BRITISH AMATEUR TELEVISION CLUB

THE BEST OF......

CQ-TV

Edited by ......

John Wood, G3YQC
Tony Marsden, G6JAT

This book includes material from CQ-TV 112 to CQ-TV [illegible] (inclusive)

First printing February 1986

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THE BRITISH AMATEUR TELEVISION CLUB

This book is dedicated to all those who have ever contributed to CQ-TV. It is they who make it what it is.

FOREWORD

Since I took over the editorship of CQ-TV some six years ago, a minor revolution has taken place within amateur television. The days are past when it was considered to be a very complicated and expensive branch of amateur radio and those who involved themselves in this specialised field were either boffins or cranks.

Of course, technology marches on, and the last few years have seen great strides not only in the equipment available to TV amateurs, but also in the techniques of production, both technical and aesthetic. On the vision side; video recorders, colour TV cameras, computers, effects units, and digital picture generators have all made their presence felt. Whilst in the communications field; solid-state transmitters and receivers have replaced the old valved units, this has meant not only increased efficiency and performance but portability too, providing the opportunity to take equipment out of the shack and so widen the interest and scope of the television medium. The advent of FM television and the opening up of the 1.3GHz allocation has brought a whole new challenge to experimenters, especially since ATV repeaters started to make an impact. It is fascinating to observe the ever-changing tide of this technological revolution, and especially to see so many newcomers taking advantage of the tremendous and exciting opportunities in amateur television.

Six years ago there were some eight hundred members of the BATC, the majority of which could be considered 'old hands', having been in ATV for many years. Now though, it is an entirely different matter. The present membership is fast approaching two-and-a-half thousand and this increase in interest can be seen, not only within our own organisation, but also in many other circles. It is common now to see references to ATV in the amateur radio press as well as the more professional and commercially orientated journals - including such prestigious ones as the "New Scientist". Many films and reports have appeared on the TV broadcast networks in recent years as well as in both local and national radio programmes.

All of this reflects a great awareness in the importance of television within the modern society, and we in the BATC like to think that, by channelling this new technology into an effective organisation and making the latest techniques available to amateurs, we are playing a significant part in today's television revolution.

Since there have been so many new members, the BATC hasn't been able to keep up with the demand for back issues of CQ-TV. Acutely aware that a wealth of practical material has been published in our magazine, the club has assembled those articles which it considers to be most useful to newcomers, into this single volume, thus ensuring that the material remains freely available to all.

John Wood, G3YQC
Editor, CQ-TV magazine
January 1986

70CM ATV CONVERTER

by John Hopkins G4DYP

This popular 70cm ATV up-converter was originally designed to be constructed without the use of a special printed circuit board. The BATC has, however, designed and produced a ready-made pcb which is available from Members Services for those who prefer this method of construction. The circuit is shown in fig.1, whilst the board layout may be found in fig.2.

The unit is intended to connect directly to the aerial socket of a standard broadcast TV set.

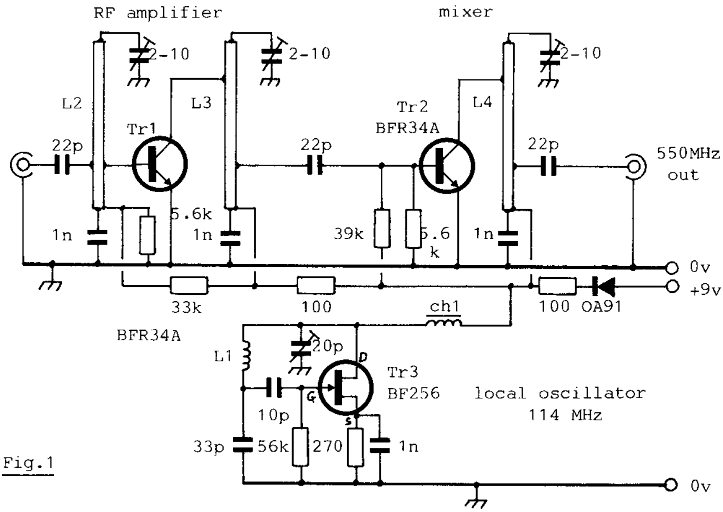


Fig.1

The 70cm aerial is coupled to the input tuned line L2 via a 22pf capacitor. The line is tuned to 436MHz by the 2-10pf trimmer capacitor at one end. A second tuned circuit is used at the amplifier output to further improve the selectivity of the converter and to provide a low impedance feed to the mixer. The mixer collector circuit is tuned to the chosen IF frequency and, although the tuned line L4 is the same size as L2 and L3, there is sufficient range on the 2-10pf trimmer capacitor to accommodate the high frequency.

The local oscillator employs a standard L/C circuit tunable over an approximate range of 100 to 150MHz. Other frequencies could be used by varying the coil L1 and/or the 2-20pf trimmer. Local oscillator injection is somewhat unconventional in that it relies on stray coupling into the mixer. This is achieved by the proximity of the components, especially L1 and foi this reason the layout shown in fig.2 should be closely followed if that method of construction is chosen.

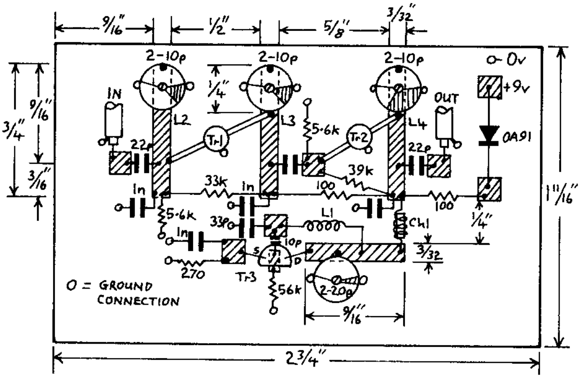
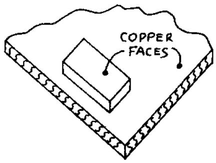


Fig. 2 LAYOUT DIAGRAM

PCB available



Component mounting pads cut from PC board and 'instant' glued to main copper laminate board. Pads are shown as shaded areas. All components are mounted on the copper side.

CONSTRUCTION

If you are not using the printed circuit board then take a piece of single sided copper laminate 2$\frac{3}{4}$" x 1 11/16" and place it copper side uppermost. Now cut out the pieces indicated by the shaded areas in fig.2 from another piece of similar board using a small saw. Glue these pieces, copper side up, to the main board so that the copper is insulated from the earth plane (position as shown in fig.2). The small pads are $\frac{1}{4}$" square, their actual positions on the board are not too critical but should be close to those in the illustration.

All capacitors should be good quality small plate types and resistors should be low noise 1/3W or smaller. Trimmer capacitors may be good quality film dielectric or ceramic types. Choke Ch1 is made by close winding as many turns of 34swg enamelled copper wire as will fit on a single layer wound onto a 1/3W 1M resistor. L1 is 6 turns of 20swg enamelled copper wire wound onto a 3/16" drill, 3/8" long and self-supporting.

ALIGNMENT

First check that the oscillator stage is working correctly and that it will tune to the frequency required. Connect the output to the aerial socket of a domestic TV set adjusted to a convenient channel around number 32. Switch on the converter and adjust the oscillator and mixer trimmers for maximum noise on the screen. Connect a signal generator to the 70cm input (a local amateur TV signal may be used or, if neither of these are available, the third harmonic of a 2 metre transmission). Carefully tune the oscillator trimmer to receive the signal, finally peak the RF amplifier and mixer trimmers for maximum signal - indicated by minimum noise (snow) on the picture.

A 24CM ATV CONVERTER

By John Wood G3YQC

This unit will convert amateur television signals in the 1.3GHz band to a frequency within the broadcast UHF TV spectrum, thus permitting any domestic 625-line TV set to be used for amateur TV reception without modification.* The converter is connected directly to the TV aerial socket.

Design and construction techniques have been purposely kept simple in order that the converter may be built and aligned without the need for a special printed-circuit board and elaborate test equipment. Because of the simplicity, exeptional performance (when compared with professionally engineered units) should not be expected although performance is adequate for most purposes.

SPECIFICATION

Input frequency:	1240 - 1330MHz (adjustable)
Output frequency:	Adjustable over UHF bands 4 and 5
Overall gain:	20db (typical)
Noise figure:	around 4db (optimised)
Bandwidth:	+20 -40MHz from centre frequency @-3db (typical)
Power requirements:	11 - 14v DC (12v nominal)
Overall size:	100mm x 65mm

CIRCUIT DESCRIPTION

A BFR91 was chosen for the first signal amplifier which is adjusted for best noise performance. The second amplifier employs a BFR90 and is set for maximum gain. These transistors, although rather dated by todays standards, have proved among the easiest to use in this design, and are still readily available. All the gain for the converter is obtained from the two signal frequency amplifiers.

The mixer Tr3 is, for simplicity, a single-ended transistor type which is biassed for unity gain. The IF is selected by the collector tuned circuit which will tune between 450 and 800MHz.

The local oscillator Tr4 uses a FET and is tunable over a wide range enabling virtually any IF in the UHF TV band to be used. The oscillator was found to be quite clean and to be sufficiently stable. It is quite important to use the specified FET, other types may not be very satisfactory.

COMPONENTS

All components should be of good quality. Fixed capacitors are sub-miniature ceramic. Trimmer capacitors may be good quality plastic PTFE types. DAU and Mullard makes are good. Do not try to use some of the cheaper types - they may not be PTFE.

*(AM transmissions only).

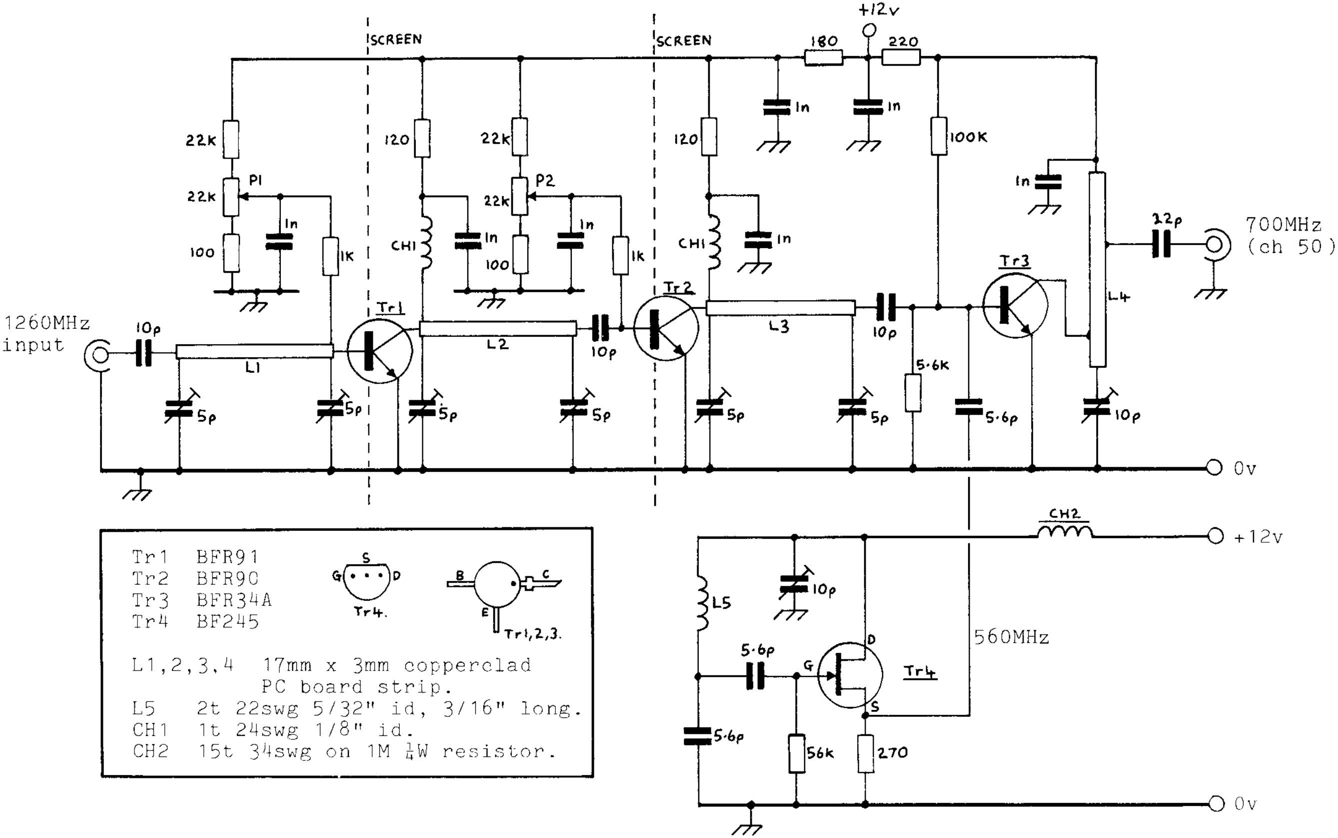


Fig.1 G3YQC 24cm ATV DOWN-CONVERTER

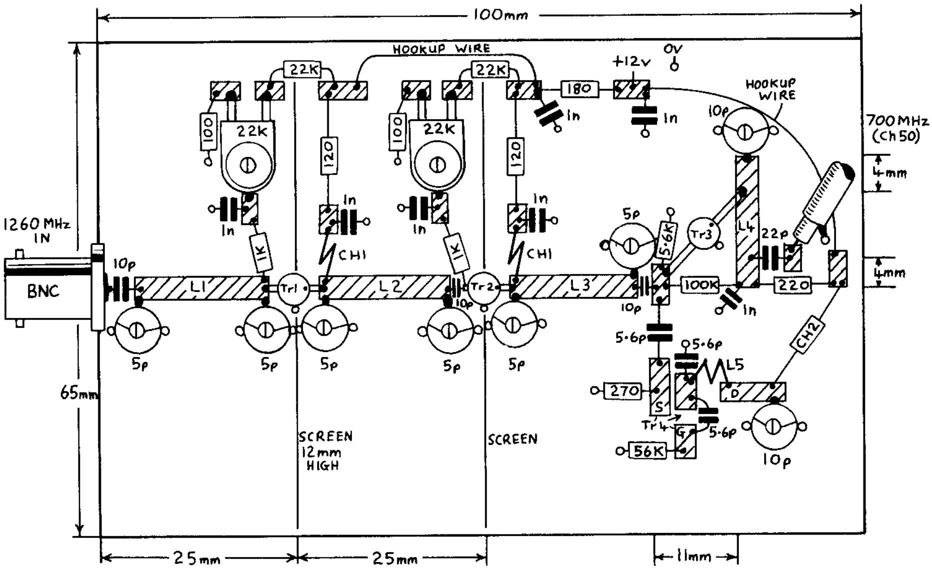


Fig.2 LAYOUT DIAGRAM, 24cm CONVERTER.

CONSTRUCTION

Although printed circuit techniques are used in order to ensure repeatability, it is not necessary to etch and drill a conventional printed circuit board.

Take a piece of good quality, single sided fibre glass board 100mm x 65mm and place it copper side uppermost. Cut out the pieces indicated by the shaded areas in Fig.2 from another piece of similar material using a small saw. Glue these pieces, copper side up, to the main board so that the copper is insulated from the earth plane. Position the pads as shown in fig.2. The small pads should be about 3mm wide and no longer than that required. 12mm high screens should be soldered to the ground plane in the position shown. Thin guage copper, brass or tin plate may be used for these.

It is strongly recommended that the converter be installed in a screened box before alignment. The box may be made from single sided PC board material. If possible the converter should be soldered around the edges inside the box. If this is not possible, the enclosure should be large enough to allow at least a quarter of an inch between the edge of the board and the inside walls of the box. Failure to do this may result in a variation in tuning when the box is handled. Should neither of these techniques be possible and a small gap is unavoidable, the board should be bonded to the case in several places using either solder tags or copper fingers soldered to the board and bent up to press against the inside of the case.

Fig.2 illustrates the ideal input connection where the socket is adjacent to the end of L1. It is strongly recommended that either type N or BNC sockets are used, especially at the input. It is advantageous also to mount the connector in such a way as to eliminate the need for a coaxial cable within the box.

All capacitors, with the exception of the oscillator injection, should be wired so as to keep their leads VERY short.

ALIGNMENT

Up-end the 180 Ohm resistor from the +12v input and apply power. Monitor the oscillator frequency on a TV receiver and, with the aid of a piece of wire soldered to a short length of coax, connect it to the TV aerial socket and place near to the converter. Tune the oscillator to the required frequency as indicated on the screen.

Re-connect the 180 Ohm resistor and connect a milliameter in series with the +12v supply to Tr1. Adjust P1 for around 3.5mA. Re-connect the resistor and repeat the operation with Tr2, adjusting P2 for about 4.5mA.

Connect the output to a TV receiver tuned to the IF frequency and adjust the output tuned circuit for maximum noise. Apply a 24cm signal, either from a test generator or from a local amateur, and tune it in on the TV set. Carefully peak all trimmers for best signal. The first stage should be optimised for minimum noise whilst the second is set for maximum gain. The pairs of trimmers on the tuned lines are, to a certain degree, interdependent and the optimum position may be found by trial and error.

This tune-up procedure is often the most difficult since a strong enough signal must be found to pass through the converter before it is properly aligned. It may therefore take a little patience to find the first signal, after which alignment will take a very short time.

NOTES

Because this converter is operating at such high frequencies, component tolerances become more significant if repeatability is to be assured. The problems most likely to be encountered are those associated with using widely differing base materials for the copperclad board. Experience has shown that some materials (particularly boards thinner than about a sixteenth of an inch) cause the resonant frequency of the tuned circuits to become lower, thus the converter will not be able to be tuned to a high enough frequency. The solution is to reduce the lengths of L1,2 and 3 by a sixteenth of an inch (or even more) until the circuits tune over the required band. Different trimmer capacitors, perhaps with a lower minimum capacity should also help.

As with any single-ended mixer, little attenuation of the local oscillator signal is realised, therefore the fundamental and second harmonics appear at the output at fairly high levels. In practice this does not affect the performance of the converter although it is wise to space the oscillator and IF frequencies as far apart as possible.

A series tuned circuit at the oscillator frequency may be connected to the output socket, this should attenuate the oscillator signal by around 40dB. Obviously a balanced mixer would be more suitable but for simplicity it was decided to use the single ended system.

With this type of converter there is always the danger of other signals (particularly in the UHF TV spectrum) getting into the converter and appearing as unwanted signals at the output. A good deal of work has been carried out to ensure that the converter will handle such signals and will not add to them by spurious mixing. Users in very high signal strength areas adjacent to a local TV transmitter could still suffer however. One user, who is line-of-sight to the large Sutton Coldfield transmitter, experienced this problem and overcame it by installing a bandpass filter at the converter input, (see elsewhere in this book).

The IF output level is fairly high and in general up to about 6dB of attenuation may be used between the converter and a tuner before any noticeable degradation of the picture takes place.

This converter system may be considerably enhanced by adding a good quality low noise pre-amplifier in front. The Microwave Modules is a good choice. The amplifier should ideally be mounted at the mast head to eliminate losses in the coaxial feeder to the converter.

MICROWAVE BANDS

There's 24cm, there's 13 and 3cm, there's 4 and 12GHz satellite TV not to mention microwave links and radar interference....! Now that we seem to be placed firmly in the microwave camp (not that we're fogetting the rest of course) it is perhaps time that we learnt what those funny band letter designations realy mean. For example, what is 'X' band? That's easy 'cos 10GHz comes into it but what about all the rest? OK then, here they are:

L band	390MHz	-	1.55GHz
S band	1.55GHz	-	5.2GHz
C band	3.9GHz	-	6.2GHz
X band	5.2GHz	-	10.9GHz
K band	10.9GHz	-	36.0GHz
Q band	36.0GHz	-	46.0GHz
V band	46.0GHz	-	56.0GHz

There have been other designations but the above is the one now agreed worldwide. You should however be aware that a military standard exists which is somewhat different from the above, especially if you are offered any ex-WD gear!

A GaAsFET PRE-AMPLIFIER FOR THE 23/24cm TV BAND

By Peter Johnson G4LXC

It has only been in relatively recent times, that the GaAsFET has emerged onto the amateur radio scene as a serious contender to bipolar and MosFET devices, for low-noise RF amplification. Although they have been around for some years, prices have dictated their employment, which has remained largely in commercial and military fields. Then the RSGB Microwave Committee managed to obtain a number of Mitsubishi MGF1402 devices from Aspen Electronics, and these have helped to popularise their use in amateur radio (and TV) applications. The devices are available from the RSGB at £12 each (while stocks remain), but I believe they are also available from some retailers.

CIRCUIT DESCRIPTION

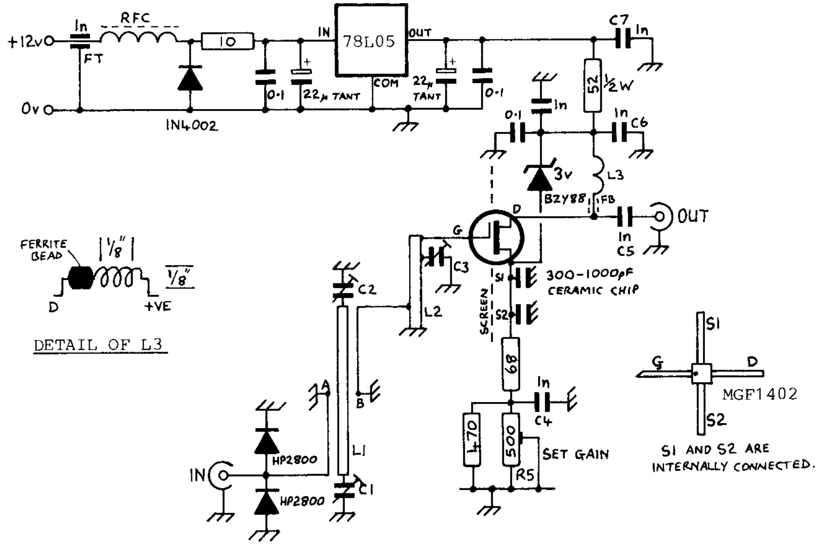
The circuit described here was developed to precede my CQ-TV (117) down converter but can, of course, be used in front of most converters, including narrow-band ones. The amplifier has been designed to work over the range 1200 - 1350MHz making it ideal for ATV applications. However, since, for performance reasons, a bandpass filter is incorporated in the design, a reasonably flat bandpass characteristic is normally available over only about half the above range. Consequently, to change from one end of the band to the other, C's 1,2 and 3 need to be changed and the unit re-aligned. Fig.4 shows two dotted wires across the filter; these may be used if required and, when brought into close proximity, provide over-coupling of the bandpass filter so reducing the through loss and increasing overall bandwidth. This form of modification however will certainly reduce the amplifier's noise performance, although not usually to a significant degree.

If operation over the whole band is required, points 'A' and 'B' on the input circuit should be linked together with a short piece of insulated wire, (ground 'stakes' should of course be omitted). This removes the filter and effectively provides a constant 50-ohm input line. If this is done C1 and C2 should be omitted and the grounding 'stakes' at the ends of the two lines.

The design has proved stable in operation, provided certain precautions are observed; the most important of these is the screening of the input from the output, this is due to the high gain of the amplifier. The use of low-Q striplines helps to maintain stability.

The gain of the MGF1402 is specified at 19.5dB at 1300MHz with a quoted noise figure of <1dB, which only rises to 1.1dB at 4GHz. I have every reason to suppose that the performance of this unit is reasonably close to that specified for the device.

The preset source resistor (R5) is set for optimum gain/noise figure, (gain increases as R5 is reduced in value), this represents approximately 30mA current at 3v although devices will vary slightly, but the values chosen



C1,C2,C3	0.2 - 1.5pF PTFE tubular (for 1290 - 1350MHz) 1.0 - 3.5pF PTFE tubular (for 1240 - 1300MHz)
C4,C5,C6,C7	1n min plate ceramic
L3	3t 22swg enam. 1/8" dia 1/8" long, with small ferrite bead over drain end (see inset)
RFC	3t 26swg on ferrite bead

Fig.1 1.3GHz GaAsFET PRE-AMPLIFIER

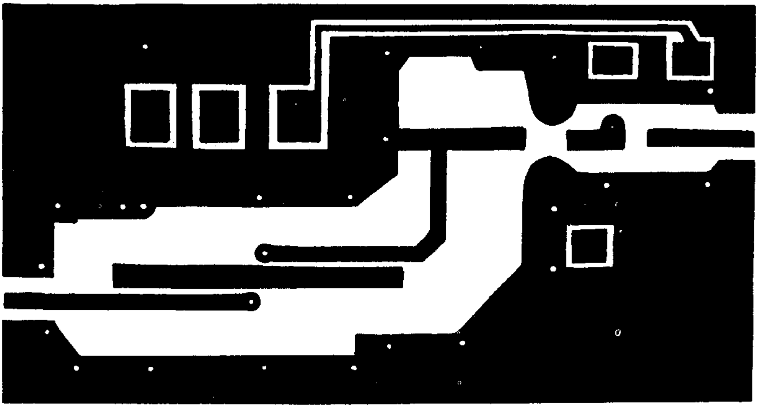
ensure safe operation. It is worth remembering that the permitted voltage across the source and drain should be no more than 3v. R5 is normally set to around mid-range.

CONSTRUCTION

A printed circuit board to the size and layout detailed in Fig.2 should be made. Material should be double-sided and of good quality glass fibre around 1.6mm thick. All components fit on the printed side of the board.

Before any components are mounted, wire 'stakes' connecting the top and bottom ground planes should be soldered in where indicated by dots in Fig.4. They may be made from resistor leads or 18-22swg tinned copper wire. Be sure to solder both sides making as short a connection as possible, and clip the ends off neatly.

54mm



103mm

Fig.2 PRINTED BOARD PATTERN

Next the two leadless ceramic source capacitors should be carefully fitted. They should be flow-soldered onto the copper land using a 25-45 W soldering iron. Fit the remainder of the components as shown with the exception of the GaAsFET. If the input bandpass filter is not required, points 'A' and 'B' should be joined across with a short length of hookup wire, and C's 1 and 2 omitted.

An enclosure should be constructed to exactly fit the PC board. (A die-cast box is not suitable since correct earthing cannot be effected). The box may be constructed out of copper laminate PC board or tinplate. The PC board should be fitted into the enclosure and soldered ALL ROUND on both the top AND bottom earth planes. Holes to facilitate tuning of the tubular trimmers should be drilled in the sides in appropriate positions. BNC coaxial sockets (or 'N' types if preferred) should be firmly fixed to the box and the solder spills soldered to the PC board tracks. A tinplate cover should be made to be a press-fit over the compartment covering the component side.

Microwave components such as the chip capacitors, PTFE tubular trimmers, min. plates, Schottky diodes etc. may be obtained from LMW Electronics, 102 Stamford Street, Ratby, Leicestershire LE6 0JU. (SAE for enquiries/list).

TESTING AND ALIGNMENT

The GaAsfet should still not be fitted.

Check over the circuit carefully and, if all is correct, apply 12 V dc and check that +5 V is available from the regulator.

The zener source biassing circuit may be checked by connecting a test meter (0-100 mA range) between S1 and S2 capacitors. Varying R5 should show a point where the current variation stops. This means that the circuit is working correctly.

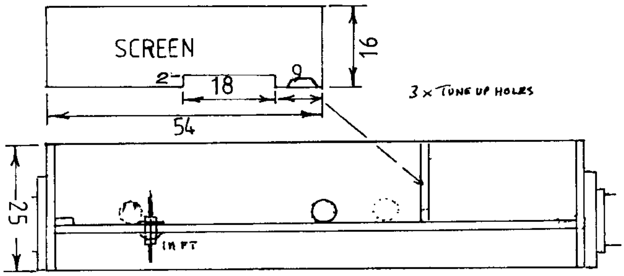


Fig.3 POSITION OF SCREEN AND BOX DETAIL

The GaAsFET should now be installed and the following sequence is recommended:-

1. Remove the power lead from the unit.
2. Lay the unit on a 12" x 12" piece of kitchen foil and connect the two together using a short piece of wire and two croc clips. Using another jumper, connect the box to a 15W soldering iron fitted with a fine tip. Similarly connect yourself, via a metal wrist watch bracelet or a piece of foil, to the box.
3. Carefully remove the device from its anti-static packaging and, using an insulated tool, place it the correct way round in position. Make sure the gate is correct and don't drop it onto a nylon carpet!
4. Solder the source leads to the tops of the disc capacitors (1-2 seconds max.) using as little solder as possible.
5. Solder the gate to L2 stripline.
6. Solder the drain to the output line and clean off surplus flux resin with a small brush dipped in cellulose thinners or PCB cleaning solvent.

The screen may now be fitted in the position shown in Fig.3. The cutout in the screen is to accommodate the GaAsFET and chip capacitors and should be checked for size before soldering in. The lid may now be fitted.

Tune the converter/receiver to a suitable off-air or local signal source and connect the amplifier. Check that the total current drawn is of the order of 40-50mA then, using a non-metallic trimming tool, tune for maximum signal. Be sure that the signal you are receiving is coming in at the aerial socket and not by stray pickup. You may notice that even a non-metallic trimming tool has a small effect on the gate tuning, however this is not enough to de-tune the circuit significantly when it is removed.

Now some important DON'Ts:

Do not flow solder along the PCB tracks, particularly the tuned lines.
To prevent tarnishing, the board should be sprayed with a PCB lacquer such as 'Electrolube' prior to fitting any components.

Do not fit the GaAsFET until all checks are carried out.
Do not apply power until pre-power checks have been completed.
Do not run the amplifier without its screen.

Optional schottky diodes may be fitted as shown at the input of the circuit diagram. If a relay is in use, they protect the input from excessive power leakage.

A weak, off-air signal is ideal for final tune-up, and the unit will need to be re-peaked depending on whether you are receiving in the top or bottom half of the band, if you are using the input bandpass filter.

Results with the CQ-TV converter (elsewhere in this book) have proved excellent, and the presence of the input bandpass filter has effectively eliminated broadcast breakthrough via the front end input.

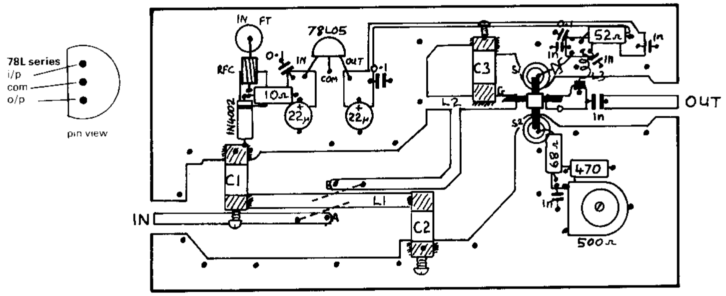


Fig.4 COMPONENT LAYOUT

The importers for Mitsubishi GaAsFETS are:-

Aspen Electronics,
2 Kildare Close,
Ruislip,
Middlesex.

NOTES

Since the original appearance of this article in CQ-TV131 some further thoughts have been sent in by members:

The GaAsFET specified here may be replaced by a number of other types. If the Plessey GAT-4 or GAT-5 is used, the 68-ohm resistor in the source bias chain should be changed to 20-ohms. Using the specified device the circuit works well, however a little more gain may be realised if the 68-ohm source resistor is reduced to 47-ohms. Also chip ceramic capacitors of around 360pF seem to be most suitable at S1 and S2.

It has been found that the amplifier also works well at 934MHz and, with C1,2 and 3 substituted for 5-20pF trimmers it will work on 70cm as well.

FM-TV RECEIVER

by John Wood G3YQC

There is no doubt that frequency modulation is by far the most widely used ATV mode at present in use in the 1.3 GHz band. This is probably due to the realisation of the not inconsiderable advantages that this mode offers over amplitude modulation. Another leading factor is that all of the currently operating or proposed ATV repeaters cater for FM-TV.

When presented with the choice between AM or FM,the first and most common reaction is "....but FM is so difficult to receive as it requires a special demodulator for correct reception". True, it does need a special demodulator, but it need not be very complicated or expensive to build and - in this design - needs almost no test equipment to align.

There are various ways of incorporating an FM-TV receiver in the shack and these will be discussed later on.

SYSTEM REQUIREMENTS

1. An FM-TV receive system needs to have sufficient bandwidth to enable the whole of the signal to be demodulated. If the receiver bandwidth is narrower than the signal deviation, video or syncs will be lost, conversely, if the receiver bandwidth is too wide, the demodulator will not produce a full amplitude video signal at its output.

2. Front-end gain should be sufficient - when used in conjunction with a domestic varicap tuner - to cause limiting in the PLL (IC2) at around the noise threshold, this will ensure that even a weak signal will be correctly received.

3. The system should have a low impedance input and be capable of being driven from a varicap or similar TV tuner.

4. The system should deliver a standard 1 volt peak-to-peak composite video output suitable for feeding a monitor or an RF modulator.

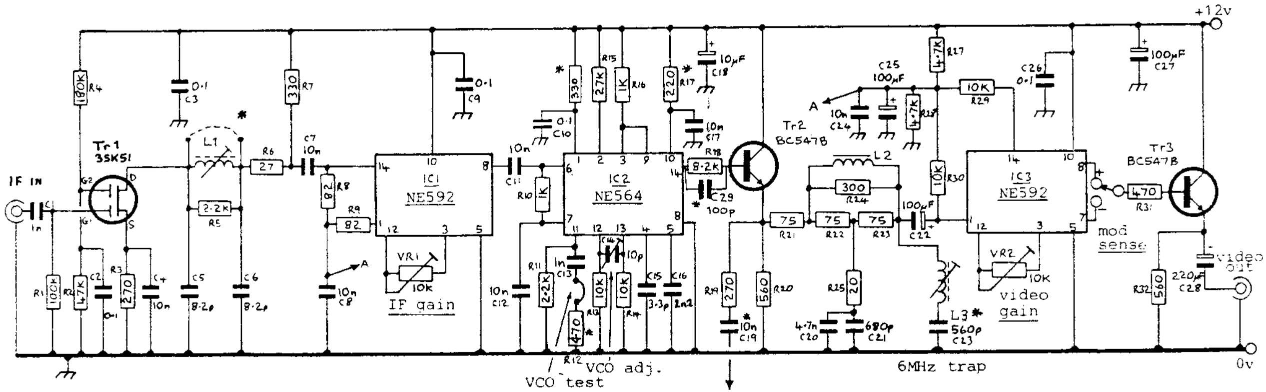
5. Variable front-end gain should be provided to cater for different input levels.

6. CCIR standard de-emphasis should be available as an option.

7. Provision should be made to extract an inter-carrier sound signal.

8. The unit should be powered from a single 12 volt d.c. source (excepting any tuning voltage requirements) to enable portable operation.

9. The whole should be accommodated on a single printed circuit board.



PCB available

L1 - Toko TKXCA34732CQN (36MHz)**
L2 - 33uH fixed inductor
L3 - Toko MKANSK1731HM (6MHz)

**For amateur applications L1, R5, C5, C6 may be omitted. The link should be made.

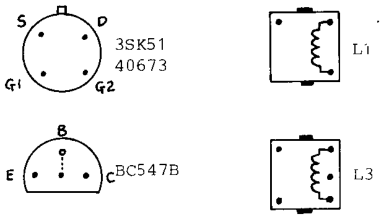


Fig.1 CIRCUIT DIAGRAM

CIRCUIT DESCRIPTION

Input to the receiver is directly from a varicap tuner and is applied to gate 1 of Tr1. A MOSfet is used to give high amplification together with low noise performance. The (optional) tuned circuit L1, C5 and C6 provides some selectivity which helps the overall noise performance - R5 damps this circuit to provide sufficient bandwidth. The signal passes to an NE592 wideband amplifier i.c. operating at the IF frequency. A gain control is provided but in this design will usually be set to maximum. The output of IC1 passes directly to the PLL demodulator IC2. This device was chosen for its superb linearity and ease of use. The circuit in various forms has been described before in CQ-TV. C14 sets the voltage controlled oscillator (VCO) which should be at the IF centre frequency. A test point is provided on the board for this purpose. The demodulated video signal passes through an emitter follower (Tr2) where the sound signal is extracted. The following passive circuit is a de-emphasis network whose response is set for the CCIR standard. At present, in the U.K., no emphasis standard has been established and indeed there may not be a need to do so for amateur work. Provision is made on the board though, in case de-emphasis is needed in the future, or in case the receiver is used for the reception of satellite TV. As not all received pictures may be pre-emphasised some may be degraded if the de-emphasis is left in circuit. For this reason constructors might choose to make the network switchable. Video passes to IC3 - a second NE592 - this time acting as a video amplifier. This stage also has a gain control which sets the video output to 1 volt peak-to-peak into a 75 ohm load. There are two outputs from IC3 providing both positive and negative-going video signals. Provision is made to switch between these outputs enabling both standards to be received - useful for the continentals! Tr3 is another emitter follower providing a 75 ohm video output.

COMPONENTS

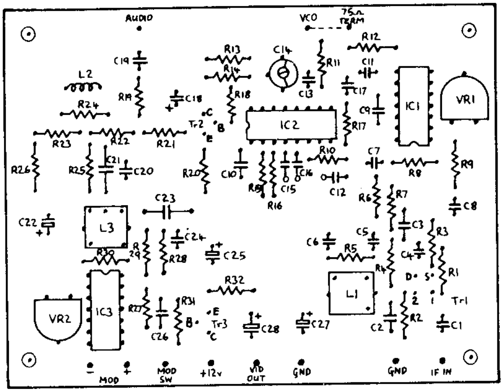
Most of the components are available from Cirkit (formerly Ambit). The three integrated circuits are ordinary plastic dual inline packages (suffix 'N'). If de-emphasis is not required, the following components should be omitted: R21, 22, 23, 24, 25, C20, 21,23, L2 and 3. The emitter of Tr2 should then be connected to the negative side of C22. The intercarrier sound trap cannot remain connected in its present position if the de-emphasis components are omitted. It may be possible to connect it later in the circuit if required, perhaps in the base circuit of Tr3. It is <u>not</u> recommended that i.c. sockets be used - especially for IC1 and IC2.

NE592 devices are unfortunately a little hard to come by (see suppliers list). A possible substitute could be the uA733. The device is pin-compatible and similar in concept, but has not been tried in this design. The uA733 is reported to be a lower-noise device, especially in IF applications.

CONSTRUCTION

The printed circuit board is double sided, its component side being predominantly a ground plane to ensure circuit stability. Components should be mounted carefully using minimum lead lengths. Where possible leads which connect to ground should be soldered on both sides of the board. Note that C12, C15 and C16 earth leads are soldered direct to the top of the board, there being no holes provided. The component side track connecting R9 and

C24 should be soldered on both sides at each end. Care should be taken to insert active devices the correct way round. Vero wiring pins should be inserted into the holes provided round the edge of the PC board, these are used for the external connections.



o =earth to
top of board

Fig.2

FM-TV RECEIVER COMPONENT LAYOUT

ALIGNMENT

Alignment is very straightforward and may be carried out using no test equipment. However, the following sequence should be carried out if possible: Connect +12 volts and ensure that this voltage appears on the appropriate i.c. pins and transistor collectors. Connect a frequency counter to the VCO test point and adjust C14 for a reading equal to the IF frequency (36 MHz) - usually around the half mesh position. Switch off and connect a link wire to terminate the test point with R12. Turn VR1 to maximum (fully clockwise) and VR2 to halfway. Connect the IF output from a varicap tuner to the input (see figs. 4 and 5) and a video monitor or oscilloscope to the output. Switch on and make sure there is plenty of white noise (snow) on the screen. Adjusting VR2 should alter the contrast. Peak L1 (if fitted) for best signal - its tuning will be rather flat.

OPERATION

Although it is possible to receive an FM signal on an AM receiver by 'slope detecting', it is not possible to see an AM signal on an FM receiver, therefore you will need an FM-TV signal to finally check the unit. When you first tune in a picture it is tempting to tune for maximum signal (best contrast) just as you do for AM. With FM though, this is not necessarily the optimum position. In practice the receiver should be tuned for the best LOCKED picture (correct 7:3 video:sync ratio if viewed on a 'scope).

NOTES

Several of these units have been constructed and they have worked without troubles. Please realise that tuning in an FM-TV picture is different from what you are used to so a little patience and experience may be required to realise the best from the system.

It has been found that pins 3 and 9 of IC2 require between 1 and 1.5 volts on them - this may be adjusted by altering the value of resistor R17. Changing this voltage will alter the demodulated bandwidth which is set here to around 10 MHz. One user has arranged to vary the main supply rail to achieve this effect, in this case the demodulator was being used to receive the Russian Gorizont TV satellite in the 4 GHz band and thus required a bandwidth of some 30 MHz! Of course the tuned circuit (L1) was removed.

The coil in the intercarrier sound trap does not have to be the Toko type suggested - a home-constructed circuit will do, provided L3/C23 are series resonant at the sound frequency in use, which may be either 5.5 or 6 MHz. It might be useful to fit a switched trap so that either standard can be received. Whilst on the subject of intercarrier sound, it is worth noting that some constructors have found it necessary to reduce the value of the sound take-off capacitor (C19) - in one case to as low as 15 pF, in order to correctly match into their sound demodulators. The original value was designed to drive the usual ceramic filters found in most domestic sets. Also, some constructors have experienced problems with excessive local oscillator output from the VCO. Changing R12 to the new value of 470 ohm (previously 75 ohm) should help this. It is important to ensure that during normal operation, the terminating link is in place - it is only removed during setting-up. It may be advantageous to run the entire board from a slightly lower, i.e. 11 volt supply - the NE564 seems to be happier at this voltage. The supply must not be greater than 12 volts.

For those interested, Figure 3 shows the demodulated waveform obtained by applying a sweep signal to the RF input.

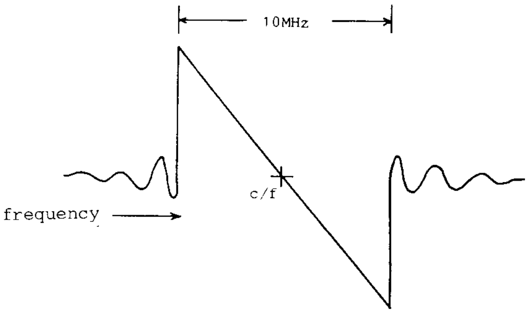


Fig.3

A measure of the linearity is the straightness of the line - although re-drawn here, it is indeed very straight on an analyser screen.

INSTALLATION

The easiest and most versatile way to construct an FM-TV receiver is to custom-build it. A demodulator can be installed into an existing TV set, especially if the set is not required for AM as well, but this may mean a fair bit of work and will restrict the unit's versatility. A straightforward system is to simply connect a varicap tuner to the demodulator, provide a tuning control and put it into a metal box. This could, if desired, house a sound board and loudspeaker as well. Figures 4 and 5 give details of the connections for the U321 tuner and for the popular ELC1043 range. It is useful to provide a meter on the front panel to monitor the tuning voltage, this will give some idea of where in the UHF band you are tuned and may be calibrated in frequency or channel numbers if calibration facilities are available.

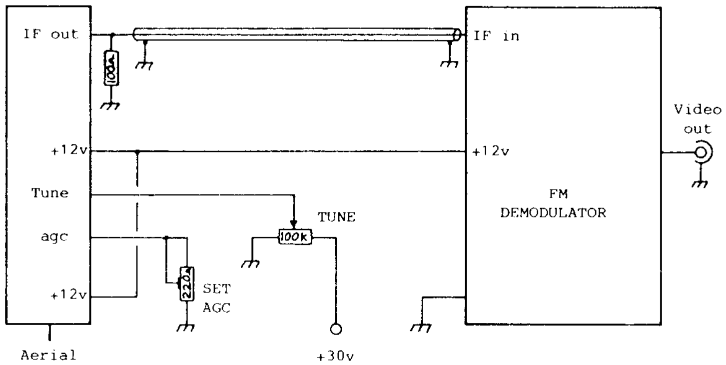


Fig.4 USING THE U321 VARICAP TUNER

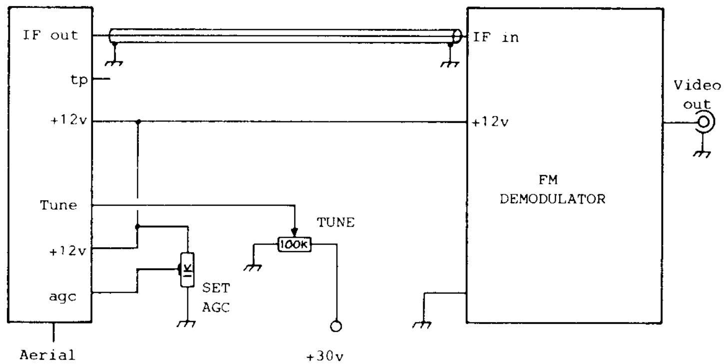


Fig.5 USING THE ELC1043 STYLE TUNER

All components, including the NE's, are available from Cirkit (formerly Ambit):

Cirkit, Park Lane, Broxbourne, Hertfordshire, EN10 7NQ.

NE592 and NE564 devices are also available from:

Fortop Ltd., 13 Cotehill Road, Werrington, Stoke-on-Trent, Staffs.
Technomatic Ltd., 17 Burnley Road, London NW10 1ED.
Quarndon Electronics Ltd., Slack Lane, Derby.

PRINTED CIRCUIT BOARDS are available from BATC Members Services.

A 70CM TRANSMITTER

By John Wood G3YQC

This transmitter has been developed primarily so that it is easy to construct and align using the minimum of equipment. Particular attention has been paid to the problem of instability which can cause trouble when commissioning a home-built transmitter, and for that reason use has been made of capstan type transistors in the final two stages.

The transmitter is intended either as a low-power self-contained unit or as a driver for subsequent linear amplifiers. The video modulator is included on the printed circuit board and requires only the addition of a 100-ohm carbon potentiometer to provide adjustment of the video input level.

CIRCUIT DESCRIPTION

The circuit diagram is shown in Fig.1. Tr1 forms a crystal controlled oscillator which operates at 108.875MHz. In order to ensure maximum stability and spectral purity, the oscillator is powered from a three-terminal voltage regulator (IC1). The output is coupled directly to the base of Tr2 which operates as a frequency doubler. The collector tuned circuit (L2) resonates at 217.750MHz and, together with L3, forms a simple bandpass filter. Tr3 is another doubler stage and brings the signal to its final frequency of 435.5MHz.

The collector of Tr3 also connects to one half of a bandpass filter (L4) but derives its supply from the video modulator. Tr4 is the output amplifier and is also powered by the modulated rail. The collector connects to a simple pi output stage which provides a low impedance output suitable for matching into 50 or 75-ohm coaxial cables.

Video modulation is applied to the base of amplifier Tr5 via a panel-mounted 100-ohm variable carbon control providing adjustment of the actual video level. Tr5 base is biassed from a potentiometer circuit fed from a zener stabilised voltage source. DC restoration is provided by a diode and Tr6 is an emitter follower delivering up to 12-volts (modulated) to Tr3 and 4.

CONSTRUCTION

A double-sided printed circuit board and crystal is available for this transmitter from the BATC's 'Members Services' department, the component layout is illustrated in Fig.2. The component side of the board acts only as an earth plane,and where possible component leads which are connected to ground should be soldered to both sides of the board. Although HC-18/U or HC-25/U crystal packages are most often used at frequencies over 100MHz, provision has been made on the board to accommodate the larger HC-6/U style as well.

A couple of small modifications have been made to the oscillator since the PC board was designed. Originally the 5.6pF capacitor coupling the oscillator to Tr2 was taken directly from the collector of Tr1, and a hole is provided on the board for that purpose. This new circuit requires the capacitor to be connected to a tap on L1, this means that only the hole at Tr2 base is used,

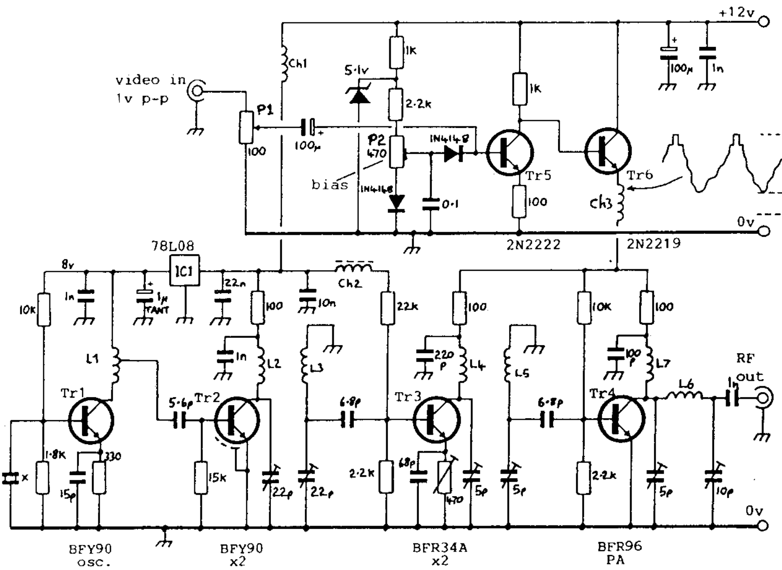
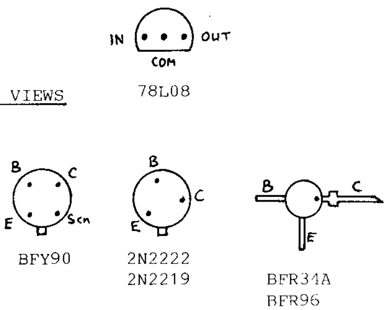


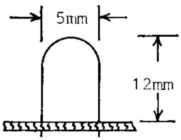
Fig.1 TV TRANSMITTER CIRCUIT DIAGRAM

L1 - 10t 26swg enamelled copper on 4.5mm former, with core, tap 3-turns from 'cold' (supply) end.
L2,3 - 1¾t 18swg enamelled copper, 5mm i.d. spaced 2mm from board.
L4,5 - ¾t 18swg enamelled copper bent to shape as illustrated.
L6 - 1¾t 18swg enamelled copper or silver plated, spaced 2mm from board.
L7 - 3t 26swg enamelled copper, 3mm i.d. close wound.

Ch1 - 10t 26swg enamelled copper, 3mm i.d., self supporting.
Ch2 - 3t thin insulated wire on ferrite bead.
Ch3 - 8t 26swg enamelled copper, 3mm i.d., self supporting.

PIN VIEWS





Detail of L4 & L5

the other end of the 5.6pF connecting directly to the tap. L1 has also been increased to 10-turns, the tap being made at 3-turns from the supply end. Originally a capacitor was connected between Tr1 collector and ground, this should be omitted.

Trimmer capacitors should be good quality plastic film types; Mullard or DAU types are among the better quality ones commonly available. (Note that this type of trimmer is not intended for lots of "twiddling" and may become unserviceable if subjected to too many adjustments). All lower value capacitors are miniature plate ceramic. One 100uF electrolytic is axial mounted whilst the other is a vertical radial type. A small heatsink should be fitted to Tr6.

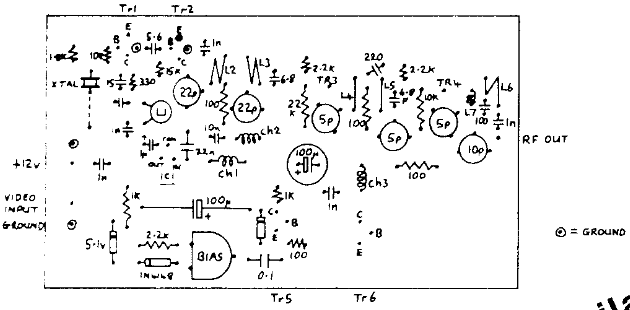


Fig.2 COMPONENT LAYOUT

PCB available

COMPONENT LAYOUT

L2 and L3 are wound in opposite directions and should be wound to fit the holes provided. The screen lead of Tr1 may be either clipped off or soldered to ground on top of the board.

A suitably sized hole should be drilled to accept the former used for L1. This should be glued into position. 3/16" holes should be drilled in the board at the places indicated for Tr3 and Tr4. These transistors are mounted on the print side of the board and carefully soldered to the tracks provided. Care should be taken to ensure that the devices are installed the correct way round. The printing on the transistor package faces downwards.

The completed unit may be housed in a screened metal box fitted with a BNC socket for the RF output and power fed in through a 1000pF feedthrough capacitor.

ALIGNMENT

Alignment is straightforward and may be carried out using the minimum of equipment.

Temporarily up-end Ch3, apply power to the unit and check that there is +8volts at the collector of Tr1. Using the RF 'sniffer' probe described below, (Fig.3) place the loop over the oscillator coil former and adjust the slug until the oscillator starts, indicated by a reading on the test meter.

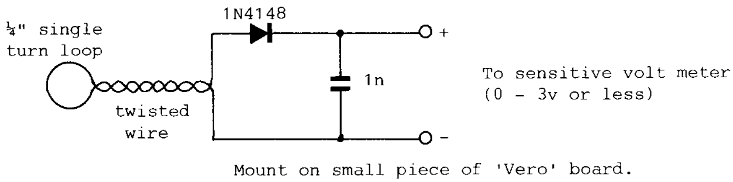


Fig.3 RF 'SNIFFER'

Now place the probe near to L2 and adjust its trimmer for maximum indication. Whilst in this position, re-peak the oscillator for maximum output then withdraw the tuning slug about a quarter turn, this should ensure that the oscillator starts readily. Switch the unit on and off several times to check that it does.

Re-connect Ch3 and turn the Bias control (P2) fully clockwise, set the video gain control to minimum. Make a test load/detector according to the circuit in Fig.4 and connect it to the RF output. Apply power and adjust L2, L3 and L5 tuned circuits for maximum indication on the test meter. Adjust the output tuned circuit for maximum output, playing one capacitor off against the other. At this stage a variation in the output power should be noticed if P2 is adjusted. If all is well apply video and turn up the video gain control. Turn P2 slowly anti-clockwise and, as you do this the output power reading should fall, this indicates that video modulation is present. Do not be troubled if, when modulation is applied, the indicated power output falls considerably, this does not mean that the actual PEAK power is degraded, it is merely the effect of the power indicator which is averaging the signal indication. To establish the peak power level simply unplug the video signal and watch the power indicator, it will be showing the ACTUAL power output level.

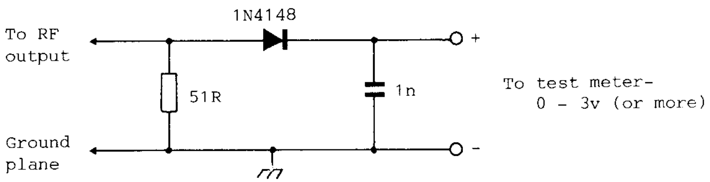


Fig.4 OUTPUT POWER INDICATOR

Monitor the output signal using either a monitor probe (elsewhere in this book) or by receiving the signal on the station TV receiver, and adjust the bias control for correct video/sync ratio (3:1) - in practice this is usually almost at the fully anti-clockwise position. The video gain control should be turned up 'till just before the white parts of the picture start 'flat topping' or becoming over-white, this would indicate that white crushing of the waveform is occuring and is best seen on a 'scope. In other words you are driving the amplifier into non-linearity.

This transmitter has been carefully designed so that even when adjusted without the aid of a spectrum analyser, all harmonics should be better than 30dB down on the wanted frequency. However if test equipment is available the transmitter should be aligned for minimum harmonic content.

70 CM TV TRANSMITTER

by John Hopkins G4DYP

This unit was designed as a low power, high quality 70 cm television transmitter which is capable of producing well in excess of 100 mW peak sync. power and can be used either as a QRP transmitter for local or portable working, or as a driver for a higher power amplifier.

The transmitter has been well tried and tested on the air, with several units in regular use and, needing no special printed circuit board, is easy to construct and operate.

When correctly tuned and adjusted, the transmitter will handle a video signal having a bandwidth of greater than 6 MHz and is therefore adequate for colour as well as monochrome operation.
Although printed circuit techniques are used to ensure repeatability, it is not necessary to etch and drill a conventional pcb.
All components used in this design are common types and readily obtainable.

CIRCUIT DESCRIPTION

The RF stages of this transmitter follow conventional practice. A crystal oscillator of around 72.5 MHz drives T2 which acts as a tripler. The resulting 217 MHz signal is doubled in T3 which uses a BFY90 transistor and the 70 cm signal is coupled to the first amplifier T4.

Both BFY90 amplifiers T4 and T5 receive modulation principally on their bases - in practice this was found to work better than applying modulation to the collectors only. The depth of modulation and the RF output level are controlled by the 47 k preset in the base circuit of T4. Since both stages have video signals on their supply rails, decoupling is kept to a minimum to reduce any restriction of the video bandwidth.

The modulated 70 cm signal is finally passed via C5 to the linear amplifier T6, which raises the level to 100 mW or so. The network L6, C6 and C7 matches the amplifier to a 50 ohm load.

A standard 1 V p-p video signal is applied to the input, the gain being set by a 100 ohm carbon pot., which may be panel mounted if required. An RC pi network helps to keep rf out of the modulator. The OA91 diode in conjunction with a 2.7 k preset provides DC restoration, setting the DC output voltage of the modulator, which provides the modulated 11 V supply rail to the rf stages.

COMPONENTS

All capacitors should be good quality disc or tubular ceramic types. Electrolytics should be at least 16 V working. Trimmer capacitors should be plastic film types. All resistors are 1/4 W except where otherwise stated. To ensure adequate video gain, the BC109 transistor used for T7 should be one of the high-gain group, suffix 'B' or 'C'.

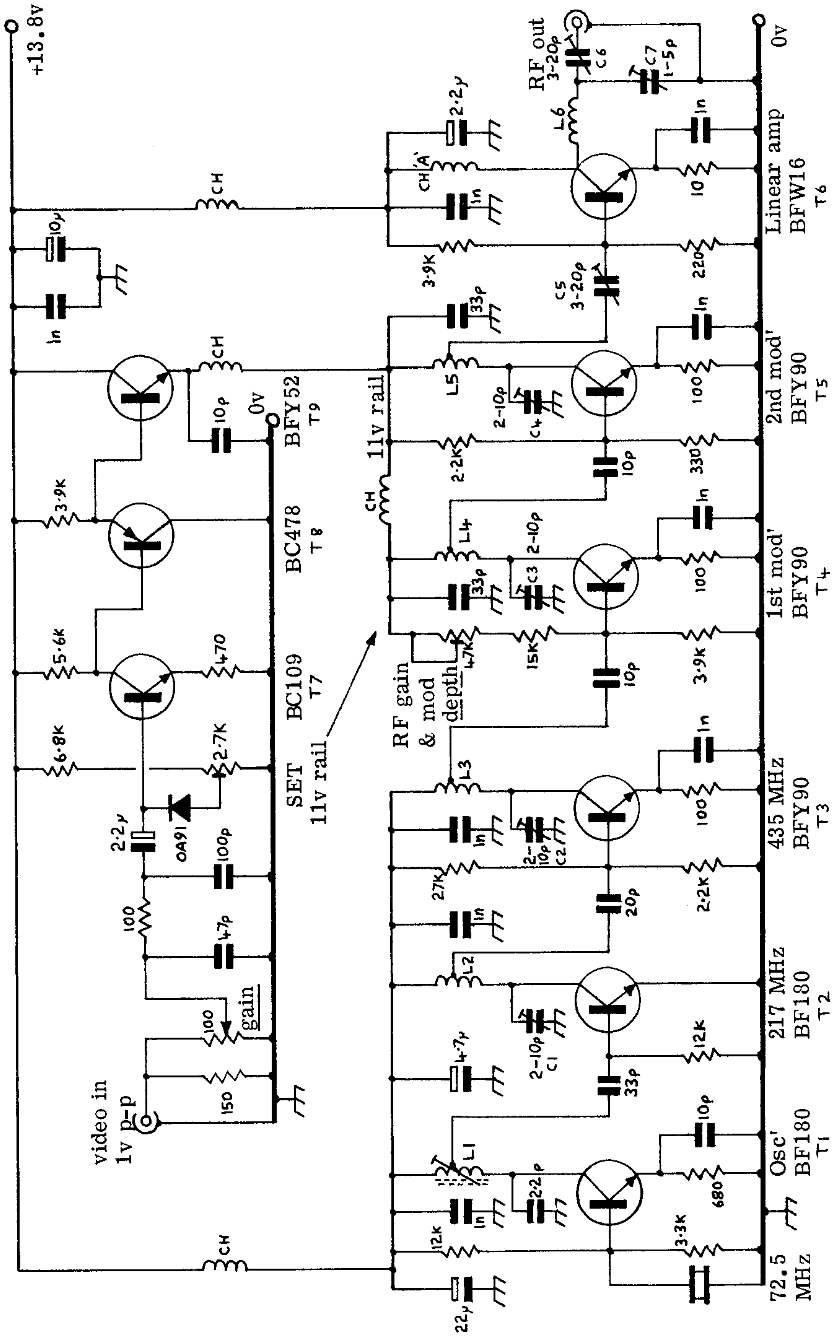


Fig.1

CIRCUIT DIAGRAM

CONSTRUCTION

Take a piece of single-sided copper laminate board 4 7/8" (124 mm) by 1 5/8" (41 mm) and place it copper side uppermost. Cut from a similar piece of board the pads indicated by the shaded areas in figure 2, using a small saw, and glue these pieces copper side up onto the main board in the positions shown. The size of the pads should be kept as small as practicable, especially those associated with the tuned circuits, as too large a pad may mean that the circuit will not tune correctly.

All rf decoupling capacitors should be wired in such a way that their leads are as short as possible - this is most important for stable operation. The emitter components of T3, 4, 5 and 6 should be wired as shown in figure 2, keeping the leads very short. The 100 ohm emitter resistors for T3, 4 and 5 should be 1/8 W if possible, since these are shorter than the usual 1/4 W types.

The layout shown in figure 2 should be followed as closely as possible, and dimensions are given to assist in the correct positioning of the pads.

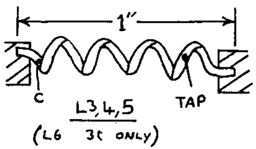
ALIGNMENT

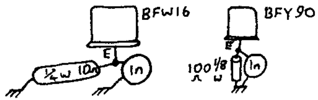
Disconnect the chokes from the supply rails to T4 and 5, and T6. Apply 13.8 V to the transmitter and adjust L1 until the oscillator starts. Switch the transmitter on and off several times to check that the oscillator starts reliably every time. Tune C1/L2 to 217 MHz and C2/L3 to 435 MHz. The output frequencies should be checked with an absorption wavemeter. Re-connect the choke feeding T4 and 5 and, with no video input, adjust the 2.7 k preset in the modulator for 11 V on the 11 V modulated rail. Tune C3/L4 and C4/L5 to 435 MHz, and check that the 11 V rail is still correct, re-adjusting if necessary.
Apply the 13.8 V supply to T6 by re-connecting its choke and connect the rf output to a 50 ohm load. Adjust the network L6/C6/C7 for maximum rf output, which should be in excess of 100 mW. Adjust C5 for the correct power output - the rf gain preset should also affect the output level.
Apply a video input, and advance the video gain control. The rf output, when measured on an average-reading power meter, will drop to around half the previous peak reading when a good depth of modulation is present. Monitoring the rf output using a demodulator probe, adjust the video gain and rf gain presets and C5 for an undistorted picture as viewed on a monitor or oscilloscope. The idea is to achieve maximum modulation without distortion to either sync. tip or peak white. To achieve maximum performance from the transmitter, the biassing of the amplifier transistors T4, 5 and 6 may be adjusted to suit the particular transistors used. With the oscillator crystal removed, the BFY90 transistors should have a quiescent current of around 2 mA, whilst the BFW16 should have around 4 mA.
If there is insufficient depth of modulation available even with the rf gain control at maximum, the value of the 15 k bias resistor in the base circuit of T4 may be reduced.

CONCLUSIONS

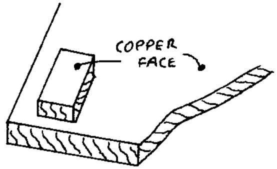
Several transmitters have been constructed to this design, and the only problems encountered were due to faulty or unsuitable components, long leads on decoupling capacitors or the use of different transistors from those specified.

L1.	15t 30swg on 4.5mm former with core
L2.	4t 22swg 3/16" id, 1" long
L3,4,5.	4t 22swg 1/8" id, 1" long
L6.	3t 20swg 9/32" id, 1" long
	Tap L1 4t from supply end, all others tap 1t from supply.
CH.	10t 30swg 1/8" dia, self supporting
CH'A'	4t 20swg 1/8" id, 1/4" long





Detail of emitter components on high frequency transistors.



Fitting pads to copper clad board with instant glue.

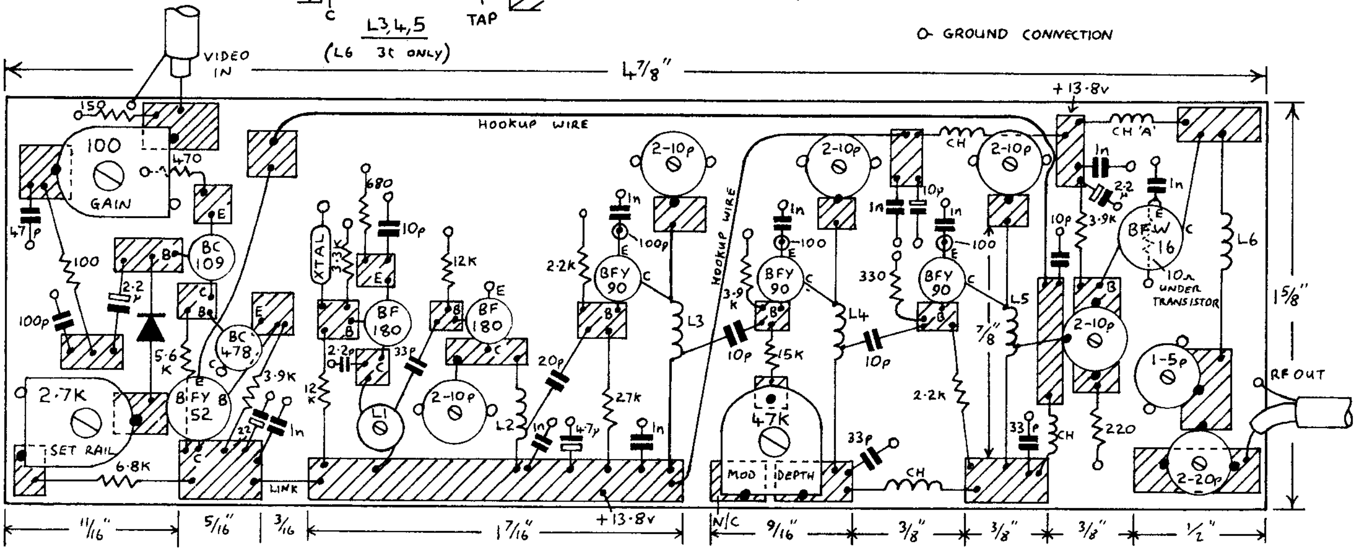


Fig.2 CONSTRUCTION AND COMPONENT LAYOUT

70CM RF AMPLIFIERS

by John Hopkins G4DYP

This article describes a set of linear amplifiers designed for use with the G4DYP 100 mW TV transmitter.

Four amplifiers are described with output powers ranging from 750mW to 30 W peak output power. These enable constructors to build amplifiers up to the required output level. The amplifiers can all be built separately and coupled together as required using coaxial cable links, or they may be built as a single unit stringing together those stages needed for the required output power. Figure 4 shows the four amplifiers connected together to give about 30 W peak output.

The circuits are conventional and identical to each other, and feature extra decoupling of the supply rail to cope with both rf and video frequencies.

Figure 1 shows the circuit of the 750mW amplifier with both input and output tuned circuits and illustrates how any amplifier can be used on its own.

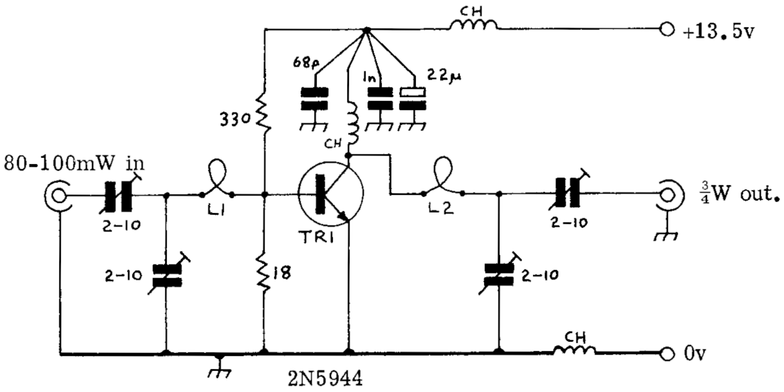


Fig.1 750mW LINEAR AMPLIFIER

Figure 2 shows the circuit of the 6 W amplifier where the transistor, as in all the other versions, operates in the grounded emitter mode. Again, the supply rail is adequately decoupled for all frequencies. This figure illustrates how any amplifier can be connected to the output of another. Note that the input tuned circuit is also the output tuned circuit of the previous stage. This arrangement is used only if the two stages are to be built together. Figure 2 also shows the coupling arrangement used between separate amplifiers. Particular attention should be paid to the length of the coaxial lead, which should be a whole multiple of 1/2 waves, in order to avoid problems with reflections on the line, since the impedances at both ends are reactive.

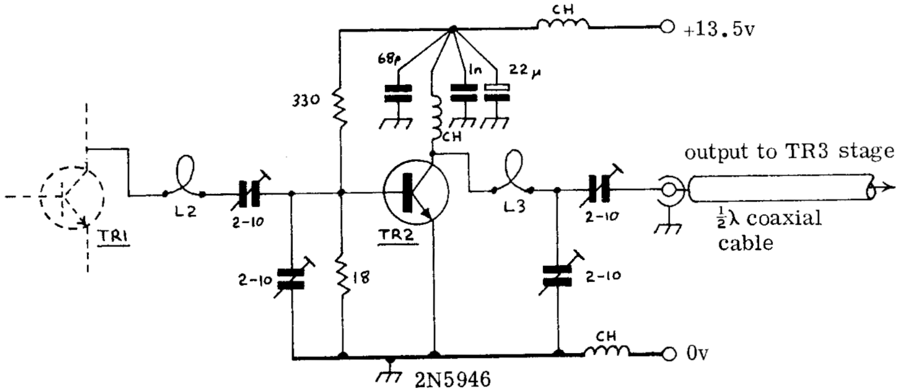


Fig.2 6W LINEAR AMPLIFIER

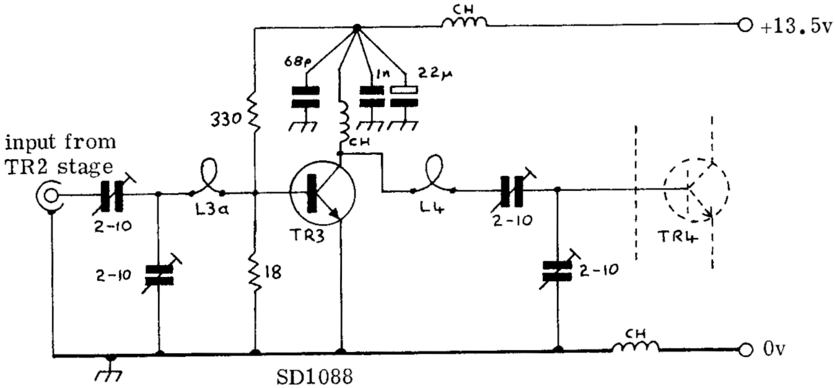


Fig.3 15W LINEAR AMPLIFIER

The 15 W amplifier shown in figure 3 employs an SD1088 transistor. Figure 3 also illustrates the input arrangement used for a string of one or more amplifiers.

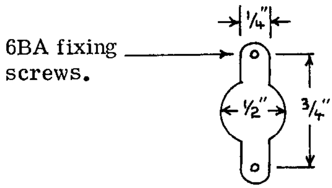
CONSTRUCTION POINTS

The technique used is similar to that used for the 100 mW transmitter. Pads are cut from single-sided copper laminate and glued to the main copper clad board in the positions shown. Care should be taken to keep leads as short as possible. All transistors require suitable heatsinks to dissipate the fairly considerable heat generated, especially in the high power stages. Don't forget that a TV transmitter is often operated continuously for quite long periods, and some ATVers even use a blower fan to keep cool air moving across the heatsink, although the need for this depends on the size of the heatsink used.

The resistors used in the prototype were 2.5 W wirewound vitreous enamel types from RS Components, but no doubt other types would be suitable. Lower power carbon resistors could be used in the first two stages, but because of the need to dissipate greater power in the larger amplifiers, wirewound types should be used. A resistor failure could mean the loss of an expensive transistor.

Where a transistor lug is not joined to a pad for connection purposes, a small insulating pad should be glued under the lug to prevent it accidentally shorting to the main board. Plastic tape should be used under the power supply chokes on the main board, also to prevent accidental short circuits.

It may be necessary to trim the leads of TR1 and TR2 to make a neater and more rigid layout. Care should be taken when mounting the capstan power transistors, as the ceramic is quite easily broken if stress is applied to it whilst tightening down the stud mounting. TR1 and TR2 have a ¼" shoulder under the ceramic package, and a ¼" hole to accommodate this shoulder should be drilled in the main board. Make sure that the laminate used is not thicker than the shoulder, otherwise strain will be put on the ceramic when the stud is tightened. To avoid this problem, either countersink the ¼" hole on the top of the board in order to seat the transistor below the surface, or build up the shoulder thickness with a washer. The transistor should only be soldered in after mounting is complete. Similar problems arise when fitting TR3 and TR4 except that their shoulders are shaped as illustrated below:



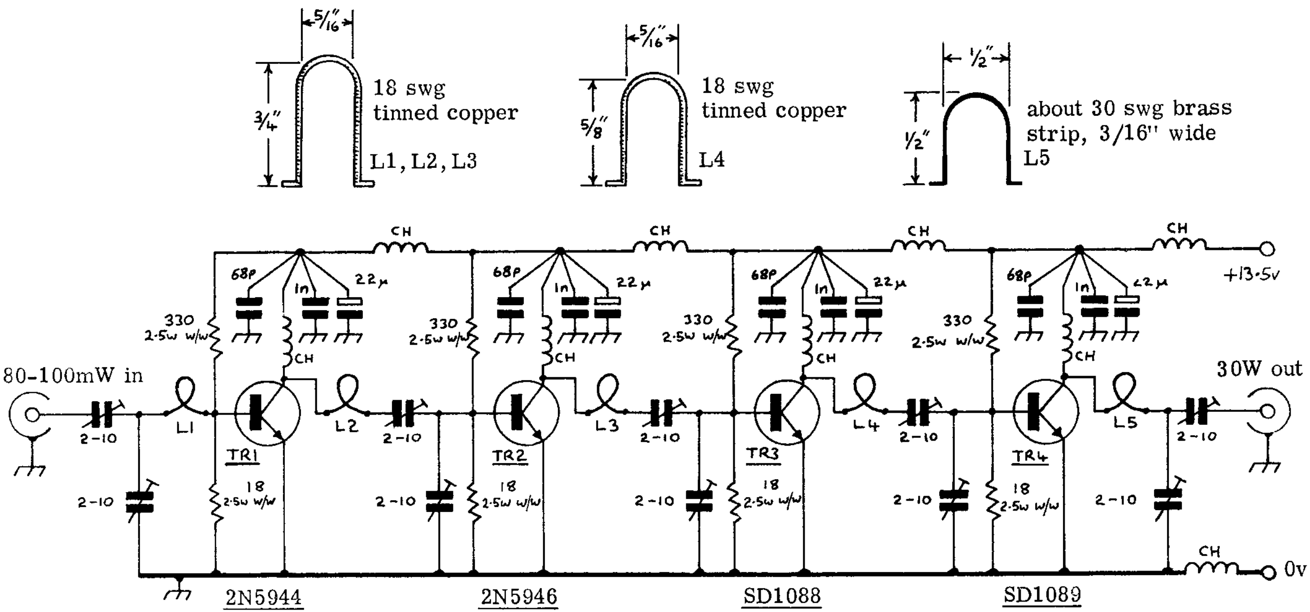
This shape should be cut out of the main board to enable the boss to pass through. Two 1/8" holes are drilled through the heatsink to take the 6 BA screws which are used for bolting down. On the prototypes the emitter lugs were soldered to ground at each end only, as shown in figure 5.

CONSTRUCTION AND ALIGNMENT

Construction and alignment should present little problem if the layout is followed closely. The method used on the prototypes was as follows:

N.B. Limit power supply volts to 12 V maximum until alignment is complete.

Inductor sizes may require altering to suit individual layouts (usually smaller)

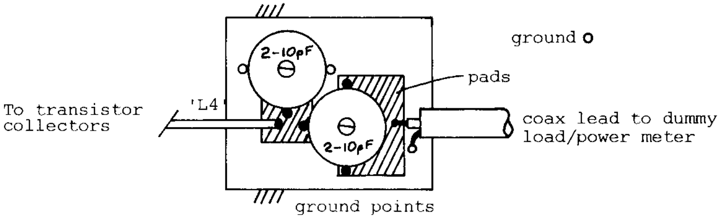


All resistors 2.5W wirewound vitreous
CH. 6t 28swg 5/32" id, 3/8" long

22uF capacitors - Tantalum 25v
Trimmers - min. plastic foil

Fig.4 30W ATV LINEAR AMPLIFIER

1. Cut the main board to the size shown in figure 5.
2. Drill the transistor stud mounting holes and cut-outs in the positions shown, mount the board on the heatsink and install TR1.
3. Build TR1 circuit as shown except for L2 and the two trimmers.
4. Make up an LC output circuit using and inductor similar to L4 on a small piece of tinplate, as shown:-



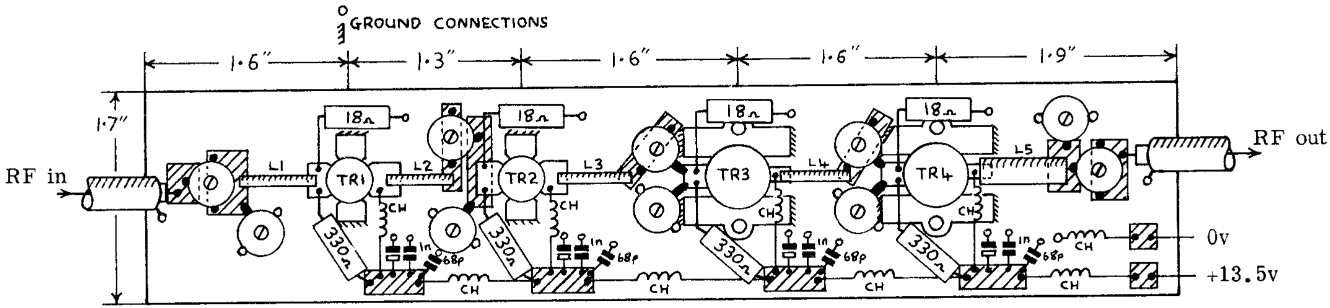
5. Connect a length of coaxial cable between the output and a 50 ohm Wattmeter and dummy load.
6. Place the temporary board adjacent to TR1 and solder the loop inductor to the collector.
7. Up-end the collector choke at the supply rail end and insert a milliammeter.
8. Apply +12 V to the stage WITHOUT applying rf drive and check that some standing current (of the order of 10 mA) is indicated.
9. Remove the meter and re-connect the choke.
10. Apply power and drive and adjust both input and output tuned circuits for maximum on the power meter.
11. Remove the temporary board and install the correct tuned circuits.

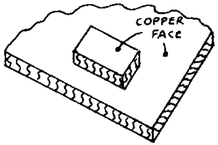
The same method is used to build and align the other three stages in turn. The standing currents will be of the order of 20 mA for TR2, 40 mA for TR3 and 80 mA for TR4. The actual values are not critical.

When the alignment is complete, the supply may be raised to around 13.5 V and the whole amplifier should be re-peaked for maximum output on the power meter. It is useful to check the output with an absorption wavemeter for the presence of harmonics and other spurious signals.

With video modulation applied, the output power indicated by an ordinary rms reading power meter will drop to around half peak power, indicating that a good depth of modulation is being obtained.

Since these designs were first published several new power transistors have made their appearance on the amateur market. Using the circuits and techniques described here, it should be possible to use many of these devices, although certain components and perhaps tuned circuit dimensions may need adjusting in order to accommodate differing semiconductor parameters.





Component mounting pads cut from PC board and 'super-glued' to the main copper laminate board. Pads are shown as shaded areas.

Fig.5 BOARD LAYOUT (approximately to scale) - 30W LINEAR AMPLIFIER

AN FM-TV GENERATOR

By John Wood G3YQC

Deciding on a design for a 24cm ATV FM transmitter can be a little perplexing for some, especially since there are several ways of obtaining the same end-result. Perhaps the two most popular methods so far are by generating a 430MHz signal, modulating it and then tripling up to the required frequency, or by generating directly at signal frequency, modulating and amplifying to the required level. Both methods have their merits and drawbacks so here is an alternative approach which could be said to be "nicer" and which is not dissimilar to methods used commercially.

For many of us, building and aligning RF power circuitry at 1.3GHz is not an easy task, and one is certainly tempted to buy commercial where possible. However, some of us may have a redundant 23cm narrow-band transverter or mixer-type transmitter in the cupboard, or may be able to aquire one second-hand at a reasonable price, so why not make use of them? Most transverters seem to have an IF at 144MHz as they are designed of course for use with 2-metre equipment, if this frequency were changed to say 70MHz (the industry standard), then a very nice FM-TV transmitter could be constructed with a minimum amount of effort.

Why not leave the IF at 144MHz? Well of course you can, that is if you want your 2m rig to be blocked out by vision every time you go on 24! Any reasonable IF frequency can be used however, perhaps to suit a crystal which happens to be in stock. The local oscillator frequency will need altering of course so that when mixed with the new IF the resulting signal will be on the frequency of your choice.

A 70MHz GENERATOR

This generator is designed to produce up to around 20mW of drive, although 5 to 10mW is usually sufficient to drive most transmit mixers, that is of course after any input attenuators which may be fitted have been disconnected.

Fig.1 shows the circuit of the complete generator. Video at the standard 1v p-p level is applied to the input which is provided with a gain control used to set deviation. The signal passes through a standard CCIR pre-emphasis network, this may be omitted if required although it will increase versatility if an arrangement were made to switch between the pre-emphasis network or a 'tee' or 'Pi' resistive attenuator, whose attenuation is equal to that of the emphasis network, in this way deviation will not be altered when emphasis is switched in and out.

The signal passes to a pair of transistors wired as a wide-band inverting amplifier. The swept frequency response of this amplifier shows it to have a virtually flat response between 20Hz and 7.5MHz. The circuit as shown is set

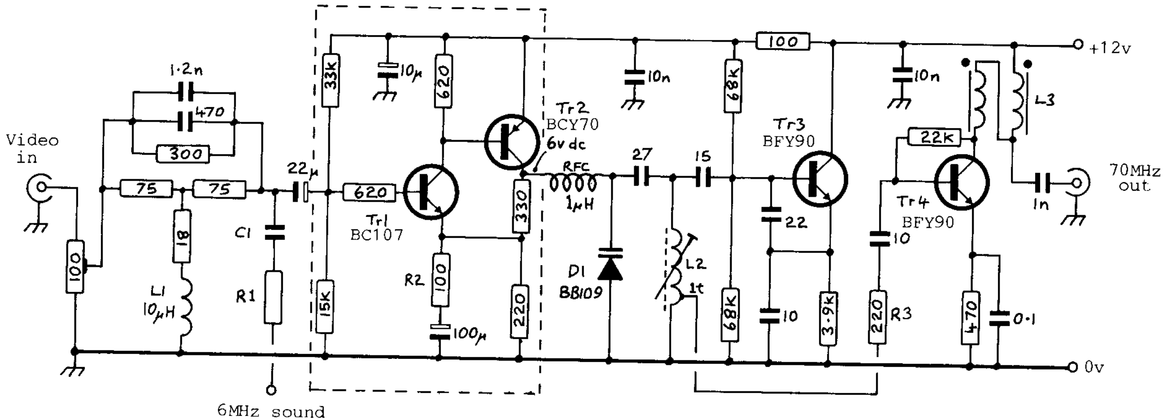


Fig.1 70MHz FM-TV GENERATOR

L1.	Fixed inductor
L2.	Toko S18 coil (white) Cirkit No. 35-10803 with can.
L3.	See text
D1.	BB109 (green tip)

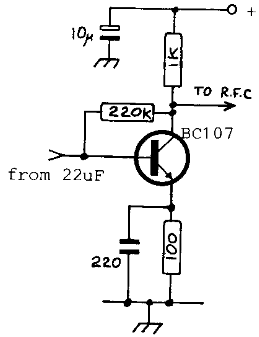


Fig.2 An alternative 'inverting' amplifier.

for a gain of 5.5 however if less than that is required then the 100-ohm emitter resistor (R2) may be changed as follows:-

R2 = 220-ohms voltage gain = 4
R2 = 150-ohms voltage gain = 4.5
R2 = 100-ohms voltage gain = 5.5

A DC level of around +6v is present on Tr2 output (without modulation), this is to ensure that modulation takes place on a linear part of the diodes' characteristic curve, thus providing good linearity. The 70MHz voltage controlled oscillator is based around a standard Colpitts circuit and has been optimised not only for stability but also for a reasonably flat amplitude response over the required frequency range. The circuit in use by myself uses the largest VHF Toko coil available and, provided a ferrite core is used, may be tuned well either side of 70MHz. A can should be fitted over this coil to aid frequency stability.

Automatic Frequency Control of the oscillator was not found to be necessary in this application; drift on the prototypes was within a very few tens of Hertz per minute - after a five minute warmup period.

The oscillator signal is lightly coupled to the output buffer by means of a tap, well down the 'earthy' end of the coil. A series resistor and capacitor provides very light coupling (preserving stability) and also a means of adjusting the output level of the amplifier. The 220-ohm resistor shown at R3 is typical of that needed in order to drive a transmit balanced mixer, however it may be either increased or decreased as required. If there is still insufficient output then the tap on L2 (nominally at 1-turn from the ground end) may be taken further up the coil. Care should be taken with this adjustment however since too high a tapping could adversely effect the frequency stability of the oscillator.

Since a FM-TV signal with a reasonable peak-to-peak deviation occupies quite a large bandwidth, the output amplifier (and subsequent stages) should be wide enough to cater for such a wide signal. For this reason a wideband transmission line transformer is used as the collector load for Tr4, details of which are given in Fig.3 and under the heading 'Components' later in the text. The output impedance of the amplifier is around 50-ohms enabling efficient coupling into the mixer which will typically be via a link into a double tuned circuit.

Provision is made after the pre-emphasis network to insert a 5.5 or 6MHz sound carrier. The resistor/capacitor combination (R1/C1) should be made suitable for the system used, values being typically 470-ohm and 470pF.

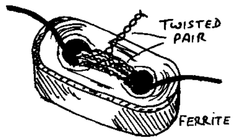


Fig.3

6-10t thin insulated wire bifilar wound onto a ferrite former or ring. Drawing shows typical 'surplus' shaped ferrite.

FURTHER CONSIDERATIONS

23cm transverters invariably have their local oscillators on the low side of the wanted frequency, this being so then sideband inversion will not take place in the mixer and therefore video inversion must not take place in the generator, (assuming that conventional modulation standards are being used). The circuit in Fig.1 is non-inverting (actually double inverting) therefore, assuming no other mixes in the system, the signal should come out the right way up. If however a transmitter has its local oscillator on the high side then an inversion will take place, therefore a similar inversion must also take place elsewhere in order to restore the status-quo. The circuit shown in Fig.2 is an inverting amplifier having a similar performance to the two stage one and may replace the circuit shown within the dotted lines if required.

To set-up the FM generator simply adjust the core of L2 for a frequency of 70MHz - measured at the output with a counter, after allowing a five-minute warmup period. No modulation should be present whilst this is done!

FILTER CONSIDERATIONS

Obviously it is in everyone's interests to keep radiated harmonics to as low a level as possible therefore filters should be provided where appropriate. The 70MHz signal may be passed through a bandpass filter which should be centred on 70MHz. Carson's law states that the required channel bandwidth for a FM modulated TV signal is equal to twice the peak deviation plus twice the highest modulating frequency; a typical bandwidth for amateur transmissions could therefore be of the order of 15-20MHz.

As far as video is concerned a low-pass filter may be provided to cut off at around 5MHz. This will ensure that video does not get into the sound channel (particularly important if you are using digitally derived pictures from a computer). The choice of 5MHz ensures that the colour subcarrier is not attenuated but the option of both 5.5 and 6MHz sound is retained without the need to change the video filter.

COMPONENTS

L1 can be an ordinary fixed inductor or choke; the Toko range is suitable here. The BB109 diode is the green tipped device which has no suffix letter. L2 is a Toko coil as stated on the circuit diagram, however this may of course be hand wound on a coil former in which case around 8-10 turns of 24swg should be space wound on a former around 3/16" or 1/4" in diameter. A VHF ferrite core should be provided for adjustment purposes. L3 is wound on a suitable ferrite former. This may take many shapes: large bead (not the small ones widely used for decoupling and parasitic stopping), ring, single or double-holed moulding etc. Fig.3 shows the type used by myself and is typical of those available by the handful at rallies. The number of turns is not too critical (as long as there are sufficient to pass the required signal), 6 to 10 on a typical former is about right. The coils are bifilar wound using the following method: Take two pieces of thin insulated wire (wire-wrap is very good) and twist them together, wind this pair through the ferrite for a suitable number of turns, now connect one of the wires from one end to the other end of the second strand, this provides the three connections required. Two dots on the circuit diagram indicate the common end of each winding.

Most components are available from Bonex Ltd of 102 Churchfield Road, Acton, London W3 6DH (Tel: 01 992 7748) or from Cirkit Holdings.

24CM FORWARD POWER INDICATORS

Unlike many lower frequency amateur bands, forward power meters and VSWR bridges are not so readily available for 24cm (they are expensive too), however it is essential when setting-up and operating a power amplifier that a reliable indication of forward power be available. One of the problems soon encountered in using a simple probe is in the pickup of stray signals as well as those present in the aerial feeder. The easiest way of avoiding this is to insert the probe much further along the coax away from the transmitter although this is not very neat, it is however desirable to house the indicator within the transmitter cabinet.

In "Radio Communication" magazine for January 1976, an article by P.Blair G3LTF and C.Suckling G3WDG described a forward power indicator suitable for insertion at the output of the transmitter. As you can see from Fig.1 the circuit is etched onto a piece of good quality double sided printed circuit board. The dimensions shown should be closely followed otherwise losses caused by mismatching may occur. The insertion loss is quoted at around 0.5db.

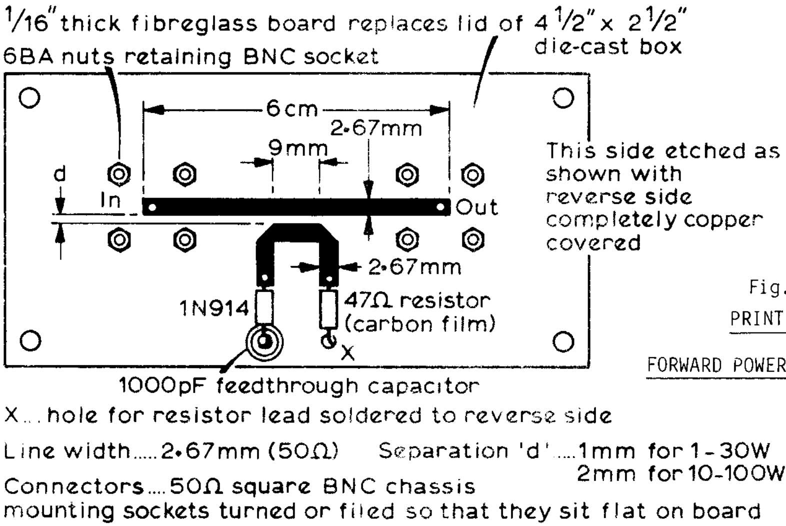


Fig.1
PRINTED CIRCUIT
FORWARD POWER INDICATOR

The reverse side of the board is left as plain copper. Square flanged BNC sockets are mounted at the position shown and the board drilled at the corners so that it will replace the lid of a 4.5" x 2.5" die-cast box. Alternatively a suitable box may be made from PC board. A meter is connected between the feedthrough capacitor and ground, the sensitivity of which will depend on the amount of power used and the degree of coupling employed.

Different output levels may also be achieved by using different diodes. It may be worth experimenting to find one most suitable for your own use.

For those who feel that there are enough losses in a 24cm system without introducing the risk of more by using two coax connectors and a PC board, a variation on the above system is described here which is in use regularly. Since all that is required is a short loop to pick up a "sniff" of RF from the coax feeder, there is no real need to cut the cable at all. Cut an aperture (about 20mm x 5mm, into the outer covering of the coax at a suitable point, exposing the braid. Using a stout sewing needle thread a thin piece of insulated wire for about 10 to 15mm underneath the braid but not into the inner dielectric.

Make a box about 50 x 25 x 25mm from PC board material and drill a hole in each end suitable for taking the coax cable. Slide the box onto the coax to the position shown in Fig.2. (a small notch may have to be filed into one of the holes to enable the probe wire to be pulled into the box). Connect the diode and resistor as shown and solder a lid onto the box to make it RF tight. The box may be suspended on the coax cable or fixed to a convenient bracket or cabinet panel. Do not forget that this is a DIRECTIONAL coupler therefore forward power will only be observed if the input/output connections are as shown in figs 1 and 2. The diode may be connected either way round and the meter polarity should be observed accordingly.

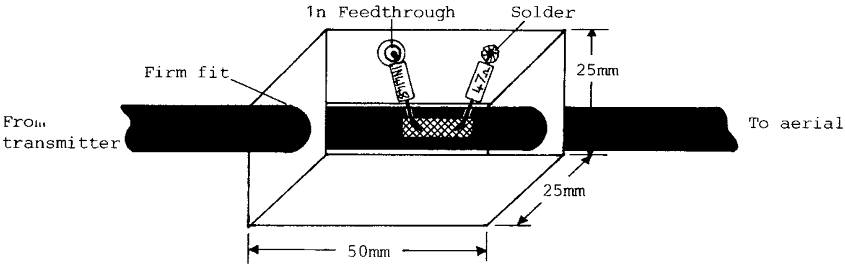


Fig.2 INLINE FORWARD POWER INDICATOR

With grateful acknowledgement to the RSGB for permission to print material in this article.

INTERNATIONAL ATV SIMPLEX 1255.0MHZ

A 24CM ATV POWER AMPLIFIER

by Rod Timms, G8VBC

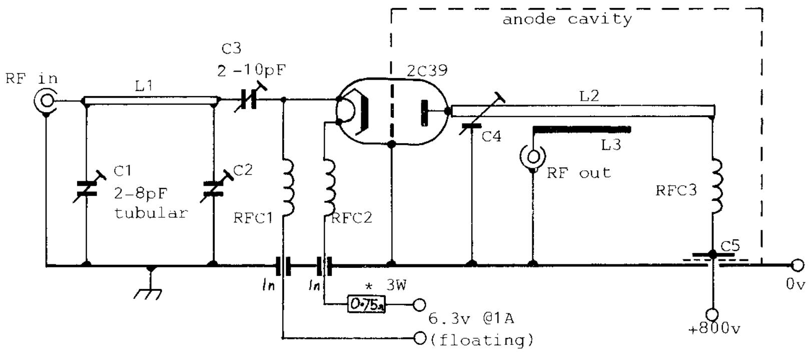
This amplifier is based on a design which appears in the RSGB VHF/UHF manual, (third edition page 5:74). In its original form the unit was known to be somewhat inefficient. Doubts were also expressed as to its ability to tune to the ATV allocations, or if in fact it would handle a wideband television signal at all.

The purpose of this article is to bring together a number of modifications published over the years, and some other ideas, to enable the TV enthusiast to construct an amplifier capable of producing over 30 Watts of RF in the 1.3GHz allocation. The original of this article, which appeared in CQ-TV 119, dealt with its use in AM TV service, however, since then the mode used almost exclusively on 24cm has become FM, and so the article has been edited with this mode in mind.

SPECIFICATION

Power output	30 Watts
Drive power	2-4 Watts (under linear conditions)
Anode voltage	800 volts
Current consumption	approximately 100mA
Amplifier gain	10dB
Efficiency	40%
Heaters	5.8v ac (floating)

The above figures are those measured on the author's prototype but may be considered as being typical. The amplifier circuit diagram is illustrated in Fig.1



* selected for around 5.8v heaters.

For details of inductors - see next page.

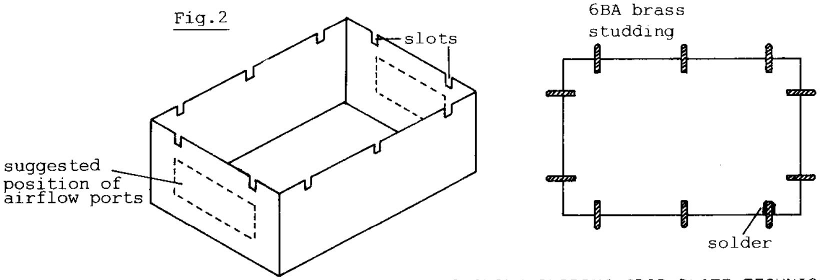
24cm TELEVISION AMPLIFIER CIRCUIT Fig.1

DESCRIPTION

The amplifier uses a 2C39 ceramic valve which has an anode dissipation of 100 Watts. When purchasing a valve make sure that the radiator has a diameter of 1.2". 2C39 valves with smaller radiators are available but their suitability for this design has not been established. Problems may occur with the cooling and possibly with the capacitive effect between the valve face and the cavity base, although this could be compensated for by adjustment of the grid plate.

In the original design the grid plate was bolted to the top of a diecast box but because of the differences found in apparently similar boxes, it proved very difficult to tune the amplifier. To overcome this problem a cavity box, constructed from 1/16" sheet copper or brass is employed, and the grid plate cut so as to be a sliding fit within the cavity. This method affords easy coarse tuning of the amplifier over a considerable frequency range, and the principle may be determined from Fig.2.

Fig.2



GENERAL ARRANGEMENT OF CAVITY SHOWING SLIDING GRID PLATE TECHNIQUE.

INDUCTOR DETAILS FOR Fig.1

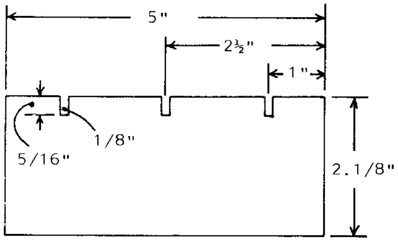
L1 - 1" long copper or brass tube, 1/8" dia. (lay across top of C1,C2, not between)

RFC 1,2,3 - 7 turns 22swg enam. copper wire on 1/8" former, self supporting.

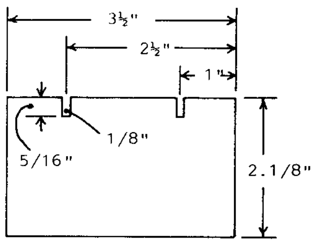
Other components - see text.

CONSTRUCTION

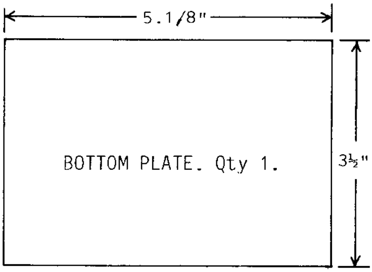
The cavity is constructed first. Accurately cut out the sides, ends and bottom according to Fig.3 and assemble the box with the aid of a vice or clamps. Using a blowlamp or gas torch, solder the joints together applying only small amounts of solder. The finished joint should be smooth. After assembly check that the internal dimensions are: 5" x 3.3/8" x 2.1/8". The air vents can be made by either drilling a pattern of small holes or by covering a large aperture with fairly fine wire mesh or gauze. Whichever method is used, avoid large gaps as this will disturb the RF field and allow leakage. Exact details are not given for the cooling arrangements since there are many different types of blower fans and air ducting available. Ensure that adequate air cooling is provided otherwise inferior performance and damage to the valve may result.

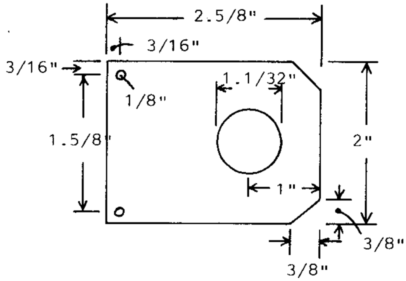


SIDE WALLS. Qty 2.



END WALLS. Qty 2

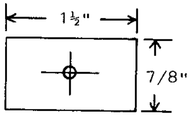




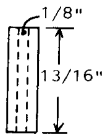
ANODE LINE, L2.

Material for all parts 1/16" thick (16swg) copper or brass sheet.

Fig.3

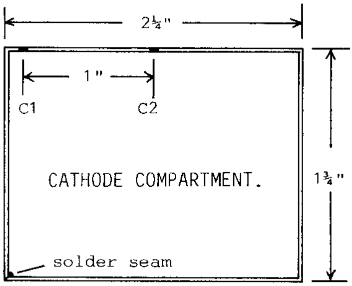


ANODE BYPASS CAPACITOR PLATE, C5.

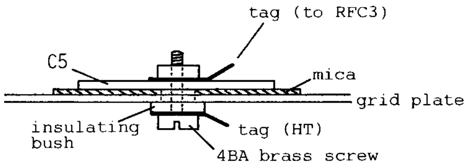


¼" PTFE tube

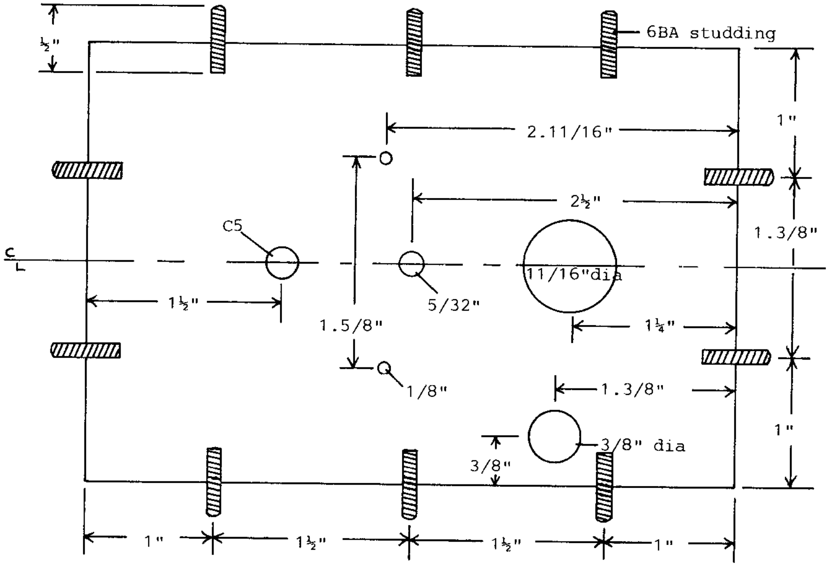
L2 SUPPORT PILLARS. Qty 2



Bent from 1" wide copper or brass strip, 1/16" thick



DETAIL OF C5 INSULATION.



GRID PLATE, INCLUDING DRILLING DETAILS. Material: 1/16" copper sheet.

Fig.4

The grid plate should be cut to the size shown in Fig.4 and should be individually tailored to achieve a sliding fit inside the cavity. Drill the holes in the plate according to the figure. Screws are soldered to the grid plate which correspond to the slots in the cavity walls, this allows the grid plate to be firmly fixed after initial tuning, (see Fig.2). It has however been found quite difficult to solder all the grid plate securing studs to the plate without some of them dropping off and an alternative method is to solder the studs onto solder tags or into eyelets, these can then be bolted down into position through holes drilled into the grid plate. The holes should be countersunk on the underside, (see Fig.5).

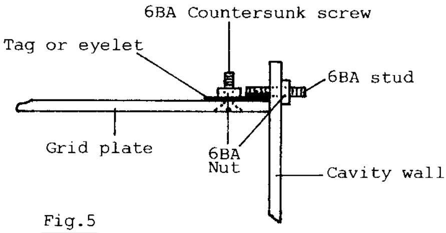


Fig.5

The fingering used for connection to the valve electrodes plays an important part in the final results. Articles on its manufacture have been published and it can occasionally be found at mobile rallies. Fingering may be made using phosphor bronze draught-proofing strip, (see Fig.6). The material should be about 5/8" wide and slots should be cut as shown leaving fingers about 1/8"wide. All burrs should be carefully removed with a fine file. The fingers should then be bent to the shape shown and the finished strip bent to fit into both the grid plate and L2, ensuring that it is a good firm fit over the valve flanges.

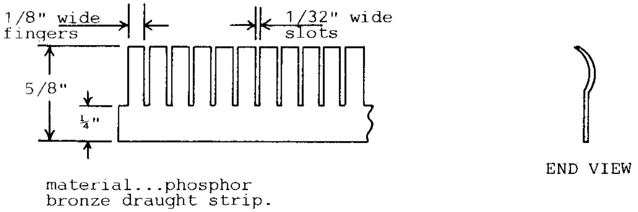


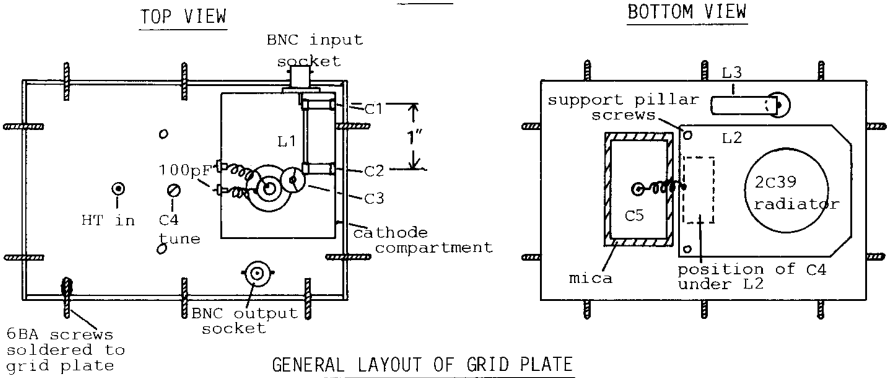
Fig.6 CONTACT FINGERING.

Form the cathode compartment into the shape shown in Fig.7 (top) (dimensions in Fig.3) and solder the following onto the grid plate:-

1) Cathode compartment.
2) Grid fingering.
3) 6BA brass studs (10 off).
4) Anode tuning capacitor (C4).
5) Anode tuning screw nut.
6) Aerial output socket support nut.

Avoid excessive heat on the finger stock as this will soften it. Copper is an excellent conductor of heat and it is therefore quite difficult to solder parts onto the plate without unsoldering those already fitted. This may be avoided by applying tissue or cloth soaked in cold water to act as a heat shunt thus conducting heat away from the components already soldered. This technique may take a little practice to perfect.

Fig.7

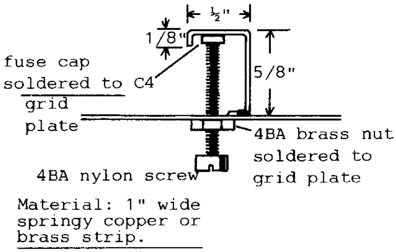


GENERAL LAYOUT OF GRID PLATE

Drill holes in the cathode compartment walls (Fig.7) to accommodate the BNC input socket, C1, C2 and the feedthrough capacitors. The height of L1 should be the same as the cathode flange (about 1/2"). There are three ways of making the connection to the valve cathode: (1) by using finger stock. (2) by a ¼" wide piece of springy copper or brass bent into a hook which should be a push-fit over the cathode, and (3) direct soldering to the valve. Whichever method is used, ensure that the connection is positive. Solder the film trimmer C3 between the junction of L1/C2 and the cathode connector. The heater connection may be made using a small screw or pin that fits snugly inside the heater sleeve. Make sure that the connection is not too tight or the valve insulation may be damaged.

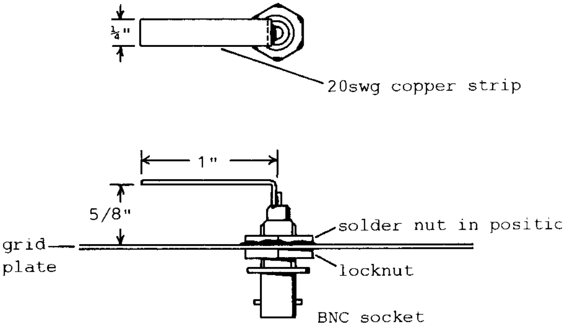
Cut out L2 and drill the holes to the pattern shown in Fig.3. Mount the fingering and solder into place. All fingering should point in the same direction - upwards away from the base of the cavity. The material chosen for the L2 support pillars is most important. PTFE is by far the best but other possibilities are fibreglass or ceramic, it is best to avoid some plastics and bakelite as these may be lossy and could also be affected by the heat.

A piece of mica should be glued to the underside of L2 to provide insulation from the tuning capacitor C4 (Fig's 7 & 10). Remember that the anode line will get quite warm therefore a suitable glue should be used. The pillars should be fitted using self-tapping or 4BA screws no longer than about ¼".



DETAIL OF C4

Fig.8



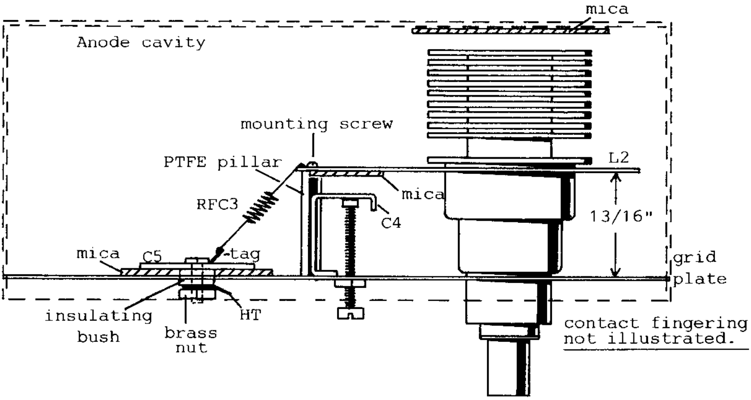
DETAIL OF OUTPUT COUPLING PROBE L3.

Fig.9

C4 is made according to Fig.8. The metal end of a glass cartridge fuse is soldered to the underside of the capacitor into which a nylon screw fits, C4 is thus not allowed to bend outwards whilst the capacitor is being adjusted. C4 adjusting screw may also be made from brass or steel instead of nylon, this makes it sturdier and enables a drive to be attached so that front panel tuning can be used.

Mica insulation is used in three major places, these are detailed in Fig.10 The thickness required is approximately 0.010" and a suitable supply may be found in toaster or iron elements! The mica used for C5 should be at least 3/16" larger than C5 plate, this ensures that the high voltage does not track between the plate edges and the grid plate.

Fig.9 details the output coupling probe L3. Output loading is made adjustable by rotating the assembly.



GENERAL ARRANGEMENT OF AMPLIFIER SHOWING POSITION OF MICA INSULATION.

Fig.10

VARIABLE BIAS SUPPLY

It is useful to be able to vary the output level from a power amplifier such as this, and provided the amplifier is not being directly modulated (as with AM) this is quite easy to accomplish.

The circuit shown in Fig.11 has a bias range which will control the valve from virtually zero output to its maximum. If the valve is to be run in a fairly linear manner, with only around say, 20 to 30mA of standing current, then a 2N1613 or similar TO-5 can transistor is all that is required. If however the valve is to be run nearer to class C (FM) then a larger transistor such as a 2N3054 or 2N3055 will be needed. The 1k potentiometer may be panel mounted if required.

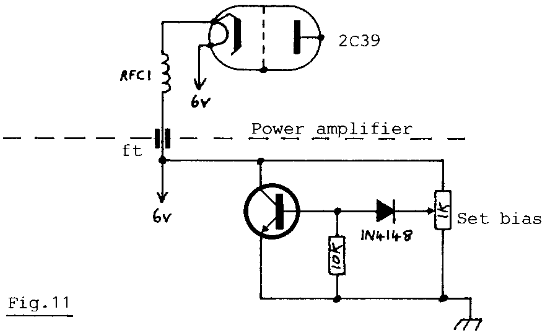


Fig.11

ALIGNMENT

EQUIPMENT REQUIRED

Power meter
RF demodulator probe
Oscilloscope
HT current meter
Volt meter
Aerial or dummy load (50-Ohm resistive)

Adjust the grid plate to the maximum depth available and tighten the securing nuts. The position of the grid tray is not too critical since there is a considerable capacity swing with C4. This wide range effectively compensates for variations in actual cavity size. It should be borne in mind however that resonance should not be obtained at either extreme of C4, otherwise re-tuning to a different frequency may not be very easy. Set L3 to a position parallel to L2, (Fig.7) and tighten up the locknut. Connect a thruline power meter between the drive source and the amplifier input and ensure that the heaters and HT are OFF. Apply drive and adjust C1 and C2 for maximum forward power and minimum reflected. Switch off the drive source, remove the power meter and connect the drive input directly to the amplifier. Connect the power meter between the dummy load (or aerial) and amplifier output, switch on the blower fan then the heaters and allow a warm-up period of at least one full minute.

Apply a reduced HT voltage and adjust the bias supply for a quiescent current on the anode current meter of arounu 20mA. Apply drive and adjust C3 and C4 for a reading on the power meter, alter the position of L3 for maximum RF indication. If no reading can be obtained, switch off and move the position of the grid plate a couple of millimeters, switch on and repeat the above procedure, continue in this manner until resonance is found. At resonance, C4 should not be set at either extreme of its adjustment, about halfway is ideal.

Tune the amplifier for maximum output power using C1, C2, C3, C4 and 13. Finally apply full HT and repeat the tune-up procedure. Try to obtain maximum output power for minimum current consumption, this will probably mean a small re-adjustment to the cathode tuned circuit - playing C1 off against C2. When the drive source is switched off the standing current should be of the order of 20-30mA or so, the bias control may be re-adjusted if necessary.

NOTES

Adequate cooling is essential. The 2C39 has an anode dissipation of around 100W when forced air cooled but only about 10W without. The valve will almost certainly be destroyed if the cooling is interrupted, for this reason ensure that the cooling fan is operating as soon as the heaters are switched on.

When adjusting L3, MAKE SURE that you don't move the probe too close to the valve or it may touch and short out the HT. For this reason it is best to switch off the supply, move the probe and tighten up the locknut before switching the amplifier back on.

It will be found beneficial to totally enclose the cathode tuned circuit compartment, this is to reduce radiation from L1 and will ensure that most of the drive power goes where you want it - into the valve! A lid may be bent from thin sheet brass, copper or tin. The lid should be a push-fit over the outside of the compartment. A hole can be drilled in the lid to allow access to C3 and several 1/8" holes should also be drilled to allow a reasonable passage of air.

Please note the following safety precautions when operating the amplifier:-

1) Do NOT look down the gaps between the grid plate and the cavity wall.*
2) Do NOT look into the air vent output.*
3) Avoid accidental contact with the HT by ensuring that all exposed connections are adequately covered.
4) Ensure that there is a bleed resistor connected from HT to ground so as to discharge the reservoir capacitors after the amplifier has been switched off.
5) Fuse the HT at 250mA.

* These only apply when the amplifier is switched on.

In use this amplifier has given excellent and reliable service. Due to the heat generated by the valve, slight expansion of the cavity parts causes a small drift in tuning during the first few minutes of operation making a small adjustment to C4 necessary. Provided the cooling is adequate, power output remains unchanged after well over an hours soak test at full power.

A 1.3GHZ POWER AMP'

By Zbigniew Pokusinski G4JQU

This simple project, which can easily be built in 20 minutes or so, gives a typical power gain of between 6 and 8dB at 1.3GHz yet costs less than £6 to build. The circuit requires no special printed board and no special components. The transistor used is an MRF511 available cheaply on the surplus market (1) and is believed to be capable of delivering around one Watt or so at 1.3GHz.

CIRCUIT

Fig. 1 shows the circuit diagram. Drive is fed to the unit in a rather unorthodox way as the first component is a variable capacitor to ground (C1). C2 couples the signal to L1 and is set for optimum power transfer. L1 and L2 are formed from the actual transistor leads themselves, (more on that later). A conventional amplifier circuit has its base bias set by a potential divider consisting of R1 and R2 whilst RFC1 prevents RF from getting onto the power rail. 13.8v is applied to the collector (via RFC2) and L2, C3 and C4 provides the low-Q output tuned circuit. It is recommended that a reverse supply protection diode be fitted in the interests of protecting the transistor.

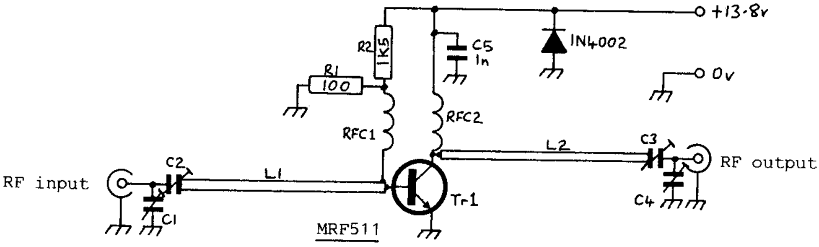


Fig.1 CIRCUIT DIAGRAM

CONSTRUCTION

Construction is very straightforward, and reference to Fig. 2 should be made for the details and parts placement. A piece of good quality double sided PC board material measuring approximately 8 x 4cm has been used in all the units built so far but, since the copper surface is used purely as a ground plane, single sided board should also be suitable.

A 4mm hole is drilled in the centre of the board to accomodate the transistor which should be installed as detailed in Fig. 3a, the two emitter leads being soldered to the ground plane as shown using the shortest lead length possible. The base and collector leads should be spread out as indicated in Fig.3b and should rest about 3mm above the board.

Fig.3a

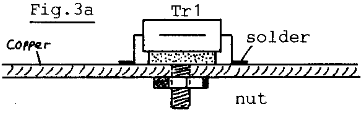
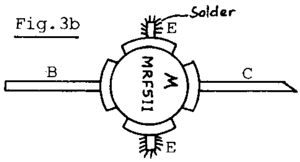


Fig.3b



Bend down emitter leads and solder to ground as short as possible.

C1 should be soldered between the base lead and ground - its body being 9mm from the transistor (see Fig.2). C2 is then soldered as shown and should be positioned as close to C1 as possible. C3 and C4 are fitted in similar fashion however C3 should have one of its earthy legs removed before fitting, the remaining legs being bent as required. The other components may now be fitted according to Fig. 2 and short pieces of good quality miniature coax (I used UR43), complete with connectors, installed at the input and output points.

ADJUSTMENT

Before switching on set C1 to 5° mesh, C2 to 25°, C3 to 50° and C4 to 25°. Apply power and, without drive, check that +13.8v appears at the collector and that +0.76v is at the base. Apply drive (100 - 500mW) and tune all variable capacitors for maximum RF output.

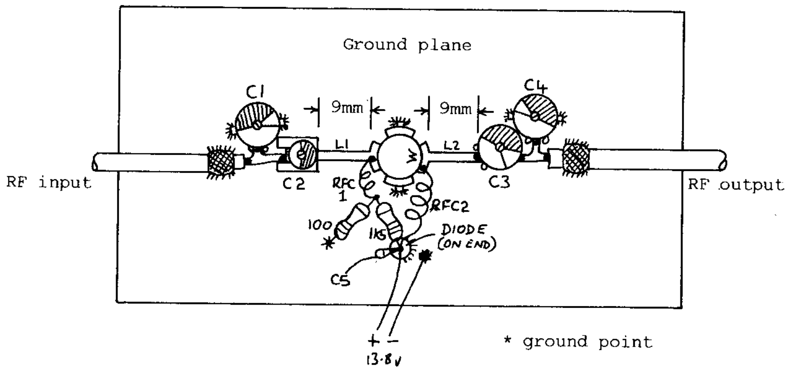


Fig.2 COMPONENT LAYOUT

RESULTS

When used with the Solent Scientific 200mW FM-ATV transmitter, an improvement of well over a picture grade is easily achieved without, of course, degrading the picture in any way.

Further power gain may be obtained by adding a second amplifier module. In my case this brought a weak grade 3 picture up to a cracking P5. Even with the second amplifier obviously dissipating more power I found extra heat-sinking unneccesary.

The output of these modules should be consistant over long periods of operation and overall stability was found to be excellent, however long-term stability can be assured by more rigidly fixing the tuning capacitors to the ground plane, perhaps by gluing nylon spacers to the base and collector leads.

EDITOR's NOTES

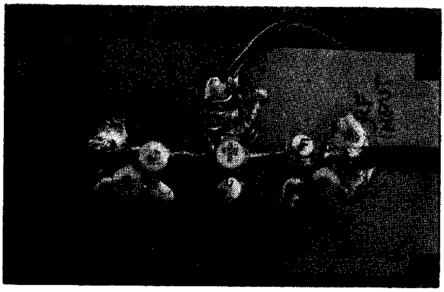
The author kindly loaned me one of his units in order that I might try it out using laboratory test equipment, the results of which are detailed below:

(Test frequency 1280MHz)

Power gain with a 11v supply	1.5dB
" " " 12v "	5dB
" " " 13v "	7dB
" " " 14v "	8dB
" " " 15v "	8dB

Bandwidth measured at the 1dB down points - +25MHz and -70MHz from the test frequency.

The test equipment used was a Hewlett Packard 8558B spectrum amalyser, Hewlett Packard 8614A signal generator and a Kingshill T60V2 variable power supply. Tests were made into a resistive 50-ohm load.



Adjustment was found to be unconditionally stable and pleasantly non-critical - just the job for those without a spectrum analyser! Unfortunately a variable power source with sufficient output was not available at the time of testing, therefore I was unable to ascertain the amplifier's maximum output level before compression. However, looking at the transistor (having no specification either) I should think that well in excess of 1W should be achievable, especially if a heatsink is fitted.

I must say that this little circuit is probably the nicest unit to come my way for some considerable time. It is difficult to understand why some manufacturers seem to have such difficulty in generating this order of power using, as they invariably do, fancy PC boards, separate bias systems, microwave chip capacitors and the like. This circuit is, for wideband ATV work, absolutely ideal since it is capable of such wide bandwidth and useful gain.

For those members who are perhaps not too experienced in power amplification at these frequencies, yet would like to experiment with various RF transistors, there are one or two conclusions which may be drawn from this design and applied to others: The most likely reason that power gain can be kept high is that use is NOT made of potentially lossy PC board materials, the tuned 'lines' being suspended in free air. Bandwidth, as we know, is increased as the Q of a tuned circuit is reduced. There is little doubt that in this unit, the Q of the lines must be somewhat less than many similar amplifiers.

COMPONENTS

C1, C3, C4	- 1-5pF grey plastic trimmer.
C2	- 0.5 - 1pF Mullard glass dielectric (2)
C5	- 1n fixed ceramic.
Tr1	- Motorola MRF511 (1)
R1	- 100-ohm ¼W
R2	- 1.5k ¼W
RFC1	- 2.5 turns of standard resistor lead, 2mm i.d. 4mm long
RFC2	- 2.5 turns of 20swg copper wire 3mm i.d. 10mm long

References: (1) J Birkett, 25 The Strait, Lincoln LN2 1JF
(2) Solent Scientific Ltd., 75 Chalk Hill, Southampton, Hants.
(Please either phone for details or enclose a stamped, addressed envelope with any enquiries).

24CM INTERDIGITAL FILTER

An almost essential piece of equipment in any ATV station is a good quality bandpass filter. This is needed in the transmitter output to ensure that any signals present, other than the wanted one, will be suppressed. At the receiver input, such a filter will attenuate unwanted signals (it's amazing how much rubbish can be found when using a "wide open" receiver) and will help the overall system noise performance by restricting the receiver bandwidth.

The design shown in Fig.1 is excellent for our purposes and is taken from "Radio Communication" (Jan 1976) with thanks to the RSGB. The unit is made from brass which should be accurately machined according to the dimensions shown. Although "N" type connections are shown in the illustration, it may be easier to use BNC sockets. Square flanged sockets may be mounted as shown or screw threaded types may be used. A better arrangement for connecting the centre pin to the line is to drill and tap the filter side walls to accept the socket, this enables the socket centre pin to reach the line.

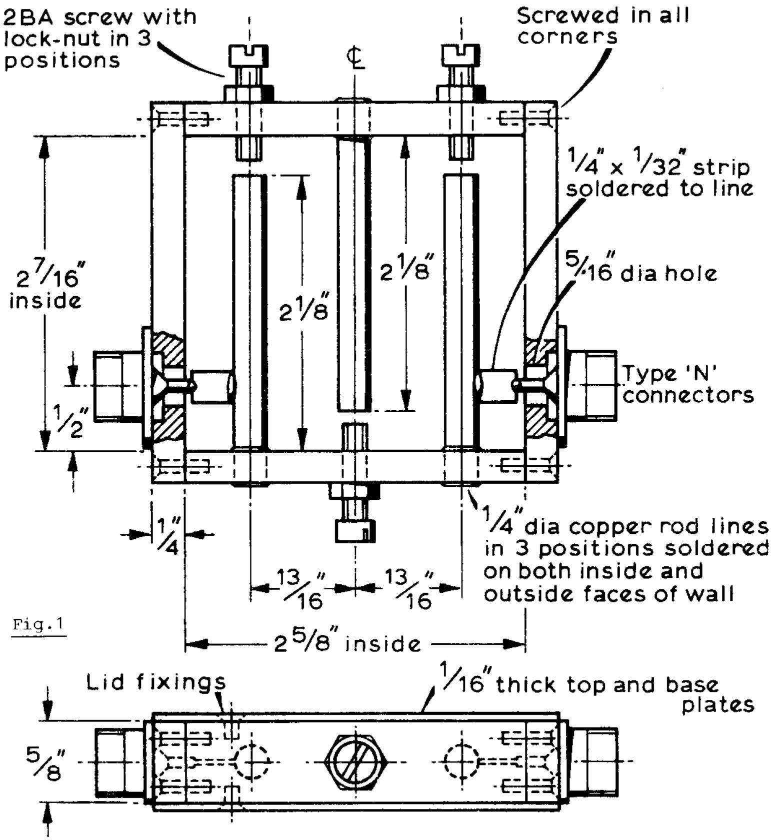


Fig.1

The elements are shortened quarter-wave lines tuned by capacitors made from 2BA screws. Alignment is best carried out using a sweep generator, but in the absence of one (if the filter is built carefully as described), tuning up can be done using the station 1.4GHz converter and a small signal source or received amateur signal centred in the middle of the required passband. With the source some distance away and the filter connected in the aerial feed to the converter, peak the centre tuned circuit for maximum. Now the other two may be adjusted for maximum signal (minimum insertion loss) although these outer two actually adjust for correct symmetry and are best set either by using test signals at around +-15MHz from the centre of the filters passband, or with sweep equipment. This procedure should be made with the filter "isolated" between two pieces of thin coaxial cable approximately 20-50ft long which act as buffer attenuators.

The insertion loss is small (typically less than 0.5db) and so virtually no loss of output power should be observed when the filter is put directly in the output of the transmitter. The typical response from a correctly aligned filter is shown in Fig.2. The filter may be aligned to cover any segment between 1240 and 1320MHz.

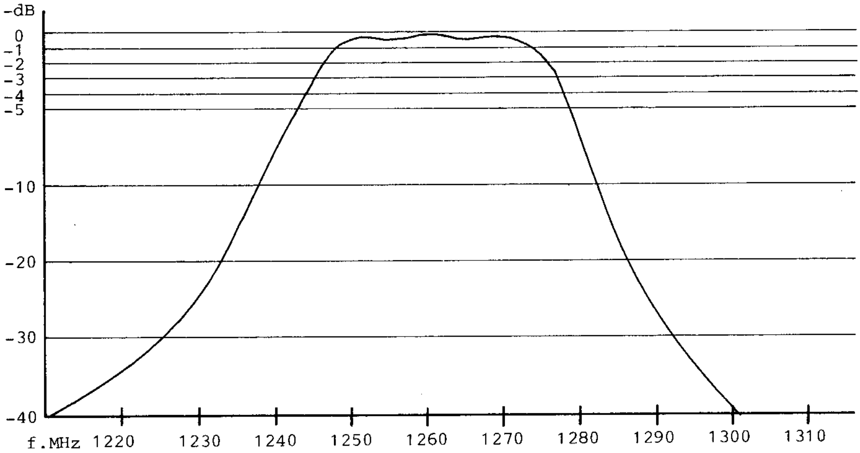


Fig.2 TYPICAL INTERDIGITAL BANDPASS FILTER RESPONSE

With grateful acknowledgement to the RSGB for permission to print this design.

A 70CM MONITOR PROBE

By John Wood G3YQC

The output signal from an amateur AM television station should be monitored with an RF probe and an oscilloscope to check that an un-distorted signal is being radiated. It is not sufficient to receive your own signal in the shack (except perhaps when only very low RF powers are being radiated), as you are then relying on stray fields within the shack which will themselves cause distortion, therefore you will never be certain whether or not your equipment is at fault or whether your monitoring system is suspect.

Fig.1 shows the circuit of such an RF probe. A pickup wire is connected to a demodulator diode to produce a video signal. This is fed to an emitter follower whose output is suitable for displaying on a video monitor.

Construction should preferably be on a printed circuit or plain copper laminate board. When complete the unit may be secured to the aerial feeder, fitted in a position adjacent to the transmitter RF output socket or fitted into a small metal box with a coax socket at each end, joined inside with a short length of coaxial cable in which the probe wire will be inserted (Fig.2). The box may then be connected in series with the aerial lead.

To insert the pickup wire cut out a small square of outer covering from the coaxial cable and push apart the braiding. Thread a piece of thin insulated wire under the braiding for a distance of about half an inch and connect the free end to the diode using as short a lead as possible. The actual length of wire will vary according to the RF output power of the transmitter but will usually be between a quarter and a half an inch.

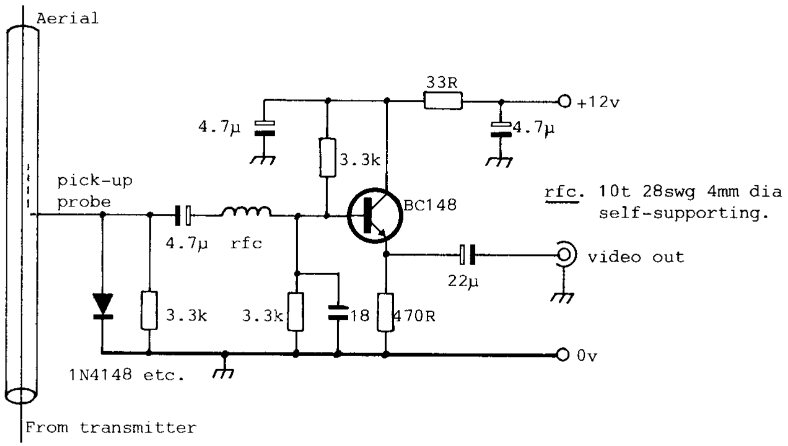


Fig.1 RF DEMODULATOR-SENSING PROBE

Connect the video output to an oscilloscope terminated in 75 Ohms. Transmit a properly modulated picture and adjust the input tuned circuit for maximum indication. Adjust the length of the probe pickup wire until about 1 volt peak-to-peak of video is obtained. Do not couple the probe in too tightly as this will overdrive the circuit and cause distortion of the demodulated signal. The resulting video may then be viewed on a monitor enabling you to keep an eye on the picture quality being radiated.

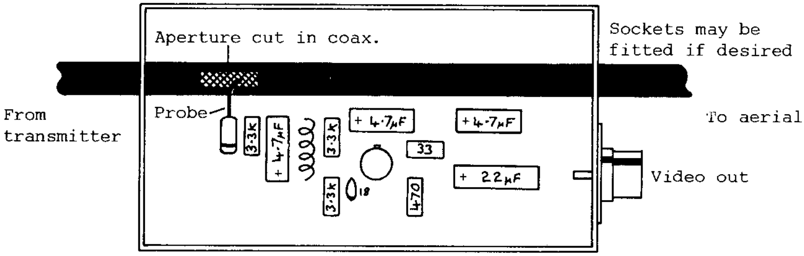
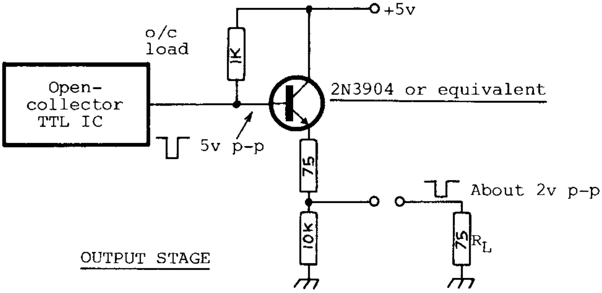


Fig.2 SUGGESTED METHOD OF INSTALLING OFF-AIR PROBE

Drive pulses from TTL

This interesting little circuit from John Goode suggests how 2v p-p drive pulses may be easily obtained from TTL I/C's.

By using open-collector TTL chips it is possible to obtain 5v pulses, which when buffered and terminated correctly, should deliver around 2.1v p-p across 75-ohms. The circuit must be terminated in order to work correctly.



OUTPUT STAGE

IN THE STUDIO.....

Pulses and Signal Distribution

From the original series of articles by JOHN GOODE

STANDARD LEVELS

Standard levels for both video and pulse distribution are defined as being measured when the source is correctly matched into the standard impedance of 75-ohms. Consider Fig.1, which shows the equivalent circuit of a correctly matched source and load. This consists of a source of E.M.F. (Es), in series with a resistance Rs, representing the source impedance. This is connected to RL, the load, which, for correct matching, should be equal to Rs.

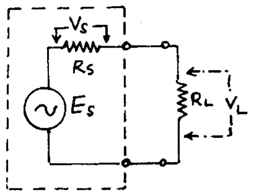


Fig.1 IMPEDANCE MATCHING

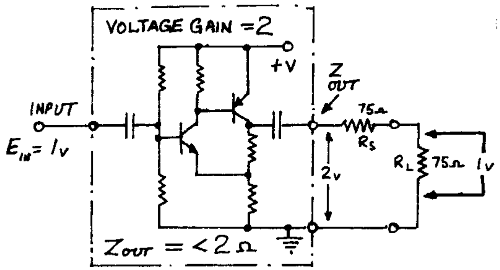


Fig.2 ACTUAL CIRCUIT

It can be seen that Rs and RL form a 2:1 potential divider across Es, and so if one volt of signal is required across RL, the signal voltage Es must be double this, 2 volts. Also, for the source impedance to be equal to Rs, the signal source Es must theoretically have zero output impedance - in practice a value of a few ohms will be satisfactory.

Fig.2 shows a practical realisation of Fig.1. In order to give a correctly matched 1-volt signal across 75-ohms an amplifier with a gain of 2 and a very low output impedance is required to feed the potential divider Rs and RL.

If the source is now fed into a load that is much greater than 75-ohms, virtually all of the signal (Es) will be developed across RL, and to all intents and purposes the signal will be double that when correctly loaded. The output is then said to be "unterminated".

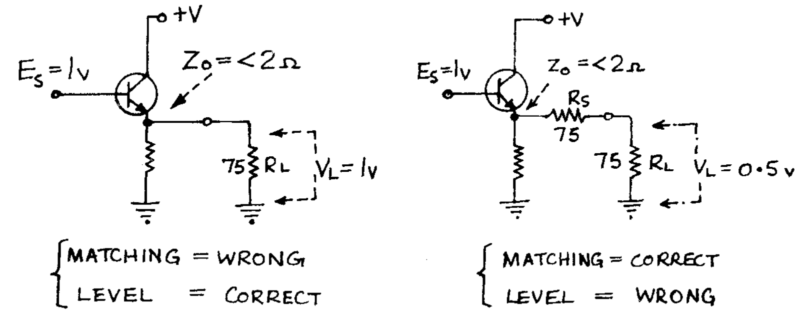


Fig.3 EMITTER FOLLOWER

It IS possible to feed from very low impedances directly into RL without a 'build-up' resistor (Rs), (see Fig.3). Although this will give the correct level across 75-ohms without the necessity for a voltage gain of 2, it is incorrect as the source and load are not matched, and reflections could occur (particularly when feeding long cables). I do not propose to go into transmission-line theory in this article, but this is the criterion that should apply to all video and pulse matching.

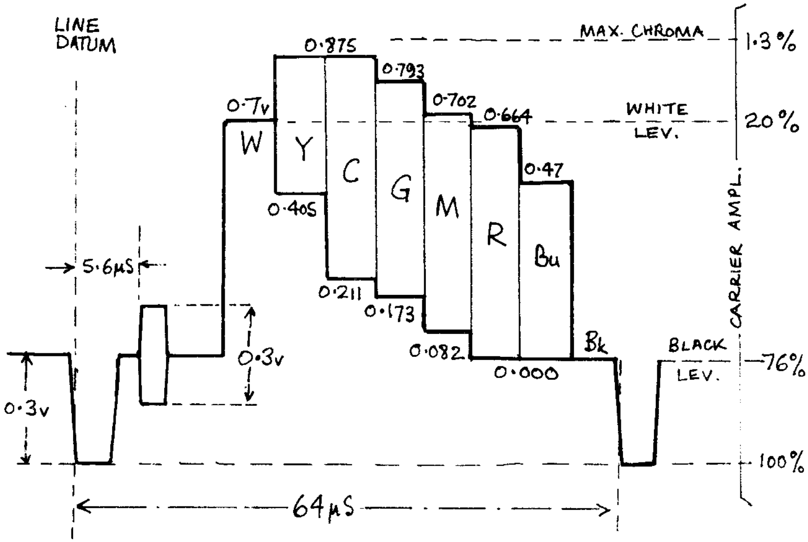


Fig.4 95% COLOUR BARS

VIDEO LEVELS

The standard levels for the UK PAL composite colour signal are shown in Fig.4, together with carrier-amplitude values for broadcast transmitters. The signal illustrated is the 95% saturated colour bars as radiated by the BBC. This is at the normal level adopted in studios - 1-volt peak-to-peak, 700mV picture, 300mV syncs. When viewing this signal on a 'scope or waveform monitor notice that the burst and syncs should be of equal amplitude - this is a quick check for any H.F. attenuation.

When distributing colour signals in their R.G.B.form the norm is for the signals to be non-composite, with syncs distributed separately giving a 4-wire system. See Fig.5(a). The video signals are therefore 700mV p-p, syncs are normally 2-volts p-p, negative-going, (all into 75-ohms, as above). However, two variations on this standard do exist, and they are:-

(1) In order to have a 3-wire system, 300mV sync can be added to the Green signal, giving R=700mV; G=1 volt; B=700mV. See Fig.5(b).

(2) With the increasing use of micro-computers, RGB + syncs distributed at TTL level is becoming widely used (mainly for connecting computers to RGB monitors). However, this system is not correctly impedance-matched, and should not be fed down cables longer than about 18".

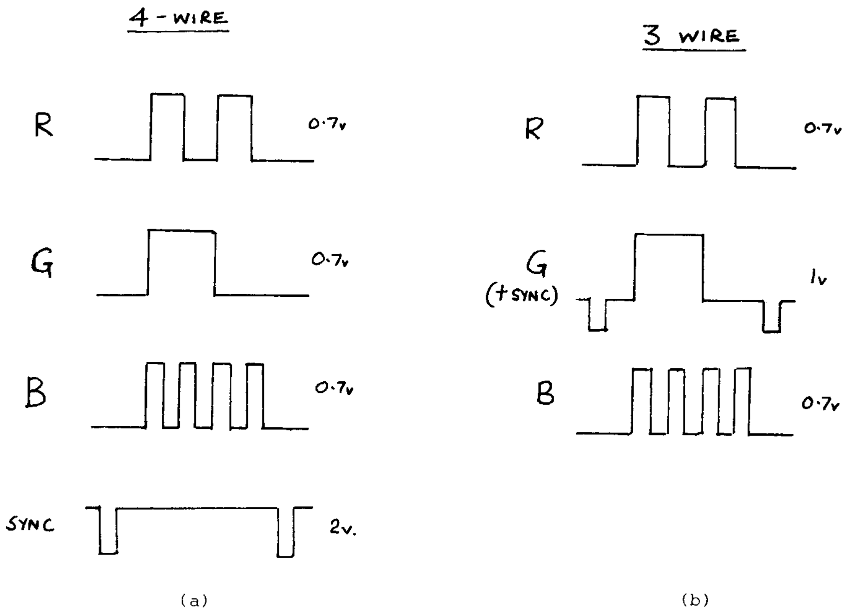


Fig.5 R.G.B. FORMATS

VIDEO DISTRIBUTION AMPLIFIERS

V.D.A's should have the capability of driving several mutually isolated 75-ohm outputs, all correctly terminated. The input impedance should be high enough to allow several (say 10) inputs to be paralleled across 75-ohms without measurably dropping the signal level. Figs 6,7 & 8 show examples.

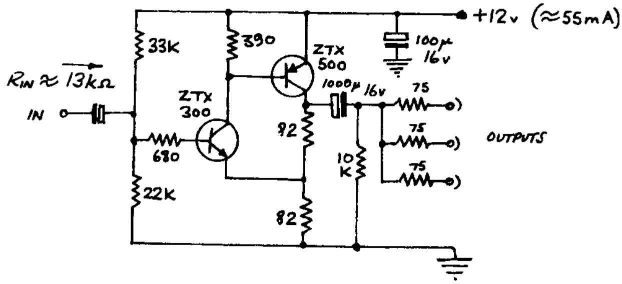


Fig.6 SIMPLE V.D.A. (SINGLE RAIL SUPPLY)

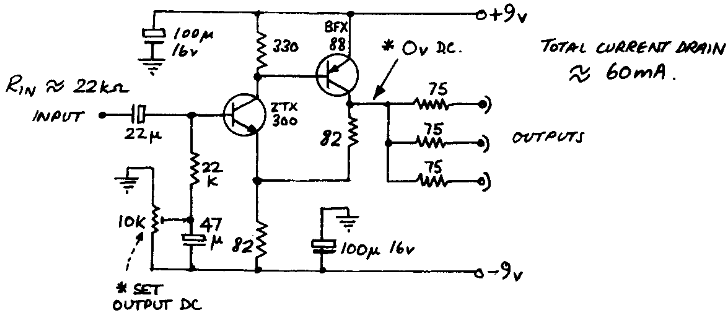


Fig.7 SIMPLE DUAL SUPPLY V.D.A.

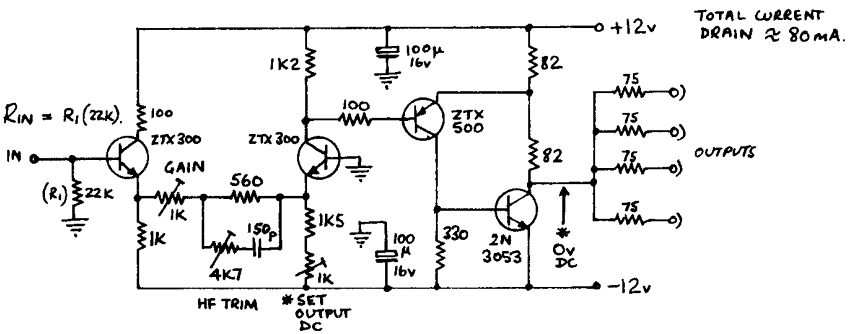


Fig.8 VARIABLE GAIN, DC-COUPLED V.D.A.

STANDARD PULSE LEVELS

Distribution of pulses within television studios is, for the most part, standardised at 2-volts p-p into 75-ohms, although in some cases a level of 4-volts into 75-ohms is adopted. To add further to the confusion, there are some SPG's that give 2-volts out for all pulses except the PAL squarewave, which is a 1-volt signal. Generally speaking, however, most pulse amplifiers and sync generators are standardising on 2-volt pulses.

Most sync-generators in use today use TTL i.c's in the pulse-forming circuits. This leads to the need for circuits to interface from TTL to 75-ohm driving capability. Simply hanging an emitter-follower on to the TTL output is not really good enough, as TTL level is approximately 3.2 volts. If the load is correctly matched using Rs and RL, the voltage across RL will only be about 1.5 volts. Omitting Rs will double the level, but then the source impedance will be incorrect, (see Fig.9). Some alternative suggestions are shown in Fig.10.

Fig.11 shows a pulse distribution amplifier (PDA) suitable for feeding 2 or 4-volt pulses into 75-ohms.

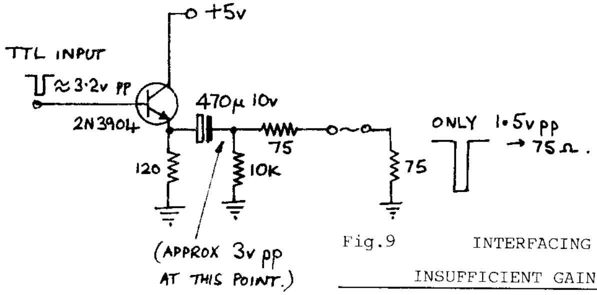


Fig.9 INTERFACING TTL - INSUFFICIENT GAIN - SEE TEXT

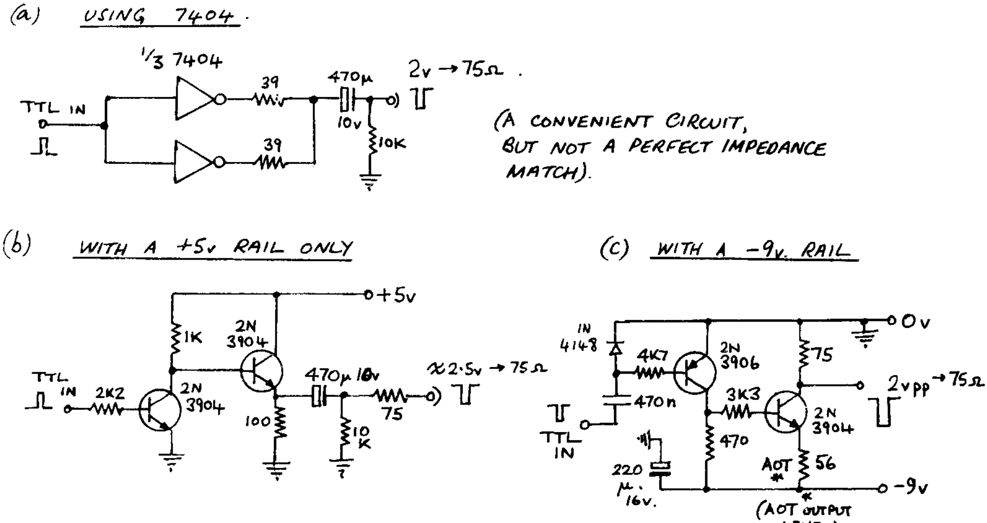


Fig.10 SOME TTL TO 75-Ohm INTERFACES

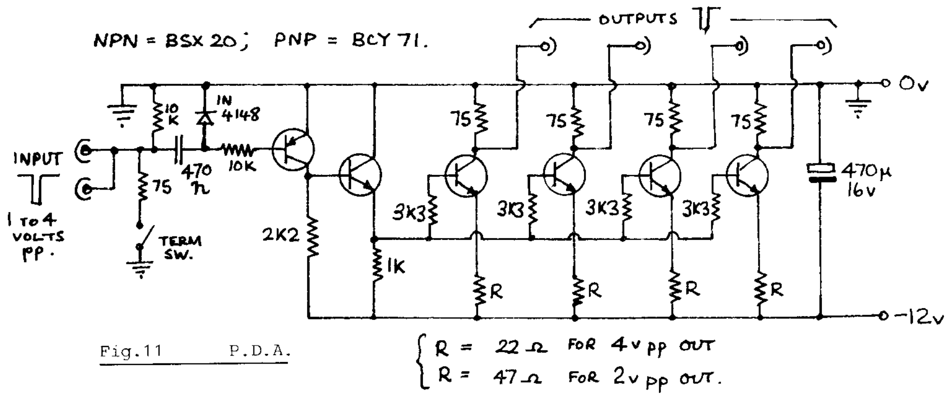


Fig.11 P.D.A.

DISTRIBUTING SUBCARRIER

The standard level for distributing colour subcarrier (CSC) is 1 volt p-p into 75 ohms. When routing subcarrier to the various colour sources within a studio complex it is necessary to be able to adjust the phase of each feed independently, to compensate for different signal-path lengths when the encoded colour signals are mixed or wiped together.

A distribution amplifier suitable for CSC phasing is shown in figure 12. This works by converting the CSC into a TTL signal, using monostables for phase adjustment, and then re-converting to a sinewave by filtering. This design is an improvement over the circuit published in CQ-TV 122.

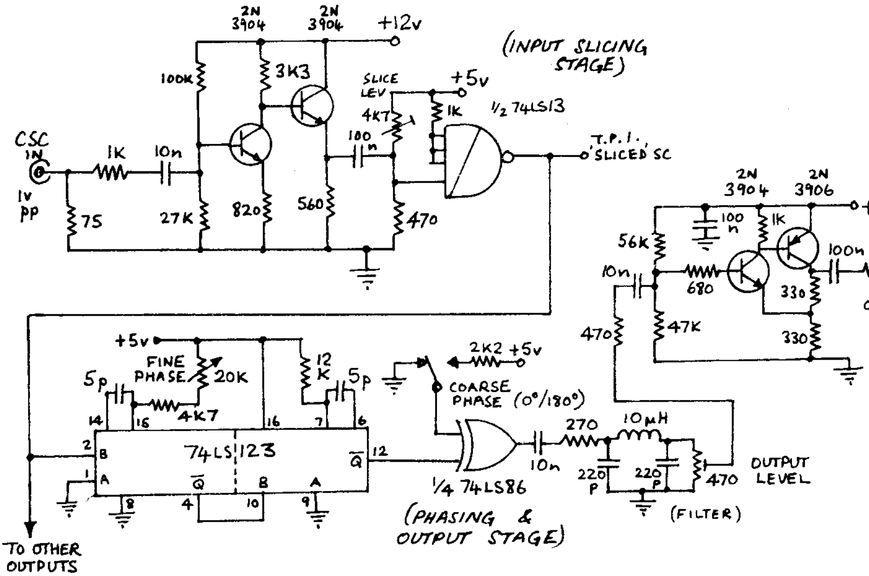


Fig.12 CSC DISTRIBUTION AMP'

DISTRIBUTING PULSES

The preferred method of distributing the six SPG pulses is to use a multiple output PDA for each type of pulse. Because these pulses are sometimes given different names, I shall list them below:-

L.D. = Line Drive (Horizontal Drive or Trigger)

F.D. = Field Drive (Vertical Drive or Trigger)

M.B. = Mixed Blanking (Composite Blanking)

M.S. = Mixed Syncs. (Composite Syncs.)

B.G. = Burst Gate (Burst Flag)

P.S. = PAL Squarewave (PAL Switch, V-axis Switch)

Although in a large system using six PDA's is best, in a smaller set-up it is possible to distribute the pulses by looping-through at high impedance, with only the end of the chain terminated. This works quite well for up to about half a dozen pieces of equipment. This method is greatly facilitated by using multi-way cable and connectors for the six pulses. Fig.13 shows wiring for employing RS standard multipole 8-way connectors as used on Electrocraft Studio Equipment. I have adopted these connectors on my home-brew designs. By having a looped plug and socket on each unit, and then terminating the chain with a dummy plug with 6 - 75-ohm resistors in it, the number of PDA's required in a given system can be drastically reduced.

standard multipole

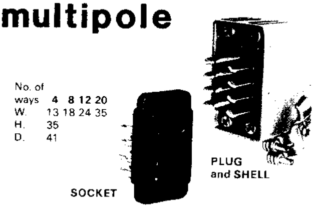
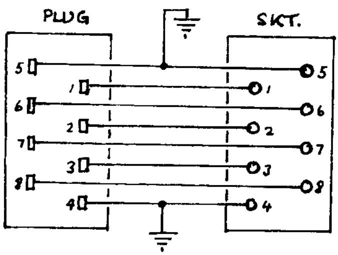


Fig.13 SPG MULTIPOLE WIRING

RS 8-WAY STANDARD MULTIPOLE CONNECTORS STOCK Nos
PL. 466-028
SKT. 466-062
COVER 466-107



PINNING	
1. MB	5. GND.
2. BG	6. MS
3. FD	7. PS
4. GND.	8. LD.

NB:- ALL EQUIPMENT FITTED THUS MUST HAVE HIGH-IMPEDANCE PULSE INPUTS TO PERMIT 'LOOPED' WORKING.

COLOUR VISION MIXING

from an original article by John Goode

The techniques used to vision mix with PAL or NTSC composite colour signals are a little more complex than those used for monochrome signals. In order to pass the colour signal without distortion, it is necessary to ensure that the vision mixer output retains the colour burst signal, and that the signal paths through the mixer preserve the precise phase relationship between the burst and the chrominance signal - it must be remembered that, in both the PAL and NTSC systems, it is the instantaneous phase relationship between the burst and the chrominance signal which represents the instantaneous hue of the picture.

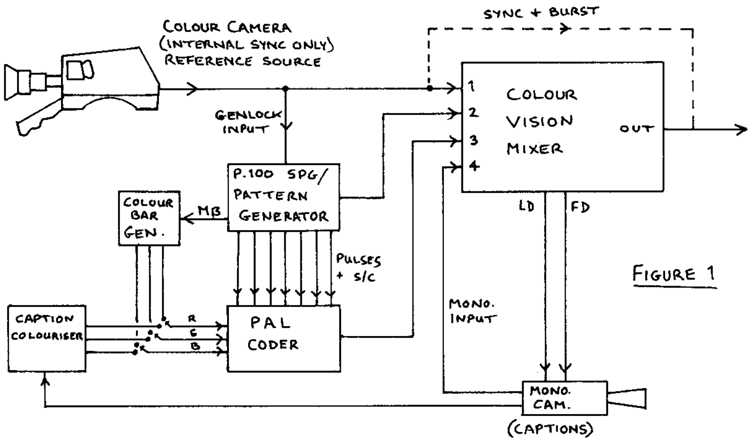


FIGURE 1

A typical colour system might be as shown in figure 1, with (for example) a domestic colour camera, which is capable of only internal sync operation, driving a genlockable sync. pulse generator (such as the BATC Project-100), from which are derived all the necessary pulses to drive an external coder for coloured captions, colour bars etc.

In order to lock a monochrome camera system, it is only necessary to distribute four pulses to each camera, viz. line drive (LD), field drive (FD), mixed (or composite) blanking (MB) and mixed (or composite) sync (MS). For colour operation, seven pulse feeds are required - in addition to the four above, burst gate (BG), V-axis switch (or PAL switch) (VAS) and colour subcarrier (CSC). Fortunately, many modern colour cameras are capable of being genlocked, which means they can be locked to a source of video, or preferably, 'colour black', otherwise known as 'black-and-burst', i.e.

composite sync with colour burst (the equivalent of a colour video signal with no picture content). This means that only a single cable is needed to distribute the genlock signal, and timing adjustments can usually be performed on each camera.

The full set of colour pulses may, however, be required, if, for example, it is required to drive an external colour coder, or a camera that does not have a genlock facility. In the system illustrated in figure 1, the SPG is genlocked to the master signal source, in this case a camera, and is used to derive the pulses needed to feed other equipment. The monochrome caption camera in this example is shown driven from LD and FD derived within the mixer - it could equally well have been driven directly from the SPG.

It can be seen from figure 1 that the vision mixer derives its syncs. from the 'reference' input signal, and all other sources are either directly or indirectly genlocked to this source. It is essential that the paths taken by the video and reference signals have identical phase shifts (to within a few nano-seconds - which represents a few degrees of colour subcarrier). Another way of putting it is to say that the transmission time must be the same for all paths. The surest way of achieving this without using expensive delay-lines (and the test equipment to adjust them) is to arrange for all signal paths and the burst (reference) path to pass through similar circuitry.

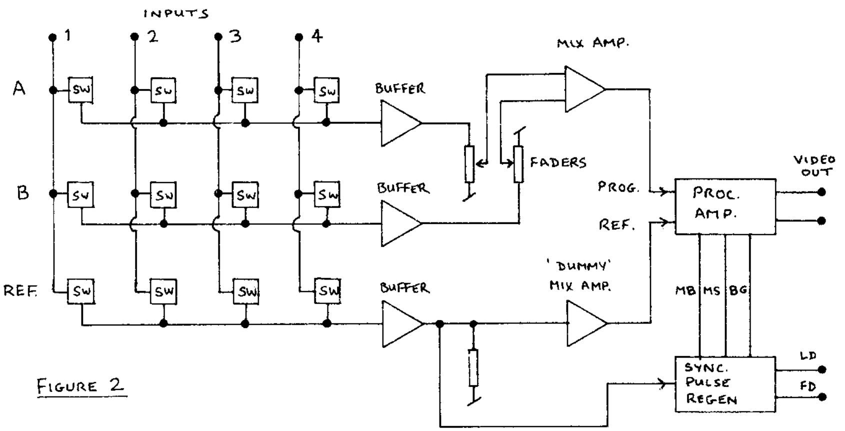


FIGURE 2

Consider figure 2, the block diagram of a simple AB vision mixer. Four inputs are shown, with some form of electronic switching - this will almost certainly be necessary, as it is almost impossible to achieve good isolation at subcarrier frequency using mechanical switching. Consequently, similar electronic switches are used for the reference source selection, in order to ensure identical signal delay. However, whereas interfield switching would probably be provided for banks A and B, a simple rotary selector switch would suffice for the reference source. A dummy fader and mix amplifier is also included in the reference path, thereby ensuring that the video and reference signals arrive at the processing amplifier inputs having suffered identical delays. The purpose of the processing amp. and sync. pulse regeneration circuitry will be described shortly.

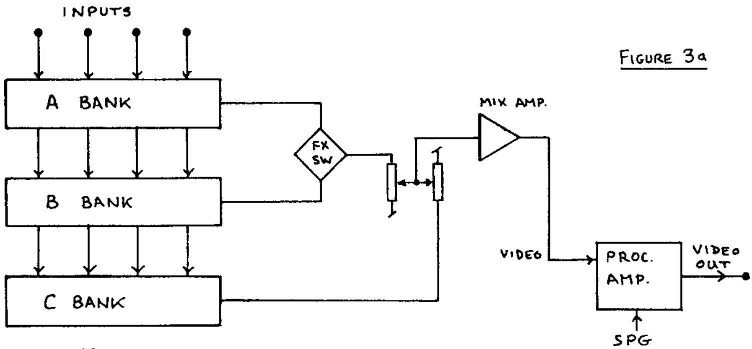


FIGURE 3a

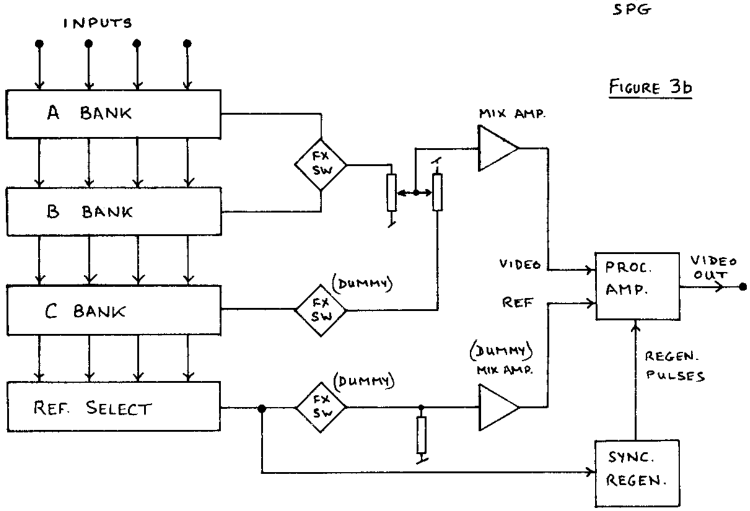


FIGURE 3b

A popular configuration of vision mixer amongst commercial manufacturers is the 'ABC' mixer and effects generator. Wipes and mattes are performed between banks A and B, which are then combined with bank C in the mix stage. This is illustrated in figure 3a in simple form, and in figure 3b with the added dummy circuitry needed for equalised path delays. Note that it is necessary to use dummy circuitry not only in the reference chain, but also in the C path, in order to equalise the delay with respect to A and B.

The sync. regeneration circuit derives from the reference input all the pulses needed within the vision mixer, and can also supply LD and FD as well as MS to feed ancillary equipment (e.g. a monochrome caption camera).

The processing amplifier (proc. amp) clamps and blanks the output video signal, then re-inserts burst and syncs from the reference chain, thus ensuring that the output of the mixer always carries clean syncs and burst, regardless of the path the video has taken. The output of the proc. amp is a distribution amplifier, to enable more than one feed to be connected.

ABC COLOUR VISION MIXER

by John Goode

INTRODUCTION

Following the previous discussion of the underlying principles of colour vision mixing, this article describes the circuitry necessary to realise the ABC vision mixer of Fig.3b. The mixer provides four corner wipes or external keying on banks A and B, with mix to bank C. The reference source has been hard-wired to input 1, instead of being made switchable, this slightly simplifies the input matrix.

Colour signals (particularly test signals such as colour bars) can cause difficulties with breakthrough due to the high energy at 4.43 MHz (colour subcarrier). Consequently, certain precautions have been taken in this mixer to overcome these problems that make the design slightly more complex than it might otherwise have been. These features will be explained in the circuit descriptions.

Figure 1 is a block diagram showing how the circuit is sub-divided into boards. In the prototype all circuits were built on 0.1" copper strip matrix board ('Veroboard'). For the keenest constructor, the circuits could be laid out on printed circuit boards.

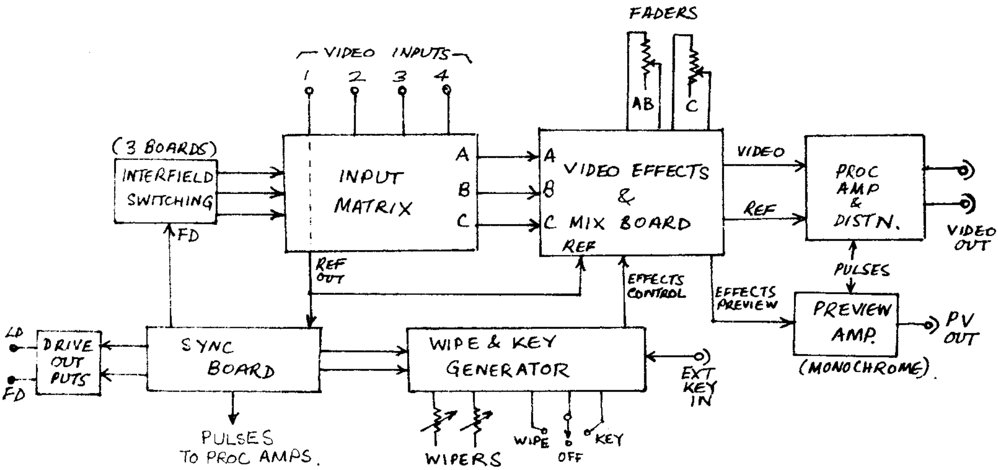


Fig.1 BLOCK DIAGRAM

CIRCUIT DESCRIPTION

Power Supply (see Figure 2)

Because of the problems of crosstalk getting between circuits via the power rails, it was decided that wherever practical, use would be made of the 78Lxx and 79Lxx series of 100mA plastic regulators mounted actually on the boards themselves. For instance, most of the video circuits use ±5 Volt rails; they are fed with ±9v, and reduced to ±5v on each board.

As a result of the above philosophy, the power unit provides four voltage rails, each to be reduced on the boards as necessary. These rails are ±9v stabilised and ±17v (nominal) unstabilised. Remember when mounting the 7805 positive regulator, that the 'ground' or 'common' terminal (which is connected to the case) will be at +4v, and must therefore be insulated from the heatsink.

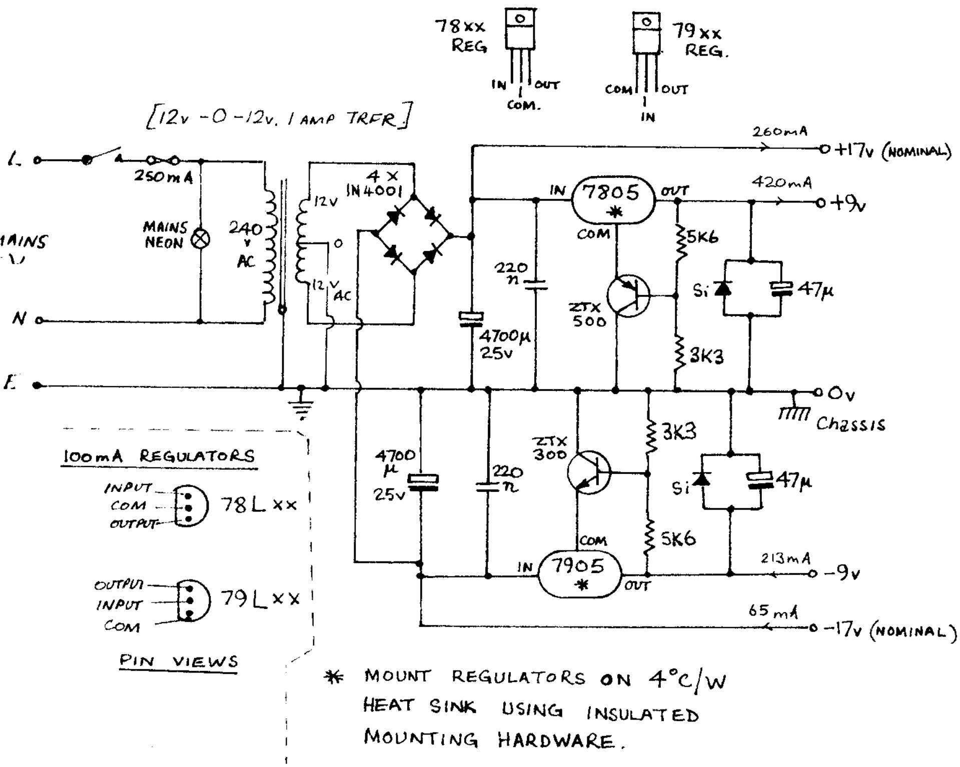


Fig.2 POWER SUPPLY UNIT

Interfield Switch Boards (see Figure 3)

As the prototype has only four video inputs, the package count need only be three, i.e. 74LS75 latch, 74LS20 gate and 74121 monostable (for switch-on select). More video inputs could be used, but this would entail some re-designing of the logic circuitry. Each switching board has its own 78L05 regulator fed from the +9v rail.

The push-buttons used for the vision input selection in the prototype were 'Schadow' rocker switches, which are momentary action SPDT, and are available with integral LED for tally indication (RS Components etc). Unfortunately they are somewhat expensive, and a possible cheaper alternative would be the push-to-make PCB-mounting switch with square buttons from Maplin. Many other types of button could be used, the choice of 'touch' and styling being mainly a matter for personal taste. The buttons should not be latching types, but momentary-action. Although only a push-to-make contact is essential, if a switch with changeover contacts is used, 'button-priority' can be achieved, so that the switch action is mutually exclusive and double selection is impossible. Figure 3a shows the mechanical mounting arrangement used in the prototype.

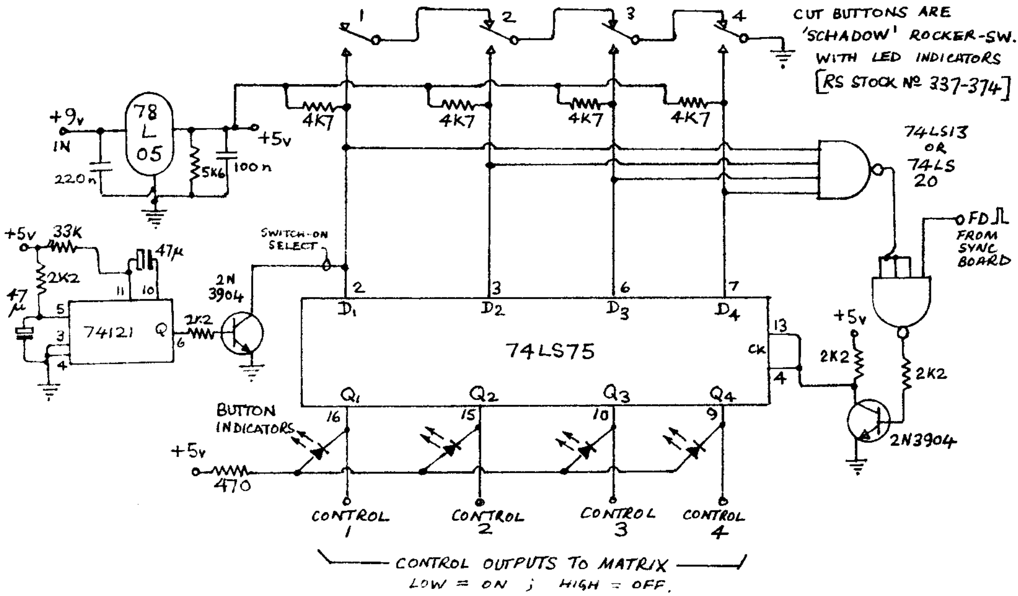


Fig.3 INTERFIELD SWITCH BOARDS (3 required)

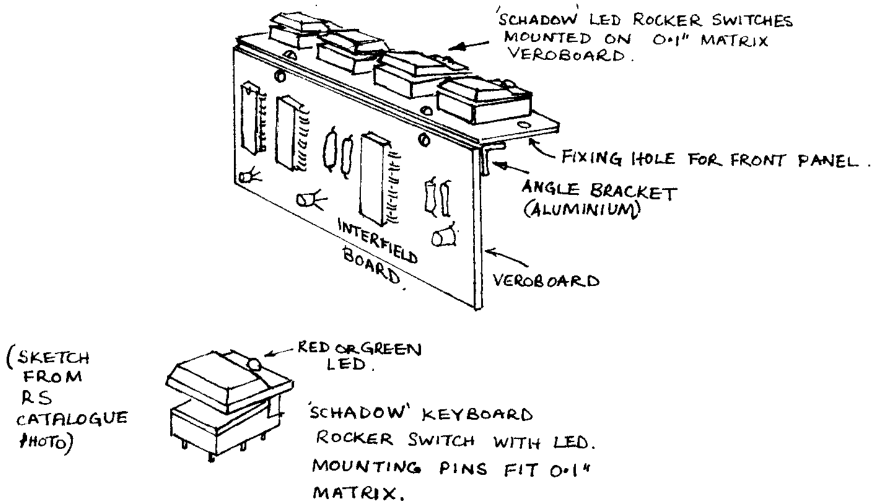


Fig.3a INTERFIELD SWITCH - BOARD ARRANGEMENT

Input Switching Matrix (see figure 4)

The switching element used consists of two diodes and a transistor. This gives three-way isolation when 'off' - series, shunt and series - see figure 4a, the equivalent circuit of an element in the 'off' state. The reference input is wired from input buffer 1 and consists of a similar circuit to the switch elements, for identical signal delay. Figure 4 also shows the arrangement of 'mother' and 'daughter' boards - this kind of arrangement is necessary in switching matrices to avoid excessive crosstalk. The on-board regulator is a 78L12, and is fed from the +17v supply.

Sync. Regeneration Board (see figure 5)

The sync. separator is fed from the +17v rail, which then feeds an on-board regulator for the TTL supply. The 7805 is used here as the current drain is approximately 160mA, too much for the 78L05. The regulator is fitted with a small heatsink consisting of 2sq.in. of 18swg aluminium bent into a U-shape. In order to regenerate drive and blanking signals which have leading edges in advance of line and field syncs respectively, it is necessary to incorporate delay monostables, and these must be adjusted as part of the setting-up procedure, as illustrated by the diagrams in figure 5, which should be self-explanatory.

In the B&W mode, the Colour/B&W switch suppresses the burst gate output, disabling the colour burst gating in the processing amplifier. If the mixer is used with a B&W reference signal, this results in a 'cleaner' back porch.

Fig.4 INPUT SWITCHING MATRIX

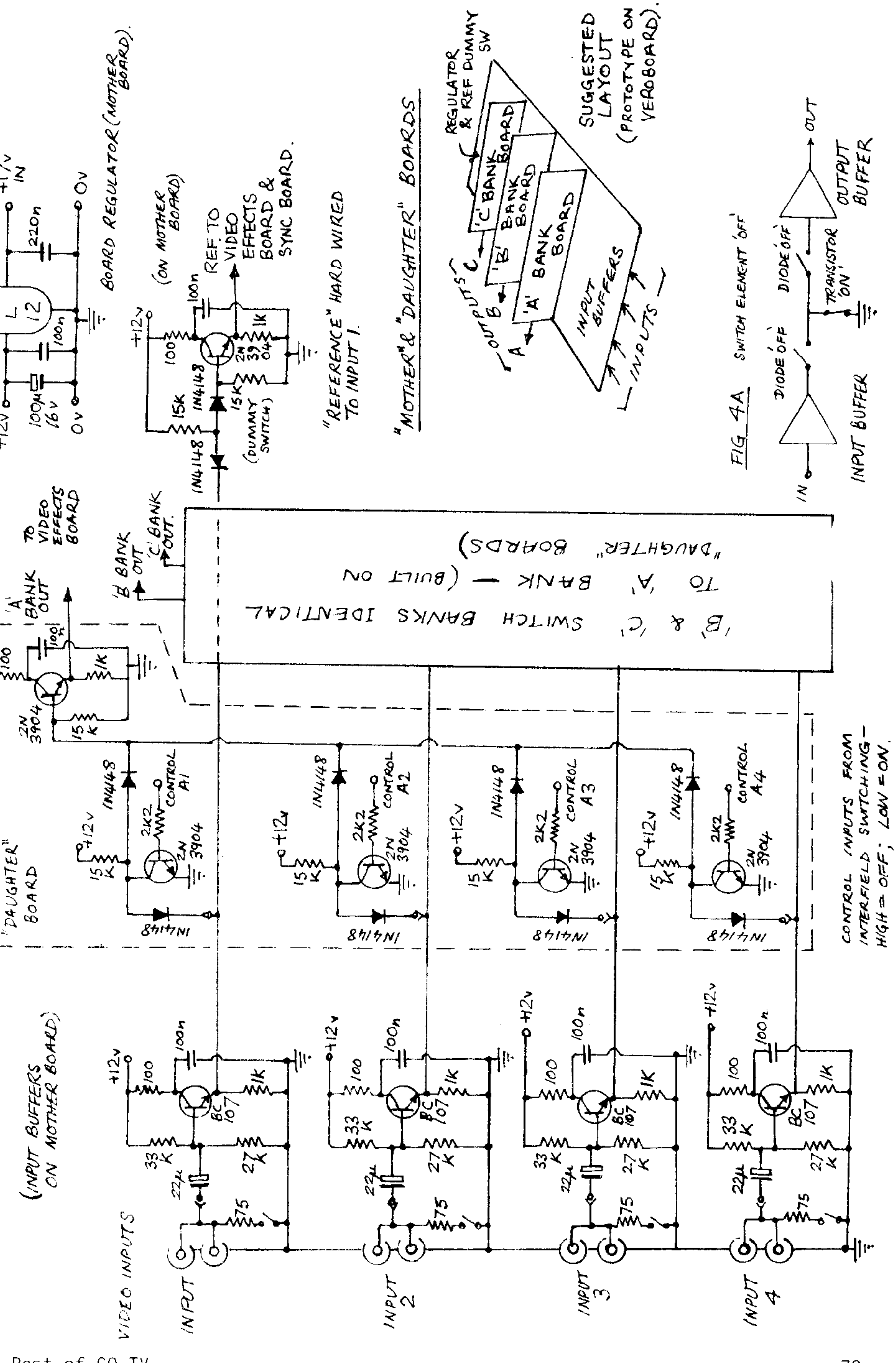


FIG 4A

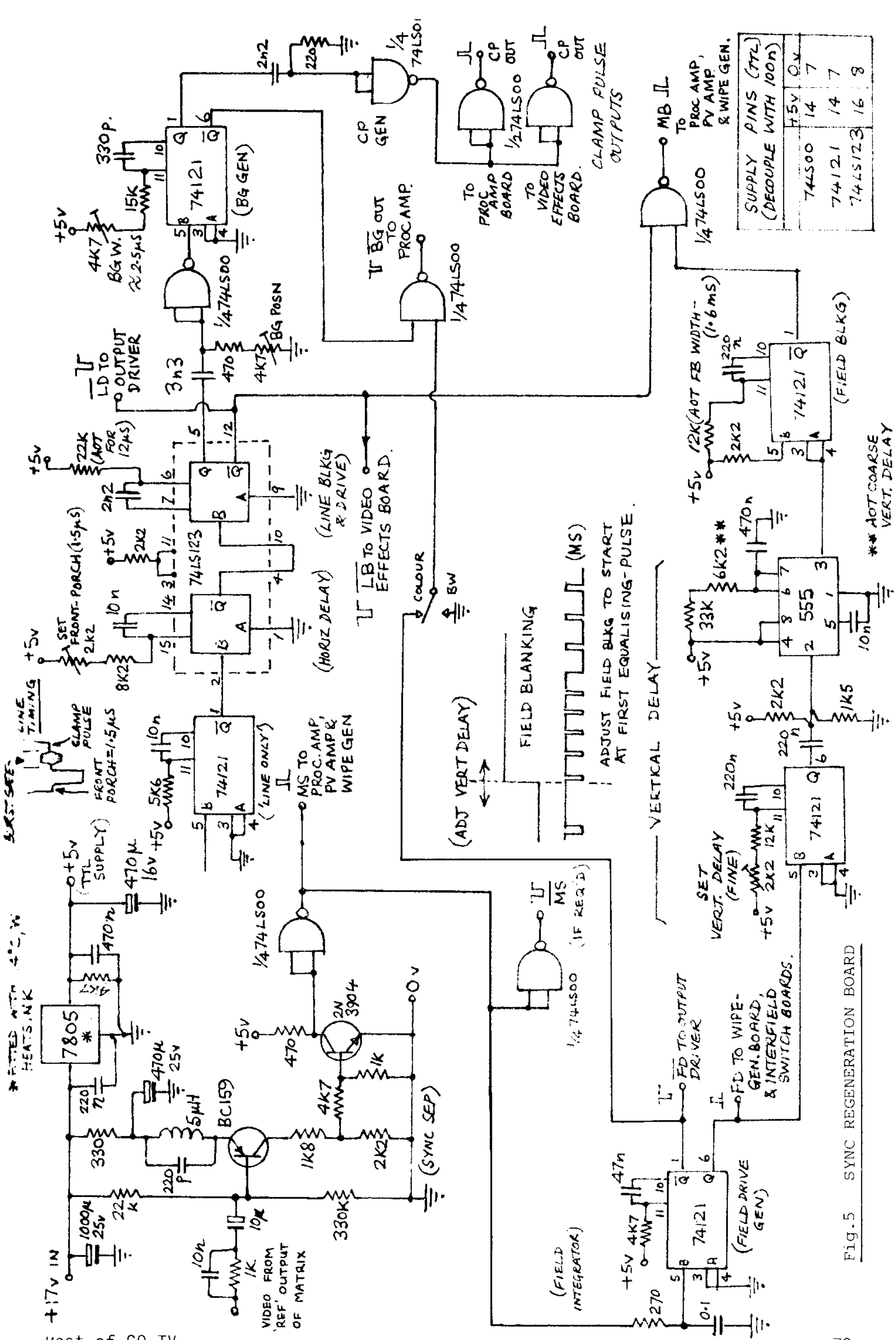


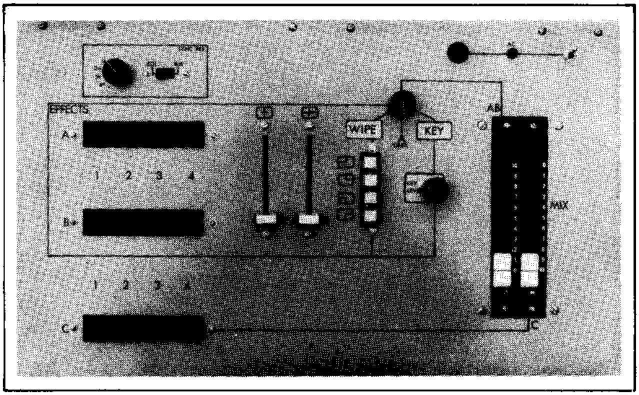
Fig.5 SYNC REGENERATION BOARD

Video Effects and Mix Board (see figure 6)

The supply to this board is +9v, and it has no less than six on-board low power regulators! This is because, as well as the effects switch and mix amplifier, this board also carries the 'dummy' circuits required for the 'C' and reference chains. The 'AB' chain is fed from one pair of 5v regulators, the 'C' path from another pair and the reference path from a third.

The effects (FX) switching is achieved using diode bridges, for high speed (remember, some effects require switching to take place during active line time, when any transients generated will be visible). There are two presets for each switch, 'bias' and 'adjust video switch' - both are adjusted to give the cleanest (transient-free) switching. Note that in both cases extreme adjustment will result in the video switch not working, or working poorly (poor suppression of unwanted signals). However, it should be possible to achieve good results without too much trouble.

For simplicity, it was decided to use 'signal-carrying faders' rather than voltage-controlled amplifiers. However, the prototype is fitted with professional 'Penny & Giles' 1800 series faders, with a microswitch at the 'fade-down' end. These components are now obsolete, although a possible alternative might be the 3000 series, which are rather expensive and take several months delivery from the manufacturer. Suitable items can often be obtained through the "Market Place" columns of CQ-TV magazine, possibly by breaking an old mixer. The lowest available value for the 3000 series is 1k, so it would be necessary to buy dual-gang faders and wire the two tracks in parallel. Less expensive slider pots could be used (again, two 1k lin tracks wired in parallel to give 500-Ohms), provided some means can be devised for fitting fade-down microswitches. These are essential in this design, as they are used to achieve good signal suppression at fade-out. They are used to operate electronic switches situated just before the faders (the BSX20 transistors at the FX bridges outputs), and this gives complete signal suppression when 'faded to black'. The equivalent BSX20 circuit in the reference chain is used to suppress the active-video period, so that the reference signal passes only syncs and burst on to the proc. amp. In order to do this, it is fed with inverse line blanking (NOT mixed blanking).



PHOTOGRAPH OF THE AUTHOR'S PROTOTYPE

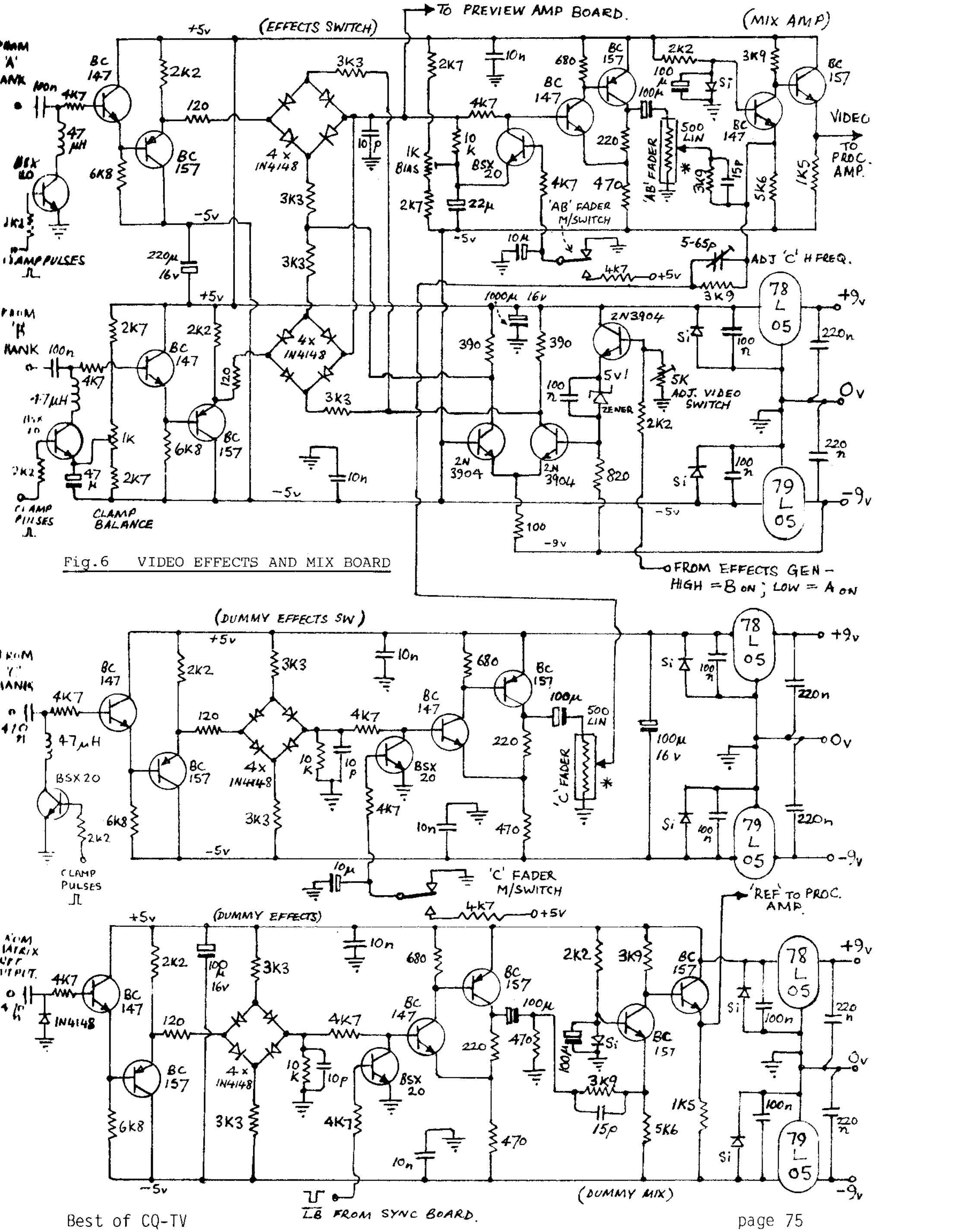


Fig.6 VIDEO EFFECTS AND MIX BOARD

Effects Preview Board (see Figure 7)

A simple monochrome processing amplifier is provided to give an FX preview output. This is fed from the FX bridge on the video FX and mix board. A -17v supply is used, regulated on the board to -12v (a negative rail was chosen in order to even-up the current drain from the power unit).

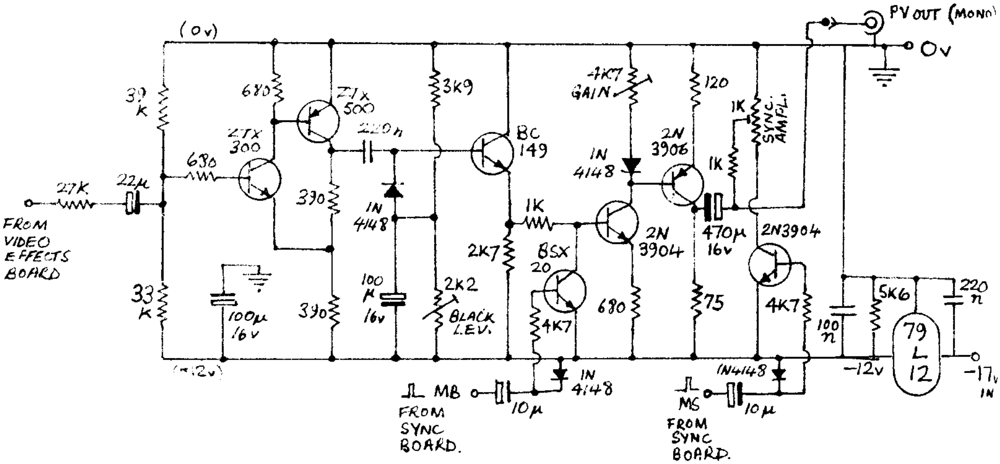


Fig.7 EFFECTS PREVIEW BOARD

Wipe and Key Generation Board (see Figure 8)

Wipe generation is entirely conventional, being initiated by line and field-rate sawtooth (ramp) generators. These signals are applied to voltage comparators, the reference voltages for which are derived from the 'Wipe' sliders. The LM319 comparators have open-collector outputs, and can therefore be made TTL compatible by means of the 1.8k resistors connected to the +5v rail.
The 'vertical' comparators are fed to a 74LS74 dual D-type flip-flop, which is clocked by line syncs, thus ensuring that the vertical component of the wipe always begins or ends during the line blanking period. The effect of this is to make all horizontal split screen transitions lie along a complete scanning line, eliminating the unsightly 'jitter' that can occur when these transitions begin or end at a point during the active line period.

The outputs of the D-type flip-flop and the 'horizontal' comparators are then gated together to give the four standard corner wipes, pattern selection being effected by a bank of four mutual-release pushbuttons (mechanically interlocking type). By using the faders independently, the size and shape of the corner insert wipes can be altered, and by leaving either fader at one extreme and using just one fader, two further wipe patterns are available, i.e. vertical or horizontal split-screen.

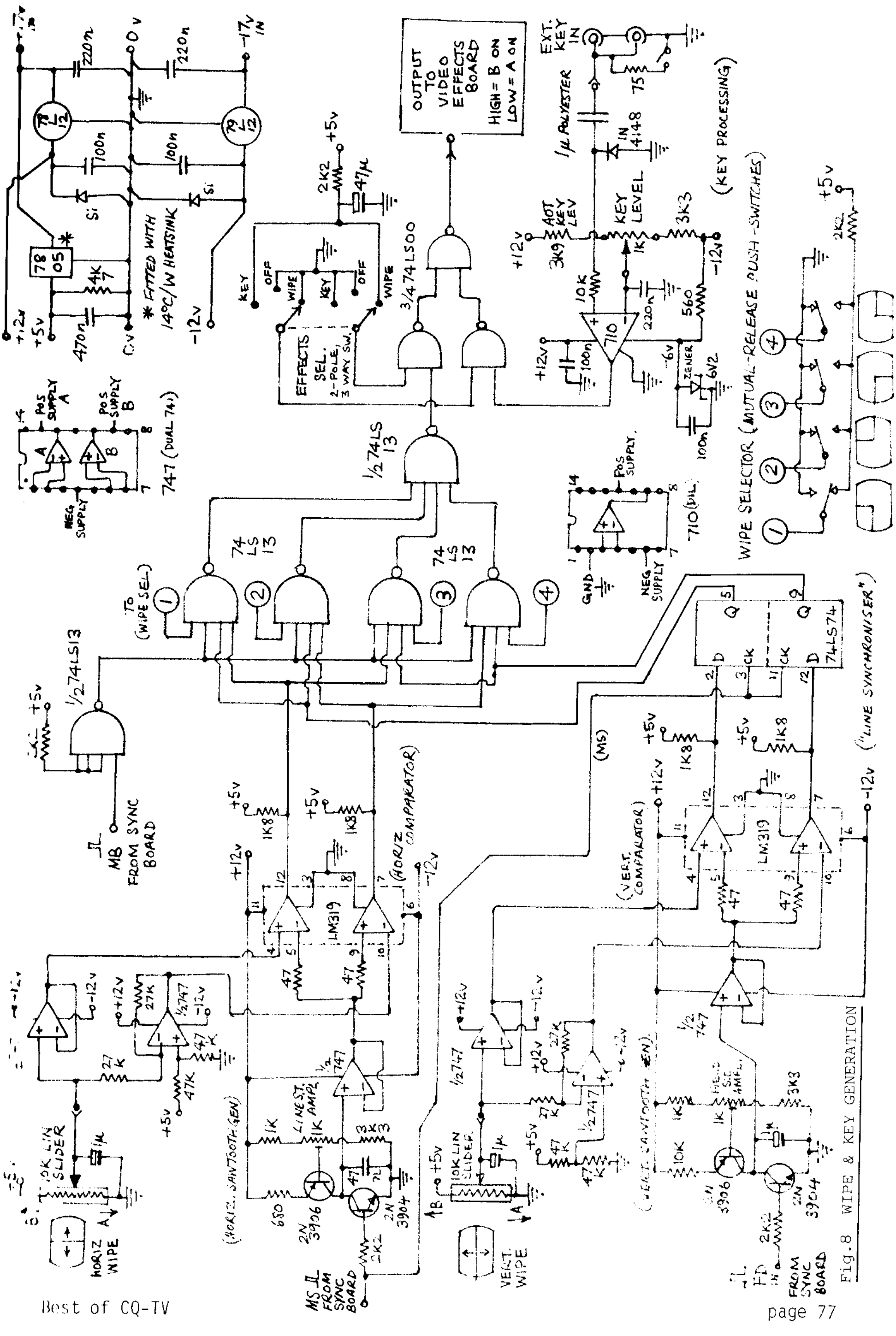


Fig.8 WIPE & KEY GENERATION

Note that on figure 8 the ends of the 'wipe' faders are marked 'A' and 'B'. They should be physically mounted with the 'A' ends adjacent to the 'A' cut bank and the 'B' ends adjacent to the 'B' cut bank. If this is done, the active cut bank will be indicated by the fader knobs (when together) when the 'wipe' mode is selected.

A 710 comparator is used to process the 'External Key' video signal. Its output is TTL compatible, and so a 74LS00 gate is used to select either 'Key', 'Wipe' or 'Off'. In the 'Off' position, the 'B' cut bank is not used, all selections being made on the 'A' and 'C' banks. Because of the need for op. amps carrying DC in the wipe generator circuit, three on-board regulators are required, +12v, -12v and +5v, fed from the ±17 V supplies.

Processing Amplifier and Distribution Amplifier (see Figure 9)

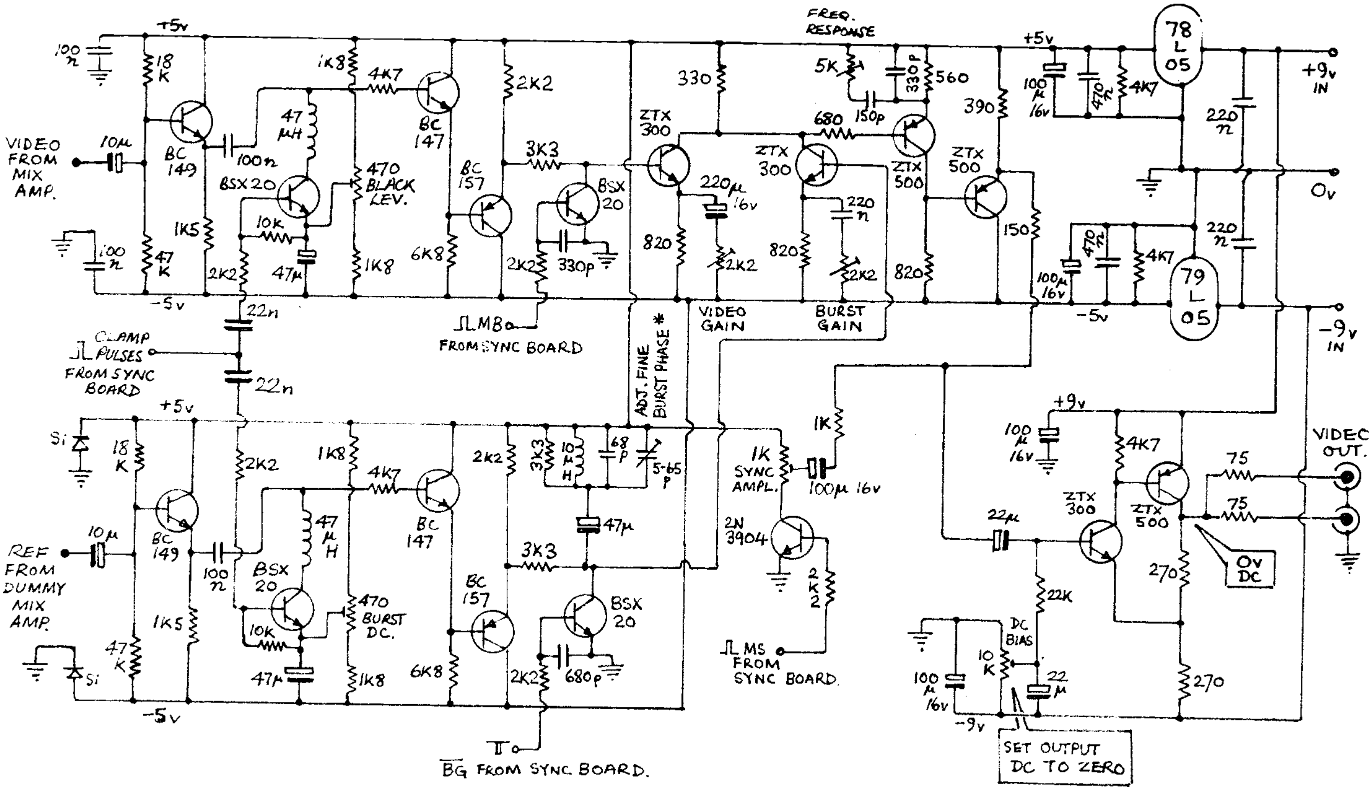
This circuit is fed from + and - 5v power rails, in order that the final output may be DC coupled. The video output from the mix amp. is AC coupled into a clamping stage, re-blanked to remove existing syncs and burst and passed to the output stage via burst and sync adding circuitry and an adjustable HF boost. The reference chain passes through a similar clamping stage, followed by a burst gating stage, where the phase of the burst can be fine adjusted. Although only two outputs at 75-Ohm are shown, a third may be added if required.

There are several preset adjustments on this board, and they should be adjusted as follows: All these adjustments should be made by measuring at one of the outputs, which should be correctly terminated with 75-Ohm, and with a colour bar signal fed to input 1. An oscilloscope with a bandwidth of at least 15MHz should be available.

1. Set output DC of the distribution amp. to zero.
2. Fade to black. Set black level, then set sync amplitude to 0.3v p-p.
3. Set 'burst DC' to give minimum transients at the leading and trailing edges of burst. Set 'burst gain' for 0.3v p-p burst amplitude.
4. Fade up colour bars. Adjust video gain and frequency response so that output agrees with input. If the HF response has been adjusted, it will now be necessary to re-set the 'burst gain' for 0.3v. If there is a discrepancy in HF response between the 'A-B' and 'C' paths, there is a trimmer on the video mix and FX board to compensate.
5. If a vectorscope is available, adjust burst fine phase so that colour bar vectors and burst phase agree. In the absence of a vectorscope, adjust the burst fine phase for maximum burst amplitude. Either method of adjustment will necessitate re-checking the burst amplitude.

Drive Pulse Output Board (see Figure 10)

This board provides 2v p-p negative-going pulses into a 75-Ohm load for driving (say) a monochrome caption camera etc. The circuits are very straightforward, except that the line drive amplifier includes a differentiator, to reduce the width of the input from the sync. board. This is because it is in fact line blanking, with a width of 12uS. The differentiating circuit reduces this to approximately 6uS, which is close to the CCIR system I specification.



(* BURST FINE PHASE — ADJUST FOR MAX AMPLITUDE IF NO VECTORSCOPE IS AVAILABLE)

Fig.9 PROCESSING AMPLIFIER AND DISTRIBUTION BOARD

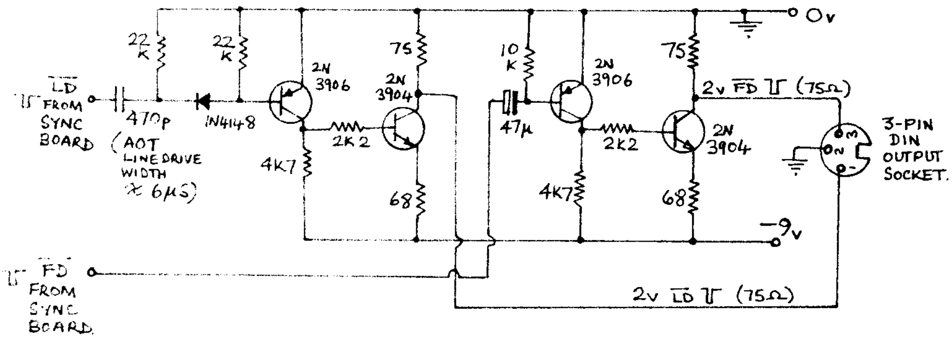


Fig.10 DRIVE PULSE OUTPUT BOARD

Tally Circuit (see Figure 11)

The circuit of figure 11 is a complete theoretical circuit for a tally switching system, which will drive four relays to operate external camera cue lights. It also contains the circuitry associated with the fader microswitches, which provides the faded-down muting facility. As the circuit is basically fairly self-explanatory, no detailed description will be given.

Conclusion

The performance of the prototype, using BBC and IBA off-air signals, appears to be excellent. Unfortunately, extensive sophisticated test equipment was not available to me, and so parameters such as signal-to-noise degradation, chroma noise, differential gain and phase etc. cannot be effectively measured. However, A - B comparison tests using a broadcast test card direct into a monitor, and then with the same signal fed via the mixer show no observable difference.

Should members wish to obtain Penny & Giles faders, they should contact:-
Penny & Giles Conductive Plastics (Audio Fader Division)
Blackwood, Gwent, NP2 2YD. Tel. 0495-228000
They will supply in one's and two's, but it is not certain what arrangements exist for private purchasers, as the faders I used were ordered as 'spares' on an official order. The details of the faders are:-

Penny & Giles 3000 series faders
1 off 1k dual linear, 'fade up', microswitch at zero end (type 3612/B-35)
1 off 1k dual linear, 'fade down', microswitch at zero end (type 3612/B-36)

The 'fade up' and 'fade down' refer to the bezel scale, one being 0 - 10 and the other 10 - 0, as required for back-to-back faders. Although expensive, they are of superb quality, and are highly recommended. As well as RS Components, who will only supply trade customers, the 'Schadow' push buttons referred to earlier are also available from:
Technomatic Ltd., 17 Burnley Road, London NW10 1ED.

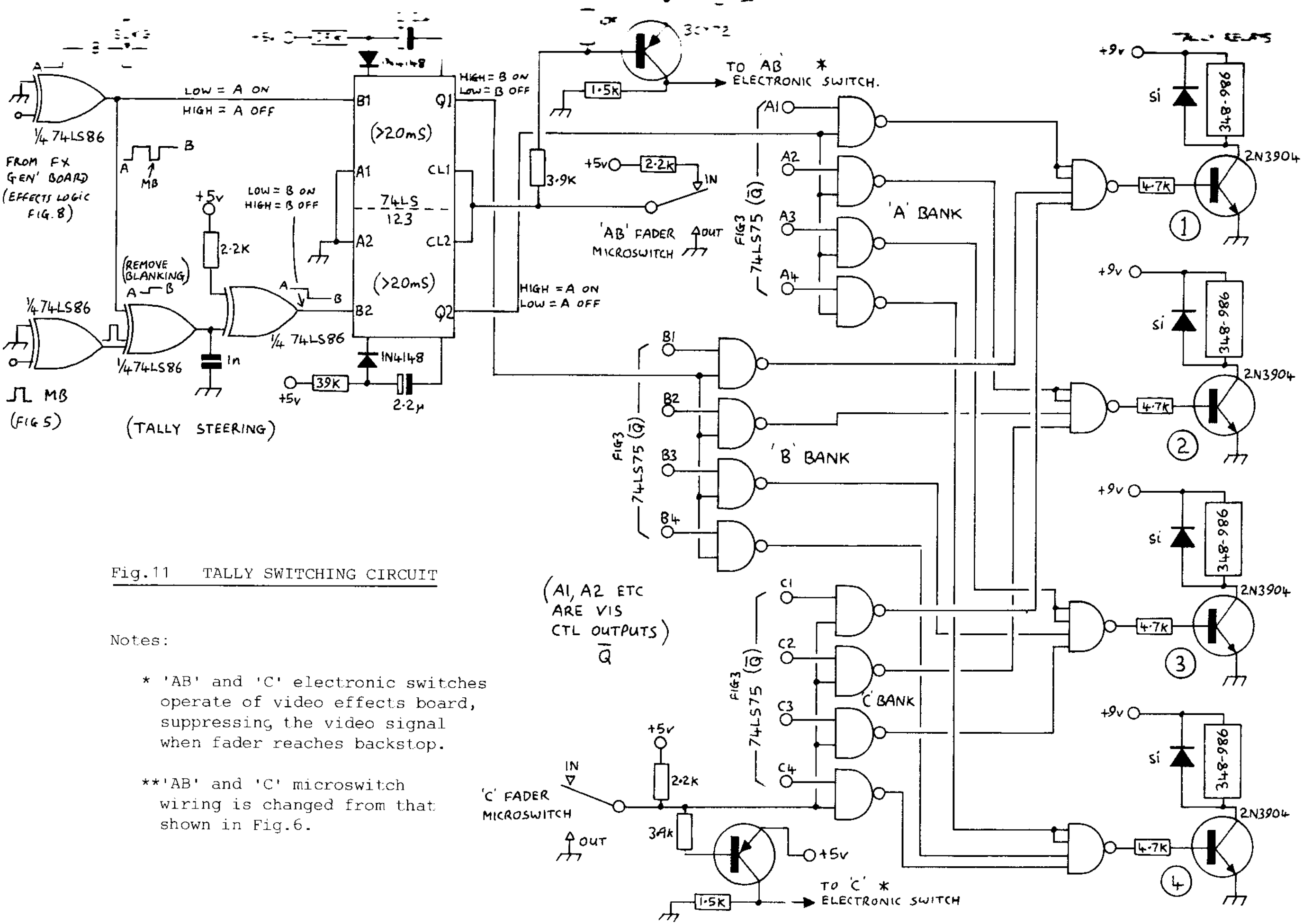


Fig.11 TALLY SWITCHING CIRCUIT

Notes:

* 'AB' and 'C' electronic switches operate of video effects board, suppressing the video signal when fader reaches backstop.

** 'AB' and 'C' microswitch wiring is changed from that shown in Fig.6.

GREY-SCALE GENERATOR

By B.J.Dandy G4YPB

The various designs of grey-scale generator which have appeared in CQ-TV in the past suffer from two minor defects, namely, that the first bar is too wide, and the staircase is non-linear, owing to poor summing. Although adequate on the TV screen, these defects are rather annoying when using a 'scope for testing.

The present design sets out to overcome both problems as simply as possible.

FIRST BAR

A monostable driven from mixed blanking generates a short line blanking period, adjustable in duration, which allows the oscillator to start before the end of line blanking proper.

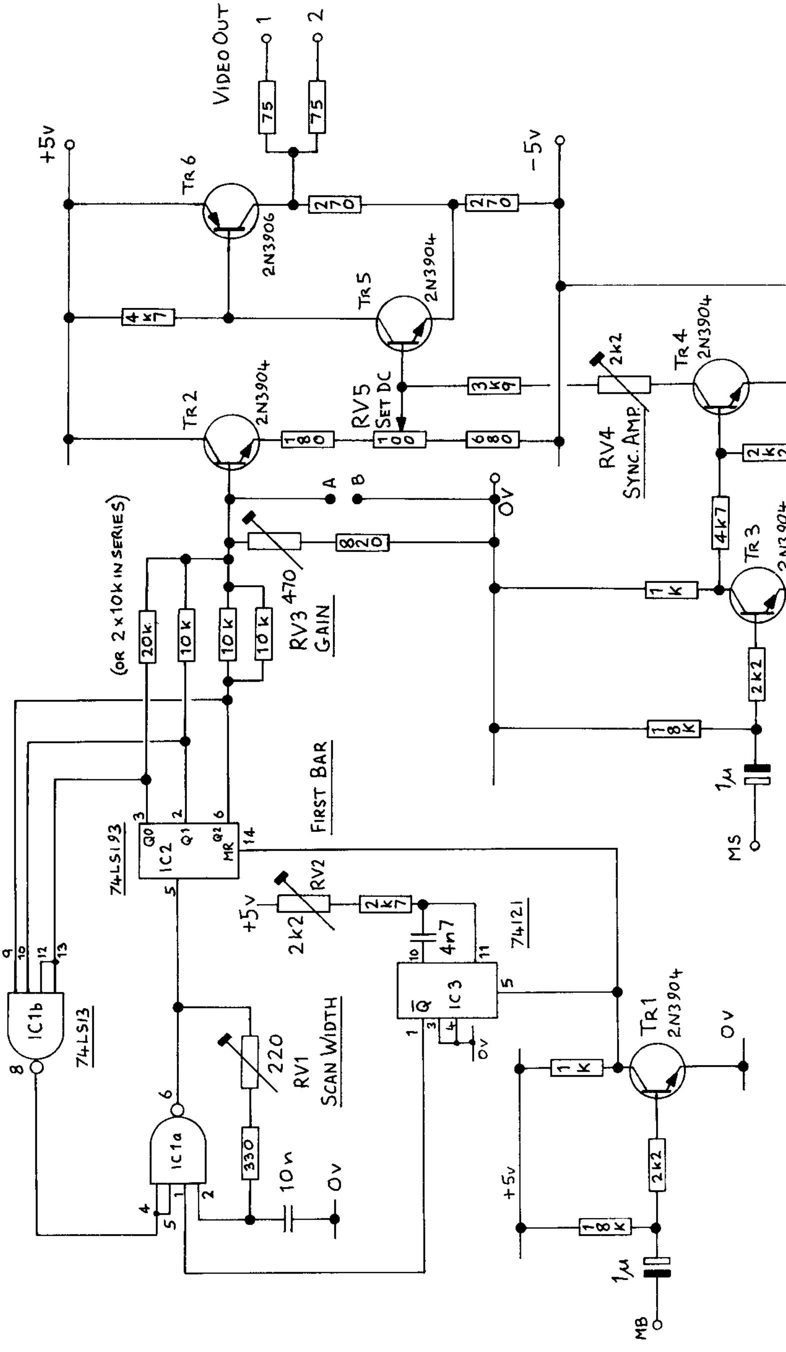
STAIRCASE LINEARITY

The summing point of the resistor network should strictly speaking be a virtual earth, however, in practice about 1k is acceptable. The result of this is that the waveform amplitude is too low, so the output stage has to include some gain - 2 times is sufficient. The emitter follower output stage not only buffers the output, but also serves to set the DC level to zero.

SETTING UP

1. Disconnect sync input and short A-B
2. Set DC level at video outputs to 0v with RV5
3. Remove short from A-B, terminate both video outputs in 75-ohms and confirm that the staircase is correct. Set the output level to 0.7v with RV3.
4. Re-connect sync input and set sync level to 0.3v using RV4.
5. Adjust 'scan width' (RV1) and 'first bar' (RV2) to give a correctly proportioned display.

For anyone who may be interested, a printed circuit board layout is available from the author at 21 Summerhill Avenue, Kidderminster, Worcestershire DY11 6BY.



GREY SCALE GENERATOR

Fig. 1

PRETTY COLOUR GENERATOR

by John Lawrence GW3JGA

This circuit was designed in order to demonstrate the capabilities of the GW8PBX coder (BATC "ATV Handbook 1" & "Micro & Television Projects"), but is equally suitable for use with any other coder. It generates a changing three-phase sequence of RGB signals which when fed to a coder produce a colour background which changes smoothly through the six primary and secondary colours. With the addition of a callsign, caption etc. quite an eye-catching display can be created.

A clock oscillator running at about 0.5 Hz is divided by 2 to give a 0.25 Hz square wave, which drives three J-K flip-flops connected to provide three-phase outputs. These outputs, representing red, green and blue signals are fed to three simple Miller integrators. The 'ramping' output of each integrator provides a smoothly changing three-phase sequence as shown in figure 1. To define a zero level, for signal processing purposes, the output of each integrator is blanked with mixed blanking pulses, and then fed to three simple emitter-follower stages to provide 0.7 V p-p RGB video into 75 ohms, suitable for feeding to a colour coder.

REFERENCES

Astable and Monostable Oscillators using RCA COS/MOS — RCA application report ICAN-6267

Johnson Counters — Wireless World Circard, set 14 number 3

Counters — Texas Instruments application report CA102

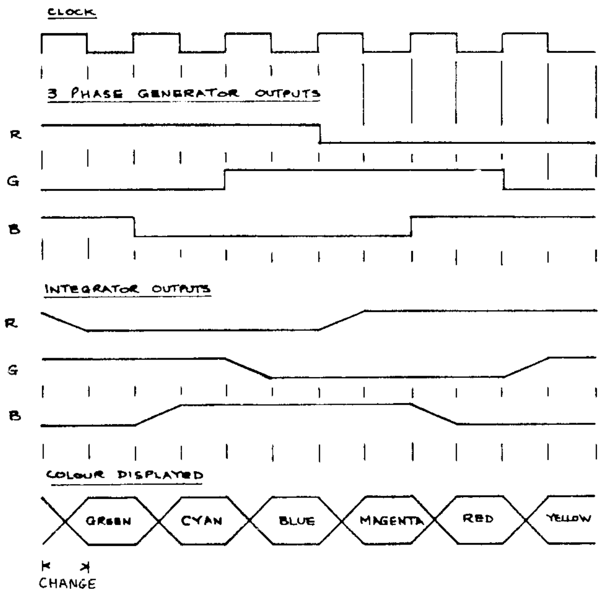
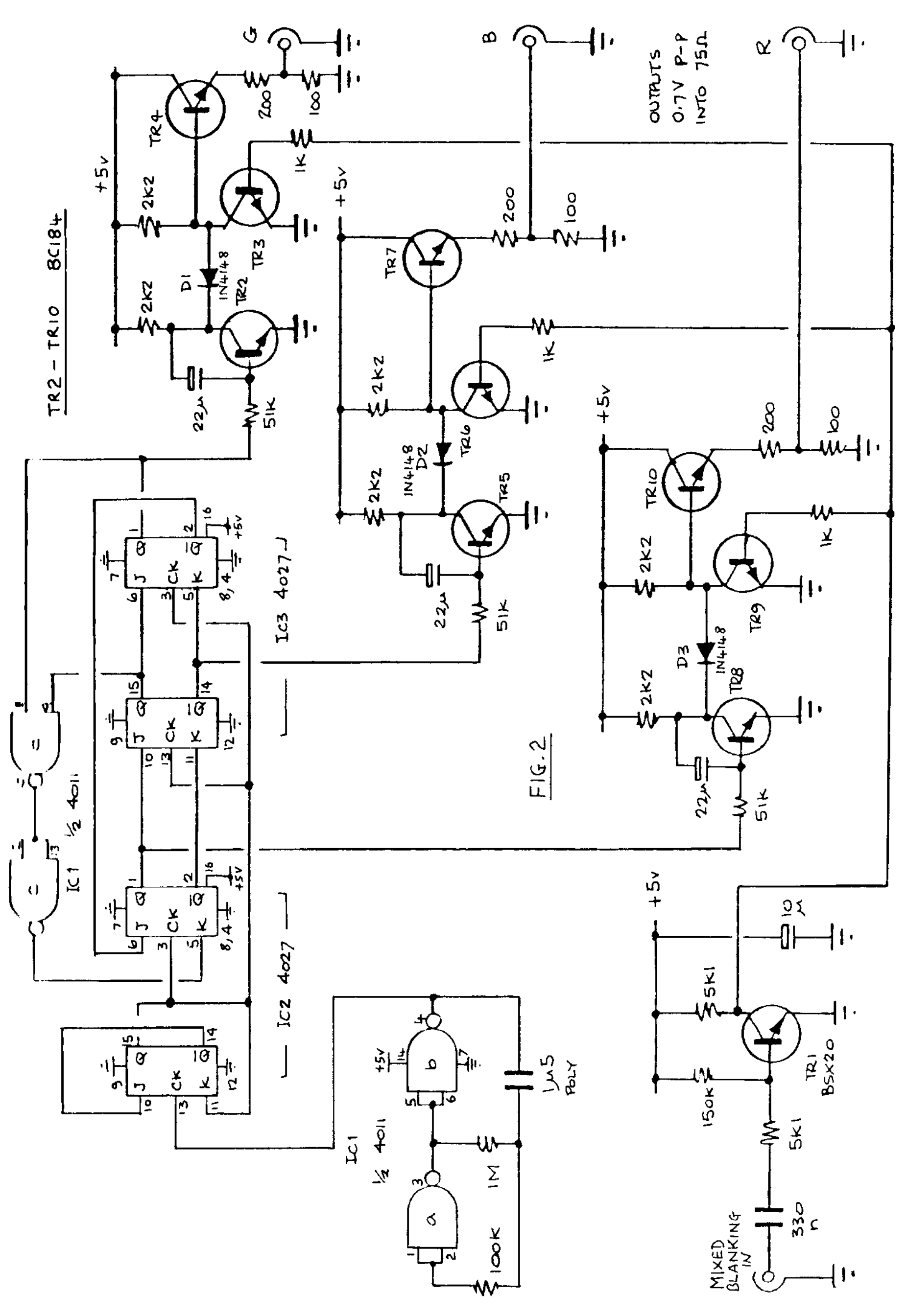


Figure 1 Waveform Timings



TR2 - TR10 BC184
OUTPUTS 0.7V P-P INTO 75Ω
G
B
R
TR1 BSX20
TR2
TR3
TR4
TR5
TR6
TR7
TR8
TR9
TR10
D1 1N4148
D2 1N4148
D3 1N4148
IC1 ½ 4011
IC2 4027
IC3 4027
1μ5 POLY
MIXED BLANKING IN
330 n
10 μ

FIG. 2

SYNC SEPARATOR

By John Lawrence GW3JGA

The circuit to be described is a combination of two circuits which appeared in the 'Design Ideas' section of EDN magazine, January and May 1982.

CIRCUIT DESCRIPTION

Incoming video signals are a.c. coupled and d.c. restored before being fed to the inverting input of the voltage comparator IC1 (LM311). This operates as a picture-information-stripping stage. Positive feedback is provided by the 100k resistor taken to the non-inverting input, this speeds switching and gives some hysteresis. The bias level is adjusted by RV1 which is normally set so that switching takes place about half-way up the sync pulse.

The inverted sync output from IC1 is taken to the positive trigger input of IC2a, connected as a non-retriggerable monostable. This generates a positive line pulse coincident with the leading edge of the sync pulse, but of somewhat longer duration, about 10uS, set by RV2.

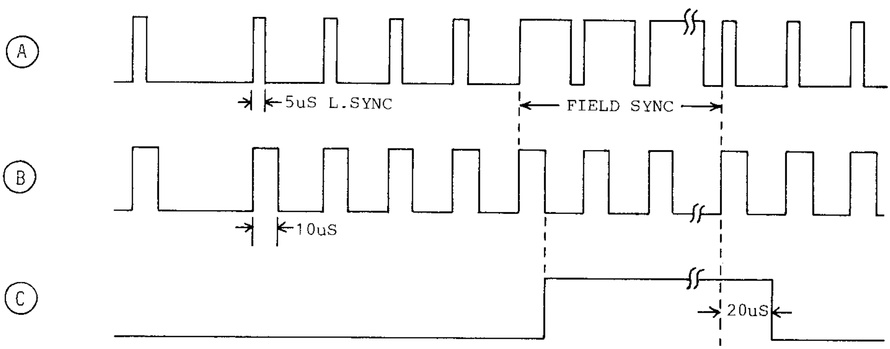
The output from IC2a is taken to the negative trigger input of IC2b, again connected as a non-retriggerable monostable. This circuit triggers only when its Cd input (pin 13) is HIGH, a situation that occurs when the input's duty cycle exceeds IC1's time delay (i.e. during the field sync signal). The OR gate IC3a senses this condition.

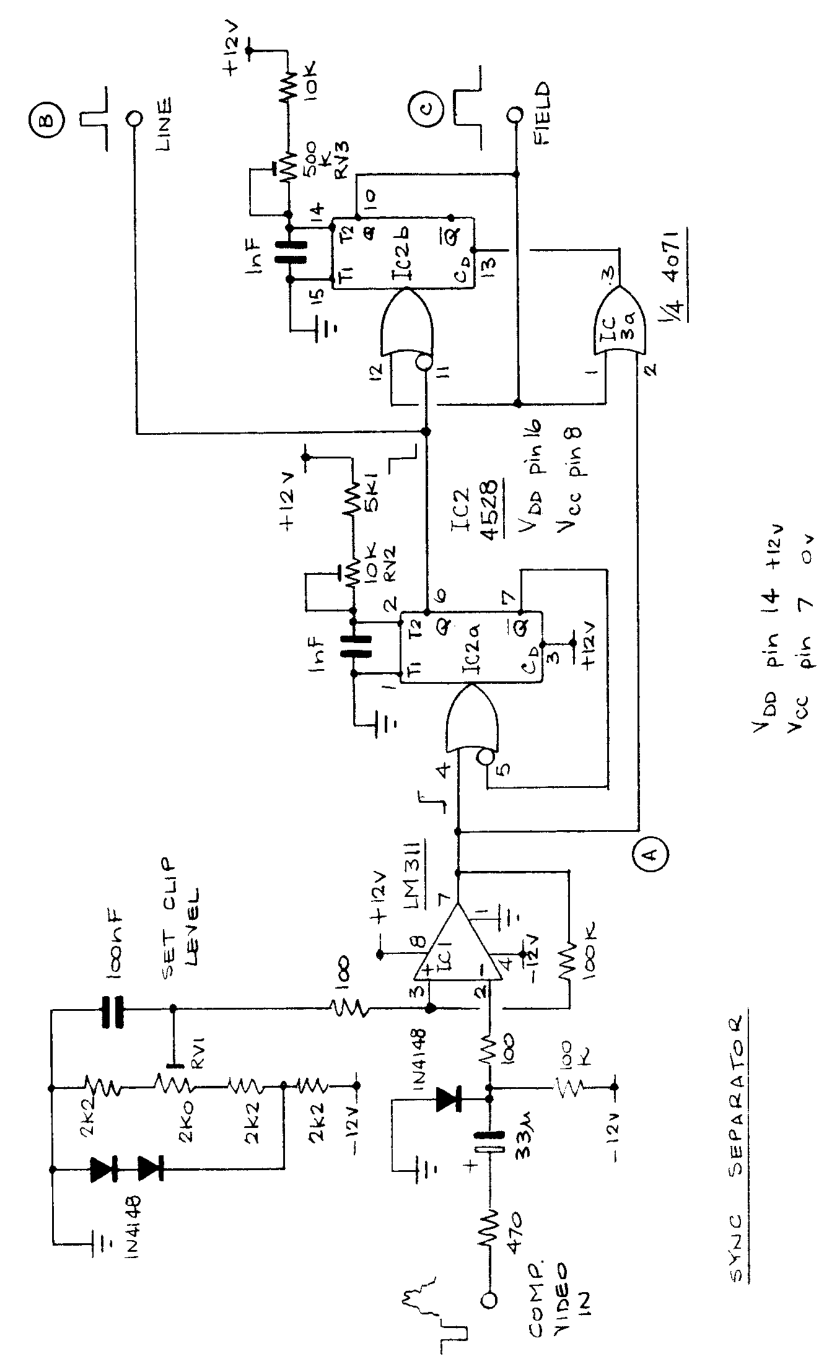
Once triggered, IC2b times-out for a period determined by the setting of RV3. This should be adjusted to give a field pulse duration equal to the field sync, plus 20uS. This prevents possible retriggering at the end of the field sync.

Negative sync outputs can also be obtained from the Qs of IC2a and IC2b.

REFERENCES

1. Design Ideas "Sync separator provides speed, accuracy" Bradley Albing, EDN January 6th 1982 p.207.
2. Design Ideas "Modified sync separator uses fewer IC's" Stephen J.Bepko, EDN May 26th 1982 p.204.
3. Motorola McMOS data sheet for MC14528 (4528).




SYNC SEPARATOR
COMP. VIDEO IN
SET CLIP LEVEL
LM311
IC2
4528
V_{DD} pin 16
V_{CC} pin 8
V_{DD} pin 14 +12v
V_{CC} pin 7 0v
1/4 4071
LINE
FIELD

COLOUR FIDDLE BOX

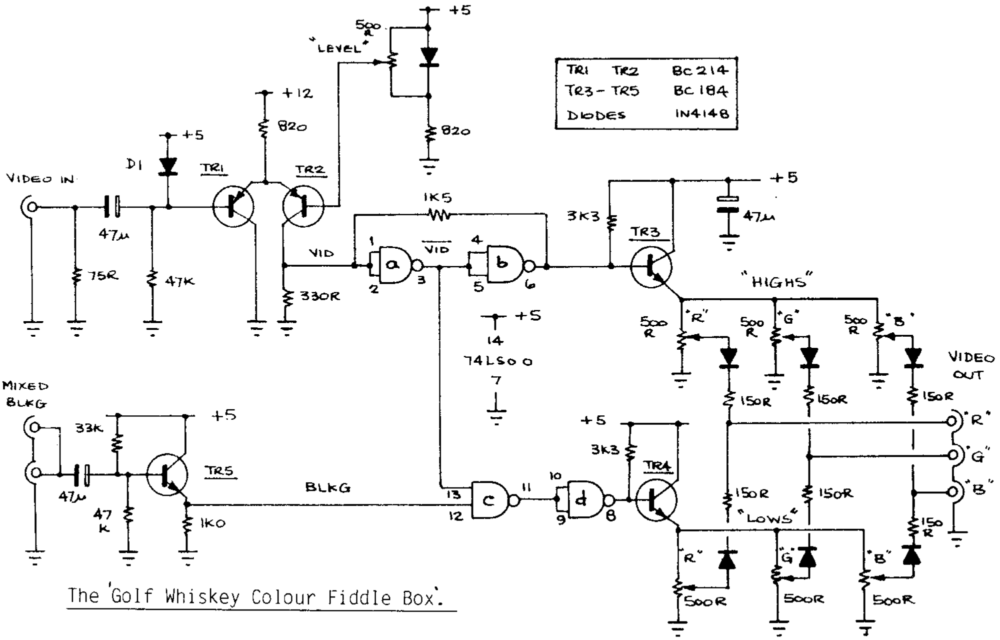
By John Lawrence GW3JGA

The purpose of this circuit is to synthesise a two-colour picture from a monochrome camera input. Ideal for simple colour captions, digital clock etc., this is how it works:

The monochrome video input is fed to the long-tail pair, Tr1,2. The video is DC restored to the +5v supply by D1 and amplified video appears at the collector or Tr2. The base of Tr2 is taken to the 'level' control which enables the output of Tr2 to be "windowed" through the video signal.

Gates a and b of the 74LS00 form a Schmitt trigger with a non-inverted output going to Tr3 and an inverted output via gates c and d to Tr4. For video signals above the level control setting, Tr3 will be turned on and Tr4 off. The RGB outputs will be determined by the settings of the upper RGB potentiometers. For video signals below the level control setting, Tr3 will be turned off and Tr4 on. The RGB outputs will then be determined by the settings of the lower RGB potentiometers. Because Tr4 would normally be on during blanking and would result in RGB outputs, it is necessary to blank the inverted video signal to Tr4. This is done by gate c. Mixed blanking for this purpose is fed from the buffer stage Tr5.

All outputs are 0.7v p-p when terminated in 75-ohms and are suitable for feeding into the BATC PAL colour coder (ATV Handbook - blue. now out of print).



The 'Golf Whiskey Colour Fiddle Box'.

A VIDEO FILTER

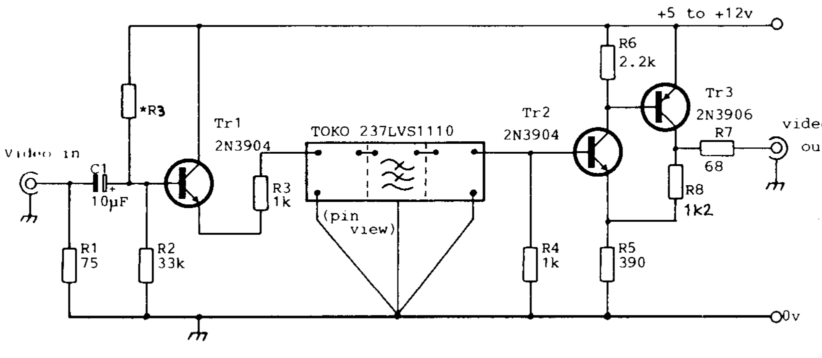
Based on a design originally by Roy King G8CHK

With the advent of digitally generated video sources, including computer outputs, care should be taken that the high frequencies (caused by fast logic switching) are not radiated, as they may extend out of the top of the 70 cm band. An easy way to avoid this is to feed the video through a low-pass filter with a cut-off at a suitable frequency. The circuit described here uses a filter module from the range manufactured by Toko, which cover frequencies of 2.3 MHz, 4.5 MHz and 10.5 MHz (at -3dB). The one used here cuts off at 4.5 MHz, which gives adequate bandwidth for a colour signal.

The filter impedance is 1 k, so a simple circuit is needed to match into a 75 ohm system. Note that the value of R3 needs to be altered to suit the power supply voltage in use.

A BATC pcb is available for this circuit from Members' Services. The Toko filters are available from Cirkit (formerly Ambit) - their part number is 18-11100.

Cirkit, Park Lane, Broxbourne, Hertfordshire, EN10 7NQ.
Also from: Bonex, 102 Churchfield Road, London, W3 6DH



*R3= 33k for 9volts
22k for 5volts
47k for 12volts

PCB available

COLOUR ON A ZNA234

By Trevor Brown G8CJS

The ZNA234 single-chip pattern and sync generator was originally designed for black and white use only. However, now that colour is reasonably easy to generate by us amateurs, being able to add a colour facility to this chip would increase its usefulness around the shack as a sync generator, it being somewhat cheaper than the ZNA134J.

The main consideration is that of deriving the two colour pulses - burst gate and PAL square-wave or axis switch. Burst gate can be derived by using the leading edge of mixed blanking to trigger a burst position monostable, which in turn triggers a second monostable to give the required burst gate signal. The 74LS221 is a dual monostable chip and thus it can be used to achieve both tasks in a single package.

To generate PAL square-wave the negative-going edge of mixed sync is used to drive a monostable whose unstable period is greater than half a line, the resulting waveform is a continuous chain of pulses which are wider than line drive, but that are continuous throughout the vertical interval. The positive-going edge of these pulses is timed with the leading edge of sync, and when divided by two in a positive, edge-triggered D-type flip-flop, then a waveform which can be used for PAL square-wave will result.

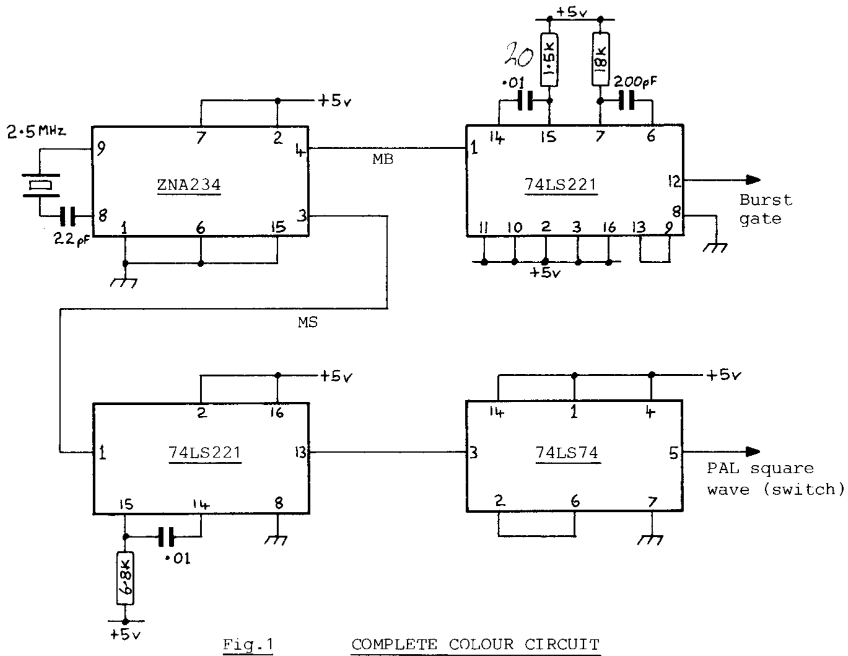


Fig.1 COMPLETE COLOUR CIRCUIT

The circuit of a sync generator is shown in Fig.1 whilst Fig.2 gives a buffer circuit to convert the TTL pulses into standard 2v p-p ones (when terminated in 75-ohms). Four of these will be required for a complete sync generator - mixed syncs, mixed blanking, burst gate and PAL square-wave.

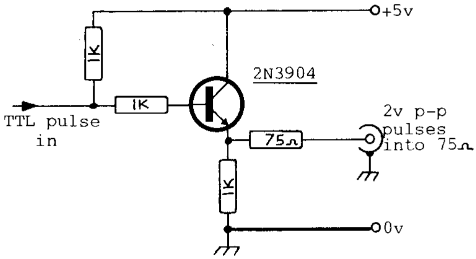


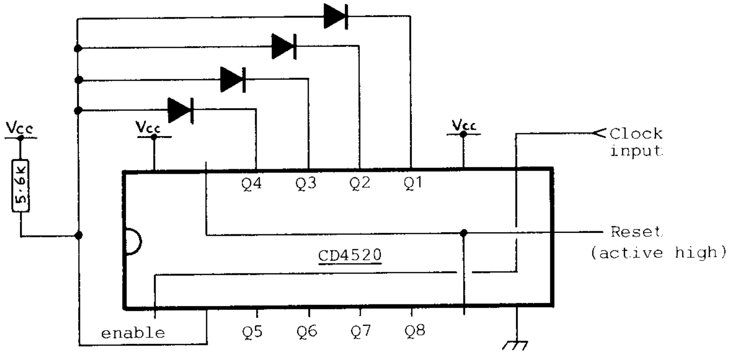
Fig.2 PULSE OUTPUT AMPLIFIER

Using a CD4520 as a single 8-bit synchronous counter

By Trevor Brown G8CJS

Synchronous counters such as 74193 (as opposed to ripple counters like 7493) have the advantage that all their 'changing' Q outputs change in unison when clocked. This is not the case with ripple counters however where momentary glitches and invalid counts often occur.

In C-MOS the CD4040 is a ripple counter but the CD4520 is synchronous. It is a dual 4-bit counter but to use it as a single 8-bit device it may be wired as follows:-



Both counters are clocked but the 'B' half is disabled by the four diodes. When the 'A' part is full it enables the 'B' half for one clock pulse, then it overflows to zero and removes the enable. In this way a "synchronous cascade" of both halves produces a single 8-bit counter.

A TELEVISION ALARM

By I.Waters G8ADE

I have often thought that there is probably more ATV to be seen on the bands than is actually seen. The problem is knowing when it is there. The notion of leaving a receiver running all the time was rejected. Quite apart from energy, heat and tube life considerations, who wants to live with a screen full of noise even assuming one looks in the right direction at the critical moment.

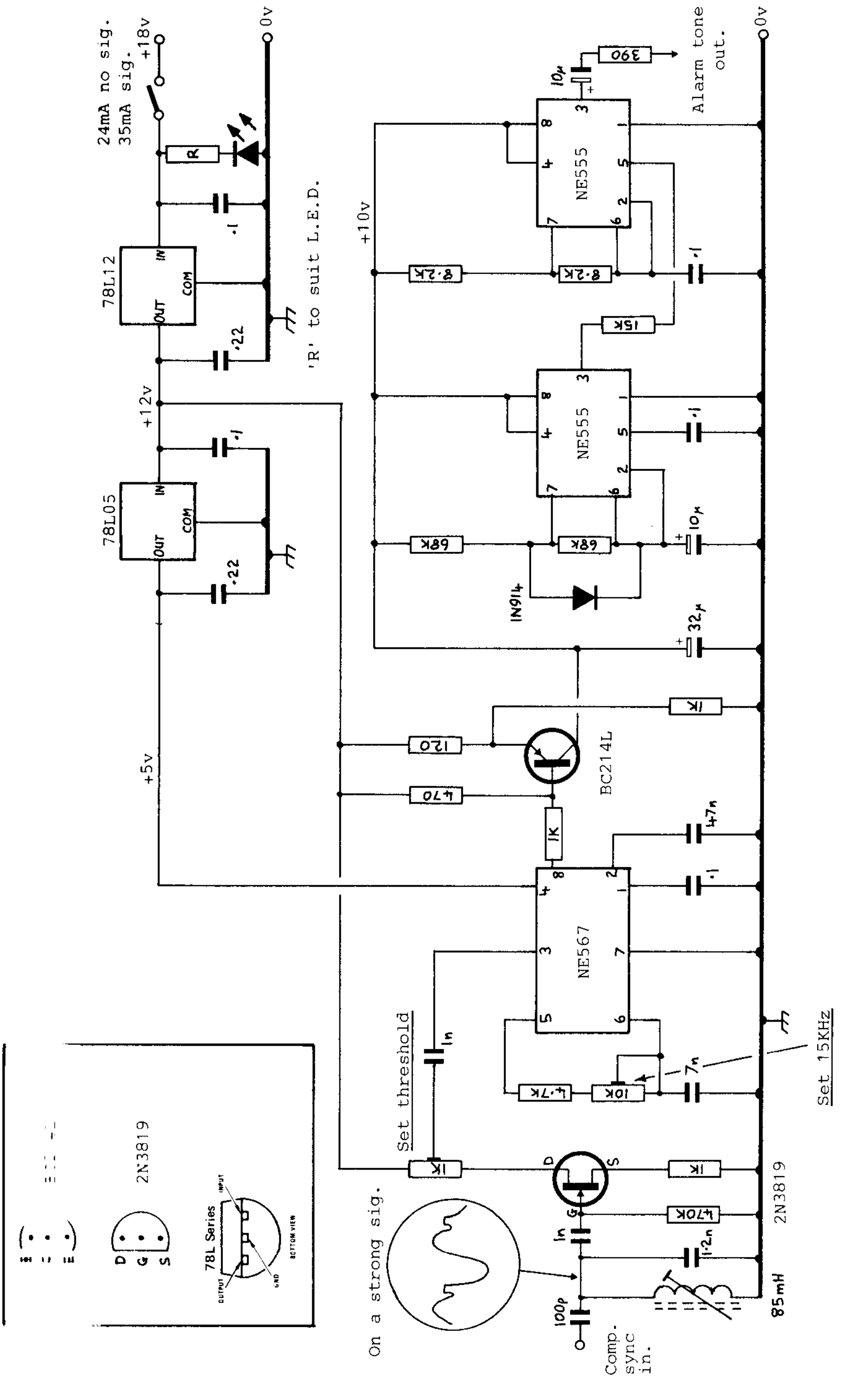
The circuit shown in Fig.1 is incredibly sensitive. It will reliably detect 15.625KHz modulation which is buried many dB under the noise and give an audible alarm. This could of course take any form but is in this case a strident simulation of a two-tone emergency horn! At G8ADE 70cm signals from the receive mast head amplifier are fed via a distribution amplifier to two converters. One, narrow band, feeds a communications receiver covering 432 - 434MHz. The other, a broadband unit covers 434 - 440MHz. The I.F. (36MHz) from this feeds a TV I.F. strip which in turn delivers video and audio at line level to monitors and a speaker/amplifier respectively. The alarm circuit forms part of this TV I.F. strip.

CIRCUIT DESCRIPTION

Composite syncs, from a separator in the I.F. strip (necessary to re-set the a.g.c. circuit [GW8PBX note]) are coupled via a 100pF capacitor to a parallel tuned circuit at line frequency which, in fact, uses a horizontal oscillator stabiliser coil from an old TV set. This signal is buffered by a high impedance input F.E.T. and fed via a "threshold" control to an NE567 IC in a phase locked loop decoder circuit. The detection frequency is set to 15.625KHz by the 10k pot., and when this frequency is detected pin 8 goes low, the following BC214L transistor turns on enabling power to be applied to the alarm tone generator.

The alarm tone is fed via a mixing pad, so that it will be heard regardless of what else may be happening on the station loudspeaker.

The sensitivity is such that the circuit will reliably detect the presence of a TV signal which is so weak that nothing, not even floating diagonal lines, is to be seen in the noise on a monitor screen. The presence of the vertical interval can however JUST be detected in the noise on a waveform monitor. The detection is however quite positive as the alarm will cease when the aerial is disconnected. This sensitivity may seem somewhat of an overkill but in practice it allows for the converter being a bit off tune (in practice tuned to 435MHz) and/or for beam heading.



CIRCUIT DIAGRAM OF T.V. ALARM.

Fig.1

ADJUSTMENT

Tune to a strong signal, look with a 'scope on the drain of the F.E.T and tune the 85mH coil for maximum sinewave. Now tune to a weak signal and adjust the 10k pot to mid-travel during which pin 8 goes low. Disconnect the aerial and adjust the 1k "threshold" pot. so that the circuit is just not giving a chattering output on noise.

The power switch allows the alarm (racket!) to be shut off once a signal has been identified but the associated L.E.D. shows at a glance whether the system has been left in the "armed" state.

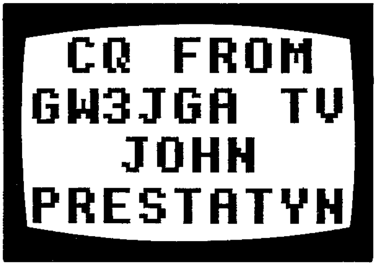
"BIGTEXT PROGRAM"

FOR BBC MICRO's

By Geoffrey Lawrence.

This is a useful large text display for TV amateurs who have a QTH of up to 9 letters. The text is typed-in in the normal way a line at a time, hitting RETURN generates the big letter version. Total screen area is 4 lines of 9 characters. The text is automatically centred and the text moves up when the screen is filled.

```
100 REM *** GEOFFREY LAWRENCE 1984 ***
110 MODEØ:VDU23,42,255,255,255,255,255,255,255,255
120 PRINT CHR$11:INPUT A$:C$=""
130 IF LEN(A$)>9 OR LEN(A$)=Ø GOTO 11Ø
140 PRINT CHR$11;CHR$13;"              "
150 FOR A=Ø TO 6:FOR B=1 TO LEN(A$)
160 C=&BFØØ+(ASC(MID$(A$,B,1))*8)+A
170 C=?C:D=128:B$="":REPEAT
180 IF C>D-1 C=C-D:B$=B$+"*":GOTO 2ØØ
190 B$=B$+" "
200 D=D/2:UNTIL D=.5:C$=C$+B$:NEXT
210 D$="":FOR E=1 TO (8Ø-(LEN(A$)*8))/2
220 D$=D$+" ":NEXT:D$=D$+C$:C$=D$
230 PRINT C$:C$="":NEXT:GOTO 12Ø
```



MOBILE VOLTAGE REGULATOR

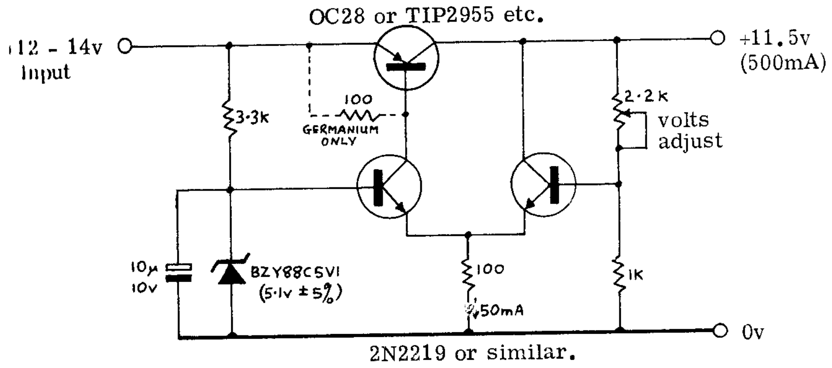
by C. Brownbridge G6BIN

It is often necessary to derive power for portable video equipment from a car electrical system. The problem is that the actual voltage obtained from the car electrics can vary from around 11.5 V to over 14.5 V. Sensitive equipment such as the BATC coder, vision switcher, off-air receiver etc. cannot tolerate such wide variations on the supply rail.

Conventional three-terminal regulators require a drop of around 4 V, and therefore cannot be used to provide a nominal 12 V supply from a car system.

The circuit described requires very little volts drop and, if the output is set to 11.5 V (which is usually adequate for most circuits), good regulation will be maintained down to the point where the battery becomes badly discharged.

The PNP power transistor may be any high-current audio type. If a germanium device is used then the 100 ohm resistor (shown dotted) should be included. The two NPN transistors can be any audio type capable of dissipating at least 600 mW. TO-5 type transistors are to be preferred, as they get quite hot.



DC CONVERSION FOR 'MAINS' CAMERAS

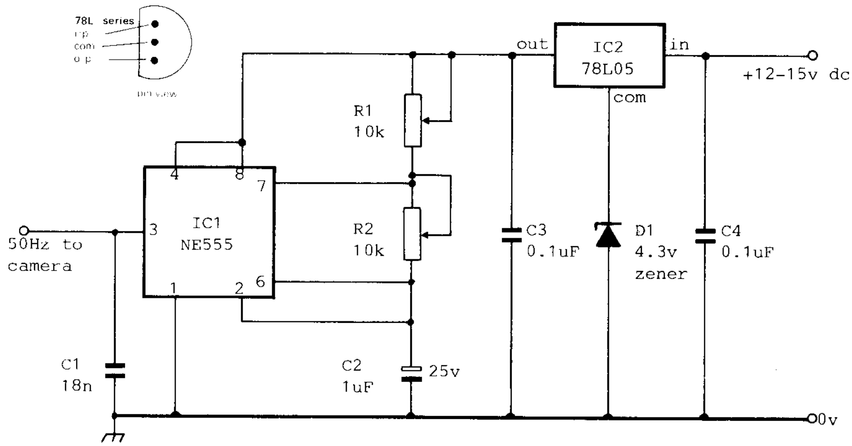
By Shaun O'Sullivan G8VPG

Like myself, many ATV'ers use ex-surveillance cameras as their primary vision source. Such cameras usually have an internal mains power supply, which is convenient for shack use but can cause problems if portable operation is envisaged. Although most solid-state cameras employ a 12 - 15v dc supply, they frequently need a source of 50Hz to derive the frame syncs. This signal is usually taken from the low-voltage ac supply before the rectifier diodes.

The circuit shown here will produce a suitable 50Hz signal which, when used with a 12 - 15v dc supplied camera, will enable correct operation for portable use, (provided of course the tube voltages are derived from the 12v supply).

IC1 is an NE555 timer wired as an Astable oscillator. R1 and R2 allow the frequency and mark/space ratio to be adjusted. This may be done using a 'scope or by trial and error on the camera itself. C1 eliminates any spurious oscillations which may be present and which could cause noise on the picture; this may need adjustment on test. IC2 produces a stabilised supply voltage of around 9v.

The circuit was developed for use with my Hitachi HV62 and works very well. Doubtless other cameras will be able to use the circuit to good effect as well.

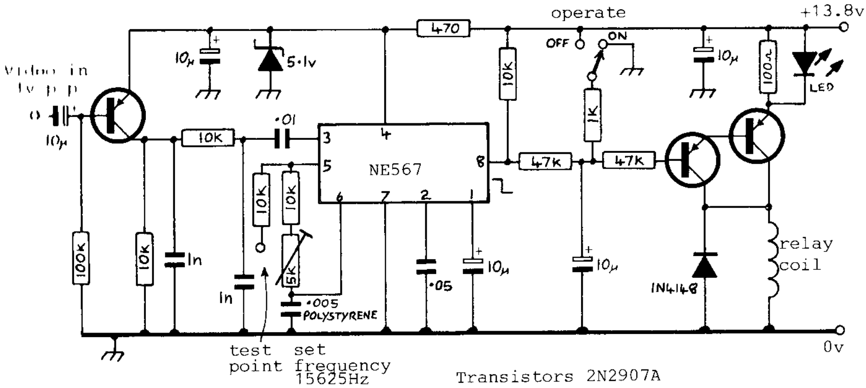


50Hz OSCILLATOR FOR 'MAINS LOCKED' VIDEO CAMERAS.

VIDEO OPERATED RELAY

This video operated relay is designed to key a small 12v relay when horizontal sync is sensed at its input. It can be used in a variety of applications, for example, to remotely activate a video recorder, in an ATV repeater system or as a receiver warning alarm. Should it be necessary to activate a heavy relay, say for transmitter power applications, the small relay may be used to switch in a large one.

The VOR circuit first separates horizontal sync from the video and noise, this then passes to a NE567 tone decoder IC whose frequency is set to 15625Hz (line frequency). The decoder output signal changes state after about a tenth of a second and causes current to flow in the final transistor so energising the relay. A switch is provided to enable the circuit to be de-activated. A drop out delay of around 0.5 second is provided to cater for quick fades or multipath dropouts. The attack and delay times are determined by the 10uF and the 47k resistors associated with pin 8.



The frequency of the decoder should be set by using a frequency counter connected to the test point and carefully adjusting the pot to within 100Hz of 15625Hz. This should be done with no video connected. The normal lock-in range is around plus and minus 800Hz to allow for odd computer horizontal frequencies or badly adjusted cameras.

This circuit appeared in A5 Amateur TV magazine for August 1984 and thanks are due to the author and publisher for permission to reproduce it here. The design is from P.C.Electronics of 2522 Paxson Lane, Arcadia, CA91006, USA who produce a printed board or assembled module.

T.V. INTERFERENCE

Television interference has bugged amateur radio for many decades and unfortunately, 70cm ATV is also capable of causing interference (although not often). This simple cure should clear-up all but the most stubborn cases.

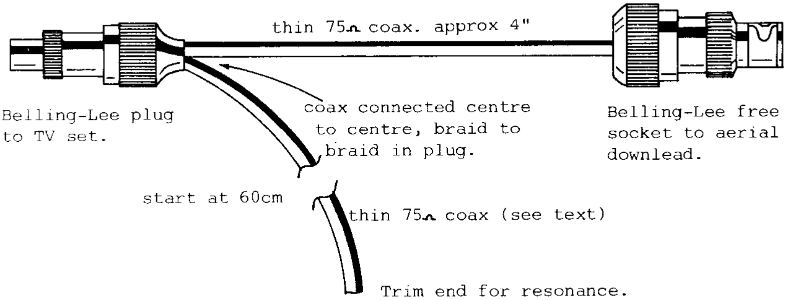
First make sure that the interference is coming down the TV aerial lead. To do this, switch-on the transmitter and monitor the interference on the set. Then simply pull out the TV aerial plug. If the problem disappears, along with the programme, then it is probable that the 70cm signal is "blasting" down the TV aerial.

If this is the case a filter to remove the 70cm content but which does not attenuate the wanted TV signals is required. An easy way to do this is to simply use a 3/4-wave coaxial stub at the TV aerial socket. Being a multiple of quarter-waves the 70cm signal will be shorted out but not the wanted signals since they are on different frequencies. A 3/4-wave stub is used rather than a ¼ as this will also be a ¼-wave at 2 metres which means that you can do two bands at once.

The stub is made by cutting a piece of thin coaxial cable about 60cm long and connecting it to a cable link as shown in the diagram.

There are two ways of aligning the stub; either connect the device 'in situ' and trim the free end about 1/8 of an inch at a time until the interference disappears or, insert the stub at the aerial input of a 70cm receiver, tune in a fairly strong signal (beacon, repeater etc.) and trim the stub for minimum signal. Put this at the back of the TV set and the TVI should have gone.

To finish it off, the stub itself may be coiled around the coax link and taped over to make it neat. It is a good idea to lay in a stock of these so that they may be handed out if a complaint is received.



A SIMPLE T.D.R.

By John Lawrence GW3JGA

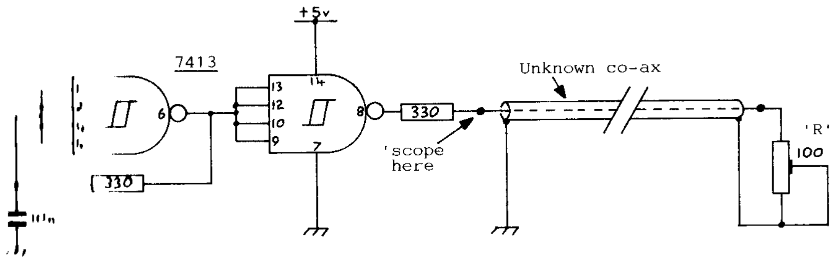
Recently I needed a simple method of measuring the characteristic impedance ZO (Zed Nought) of a coaxial cable. Actually I was looking at the RS Components 367-577, 4 individually screened conductors in one cable, to see if it would be suitable for carrying RGB and Sync from a BBC micro to several RGB monitors. The characteristic impedance is not quoted by RS, so this is what I did:

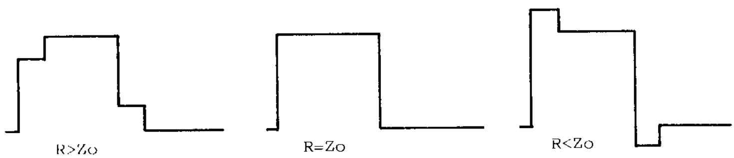
I patched up a simple square-wave generator using a 7413 I.C. to give a good square wave of approximately 200 KHz. I fed this into the end of one of the coax cables and connected a 100-ohm carbon pre-set pot. across the other.

I monitored the input to the coax with a 'scope, set to 2v/div and 0.5uS/div. I then twiddled the carbon pot. until a clean square-wave was obtained. This indicated that the coax was terminated in it s characteristic impedance and no signal was being reflected. I then unhooked the pre-set control and measured it on the ohms range of my Avo and Bingo! it read 60-ohms.

To confirm the results, I repeated the measurement using a drum of UR46 co-ax 50 ohms and some TV co-ax - 75-ohms, both checked out within an ohm or two. You need to have at least 10 metres of cable or the pulse propogation time is too short for easy measurement on the usual 10 MHz 'scope.

O.K. the Time Domain Reflectometer is nothing new but this is a lot cheaper than a Hewlett Packard! Going back to the RGB monitor, I paralleled the normal 75 ohm termination resistor with 330-ohms, to bring it nearer to 60-ohms, and it worked fine.





A MINI-AERIAL FOR 24

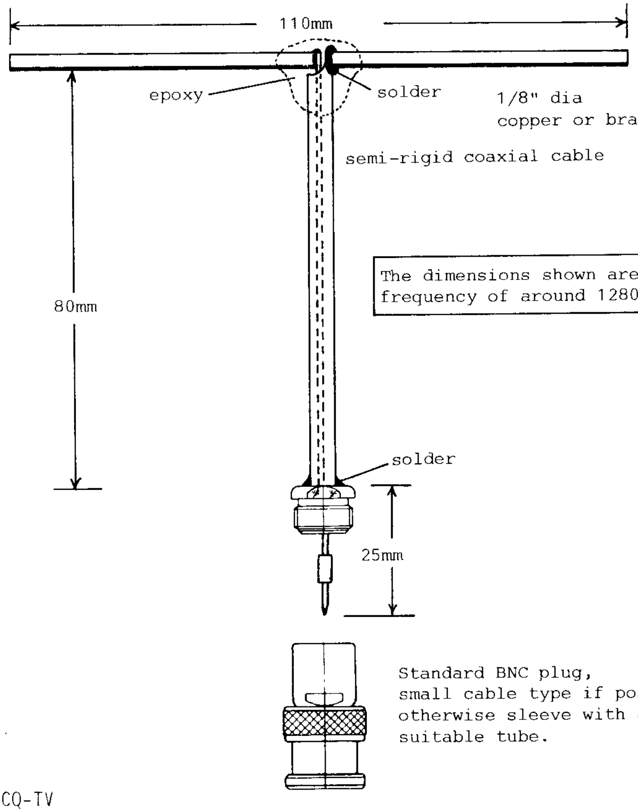
By John Wood G3YQC

The simple aerial described here is the result of a little research and experimentation. Purists will no doubt find fault with the design but it is simple and works well with my Solent Scientific 10mW 24cm transmitter for which it was designed.

VSWR and polar diagram tests have not been carried out although its directive properties are about what one would expect from a simple dipole.

For those not familiar with semi-rigid coax, the type I use is about 3.5mm in diameter, has a conventional looking inner but has a metal tube (usually silver plated) as the outer sheath. This cable is employed because of its rigidity. It can be found in many junk boxes and at rallies, often attached to pieces of microwave gear. It can also be purchased new from JVL Electronics, 26 Fernhurst Close, Hayling Island, Hampshire PO11 ODT.

Construction details may be learned from the diagram. When shaping the end of the coax outer, be sure that there is adequate clearance for the centre conductor element. A blob of epoxy adhesive will keep the elements in position.



The dimensions shown are for a frequency of around 1280MHz.

Standard BNC plug, small cable type if possible otherwise sleeve with a suitable tube.

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THE FOLLOWING PRINTED CIRCUIT BOARDS AND COMPONENTS ARE AVAILABLE, TO MEMBERS ONLY, FOR PROJECTS DETAILED IN THIS BOOK AND IN CQ-TV MAGAZINES, AS WELL AS OTHER BATC PUBLICATIONS:

70cm ATV converter.

FM-TV receiver.

A 70cm transmitter;
108.875MHz crystal.

A video filter.

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