CQTV

100

November 1977 THE BRITISH AMATEUR TELEVISION CLUB

The British Amateur Television Club.

C Q - T V is the quarterly journal of B.A.T.C.
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WHO TO WRITE TO

Subscriptions and changes of of address should be sent to the Treasurer. Membership enquiries should be sent to the Membership Secretary. Please address your letters to the most suitable club official, and enclose a s.a.e.

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cq~tv is 100!

We thought it would be a nice touch to invite Mike Barlow, who really founded the B.A.T.C. and edited C Q - T V for its first rather hectic 9 years, to write us a note on our 100th edition. Mike was in the army when he started C Q - T V, carried on through University and Marconi's at Chelmsford until he joined Canadian Marconi in 1957. He is currently a supervising engineer with the CBC responsible for tv, radio and film studios. Guess where he got all that experience!

Happy 100, BATC - and may you make it 200!

That is my professional lifetime, and quite a few others can say the same thing, you know. Back in 1948 I was doing my National Service at Catterick in the Signals when I heard about the Groningen amateur TV group in the Netherlands. I wrote to them and so met Hendrik de Waard PAoZX; I then advertised in the RSGB Bull and SWM for fellow enthusiasts, and we started circulating a newsletter. In October 1949 CQ-TV Number 1 appeared, badly duplicated on a jellygraph duplicator and typed on the guardroom typewriter at Catterick! But it was a start, and the idea of amateur TV seemed to appeal to the more experimentally minded amateurs. Bear in mind that at that time there was only one TV station, and that was in London. Receivers were scarce and expensive, but it was the heyday of war-surplus, and a number of home-brewed TV sets appeared using VCR97 green CRTs and EF50s in profusion.....

Specialised TV equipment such as cameras lenses sync generators etc were of course quite unobtainable. We knew of three 5527 iconoscopes in the entire country; to import one required a special import licence, and £25 was no small matter in those days. 931A photocells, used with more VCR97s in simple flying spot transparency scanners, were the norm. It was of course quite illegal to actually transmit TV.

By late 1950 the very informal BATC had 36 members. Ivan Howard G2DUS living in the tiny village of Stotfold gave a widely reported demo of his 5527 camera - ending with an encounter with the Bedfordshire constabulary at 2 a.m as he pushed an old pram laden with electronic gear down a back road (petrol still being rationed). "Whats all this 'ere then?" says the constable. "Just a television camera, officer" says Ivan - well, it came out all right in the end, luckily! About this time the Editor of CQ-TV confidently announced that publication would cease when stocks of paper were used up....

In July 1951 we had our first Convention, to which the Royles G2WJ and family came and were hooked. 70cms was released for TV transmission, and in 1952 the club was more formally organised. Grant Dixon was the first Chairman, and did 10 years in that post. By 1952 G5ZT and G3BLV had made the first QSO over 3 miles, and the club numbered 189 souls. The magazine was now appearing quarterly, hand typed addressed mailed etc. By Christmas of 1953 Grant Dixon had produced closed circuit color pictures. Rotating filter wheels agreed, but an extraordinary feat for someone with no professional facilities to borrow, and only the kitchen table for a bench.

In 1954 CQ-TV was photolithod for the first time and took on a more professional appearance. By issue number 21 the sub was 10/- a year, and Doug Wheele took over the Secretary's job leaving me with the magazine. April 7 1956 we had the first two-way amateur color TV QSO between G3CVO and G2WJ using Grant Dixon's color equipment. The was much traveling btween the two stations so that everyone could see the pictures. The TV articles in the RSGB Bulletin were reprinted as the first "Introduction to Amateur TV" booklet - now a valuable and rare masterpiece, no doubt! Christmas 1956 we passed the 500 member mark. Number 34, Autumn 1957, was the last CQ-TV for which I was the Editor, as I emigrated to Canada at that time. With subsequent professional involvement in television, I have been extremely inactive in amateur TV, but I have retained a strong interest in the Club, and much look forward to receiving each issue of CQ-TV.

Now we are up to 100 editions, which must be something of a record for a non-profitable, very volunteer organisation. Looking back, it is extraordinary how many people have been prepared to give their time and energy to assist. Some have benefitted from the association in other ways - many members who joined while apprentices or junior employees at some of the better known companies have gone on to become Big Names in professional TV. Perhaps the blind eye that didnt see the liberation of a few resistors from somebody's parts box knew a thing or two about self-training too!

My particular soft spot, however, must be reserved for the unsung heroes of the Club who have assisted in any way with the production of CQ-TV. I well remember the relief it was to unload the simple problem of folding the magazine, addressing it and mailing it on someone else - and to be able to rely on them time and again. John Tanner turned out 15 editions, and I've lost count of how many Andy Hughes has done, each seemingly bigger and better than the last. Others have helped, and you know it really is a real slog; if you haven't tried pasting up 32 pages of other people's articles and fuzzy photos into something worthwhile, then don't knock it. The BATC has been very fortunate to find a series of Editors with a knack of doing the right thing just because they like doing it. Every time that magazine drops through my mailbox I'm amazed at what it represents in total effort, from the writer of the article to the finished product. My congratulations to all of you, and good luck with the 200!

Mike Barlow.

Letters to the Editor

Dear Sir,

I hope that I may be permitted to reply to Arthur Critchley's letter in CQ-TV 99. I am relieved that he has taken my remarks about him as intended. Some of my friends said that I was being sarcastic or snide - just not so!

405 line tv has not been resurrected; it just never died. In a band only 8 MHz wide what other standard is there that does not require clever tricks with filters? The other points in favour of 405 have been aired before and would not gain by repetition.

I would not argue with Mr Critchley about designing circuits arround ICs; he has probably forgotten more than I ever knew about them. I was however rather hurt by his suggestion that I was making a purely paperwork criticism. I would certainly not do this. I arrived at the modification by fault finding on my own SPG which has been built.

Mr Critchley may be interested to know that G3LEE Gordon Sharpley's SPG exhibited just the same symptoms and was cured in the same way. I only know of two other SPGs built to this design; both of them also produce a 450 line picture. So, far from "not doing any harm" , my mod. was the means by which four units at least functioned on 405 lines.

Finally, could I suggest that it might not be a good idea to rely on internal fiddle factors of ICs when using them, rather than using just a few extra parts in a, perhaps more logical arrangement?

A. Jaques G3PTD
Manchester.

Dear Sir,

It is with pleasure and excitement that I am able to report that the Australian Post and Telegraph Department have granted to the South Australian Amateur TV Group the first licence to operate an unattended Amateur Television Repeater in Australia.

The new repeater will service the City of Adelaide (pop. approx 750,000) and suburbs on the Australian 50 cm Amateur band (579.25 MHz vis. carrier, 584.75 MHz FM sound) which is just above channel 34 on the International UHF channel allocation. It is hoped that this will go a long way towards popularising atv as the general public will be able to "watch in".

The callsign is VK5RTV, and access to the repeater will be in the 70 cm Amateur Band (426.25 MHz vis. carrier, 431.75 MHz FM sound). The max. licenced power is 150 watts d.c. input, and the repeater is hoped to be in service early in 1978.

Although atv repeaters have been licenced in several countries already, in each country the "battle" must be waged anew and this "victory" in Australia has taken almost 19 months from the initial approach to the authorities. It is to be hoped that our success is of help to other groups both in Australia and elsewhere. In anycase the real work now starts - that of building up the hardware!

John Ingham VK5KG
South Australia Amateur TV Group.

Dear Editor,

Doubtless BATC Committee members are already aware from their own participation, or merely as G8 listeners, in their sponsored sstv Albatross contest of 10th & 11th September of the unfortunate clash of dates with the European DX contest (WAE) on all bands 3.5 to 28 MHz with its possible treble length of each QSO due to its QTC points multiplier exchange of information of details of other and previous QSOs etc (see page 543 Radio Communications July 1977). The weekend of 17th/18th Sept seemed devoid of LF/HF bands contests activities in contrast.

Apart from the change of date for the next sponsored SSTV contest perhaps the committee would kindly give consideration to the required content of the message to be passed by video. The present required captions of callsign, report and serial number can be passed by RTTY in a fraction of the SSTV time of 7.8 seconds per frame (of course a half frame can be used but a full frame of three lines is generally required under LF/HF

bands QRM conditions). Surely SSTVs primary function is to transmit pictures of objects not otherwise transmittable by other means at the same speed? Should not therefore the "message" contain a picture, preferably a clear photograph rather than a drawing, the picture to be described in the contest entry eg. self portrait, landscape, child with dummy in mouth = (as YU1PKW) At least one JA station on 20 m already can type the message on the lower half of the frame below his self portrait from the camera.

Richard Thurlow G3WW
Wimblington.

THE CQ-TV AWARD

To mark the one hundredth issue of CQ TV BATC is introducing an operating award scheme whose aim is to encourage activity in amateur television by providing an incentive in the form of a certificate.

This award is available to both transmitting and receiving amateurs and SWLs in any part of the world whether they are members of the British Amateur Televisio Club or not.

The award is for contacts made using fast scan high definition television systems only.

Consideration has been given to the advantages achieved by stations in high activity areas or with exceptional geographical locations, therefore qualification for the award is on a points basis as detailed below:

TRANSMITTING AWARD

For pictures transmitted which have been successfully identified by another station claim 2 points per kilometer; if the contact becomes a successfull 2 way exchange of pictures then 10 bonus points may be claimed by each station regardless of distance.

Carefull logging of transmissions is esential.

RECEIVING AWARD

For any picture positively identified claim 2 points per kilometer.

POINTS

Points are claimed as above; however if the contact is on 23 cm or above, the points should be doubled.

The award is divided into three grades, for the Bronze - 1000 points, for the Silver - 5000 points and for the Gold - 10,000 points.

CONTACTS

A station may be worked once only per day for the purpose of this award.
It is quite possible for the award to be gained by working the same station many times, but the aim is to promote activity of any sort.
Points may only be claimed for contacts made from the 1st November 1977.

THE CERTIFICATE

Upon qualification for the Bronze award a certificate will be issued together with the Bronze seal; the certificate may be upgraded later with Silver and Gold seals.
No charge will be made for the award, but please send return postage with each application.

APPLICATIONS

Applications should include log details consisting of call-sign, date of QSO, band, location of the station worked and points claimed. Contacts made from other than the home station should be clearly marked.
QSL cards are not required, but the application should be checked and signed by one other licenced amateur.
Applications should be made to the award manager John L. Wood G3YQC, 54 Elkington Road, Yelvertoft, Northampton, NN6 7LU

An off screen photo from G3YQC for CQ TV 100.

THIRTY LINE TV

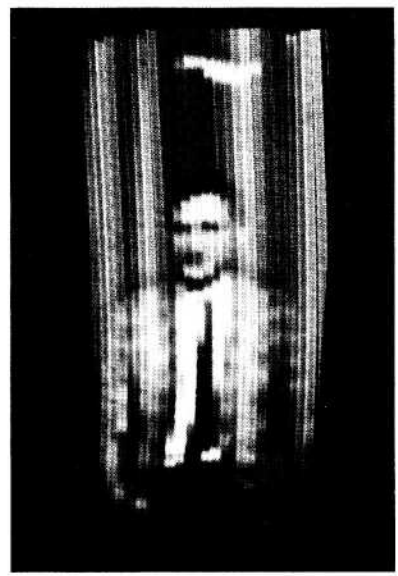
by Norrie Macdonald GM4BVU

During January 1976 I became involved in a rather unusual tv project - maintenance on a daily basis of a thirty (yes 30!) line mechanically scanned tv system. The University of Strathclyde in Glasgow has an Educational Television Service, and as the Jubilee of John Logie Baird, the inventor of tv and a former student, fell due, it was felt appropriate that the TV Service should organise an exhibition in commemoration.

With the aid of various university departments an elaborate display of photographic and archival material was mounted. But all this was covered extensively in the technical press and TV at the time, so suffice it to say that as the Senior Engineer in the TV Unit at that time, I became responsible for the installation, maintenance and operation of the 30 line camera kindly loaned to us by a gentleman from the Isle of Man.

The 30 line system used vertical scanning employing the Nipkow Disc principle, the camera being based on one of Baird's original Televisor receivers. Various add-on units had been attached to the basic Televisor, however, and these generated crude syncs, processed the video etc., to produce a composite video signal which could be fed along standard coax cable.

For display purposes, two methods were used. Firstly, the "high-quality" display was provided by a conventional domestic receiver manufactured by - yes you've guessed it! - the Baird Company. Of course it was suitably modified to handle the vertical aspect ratio picture of 30 lines. A "spot wobble" circuit was also incorporated to fill in the gaps between adjacent lines, and this worked very well as can be seen in the photograph. This photo, taken from the Baird set, shows the writer seated in front of the cameras, wearing his "test pattern" jacket (all check) The bright area above his head is a notice pinned above the seat inviting visitors to sit down to view themselves on the set.



The camera plus monitor functioned with only one major fault occuring during the seven or eight weeks use, and this was due to the brushes in the motor for the camera scanning wheel wearing out. New brushes were filed up from Hoover spares, and we were back in business!

Perhaps the most intrigueing part of the exhibition, apart from new fangled things like Ceefax, was one of Baird's original Televisors in original condition connected to the output of the camera. By very careful fiddling of the picture phasing control on the Televisor it was possible to lock the picture, which was reproduced exactly as in Baird's day by modulating a neon lamp with the video, viewing the lamp through the scanning wheel and synchronising via two coils and a toothed wheel. Very basic, but it worked and I'm sure the excitement which we felt when we first viewed the electro-mechanical picture must have echoed Baird's own feelings!

Being pessimists, we had a spare neon

specially manufactured, but as I recall it was not required despite continual use for some nine hours per day over a seven or eight week period.

Our plans had included tape recording of various easily recognisable images, such as Micky Mouse, but in the time scale available to us we were unable to solve problems with recording low enough in frequency to get good syncs. However as a result of some experiments a curious fact emerged. While trying out a National Video Cartridge Machine we discovered that despite it being designed for 625 line video, with typical Japanese versatility, it could also handle the mechanically derived 30 line pictures! Admittedly it lost frame sync every now and again, probably due to switching between the heads of the VTR, but nevertheless, quality was excellent!

Just to complete the display, a Baird mirror drum scanning assembly was arranged to reflect a spot of light on to a screen, thereby demonstrating how mechanical scanning works, as the drum was accelerated from standstill on the push of a button.

These projects proved very interesting and rewarding, and although no longer engaged professionally in tv engineering, as I pursue my amateur tv interests,I will always remember the time when I became an expert in John Logie Baird's mechanical telly!

ERRATA

There are a few errors in the first edition of "A Guide to Amateur Television" which were not printed in the list of mistakes in the last issue. They are:

p 81 Fig 10 IC1 pin 7 connect D5 (OA91) to earth (positive to IC)

Fig 11 Connect IC 14 pin 12 to IC 15 pin 10
Label three terminals at bottom on left (from top) Y ST +5v

p 82 Fig 12 IC 14 pin 8 label Y
IC 18 Pin 2 connect C38 to earth
Replace link between IC 18 pin 2 & IC 20 pin 8 with R65.

All these errors have been corrected in the second edition of the book, which is now on sale from B.A.T.C. Publications.

SUBSCRIPTIONS

Elsewhere in this issue is a subscription reminder and a banker's order form. Please send your subscription NOW.

Please remember also that the subscription year runs from January to December - any money overpaid will be credited to next year. So please pay on time - if you leave it until after 31st March, you will have to pay the new enrollment fee!

EQUIPMENT SALES

order from: C.G.Dixon (BATC Sales)
Kyrles Cross
Peterstow
ROSS-ON-WYE HR9 6LD

Further supply of ultra miniature dc to dc convertors (see C Q - T V 98, page 29)
75p each.

Small power packs, 115 v input, 6 v, 100 mA output. Buy two and put primaries in series across the mains. Secondaries are centre tapped, and there are two diodes and a capacitor in each pack
70p for two, plus 30p postage.

FREE to B.A.T.C. Members!
MOSTEK Memory Catalogue with application notes. Limited number available.

Send a 12" x 8" self-addressed envelope with a 26p stamp to C. G. Dixon (BATC Sales).

Remember - this is available to members only.

See Club Sales advert for other items.

CONTEST NEWS.

by Peter Johnson G8EIM

INTERNATIONAL ATV CONTEST 1977

Although a few log sheets have arrived, we will not know the results of this contest until after all the international results have been received - probably for the next issue.

This was to my mind one of the best atv contests ever - I heard F2XL F6BQH who I think was able to work G8DDC/P on Dunstable Downs (results not yet received), G8GLQ/P in Tewksbury was also heard on 2 m talkback, but where I was in Harrow nothing was seen due to the Big Hills in between!

A most interesting point that has arisen from this contest is the use of 144.7 - 144.75 as the atv calling frequency. There is no doubt that many contacts were established in vision due entirely to the use of the 2 m talkback - alignment of the signal on 2 m with the beam ant nae produced accurate alignment for the 70 cm antennae. G8DDC/P was in my opinion one of the best sited stations. My 2.5 w of vision signal was finally read by them on the Sunday, after trying unsuccessfully on the Saturday with an 18 w linear! We made a two-way at 1000 GMT, congratulations G8DDC/P - lets have some photos and information on the station for the next issue. Another strong signal I picked up was G8DTQ in Caterham - looked good for a score.

All the stations working seemed pleased with the contest, so lets have some comments for the next issue - address inside front cover.

LOG SHEETS

Please note that if you need log sheets or contest sheets, all you have to do is send me a stamped addressed envelope. Then to save the Club money - and yourself postage - you only need to Xerox as many copies as you need.

ACTIVITY WEEK

7th - 14th January 1978

This is organised to promote the use of 70 cm for atv activity. Please support it strongly. Use 2 m for every contact. If you have problems with talkback on 144.7 - 144.75 causing ATVI on your own receiver, you should fix the problem with a filter ahead of your tuner. A harmonic filter on the 2 m Tx will also show considerable improvement. The French solved this by utilising 144.15 to 144.25 as their talkback; perhaps this is the real solution! Any comments?

Please let me have all your Contest Sheets as soon as possible.

The prize for the Activity Week is a set of pcbs to construct a 6 digit DFM, with circuits and information. It was designed for the Harrow Radio Society some two years ago, and Radio Communications will be publishing the design (when I do not know, they have had the material since February 1977!)

B.A.T.C. SSTV Contest

This will again be held in December, see overleaf for details.

The British Amateur Television Club UK SSTV Contest.

WHEN The 10th and 11th December 1977

FREQUENCY BANDS The 3.5 MHz and 144.00 MHz Bands only.

TIMES 19.00 to 23.00 on Saturday 10th December on both bands.
7.00 to 11.00 on Sunday 11th December on 3.5 MHz Band.
9.00 to 13.00 on Sunday 11th December on 144.00 MHz Band.
Contacts via OSCAR will also count.

ELIGIBLE ENTRANTS All entrants must participate in the contest from a UK location.

SECTIONS Section A. Stations both transmitting and receiving SSTV.
Section B. Stations only logging SSTV signals.

CONTEST EXCHANGE The Contest Exchange shall consist of the Callsign, Signal report (RST), Serial number, QRA Locator or QTH. (Of these the last three shall be exchanged in video only. If the location is given in sound then it must be given given in a form different from that given by video eg video Didcot is in Sound 10 miles South of Oxford). Serial numbers shall commence at 001 and advance by 1 during the duration of the contest. Only one contact with each station will count for points.

SCORING Section A.
5 points per station contacted on the 3.5 MHz band.
10 points per station contacted on the 144.00 MHz band.
25 points per station contacted via OSCAR.
Section B.
As above for each station logged.

CONTEST LOG The Contest Entry Log must give the following information: Date, Time, Band, Callsign received, Report and Serial No. sent, Report and Serial No. received, QRA Locator/QTH received, Points claimed and Final Score.

ENTRIES All entries should be postmarked not later than the 1st January 1977 and should be sent to: Mr. P.A. Johnson G6AFF/T, 38 Kynaston Wood, Harrow Wealdstone, Harrow, Middlesex. Entries will not be returned.

GENERAL Each entry should be accompanied by a brief description of the station together with details of the callsign used, the QRA locator and QTH locations as transmitted on sound and vision together with any other relevant information. Stations entering the contest may only operate from one location for contest contacts. Stations who confirm their video message contents by sound will render themselves liable to disqualification. Results of the Contest will be published in C Q - T V as soon as is practicable.
Recommended frequencies are 3.730 $\pm$ 5Kcs and 144.23 $\pm$ 5Kcs and via OSCAR.

tv on the air by John Wood G3YGC

It is with great pleasure that I prepare this column for the centenary issue of CQ-TV. Over the years the magazine has progressed from a simple newsheet into it's present form, and our thanks go to the members past and present whose task it has been to prepare, print and distribute this journal. Thanks too to the members who contribute material for publication without which the magazine could not survive.

CQ-TV is recognised throughout the world as one of the leading sources of information on all aspects of amateur television and it is known that the authors of several books have drawn considerably from material published therein.

Rumour has it that a new tv group is starting up in the Stoke-on-Trent area and that activity in those parts is on the increase. This news reflects the upsurge of tv activity throughout the country. I would appreciate any further details from this and any other Club with interests in the atv field.

On the 5th October a two way colour video link is being set up between Arthur G5KS and the South Birmingham Radio Club. PAL colour pictures will be transmitted and a two way contact will be attempted using equipment built by G5KS and sited at the club rooms. The purpose is to demonstrate the high quality of vision transmissions made possible to amateurs by the use of modern solid state equipment.

Similar transmissions will be made to the Midland video group during the winter; this club will have its own television equipment. A talk will also be given on the DJ4LB solid state tv transmitter detailing various modifications and practical experiences concerned with its construction. Anyone interested in attending the meetings should contact the chairman, G5KS QTHR.

Arthur's equipment consists of an Akai colour camera and a Sony video cassette recorder; the transmitter is a DJ4LB vision IF generator and a Microwave Modules transverter with a 4CX250B linear amplifier.

Transmissions to G8GUN have taken place regularly from the beginning of September, and pictures received are virtually noise free, with excellent colour and picture quality.

I have to admit that I was unable to operate in the September International atv contest, but I understand that conditions were good and that there were quite a number of stations active. I would like to hear of any noteworthy contacts made and of any experiences or comments on the contest.

The mail seems to be dwindling a bit just lately, so I would be pleased to hear from you about anything connected with atv activity.

Please send your letters to: "tv on the air", 54 Elkington Road, Yelvertoft, Northampton, NN6 7LU

PROJECT 100

PART 1

by Eric Putt and Tom Mitchell G3LMX

A PAL COLOUR PATTERN GENERATOR and SYNC PULSE GENERATOR

In this issue we are introducing two new Club projects, and printed circuit boards for both are available from Club Sales.

The electronic design and board layouts are both by Eric Putt, and are based on parts of his own colour system.

When used together all timings are derived from a 5 MHz crystal oscillator in the sync pulse generator and the line frequency locked to the pattern generator subcarrier. In this mode the last 25 Hz offset in the full 'subcarrier to line' relationship is omitted for simplicity.
i.e. for PAL $F_{sc} = \frac{1135}{4} \times$ line frequency $+$ 25 Hz

Perfectionists who find a 25 Hz error at F_{sc} excessive can always offset the line oscillator with respect to Broadcast colour syncs so that the rate of drift is $11\frac{1}{3}$ seconds per line. If the monitor is locked to broadcast syncs, then the pattern should move to the left.

However a full colour genlock and subcarrier locking system has been developed in prototype form and will be published later.

THE COLOUR PATTERN BOARD

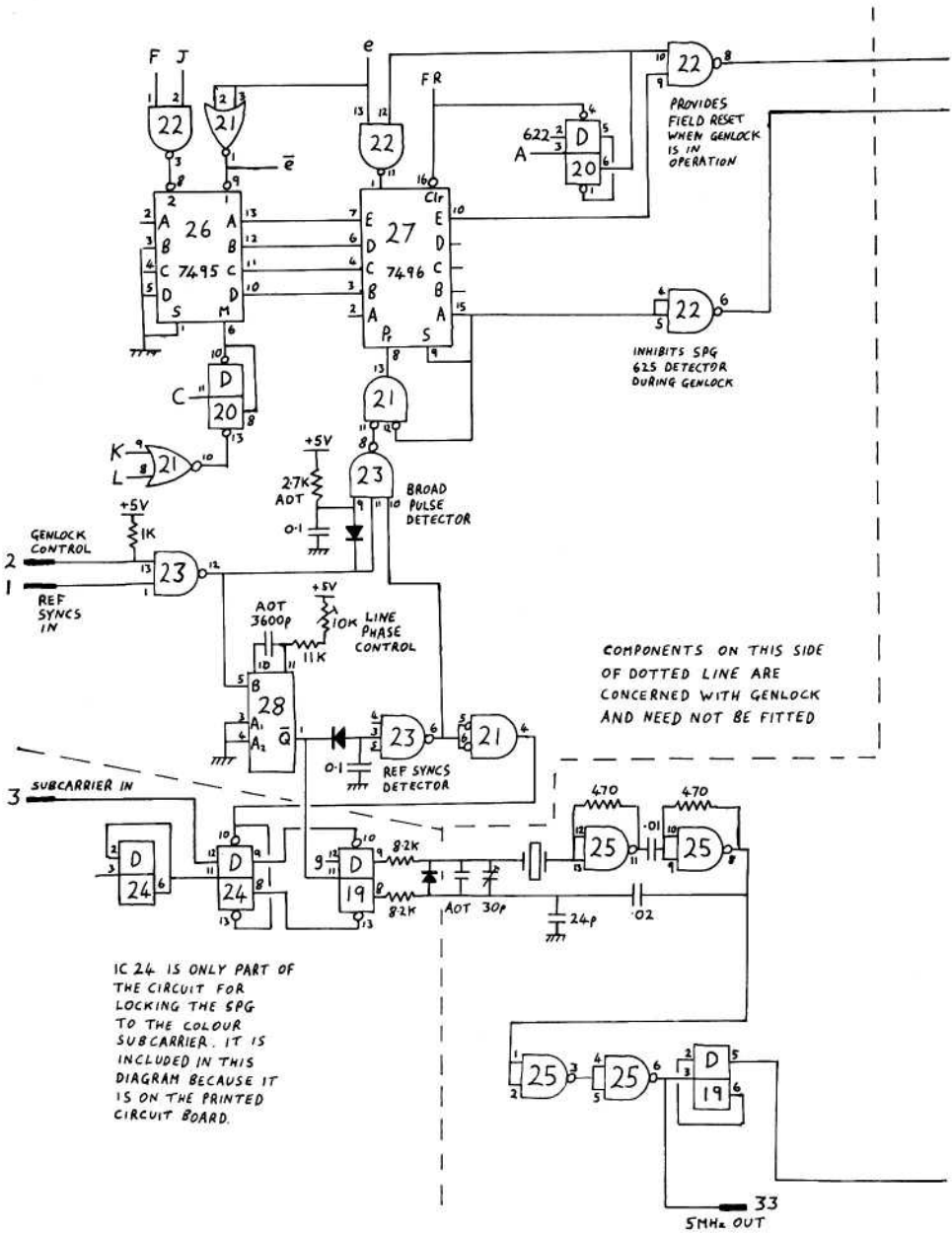
This was originally designed to provide synthesised, rather than coded, colour test patterns for setting up monitors and 'delay line' PAL decoders. However those of you who visited the BATC stand at AP will have seen the large range of patterns available. The basic patterns are:

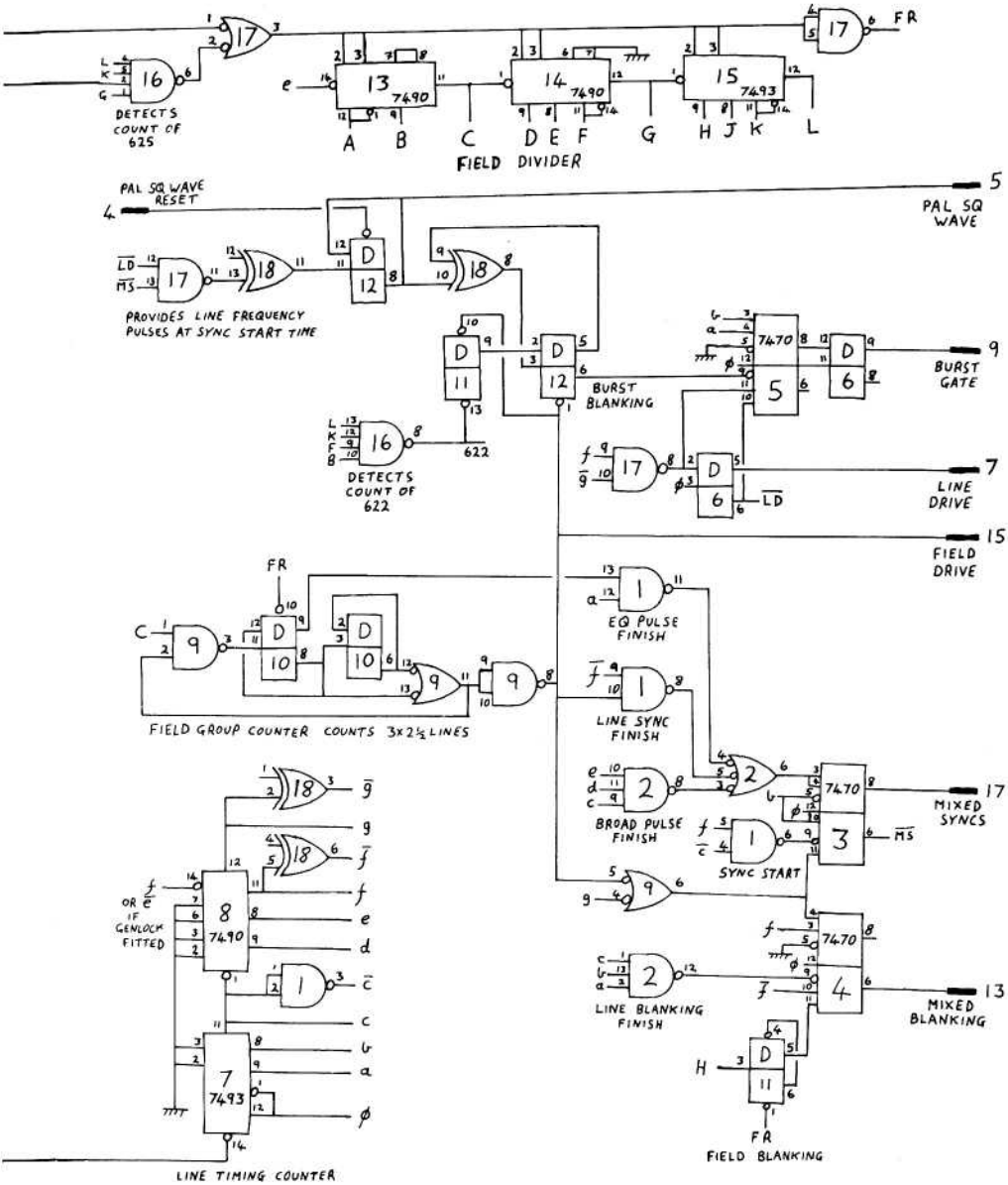
a)	Grey scale with burst	for tracking
b)	Grille with castellations	for convergence and scans
c)	Plain red	for purity adjustments
d)	Colour pattern	for decoder line-up

On the prototype shown at AP, by using four separate changeover switches, many other patterns and combinations of patterns could be produced. These included chequer-board, black and burst and peak white; in fact the 16 possible switch positions produced 14 different patterns. (It has been decided to include an extra divider chain in the pattern generator board to enable it to operate with other SPGs and the opportunity is being taken to make some improvements, and unfortunately the final layout and drawings are not available for inclusion in this issue; there may therefore be some additional patterns available from the final version.)

The horizontal timings are derived either from an RC clock oscillator, or from the SPG, giving an output at 20 times line frequency. By clocking a binary counter, reset by line blanking, we derive timings for 16 vertical lines, and outputs for the grey scale generator, during active line time.

Vertical timings are derived by line counting. This means that all the luminance and


F J
e
FR
22
21
22
22
PROVIDES FIELD RESET WHEN GENLOCK IS IN OPERATION
622 A
D 20
26 7495
27 7496
Clr
INHIBITS SPG 625 DETECTOR DURING GENLOCK
D 20
C
21
K L
21
+5V
2·7K AOT
0·1
23
BROAD PULSE DETECTOR
+5V
1K
GENLOCK CONTROL
2
1
REF SYNCS IN
23
AOT 3600p
+5V
10K
11K
LINE PHASE CONTROL
28
COMPONENTS ON THIS SIDE OF DOTTED LINE ARE CONCERNED WITH GENLOCK AND NEED NOT BE FITTED
0·1
23
21
REF SYNCS DETECTOR
3
SUBCARRIER IN
470
470
25
25
·01
D 24
D 24
D 19
8·2K
8·2K
AOT 30p
24p
·02
IC 24 IS ONLY PART OF THE CIRCUIT FOR LOCKING THE SPG TO THE COLOUR SUBCARRIER. IT IS INCLUDED IN THIS DIAGRAM BECAUSE IT IS ON THE PRINTED CIRCUIT BOARD.
25
25
D 19
33
5MHz OUT


DETECTS COUNT OF 625
FIELD DIVIDER
A B C D E F G H J K L
FR
PAL SQ WAVE RESET
PAL SQ WAVE
PROVIDES LINE FREQUENCY PULSES AT SYNC START TIME
BURST BLANKING
BURST GATE
DETECTS COUNT OF 622
622
LINE DRIVE
FIELD DRIVE
EQ PULSE FINISH
LINE SYNC FINISH
FIELD GROUP COUNTER COUNTS 3x2½ LINES
BROAD PULSE FINISH
MIXED SYNCS
SYNC START
OR $\bar{e}$ IF GENLOCK FITTED
LINE BLANKING FINISH
MIXED BLANKING
FIELD BLANKING
LINE TIMING COUNTER

chrominance patterns are superimposed at exact timing edges.

If clocked from the 'Project 100' SPG the only RC derived timing in the two units sets the width of the vertical lines in the grille.

Generation of the PAL colour pattern is done by means of a crystal oscillator running at four times subcarrier frequency, feeding a ring counter and a data selector. This provides four accurate quadrature phases of subcarrier of equal amplitude. Note that as two of these are used as the burst axis, the resultant display on a vectorscope is shown in Figure 1.

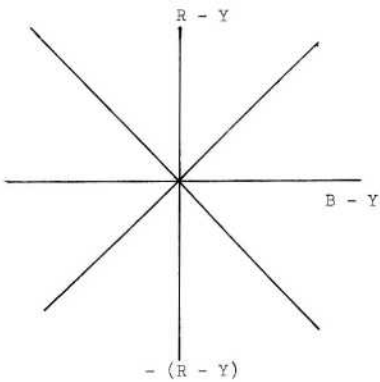


FIGURE 1

The secret, if any, in the production of the patterns is deriving the correct data select waveforms to put the possible out uts in the most useful positions.

None of the vectors shown in Figure 1 lies exactly on any pure colour axis, and therefore the names given to the coloured squares in Figure 2 are only approximations.

Remember the following notes assume that we are using a 'delay line' type of PAL decoder.

Using the test pattern shown in Figure 2, the centre squares marked 'x' will all match and show no chrominance with a perfect decoder. This is a very sensitive test of small errors with any practical decoder.

In use, first set the 'delay line gain' and 'delay' for minimum Hanover bars; in practice the two interact, so repeat the adjustment several times.

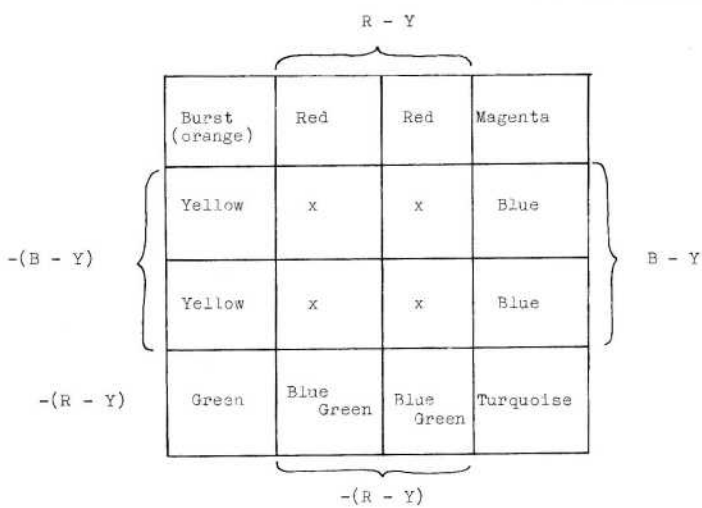


FIGURE 2

The quadrature is set by adjusting for matched saturation on the pairs of colours in the centre of each side of Figure 2. Decoders have in fact two phase controls, one to set the overall phase, and one labelled 'set 90'. There is no hard and fast rule about which feeds which detector, so it is a case of 'try it and see', the overall phase being set first for those colours which do not respond to the 'set 90' control.

This process may sound complicated, but in practice is very simple, and much more

accurate than the normal methods employing a colour bar generator and a 'scope.

PROJECT 100 SYNC PULSE GENERATOR

Apart from the question of compatibility with the pattern generator, there are a number of reasons for publishing yet another SPG in CQ TV. One is that we have not produced a design with a printed circuit board available for it since Arthur Critchley's unit in CQ TV 75, six years ago.

The modern 'Single Chip' SPGs described in recent issues are still expensive, require made to order crystals and are monochrome only. They have no built in provision for genlock and in most cases have difficulty meeting the CCIR timing specifications, let alone the tighter tolerances used by the BBC and IBA in the UK.

In comparison, the new BATC SPG:-

1) uses a fairly common 5 MHz crystal

2) meets the UK broadcast timing spec. (we admit only just in the case of sync width!)

3) gives correct Bruch blanking ie will operate Sony and Hitachi equipment which gets around the PAL patents by not using the swinging burst for R - Y switching.

4) no RC timing components, all output timings being derived from the crystal oscillator.

5) has genlock facilities for use with stable sources (ie crystal derived, NOT mains lock or simple VTRs). Note however that for colour locking the VAS has to be externally reset in phase with the incoming video.

6) has provision for a form of 'subcarrier lock' (to be described later).

In the absence of any other Club standards, the board was made the same as for the CQ TV SPG, ie ISEP, 6.95" x 4.4". This led to space problems, which were resolved by;

a) making all inputs and outputs TTL level

b) allowing some links to be not quite straight, so that drilling could be at a standard 0.1 inch spacing; this means insulated wire has to be used to prevent links shorting.

The SPG is in fact a multi-option board, for example genlock can be omitted, saving a few ICs, outputs can be linked to complements if required to drive inverting buffer amplifiers and the same board can be used for 525 by changing some links and using a different crystal. In this latter case, the SPG comes very close to meeting the new tighter recommended specification for NTSC published earlier this year (EIA Television Systems Bulletin No 4).

In accordance with modern practice, the circuit diagram contains information regarding the function of each group of ICs. This should provide enough data to localise any faults. Logic experts will no doubt study and analyse the unit and modify it to suit their own needs; the keen constructor has all the information necessary to build a hand-wired version. For the rest of us who just require a good SPG, BATC Club Sales will provide a pcb with data sheets showing just where all the links go. For those in the last group with limited experience of tv or logic, the following notes may help you to understand the basic design philosophy.

BASIC SPG

For stability the 2 x line frequency into the field divider is derived from a crystal oscillator running at a multiple of 2lf. The simple and cheap method would be to use a 1 MHz xtal,

in which case $2lf = \frac{1000}{32}$ kHz

However if all the timings are to be derived from the crystal rather than RC networks (eg monostabs) it is necessary to have a clock, or basic timing interval, which is a sub-multiple of all the various line and field timings - and unfortunately 1 MHz gives too coarse an interval. In the case of the Project 100 SPG the clock used is a 1.25 MHz square wave from a binary divider; this means the

oscillator must be a multiple of 2.5 MHz.

In practice the final choice was 5 MHz as this, like the 1 MHz, is a frequency for which crystals can easily be acquired from stock, rather than being made to order. The 21f and the clock ϕ can now be obtained from the same counter chain, since

$$21f = \frac{5}{32 \times 5} \text{ MHz}$$

and

$$\phi = \frac{5}{4} \text{ MHz}$$

The waveforms out of the counters used for gating the logic are labled alphabetically in order of decreasing frequency; inverted outputs are indicated by the bar sign eg $\overline{C}$. Waveforms indicated by a capital letter come from the field divider, those by a lower case letter from the line timing counter.

GENLOCK

This looks quite complicated at first glance but can in fact be omitted if not required, or while testing the basic SPG; in this case only one link needs to be changed (see note on circuit diagram adjacent to IC8).

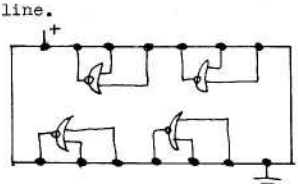
The line genlock is fairly conventional, except for the fact that there is provision for a subcarrier input. This is not required for normal genlock - in fact IC24 can be omitted sltogether until the colour locking system is published.

The TTL gate oscillator may not win many prizes for stability; however in the unlocked mode it is adequate for amateur use, and when genlocked to video from a broadcast source it exceeds any degree of stability that the enthusiast could achieve at home. We did in fact produce a board with a transistor oscillator similar to that used in the pattern generator board; stability was great, but the pull-in range was too small. The crystal oscillator is a little unconventional in that the diode is not a varicap but a switch, connecting extra capacity across the trimmer.

The field genlock is able to increment or decrement the field counter by up to two pulses per field, taking the shortest direction to synchronisation. Once in lock a window protects the system against noise except for a small period when the field sync is excepted. The SPG logic also takes care of the fact that the field group has already started by the time the first broad pulse is detected, and should the genlock source be lost both line and field genlock systems are inhi - ited.

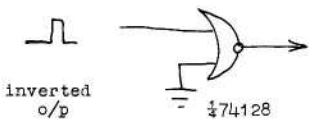
PULSE OUTPUT STAGES

Due to lack of space on the pcb the output pulses are at TTL level and cannot produce 2v into 75 ohms directly. Arthur Critchley covered this problem at some length in his articles in CQ TV 75 - 77, some years ago. Since then a new IC, the SN74128, has become available at a very reasonable price. The 74128 is a quad dual input nor gate designed to feed TTL signals into a 75 ohm line.

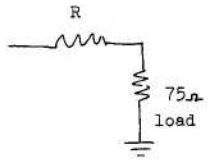


As the voltage swing out of TTL is about 3.6v and is dependdant on your power supply voltage, a pad of about 5.5dB is required to produce 2v pulses. In fact 6dB would be close enough for most purposes.

Three suggested pads are shown on the next page.

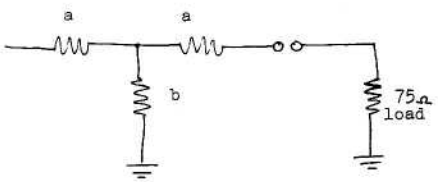


a)



A simple unmatched dropper with R = 75 ohm gives an output of about 1.8v

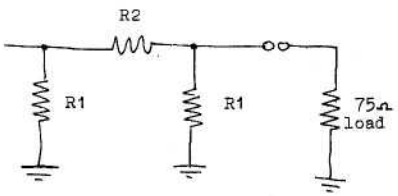
b)



A simple T pad

attenuation	resistors a	b
5.3dB	22Ω	110Ω
5.7dB	24Ω	110Ω
6.0dB	25Ω	100Ω

c)



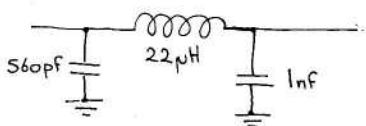
Π pad

attenuation	resistors R1	R2
5.05dB	270Ω	47Ω
5.57dB	240Ω	51Ω
6.07dB	220Ω	56Ω

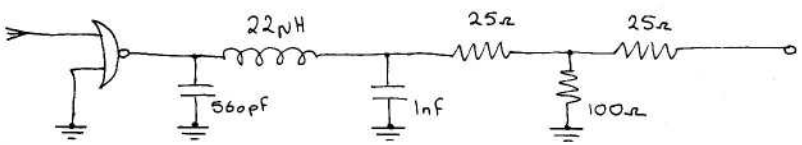
RISE TIME

Even when 2 volt pulses have beenproduced into 75 ohms, the rise times will still depend on the logic used. They will probably be quite good for amateur tv, but not for broadcast use.

Broadcast SPGs tend to use band limiting filters in each output, but as these cost about £20 you may care to use something simpler! The circuit below uses values taken from Arthur Critchley designs:



As this filter must be terminated at all times to protect the logic from spikes, it is recommended that the filter be placed between the IC and the pad so that the output is never open circuit.



LIST OF ICs and DIODES

No required	Type	Circuit reference
5	7400	ICs 1,9,17,22,25
1	7402	IC21
2	7410	ICs 2,23
1	7420	IC16
3	7470	ICs 3,4,5
7	7474	ICs 6,10,11,12,19,20,24
1	7486	IC18
3	7490	ICs 9,13,14
2	7493	ICs 7,15
1	7495	IC26
1	7496	IC27
1	74121	IC28
3	switching diode eg 1N1418, 1N914	

Printed circuit boards for this design are available from BATC Club Sales at a price of £4 post paid (£4.50 to non members)

A similar pcb will be available for the pattern generator when this design is published.

CMOS

A.CRITCHLEY Dip El; C Eng; MIERE.

A series on CMOS digital IC's and their uses for television.

This first article has been specially written in celebration of the 100th edition of CQ-TV. The author has been with the BATC since CQ-TV number 19.

Introduction

What is CMOS? Everybody seems to mention it these days. Why is it better than TTL or any other sort of IC? Well, this series attempts to explain what CMOS is and how it can be used instead of TTL.

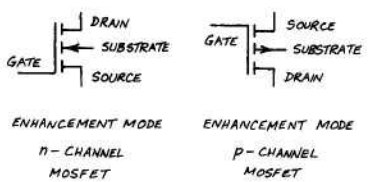
CMOS stands for Complementary Metal Oxide Semi-conductor and it consists basically of nothing but Field Effect Transistors (FET's).

In a Metal Oxide Semi-conductor FET (MOSFET) a metal control 'gate' is separated from the semi-conductor 'channel' by an oxide layer. Unlike a junction FET the input resistance of the gate of a MOSFET is very high indeed and not affected by the voltage present on the gate.

The operation of the MOSFET is somewhat like that of a valve (remember those hot things?) in that the voltage charge on the gate controls the current in the channel. The channel is resistive and has two end contacts known as the Source and the Drain. (Which may be inter-changed).

The gate electrode can either deplete the channel of active carriers or it can enhance (increase) them. There are two kinds of conduction available for the channel - n-channel using electron conduction or p-channel using hole conduction. Either type may have enhancement or depletion modes of operation. Enhancement is when the gate potential has to be taken towards the drain potential to turn the FET on. Depletion is the opposite and requires a reversed bias.

In CMOS two types of MOSFET are used; enhancement mode n-channel and enhancement mode p-channel. The two types are shown diagrammatically below.

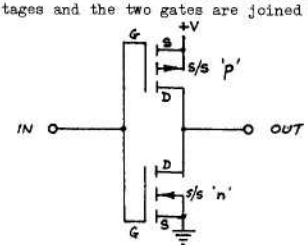


Note the direction of the arrowheads and the positions of Source and Drain. These match the conventional method of drawing npn and pnp transistors with the positive potential uppermost.

Fundamentals

CMOS uses a complementary pair of these MOSFET's in cascode. The substrates are connected to the most positive potential for the p-channel and the most negative potential for the n-channel so that they do not conduct.

The effective gate potentials are within the supply rail voltages and the two gates are joined together.



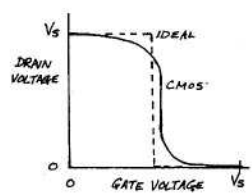
If the input gates are at earth potential then the p-channel FET will be 'on' and the n-channel one 'off' so that the output is connected to the positive rail via the 'on' resistance of the p-channel FET.

If the gate potential is made the positive supply rail voltage then the output will be joined to earth via the n-channel FET only.

Only one FET is on at a time and therefore the dissipation of the device is practically zero.

What happens in between? Enhancement FET's have a feature known as 'pinch-off' which means that they have a voltage threshold which has to be overcome before the device will turn on. Typically this is 3 volts and largely determines the minimum operating voltage of CMOS.

The transfer characteristic of CMOS is far from straight because the FET's have this pinch-off effect and also because their gain is low. As the supply voltage is increased the non-linearity becomes more marked but for all levels of supply voltage the point at which the output changes over is nearly half the supply voltage. This gives CMOS good noise immunity.



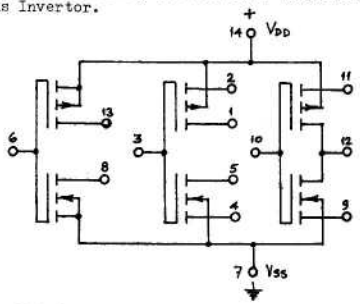
During the transition both FET's are on together in this mid-region and therefore shunt the supply, drawing current which is wasted in heating the device. This condition is avoided by rapid switching which is why CMOS is used for digital logic and also why unused inputs should not be allowed to float. They must be tied down to one rail voltage or the other.

Unfortunately CMOS possesses stray capacitance like everything else and high-speed switching of voltage across capacitance requires energy in the form of a charging current during the voltage change. Every change of state therefore creates a pulse of current and the more often the changes, the more power is used.

So whilst CMOS in the static state takes virtually no power, when operated it does so - particularly at high frequencies. Typically the static dissipation of CMOS is less than 1% that of TTL but at 10 MHz is about the same as TTL. The maximum speed increases with supply voltage.

Practical CMOS

Now that we know how CMOS works, what can we do with it? To answer this we will look briefly at one of the first CMOS devices, the 4007 Dual Complementary Pair plus Invertor.

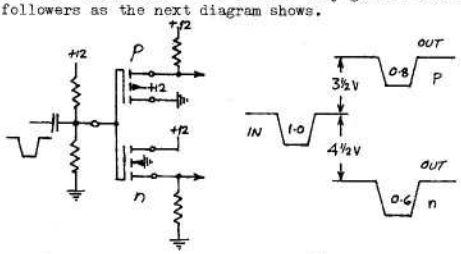


This has three main parts incuding isolated FET's which may be used for source-followers or whatever.

The Invertor section (pins 10,12) is the typical CMOS invertor if pin 11 is taken to V_{dd} and pin 9 to earth.

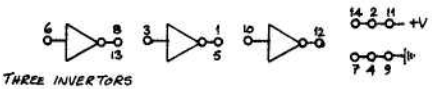
Output impedance is of the order of 500Ω whether high or low and the input resistance is a staggering 100,000 MΩ (10^{11} Ω) which is so high as to be ignored. It is possible to statically drive a vast number of CMOS gates from such an invertor and even at high speed the number is considerable, say 50. The problems of fan-out and loading rules therefore do not apply to CMOS.

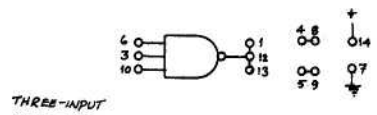
The individual FET's are not very good as source-followers as the next diagram shows.



The p-channel has a gain of 0.8 with a voltage rise of 3½ volts whilst the n-channel has a gain of only 0.6 with a voltage drop of 4½ volts.

The 4007 can be inter-connected in a variety of ways to form various functions. Some are shown below.

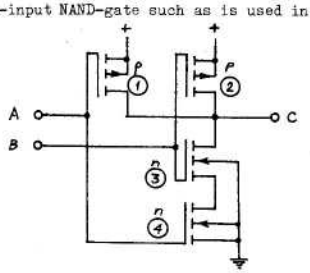




Whilst this is all very well, more basic functions are desirable and these are easily implemented.

Logic gates

A NAND-gate is easily made from the FET's by means of a series-parallel arrangement. The next diagram shows a two-input NAND-gate such as is used in the 4011.

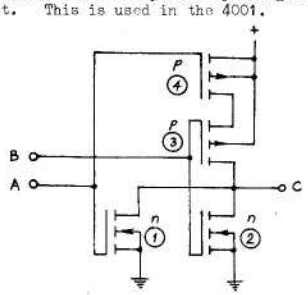


If input A is made high (positive) then FET 1 will be 'off' and FET 4 will be 'on'. If input B is made high then FET 2 will be 'off' and FET 3 'on'.

If both A and B are high then the output C will be connected to earth via FET'S 3 and 4 in series. If either A or B is low then C is joined to the positive supply through either FET 1 or 2.

This implements the NAND function $C = \overline{A.B}$

A NOR-gate is similarly made by using the inverse arrangement. This is used in the 4001.



When input A is high FET 1 is 'on' and FET 4 is 'off' so that C is joined to earth. If input B is high FET 2 is 'on' and 3 'off' and C is again earthed. If both A and B are low then FET's 1 and 2 are 'off' and 3 and 4 'on' so that C is high.

This then implements the NOR function $C = \overline{A + B}$

The series-parallel arrangement may extended to as many as four pairs of FET's but then the output impedance is becoming rather unbalanced.

For the 4078 eight-input NOR-gate the system is arranged in two lots of four-input NOR-gates which are then NAND'd and inverted.

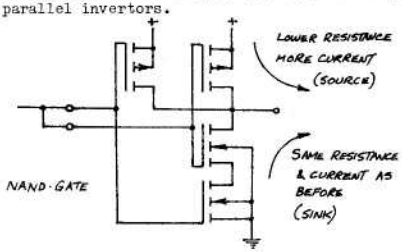
i.e. $\overline{(A + B + C + D).(E + F + G + H)} = \overline{A+B+C+D+E+F+G+H}$

The asymmetry of output impedance is not normally a problem as CMOS gates present such a small load but it can be altered by paralleling of inputs in a multi-input gate instead of using invertors.

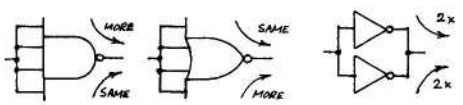
Paralleling the inputs of a NAND-gate will increase the output current from the supply rail but not the earth rail. i.e. Source current but not Sink current.

For a paralleled NOR-gate the Sink current is increased but not the Source current.

If both currents are to be increased then the only way is to parallel invertors.

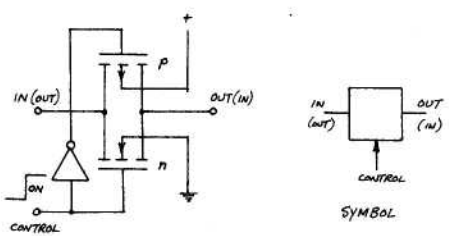


Note: This is not the wired-OR configuration as the inputs are paralleled. Wired-OR is not permitted in CMOS.



Transmission Gate

This device is peculiar to CMOS and is also known as a bi-lateral switch.



Two complementary FET's are connected back-to-back in parallel. The two gates are driven in opposite directions by an invertor so that either both FET's are 'on' or they are 'off'.

When 'on' the input is joined to the output via the parallel resistance of the two - about 300Ω. Voltages at the input are passed to the output whether they are digital or analogue.

There is a slight problem with the pinch-off voltages since at one end of the input voltage range one FET will not be conducting and at the other end of the range the other will not. This means that the 'on' resistance varies with the signal voltage to introduce distortion if the load resistance is low. The effect is less at higher supply voltages.

Since FET's are reversible the transmission gate may be used in either direction. Inputs are also outputs and vice-versa.

All CMOS devices are based on a combination of the invertor and/or the transmission gate.

Handling CMOS

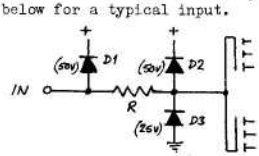
One hears all kinds of stories about the ease with which CMOS may be destroyed. With a bit of common sense it is no problem to handle at all.

The basic reason for the problem is the oxide layer insulating the gate from the channel. This breaks down with a voltage of between 70 and 100 volts. One breakdown is all that is necessary, it is then permanently shorted.

The problem is further compounded by the very high impedance of the gate. Practically every movement of bodies causes an electrostatic charge on those bodies. Normally, electronic devices are of a low impedance in nature and any static charge is rapidly dissipated. With 10^{11} Ω this just does not happen and the static simply destroys the oxide layer.

It does not take much to exceed 70 volts static!

CMOS therefore requires some protection and this is shown below for a typical input.



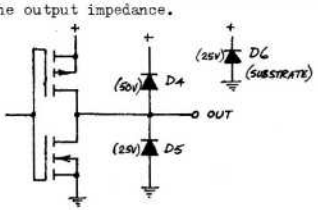
Any positive potential on the input causes D1 to conduct which shunts away the voltage to the supply rail. D2 also shunts away any excess via R.

Negative potentials are shunted to earth via D3 and R.

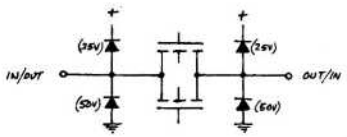
The input potentials are thus limited approximately to the diode drops beyond the supply range. The resistor R is about 2kΩ and is included to limit the current in the diodes. The protection arrangement is capable of handling 2kV discharged from 250 pF.

All CMOS control inputs are protected in this way with the exception of two devices (4049 & 4050) but transmission gate signal inputs and outputs are not.

CMOS outputs are protected by a simpler system of only two diodes as the series resistor cannot be allowed to increase the output impedance.



A similar arrangement is used on the transmission gate signal inputs and outputs in order to keep the signal path resistance low.



Consequently, transmission gates are more easily destroyed than other devices,

One should follow these simple rules;

1. Keep the CMOS in black conductive foam or metal containers - NEVER in white polystyrene foam or plastic bags.
2. Do not handle it unless necessary.
3. Touch the foam to the circuitry before removing the CMOS for installation.
4. Use an earthed soldering iron and touch the board before the CMOS.
5. Solder the supply pins first.
6. Handle by the ends of the package.
7. If you must go for a walk in the middle of the job and are wearing nylon trousers, etc., touch the board before you do anything else.

It all sounds frightening but is really common sense. CMOS already installed in a circuit should be safe enough.

Static is not the only problem in handling CMOS. The other major one occurs when it is interfaced to the outside world because of the diodes fitted to control static.

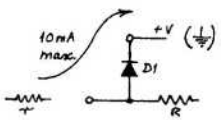
If a signal source is driving CMOS and the CMOS supply is switched off, then the input voltage will exceed the diode drops and the signal source will pass current into the CMOS devices via these diodes.

If the source is a low impedance the current will destroy the diodes, CMOS and all. Hence low-impedance signal sources should be avoided. Even if the CMOS is not ruined its circuitry may do funny things because the signal source is providing the supply voltage.

This problem is overcome by fitting a resistor in each input to the system. It is not necessary between gates within the system. Output feeds should likewise be protected. A permissible abnormal current is 10 mA maximum so that at least 1KΩ is required.

The manufacturers recommend that CMOS supplies be turned on first and off last but this is clearly not practical. Protection is better than replacement - particularly if the system includes several boards which can be individually removed.

This problem is particularly noticable when transmission gates are involved as conduction of one diode causes all the rest to misbehave and may result in total ruin.



Reversing the supply voltage polarity with CMOS is not usually fatal. Only the main substrate diode will conduct as the others are arranged as two in series. The IC gets hot but if caught soon enough will be OK. The main cause of this is inadvertent reversal of the package but since many of the packages are symmetrical reversed inputs are still inputs and only the main substrate is affected.

Acknowledgement

The author wishes to thank Richmond Hill Laboratories Ltd.,Scarborough, Ontario, Canada, for permission to publish this article.

20 YEARS AGO...

At the 1957 Radio Hobbies Exhibition the B.A.T.C. stand showed a "TV Telephone". Using Ivan Howard's Staticon camera and Peter Allott's dialling gear and selector (all relays) visitors could dial a two-way vision conversation. Strangely, the general opinion was that it was NOT a good idea!

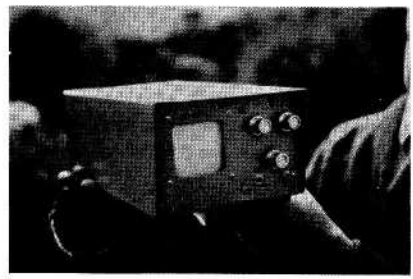
Grant Dixon was building a colour tv system, using frame sequential scanning with a rotating drum. Problems with scanning power and registration made this a difficult project, but success WAS achieved. Ivan Howard built a converter to display BBC experimental colour tv on a frame sequential monitor, also with success.

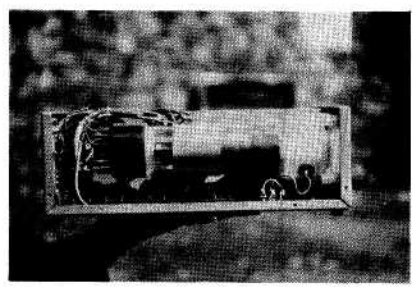
Bill Stapleton in Dublin, Eire, succeeded in recording pictures on tape. He used a 100 line system, with one field every two seconds, and a 10 kc/s bandwidth. Recording speed was 15 ips. The loss of dc component and lf distortion was a nuisance, as clamp pulses proved difficult to generate every 1/100th second. The push-pull scan circuits used two KT66s.

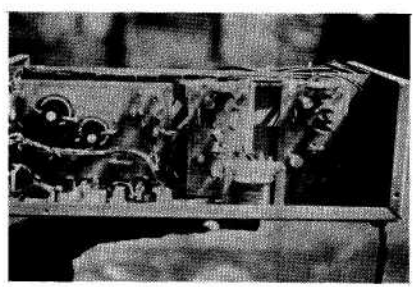
Peter Bursge was collaborating with Roy Martyr in building a 3 cm vision Tx, using 723A/B klystrons and 45 Mc/s FM Pye strips, but was having problems with adequate bandwidth at IF for good tv. Ted Pegran G3LNY/T was using CV67 klystrons in his 13 cm tv link, using AM and grid modulation.

At the 1957 Dagenham Show the B.A.T.C. display went all round three walls of a forty foot square marquee. A complete six camera studio was set up with mixer, effects generator and monitors (including one 300' away for the mayor) B.A.T.C.s OB unit "Matilda" was there, with a 70 cm vision link and sound on 4 m and 10 m. Tubes used were Photicons, Image Orthicons, Staticons and Vidicons.

Some photos of a sstv 'Minimonitor' built by G3LPB.







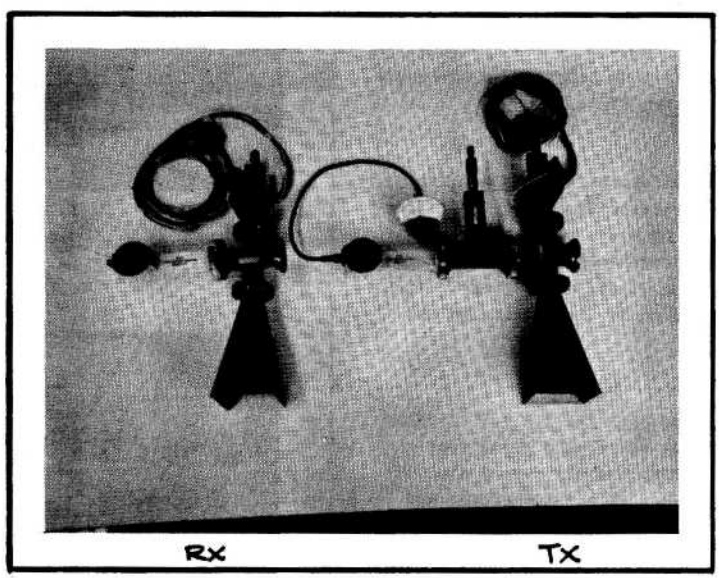
CIRCUIT NOTEBOOK No 28

J. Lawrence GW6JGA'T

ATV EQUIPMENT FOR THE 3 CM (10 GHz) BAND.

Although the amateur allocation of 10.0 GHz to 10.5 GHz has been available for many years, only a very few atv stations have used it for transmitting video. These notes and references are being included in the hope that they will stimulate some interest and will encourage those who have already got some gear working on 10 GHz to write in to the Editor with details for publication in CQ TV.

Both the transmitter and receiver to be described use Reflex Klystrons Type 723A/B. Although this valve was developed some 30 years ago, huge quantities were made and there are still quite a few about. The 723A/A was designed for operation around 8.5 to 9.6 GHz, but by unlocking the nuts on the side arm and screwing these outwards the frequency can usually be moved into the band. Some loss of power is inevitable and some 723A/Bs fail to oscillate altogether when stretched in this way. The valve has an octal base and in place of pin 4 there is an output coupling probe. The valve is mounted so that this probe projects into the waveguide and provides the required coupling.



The 10 GHz equipment described in the article.

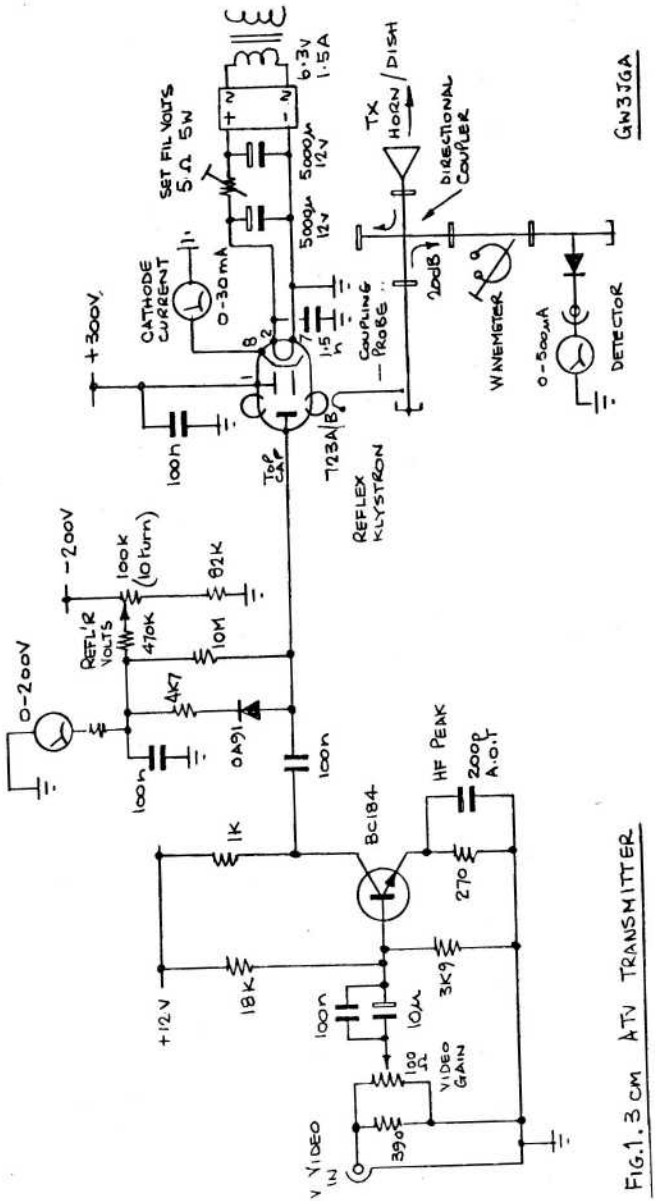


FIG.1.3 cm ATV TRANSMITTER

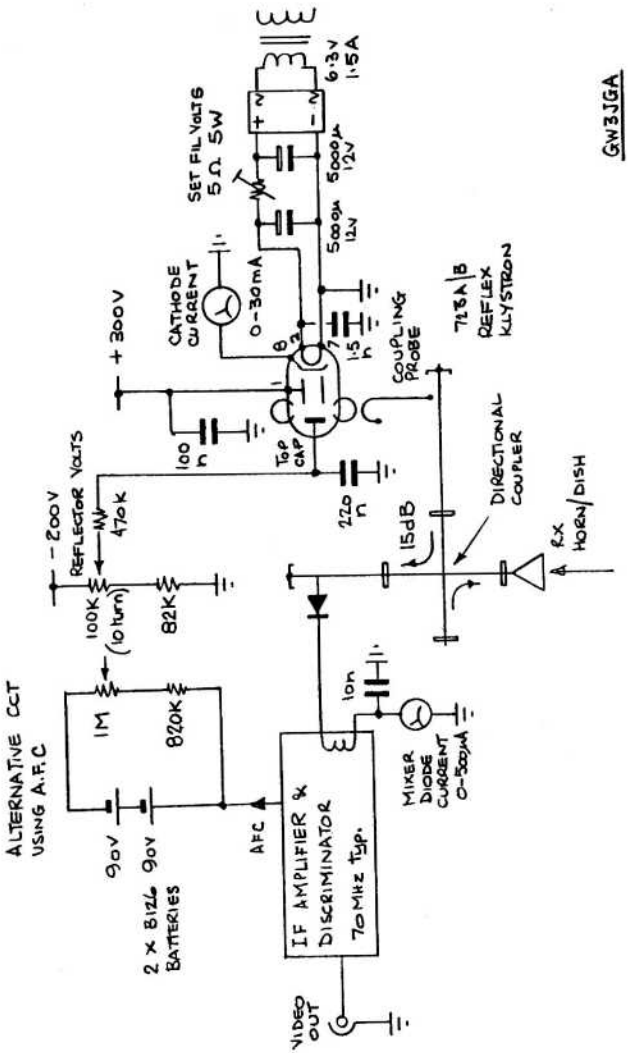


FIG. 2. 3cm ATV RECEIVER

TRANSMITTER

In the transmitter, shown in Figure 1, the Klystron output passes through a directional coupler and out to the aerial horn or dish. The directional coupler siphons off about 1 % of the power and this passes through an absorbtion wavemeter to a detector. This enables the outgoing frequency to be checked.

In operation, the wavemeter is first detuned and the reflector voltage is varied over the range 90 -100 volts and the detector current monitored. It is usual to find more than one point at which output is obtained, and the highest peak should be chosen. The mechanical tuning of the Klystron can be adjusted to obtain the required operating frequency, as checked by the wavemeter, and the reflector voltage re-peaked.

Video modulation is applied to the Klystron reflector and this produces frequency modulation of the carrier, a typical figure for the 723A/A being several MHz per volt. The output of the modulator is dc restored before being applied to thr reflector.

RECEIVER

The receiver, shown in Figure 2, employs a Klystron as the local oscillator in a superhet arrangement with a detector diode as a mixer. The received signal passes in through the directional coupler to the mixer diode. The local oscillator is also coupled to the mixer diode through the other arm of the directional coupler. The difference frequency IF is fed to the IF amplifier and FM discriminator. A typical frequency for the IF would be around 70 MHz, although other frequencies could be used. If the reflector supply is floated, for example by using batteries, then an AFC (automatic frequency control) voltage can be taken from the discriminator and fed back to the reflector to correct any frequency drift

IF AMPLIFIER AND DISCRIMINATOR

To get started, a VHF tv receiver, tuned to a band 1 channel, could be used and the FM IF signal slope detected by slightly detuning. However, this is not very satisfactory and a Radar IF strip modified by adding a discriminator would be much more suitable. Anyone having modified or built such a unit - please send details.

GENERAL

The Klystron frequency is very susceptible to fluctuations and ripple on the supply voltages, in particular the reflector. This supply, and that to the resonator, should be well smoothed and stabilised. It is an advantage to supply the heater from dc and if this can be stabilised also, so much the better. The Klystron is also rather temperature sensitive and is more stable if mounted in a steady air stream from a small fan blower. If you begin to get seriously interested in a 10 GHz set up, then you would be well advised to study very closely Chapter 8 in the RSGB VHF/UHF Manual by Evans and Jessop. It's an absolute mine of really practical information.

In the photograph, the Klystron sources are similar to the one described in the VHF/UHF Handbook, as are the directional couplers. The detectors are Government surplus, and the wavemeter a copy of a Sanders type.

YET ANOTHER UHF MODULATOR.

This UHF Modulator accepts a composite video input and provides a UHF output modulated by the video and suitable for feeding into a normal domestic tv receiver.

The circuit consists of an oscillator, provided by TR1, with the frequency determined by L1 and TC1. The output of the oscillator is tapped of the 'line' and taken via C6 to the emitter of TR2. The video input is also applied to the emitter of TR2 via C5. RV2 provides an adjustable

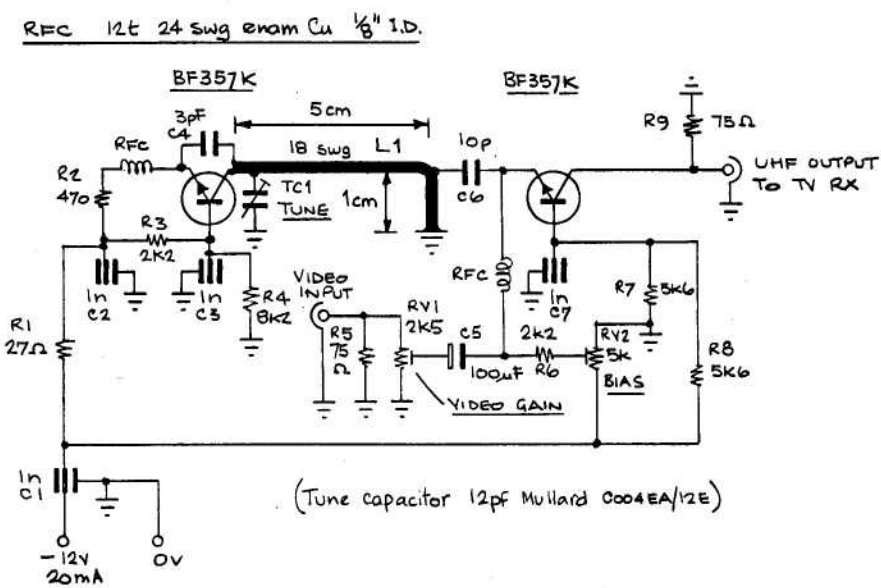
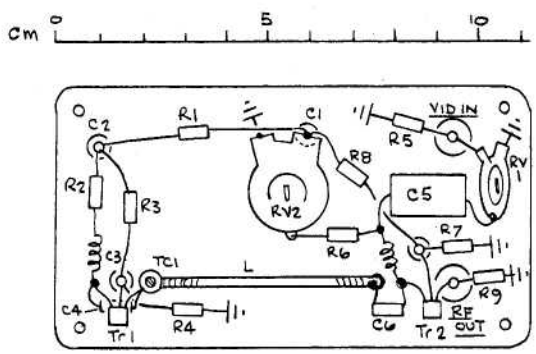


FIG.3. UHF TV MODULATOR GW3JGA.



COPPER CLAD BOARD TO FIT TOP OF EDDYSTONE DIE-CAST BOX 7134P

FIG.4. UHF TV MODULATOR GW3JGA.

bias voltage which is set so that TR2 is just conducting. The video input then modulates the rf in the emitter-base junction of TR2 and modulated rf currents in the collector generate a voltage across R9 and the output coax socket.

The circuit is shown in Figure 3 and the physical layout is given in Figure 4. The unit is built on a piece of copper clad board which replaces the lid of an Eddystone die-cast box. (type

7134P) in which the unit is housed. The board is fitted with the copper side inwards and the components are wired point to point and soldered direct to the copper where an earth is required. Lead thro capacitors C1, C3, and C7 are mounted through the board and support various components etc. All the wiring is on the same (copper) side of the board.

SIMPLE VIDEO SWITCHER.

This switcher is very basicand consists of a multiway push-button switch which connects the required video input into a common bus-bar and to a video buffer amplifier. Each input can be looped through or terminated in 75 ohms. The buffer amplifier causes negligible loading on the i/p circuits and so switching does not cause any 'bumps' on the input signals.

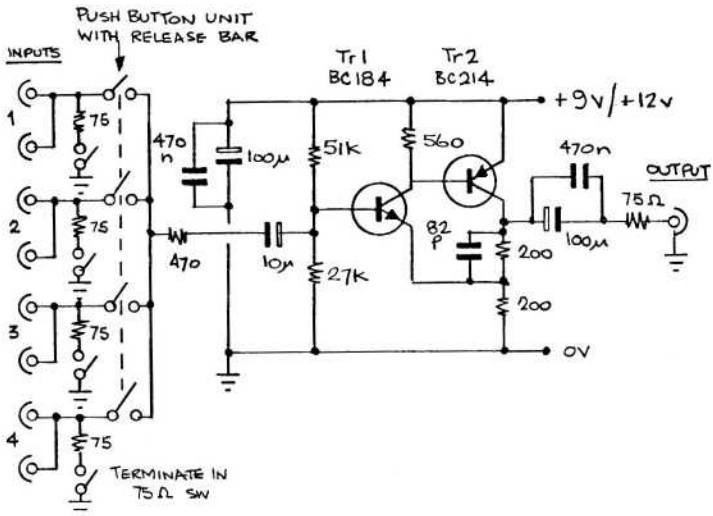


FIG.5. VIDEO SWITCHER. GW3JGA

The amplifier has a gain of x2 and a bandwidth in excess of 6 MHz. The output of the amplifier is taken through a 75 ohm resistor to provide the correct sending resistance and will deliver 1v p-p video into a 75 ohm load. Ideally the switcher should be used with non-composite video (without sync) into a video processer. However it will work satisfactorily with composite video signals but it is preferable for all the signal sources to be locked to the same sync source. If composite video is fed through the switcher to a VTR, problems will result due to a small break in the continuity of sync during switching.

A SLOW SCAN CQ GENERATOR

by G. L. Sharpley G3LEE

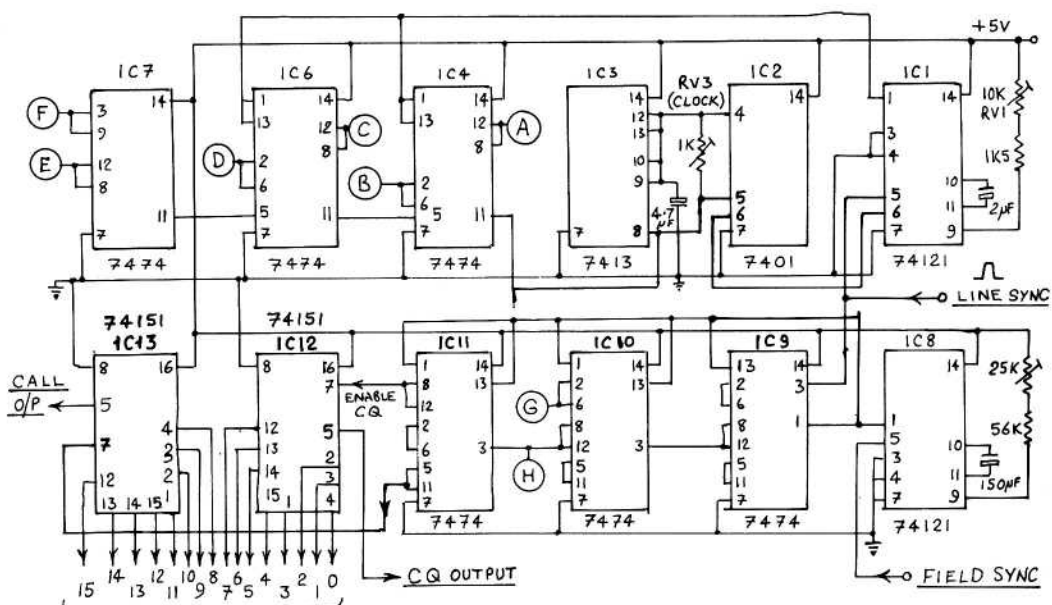
This is a diode matrix programmed call-sign generator. Two lines of up to five large size letters or figures are possible. The large character size and possibility of constructing different letter styles make this an ideal CQ calling or identifying device. It is possible to change the message by using plug-in matrices, but a 48 way connector would be required.

The line-up of IC types may seem a bit cumbersome, but they are commonly available from ex-computer boards. Obviously the 7474 counters could be replaced by one 7493 in the line and field circuits. The slow scan screen is effectively divided into 16 x 32 = 512 squares. A diode in the matrix means one of the squares is "filled-in".

When constructing, please remember the golden rules of IC layout; direct thick power and earth rails. It is helpful to have 0.1 mf capacitors across the supplies near each device and a few 50 to 100 mf capacitors across the supply rails of each board.

SETTING UP

Positive going TTL level line and frame pulses are required. The clock frequency is set by RV3 to approximately 535 Hz. RV1 sets the starting position of the characters from the left hand edge of



CIRCUIT 1. SSTV CQ GENERATOR

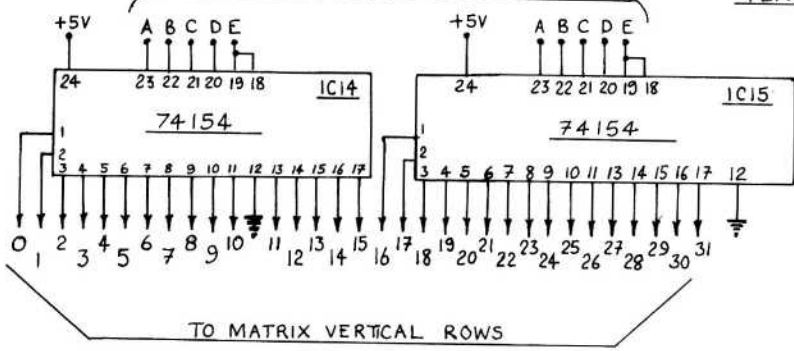
CLOCK COUNTER + HORIZ SELECTOR

CIRCUIT 2

INPUTS FROM COUNTERS

SSTV CQ GENERATOR

VERTICAL SELECTOR



CIRCUIT 3

SUGGESTED OUTPUT ARRANGEMENT FOR CQ GENERATOR

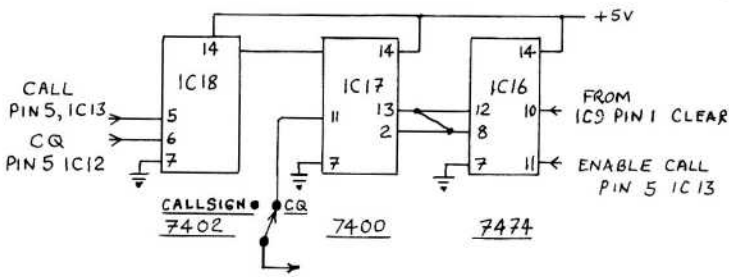
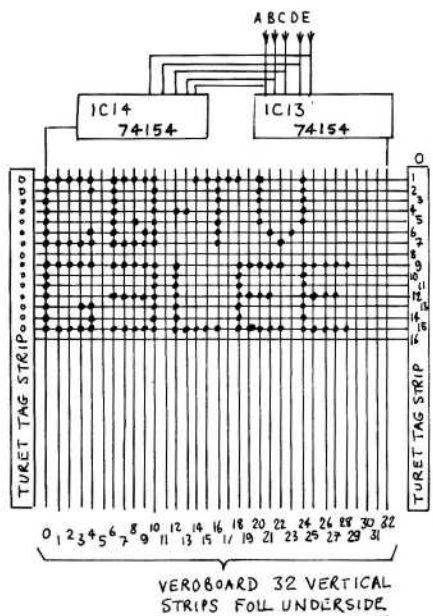


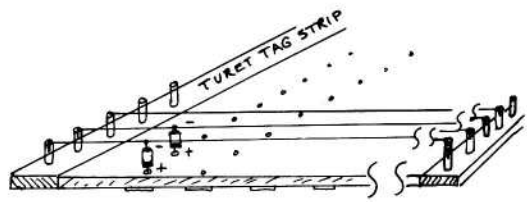
DIAGRAM 1



the screen. Adjusting RV3 will alter the width of the letters and this can be used to centralise the message on the screen. RV2 sets the distance from the top of the picture at which the first line of the message starts.

The output circuit shown could be improved to give positive or negative pictures. If the call-sign/CQ switched output as shown in the diagram is used, do not program line 8 or 16 of the matrix. A suggested method of constructing the matrix is shown. Do not try to be clever and sandwich the diodes between two veroboards with the tracks at right-angles. You will regret this when you wish to replace a diode or correct a mistake!

METHOD OF CONSTRUCTING MATRIX



DIODE'S LOOPED OVER WIRE AND OTHER END PASSED THROUGH VEROBOARD FOIL UNDERSIDE STIFF TINNED WIRE BETWEEN TURRET TAG STRIPS ABOUT 18 SWG T/COP. + CATHODE OF DIODE CONNECTS TO VERO STRIP

SSTV CONVENTION

PLACE — UNIVERSITY OF ASTON, BIRMINGHAM

DATE — SATURDAY 19th NOVEMBER 1977

Timetable

0900 Rooms 110 and 118 open for those bringing equipment
1000 Convention opens for exhibition of equipment
1330 Lectures start in Room 108
1 The W9LVI slow to fast converter
2 Microprocessers
3 RAMs
4 Q & A Session
1730 Convention closes.

Many exhibitors have been invited, both with commercial and home built equipment.
If you have any SSTV equipment you wish to exhibit, just bring it along

Please remember, no food is available at the University.

There is no need to book in advance, but remember a charge of 50p will be made to defray expenses. The University is located near the centre of Birmingham at the south end of the Aston Expressway, (A38M), which connects with jnc. 6 of the M6. DO NOT FOLLOW THE SIGNS TO ASTON.

MODS TO THE G8CGK SSTV GENERATOR

by Johnny Brown G3LPB

A small advert appearing in C Q - T V recently announced that a printed circuit board and data sheet for a slow scan pattern generator were available. For a cost of £3.50 a really professional board arrived, together with sheets of data.

Using 20 ICs (all easily obtained) and a minimum of links, the completed unit produces black and white rasters, 4 and 8 step grey scales plus a chess-board pattern. Also available are three standard frequencies, 1200 Hz for sync, 1500 Hz for black and 2300 Hz for white. All these frequencies are developed from a Master Oscillator, using dividers, to produce stable patterns; last of all, line and frame sync pulses are produced to drive ancillary equipment.

There is also provision for 50/60 Hz operation, and 120 or 128 lines. This allows it to be used in other countries than the UK. In my model I have brought all these out yo switches to allow immediate selection of any combination. Likewise I have brought out the sync feeds to a front panel mounted socket.

I have used the spare gates of a 7400 to do other functions, which are described in this article; also, by using a small extra board, I have modified the unit for 256 lines.

As previously stated, the Master Oscillator is set up with a pre-set pot. The frequency it runs at should be 276 kHz - the better the accuracy the better the results. A counter is the ideal, or at least, a 'scope. To obtain our 1200 Hz (sync) frequency, this M.O. is divided by 23, then 10; to obtain 1500 Hz (black) frequency, the M.O. is divided by 23 then 8, and the 2300 Hz (white) comes by dividing by 10 then 12. The choice of 50 or 60 Hz and 120 or 128 lines is made in the other dividers. The board also produces:

FRAME sync, frame square wave, 2 x frame square wave and 4 x frame square wave.
LINE sync, line square wave, 2 x line square wave and 4 x line square wave.

The output is via a sync driven 566 Vco to a 741, the output of which is quoted as 2 v p to p. This is more than enough, in fact I have fitted a gain control.

CONSTRUCTION

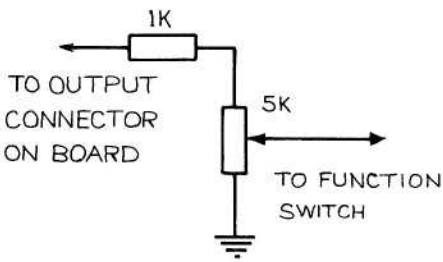
It is best to start by inserting the links, then IC holders and then components. I DO SUGGEST that good pre-set pots are used; many which are available are of weak construction and will drop to bits quite easily. The data sheets show the complete layout which is easily followed. The board has all external connections brought out to an edge connector; alternatively one could drill and fit small pins. All the components are easily available ones and "shopping around" could cut the cost quite a bit. It is not cheap to build, but is well worth the money, and the first sight of the chessboard pattern is very fine.

Whilst any power supply could be used, the circuit shown here was built up as the writer thought a decent unit was justified. The generator is then a completely self-contained unit, and as such has caused quite a lot of interest at shows and demos. The photograph shows the general appearance.

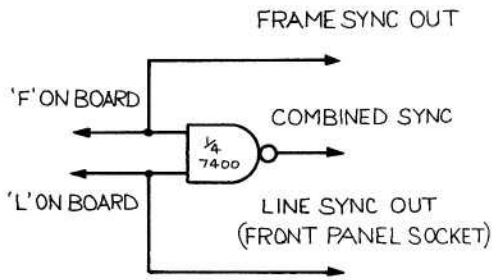
If you have had experience of ICs, by all means solder them direct to the board; but remember that removing them can wreck the pcb unless one has "solder braid" or a "solder sucker". Mine went off "first go" and I feel great credit is due to G8CGK for his efforts in designing a

standard that was much needed.

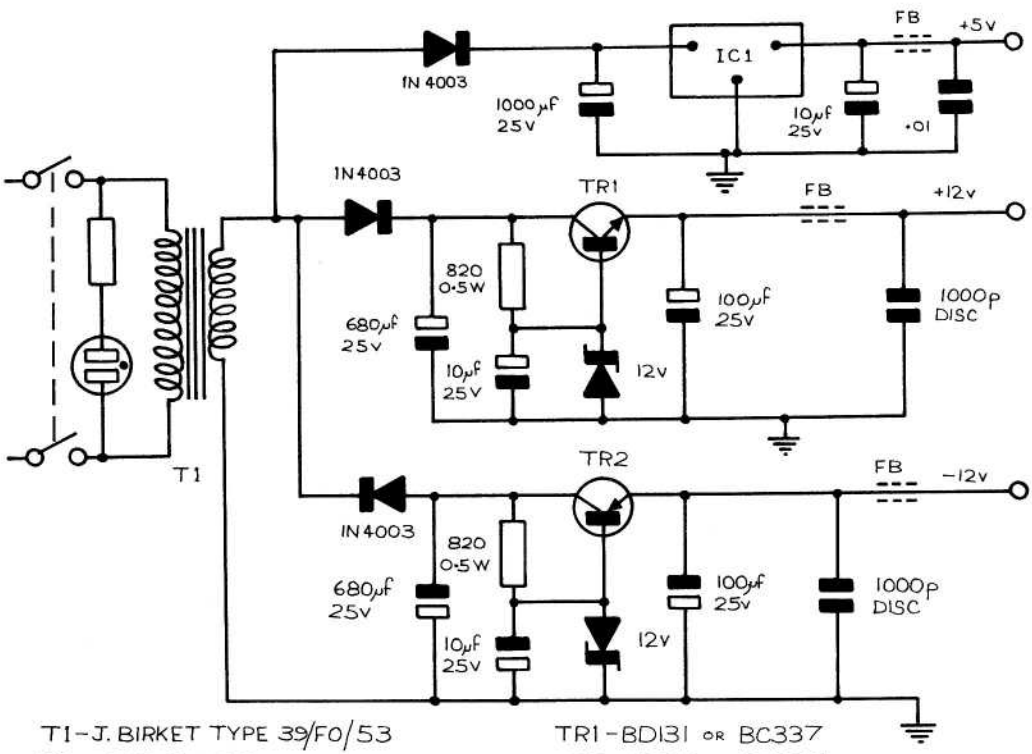
GAIN CONTROL



ADDED SYNC OUTPUT



POWER UNIT



T1 – J. BIRKET TYPE 39/F0/53
FB – FERRITE BEAD
IC1 – 7805 OR MVR5V 5V REGULATOR

TR1 – BD131 OR BC337
TR2 – BD132 OR BC327

MODIFICATIONS

All have G8CGK's acceptance.

Each circuit diagram shows a separate mod.

1 Gain control
2 Function switch
3 Extra syncs out
4 Sync visual display
5 256 line mod
6 power supply
7 Extra "split" pattern.

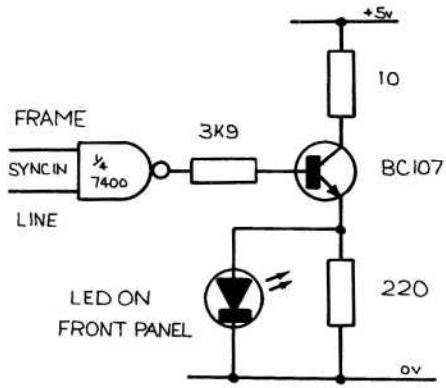
Boards are available from M. E. Dixon, Kyrles Cross
Peterstow, Ross-on Wye
HR9 6LD

Transformer from J. Birkett, 25 The Strait,
Lincoln.
(Type 39/F0/53 at 85p plus post)

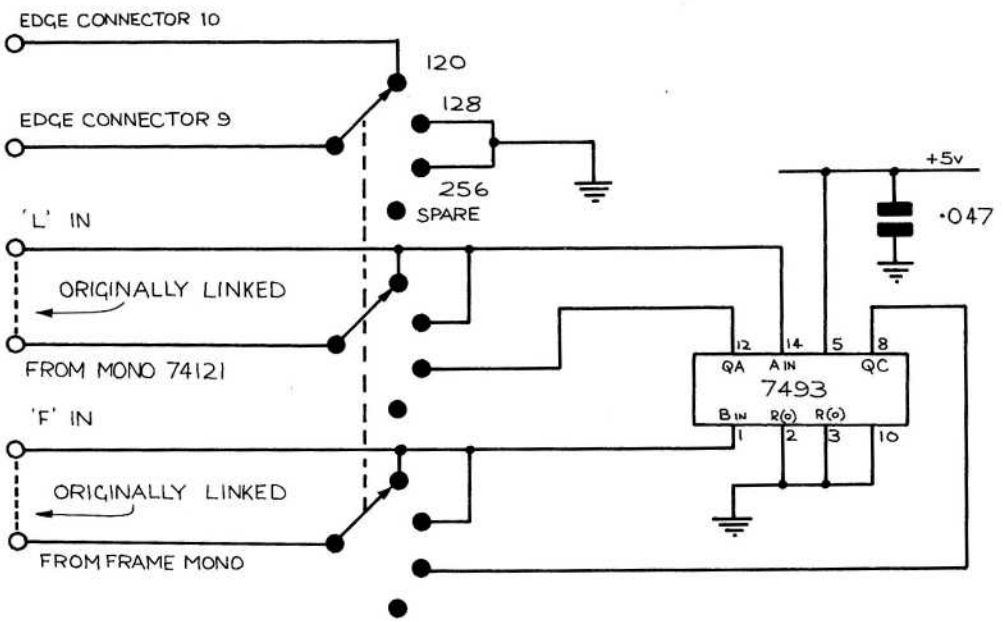
Components from J. Hartley, 78b High Street,
Bridgenorth, Salop.

There are many other suppliers, the above are mentioned only because the items are known to be in stock.

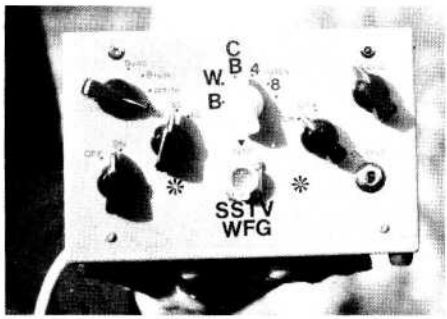
SYNC DISPLAY

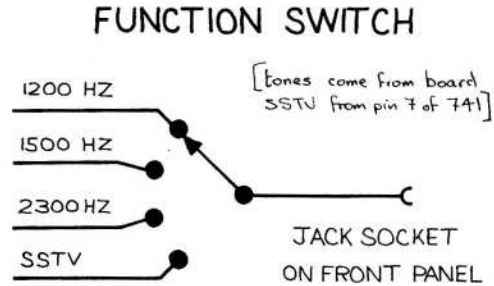


LED CONTINUALLY FLASHES ON LINE
LONGER, BRIGHTER FLASH ON FRAME



3 POLE 4 WAY SWITCH





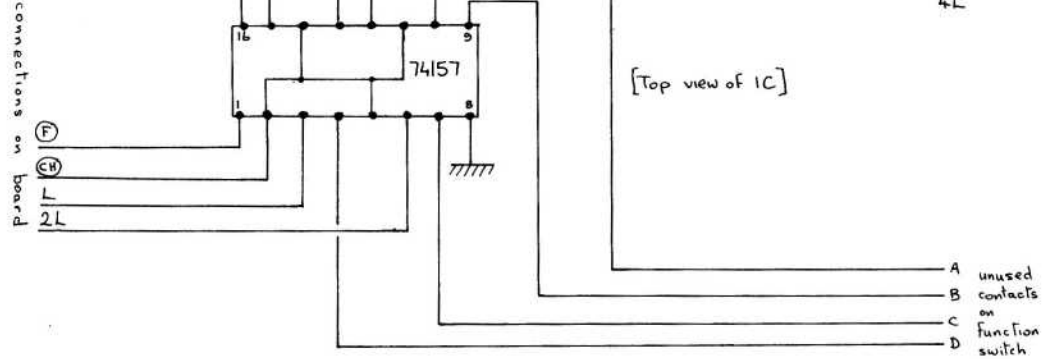
The photo shows the instrument as finished by the author. The case is 9 ins long, 7 ins wide and 5 ins high. The frequency switch reads only 120 or 128 as the 256 mod had not been done when the photo was taken.
All power leads were decoupled with 1000pf ceramic capacitors, and a few ferrite beads were put on the leads carrying 5 v.

EXTRA SPLIT PATTERN

This mod came about to make a complete new pattern. It is a split pattern, with the top half a chessboard and the bottom half grey scale. The 74157 is acting as a fast 4 pole electronic switch, with the control on pin 1.

It is assumed that when you build the generator, you use the switch recommended in the data sheet, that is a 6 way 4 pole switch. One complete set of 4 positions are thus unused and available for this mod. All the wiring can be done on this switch, and the IC can be mounted on a small extra board fixed to the case with a self tapping screw.

On 120 lines it shows half chessboard and half greyscale; on 256 lines we get a number of these repeated. The outcome is very pleasing and looks good at demonstrations. It also gets through the QRM where video becomes unreadable - according to reports from other stations!



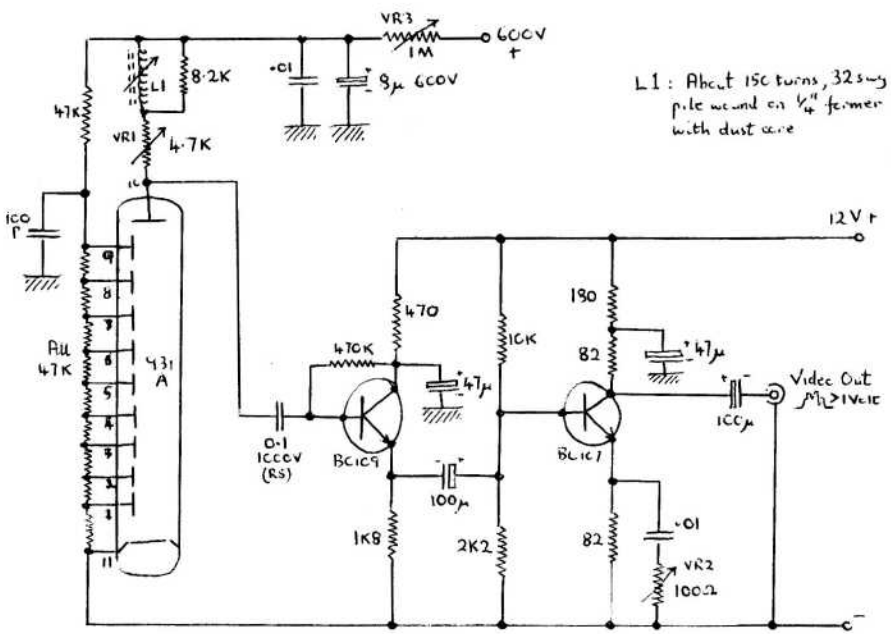
LETTER FROM A NEW MEMBER

Ray Howgego G4DTC

As a new member of B.A.T.C. Ithought you might be interested in the work in progress at this QTH. Since I could not afford to build a TV camera, I decided on a 625 line flying spot system using the well known 931A. I was fortunate enough to have been given two Ferranti 7D/26AB scanning tubes; these are very short persistance microspot tubes, with an optically flat face (I have full data on these tubes if any other members require it).

The tube is driven directly from a Thorn 950 Mk.II receiver with the raster locked directly to BBC sync pulses. This required little or no modification to the receiver, although some difficulty was experienced in reducing the width while retaining good horizontal linearity. This was eventually accomplished by placing another set of line scan coils in series with those used for scanning the tube. The BBC syncs are then re-mixed with the video from the 931A to give the composite video signal. To mix video and syncs I use the Video Mixer of M. J. Hughes described in the December 1973 issue of "Television". This ensures ideal mixing and a one volt output without any fiddling. Previous circuits tried resulted in poorly shaped syncs and line pulling on blacks. At present a simple UHF video modulator is used to feed a standard tv but it is hoped to produce some 70 cm signals within a few months.

The picture quality obtained is superb; Test Card F when televised off-air from a BBC transmission, after passing right through the system, is indistinguishable from the original. It is for this reason that I reproduce the circuit of the head-amplifier and 931 supplies, as it



might be of interest to other members. Since the afterglow of the Ferranti tube is virtually negligible there is little provision for its correction. VR2 gives HF peaking and should be adjusted until overshoot just disappears. VR1 has some effect on the LF response and the gain of the photo-multiplier. L1 should be adjusted for minimum overshoot. VR3 controls the anode voltage of the 931A and I operate the tube at only 300 - 400 volts. Above this the tube becomes unduly noisy.

The optical system I use provides for slides to be placed immediately on the face of the tube or for scanning 35 mm slides.

I also have DX TV receiving equipment for broadcast and amateur transmissions. This summer has shown few openings but previous years have brought in openings to nearly all European countries. The receiving equipment consists of a Bush TV125 (the best for DX) fed via a Philips vision selectivity panel from a home-brew low noise tuner (all bands). The pre-amp uses the now rare BF272.

PROJECTION SETS AGAIN?

An optical company has developed a new process for producing Schmidt correction plates for large screen tv projection systems of the type used for mass audience systems. The process has been used for the Pye Mammoth projector and for flight simulator viewing systems, and when a module which will interface directly with a set manufacturers cathode ray tube, very large sales are predicted.

THE BRITISH AMATEUR TELEVISION CLUB

SUBSCRIPTIONS.

Once again it is necessary to remind members that all subscriptions are due on the 1st of January 1978. Please try to remember to pay on time as the expense of reminders only increases the cost of running B.A.T.C. Just send your cheque or GIRO order (a/c 25 612 4000) to the Treasurer whose address is on page 1.

Many members have asked for Banker's Order Forms, so we print one below. Just fill it in, cut it out and send it to the Treasurer, or send it direct to your bank and inform the Treasurer that you intend paying this way in future.

THE BRITISH AMATEUR TELEVISION CLUB

BANKER'S ORDER FORM

To the Manager Date _____

Member's Bank _____

Please pay on my behalf IMMEDIATELY AND SUBSEQUENTLY on the first day of January each year, commencing 1st January 197___ the sum of TWO POUNDS to the account of:

The British Amateur Television Club a/c 0101260
Lloyds Bank Ltd., (sorting code No. 30-91-23)
Bigby Street, BRIGG, Lincolnshire.

Name _____

Address _____

Signature _____

Delete the words in heavy type if the current year's subscription has already been paid.

ADVERTS

ADVERTISING RATES

Back page	£12
Inside page	£10
Half page	£ 6

Small ads 10 p per line; free to members of BATC.

Advertisements are inserted in C Q - T V on the understanding that advertisers comply with the law and accept responsibility for their wording. They must also undertake to reply to all those who enclose a stamped addressed envelope.

B.A.T.C. Equipment Registry exists to help members of the Club who have equipment for disposal or who wish to purchase some specific item. Send a list of your "wants" and "disposals" to the address inside the front cover of this issue and during the six months for which your application is valid, the Registry will attempt to put you in touch with someone who will buy your surplus or sell you your needs. A s.a.e. would be appreciated when using this service.

B.A.T.C. possesses a Marconi Sideband Analyser which was donated to the Club some years ago. If anyone wishes to use this equipment, could they contact Ian Waters at 39 Stow Road, Stow-cum-quy Cambridge. They will need to provide their own transport.

FOR SALE

Camera built to circuit in CQ-TV 65, with mains power supply. Could be converted to 12 v use. Complete with vidicon and Dalmeyer F1.9 tv lens Mk.2. Needs attention to video circuits.
5FP7 c.r.t.
931A mounted in a slide projector body.
Monoscope tube type C913'C'
Tubes all believed to be OK.
Prefer buyer collects. What offers?
P.Worrell
21 Milford Drive
Bear Cross
Bournemouth. Tel Northbourne 2656

FOR SALE

Rank Cintel Type 28881 multistandard 21" monitor	£ 5.00
Comprehensive manual (new)	£ 4.00
NEV transistor camera, video op	£11.00
NEV Transistor camera, rf op	£12.00
NEV 14" 625 line monitor	£ 7.50
Marconi industrial camera channel type BD871 with manual and cables	£17.00
Marconi industrial camera channel type BD871 with remote optical focus, manual and cables	£19.00
Marconi CCU 5128B, spare for either of the above	£ 7.50
Pye SPG type 2516, with 625 Xtal and manual	£10.00

All "buyer collects". Many other items, including SSTV gear.
G8AXC QTHR
Tel: Scarborough (0723) 85252

AMATEUR TV Ham wishes to hear from another, London area, re business proposition.
A. Ashley
15 Clifton Gdns
LONDON N15

FOR SALE

Home built audio oscillator, 16 Hz - 150 kHz in 4 ranges, 7" x 4½" x 2", battery operation. £5, plus postage or buyer collects.
A. Hughes
17 Woodside Ave
Esher
Surrey

FOR SALE

SSTV Pattern Generator printed circuit board, drilled and roller-tinned, supplied with data sheets £3.50 post paid
(This generator provides the three standard frequencies, 2300, 1500 & 1200 Hz; white raster; black raster; chessboard; 4 & 8 step grey-scales)
M. E. Dixon
Kyrles Cross
Peterstow
Ross on Wye
Herefordshire HR9 6LD

WANTED

Vidicon camera, in reasonable working order and reasonably priced, preferably Pye Lynx. Also Philips Recorder LDL1000/00/01 part no. EL1800 (recorder to standard tv)
G. P. Barkshire
8 Hove Lodge Mansions
16 Hove St
Hove, Sussex, BN3 2TS Tel: Brighton 722366

FOR SALE
Second hand vidicon tubes ($\frac{2}{3}$ & 1")
Enquire for prices.
M. Cox
13 Dane Close
Broughton, Brigg
South Humberside.

WANTED
Phillips Projection cet Type MW6 - 2
Viewfinder tube
J.T.Bubeo
14 College Road
Haywards Heath
West Sussex
RH16 1QN

FOR SALE
Spacemark SSTV monitor £65
C.Fawcett
761 Ashton Road
Bardsley
Oldham
Lancs.

WANTED
Jellypot transformer and tripler for
5FP7 tube
3 Focussing magnets for 5FP7
T.L.Beckham
33 Eleanor Road
Bowes Park
London N11 2QS

FOR SALE
Northeastern Model 148 Spectrum Analyser
£30
Racal MA150D Frequency Synthesiser £30
WANTED
Marconi Mk 1 or 2 picture and waveform
monitor (or similar RCA)
Any ALL VALVE colour equipment (encoder,
bar generator, CCU, monitor etc prefer
Marconi or RCA but others if circuit is
available)
Greg Trice G8DAV
Flat 2
8 St Mary's Road
Leamington Spa
Warwickshire

We have received a letter from "Eurolec" with an offer to BATC members. Written by Alan Coombes, who's call is G3OLV, the letter reads:

"We deal mainly in the export of video tape of all types, but we are also only too happy to relieve tv studios of their surplus equipment if it is offered to us at a sensible price! We hold at the present time quite a selection of tv equipment at extremely reasonable prices, and would be only too happy to offer equipment to BATC members on a 'handling Charge' only basis. We could also supply used video tapes and cassettes at cost to members if required, and also produce video spools in various sizes for the commercial market abroad."

If anyone would like to take up G3OLV on his offer, the address is:
Alan Coombes G3OLV
Eurolec
15-16 Rose Hill Court
Rose Hill
Morden
Surrey.

NOTICE

From time to time BATC exhibits at various shows around the country, and requires volunteers to man the stands. A small number of members have been involved in this work up to now, but a better display could be organised if more people were available. If you could help - just an afternoon here, a couple of hours there - the Club would be very grateful. Volunteers should write to Mike Crampton at 16 Percival Road, Rugby, Warwickshire,indicating how far from home they are prepared to travel. It is hoped this way to build up a pool of people all over the country, so that BATC will be able to man a stand at as many exhibitions, rallys, etc as possible.

CLUB SALES

			PRICE	POST & PACKING
Camera tubes	EEV Leddicon		£82	nil
	1" 9777 E.M.I. Ebitron		£28.00	nil
	⅔" 9831 E.M.I.	Amateur grade	£11.00	nil
	1" P849 English Electric	Amateur grade	£12.00	nil
	1" 9677 E.M.I.	Amateur grade	£11.00	nil
	1" 9728 E.M.I.	Amateur grade	£11.00	nil
	4½" 9565 E.M.I. Image Orthicon		£10 for two, buyer collects	
Coils	1" B.A.T.C. coils (limited no of ex-industrial @ £6 + 54p)		£11.50	54p
	⅔" E.M.I. coils		£11.50	54p
Paxolin sockets for 1" or ⅔" vidicons			.32	8p
C mount for lens			.50	10p
Lapel badges			.40	8p
Adhesive badges			.15	8p
B.A.T.C. headed note paper and envelopes (50 sheets)			£1.75	
Reporting charts			.6	8p
EEV Camera chart			£ 1.65	30p
B.A.T.C. Test Card			.50	10p
Film strips of past C Q - T Vs (10 issues per strip)			£ 1.20	10p
Windscreen stickers			. 6	8p
C Q - T V SPG printed circuit board ready drilled			£ 3.00	10p
C Q - T V SPG Genlock Unit printed circuit board ready drilled			£ 3.00	10p

Rapidly increasing postal charges have compelled us to quote the above post and packing charges. Will overseas members please ask for a quotation before sending cash. Obviously, for small items such as lapel badges, sdhesive emblems, windscreen stickers e.t.c., one can send several items for the same price as one - please try and estimate the right amount. Our thanks go to those members who estimate on the high side and suggest that any balance can be put to Club funds.

Please send your orders to C.G.Dixon (B.A.T.C. Club Sales)

Kyrles Cross
Peterstow
Ross on Wye
Herefordshire.

PUBLICATIONS

This is a separate department of the Club, do not send orders for publications to Club Sales, send orders to B.A.T.C. Publications
64 Showell Lane
Penn, Wolverhampton
West Midlands.

Slow Scan Television by B.J.Arnold G3RHI published by B.A.T.C. 2nd edition 35p + 8p p&p

A Guide to Amateur Television published by B.A.T.C. price (post paid) £1.50 to members and £2.00 to non members. Overseas postage rates on request.

Slow Scan Television Handbook sold out

C Q - T V back issues. Back issues are available for issue No. 64 to the current issue, with the exception of Nos. 65, 71, 72, 75, 81, 85, which are sold out. There are less than ten copies of Nos. 64, 66, 67, 70, 74, 78, 80, 84, 98 left, so first come, first served. Return postage allowance would be appreciated. Back issues cost 50p each for Nos. 93 onwards and 25p each prior to 93. A list of all the main articles which have appeared in C Q - T V giving details of how many sheets are required to reproduce it is available for 20p (in UK postage stamps please) plus a large (9" x 4") stamped self addressed envelope. Any article which has appeared in the journal can be supplied in photocopy form at 5p per sheet. Payment for this service should be in UK postage stamps.

PLEASE NOTE THIS LIST CANCELS ALL OTHERS.

Printed in England by Photoset Litho Ltd., Lawn Lane, SW8 1TS

The Crofton C.C.T.V. Camera

The high performance of the Crofton C.C.T.V. Camera constructed from our comprehensive kit still surprises most constructors and users.

If you have an application for a camera, come along and see it in action; we think you will like it, and what's more it's ALL BRITISH, apart from the lens, and it will work with any existing equipment you have, including Video recorders. With one of our U.H.F. Modulators it can be plugged directly into the back of a standard U.H.F. television receiver.

CROFTON ELECTRONICS LTD

35 Grosvenor Road, Twickenham, Middlesex. Telephone: 01-891 1923

WE ARE ABLE TO OFFER:–
UHF Modulator, Simple 2 Camera Mixer, Electronic Ignition, Vidicons from £5.00. ETI Printed Circuits, Major Parts for ETI Projects.

S.A.E. 4" x 9" for lists.

BARCLAYCARD & ACCESS

New & S/H T.V. Lenses

ALSO:
A Wide Range of New and Secondhand T.V. Equipment Mono & Colour,

TYPICALLY:–
Non-renovated Cameras, Monitors & Video Tape Recorders from £40, £20 & £70 respectively.

The Crofton PCB Service

The Crofton P.C.B. service has been set up to offer a service to both the small and medium sized electronics company.

Being fully aware of the pressures on most engineers today, we have set up a specialist operation capable of producing P.C.B. designs and boards from the most scanty information.

You give us the circuit and we will do the rest. Whether you want high quality or low price commercial boards we can offer you a competitive service. Prototypes can normally be provided within 2–3 days from receipt of artwork.

So next time you're in the market for this type of service just give us a ring.