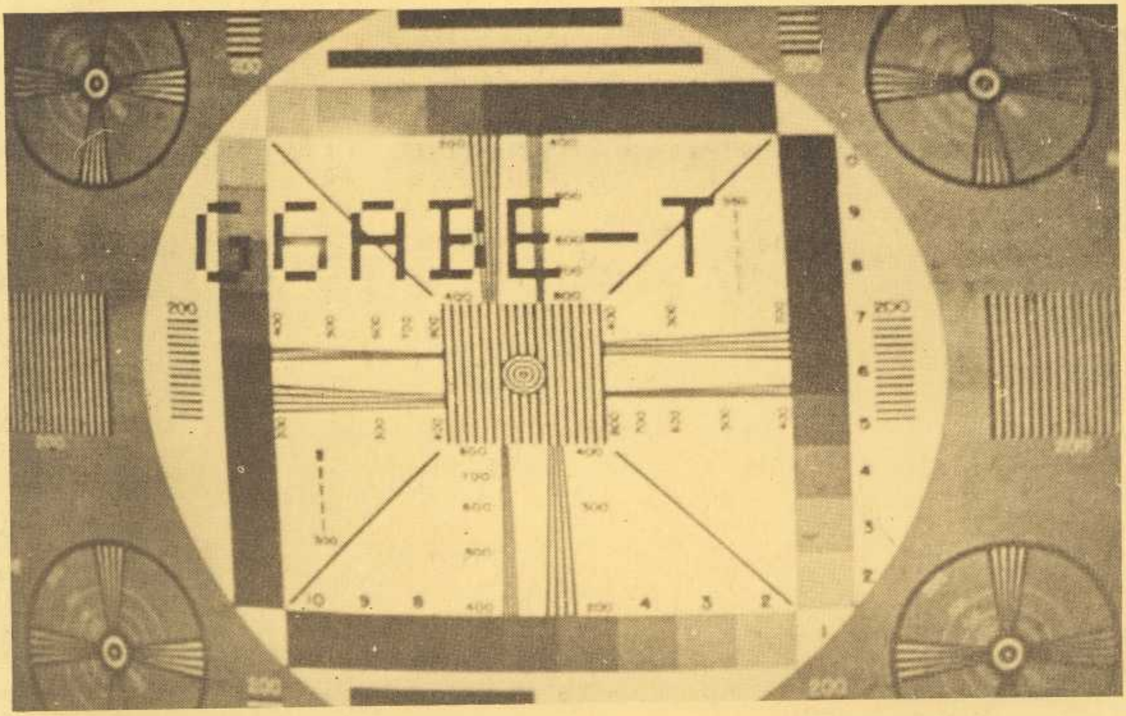

CQ TV

MAY 1971

74

THE JOURNAL OF B A T C

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EDITORIAL

May I first apologise to the half of you who received C Q - T V 73 so long after the cover date of Febuary 1971; the reason was, of course, the recent Post Office dispute. Had it started just one day later, you would have all received a copy, but.... .... !

However, if you missed the SSTV contest because of this delay, I'm sure you will be able to enter the next one instead. And to make up, we have increased the size of the magazine once again. Thanks to your support we are now able to print 30 pages, a record for C Q - T V, permitted only by the recent subscription increase. And if this rise still rankles with you (it does me!) let me justify it by saying that our postal bill alone has increased by 100% this year. Paper costs also are rising - though all thanks must go to our long-suffering printers who have worked wonders to keep prices down.

One of the most straightforward pieces of circuitry in amateur tv is power supplies - but to hear some people talk you would think one needed a Ph.D and an MIEE even to be allowed to mention the subject! Vidicon cameras which are quite splendid in design other than the three or four different batteries they need are much too common. So John Lawrence's articles on Zener diodes and power supplies should be compulsory reading for everyone. John's Circuit Notebook has been running for two years now and may one day cover every aspect of the hobby. As one of the Club's most successful /Ts, John's articles are the voice of experience and are proving extremely useful to both new and old members. Our thanks goes to GW6JGA/T for all the hard work he puts into the series.

The Call Sign Generator by Dave Lawton which is printed in this issue shows just one more of the many uses of Integrated Circuits. Since they generally became available to amateurs at a reasonable price the projects attempted by B.A.T.C. members have increased tremendously. Dare we suggest Arthur Critchley's articles have caused this? However, 'ABE/T's generator is a really great design and we hope all active /T's will head for the bench immediately - and the possibilities are endless. Who will be the first to link one to a typewriter and have a truly automated caption machine!

Finally, if you've read "Letters to the Editor" in the last few issues you will appreciate that there is quite a vitriolic 625 versus 405 battle waging at the moment. Just in case you're thinking of writing your piece - don't! The letter printed this time is definitely the LAST! And just in case you're not too sure just what 625 is, on page 27 you will find a complete specification of the standard, taken from the most recently published information.

THE EDITOR

CONTENTS

AN I.C. CHARACTER GENERATOR

Dave Lawton G6ABE-T

The unit to be described will work on both 405 and 625 line standards. Its function is the electronic generation of the amateur television callsign, such that when a composite one volt video signal is applied at the input, the output will be the original video signal plus the station callsign superimposed upon it. The unit can be constructed so that the individual letters are pluggable, so that any selected seven letters can be produced. The output produced is shown in the photographs printed below.

Construction is in Three main parts:

1) Gating Waveform Generator
2) Shift Register Output Matrixing
3) Processing Amplifier

Generation of letters

If we have a rectangle five units long by seven units high, by selecting particular units, letters may be formed. (e.g. the letter E Fig. 1a)

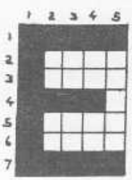


FIG ONE (A)

By having a series of rectangles each five by seven units and spaced say two units apart, by selection of units in each rectangle we can form callsigns or other combinations of letters required. (e.g. G6ABE/T Fig. 1b).

In the character generator this is achieved by the use of shift registers, one to represent the horizontal direction and one the vertical direction. The shift registers are driven from pulses derived from the television synchronising pulses, and the outputs of the shift registers are matrixed to form the letters.

The basic principal of a shift register is that, if an "ON" condition is set up at the OUTPUT ONE stage of the register, when CLOCK pulses are applied, the "ON" state will travel down the outputs such that only one output is

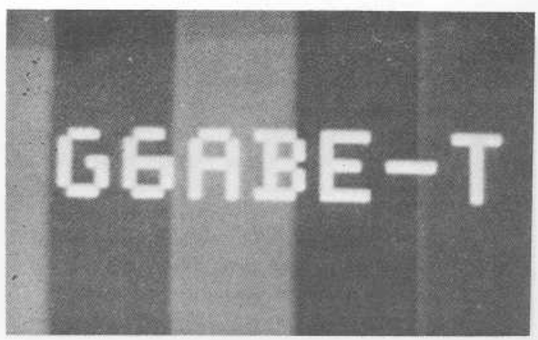
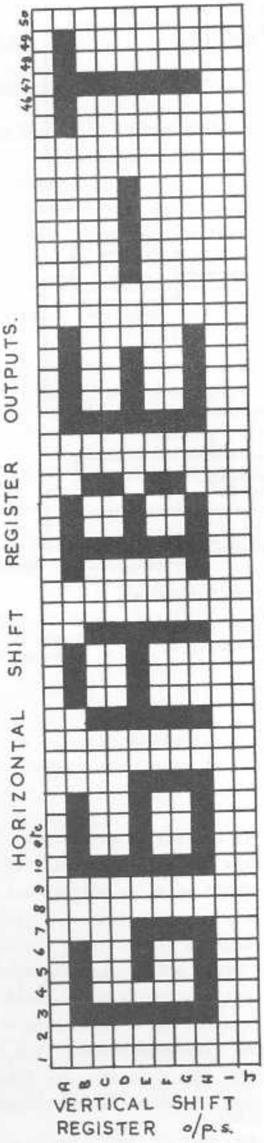


FIG ONE (B)



in the "ON" state at a time. The duration of the "ON" state at outputs, other than output one is that of the CLOCK duration.

Gating Waveform Generator

This is shown in the block diagram in Fig. 2. It is left to the individual to use what Integrated Circuits are available to them, so actaul wiring details are not shown as this will vary with Integrated Circuit types.

It is suggested to those not familiar with Integrated Circuit techniques to read the articles by A.W. Critchley in previous editions of C Q - T V. All the functions shown in the blocks of Fig. 2. have been covered in C Q - T V Nos. 71, 72 and 73 with the exception of the shift registers, these therefore will be discussed in more detail later.

Let us consider the operation of the gating waveform generator over one field. Mixed syncs from the Processing Amplifier suitably reduced in amplitudes to approx. 4-5 volts by resistor R1 at the input are fed to gate B and the Field sync sep. The resulting field pulse out of the field sync sep. is used to trigger the frame monostable and "CLEAR" the V.S.R. i.e. make the outputs of the V.S.R. go to the "O" state. At this stage "AND" gate B is in the closed state so that the Mixed Syncs are not passed by it. The period of the frame monostable is variable and this period determines the start of the inserted letters in the video waveform in the vertical direction. The trailing edge of the pulse produced by the frame monostable is used to trigger bistable "A", thus allowing gate "B" to open passing the mixed sync pulses.

The first line pulse through gate "B" triggers the line monostable and "CLEARS" the H.S.R. The period of the line monostable is also variable and determines the start of the inserted letters in the horizontal direction. At this stage we have "set" an "ON" condition in the first output of both H.S.R. and V.S.R.

GATING WAVEFORM GENERATOR.

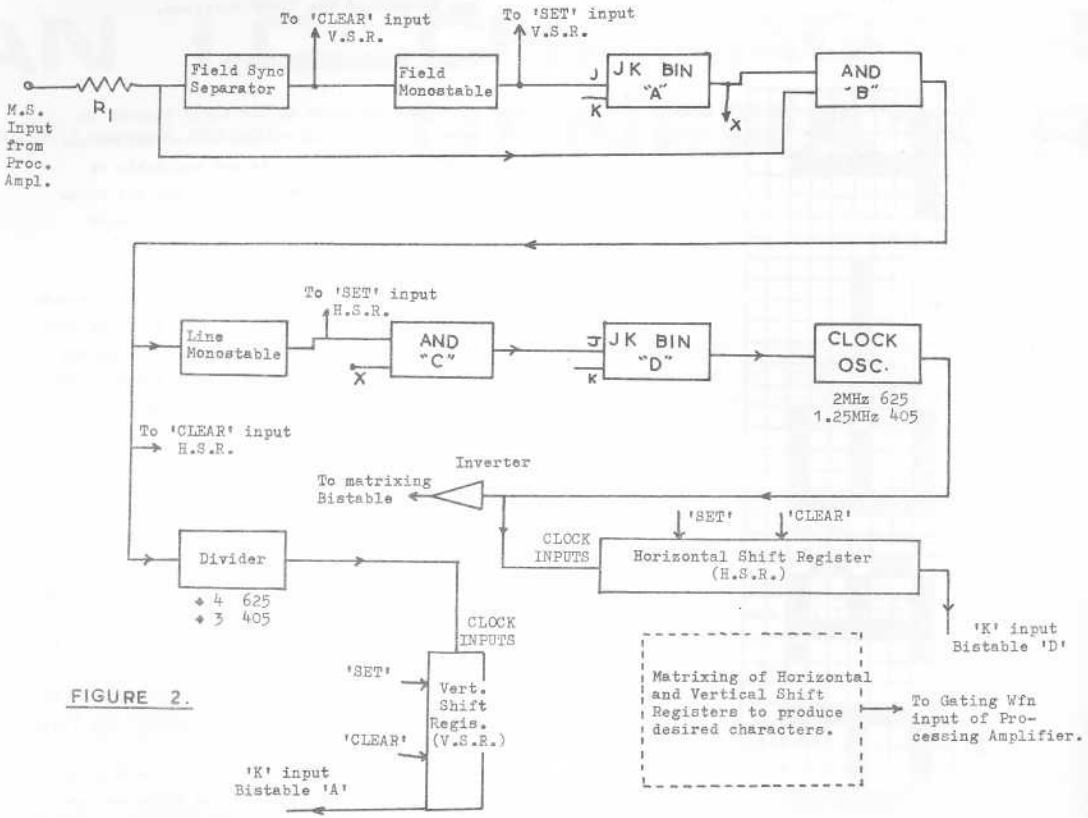


FIGURE 2.

The trailing edge of the pulse formed, triggers the J.K. bistable D which changes state and sets the oscillator into operation. The start of the oscillator controlled by this bistable ensures that the verical edges of the letters are not ragged. The oscillator "CLOCKS" the H.S.R. until the pulse "falls out" at the other end f of the register, triggering bistable D to its original state and stopping the oscillator. This procedure continues every line pulse.

The V.S.R. is clocked by pulses from the Divider, i.e. in the 625 line case every four lines. When the "SET" pulse is shifted out of the V.S.R. it resets bistable A thus closing gate B. The sequence is now complete and starts again on the next field pulse - interlace being automatic. The last line pulse which ended the sequence is not required but it will have already triggered the line monostable. This is the purpose of "AND" gate C to stop the trailing edge of the line monostable pulse triggering the bistable D.

By adjustment of monostable, oscillator and divider parameters we can alter the size of the letters and position in the video waveform. Typical values are shown below:

Oscillator	2MHz 625 lines ; 1.25MHz 405 lines (width)	
	($0.5\mu S$) ($0.8\mu S$)	
Divider	÷4 625 lines ; ÷3 405 lines (height)	
Frame Mono	Approx 2-16ms 405 and 625	
Line Mono	Approx 15-30 625; 20-40 405.	

These figures will give the total width of the letters approx half the active line time. If larger letters are desired, the oscillator frequency may be reduced and the divider count increased. By varying monostable time constants positional control of letters is achieved.

A simple equation to work out the correct Oscillator frequency and Divider ratio is shown below:

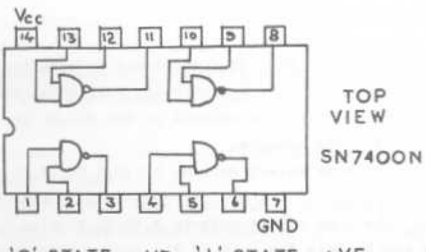
$$\frac{\text{Divider Ratio}}{\text{No. of active lines per field}} = \frac{\text{Oscillator period } (\mu s)}{\text{Active line time } (\mu s)} \times \frac{4}{3}$$

It is best to start with the Divider Ratio as this is in Whole Numbers:

e.g. 625 lines. $\frac{\text{Div. Ratio}}{300 \text{ approx.}} = \frac{\text{Osc period}}{50\mu s \text{ approx}} \times \frac{4}{3}$

$\frac{4}{300} \times 50 \times \frac{3}{4}$ = Osc period μs = $0.5\mu s$ = 2MHz

A suitable device for constructio of the monostables, oscillator, gates and field sync seperator is the Texas 7400N Quadruple two-input NAND gate.

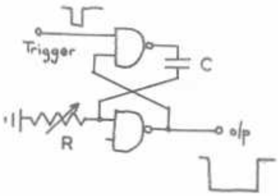


'O' STATE -VE, 'I' STATE +VE.

TRUTH TABLE - 'NAND'

I.P.	I.P.	O.P.
0	0	1
0	1	1
1	0	1
1	1	0

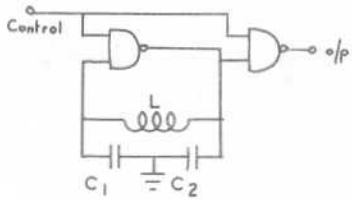
Monostable



	C	R
Line Monostable	$0.02\mu f$	390Ω in series with $1K\Omega$ pot.
Field monostable	$4\mu f$	

The values of R and C are suitable for both 405 and 625 standards.

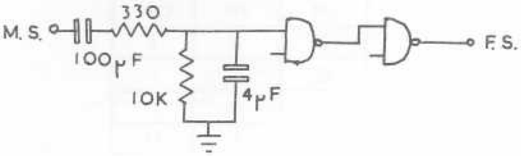
Oscillator



L :- 50T 28swg 3/8" former
C1 :- 1000pf C2 :- 470pf
Control:- +ve to start oscillator
-ve to stop oscillator.

The oscillator frequency for above components is approx 2Mc/s. Increase C1 and C2 to reduce oscillator frequency.

Field Sync Seperator



Component valves given are for 405 standard. Slight modification for 625 maybe necessary of the valves of R and C.

Shift Registers

The shift Registers were made up of Texas 7496N 5 bit shift registers. Ten in the horizontal direction for 50 bits and two in the vertical direction for 10 bits.

Vcc	+5v	'1'	Positive edge 0 - 5v
GND	0v	'0'	Negative edge 5 - 0v

All inputs operate on the positive edge except the CLEAR which requires the negative edge.

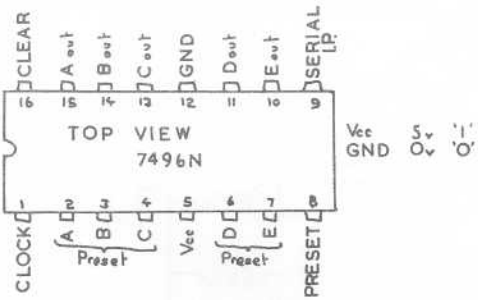


FIG. 3

Connecting registers together to form a multi-bit shift register is as follows:

First stage i.e. where we require to write an '1' state in at output one.
Connect preset inputs B,C,D,E to 0v line
Connect serial inputs to 0v line
+ve on preset input A to write in '1' state
Leave preset open circuit.
Connect output E to next Integrated Circuit Serial input.

Other stages

Leave all preset inputs A-E open circuit
Connect Preset input to 0v line
Output E of previous stage to serial input
Output E to next serial stage

Parallel the CLOCK inputs of all stages
Parallel the CLEAR inputs of all stages.

Shift Register Matrixing

To obtian letters we must select the required information from the outputs of the Horizontal and Vertical shift registers.

NOTE

We do not use the first and last outputs as they do not have the correct pulse widths, this is because of the method used to'set' into the registers and resetting of the bistables.

Basically, what we have produced at the outputof the shift register, is a scanning system. That is to say, if we combine the Horizontal and Vertical information we obtain a pulse travelling along line A outputs one to fifty then line B outputs one to fifty and so on (in practice, we scan each line a number of times - four times on 625 and three times on 405). If we made use of all the information presented by both shift registers all we would produce is a rectangle 50 bits by 7 bits.

In fact this is the same principle as employed by a flying Spot Scanner but using Shift Registers instead of a C.R.T. In the case of a F.S.S. we select the information we require by blocking off the light we do not want with a slide. In our case we select information by using only some of the Horizontal Shift Register outputs.

Consider Fig. 1b.; to obtain information along the length of a particular horizontal line we can 'OR' gate the outputs of the H.S.R. we require. For example:
For Line B we select outputs 3,4,5,6,10,11,12, 13,18,19,20 etc.
For Line C we select outputs 3,10,17,21 etc.
We can do this for each of the seven horizontal

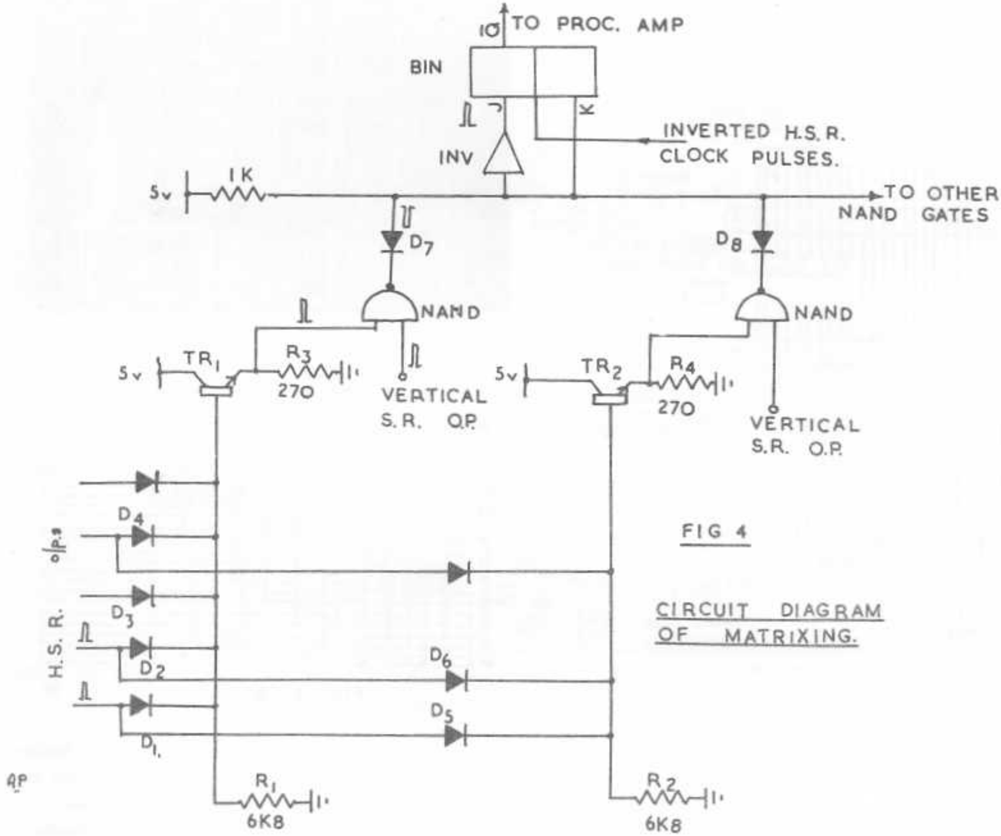


FIG 4

CIRCUIT DIAGRAM OF MATRIXING.

lines. To form our scanning system we want to distinguish between the seven horizontal lines. This is achieved by 'AND' gating each of the vertical shift register outputs B to H with their respective 'OR' gate. Finally, we can 'OR' gate together the outputs of the seven 'AND' gates.

To make up the desired letters all that has to be done is to select the required H.S.R. outputs and 'OR' gate them, doing this for each of the seven horizontal lines.

The actual circuitry of the matrixing is shown in Fig. 4.

D1,D2,D3,D4,R1 form one H.S.R. 'OR' gate }
D5,D6,R2 form another H.S.R. 'OR' gate } Diodes selected as required

TR1,TR2 etc are emitter followers.

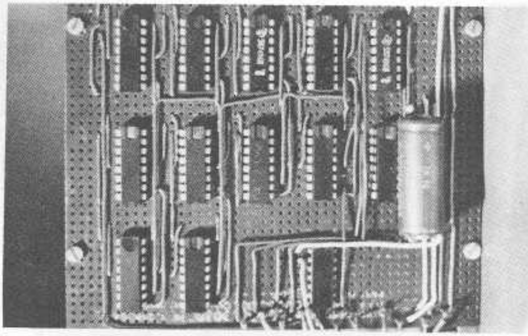
The NAND gates combine the H.S.R. 'OR' gates with their respective Vertical Shift Register output.

D7,D8,R5 form the 'OR' gate combining the NAND gate outputs.

NOTE there are a total of seven H.S.R. 'OR' gates and seven NAND gates.

The diodes for the H.S.R. 'OR' gates are selected to give the desired letters.

The waveform at the final 'OR' gate is of a very poor shape due to the capacitance effects of the divides used. To overcome this the **Bistable** is used as shown. The stroke input (or clocking input) is obtained from the Oscillator output which feeds the H.S.R. CLOCK (Fig.



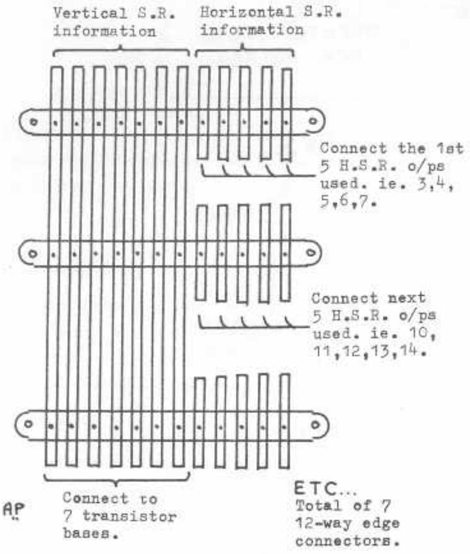


FIG 5 (A)

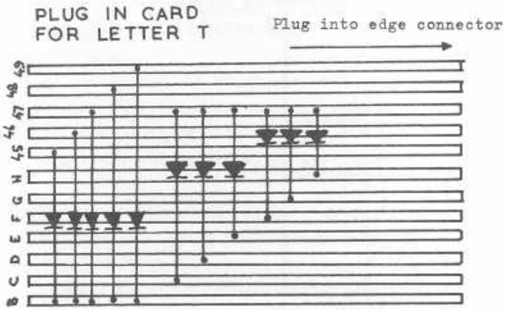


FIG 5 (B)

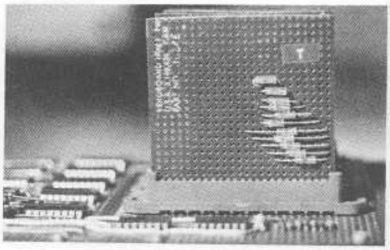
2) but an inverted version. The $\bar{Q}$ output of the Bistable is used to switch the base of TRIO is the Proc. Amp.

The letters are constructed so that they can be pluggable, Fig. 5a illustrates this, Veroboard 0.1 size being used. Edge connectors (12 way) are mounted on the veroboard so that seven of the rails are common to all seven connectors, the remaining five pins of each co connector being seperate. The seven common rails are connected to the bases of the transistors as shown in Fig. 4 - these rails form the output lines of the H.S.R. outputs 'OR' gates. The Horizontal Shift Register outputs are connected to the remaining five pins of the connector in sequence.

i.e. outputs 3,4,5,6,7, to edge connector one pins 8-12 respt.
10,11,12,13,14, to edge connector two pins 8-12 respt.
17,18,19,20,21, to edge connector three pins 8-12 respt.

Remember to miss out two outputs every five, this gives the spacing between letters.

The diodes which are used to select Horizontal Shift Register outputs can be mounted on a piece of Veroboard to plug into the edge connector (Fig. 5b). The letter T is illustrated in this case. It is essential to use high quality edge connectors as any contact resistance produced by poor sockets will lead to loss of information.



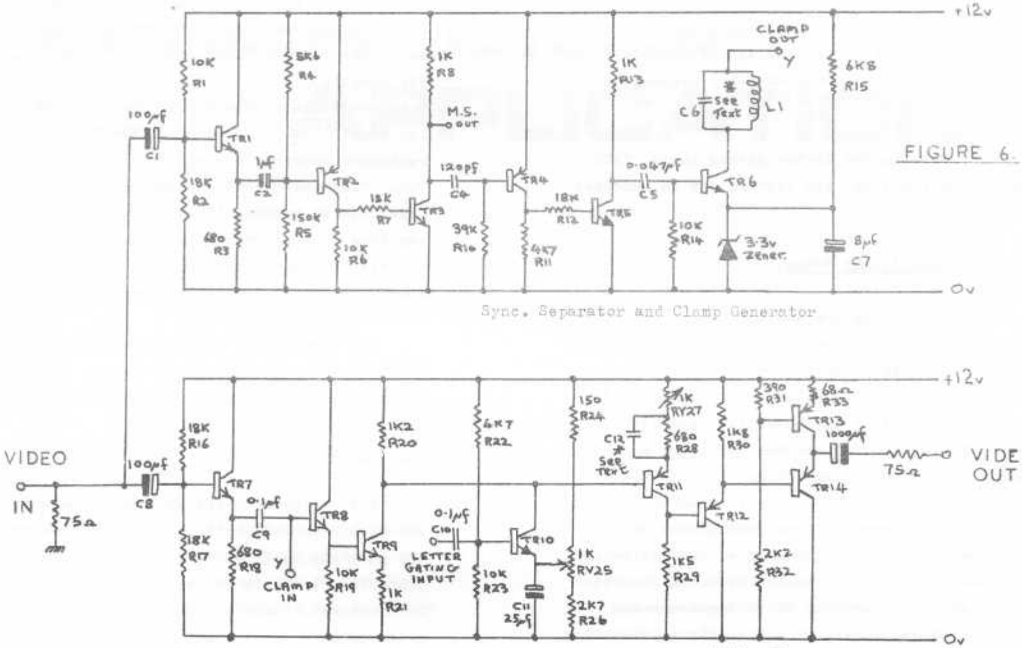


FIGURE 6.

Sync. Separator and Clamp Generator

Video Processor

TR1, TR3, TR5, TR7, TR8, TR9, TR10: 2N706 or BC107 (Silicon NPN)
TR2, TR4, TR11, TR12: 2N3702 (Silicon PNP)
TR13, TR14: 2N1131 or 2N2904 (Silicon PNP)
TR6 : OC139 or OC140

The Processing Amplifier

This is shown in Fig. 6. A standard one volt video signal is applied to TR1 and TR7 via C1 and C8, the input being terminated in 75Ω . TR2 and TR3 form a sync separator and the mixed syncs at TR3 collector are fed to the gating waveform generator.

TR4, TR5 and TR6 form the clamp pulse generator, C4 and R10 setting the clamp pulse width. C6 and L1 in the collector of TR6 are tuned to subcarrier frequency to provide a high impedance at that frequency so that the Burst in the video waveform back porch is not affected by clamping. The clamping potential is set by the Zener diode. C6 and L1 may be omitted if a monochrome video source is used, TR6 collector being connected directly to TR8 base.

The video signal being clamped at TR8 base is inverted by TR9 so that peak white is negative-going at TR9 collector. When pulses of approximately four volts positive-going are applied to TR10 base, TR10 turns on bringing the collector of TR10 to approximately the potential as set by RV25; thus the letters are added to the video signal and can be set between black level and peak white by adjustment of RV25. The signal is inverted again by TR11, RV27 is set to give one volt at the output when terminated in 75Ω . C12 is chosen to give the correct Chromiance/Luminance response at the output and in the writers case was found to be 39pf.

TR12, TR13 and TR14 form the output stage. A simpler one transistor output stage could be used of colour operation were not required.

If the character generator were to be used as a video source providing the callsign only, this may be done by feeding the video input with station mixed syncs suitably reduced to 0.3 volts.

By feeding the letter gating input, TR10 base, via a switch, the letters may be switched on or off.

Some Constructional Notes.

Supply decoupling has not been shown, but it will be found necessary on all the supply rails. Good earthing between different parts of the circuit is required also. Failure of either will result in instability and also the appearance of shift register switching spikes on the output video waveform.

The unit was built on four pieces of 0.1 Veroboard, one board for each of the following: Processing Amplifier, Gating Waveform Generator (less shift registers), Shift Registers and finally, Edge Connectors and matrixing circuitry. Each piece of Veroboard measured 12 cms. x 9.5cms.

It will be found necessary to use "Power" gates (Buffer gates) to feed the CLOCK and CLEAR inputs to the Horizontal Shift Register as the "FAN" out of a standard gate is not sufficient.

The Gating Waveform Generator is shown in block diagram form only. It is important to observe the correct logic levels between stages. For example, let us say the pulse out of the Frame monostable is positive-going on its leading edge. The "SET" input of the vertical shift registers requires a positive edge so this is O.K. Also the Bistable requires a positive edge, but we require it to trigger on the trailing edge of the monostable output pulse. Hence we have to include an inverter before the bistable to ensure the correct logic.

The 7496N Shift registers described are T.T.L. devices throughout the Gating Waveform Generator, although it is possible to combine R.T.L. and D.T.L. with T.T.L.

Conclusion

Two of these Character Generators have so far been successfully constructed. Although the unit was designed to produce only seven characters there is no reason why this cannot be increased. More horizontal shift register bits for more letters and more vertical shift register bits for more lines - complexity of wiring being the limiting factor. If one were going to construct more than one row of letters it would be found necessary to buffer the Horizontal Shift register outputs due to the increasing loading.

IN THE NEXT CQ-TV

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ZENER DIODE APPLICATIONS

CIRCUIT NOTEBOOK No. 8

JOHN LAWRENCE
GW6JGA-T

All the circuits shown in the first part of this article, in C Q - T V 73, were for 18 volts D.C. input and 12 volts output, but other voltages may be obtained by scaling the input voltage and the Zener diode voltage, in the case of the simple regulator, or the input voltage and the resistor chain in the amplifier type of circuits.

These simple power supplies are quite adequate for most purposes, but for more exacting requirements there are, on the market, many Integrated Circuit regulators, having excellent performance, available around £2 - £4, together with an abundance of application information.

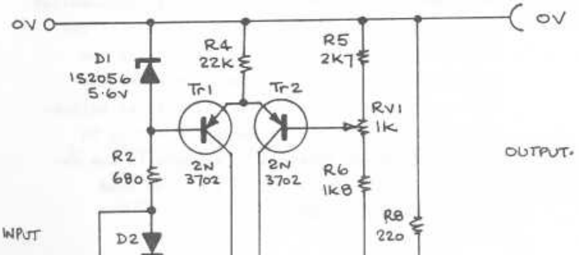


FIG. 11

For some applications only a very small voltage drop across the regulator can be tolerated. Fig. 11 shows a circuit for a regulator having an output of 10 volts at 1 amp from an input of 11 - 13.5 volts. An application for this circuit is in the power supply of a Vidicon Camera for portable use from a 12 volt accumulator. In this circuit the Zener diode is fed from the stabilised output through D2 and R2. Normally this would cause the regulator to be non-selfstarting. R1 is included so that on switching on, the current through it will cause D1 to conduct and the circuit to operate. As soon as output voltage is present, the current for D1 is available through D2.

A 12 volt input, stabilised, high voltage supply is shown in Fig. 12. This has an output of 150 volts at 100mA suitable for supplying a grid modulator in a portable /T transmitter. A standard invertor circuit provides the H.T. voltage and a fraction of the output is compared with a Zener reference voltage by the long-tailed pair, Tr1 and Tr2. The output from Tr2 drives Tr3 and Tr4, which operate as a series element, maintaining the required input current to the invertor to provide the correct H.T. output.

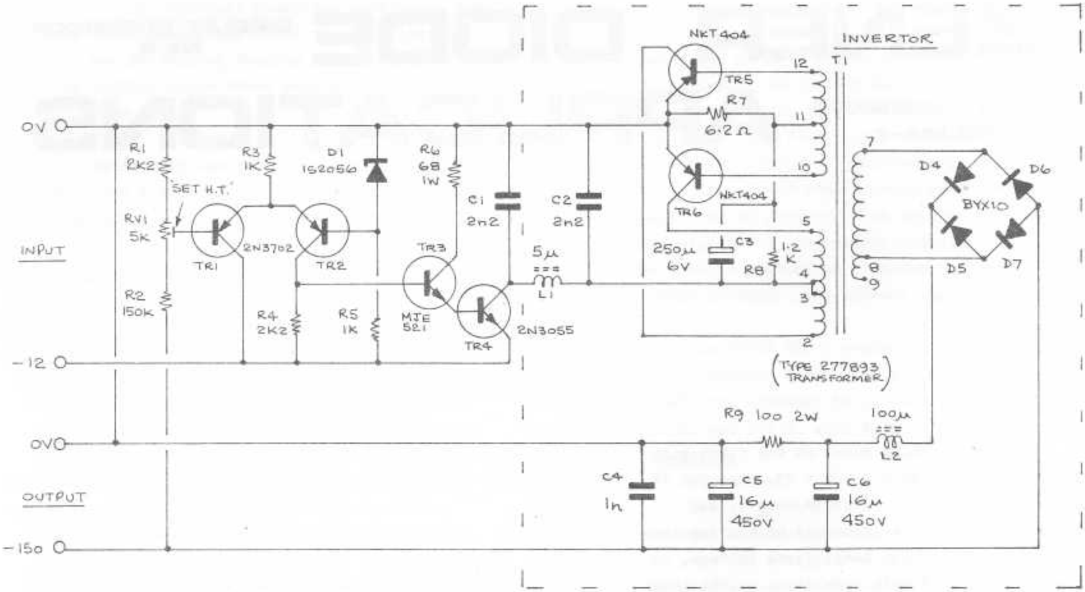


FIG 12

A stabilised E.H.T. supply, suitable for feeding a photomultiplier tube, is shown in Fig. 13. A reference voltage is provided by the Zener diode D5. The power for this is derived from a voltage doubling rectifer circuit, C5, D7, and D8, fed from one of the 6.3 volt windings on the mains transformer.

The current through RV1 and R9 is compared at the input to Tr2, with that through R10, R11 and R12. Any error signal is amplified by Tr2 and Tr1 and passed to V2 grid. V1 and V2 form the series regulator and are "beanstalked" so that the maximum voltage rating of each valve is not exceeded.

The circuits described so far have been voltage stabilisers. A zener diode can be used as the reference element in a current stabiliser circuit. A typical circuit is shown in Fi.g 14. This is a focus current regulator for the focus coil in a Vidicon Camera. The current through the coil is sampled by R6. The voltage across R6 is compared, in Tr1, with a fraction of the Zener stabilised voltage provided by D1, R1 and RV1. D2 is included for temperature compensation having a characteristic similar to that of the emitter-base diode of Tr1. C2 decouples the focus coil and D3 is a catcher diode for the back e.m.f. generated across the coil at switch-off. The current can be varied by RV1 up to 100mA and is not affected by changes in the resistance of the coil. Coils up to 65 ohms resistance may be used.

References

1. "Mullard Voltage Regulator (Zener) Diodes". Booklet . Free.
   Mullard Ltd. Industrial Markets Division, Mullard House, Torrington Place, London, W.C.1.

2. "Silicon Voltage Regulator Zener Diodes" Application Report D6. Free.
   Texas Instruments Ltd., Manton House, Bedford.

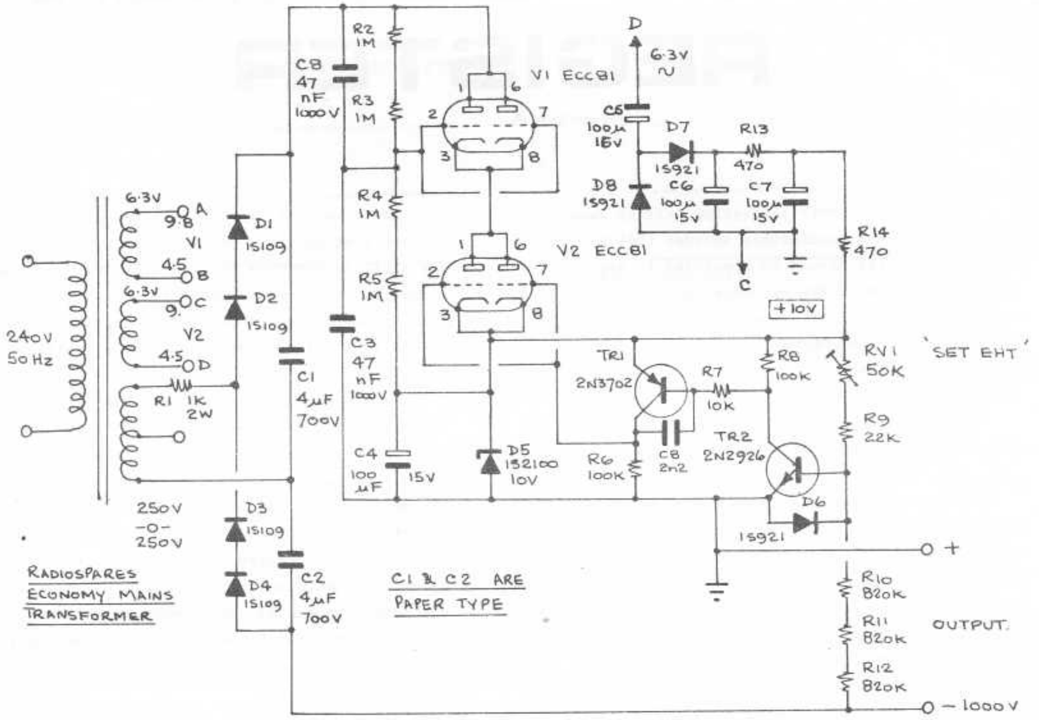


FIG 13 PHOTOMULTIPLIER E.H.T. SUPPLY

3. "Ferranti E-Line Transistor Applications" Handbook. Free.
Ferranti Ltd, Gem Hill, Chadderton, Oldham, Lancs.

4. "Power Supply Circuits" Handbook. 50p.
Tektronix U.K. Ltd, Station Approach, Harpenden, Herts.

5. "Voltage Regulators" Application Report,
National Semiconductor Corpn.
Athena Semiconductor Mktg. Co.
140 High St. Egham, Surrey. Free.

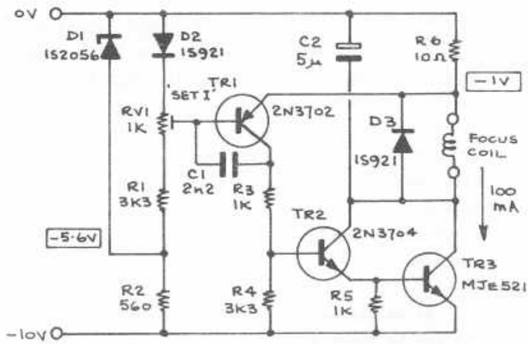


FIG 14 FOCUS CURRENT REGULATOR

B.A.T.C. EQUIPMENT REGISTER

At the Club committee meeting held in December 1970 it was unanimously decided that a new Club Official should be appointed to try and help coordinate the exchange and supply of surplus equipment, including that coming from TV studios and manufacturers as well as from members themselves.

This is a new service offered by the Club, included in the membership subscription.

On the opposite page you will find a two-part form which we hope you will find time to fill in. The top half is for equipment that members are searching for whilst the lower part is for equipment you may have but want to get rid of. We hope to be able to enlist the co-operation of the large companies who have surplus equipment, and file these into the system as well. We must all be well aware of the opportunities in the past which have been lost due to lack of coordination and contacts in the right place.

Enquiries as to an estimate for the cost of a certain piece of equipment would be welcomed either in writing or by telephone in the evening. It must be pointed out that equipment cannot be stored or collected by the Club; but items which have to be handled by the Registry will be forwarded by rail at members own risk on receipt of the necessary charge, details of which will be supplied at the appropriate time.
N.B. Remember that items such as S.P.G.s, monitors etc. with a large number of valves carry a 50% excess charge by reason of their glass content.

If we can satisfy your requirements by putting you in touch with the owner of the equipment you need, please inform us of this so that the interchange can be deleted from the records.

Don't worry if your request seems to be for the most unlikely piece of equipment; it may still be possible to find it. Perhaps from a company, or from the fantastic hoards that some amateurs have stored away somewhere thinking that no one will ever want their "rubbish".

As was explained in a loose-leaf sheet enclosed with C Q - T V No. 73, large quantities of equipment have been available from broadcasting authorities due to the changeover from monochrome to colour transmissions. A lot of this has ended up in the scrapheap, or reduced to scrap metal by dealers, because no coordinated effort was made to acquire it for amateurs, who would, generally, have been delighted to use it. The B.A.T.C. Registry, wull, we hope, go a long way towards altering this state of affairs.

In conclusion, this is a service in surplus equipment and does not alter the fact that yokes, lens mounts, tubes, badges etc are still available in the usual way from the Club Sales Officer, Mr. Grant Dixon, who advertises in C Q - T V every quarter. Please continue to use this service.

We shall be pleased to have your criticisms of this new system, which we hope will fill a gap and help benefit amateur tv enthusiasts everywhere.

Send your form, and any other enquiries, to:-

B.A.T.C. Equipment Registry
A. R. Watson
Somerby View
Bigby
Barnetby, Lincs.
Tel 06526-2287

B.A.T.C. EQUIPMENT REGISTER

MEMBER'S REQUIREMENTS

Name ______________ Address ______________

Call Sign ______________ ______________

Tel. No ______________ ______________

Please insert the following requirements in the Club Equipment Register:-

I agree to pay 10% of the purchase price to B.A.T.C. Registry (not applicable unless equipment is purchased from the Registry)

MEMBER'S SURPLUS EQUIPMENT

Name ______________ Address ______________

Call Sign ______________ ______________

Tel. No ______________ ______________

Please insert the following equipment, which is surplus to my requirements, in the Club Equipment Registry:-

Cut here (Give details of Model No., Make, Size and Weight where necessary, and give price required)

Letter from Poland

Lech Domasik SP7BLZ

I would like to take this opportunity of describing the way in which the Łódź Amateur Television Group arose. After a long depression in the development of VHF, activity started in 1967 with groups working from Lodz, one of which was mine. We learnt all about the new VHF techniques and were able to get in touch with other nearby amateurs on the 144MHz VHF waveband. We found our own capabilities and were able to organise groups working together, each with a definite function, depending on what they were able to do well.

It fell to me to choose and adapt a system, and to be a Technical Consultant when the system got under way. It also became my lot to aquire equipment which was difficult to obtain. I was given this job because of my interests and work; I am an electronic engineer at the Lodz Polytechnic, and before that I worked at the Institute of Electronic Technology. Hence I had easy access to technical literature, and the more difficult to obtain equipment, as well as such measuring equipment as oscilloscopes and generators.

At the beginning my group spent their time building apparatus for the 144MHz waveband (Transmitters and receivers) and later, having gained the best possible results under prevailing conditions, considering which of the new VHF techniques we should concentrate on, such as moon bouncer, E.M.E., television etc. Since it seemed easiest and cheapest to attain even the most modest results in the field of television, we decided that to begin with we would occupy ourselves thus: not giving up the other ideas, of course, but continuing to gather information about them.

However, plans are one thing; being able to carry them out is another! I shall write about how we managed to aquire all the bits of equipment to build our apparatus. Of course, the first source of supply is shops, but unfortunately you cannot always get the necessary parts this way- especially the more unusual ones. It is sometimes possible to aquire them with the help of clubs, or from various institutes or factories which supply clubs with slightly imperfect parts, the clubs in their turn supplying members. In this way it is possible to get vidicons, klystrons, quartz crystals etc at very low prices.

But it is much more difficult getting ready made equipment. Our greatest source of recievers, and parts for building transmitters is army surplus supplies.

It is rather difficult to describe in any length the equipment in our amateur tv station. It consists of one camera, as the rest is still in the process of being built!

The camera has been used as part of a telecine chain, where its performance, using a 7735A vidicon, was found to be as follows:

Marconi 16mm test film, still frame;

Horizontal definition		650 lines
corners	500	520
	550	550

Amplitude of 400 lines, compared with 100 lines

a) maximum A.K. - 2.9dB

b) minimum A.K. - 16dB

Gradation 5/5

Signal/noise ratio (measured on a grey scale)

a) no A.K. 41.6dB

b) Correct A.K. setting 34.0dB

c) Maximum A.K. 30.0dB

Reflections NIL

Streaking NIL

SMPTE 16mm test film, projector running.

Horizontal definition 550 lines

corners 400 lines

Low Frequency movement 10% at 50Hz

Streaking NIL

Black level stability correct

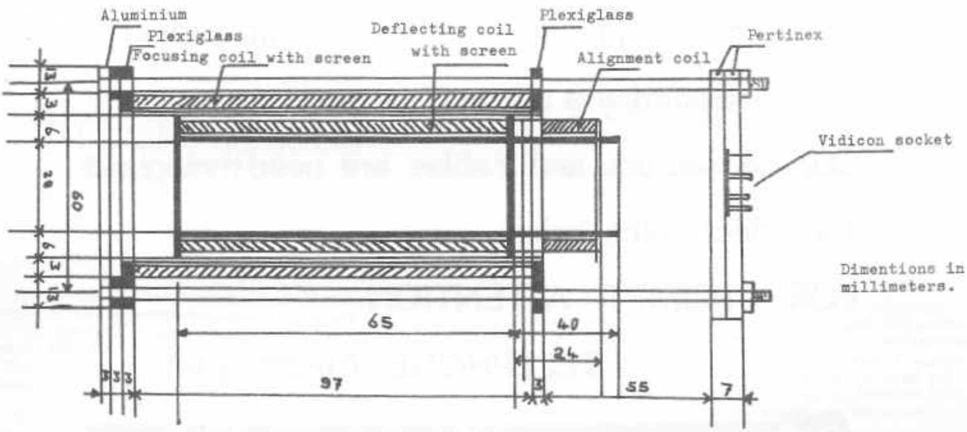
Crosshatch test

a) Vertical distortion(%)	+2	0	+1
	+1.5	0	+1
	+1	+1	0
b) Horizontal distortion(%)	-0.5	+0.5	+1.5
	-1	0	+1.5
	-2	+0.5	+1

These tests were naturaally, carried out with professional instruments, but I think they would be possible, with care, by the amateur. I enclose also a sketch of the focus and scanning coils which we use. These have 2 x 74 turns for line deflection and 2 x 500 for frame, with a focussing coil of 2200 turns. (EDITORS NOTE: SP7BLZ also sent us a block diagram of his camera, together with some cct. diagrams; we regret that lack of space prevents printing these.)

I hope the information above, which enlarges upon an article I wrote in the "Proceedings of the ATA" (published in Belgium), will be of interest to amateur television workers in Britain, and may provide a stimulus to more international contact in this field.

Lech Domasik SP7BLZ
Łódź, POLAND.



VIDICON YOKE BY SP7BLZ

INTEGRATED CIRCUITS

PART 4.

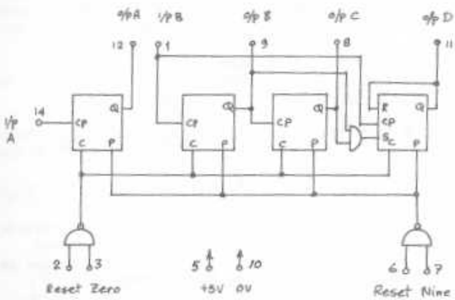
A.CRITCHLEY Dip El; C Eng; MIERE.

Using T.T.L. Digital Integrated Circuits for T.V. Pulse Generation Circuits

The previous part of this series showed mainly how to use T.T.L. bistable I.C.'s for counters. In this part, other more specialised types of I.C.'s are described, which can simplify many forms of circuit.

The Decade Counter 7490N

Fig 1 Decade Counter SN7490N



The decade counter contains four bistables arranged as two separate counters of two and five, but having a common reset system. An internal AND-gate changes the basic count of the three bistables B,C and D from 8 to 5 by omitting the counts of 6,7 and 8.

If the A bistable output pin 12 is joined to the B bistable input pin 1 then we have a ripple counter of 10.

The truth table of this system is as follows:

Table 1.

Count	A	B	C	D	
0	0	0	0	0	
1	1	0	0	0	
2	0	1	0	0	
3	1	1	0	0	
4	0	0	1	0	
5	1	0	1	0	
6	0	1	1	0	
7	1	1	1	0	
8	0	0	0	1	
9	1	0	0	1	← Reset 9
10	0	0	0	0	← Reset 0

It will be seen that this is a straight forward binary count up to 10.

The two reset gates give a means of resetting this count to either 9 or 0.

Both of these reset inputs have two inputs forming a NAND-gate. Therefore, both inputs (e.g. pins 2 & 3) must be taken high in order to reset the counter. But either pin 2 or pin 3 taken low will enable the count to proceed.

This, therefore is a resettable counter of 10, but it is possible, by using the other resetting inputs to change this count of 10 to some other count less than 10 which is more useful for T.V. work.

Most of the counters shown in standard textbooks employ additional gates in order to miss out parts of the counting cycle,but here we have a multi-stage counter with a two input NAND-gate unused - can it be put to use? The answer is yes, if we miss out one input pulse more than we require, because this reset is to 9 which is one less than the normal reset zero.
Therefore if we wished to count by 5, we should reset on the 4th pulse to the 9 state.

The truth table would be:-

Table 2.	A	B	C	D	
Count 0	0	0	0	0	
1	1	0	0	0	
2	0	1	0	0	
3	1	0	0	0	
4	0	0	1	0	detect this state and
5(9)	1	0	0	1	go to this state
0	0	0	0	0	

To detect the 4th state is easily done by joining the C bistable output to the reset 9 input(s).

The pulse at C for the 4th count occurs for only some 50nS since this pulse changes the states of the 9th count immediately it occurs.

The D output has a 4 to 1 pulse which could be useful. Now, the Reset 9 input has two inputs, so different counts are possible by ringing the changes on these two inputs between the four outputs.

The following tables show many of the counts that can be obtained by this means.

Table 3.	Pin	Pin	Earth	Open	8	9	11	12
Pins 2 & 3	6-8	7 to	÷ 10	÷ 5	÷5	÷7	÷9	÷6
to earth	6-9	"	÷ 10	÷ 3	÷7	÷3	÷10	÷4
i/p to 14	6-11	"	÷ 10	Nil	÷9	÷10	Nil	Nil
Pin 12 to 1	6-12	"	÷ 10	Nil	÷6	÷4	Nil	Nil
Output 11								

i.e. from ÷3 to ÷10 except ÷8

All outputs are of a Single positive pulse except for ÷10 and are from pin 11.

Table 4.	Pin	Pin	Earth	Open	8	9	11	12
Pins 6&7 to Earth	2-8	3 to	÷ 10	-	-	-	-	-
i/p to 14	2-9	"	÷ 10	-	*	-	÷10	-
12 to 1	2-11	"	÷ 10	-	-	÷10	-	÷ 9
Output 11	2-12	"	÷ 10	-	-	-	÷9	-

* Although outputs are normally from pin 11, other output pins may provide an output when pin 11 does not, e.g. this one gives ÷6 from pin 8.

Table 5.	Pin	Pin	Earth	Open	8	9	11	12
Pins 2&3 to Earth	6-8	7 to	÷ 10	÷ 3	÷3	÷4	÷5	÷8
Input to 1	6-9	"	÷ 10	÷ 2	÷4	÷2	÷10	÷7
11 to 14	6-11	"	÷ 10	High	÷5	÷10	High	High
Output 12	6-12	"	÷ 10	High	÷8	÷7	High	High

i.e. ÷2 to ÷10 except ÷6 & ÷9. Outputs ÷2 to ÷5 are a Single positive pulse; ÷7, 8 & 10, are low for the first 5 pulses.

Table 6.	Pin	Pin	Earth	Open	8	9	11	12
Pins 6&7 to earth	2-8	3 to	÷ 10	Low	Low	Low	Low	÷ 7
i/p to 1	2-9	"	÷ 10	Low	Low	Low	÷10	÷ 6
11 to 14	2-11	"	÷ 10	Low	Low	÷10	Low	÷ 9
output 12	2-12	"	÷ 10	Low	÷ 7	÷6	÷9	Low

outputs are as for table 3, ÷6 being a single pulse and ÷9 having the first 5 low.

Note: In all these possibilities, the other 3 outputs may have waveforms, or spikes on them - try it and see!

This SN7490N is therefore seen to be a most useful counter. However, if it is used as two independent counters it should be remembered that the reset inputs will reset both parts.

There are two other similar counters, SN7492N ÷12 and SN7493 ÷ 16, but neither of these has the Reset nine - input and therefore neither can be made to change count without extra gates unless the reset zero facility on Pins 2 & 3 is dispensed with.

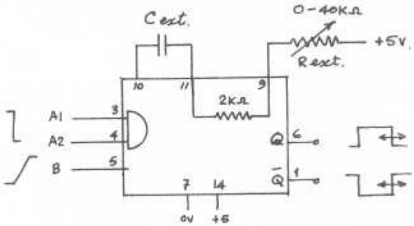
In fact, for most SPG counters, there is no need for a reset input as the counter just counts away by itself.

However, it may be desirable in some cases, but if not, then any of these 3 counters will give similar results for counts of less than 10 with feedback to the reset 0 inputs, as in tables 4 & 6.

It is possible to use a diode AND-gate in order to accept 3 outputs for feedback to get a count of 8, but there is normally no great use for ÷8 in SPG's. **However the S.P.G. described in C Q - T V 75 uses this method for 405 line generation.**

The SN74121N Monostable

Fig. 2. Monostable SN74121N



The basic monostable described in the previous parts suffers from poor voltage and temperature stability. In fact the voltage stability factor is some 30% delay change per volt of supply.

A compensated monostable has been made in the form of the SN74121N which has some other features as well.

No internal circuit diagrams are generally available for this device so a description will have to suffice.

There are two inputs A and B. A consists of two inputs to a NAND-gate whilst the B input is a schmitt trigger input - of which more later. The monostable is an edge-triggered device which implies that the input pulse can have any length - longer than some 50nS.

Either polarity of pulse can be used as a trigger. Negative going edges will trigger the monostable from either pin 3 or pin 4 (A input) - or both. Although the A inputs are both to a NAND-gate - the logic is negative - so the function is that of OR - or in other words,either will trigger the monostable, but the gate cannot be used as a NAND-gate for positive pulses.

The B input has a 'snap' action caused by internal positive feedback such that the input voltage in rising bove 1.5V, or so, triggers the monostable. This voltage level must be reached in order to start the triggering, but the rise time of the pulse is not critical, it can in fact be a slowly rising D.C. of some 1 volt per second.

There are thus two ways to drive this monostable.

1. A negative-going fast edge to pin 3(or 4, or both).

2. A positive-going edge, fast or slow, to pin 5 - in which case pin 3 or 4 must be earthed.

The delay time, of the monostable, if pin 9 is taken to +5V is about 30nS. by using stray capacity for the timing capacitor. Provision is, however, made for external capacity to be added - up to 1000μF or so - giving up to 40 seconds. Variable control is possible by adding up to 40k ohms in the pin 9 feed of +5V.

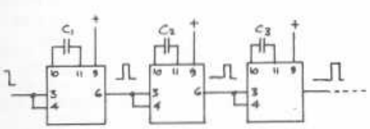
Pin 9 is a connection to an internal 2K ohm resistance which goes to the pin 11 end of the timing capacitor. The delay can be extended by the ratio of $\frac{\text{R ext + 2K ohms}}{\text{2K ohms}}$ to the delay with zero external resistance - but 40 seconds is still a practical maximum although longer delays are possible with jitter.

The external timing resistance can of course be connected directly to pin 11, but a maximum value of 1.4K ohms should be included to prevent danger to the I.C. input. The reason for doing this is that temperature stability, already good, is further improved.

The delay with external resistance zero and pin 9 to +5V is approximately 1.3mS/μF,

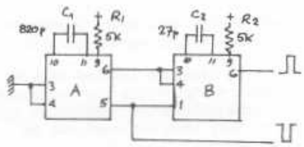
The final feature is that of both Q & $\overline{Q}$ outputs. All together, then, the SN74121N is a very useful device.

Fig 3. Cascading Monostables



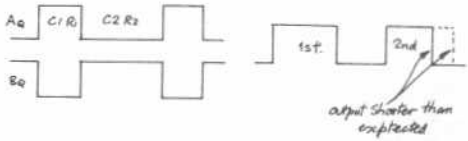
These Monostables can be cascaded quite simply by joining Q, pin 6, to pins 3 and 4 - leaving pin 5 open. They can also be connected in a cross-coupled arrangement like a multivibrator. Both Q outputs could be used but trouble would occur in starting since a pulse-edge is required and none is present unless introduced externally.

Fig 4. Cross-coupled Monostables



However, if one feed is $\overline{Q}$ to pin 5, then the chances of starting are increased. Since $\overline{Q}$ goes normally high and triggers the other monostable's schmitt input. The outputs have a total period of the sum of the two periods and various propagation delays.

Fig.5. Cross-Coupled Outputs. Fig.6. Retriggering



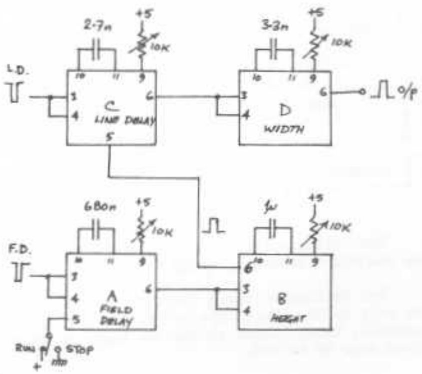
The retriggering of the SN74121N Monostable sooner than 100% of the delay time after the delay has finished may cause shortening of the second and subsequent cycles.

This means that the cross-coupled system gives a higher frequency than expected and is not so stable as it could be.

However, such an arrangement could be used as a grill generator oscillator and the timing values given provide for about 16 vertical lines on 625.

A simple rectangle, or window, generator can be constructed from four of these monostables.

Fig. 7 Rectangle, or Window Generator

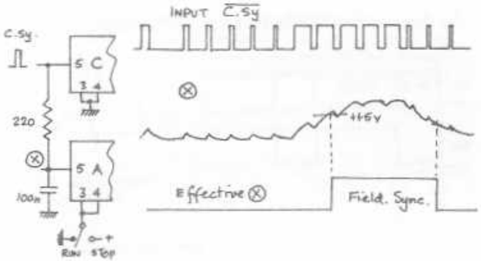


Monostable A delays the field drive pulses to define the top of the rectangle. The height is set by monostable B. The line delay is provided by monostable C and the width by monostable D.

If the connecting link was omitted then an AND-gate would be required to obtain the rectangle from B & D, but the link allows the horizontal signal to be produced only when vertical one is present ($\bar{Q}$ is low to pin 5).

This generator can be run from Sync if the Schmitt input of A is employed as a Field Sync Separator.

Fig 8. Using C.Sy. as Drive.



The Dual, 4 input Schmitt trigger NAND-gate SN7413N

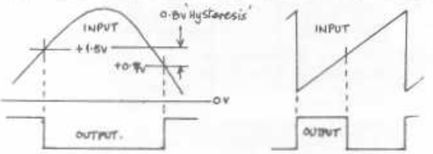
This leads on to another useful device, the Dual Schmitt-trigger SN7413N.

Basically, this is the same as a SN7420N dual 4 input NAND-gate and it will plug in the same base and work happily as a replacement for it.

But it has each of the 4 inputs arranged to give schmitt-trigger action, so that slowly rising voltages can initiate the output change.

Once again, no circuitry is available, but the basic effect will be described instead.

Fig 9. Schmitt Operation Fig 10 Sawtooth input.



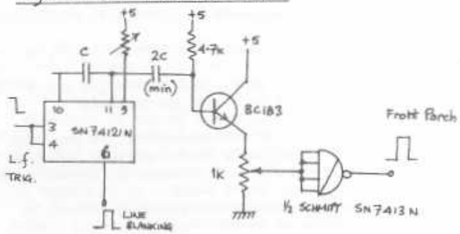
For rising voltages the threshold is +1.5V, where the output suddenly drops from high to low.

For falling voltages the threshold is different it is only +0.7V. This 'hysteresis' of 0.8V causes no trouble, though since all normal logic signals go from near 0V to +4V.

The schmitt-trigger gate can therefore be used on rough or slowly changing signals - provided that the input signals exceed the two threshold voltages i.e. have a range of > +1.5 to < +0.7V.

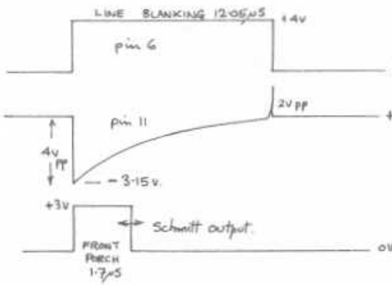
This provides a means of obtaining a time delay by triggering from a sawtooth - the flyback time is very short and so the 0.7V threshold can be ignored, but the 1.5V threshold ensures an output pulse after the desired time. The sawtooth amplitude is changed to alter the delay time.

Fig 11. Front Porch Generation



This is fact gives us a very simple way of generating Line Sync and Line Blanking with a proper Front Porch.

Fig 12 Waveforms of Monostable.



On the pin 11 of the SN74121N monostable is found a sawtooth waveform as shown - its length being the same as the pulse duration.

The emitter follower stage is used as a buffer stage to avoid loading the monostable timing circuit by presenting a high input impdeance. The emitter signal is almost identical with the monostable sawtooth signal but lower down towards earth because of the isolating capacitor.

The voltage swing at the emitter crosses the threshold voltages of the schmitt-trigger input and a pulse results which can be varied up to a maximum of the duration of the sawtooth.

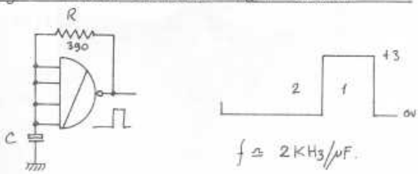
This pulse could be the front porch if the monostable was generating line blanking.

The duration of the pulse is a constant percentage of the monostable pulse duration if the monostable delay is varied.

This forms the basis of an S.P.G. described in C Q - T V 75.

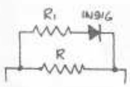
Perhaps the best use of the Schmitt I.C. is as a highly stable oscillator for driving bistable counters.

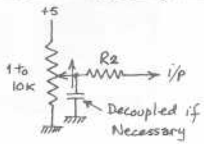
Fig 13 Schmitt Oscillator. Fig 14 Waveform



The feedback resistor and capacitor form an integrator from output to input. So that when the output is high the input rises to meet it. But when the +1.5V threshold voltage is reached the output suddenly goes low and so the capacitor voltage slowly drops again until the lower threshold of +0.7V is reached whereupon the output rises sharply again. So the system is self-starting and self-maintaining in oscillation. The output is a rectangular pulse of about 1:2 mark/space ratio, over a frequency range of 1Hz to 1MHz with 1000uF to 2nF.

Fig15 Square Waves Fig16. Changing Frequency





Frequency can be changed by changing R but this is not recommended. Because of this resistance the fan-out is reduced to 2. Note that the output voltage of the SN7413N is only about 3V pp.

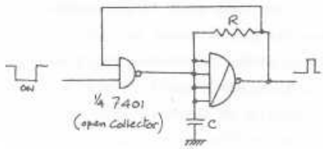
It is possible to make the output pulse square by adding a diode and resistor in parallel with the 390 ohms in order to reduce the time constant during the 'space' only. The value of R1 should be about 120 ohms.

A convenient method of frequency variation over a small range of, say 20%, is shown in Fig.16.

R2 is about 4.7K for ± 10% of frequency and the potentiometer can be placed a long way from the oscillator since it is the voltage that controls the frequency and not the resistance. It works by modifying the threshold voltages and gives plus or minus control of frequency.

This oscillator can be gated on and off for use in a grille generator.

Fig. 17 Gated Schmitt Oscillator



This arrangement produces complete cycles of oscillations but the first one is delayed due to the extra time taken for C to charge to +1.5V. Normally it only varies between +0.7 and +1.5V.

Note that simple gating by means of one schmitt input does not work in the above manner but can be used to switch on and off the oscillator.

The above arrangement can be made from ordinary gates if good frequency stability is not essential

References

CQ-TV 71, 72, 73.

Acknowledgements

The author wishes to thank the Directors of E.M.I. Electronics Ltd., for permission to publish this article.

Erratum

CQ-TV 73, p.14, fig.29. waveform C should be inverted.

In the next issues

Part 5 in CQ-TV 75 will describe a simple Colour Bar generator using 4 I.C.'s which can provide luminance, or phase, bars - as demonstrated at CAT-70.

CQ-TV 75 will also contain an article on a triple standard S.P.G. using T.T.L. I.C.'s which can be built for £10 or less.

CQ-TV 76 will have details of a genlock unit to go with this S.P.G.

LETTERS TO THE EDITOR.

Dear Sir,

I have constructed the I.C. amplifier from C Q - T V 72 and find that it does not come up to my expectations.

The outputs at both the normal and inverted terminals cut off at a maximum of 0.7v p - p with resulting crushing of whites. The bandwidth looks to be only 2MHz or so, but this is difficult to judge owing to the noise on my picture. HT is 9 volts and no change in waveform is obvious between 7v and 12 v.

If anyone else has built this circuit I would like to hear how they have got on, and what they have found about it. Also, I am looking for a circuit for a video-rf modulator for feeding a domestic set on CCIR 625 lines, preferably with intercarrier sound and would be grateful if anyone could help me.

John Spencer G6ABH/T DL5YP
Kent School, Hostert,
BFPO 40.

Dear Sir,

I note with interest the letters published in C Q - T V nos 71 and 72 from Mr. H.R. Skelhorn of Cheshire and "Modern Amateur" of N.W. London,

I would like to draw members attention to the fact that at the I.A.R.U. Region 1 Conference held in Brussels in 1969 it was agreed that the "CCIR system following the Gerber standard (625) should be adopted as the international standard transmission system for amateur tv".

Any amateur setting up a station from scratch would be foolish to ignore the fact that eventually the majority of U.K. amateur will operate on 625 lines, whether monochrome or colour.

Recently there has been a quantity of redundant 405 line commercial equipment finding new homes, and whilst this is still usable the better value of a 405 line 2 MHz bandwidth signal cannot be denied. But when used 405 line receivers become museum pieces then 625 lines will be the order of the day for all.

I personally hope that members will continue to write articles for both 405 and 625 equipment for some time to come - I have no wish to see B.A.T.C. biased in favour of either standard.
Malcolm Sparrow G6KQJ/T
Hon. Chairman B.A.T.C.

SLOW SCAN NEWS

The photos below are from I1LCF Prof. Franco Fanti who is very active on 14.230 and does a lot of DX. work. He has recently made the first Europe to Australia contact with

VK6ES, and has also contacted his first G, Robert Skegg G3ZGO, news of whom we published in the last issue of C Q - T V.

POSTBAG

W.D. Higginson of Bursledon writes to tell of his SPG (which he describes as "elderly"!) which he has got working, and the F.S.S. which he has constructed using a MC13 - 16. He is now interested in transmitting pictures and hopes to be on the air with a low power transmitter soon.

Pete Blakeborough G6ACU/T 6Y5PP in Jamaica has been given the first /T call by the P.T.T. there, and is building a small 430 MHz Tx for vision, already having a 2m station for sound. 6m is available in Jamaica, and Pete plans to use this for mobile operation. Also, as soon as the license is issued, he intends to be on 14MHz SSTV.

Mike Tooley G6AFA/T of Weybridge, Surrey has sent us some details of his QTH. Using vision carrier frequencies of 438.4 MHz and 437.5MHz he can run 25 watts peak white to a QQV0320A with a 46 element multibeam at 40ft. Vision source is a vidicon, but a FSS is under construction. The receiving set up uses a double trough line pre-amp into a dual conversion video reciever which can accept 405 or 625 positive or negative modulation. AM or FM intercarrier sound can also be handled. 'AFA/T has a very good "take off" to the North and North East and regularly exchanges good video with 'AFL/T in Stoke Poges, a 16 mile path. Regular "sked" night is Wednesday at 2200 hrs, and Mike would be only too willing to help anyone in his area with receiving or transmitting tv.

Trevor Brown G8CJS of Hollin Hill Drive, Leeds, has two cameras working and hopes to have his video Tx going soon. He is on the air in sound on 2m and 70cm, and can also receive pictures on 70cm. He would like to help members with reception checks if anyone nearby is just on the air.

Charles Brown GW8AIB in Caerswa, Montgomeryshire has also offered his services for reception checks at the weekend if your signals reach Wales. 'AIB is on the air phone on 432.11MHz.

Peter Williamson is a recent new member living in Birmingham. He writes to tell us that since joining he has become very interested in I.C.s and is trying to build all his tv equipment using them. So far he has built an S.P.G. and a camera - but admits that the scan output stages of the latter had to use archaic transistors! His current problem is in building a transmitter - we guess you're going to have at least one valve there Peter!

Mike Berry of Wigan, Lancs, started in amateur tv about three years ago after reading about DX-TV. After receiving a dozen or so different countries, he heard about 70cm, and returned to the band, only to find, for a period of three months, anyway, that there was no A.T.V. activity in the area, at least at the times he was watching. However, in order to do something about this, a FSS, SPG and monito are now being constructed with a view to transmission at some later date. But Mike still hasn't received any 70cm video, so anyone within range like to help him out?
117, Rectory Rd., Nth. Ashton is the QTH if you live nearby.

Ted Cohen W4UMF of Virginia U.S.A. writes about the ever-increasing slow scan activity in his part of the world. The ROBOT gear has had something to do with this, he says. Also, Ted wishes a lot more G's would get into SSTV- what about it everyone?

Araldo Ramundo I1RAR in Cosenza, Italy is another S.S.T.V. enthusiast, who has just completed building a monitor. It uses a 4F7 c.r.t. and 25 semiconductors, and Araldo is looking forward to taking photos of many signals on the 20m band.

625 LINES

Technical Parameters of the Standard.

Now that so many British amateurs are converting from 405 to 625, and following the I.A.R.U. recommendation that amateurs should use the C.C.I.R. Gerba standard, B.A.T.C. has brought together the specifications of this standard so that everyone may know exactly what is involved.

Figure 1 shows the 8MHz of r.f. spectrum occupied by the standard, as used by the broadcasting authorities in the U.K. This is shown as many B.A.T.C. members use standard U.H.F. television sets, re-tuned to 70cm, as their main receivers. Thus any amateur transmitting a signal exactly as in Figure 1 will find that reception techniques involve only one receiver for both sound and vision. Note that if you use a separate transmitter for sound, P.O. regulations still stipulate that you be capable of transmitting telephony on the same frequency as your video signal.

Figures 2 and 3 show the video signal in line form and frame form - in the latter case only the frame blanking portion (which differs from the picture portion) is shown. Timings are shown in microseconds and amplitudes in volts. Note that for a colour signal the colour subcarrier which is superimposed on the video can increase the total signal amplitude from 1.0 volts to 1.35 volts.

Figure 4 shows 5 of the standard pulse signals required from a television S.P.G. To

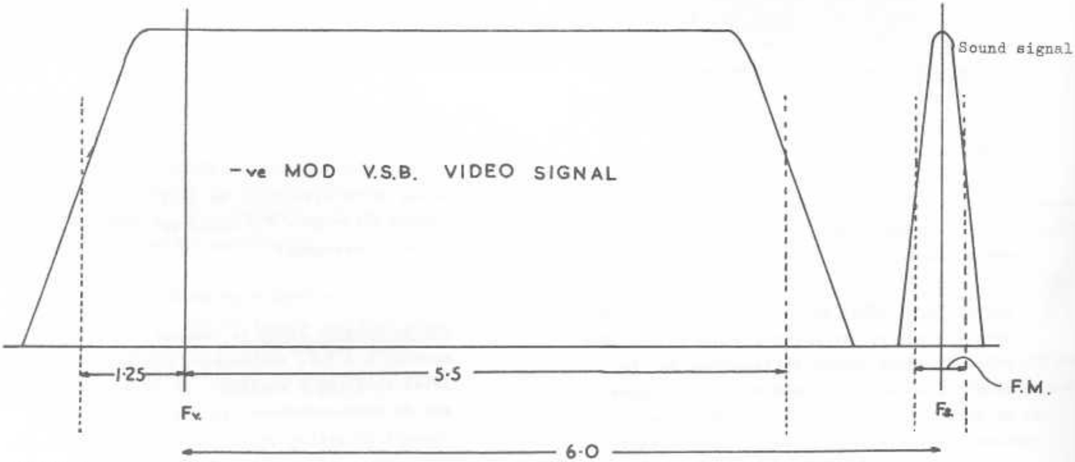


FIGURE 1

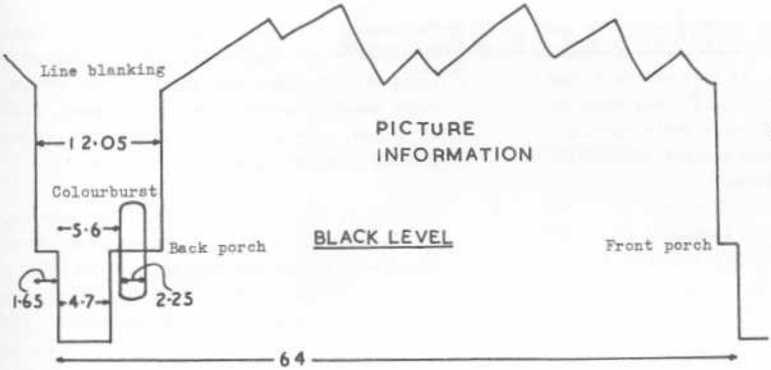


FIGURE 2

LINE WAVEFORM

All times in microseconds

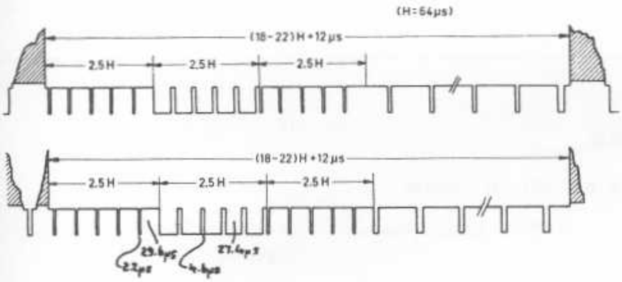
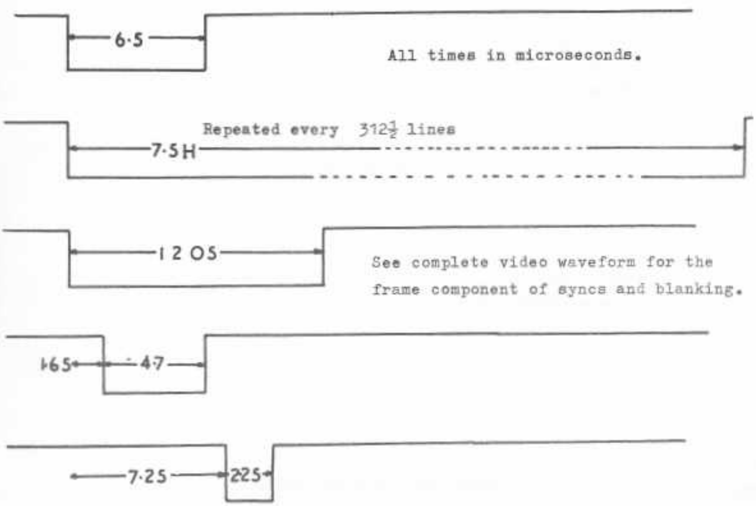


FIGURE 3

INTER FIELD SIGNAL

S.P.C. OUTPUTS

FIGURE 4



LINE DRIVE

FIELD DRIVE

BLANKING

SYNCS

BURST GATE

Continued on page 29

Continued from page 27

these must be added another two, the colour sub-carrier, a continuous sine wave whose frequency is 4.43361875MHz and the PAL line switch (often called vertical axis switch or V.A.S.) which is a square wave of 1:1 mark space ratio running at half line frequency with a start coincident with the start of line drive.

B.A.T.C. has for many years advocated a common standard for members regarding signal levels and plugs and sockets. For the sake of completeness, we repeat them here, as the advantages of interchangeability offered by this standardisation are very great - as anyone who has bought his own equipment along to some joint exhibition, or similar event, will know.

The first recommendation is the use of Belling Lee r.f. plugs and sockets throughout. Levels of video signal should be 1 volt positive going into 75 ohms, with pulses at one or two volts negative going, also into 75 ohms. Lastly, of course, make use of this standardisation by getting together with other members!

Postscript The r.f. signal described here is, of course, unique to the British Isles. Other countries, whilst maintaining the same 8MHz channel spacing differ in such factors as sound to vision spacing (e.g. 5.5MHz in Belgium, 6.5 MHz in France etc) width of vestigial sideband (e.g. ·75MHz in N. Africa) and the use of A.M. sound (e.g. Monaco). Members living abroad should therefore consult their own broadcasting authority rather than use Figure 1 above.

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7470	FJJ 101			SINGLE JK FLIP FLOP
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7473	FJJ 121			DUAL MASTER SLAVE FLIP FLOP
* 7476	FJJ 191			DUAL MASTER SLAVE FLIP FLOP WITH PRESET AND CLEAR
7490	FJJ 141			B.C.D. DECADE COUNTER
7492	FJJ 251			DIVIDE BY 12 4 BIT BINARY COUNTER
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This list of TTL I.C.s are the most suitable ones for use in counter chains and S.P.G.s.

The first 6 I.C.s listed are available on surplus computer boards, with anything between 10 and 30 mixed I.C.s on a board. They make a good buy at 5p per I.C. for all types except the 'D' at 25p. Write with a S.A.E. to: New Cross Radio, 6, Oldham Road, Manchester 4, for full details.

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WARNING As it is impossible to identify an unmarked I.C., keep them labelled at all times.

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* This I.C. is a 16 pin package, all others listed above are 14 pin packages.

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