Monitor linearity is set with the aid of a transparent plastic mask ruled into rectangles by a photographic method (Fig. 9). Fifty up and fifty across are typical values, they are rectangles because of the 4: 3 aspect ratio of the picture on which they are superimposed. The monitor scan amplitudes are reduced until the picture area with a grating input applied just coincides with the edges of the mask, which is designed to fill as much of the screen face as possible. If a protective armour plate screen is fitted on the monitor then it should be removed to reduce parallax problems as far as possible. Parallax error is illustrated in Fig. 10. Any factor which increases the distance between the mask and the tube phosphor layer will also increase the error.

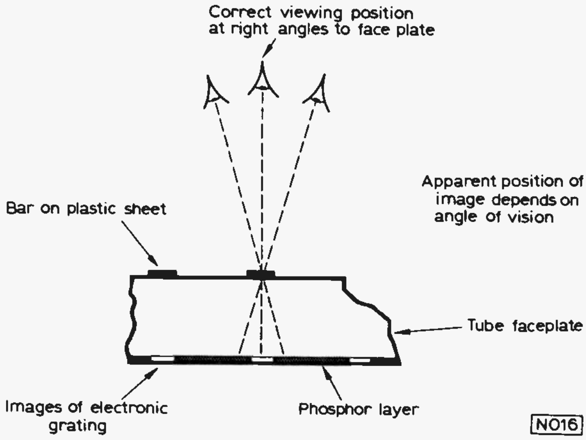


Fig. 10: The mechanism of parallax errors.

Measuring linearity

The grating and dot generator is adjusted to display the same number of rectangles as the mask. The two sets of gratings are then compared and the linearity controls adjusted for best coincidence—more of this later. If the gratings completely coincide (something of a theoretical case!) there is zero linearity error. By assessing the maximum displacement of both horizontal and vertical lines from their correct position, determined by the mask, a quantitative measurement of the linearity error can be made. It should be stressed that there are several ways of measuring linearity error (only the commonest will be covered here) so take care when comparing linearity figures. Manufacturers generally specify how their figures are measured.

Suppose, instead of 50 rectangles we had a 100 rectangles across the screen. Now, if the maximum displacement error was the width of one rectangle the error would by 1% of the picture width, and the linearity error is also said to be 1%. A pattern of 100 rectangles across a small screen is rather confusing to work with so a mask with fewer rectangles (i.e. 50) is used.A maximum error of one rectangle then corresponds to a 2% linearity error, which is a typical figure for a reasonable monitor. An identical argument applies in the vertical direction.

Thus, the complete linearity setting and measuring drill is as follows. With the mask on the screen (sticky tape helps) and the grating generator output applied (terminated if necessary), set the monitor scan amplitudes so that the edges of the displayed grating coincide with the edges of the mask. Then, starting from one of the vertical edges look along the row of vertical lines of the mask and check for position coincidence of the displayed lines beneath. Try to minimise parallax errors by keeping your line of sight at right angles to the mask (Fig. 10). Adjust the horizontal linearity controls for the best coincidence (as many lines as possible in their correct position). Repeat the process for the horizontal lines (vertical linearity) then check the verticals again, repeating the two adjustments until the best results are obtained in both directions. The maximum displacement of any one line should not be greater than one rectangle's width for a 2% accuracy.

If part of the picture is particularly bad it may be possible to distribute the error over the rest of the picture—better a small error over a wide area than a small area with a big error. Serious linearity errors point to a fault in the circuit, there are no hard and fast rules for locating such faults but leaky capacitors and resistors that have gone high are always prime suspects.

Linearity sleeve

There may be a linearity sleeve fitted under the horizontal scan coils (Fig. 11) consisting of two shorted turns of copper foil mounted on a paper tube that can be slid in and out of the coils and rotated around the tube neck. They are not connected to the coils but the currents induced into them affect the current flowing in the scan coils and thus the linearity across the picture. The sleeve must be set for optimum horizontal linearity. Don't, as the author once did, omit it after changing the tube—it plays absolute havoc with the linearity, particularly at the left hand side of the screen.

Parallax

As mentioned, parallax problems arise due to the phosphor screen and the mask not being in the same plane. One way of overcoming this is to use a slide projector with an accurately ruled grating slide instead of the mask. The projected image is focused onto the phosphor screen in the tube, through the glass faceplate. The two grating images are then in the same plane and parallax errors are eliminated. The projector must be accurately lined up at right angles to the centre of the picture on the screen.

The monitor's resolution can be quickly checked by feeding it with a video signal from a camera whose resolution is superior to that of the monitor and which is looking at a resolution test chart. The resolution of the monitor can then be read off from the resolution wedges on the test chart image in the usual way. Check that the monitor focus control is optimised.

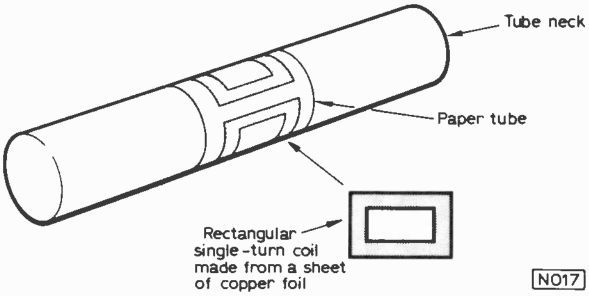


Fig. 11: The linearity sleeve is mounted on the c.r.t. neck underneath the deflection coil assembly.

A number of points arise regarding the practical use of monitors. For CCTV studio control room use the monitor is deliberately underscanned so that all the picture edges can be seen. The monitors seen by the audience will, as in normal domestic practice, be overscanned by about 10% and any intrusions, such as a microphone boom coming into the picture, can be spotted and corrected before they become evident on the final picture. To take this a step further, sometimes the final (systems) blanking pulses are not added to the video signal until just before the distribution system input so that the control room monitors have a bigger picture, in the sense that there is a border round the picture which will be lost when the wider (longer duration) system blanking is applied. Intrusions are dealt with in the same way. Test monitors, used for setting up and checking, are generally underscanned so that the whole of the picture can be analysed.

Magnification

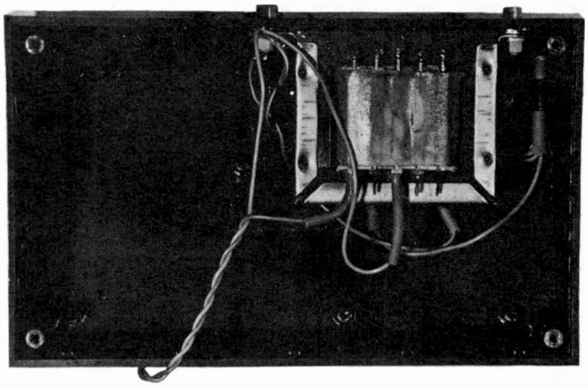
A bonus of the camera plus monitor system is that whatever area the camera looks at the final picture is the size of the monitor screen. This may sound self evident but if the field of view of the camera is very small then we can get quite considerable magnification. This is exploited for training purposes—dentistry is one example—so that a large audience can simultaneously view a magnified picture of a difficult-to-see operation in a small area.

There are one or two specialised monitors in use. The picture and waveform monitor (PWM), which we have already encountered, is a 'scope and monitor combined but with a facility to strobe out a single line from the picture on the 'scope and, at the same time, brighten up the corresponding line on the picture as a quick reference to its position. The second type is the viewfinder monitor on a camera. Frequently, this is a separate unit from the camera, sharing only the mains supply and a video output. Alternatively, it may be an integral part of the camera using the camera supply rails for its power and with the scan circuits driven directly from the field and line drive pulses within the camera.

In both cases the circuitry is generally straightforward although the interdependence of monitor and camera must be borne in mind with the second type. Accurate linearity and setting up is not so important with viewfinder monitors and they are generally set up by pointing the camera at a test chart and adjusting for the best circles.

THYRISTOR TESTER

continued from page 347



The fuseholder and T1 are mounted in the case.

★ Components list

Resistors: (all ± 5%)
R1, R2 2.2kΩ 10W
R3 10kΩ 10W
R4 100Ω ¼W
R5 10kΩ ¼W
R6, R7 1MΩ ¼W

Capacitor:
C1 0.1μF 35V Tantalum

Semiconductors:
Tr1, Tr2 BC187, BC479 etc.
D1 BY127 D2, D3 OA200, 1N4148 etc.
D4 Min. l.e.d. indicator (red)
D5 Min. l.e.d. indicator (green)

Miscellaneous
S1 S.P.S.T. rocker switch
S2 Dry reed switch 4-RSR-A plus reed operating magnet, short (R.S. Components or Doram)
S3 S.P. push-to-make switch
T1 Midget mains transformer (R.S. Components or Doram) secondaries 125-0-125V 50mA and 6.3V 1.2A (not used)
LP1 Neon indicator, rectangular (to match S1)
F1 100mA 20mm fuse plus panel-mounting holder
3 Miniature crocodile clips
Instrument case Type 21 (R.S. Components or Doram)
Plastic material for compartment and flap
Matrix board (s.r.b.p.). 63.5 x 57.5mm (2.5 x 2.7 in)
Stripboard, 2.54mm (0.1 in) pitch, 63.5 x 20.5 mm (2.5 x 0.8 in)
3-core mains lead plus cord grip

button is depressed, whereupon the neon will extinguish and the "O.K." lamp illuminate. A slight neon glow should not be interpreted as a faulty thyristor, it means only that the thyristor has a high holding current.

The "S.C." lamp will indicate a short circuit device, and the test button in this case need not be depressed. If the neon stays on when the test button is depressed the thyristor is open circuit. ■

SERVICING television receivers

L. LAWRY-JOHNS

PYE HYBRID COLOUR CHASSIS —cont.

Audio Module

The original models used an audio module (LP1162) while the latest use an SN76013N-07 integrated circuit.

The module has three transistors hiding in kennels and one out on its own. The kennels (heatsinks sounds just as bad) house an AC128 driver and an AC128 and AC176 as an output pair. The lid of the unit screws on to the top of the kennels with rather irritatingly small PK screws which seem to defy a wide variety of screwdrivers—even those which should fit merely mangle the screw head. Once the cover is off it doesn't take long to replace the faulty AC128s and possibly the AC176, together with the emitter resistors which have a value of about 2·2 Ω.

When dealing with these items or the i.c. the essential aid is some solder wick (impregnated braiding) or a solder sucker in order to clear away the solder and facilitate the removal of the chip, transistor or other component.

Tuner Unit

The tuner unit fitted in earlier models was of the usual mechanical variety found in monochrome sets of the period. These have been the subject of many paragraphs in previous articles in this and other servicing features. Our remarks therefore will be confined to the varicap tuner used in later models and its attendant circuitry. This tuner is by now quite well known, consisting of three transistors etc. in association with four diodes which vary their capacitance according to the voltage applied to them as bias. A control voltage of 0·3V to 28V is sufficient to tune over the whole band of channels from 21 to 68. Whilst the tuner itself can be responsible for tuning drift in most cases the stabilising i.c. D5 (TAA550) is the cause of the trouble. As the a.f.c. is disconnected by merely pushing in the button, this can be quickly cleared of suspicion. If the a.f.c. is at fault check the soldering around the discriminator transformer T5. Make sure that the actual coil leads are soldered to the posts (inside the can). The two diodes do not seem to give trouble but we have been told that the associated capacitors can.

Some Odd Ones . . .

Recently we unpacked a new 26in. model for a pre-delivery check on the bench and on switching on noted that the valves heated, the tube didn't. There was a hum and a ping as the thermal cut-out opened and after a little checking we found a short to chassis across C313 (the 20V positive line smoother). Disconnecting the edge connector did not remove the short so we naturally took it that C313 was short-circuit. It wasn't. Looking closer at the edge of the panel, at the 20V take off point, we found that a lead protruded through and was long enough to have been bent down and soldered to the next contact down! It seemed that this had been done during production, had never been checked and had had the final inspection blue and white card attached, duly signed by two inspectors (well there were a couple of wiggly lines in the spaces where the signatures would normally be put).

We got to thinking then, surely the thing had been converged. Therefore the wire must have been soldered down after this stage of the proceedings. If so, at what stage was that?

Anyway we unsoldered the wire and cut if off short (as it should have been in the first place) and repaired the cut-out which is fitted on the transformer between the tags. The set then behaved itself, and the convergence wasn't far out. We then thought a bit more.

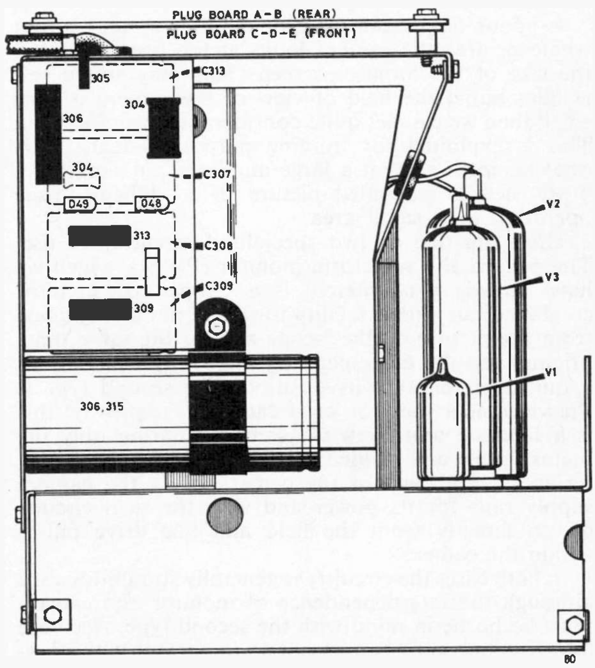


Fig. 10: The line timebase/power supply assembly used in later 691 and in the 693 chassis.

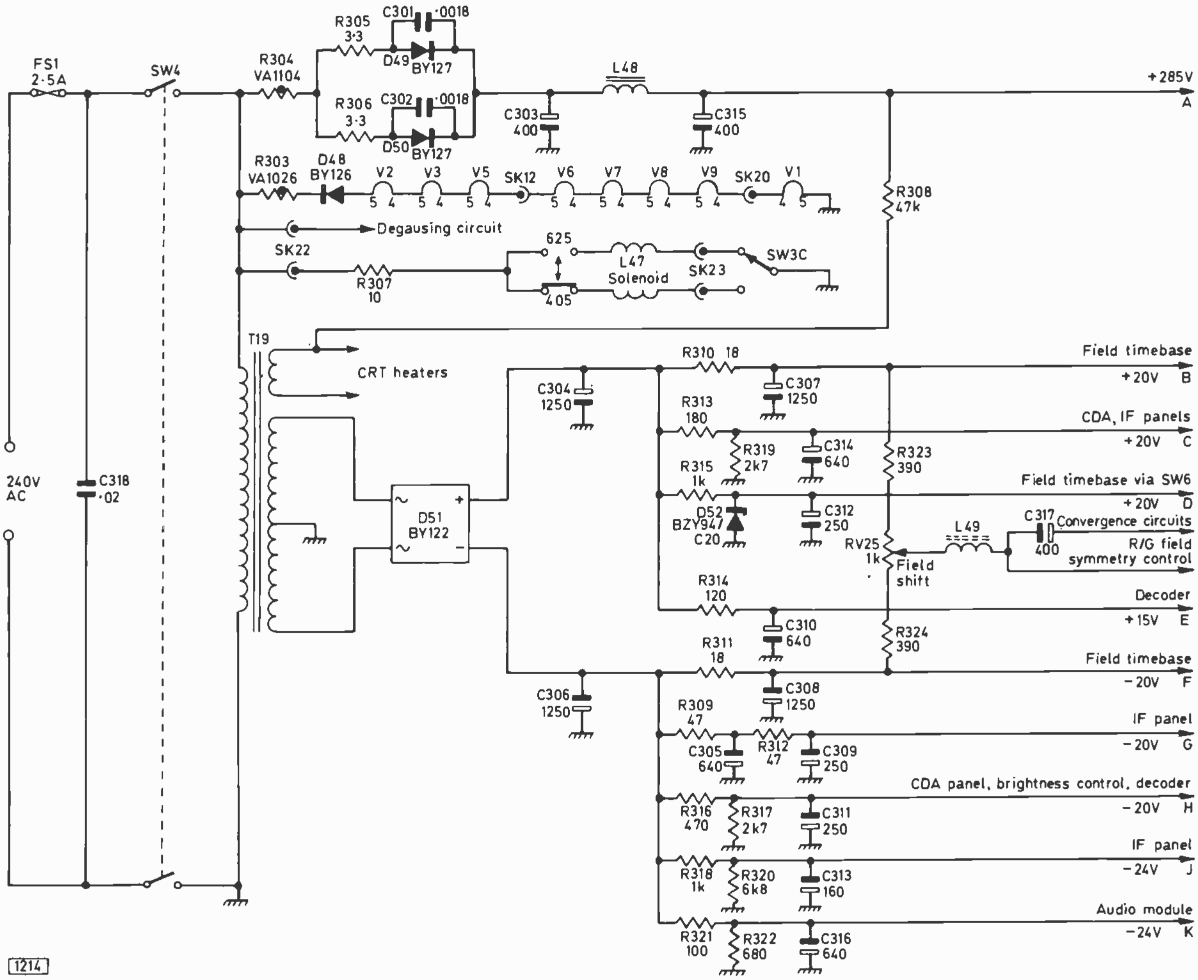


Fig. 11: The power supply circuitry used in the dual-standard 691 chassis.

The box the set came in looked as if it had been resealed. So perhaps we had not been the first to receive it and other eager little hands could have done the deed after dispatch from the factory. Further enquiries

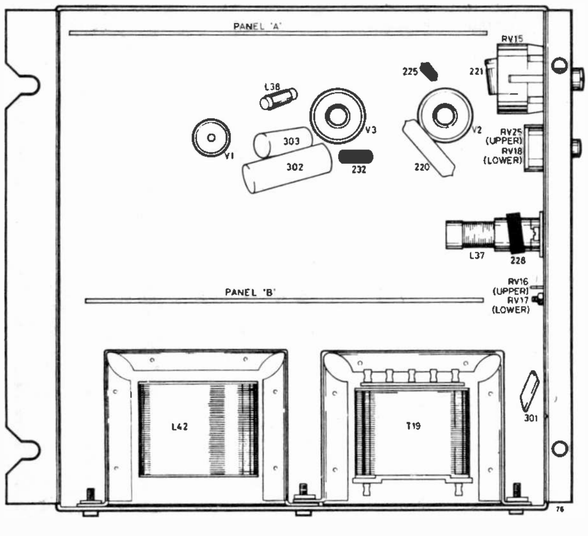


Fig. 12: Underchassis view of the line timebase/power supply assembly used in later 691 and in the 693 chassis.

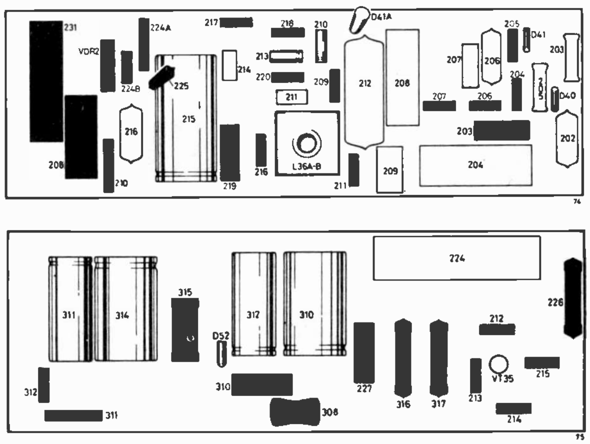


Fig. 13: The printed boards, line oscillator panel A top and smoothing panel B below, mounted beneath the line timebase/power supply assembly used in later 691 and in the 693 chassis.

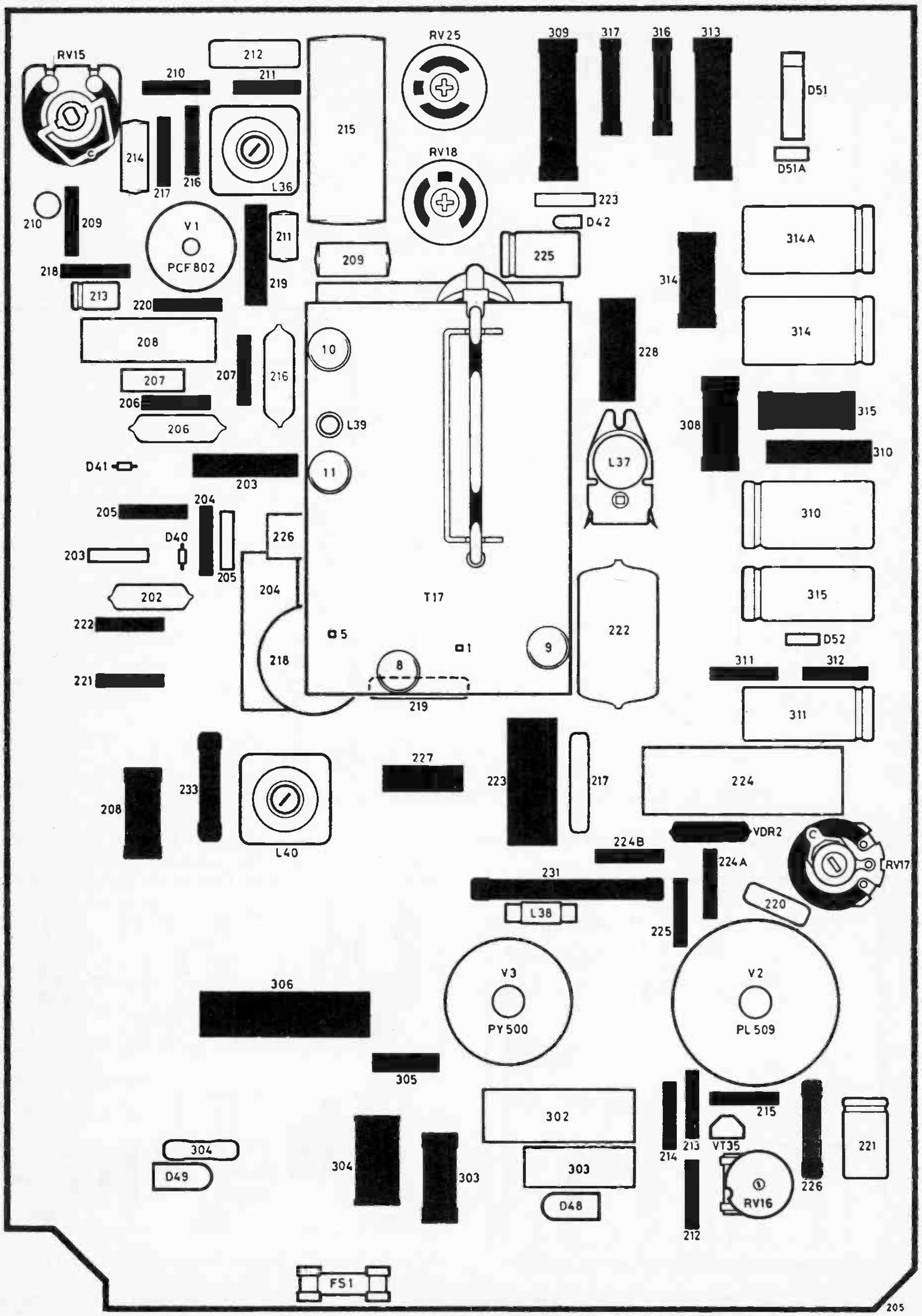


Fig. 14: Layout of the vertical line timebase/power supply board used in the 697 chassis.

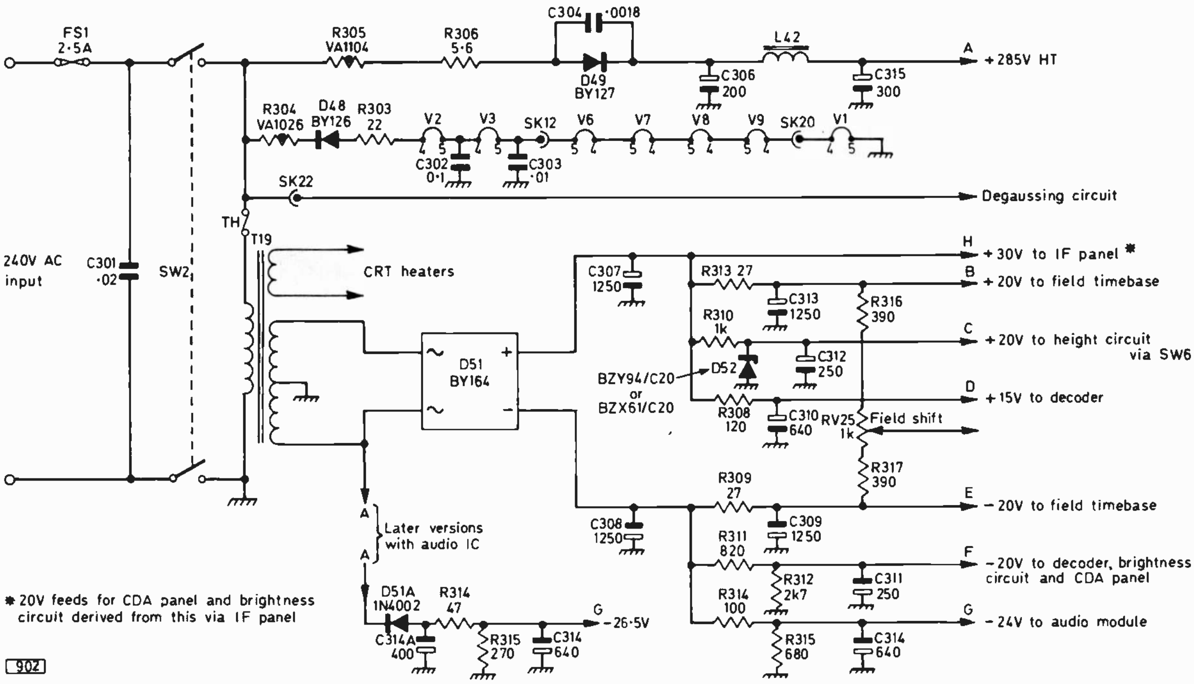


Fig. 15: Power supply circuitry used in single-standard chassis. In later versions C301 is 0·2µF, thermal fuse TH is added as shown, R306 is 3·3Ω, R303 and D48 are transposed and the heater chain is as follows: V2, V3, SK20, V9, V8, V7, V6, SK12, V1, chassis. Note different "G" supply circuit used with audio i.c.

suggested that we were not the first dealer to receive the set. We won't go into the ifs and buts as it was a long drawn out affair. The upshot is that we still do not know who did the deed and at what stage.

Bridge Rectifiers

Whilst on the subject of l.t. shorts incidentally we have had numerous sets of various types—monochrome and colour television receivers, radios and unit audios—in for service with varying symptoms of poor smoothing and excessive current demand, seemingly due to leaky or open-circuit electrolytics: the fault has been found to be due to the bridge rectifier itself however. We mention this because it could well happen in the models under discussion.

Convergence

The original models are often difficult to converge, particularly at the sides and mainly with the blue dynamic controls. Whilst it is well nigh impossible to obtain perfect registration all over the screen and a waste of time trying to achieve this (looking close up) it should nevertheless be possible to achieve good convergence when looked at from a reasonable viewing distance.

Where this cannot be done first note the action of the controls. If this is jerky the control itself is at fault. If the control has a smooth action however but will not give the desired affect the associated capacitors and the AC128 transistors—which are wired as diodes—should be checked. If tapping the panel produces convergence changes check for dry soldered joints around the control pegs and the resistors etc. Nothing is more annoying than to achieve beautiful convergence and then find that after putting the panel back on or swinging it down—as the case may be—horrible errors that necessitate finding the faulty joint and possibly doing the whole lot again are produced.

Note for Beginners

If the colours do not appear to be right don't try to set up the drive and c.r.t. first anode controls on a colour picture. Turn down the front colour control, or detune slightly to lose the colour, then set up the controls to obtain a good black, grey and white (cloudy white) picture—the drive controls for the whites and light greys, the first anode presets (mounted on the convergence board) for the darker greys. If you don't know where the drive controls are don't try to do the job at all.

Get it right in black and white, then mount the colour on top.

Power Supply Notes

The 285V h.t. supply and the supply for the valve heaters are derived from the mains via diodes in the usual way. The supply for the tube heaters and the l.t. supplies are derived from a transformer.

The l.t. supply comes from a bridge rectifier. Thus although the chassis is the negative return for the h.t. supply, as is usual in most large-screen monochrome sets, the chassis is approximately midway from an l.t. point of view, there being both positive and negative (with respect to chasses) supply lines.

In Conclusion

On the subject of poor line sync we have noted several reports, though we have not experienced this

—*turn back to page 358*

wideband aerial amplifier

Roger Bunney

THE author has been active in the field of long-distance television reception (DX TV) for many years, and during this time has used a number of types of transistorised aerial amplifier. For operational ease, particularly during periods of intense activity, the use of wideband or semi-wideband amplifiers is to be preferred. This avoids the possibility of missing exotic signals whilst changing narrowband amplifiers. The author has similarly advocated the use of wideband aerials for DX TV in recent years.

Several designs have been featured in these pages covering wideband units for Band I and Band III. All of these have involved a multiplicity of components, both active and passive, and required painstaking initial alignment to obtain the optimum gain/bandwidth product.

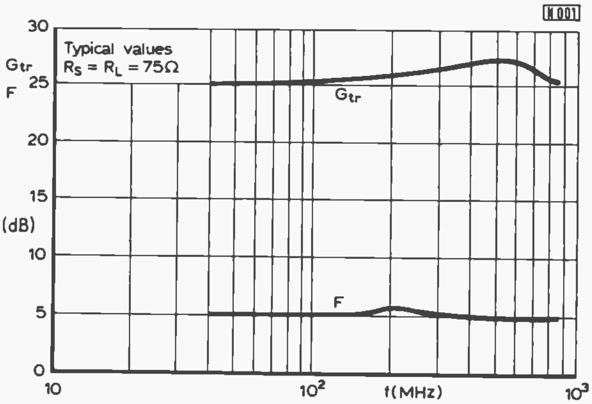


Fig. 1: Typical gain and noise figures for the OM185 hybrid amplifier module.

Hybrid Amplifiers

Electronics progress however, and an alternative approach to v.h.f./u.h.f. amplifier design is now with us. A range of "Hybrid VHF/UHF Wideband Amplifiers", intended mainly for applications in the MATV (distribution system) industry, have recently been introduced by Mullard. Four devices are at present available, each with different gain and noise figure but all virtually flat over the band 40-860MHz. No inductive components are used and so no alignment is required. Brief details of the specifications are given in the table.

★ Table

Type	No. of stages	Gain dB	Noise Fig. dB	Case
OM175	2	15	7	5-lead plastic case, metal base
OM180	2	16	5.5	7-pin in-line, resin/plastic body
OM185	3	25	5.5	7-pin in-line, resin/plastic body
OM190	2	17	7	7-pin in-line, resin/plastic body

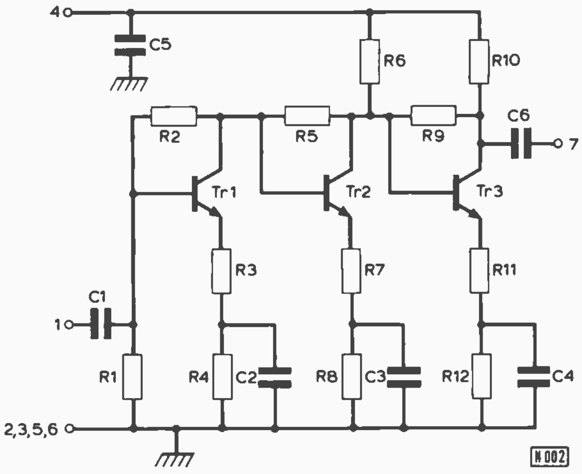


Fig. 2: Internal circuit of the OM185.

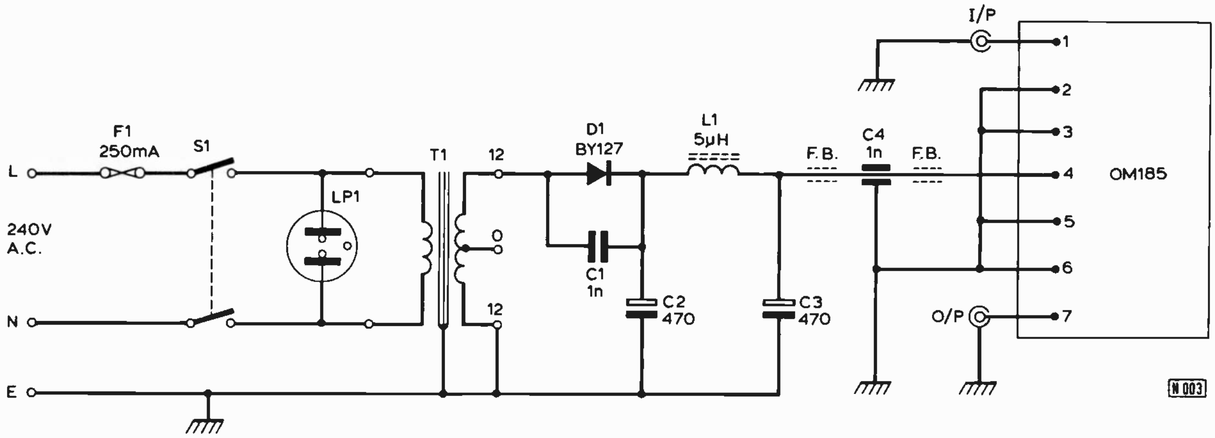


Fig. 3: Circuit diagram of the complete amplifier unit including a mains power supply.

The OM175 is designed for use in a distribution amplifier; the other three are intended for use in masthead amplifiers and preamplifiers. All the devices are very compact. The OM185, used in this particular project, measures only 30×12×6mm (1¼×½×¼in). This, together with the provision of integral input and output coupling components, means that very efficient couplings can be achieved thus maintaining optimum performance over the full bandwidth. The response of the OM185 is typically flat within 0·3dB at v.h.f. and 1·6dB at u.h.f. For the other two preamplifiers, the corresponding figures are 0·2dB and 1·4dB.

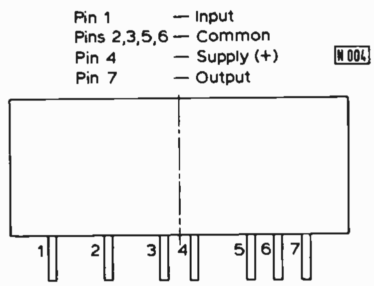


Fig. 4: Lead-out connections for the OM185.

Noise Factor

Working over such a wide spectrum the noise factor is of extreme importance. The intended use of the prototype amplifier for DX TV led to the selection of the OM185 for its high gain and low noise figure. Fig. 1 shows the extremely level gain and noise performance, and Fig. 2 the internal circuitry of the device.

With the help of Dr. Richard Kurr several development samples of the OM185 were obtained, and an initial series of tests was conducted by Ian Beckett at Buckingham. These tests confirmed the performance as shown in the graphs and also proved the suitability of the device for our purpose. Subsequently a second unit was constructed by myself to the design shown in Fig. 3.

Design Considerations

Basically the only requirements are a power supply to provide +24V±10% at 35mA, and a means of mounting the input and output sockets. Thus the ubiquitous diecast box was pressed into service, the result being as shown in the photograph.

Because of the high gain and wide bandwidth it is essential to provide screening between input and output wiring and to keep the device leads short. To avoid heat damage during soldering, Mullard recommend that the distance from joint to body should not be less than 3mm (about ⅛in). Both these requirements are met by the layout shown. A tinplate screen, also used to mount C4, is secured under one of the fixing nuts of the input coaxial socket. The OM185 is mounted only by its leads. The power supply is arranged to provide half-wave rectification which is adequate in this application and gives some 23V on load.

This unit has now been in service for some months for DX TV reception. Its combination of reasonable gain with a very low noise figure (considering the bandwidth covered) have made it a most useful addition to the receiving equipment. It would, of course, also form the basic amplifier for a small distribution system.

The OM series of amplifiers is intended for use by equipment manufacturers and as such is not available "off the shelf" from the usual semiconductor suppliers. In case of difficulty readers should contact Ian C. Beckett, at Chackmore, Buckingham, who carries a small stock. The price of the OM185 is in the region of £10. ■

★ Components list

C1	1nF 500V; C2, C3 470µF 40V; C4 1nF leadthrough.
D1	BY127, BY100 etc.; F1 250mA fuse and holder;
L1	5µH choke; LP1 Neon indicator, 240V;
T1	12-0-12V 50mA (Eagle MT12); S1 DPST, 240V;

1 OM185 (Mullard); 2 Ferrite beads; 2 Coaxial sockets; Diecast box, 114 x 89 x 55mm (4.5 x 3.5 x 2.16in.)

YOUR PROBLEMS SOLVED

★ Requests for advice in dealing with servicing problems must be accompanied by an 11p postal order (made out to IPC Magazines Ltd.), the query coupon from page 379 and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets or answer queries over the telephone. We cannot provide modifications to circuits published nor comment on alternative ways of using them.

FERGUSON 3626

The tuners in this set seem to be faulty. The symptoms are soft hissing on v.h.f., much louder hissing on u.h.f. There is neither sound nor vision. All tuner valves have been replaced and the system switching seems o.k.—J. Tomkins (Esher).

Check the common vision and sound i.f. stage, V3 EF183, by measuring the screen grid and anode voltages. The screen grid voltage (pin 8) should be about 50V: if absent check R15 (39k Ω), the upper resistor of the potential divider which feeds the screen grid. The anode voltage (pin 7) should be about 190V. Then check R5 and R4 which could well be the cause of the trouble. These resistors are mounted on the printed panel but feed the anode of the v.h.f. tuner mixer stage via the i.f. lead. If they are both charred check the tuner output leadthrough capacitor C225. If only R5 is charred check its decoupler C3 (0·03μF). Make sure that h.t. is reaching the anode of the PCF805 v.h.f. mixer. (Thorn 900 chassis.)

DECCA CTV25

The initial fault was no picture, sound o.k. The overwinding on the line output transformer was replaced, the e.h.t. and focus etc. reset and the picture was then all right. After approximately two hours however the no picture fault returned. The overwinding was replaced, also the GY501 e.h.t. rectifier and PD500 stabiliser triode, and all components on the line output assembly checked. After several minutes however the overwinding felt warm and the e.h.t. was falling. Also the 625-line third harmonic tuning coil L405 showed signs of overheating.—S. Wade (Teignmouth).

This trouble can be caused by short-circuit turns in the third harmonic tuning coil L405. If this control can be correctly set up however the problem must be excessive current being drawn through the overwinding, either via the shunt stabiliser triode (there should be no more than 1·2V across its cathode resistor R416) or the c.r.t. itself. Check the c.r.t. grid and cathode voltages therefore. If all is o.k. here confirm that the overheating ceases when the GY501 top cap is removed (keep it well insulated). Make sure that the coupling coil L407 which is beneath the overwinding is not connected back-to-front—a quick check is temporary disconnection.

PYE CT203/1

We have three problems with this set. First, a convergence problem. When close-ups are being displayed everything seems to be all right but as soon as a distant shot appears some of the colours seem to be a shade off the images. The effect is more noticeable on small images. Secondly, following the appearance of a light scene the picture flickers and continues to do so until the scene changes to a darker one. Thirdly, there is sometimes a black band approximately 2in. wide on the right-hand side of the screen. This band disappears after about thirty seconds. It may appear two or three times an evening or not occur for several weeks.—T. Franklin (Deptford).

Your convergence problem should be cleared up by slight adjustment of the static convergence magnets around the convergence yoke. The brightness trouble could be due to a beam limiter fault. Alternatively the lead carrying the a.f.c. voltage from the top of the i.f. panel to the tuner unit may need repositioning. The third trouble seems to be in the line oscillator circuit. Try a new PCF802, then check the capacitors in this stage. (Pye group 697 chassis.)

ITT FEATHERLIGHT SUPER 12

There are no vision or sound signals getting through. The raster is present and there is some "foreign" sound and white noise. Adjusting the tuning potentiometers does not affect the condition. The tuner voltages and the voltages around the SN76650N i.f. i.c. seem to be o.k., but those around the MC1330P detector i.c. are unusual, i.e. there is no voltage at pin 7 instead of 5V, 1·8V at pin 4 instead of 5·5V and no voltage at pin 3 instead of 10·5V.—R. Huxley (Northampton).

The MC1330P i.c. is definitely faulty, which is unfortunately a very common trouble with this model. If you have difficulty getting a replacement you may be able to obtain one through a Thorn dealer since the same device is used in the Thorn 8000/8500 colour chassis. (ITT VC300 chassis.)

FERGUSON 3705

There is an intermittent fault on this set. When it occurs during a colour transmission the picture suddenly takes on a yellow hue which lasts for a minute or less before changing to a blue hue. When the blue hue appears it may get gradually deeper and deeper until eventually fine white horizontal lines appear across the screen as well. Occasionally the picture will remain blue for a considerable time, unless the set is switched off for a minute —this usually eliminates the fault for a while. The fault also appears on monochrome transmissions, the picture first going yellow, then blue, before returning to normal. —K. Askew (Shepherds Bush).

We suggest you first tap and probe around the three transistors VT213, VT214 and VT215 forming the blue channel on the video board to see whether there are any dry-joints. Then suspect the electrolytic capacitor C231 (2·2μF) in the blue channel clamp circuit, also the clamp diode W208 (BA145). Make sure that the clamp pulse amplitude control R230 is correctly set up (see page 19 of the manual). If the correct voltages cannot be obtained by adjusting this suspect C221 (1μF) which decouples its slider, also possibly C222 (1μF) which decouples the h.t. supply to the board. Make sure that the track of the blue set video gain control R273 is in order and finally suspect the three transistors in the blue channel. (Thorn 3000 chassis.)

GEC 2029A

The picture on this set is dim but viewable at the lowest setting of the brightness control. If the control is advanced the picture doesn't get any brighter but goes negative and out of focus, though it does not increase in size.— K. Owen (Lancaster).

Make sure that the e.h.t. is correct (25kV) and that the value of the resistor (R529, 100k Ω) which feeds the c.r.t. first anode presets hasn't changed. The brightness control slider should sweep from −2V to −5V and at zero brightness there should be 2·7V at the emitter of the beam limiter transistor TR34 (BC108). Check these conditions, also that there is 21V across C530 and −20V across C702—these smooth the positive and negative l.t. supplies to the brightness control circuit. It is possible that the c.r.t. is of low emission, in which case it might be improved by rejuvenation.

ULTRA 6702

This secondhand colour set gives a very good picture though causing some eye strain. Close examination of the screen reveals a slight judder of the raster, more noticeable at the top of the screen. There is also occasionally field roll when the picture goes to black level, e.g. between some adverts. There are also occasionally slight increases in screen brightness—or contrast, it is difficult to tell—of a few milliseconds duration.—T. Lessing (Tring).

First check the upper resistor R25 (3·3M Ω) of the potential divider which biases the base of the sync separator transistor VT5 on the video board. The associated base-emitter reverse voltage limiting diode W2 (BA115) in series with VT5 base might also require replacement. Then if necessary turn attention to the field sync pulse separator stage on the field/sound panel: the interlace diode W1 (OA91) or electrolytic capacitor C2 (4μF) in the emitter circuit of this stage could also be responsible for the trouble. (Thorn 2000 chassis.)

INVICTA CT7051

The picture is excellent for the first few moments, then a series of "flashes" appear across the screen—sometimes so bad that the picture jumps. These flashes continue every few seconds for about ten minutes or so after which the set settles down to give a very good picture for the rest of the evening. The set is about three years old. —A. Levy (Sutton).

Check carefully for dry-joints on the i.f. board—if necessary use "freezer" to locate any poor connections. Poor earthing of the tuner or i.f. board can also give rise to this fault. (Pye 693 chassis.)

FERGUSON 3713

There are two faults on this set. First, the picture rolls for about ten minutes after first switching on from cold. The vertical hold control is hard over at the end of its track but is still unable to correct the roll, which eventually stops on its own. The second fault is that after about twenty minutes the picture and sound start to switch on and off every few seconds. The c.r.t. heaters remain alight when the picture and sound disappear.—S. Johnstone (Wednesbury).

Possible causes of the field roll, in order of likelihood, are the field oscillator transistors VT406 and VT407, the diode W408 in the oscillator circuit and C432 which smooths the supply to this stage. A squirt of freezer from an aerosol when the set is warm should pinpoint the component responsible. The "squegging" effect is due to the power supply. First of all ensure that the set e.h.t. control R725 is set for the correct e.h.t., as described in the manual. If this is correctly adjusted, suspect the semiconductors in the power supply circuit. (Thorn 8500 chassis.)

FERRANTI T1123

The problem with this set is low brightness, with an overall grey picture. The sound, raster geometry and synchronisation are all good. All valves in the line timebase have been replaced. The c.r.t. voltages are correct except for the first anode voltage (pin 3) which is low at 170V. R119 in the line output stage screened compartment is badly burnt.—T. Canning (Putney).

The first anode voltage should be 500V. We suggest you check the c.r.t. pin 3 decoupling capacitor C93 (0·1μF) therefore—it's probably leaky. Check the value of the associated feed resistor R114 (390k Ω) as well. It would be advisable to check the video PCL84 (V9) and its associated components, the vision i.f. valves (EF183 and EF184) and the preset contrast control at the top left side. R119 which is in the feedback line to the grid of the line oscillator triode does tend to change value in these sets and should be replaced before it starts to cause line timebase troubles. (Pye 11U series.)

FERGUSON 3624

There is a field sync fault on this set—the picture can only be held in two halves, with a black band across the centre. A new PCL85 field timebase valve has been fitted without making any improvement. —J. Waite (Immingham).

We suggest you replace the cross-coupling capacitors from the anode of the pentode section of the PCL85 to the grid of the triode section. These are C79 (0·003μF, 1kV) and C80 (0·01μF). (Thorn 900 chassis.)

ULTRA 6706

The picture is perfect on this set though the brightness control does not function. We have been looking for a fault on the beam limiter module but without success. According to the circuit the bias from the brightness control to the adder stage VT205 on the video board should be 5·6V at minimum brightness and 4·5V at maximum brightness, but in this set the readings are 1V with the brightness control at minimum and 1·5V at maximum. The capacitor (C209) which decouples this bias on the video panel has been checked and found to be in order.—R. Hinds (Littlehampton).

First carry out the preset brightness and beam current limiter adjustments as described on page 23 of the manual. If there is no voltage across the line output stage earth return resistor R907 on the beam limiter board check that the line output stage "earth" line is not shorted to chassis. Check for leaks in C901 and C902, the two electrolytics on the beam limiter panel. The connections to plug 22 on the beam limiter board can also be faulty, giving rise to these symptoms. Finally the offset pulse generator transistor VT204 on the video panel can fail giving the results you describe. (Thorn 3000 chassis.)

BUSH TV125

With the aerial disconnected and only the raster displayed the left half of the raster is a light grey while the right half is darker, with a distinct line down the centre. This line has a bend in it which moves up and down. Most of the electrolytics, also the flywheel sync discriminator diodes, have been changed in an effort to remove these symptoms.—P. Oliver (Caterham).

The trouble could be caused by parasitic oscillation in the PL36 line output valve—replacing the valve will cure this of course. If not, replace the 0·1μF capacitor (3C42) which smooths the supply to the c.r.t. first anode (pin 3).

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TELEVISION JUNE 1975

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This time the tuner was replaced, and after running the receiver on soak in the workshop it appeared that this action had completely solved the problem. After a couple of weeks in the customer's home however the fault recurred.

What would have been the most likely cause of the trouble and what part of the circuit had the technician overlooked? See next month's TELEVISION *for the solution and for a further item in the* Test Case *series.*

SOLUTION TO TEST CASE 149

Page 331 (last month)

PCL84 triode-pentode colour-difference output/clamp stages have high-value resistors associated with them. The technician dealing with last month's problem quite sensibly concentrated his attention first on the anode circuit of the R−Y clamp triode. He overlooked the fact that the conditions in the circuit can be changed by alteration in the value of the pentode's grid leak resistor however. This resistor is of somewhat lower value than the clamp time-constant load resistor but at around 2·2MΩ is still in the vulnerable high-value range. An ohmmeter test showed that it had almost doubled in value and that it increased even further in value as its temperature rose. Changing this resistor completely cured the trouble.

Since the matrixing to produce the G−Y colour-difference signal is carried out in the anode circuits of the R−Y and B−Y output pentodes in this chassis the changing value of the R−Y output pentode's grid leak resistor affected both the green and red content of the picture.

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