May 1974

CQ TV

THE JOURNAL OF

THE BRITISH AMATEUR

TELEVISION CLUB.

No 86

25p

THE BRITISH AMATEUR TELEVISION CLUB

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WHO TO WRITE TO

New Membership enquiries only should be addressed to Gordon Sharpley G6LEE/T, the Membership Secretary. Subscriptions and changes of address should be sent to Alan Pratt, the Treasurer. Please only address enquiries to the committee member most suitable.

C Q - T V is published quarterly by the British Amateur Television Club and is posted free to all members. Single copies are available from the Editor at 25p each; back numbers are also available to members at reduced prices.

Overseas members may have their copy of C Q - T V sent by air-mail, for a surcharge depending on their country. Details are available from the Treasurer.

Members wishing to have material published in C Q - T V should send the manuscript and drawings to the Editor; articles are invited on all subjects of interest to amateurs and should be of about 1500 words; larger articles should be divided into convenient parts for publication in consecutive issues of the journal.

THE EDITOR

Andrew Hughes, 93 Fleetside, West Molesey, Surrey. KT8 ONQ Tel. 01-979 9983

POSTBAG

Alan Antley GW3UTG, GW6AJT/T in Rhyl, North Wales is recently licenced /T and using a B.A.T.C. Pye Lynx Camera is now regularly on 437 MHz with video, beaming East. He is running 35 watts to a 6/40 feeding an 8-over-8 aerial at 35 feet. GW6AJT/T has a regular Sunday night sked with GW6JGA/T in Prestatyn and both stations have a good sea path to the Lancashire coast.

Barry Suddaby GW8FEY in Llangoed on the Isle of Anglesey, North Wales is equiped with an 18 element Parabeam for receiving 70cms video and has recently been taking pictures from GW6JGA/T. Barry has a Pye Lynx Camera and a transmitter under construction, and hopes to obtain his /T licence shortly.

George Twist G3LWH in Bristol is a newcomer to SSTV, who is thinking of building the G3RHI monitor. He has a quad aerial and a FT101B, so should be a welcome member to the ranks!

W.R. Barker G6AIQ/T of Leigh-on-Sea is already active on 2m as G8DJE and should be on the air soon with video. Working on 405, he has a one inch vidicon driven by a SPG, both home-built, viewing on a 17inch Cintel monitor. A varicap tuner and a Phillips IF strip is the receiver and proposed transmitting equipment is a QQV06 - 40A tripler/PA, screen grid mod. with a transistor modulator. The antenna has yet to be decided upon.

J. Galvin G8IFQ is building the G3RHI slow scan monitor and would like to hear of any B.A.T.C. members in his area who transmit SSTV. His address is 36 The Fairway, West Derby, Liverpool 12.

D.T. Legg G3TFZ in Knowbury near Ludlow is also a G2RHI monitor man, and has been experimenting with slow scan for a while now. He has modified the original design to give a raster with or without a signal, by altering the line and frame generators. Results are now much better.

PROGRESS REPORT ON L.D.T.V.

Early in 1972, a report of an L.D.T.V. broadcast, in the pages of "Wireless World", brought me into contact with Chris Long of Victoria, Australia. Out of the ensuing correspondence, the present L.D.T.V. revival was born. I had been experimenting for some time using 32 vertical lines and a 3 x 2 picture ratio. Chris having cut his teeth on 8 line and 16 line pictures, had suddenly broken into the news with a 48 line broadcast on the 30th of January 1972, with the help of his friend, Dan van Elkan, VK3UI.

After this, Chris changed to the Baird standard, i.e. 30 lines with a 7 x 3 picture ratio, which allows a higher picture rate within an acceptable bandwidth. From August 1972, to make our work compatible, he has agreed to use the 32 line standard and has carried out an enormous amount of work in this field, and on multiples of the standard, i.e. 64, 128, 256, 512, and (yes!) 1028 lines. This work includes outside broadcasts using portable equipment, all home-made.

Nearer home, L.D.T.V. now involves some

thirty or so enthusiasts up and down the country and during 1973 considerable progress has been made. Participants can keep in touch through a duplicated news-sheet of which six issues have appeared this year. We feel honoured to have the support of H.J. Barton Chapple, probably the top TV writer in the world during the thirties, and still a zealous defender of L.D.T.V. potentialities.

However, our overall technical level in Britain remains low, especially when compared with the achievement of Chris Long and his Australian colleagues. The technical standard of the latest video-tapes from Australia is extremely high and it will need a sustained effort during 1974 to catch up. The recruitment of a few technically expert members to our ranks would make all the difference. Although one of the principle attractions of L.D.T.V. is the low technical level, and correspondingly low cost, at which participation can commence, there is still room for an avant-garde to set the pace and raise standards of achievement.

D.B. Pitt
1 Burnwood Drive,
Wollaton,
Nottingham NG8 2DJ

GWENT TV GROUP

The core of the Gwent Group is formed be three stations, GW6OAJ/T, GW6AJM/T (GW8GKF) and GW6AGR/T(GW8AGI). Owing to geographical difficulties GW6AJM is the only station who can work the other two members of the group. The equipment in use by the members of the group is as follows:

GW6OAJ/T

The video source is a home-built camera running from 12 volts dc. The camera is fully interlaced on 405 lines at present. As a mate to the camera Cec has built a 350 MW TX so that he can go out portable on a local mountain top!

To radiate his signal from home he has a choice of two transmitters; the low power rig has a QQV03/20 in the final, the QRO rig runs a 4X150. Both transmitters are grid modulated.

The display side of the shack consists of a 17ins EMI monitor and a dual standard domestic tv modified for + or - signals on 625 lines.

To supply signals for the modified TV Cec uses a pair of home-built 18 element Parabeams and feeds these through a BF180 pre-amp and a modified converter.

Cecil's location is about 700 feet ASL, but oweing to the surrounding hills his signals can only get away to the south, hence his interest in portable equipment! Nevertheless Cec is willing to try any direction for a QSO. His landline frequency is BLACKWOOD 3067.

GW6AJM/T

Ray lives in Caerphilly and qth is about 650 feet ASL at present, but will soon be moving to a new qth at 900 feet ASL. He will be taking along his multibeam and will have it set up as soon as possible to feed signals to the two RF pre-amps and the ELC1043 converter which form the UHF part of the receive side of his station.

Video in the shack is generated by two cameras (both commercial) and to display these signals Ray has a couple of 17ins monitors, one of which has had a transistorised IF. strip added to display "off air" signals. The second monitor usually displays the RF being generated by the home brew TX, which has a QQV03/20 tripler '3/20PA grid modulated with a transistorised modulator as per C Q - T V.

Under construction is a Pulse Generator on a copy of the board layout in C Q - T V 76, and in the planning stage are fader/ mixer amps. When all these are completed Ray hopes to improve his visual presentation.

GW6AGR/T

Bob is the third member of the group, and from an RF point of view has the poorest location. His qth is about 150ft ASL but in a valley and the best direction for signals is to the south. The aerial system is a choice of either a Multibeam or a homebrew 18 element Parabeam at about 25ft. AGL.

The receiving side goes through an AF239 pre-amp, an ELC1043 converter and then feeds either a modified dual standard TV, or a transistorised IF strip which feeds one of the three monitores the shack boasts. These are a 14ins EMI, a 14ins Cintel, and a 19ins Cintel.

On the video generation side there are two cameras available; one homebrew based on C Q - T V 65, and the other is an EMI CCTV camera. A third camera is under construction, but is still only in the metal bashing stage. The electronics will be based on some of the recent articles in C Q - T V (for which Gentlemen, many thanks).

The cameras are fed from a Pulse generator, and the video is processed using circuits from - (You've guessed it!) The last link in the chain is a home brew TX with a cathode modulated A2521 that drives a 2C39A linear.

That is a brief description of the three active stations in the Newport/Caerphilly area of South Wales. There are several other people interested in Amateur Television in the area and the active members are encourageing them to broaden their activities. The list includes GW8FXM, GW8HEZ, GW3YSA, and two SWL's. To give them no chance of using the excuse "there's never any signals to copy", the group radiated some 15 to 20 hours of video a week.

The group will be giving demonstrations of closed circuit tv and fixed and portable amateur tv at the Summer Camp of the Gwent (after April 1st, Monmouthshire) Scouts on July 6th and 7th. If anyone is in the area and would like to drop in to see us they will be most welcome. The site is alongside the A40 at Monmouth.

LETTERS TO THE EDITOR

Dear Sir,

To the increasing number of SSTV operators who have recently appeared on the HF and 2m bands, my letter in Feb. 74 C Q - T V si/was obviously out of date, on publication in a quarterly magazine.

G3ZJO's Nett nightly @1900 & 1930 gmt on 145.468 has been joined by G3MED, Banstead, Surrey with a video signal that almost splits my speaker's cone; at 1815gmt on 20.1.74 G3OXZ had the first ever 2m 2xSSTV with DK5TW, near the Swiss boarder, and I taped the DK's pictures before getting my own 2xSSTV with him; G2BAR told me that earlier in the day a F station had failed to get his video through to him - great pity; our G8CGK is reported by an "eye-witness" to have given an excellent and very well received talk and demonstration of SSTV to the Hereford ARS in January; G8CGK has built a monitor on which he receives good HF bands SSTV DX which he has demonstrated to our Chairman G6KQJ at the latter's own qth, and should be on 2m SSTV soon; SWL. A 8037 Paul Barker of Grnagetown, Sunderland has a G3ZGO type Monitor and receives HF bands SSTV dx well; G2JR with a ROBOT Monitor should be transmitting HF SSTV soon with a tape; during this weekend's 4th World Wide SSTV Contest G13WWY was "seen" being called by a W8 on 14235 kcs; as short skip is not always present on the HF bands and 2m distances limited, many of the operational UK SSTVers have applied to the PMT for permission to use SSTV on the 80m band and thus join in the EU netts - to date (11.2.74.) only a postcard acknowledgement of our applications; these applicants include G3IAD using ROBOT equipment on the HF bands

R. Thurlow G3WW
Wimblington,
Cambs.

B.A.T.C. EXHIBITION STANDS

From time to time the Club mounts stands at various Exhibitions connected with the hobby, these being intended to "show the flag" and maintain or stimulate interest in amateur television.

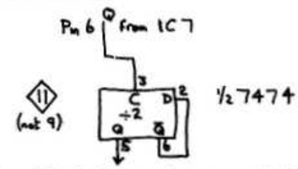
Volunteers are always required for those events, the committee members who traditionally organise not having time enough to do everything! The next event the Club is considering exhibiting at is Leicester; if you could spare some time - a day or a few hours - please contact Malcolm Sparrow (address on page 1) and let him know what help you could give.

CQ - TV 84 S.P.G.

Errata.

A number of small errors crept into this article and we list them here.

1. Page 6 "Blanking"
   "The divide-by-two counter consists of a dual D-type edge triggered bistable type SN7474...."
   Refer to Fig. 9;? IC9 ÷2 counter should be as below.



   Line Ident for colour now appears on IC9 input A output A.

2. Fig. 9 SPG Schematic
   The latch shown as IC1 should read IC11 (½SN7474)

3. Fig. 8 Block diagram
   The "Gate" should also show inputs from the ÷11 counter. The F. Sync latch should be driven from the count gate and not the Line Sync generator.

4. Fig. 12 PSU
   Capacitor Cb should be 10mfd not 100.

continued on page 25

AN SSTV PATTERN GENERATOR

by Grant Dixon

The article on the SSTV frequency standard in C Q - T V 85 had one or two minor errors in the diagram - sorry about this, but these things do happen! Please amend Fig. 2 on page 18 as follows:

1. Output from 7493 to give 1500Hz should be from <u>pin 8</u> and not as shown.
2. Outputs for 1200Hz and 2300Hz should be from <u>pin 12</u> in each case. My thanks to Arthur Critchley for pointing this out. He also suggest that an economy can be effected by using a modified ÷23 stage that dispenses with the 7410 as shown in Fig. 1. This works by detecting 20 + 2 and resetting to 99, the next pulse then resets to 00 and thus gives a count of 23. He also suggests that if you wish to reduce the number of types of I.C. you can use a 7490 as a ÷6 and then use the spare ÷2 in the 7493 to replace the 7492. See Fig. 2 for this arrangement.

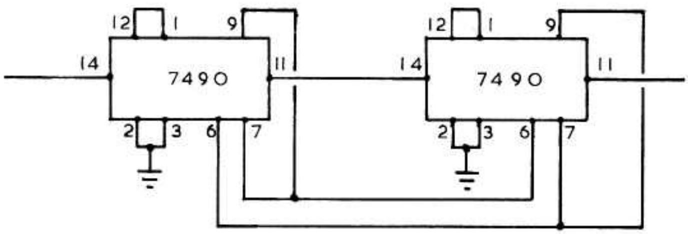


FIG. 1. ALTERNATIVE ÷23 CIRCUIT

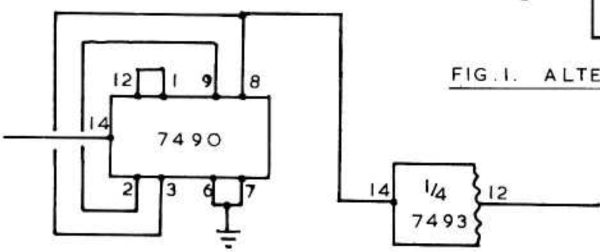


FIG. 2 ALTERNATIVE ÷12 CIRCUIT

Now where do we go once we have got our three standard frequnecies? The obvious thing is to divide still further and get our line and frame pulses as shown in Fig. 3 and Fig. 4. As the line frequency is ⅓ of 50Hz mains frequency one can more easily adjust the original potentiometer on the master oscillator of the standard frequency generator. This is now adjusted for one pulse to every 3 cycles of mains waveform.

Having got the synchronising pulses, these can be used to produce an all white or all black raster by gating in the appropriate frequencies; also, by using multiples of the line and frame frequencies one can produce test patterns. The basic idea is shown in Fig. 5 where the combined sync pulses are used to substitute the sync frequency for the black, white or pattern frequencies present at the other input.

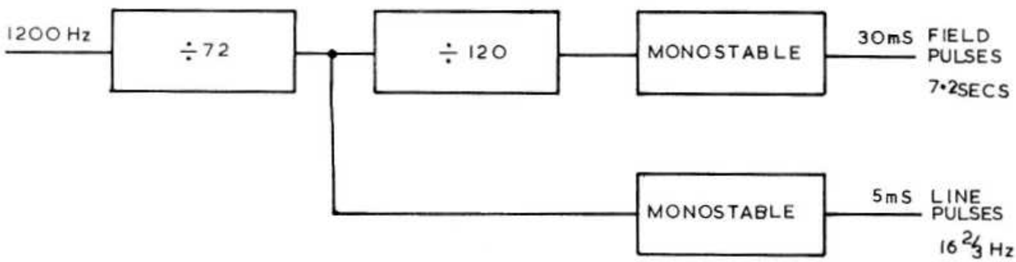


FIG. 3 BRITISH STANDARDS

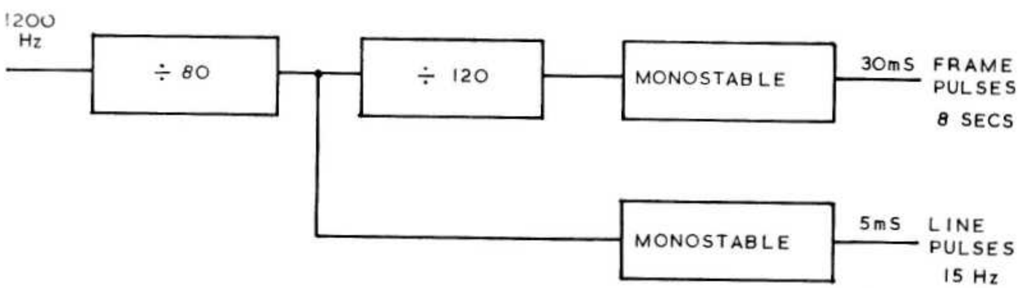


FIG. 4. U.S.A. STANDARDS

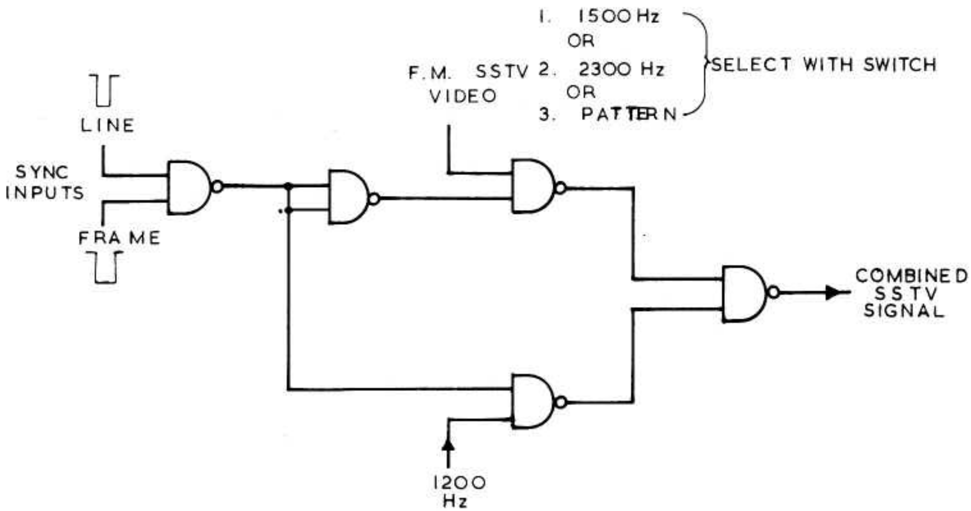


FIG. 5. CIRCUIT TO GIVE MIXED SYNC & VIDEO. (ALL GATES 1/4 7400)

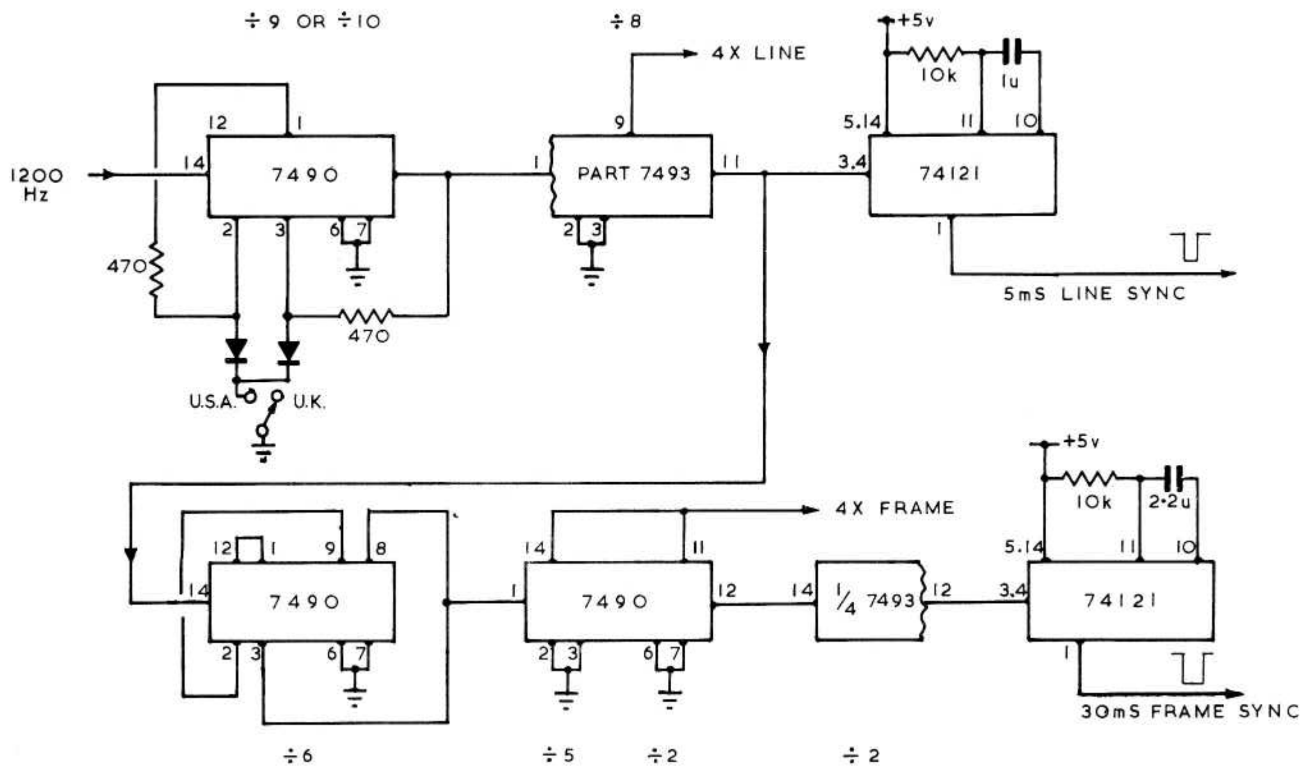


FIG. 6. CIRCUIT TO GIVE LINE & FRAME PULSES WITH CHOICE OF STANDARD.

Once again, Arthur Critchley has come to the rescue with a brilliant suggestion for switching the division standards so that one can have 50Hz or 60Hz standards available at the flick of a switch. The ÷72 (or÷80) requirement is performed by a 7290 acting as a ÷9 (or ÷10) followed by a ÷8 stage. For this latter a 7493 should be used as this will more easily provide 4 x line frequency.

Further division by 120 is accomplished by a 7490 acting as a ÷6 and a second 7490 wired up to ÷5 and ÷2, the remaining bistable of the 7493 gives us a final division of 120 to give the frame frequency. Here again, the last two stages are ÷2 and we have 4 x frame frequency available. 74121 monostables are used to give the correct pulse widths. See Fig. 6 for the full circuit.

To generate a pattern we select the 4 x line frequency and laternate this with its inverted waveform to give a chequerboard pattern - alternative patterns are available, by using the extra gates which would otherwise be surplus, but these are not so interesting as the chequerboard. The logic to do this, using cheap 7400 gates, is shown in Fig. 7.

Finally two words of warning- the regulations say that frequencies transmitted in the video spectrum must be limited to 3KHz and as the harmonies present in the TTL output extend very far up the spectrum it is essential to follow the output with a low pass filter; suitable filters are described in the "SSTV Handbook" (See advert on inside of back cover).

The second warning is that the Ministry will only allow transmissions using the $16\frac{2}{3}$Hz frequency - if this unit is used in the 60Hz mode - (15Hz line frequency) it should only be used for setting up receiving equipment. Our American members, however, are not affected by such limitations.

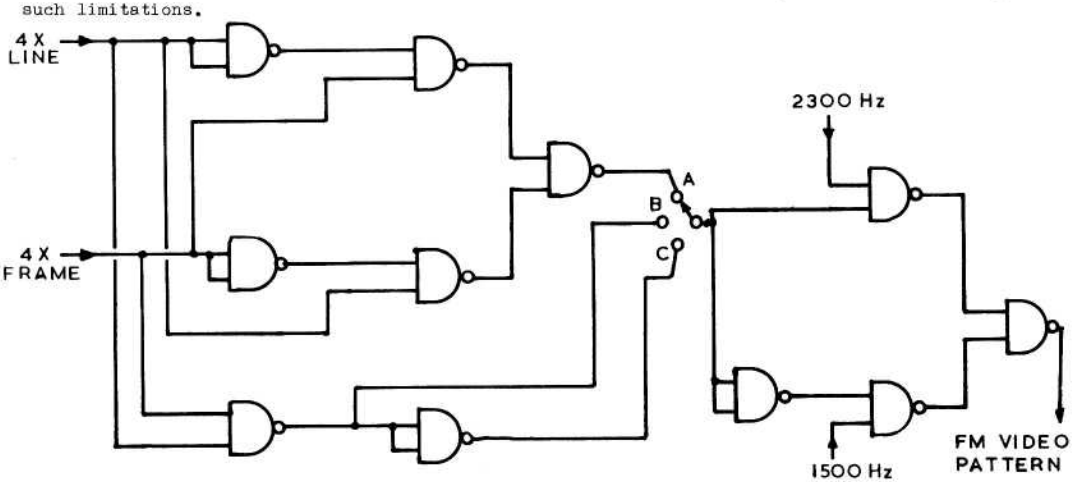


FIG. 7. CIRCUIT TO GIVE CHEQUERBOARD PATTERN ETC. (ALL GATES 1/4 7400)

A VISION MIXER

by Harold Skegg G6SOG/T

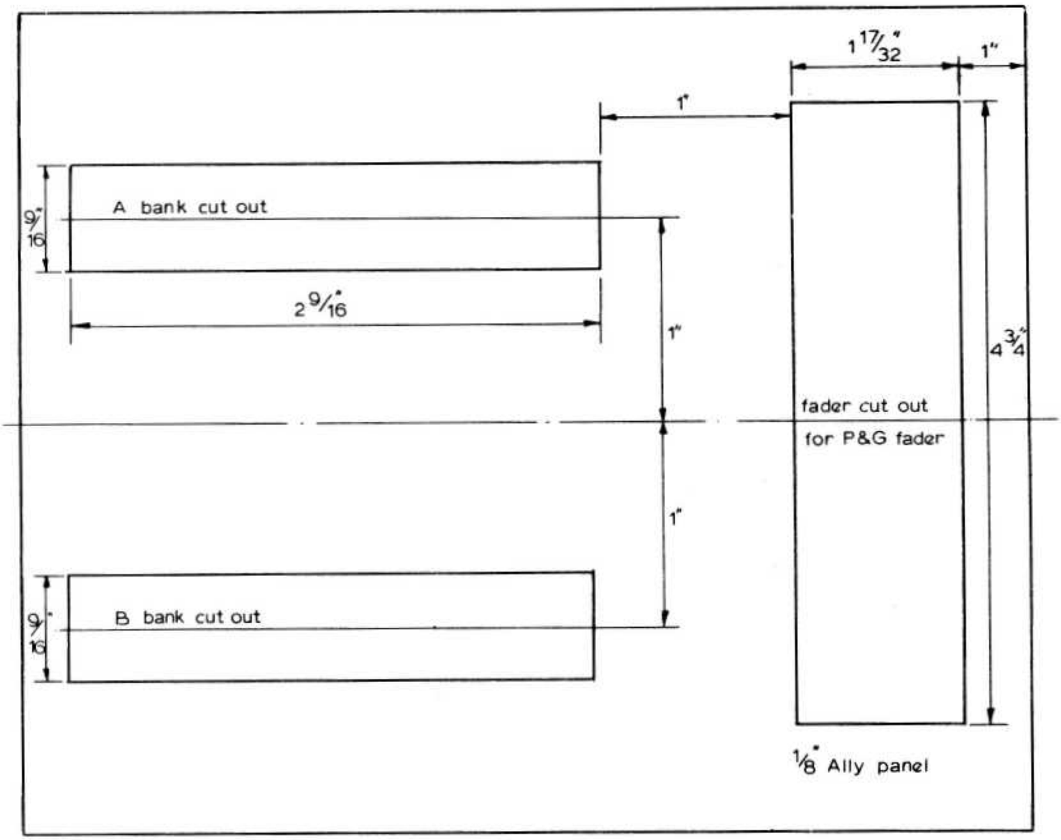
The unit is an A/B Mixer which has been used for 2 or 3 years now with complete success. The circuit operation is split into 3 parts, T13 to T17 first. T13 is an emitter follower with the channel fader A in its emitter, one end of the fader being earth. This will turn the video right off and very little break through will occur on the other channel. T16 is the B channel and is identical to A. T14 and T15 are unity gain amplifiers, with the collectors strapped to form the Video Mixer. This is passed onto T17, an emitter follower output amplifier.

T4 in Part 2, receives this signal from T17 where the gain can be controlled by the pre-set R22 in the emitter. T5 is an emitter follower to get the impedence low enough so we can clamp the video at this point. Note C12 is only 0.47uf (not 47uf)

The base of T16 is now clamped, this allows the video arriving at the collector to be processed; this processing is only to remove the syncs from the waveform, the level being controlled by R30 (sync clip). Set this with theoscilloscope onTP1 until the sync has been removed. Do not overdo this as it will crush into the pedestal. The video signal is passed through T7 and the emitter follower T8 through C15 (Note T8 C15 are identical to T5 C12) and are clamped. This now allows the sync to be added to T10 , the level being controlled by R40 (sync amp); from here the composite video signal passes to the o/p slug and emitter follower T12 to give IV peak to peak.

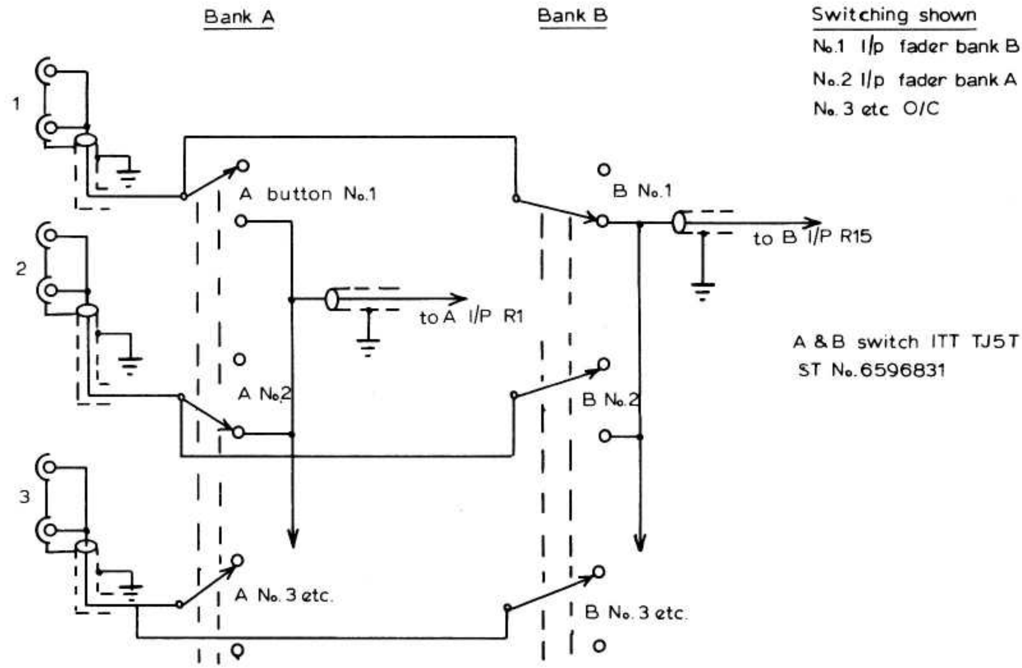
The third stage is T18 to T23. From the emitter T23 comp. sync, shaped and clipped is passed through T22 to the sync adder T10; Also from T23 emitter comp sync is differentiated by R59, C27 and C26 and this line sync is a very narrow spike. This spike is again inverted by T20 and produces a 2.4v+pulse at TP2. This pulse is now used to turn on T19 and T18 just for the duration of the pulse, the collector being directly connected to the processing amp at T6 base and T9 base. This will short circuit the video to earth and produce the clamp at this point.

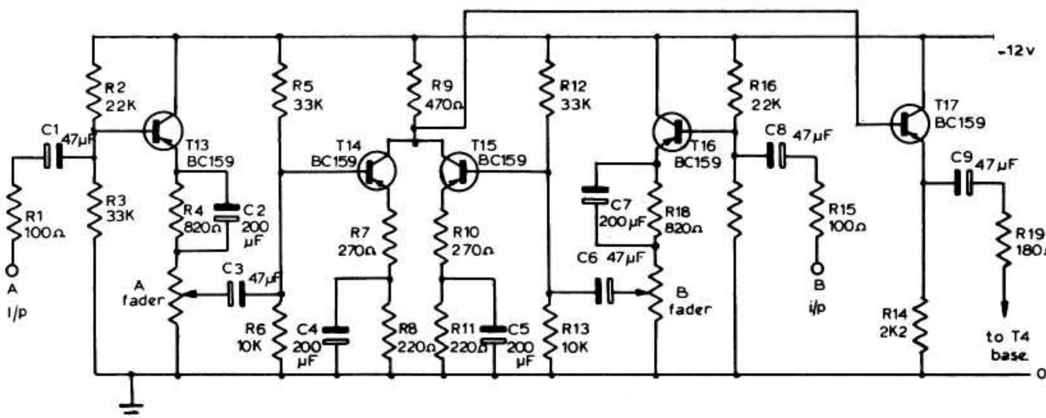
This unit has been used by myself, and G6ACW/T has built it with complete success. I have built six of these now as they are in use in schools and colleges around the district.

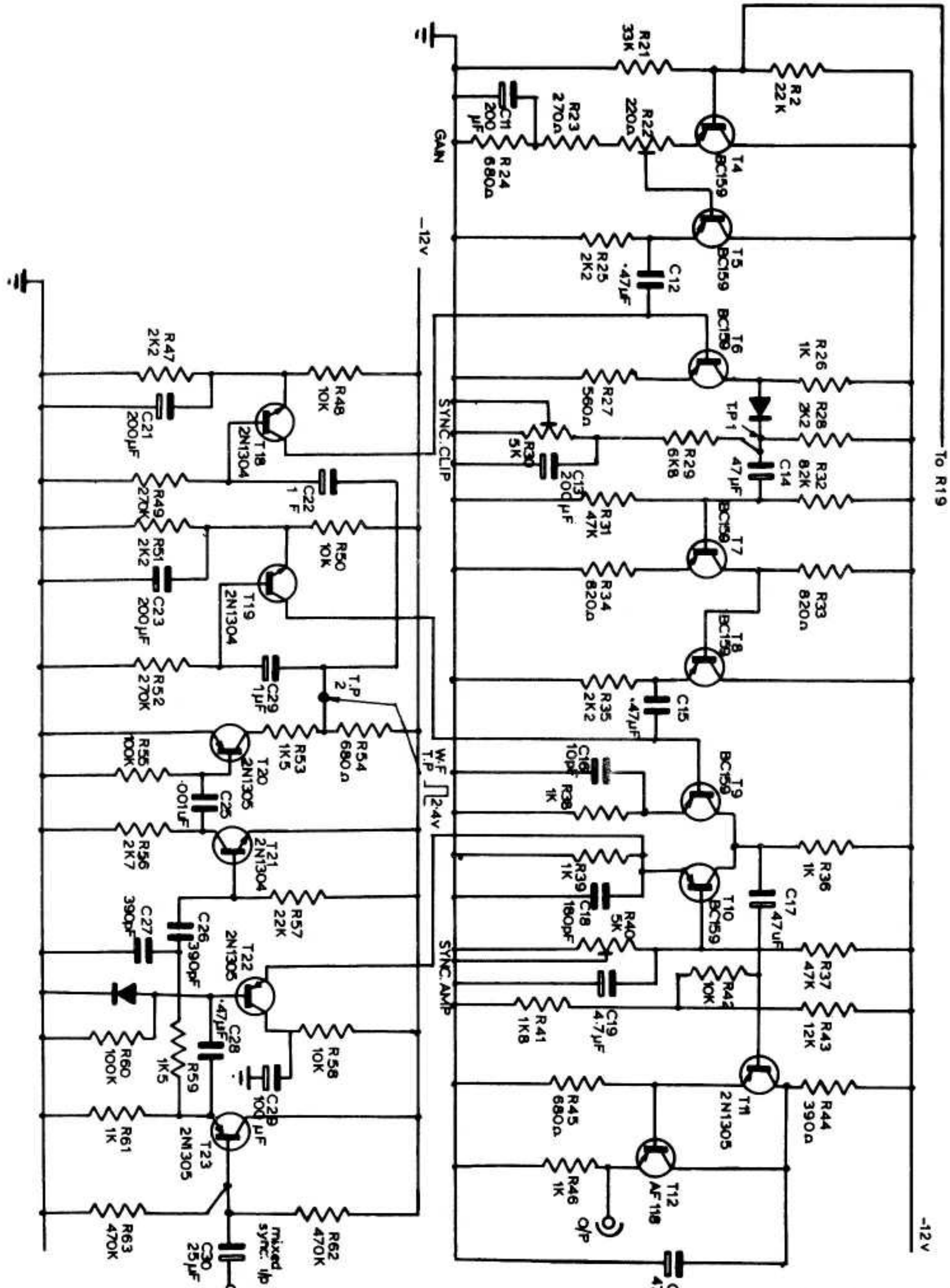


PANEL LAYOUT

In the mechanical layout of the Panel the faders are Penny and Gilles Pots Ltd of Christchurch, type 1810 500ohms. They are not low cost items at about £7 each but they can be strongly recommended. P.C. Boards can be provided, the cost is not known yet but it should not be too much.


Bank A
Bank B
Switching shown
No.1 I/p fader bank B
No.2 I/p fader bank A
No. 3 etc O/C
1
2
3
A button No.1
A No.2
A No. 3 etc.
B No.1
B No.2
B No. 3 etc.
to A I/P R1
to B I/P R15
A & B switch ITT TJ5T
ST No. 6596831


-12v
R1 100Ω
C1 47μF
R2 22K
R3 33K
A I/p
T13 BC159
R4 820Ω
C2 200 μF
A fader
C3 47μF
R5 33K
R6 10K
C4 200 μF
T14 BC159
R7 270Ω
R8 220Ω
R9 470Ω
T15 BC159
R10 270Ω
R11 220Ω
C5 200 μF
R12 33K
R13 10K
C6 47μF
C7 200μF
B fader
T16 BC159
R18 820Ω
R16 22K
C8 47μF
R15 100Ω
B i/p
T17 BC159
C9 47μF
R14 2K2
R19 180Ω
to T4 base
0



continued on page 26

The British Amateur Television Club.

STATEMENT OF ACCOUNTS FOR THE YEAR ENDING 31 - 12 - 73.

GENERAL ACCOUNT	Year ended 31.12.73		Year ended 31.12.72	
Income:				
Subscriptions: Current	795.10		688	
Arrears	15.10		23	
Advertising in C Q - T V	22.80		15	
Interest from Building Society	51.21		21	
Sales of C Q - T V	129.65		86	
Miscellaneous Income	0.00	1013.86	9	845
Sales of SSTV Booklets	108.75		39	
Sales of SSTV Handbook	136.00		-	
	244.75		39	
Less Cost	117.73	127.02	39	-
		1140.88		845
Expenditure:				
4 Issues of C Q - T V	566.48		433	
Postage thereon	189.80		155	
	756.28		588	
Printing Postage and Stationery	79.56		92	
Advertising	16.50		18	
Meeting expenses	0.00		41	
R.S.G.B. Affiliation Fee	2.00		1	
Depreciation of Office Equipment	17.00	871.34	22	762
Surplus for the Year		£269.54		£83

TRADING ACCOUNT				
Sales of Equipment		265.93		413
Less Cost: Stock at 1.1.73	144.83		221	
Purchased	262.87		254	
	407.70		475	
Stock at 31.12.73	198.18	209.52	145	330
SURPLUS for the Year		£56.41		£83

B A L A N C E   S H E E T   A T   31st   D E C E M B E R   1973

	At 31.12.73		At 31.12.72	
RESOURCES OF THE CLUB				
Accumulated Fund:				
Balance at 1st January 1973		870.15		704
General Account Surplus	269.54		83	
Trading Account Surplus	56.41	325.95	83	166
Balance at 31st December 1973		1196.10		870
Represented by:				
Office Equipment at 1.1.73	84.00			
Less depreciation	17.00	67.00		84
CURRENT ASSETS				
Stocks: Trading	198.18		145	
C Q - T V Magazines	20.18		7	
SSTV Booklets	21.20		29	
Stationery	24.61		66	
	264.17		247	
Debtors	22.80		32	
Balance with Bankers	284.77		14	
Balance with Building Society	989.47		738	
	1561.21		1031	
CURRENT LIABILITIES				
Creditors	91.71		33	
Subscriptions paid in advance	285.40		212	
Handbooks paid in advance	55.00		-	
NET CURRENT ASSETS		1129.10		786
	432.11		245	
		1196.10		870

The above Balance Sheet at 31st December 1973, together with the Trading and General Accounts for the year ended od that date are in accordance with the books of the Club as produced to me, and, to the best of my knowledge and belief show a true and fair view of the position of the Club as at 31st December 1973 and of the results for the year.

BRIGG

23rd February 1974

J. R. Gregory

Chartered Accountant.

1974 B.A.T.C. CONVENTION

Your committee have decided to hold the 1974 B.A.T.C. Convention and Bi-Annual General Meeting out of London once again. It was originally hoped to hold the Convention in Manchester at the Granada TV Studios, but on this occaision they are unable to accommodate us.

The Convention this year is to be held at the Benn Memorial Hall at Rugby on Saturday September 28th. This venue is just off the M1 Motorway for those travelling by road, and a few minutes from the Rugby Midland Main Line Station, which is only 1 hour from London.

Please make a note of the date in your diary now and try to make this our best Convention yet. Full details will appear in the next issue of C Q - T V.

The Committee members responsible for organising the Convention are Gordon Sharpley, Alan Pratt, Alan Watson and Nick Salmon. All enquiries to them please.

M A K E A N O T E I N Y O U R D I A R Y N O W ! !

CIRCUIT NOTEBOOK No17

J. Lawrence GW6JGA'T

OSCILLOSCOPE TV SYNC PULSE SEPARATOR

Many of the lower priced oscilloscopes either do not include facilities for triggering the timebase from television waveforms or include a very simple R.C. network to separate line and field synchronising pulses. In either case settings of the timebase controls are very critical if reliable triggering of the oscilloscope timebase is to be achieved. Here is an add-on or build-on circuit which will give solid line or field triggering at the flick of a switch.

It is based on principles described by G.A. Eastman in the Tektronix publication, "Television Waveform processing Circuits". The circuit has been successfully incorporated in an Advance OS2000 Oscilloscope. A suitable point of connection in most oscilloscopes would be after the sync amplifier and before the triggered input to the time base generator. The full circuit is hsown in Fig. 1.

CIRCUIT OPERATION

Input signals of positive going video (0.5 - 2.0 v p-p, sitting on +6v) are fed to the base of the emitter follower stage VT1. The positive video from the emitter of VT1 is passed to the base of VT2, thus causing VT2 to conduct on the negative going sync pulses. VT2 is cut off by the positive going video.

VT2, VT3 and MR1 form a feedback clamp circuit, operating at sync bottom, which adjusts the bias of VT2 for correct clipping of the video content of the input signal. The operation of the clamp is as follows, VT2 conducts on negative going sync pulses, producing amplified positive going sync pulses at its collector and the base of VT3. Negative going sync pulses appear at the collector of VT3, the amplitude being set by the clamping action of MR1 which completes the feedback circuit and reduces the open loop gain of VT2 and VT3 to unity at the bottom of the sync pulses.

Positive going line sync pulses of nominally 2v p-p at the collector of VT2 are passed through C3 and S1 (in the line position) to the base of VT4. The sync signal is sitting on a d.c. level of about 5.3v.

FIELD SYNC

Negative going sync at the collector of VT3 is differentiated, primarily by R9/C2, to

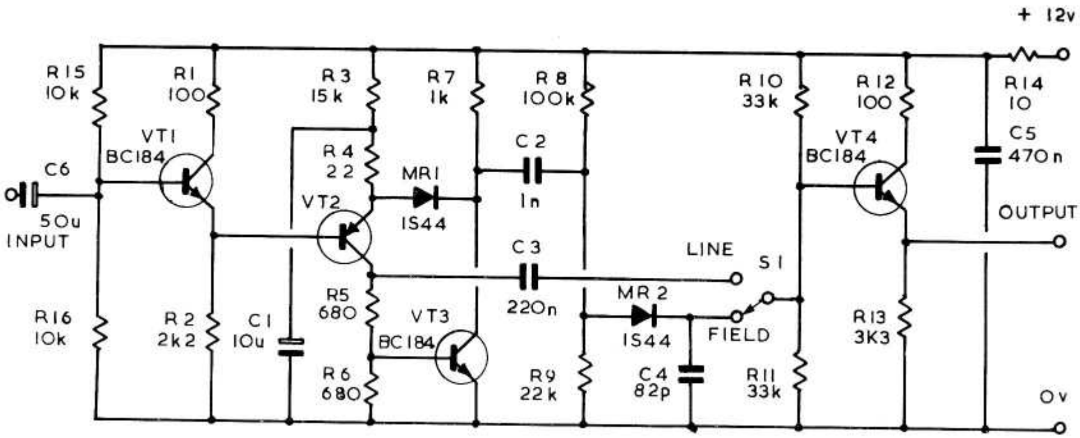


FIG. I. TELEVISION SYNC SEPARATOR FOR AN OSCILLOSCOPE.

produce a waveform in which the narrow pulses between the broad field pulses rise clear above the peak level of the line pulses. When S1 is in the 'field' position, MR2 is biased by the d.c. potential on VT4 base and effectively removes the differentiated line sync pulses and passes the burst of field pulses to the base of V4 and thus to the output. The pulses have an amplitude of about 2v p-p sitting on a d.c. level of about 5.3v. C4 shunts spurious line sync transients leaking through the diode capacitance of MR2.

NEWS FROM INDUSTRY

NEW TV SYNC-PULSE GENERATOR I.C.

Ferranti Electronic Components Division have just released details of their new T.V. Synchronising Pulse Generator IC type ZNA 103E. This I.C. provides 6 outputs, line and field drive, composite video blanking, composite cathode blanking, composite sync and line clamp. For 625 line operation the I.C. requires a 5 volt signal input from a 656.25KHz crystal oscillator.
The current drain is typically 75mA at +5 volt.
It is housed in a 24 pin D.I.L. package and , if you just want one, the price is £25.

CIRCUIT NOTEBOOK NO. 15. CAMERA TUBES AND POWER SUPPLIES

I am indebted to Mr. J. Gosling, Sales Manager - Camera Tubes, E.M.I. Electronics Ltd.

for pointing out that my statement in Circuit Notebook No. 15, para 4, might be interpreted as a warning that a separate mesh tube may be damaged if the mesh is connected directly to the wall anode (G3). This is, of course, not the case as the tube is then the same as one of the integral mesh format. This connection may be made and is the simplest way of fitting a separate mesh tube in an 'integral mesh camera'. However, in this condition the tube will be operating at its poorest resolution.

To take advantage of the separate mesh it should be connected to potential higher than the wall anode, thus improving both the resolution and shading characteristics. There is no need for it to necessarily be higher than the limiter (G2) potential although this is generally the case in production cameras and is catered for in the circuits given in 'Circuit Notebook No. 15'.

The E.M.I. publication CP142 is now no longer available but two further reprints are available free to B.A.T.C. Members from E.M.I. Electron Tube Division, 243 Blyth Road, Hayes, Middlesex. These are:

1. Reference R/T004 — Some Aspects of Vidicon Performance
2. Reference R/T006 V72 — Some Problems of Resolution in Low velocity Camera Tubes.

CIRCUIT NOTEBOOK NO. 16, GREY SCALE AND COLOUR BAR GENERATOR

Please note that the value of R1 in Fig. 1 is 150 ohms and the all transistors in Fig. 3 are BC184 or similar, not BF184 as shown.

Reference — Tektronix Circuit Concepts
"Television Waveform Processing Circuits".
by Gerald A. Eastman
Available direct from Tektronix Ltd.
Beaverton House, P.O. Box 69
36-38 Coldharbour Lane,
Harpenden, Herts.

Order by part no. 062.0955.00
£1.98 post free, inc. VAT.

More Adverts on page 28.

INTEGRATED CIRCUITS

PART 15

A.CRITCHLEY Dip El; C Eng; MIERE.

Operational Amplifiers, continued.

The author regrets that pressure of work forced the non-appearance of this part of the series in the last issue of the magazine.

Voltage Source

Operational amplifiers make excellent impedance transformers. The voltage follower has a very high input impedance and a very low output impedance. This makes it ideal as a voltage source because it takes only a minute current from the reference and can give a voltage output that hardly changes with loading. It also uses few components.

A more stable system is to employ a 3.3v Zener diode as the input reference (a 3.3v Zener has approx. zero temperature coefficient) and vary the gain to set the output voltage.

$$v_o = 3.3\left(1 + \frac{R_f}{R_i}\right) \text{volts}$$

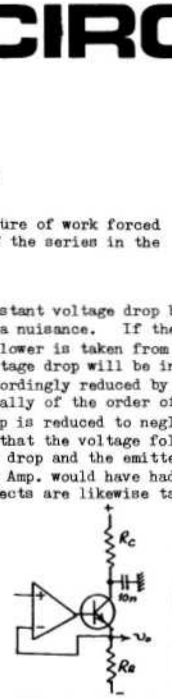
A capacitor is included to reduce noise and supply interference.

The use of a 741 in this way will provide a maximum of some 20 mA at a voltage up to within some 2v of the supply rails.

Current Boosting

Op. Amps cannot normally provide any worthwhile output power. Although they have a low output impedance they will not drive a low impedance load. A simple way to increase the current capability is to drive an emitter -follower which then increases the current by β, the current gain factor.

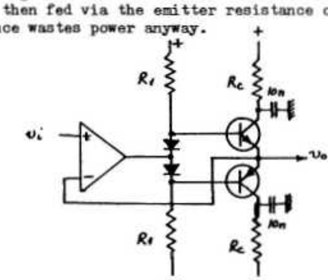
Unfortunately, the transistor has a more-or-less constant voltage drop between base and emitter which may be a nuisance. If the negative feedback for the voltage follower is taken from the transistor emitter, then the voltage drop will be included in the feedback loop and accordingly reduced by the loop gain factor. This is usually of the order of 10,000 or more and so the voltage drop is reduced to negligible proportions. What happens is that the voltage follower output rises by the amount of the drop and the emitter voltage becomes that which the Op. Amp. would have had at its output. Temperature effects are likewise taken care of.



A small resistance in the collector limits the short-circuit current to suit the transistor and is by-passed so that the emitter-follower response is not lowered at high frequencies (which may cause instability). An npn transistor is most efficient for negative outputs but a pnp transistor could just as easily be used.

This simple system is fine for relatively constant voltages but if a large swing, or one which crosses 0v, is required then a complementary system is necessary.

The simple transistor feeding a low impedance load may 'unhook' as zero volts is crossed - it stops working as a voltage follower and becomes reverse-biassed. The load is then fed via the emitter resistance only. This resistance wastes power anyway.

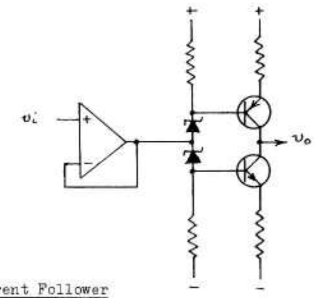


The complementary system works in class B so that only one transistor conducts at a time. Diodes are included because the Op. Amp. output cannot be at two levels at the same time, the diodes each drop some 0.6v, the same as a transistor, and therefore cancel out the transistor drop. The resistors are included only to forward-bias the diodes. No emitter resistors are necessary as all the current goes into the load. The negative feedback is again taken from the output where it helps to minimise cross-over distortion.

This kind of circuit is ideal for a scan output stage.

High Impedance Outputs

Sometimes a high output impedance is required - perhaps to drive a recording head. Adding a series resistance will not do because of the large voltage drop across it. The problem is solved by using a transistor as a current source by taking the output from its collector. This effectively places the series resistor inside the source and all the voltage is then available for the load.

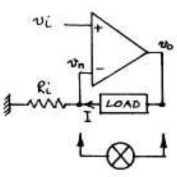


Current Follower

This is similar to the voltage follower except that the load takes the place of R_f and therefore floats. The Op. Amp. balances its input voltages so that v_n follows v_i. The inverting input therefore takes no current so all the load current flows in R_i. Hence $I = \frac{v_n}{R_i}$

but $v_n = v_i$ so $I = \frac{v_i}{R_i}$

The current is therefore proportional to the input voltage only.



This arrangement can be used to drive a lamp with a precise current if its resistance is much less than R_i. Any other variable impedance device can similarly be used.

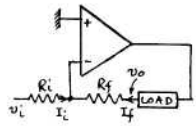
The current follower, like the voltage follower, works in common-mode - i.e. both inputs go up and down together. This can lead to change of internal gain in the Op. Amp. with consequent distortion of the output signal. Very high loop gain factors minimise this problem - luckily.

Current Invertor

This is similar to the current follower and also has a floating load. The voltage at the inverting input, v_n is zero because of the virtual-earth arrangement so that the input current is proportional to R_i.

but $I_f = -I_i$ and also v_o/R_f so that $I_f = -v_i \cdot \frac{R_f}{R_i}$

i.e. $I_i = \frac{V_i}{R_i}$

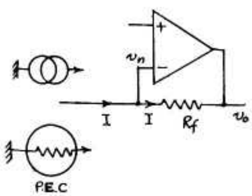


Current to Voltage Convertor

If a virtual-earth amplifier is used with the input resistance at zero, then the input to the virtual-earth point is of very low impedance and any current fed in is converted to a voltage at the output.

This can be used to measure current. For instance, if R_f is made 1 MΩ, 1 mA input will give 1 V output.

Since the voltage at the virtual-earth point does not change, stray capacity will have little effect and this feature can be of use when trying to obtain a wide bandwidth signal from a photocell. A photocell is basically a current source and such a circuit can extend its frequency response from its normal limit of 10 kHz or so up to about 1 MHz.

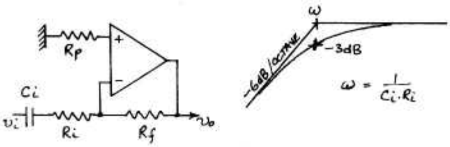


Another use is with a moving-coil microphone or, with a VDR as R_f, as a null detector.

A.C. Amplifiers

Inverting

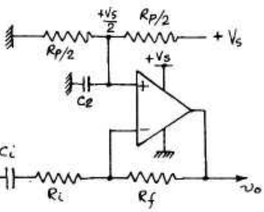
The inclusion of a capacitor in an amplifier input removes the d.c. component and gives an a.c. amplifier. In the inverting amplifier the high frequency gain is still $-R_f/R_i$ but for low frequencies is reduced due to the reactance of the capacitor.



The break frequency occurs when $X_c = R_i$ and the output signal is then reduced by 3 dB. Below this frequency the gain reduces at 6 dB per octave (or 10 dB per decade).

It is of course the circuit of a differentiator but if C_i is made large enough the break frequency ω will be below the frequencies of interest. This is then called an a.c. amplifier instead.

The main use is to exclude d.c. or hum but a useful arrangement is shown below which allows the Op. Amp. to be run from a single voltage supply rail. The zero reference is then at one half of the rail voltage and C_i permits this. C_2 decouples the non-inverting input to earth for the frequencies of interest.

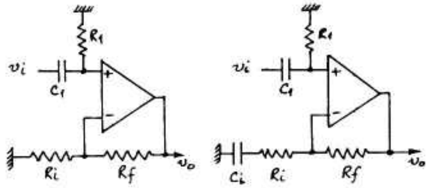


Non-inverting

The high frequency gain is as usual $1 + \frac{R_f}{R_i}$ but the d.c. gain is zero (to signals)

The non-inverting amplifier suffers from the problem that any d.c. offset voltage at the inputs is amplified equally as much as any signal because the d.c. feedback is not 100% and this may upset the wanted signals by causing clipping or saturation. Hum may also cause the same problems.

Fortunately, this can be overcome by using a different feedback arrangement to remove the d.c. connection from the non-inverting input.



Here d.c. feedback is 100% and d.c. gain is 1 because the circuit acts as a voltage follower to d.c.

H.f. gain is $1 + \frac{R_f}{R_i}$

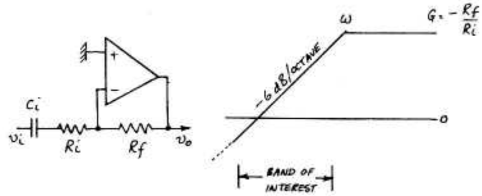
In all these a.c. coupled amplifiers the break frequency is set by the time-constant of C_i and R_i.

$$\omega = \frac{1}{C_i . R_i}$$

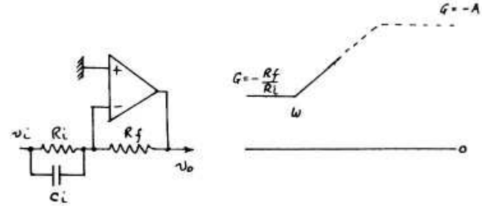
Tailoring the frequency response

The break frequency, ω, can be moved up or down by changing the value of C_i so that ω can be placed below, in, or above the frequencies of interest.

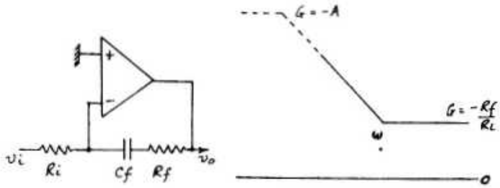
By placing it above, the response is made to rise at 6 dB/octave (although at reduced gain).



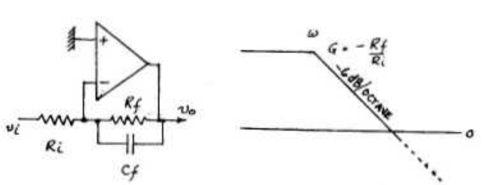
Placing C_i across R_i gives a rising response of a different kind. This starts at the normal gain and increases above ω to A, the open loop gain of the Op. Amp. The input impedance correspondingly reduces and the arrangement is not of much practical use as it leads to high noise levels.



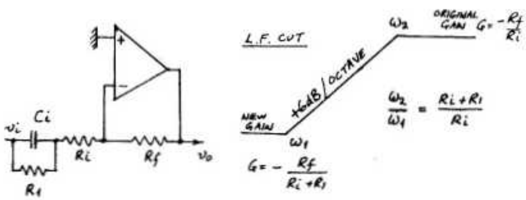
With the capacitor in series with R_f a response is obtained which falls from the maximum gain down to the normal value. This again is not of much practical use as it would tend to be unstable at low frequencies and would almost certainly be saturated due to the open loop gain multiplying the input voltage offset to enormous proportions.



The capacitor can be placed in parallel with R_f when the result is very similar to an integrator.



It is obviously desirable to limit the extremes of gain or loss and this is easily done by including a resistor in series with the capacitor (or in parallel).



At high frequencies the gain is $-R_f/R_i$ but at low frequencies is $-R_f/(R_i + R_1)$.

ω_2 is decided by the time-constant $C_i.R_i$ and ω_1 by $C_i.R_1$ if R_1 is much greater than R_i.

Since C_i is common it follows that ω_1 and ω_2 are proportional to R_i and R_1.

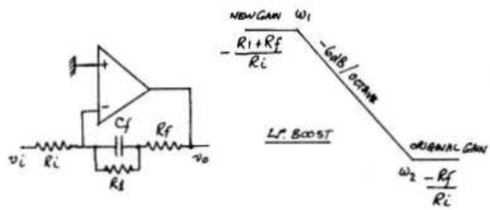
In fact, the ratio of the frequencies is equal to the inverse ratio of the resistances. The slope is at 6 dB/octave so the shape of the response is easy to arrive at.

The system could be used to make a frequency detector for SSTV. If the maximum gain was to be 10 with break frequencies of 1 kHz and 3 kHz, then :-

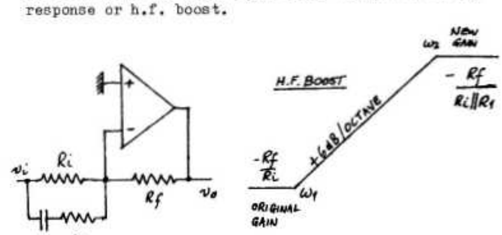
$$\frac{R_f}{R_i} = 10 \quad \text{and } R_1 = 3R_i. \quad \text{If } R_i = 10 \text{ k}\Omega,\ C = 50 \text{ nF}.$$

The system is commonly known as l.f. cut because the low frequency gain is lowered whilst the high frequency gain is unaltered.

If the capacitor is included with the feedback system then the opposite effect is obtained with l.f. boost. This is a better way to make a detector as there is less noise at high frequencies. Hum can be avoided by a.c. coupling the input.

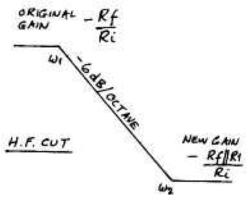


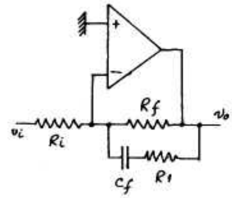
Similarly, the series combination can be used in parallel with the input resistance to give a rising response or h.f. boost.



H.f. cut can also be obtained.

The Operational Amplifier is a versatile tool

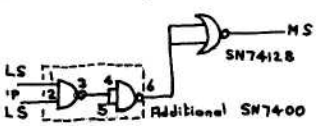




as can be seen from the applications so far, but it does have some limitations. These will be discussed in the next part of this series along with some more uses for Op. Amps. Also mentioned will be some do's and don't's.

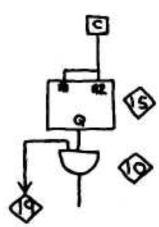
C Q - T V SPG Errata continued from page 5

5. Fig. 9 SPG Schematic
   Output to MO Disc should be taken from the F. Drive generator IC19.
6. Fig. 14 Main Timing
   Waveform (1) should be shown inverted.
   Waveform (F) is LB and (H) is LS.
7. Fig. 11 M.O.
   IC22 should read IC21
   Line Driven IC should read IC20
8. The line drive should be NOR gate and not NAND gate as shown.



The following modification is suggested to improve the accuracy of line timing.

Move IC10 from the input of IC15 to the output. Use the Q output of IC15 not the $\bar{Q}$ output.
Retain the second input to the gate IC10 (From IC19).



A VISION MIXER continued from page 14

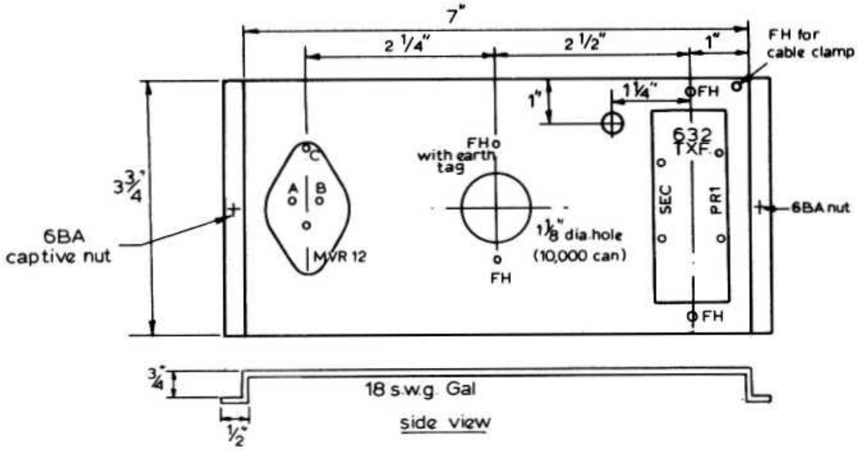
A/B VIDEO MIXER COMPONENTS LISTS

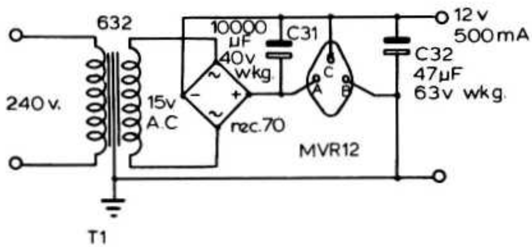
R1	100ohm	R22	PRESET	R43	12K
R2	22Kohm	R23	270ohm	R44	390ohm
R3	33Kohm	R24	680ohm	R45	680ohm
R4	820ohm	R25	2.2K	R46	1K
R5	33Kohm	R26	1K	R47	2.2K
R6	10Kohm	R27	560ohm	R48	10K
R7	270ohm	R28	2.2K	R49	270K
R8	220ohm	R29	6.8K	R50	10K
R9	470ohm	R30	PRESET	R51	2.2K
R10	270ohm	R31	47K	R52	270K
R11	220ohm	R32	82K	R53	1.5K
R12	33K	R33	820ohm	R54	680ohm
R13	10K	R34	820ohm	R55	100K
R14	2.2K	R35	2.2K	R56	2.7K
R15	100ohm	R36	1K	R57	22K
R16	22K	R37	47K	R58	10K
R17	33K	R38	1K	R59	1.5K
R18	820ohm	R39	1K	R60	100K
R19	180ohm	R40	PRESET	R61	1K
R20	22K	R41	1.8K	R62	470K
R21	33K	R42	10K	R63	470K

Potentiometers		
FADERS. Penny and Giles Ltd.		
No.1800PGF Lin. Pok 500ohm		
A. Calibration 10 - 0		
B. Calibration 0 - 10		
Pre.sets RS Components Ltd.		
MIN PRESET (+ohm)		
R22	220ohm	
R30	5K	
R40	5K	
TRANSISTORS		
T12	AF118	
T18	2N1304	T1 Supply
T19	2N1304	" "
T21	2N1304	" "
T1E.T.C.	2N1305	" "
Diodes	1S951	" "

C1	47uf	C16	10pf
C2	200	C17	47uf
C3	47uf	C18	180pf
C4	200uf	C19	47uf
C5	200uf	C20	47uf
C6	47uf	C21	200uf
C7	200uf	C22	1uf
C8	47uf	C23	200uf
C9	47uf	C24	1uf
C10	47uf	C25	1000pf
C11	200uf	C26	390pf
C12	0.47uf	C27	390pf
C13	200uf	C28	0.47uf
C14	47uf	C29	100uf
C15	o.47uf	C30	25uf
		C31	10000uf
		C32	47uf 63v

ELECTRLYTIC CAPACITORS PC E - CAP
R.S. COMPONENTS Ltd.
T1 632 RS. 15v Transformer
REC. 70 RS. Bridge rectifier
MVR12 RS. Regulator (of L005 SGS)
Switch ITT TJ5T.STN°6596831
Two required.





Power unit A/B mixer

EQUIPMENT REGISTRY

Experience has shown that a small change to the rules is required, and it is this. If your unwanted gear as notified to the Club has not been disposed of by the Registry whithin 6 months, the item will be deleted from the lists. This is in case you have sold the item yourself. If you wish it to be retained on the lists, please re-inform the Registry after 6 months.

The Registration form will be repeated in the next issue of C Q - T V for your convenience. A form is not however necessary; just write to the address on age 1.

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Circuit diagram or manual for Pye industrial camera equipment. Camera type 2026D and C.C.U. type 2316CU, for purchase or short term loan.

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WA6 8BG

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Grundig Tape TK20	£10
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Transformer 14-0-14, .1A x 2 13-0-13-8-0-8 10mA	50p
4 speed changer	£1.50p
valves	10p

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Marconi Monoscope with tube	£16
EMI SPG with PSU	£15
Ferguson WP11 colour bar generator	£12
Cintel 21" 405/525/625/819 monitor	£ 8
Pulse bar generator 625 line	£10
Pye 2691 tv pattern generator	£ 8
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