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Cover Photo B.A.T.C. Stand at the 1970 Radio Communications Show.

THE BRITISH AMATEUR TELEVISION CLUB.

Committee Members and Club Officers

PRESIDENT — Ivan James G5IJ

CHAIRMAN — Malcolm J. Sparrow G6KQJ/T G8ACB
White Orchard,
64, Showell Lane,
Penn, Wolverhampton,
09077-3037

Gordon Sharpley G3LEE G3LEE/T
52, Ullswater Road,
Flixton, Urmston,
Lancashire.
061-748-8031

GENERAL SECRETARY — John J. Rose G6STO/T G8CTG
Pinchbeck Farmhouse,
Mill Lane,
Sturton-by-Stow,
Lincolnshire.
Stow 356.

Cyril Chivers,
Mortimer Street,
Trowbridge,
Wiltshire.
Trowbridge 2848.

Ian Waters G6KKD/T G8ADE
1, St. Audreys Way,
Lynn Road,
Ely,
Cambridgeshire.
Ely 2922

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Nr. Ongar, Essex.

John Lawrence GW6JGA/T
9, East Avenue,
Brynn Newydd,
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Flintshire.
Prestatyn 3255

Alan Watson,
Somerby View,
Bigby, Barnetby,
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Searby 287

TREASURER — Alan P. Pratt
10, Grammar School Road,
Brigg,
Lincolnshire.
Brigg 3014

Ian R. Lever, G8CRJ
65, Dynes Road,
Kemsing, Sevenoaks,
Kent.
01-830-2945

MAILING LIST OFFICER — Cyril Hayward G8BBY
Marina Cottage,
Watford Locks,
Watford, Rugby,
Warwickshire.
Daventry 3974

Adrian O. Moore G6DZY/T G8BTN
3, Manor Road,
Daventry,
Northamptonshire.
Daventry 2812

C Q - T V EDITOR — Andrew M. Hughes,
16, Wilton Grove,
London, S.W.19.
01-546-4052

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EDITORIAL

You will see on page 1 that B.A.T.C. has several new officers this year, including the Chairman, Treasurer and Secretary. Malcolm Sparrow and Alan Pratt both have announcements to make, so the editorial of this issue consists of their messages.

Chairman's Message

As your new Chairman I must first thank all my fellow Committee Members for electing me to this office and assure all our members that I will do my best for B.A.T.C. during my term of office.

As I have only had the opportunity of meeting a few of our members personally, I think it might be a good idea to let you know something about myself.

I joined B.A.T.C. some eight years ago and have held the office of Hon. Treasurer for the last six years. I was first licensed G6KQJ/T in 1964 and now also hold the call G8ACB. I am interested in most aspects of Amateur Radio and Television and my activities include, on the radio side, construction of rf equipment, portable mobile and contest operating, whilst television interests include transmission and reception of amateur tv, S.P.G.s, monoscopes, videotape and colour.

I have no business connections with the Communications Industry.

The duties of running the Club have now been allocated and you will find a full list of the Club Officers and Committee Members on page 1 of this magazine. Please remember that all officers are volunteers and that Club business usually has to be conducted in their spare time, and by post. So please help them by addressing your correspondence to the right officer for your requirements.

Following an invitation from the Post Office Representative attending CAT-70, B.A.T.C. has submitted suggestions for improving the terms of the Post Office Amateur Television Transmitting Licence. It is hoped that these suggestions will be incorporated in a revised licence which will be more in line with current day practices and requirements.

Elsewhere in this issue you will read of an increase in the B.A.T.C. annual subscription. I would hasten to point out that this move was initiated during my own term of office as Treasurer and in no way reflects upon the incoming Officer. In my opinion, C Q - T V is and will remain the best value for money of its kind for many a year to come, in this sphere of Amateur Activities.

I have tried to tell you a little about myself and my activities and now I appeal to you to do the same. Please write in and let us know of your interests and activities in your own area. C Q - T V consists almost entirely of members contributions, so if you have just finished successfully building or modifying a piece of equipment why not share this knowledge with our other Club members. A photograph or circuit and a brief description is all that is needed and our Editor will do the rest. So if you have something to contribute to the Club Magazine do it now and help your Club to grow from strength to strength.

Malcolm Sparrow G6KQJ/T

Treasurers Message

By now most Members will be aware, either by attendance at the Annual General Meeting or by reading reports of that meeting in C Q - T V, that authority was given to increase Subscription to a maximum of £1. It has been decided that this is necessary, and accordingly the BATC Sub-

Continued in column 1 page 23

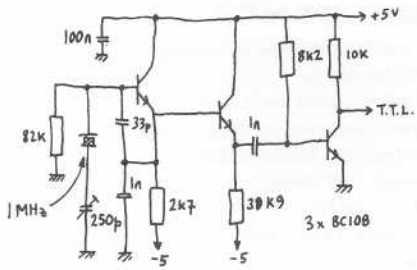
CONTENTS

AN INTEGRATED CIRCUIT PULSE GENERATOR

D. J. TAYLOR
G8ARV G6SDB/T

When the current range of TTL (Transistor-Transistor Logic) became available it was decided to investigate the possibilities of producing a fairly simple SPG (Sync Pulse Generator) for 625 lines using this range. One of the design objectives was that there were to be no preset adjustments, in particular of field frequency dividers which had caused the author some trouble in the past. It was not possible to keep to this policy totally, as to derive the line frequency pulses in such a fashion would result in a considerable increase of complexity. It is possible that this would be economically feasible using the cheap surplus I.C.s now available.

Although the design was produced in 1968, its cost at that time would have been prohibitive, three of the I.C.s costing £5 each! However the cost is now more reasonable and if new I.C.s are bought the outlay should be no more than £10, and much less if the "untested rejects" are purchased.



4.9.70 Fig. 1 1MHz Oscillator and TTL Drive G6SDB/T

The S.P.G. can be split into three parts:

a) Master oscillator and divider chain to twice line frequency (2F1).

b) Line and twice line frequency monostables (broad, equalising, sync & blanking pulses).

c) Field frequency (Ff) gating circuits and divider chain to produce composite pulse outputs.

(a) MASTER OSCILLATOR AND DIVIDER CHAIN

Precise details of the master oscillator chain will depend on exactly what crystal is available. As 2F1 has a period of 32us, an oscillator on 1MHz followed by a ÷32 would give the appropriate output. Alternatively 500KHz and ÷16 or any equivalent combination.

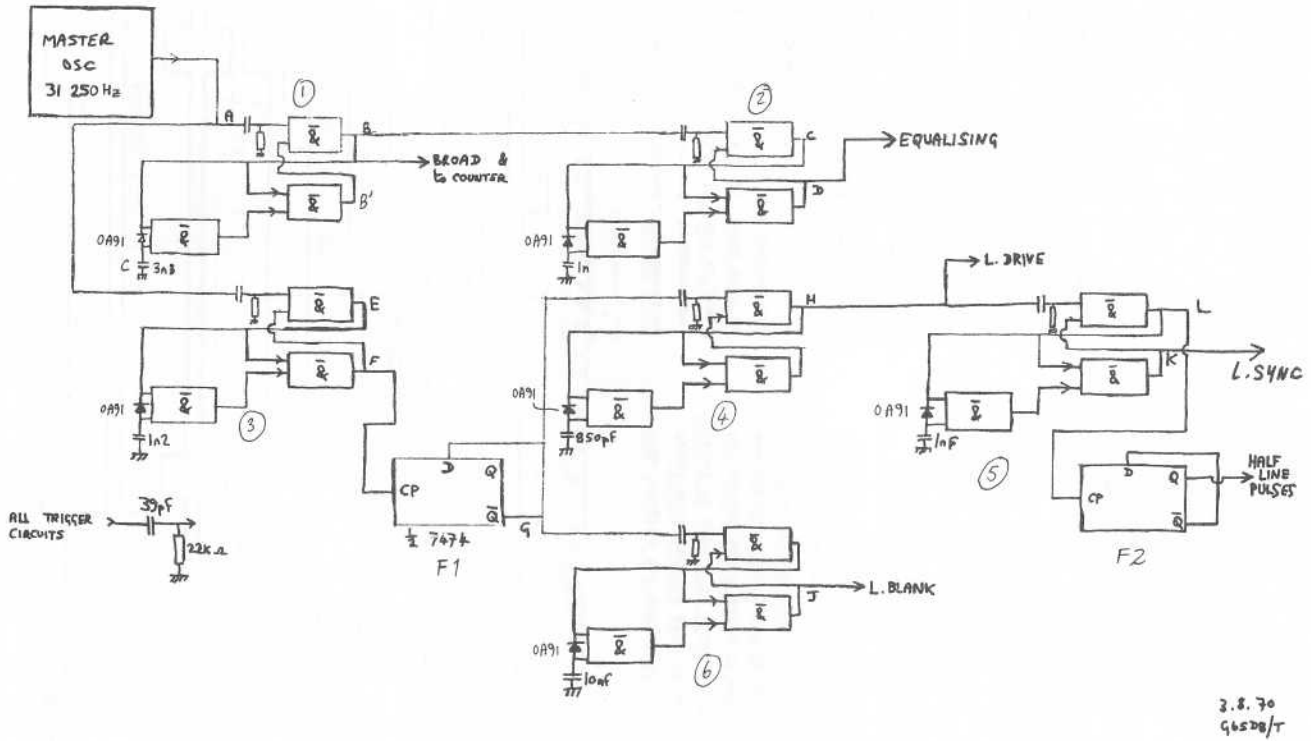
A suitable circuit for 1MHz crystals is shown in Fig. 1 together with circuitry to enable it to interface correctly with TTL voltage levels. The 250pf trimmer is used to set up line frequency exactly.

(b) F1 and 2F1 MONOSTABLES

Taking the easy way out a series of monostables have been used for F1 signals rather than the preferred divider and logic system used in the field section. (As signal timings are specified to 100ns a 10MHz oscillator would be needed as the basic clock for the whole system.

The circuit details are shown in Fig. 2, monostables are labelled 1, 2 etc., and the bistables F1 and F2. Waveforms are shown in Fig. 3 and a function diagram in Fig. 4. The monostables trigger on negative going edges.

Fig. 2 LINE AND TWICE LINE MONOSTABLES



3.8.70
G65278/T

31,250 and 15,625 Hz GENERATORS

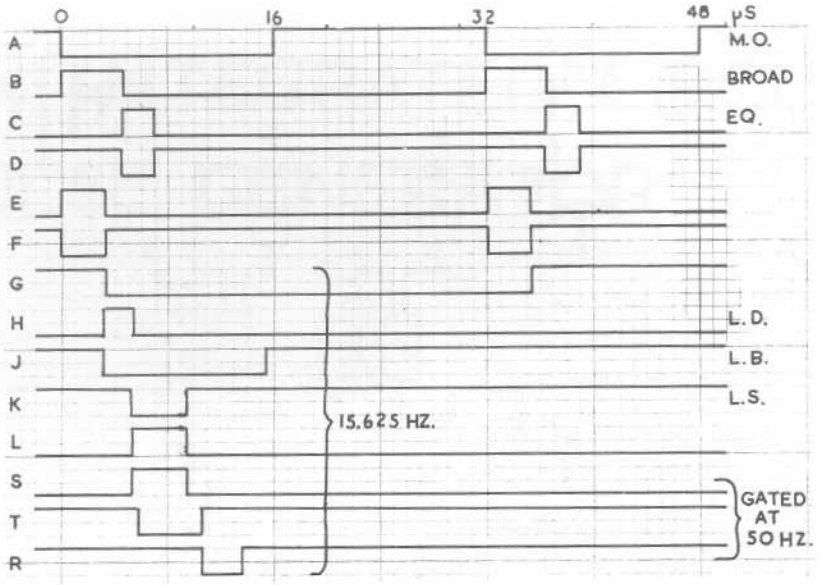


Fig. 3 31,250 and 15,625 Hz WAVEFORMS

The master oscillator pulses, A, (shown as square, but this is not important) trigger the broad pulse generator 1, which in turn triggers the equalizing pulse generator 2. Note that as pulses of the opposite polarity are desired the output is taken from D not C.

The M.O. pulses also trigger a monostable 3 which generates the delay required between broad pulses and line blanking (i.e. the width of broad pulses less the front porch. F1 then serves to get F1 from 2F1, triggering 4, the front porch generator on negative going edges at G, and also 6, the line blanking. Line sync pulses appear at K, and F1 ÷ 2 pulses for PAL switching are generated by F2. As the D-bistable changes state on the positive going edge, the inverted line sync L is used for the trigger.

(c) Ff CIRCUITS

Circuit in Fig. 5, waveforms Fig. 6.

There are three decade counters in the field divider chain. The outputs corresponding to 200 - 400 - 20 - 5 are connected to a NAND gate 7 so that when 625 master oscillator pulses have been counted the output of 7, A goes low and this feeds an inverting gate so that the counter is reset to zero. In this way division of 2F1 by 625 occurs and a pulse is generated at A once per field. This pulse is used to preset two bistables F3 and F4 to generated the twenty line field blanking pulse and the $7\frac{1}{2}$ line sync pulse sequence.

After a further 15 M.O. pulses following reset, outputs B and O are both high so that a negative pulse occurs at N which is used to clear the $7\frac{1}{2}$ line bistable F3. The negative pulse at E inhibits the line sync pulses during these $7\frac{1}{2}$ lines and enables the broad/equal pulses. Selection of these can be conveniently made by the $2\frac{1}{2}$ line pulses B and C. (The first decade counter is connected in 1 - 2 - 4 - 5 mode to enable this to be done.) The three sync pulses feeds (G,D,H) are mixed together in the NAND gate 8 to produce mixed sync at J. (Remember that the sync pulses are inverted at G,D,H so that the NAND gate acts as a NOR gate on the negative logic, i.e. if one input or any other input is low, the output will be high. Compare with the normal logic if this isn't clear).

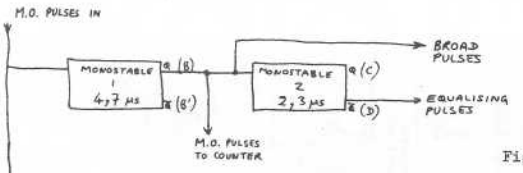
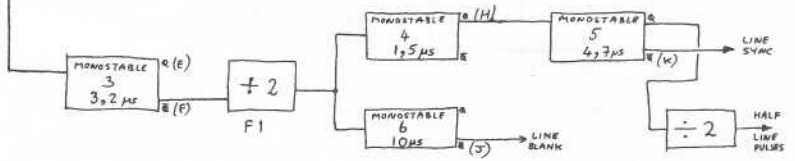


Fig. 4 LINE FREQUENCY FUNCTIONS



After a further 25 M.O. pulses (i.e. 40 M.O. pulses or 20 lines from the reset) Q goes high and therefore M goes low and clears the field blanking bistable F4. The blanking pulses are mixed together in a NAND gate 9 to produce inverted mixed blanking at the output L. If desired this could be inverted by an inverter, or a spare NAND gate.

The gated line sync pulses at H are a convenient point from which to generate colour burst blanking pulses by the two gate monostable gates 10 and 11, delayed by the 220Ω and 4n7 from the end of line sync. (Alter the capacitor to change the delay - do not increase the resistor). If desired meander gate pulses can be fed in as shown, the burst gate pulse will only be generated when the meander gate input is high (or unconnected, of course). The two gate circuit is not really suitable for long (> 5µs) pulses.

OUTPUT CIRCUITRY

A suitable interface to 75Ω line at the 1 volt level is shown in Fig. 7. As this is an invertor (output is + 1 volt when input is low) it should be driven from inverted output, or driven through an invertor as shown. One circuit is required for each pulse feed to be taken from the generator.

POWER SUPPLY

As most people will have 12 volts d.c. available a power supply giving regulated 5 volts from 12 volts is sketched in Fig. 8. The voltage on the integrated circuits should be 5 volts ± 0,25 volts, i.e. within 5%. In any case it MUST NOT RISE ABOVE 7 VOLTS. A 5,6 volts zener may be connected across the H.T. line to prevent spikes appearing. The function of the bulb in the collector supply line is to indicate an "ON" condition, while lowering the dissipation of the 2N3055.

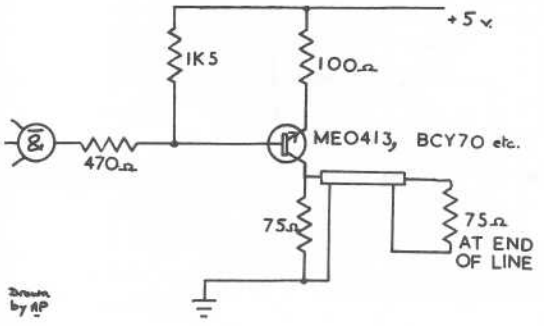


Fig. 7 TTL to 75 ohms LINE OUTPUT

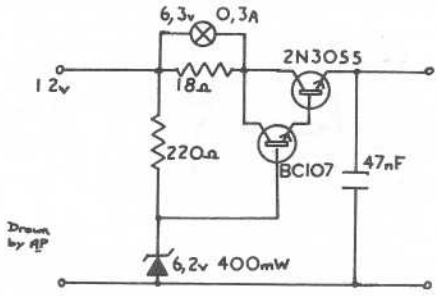


Fig. 8 12 volt POWER SUPPLY

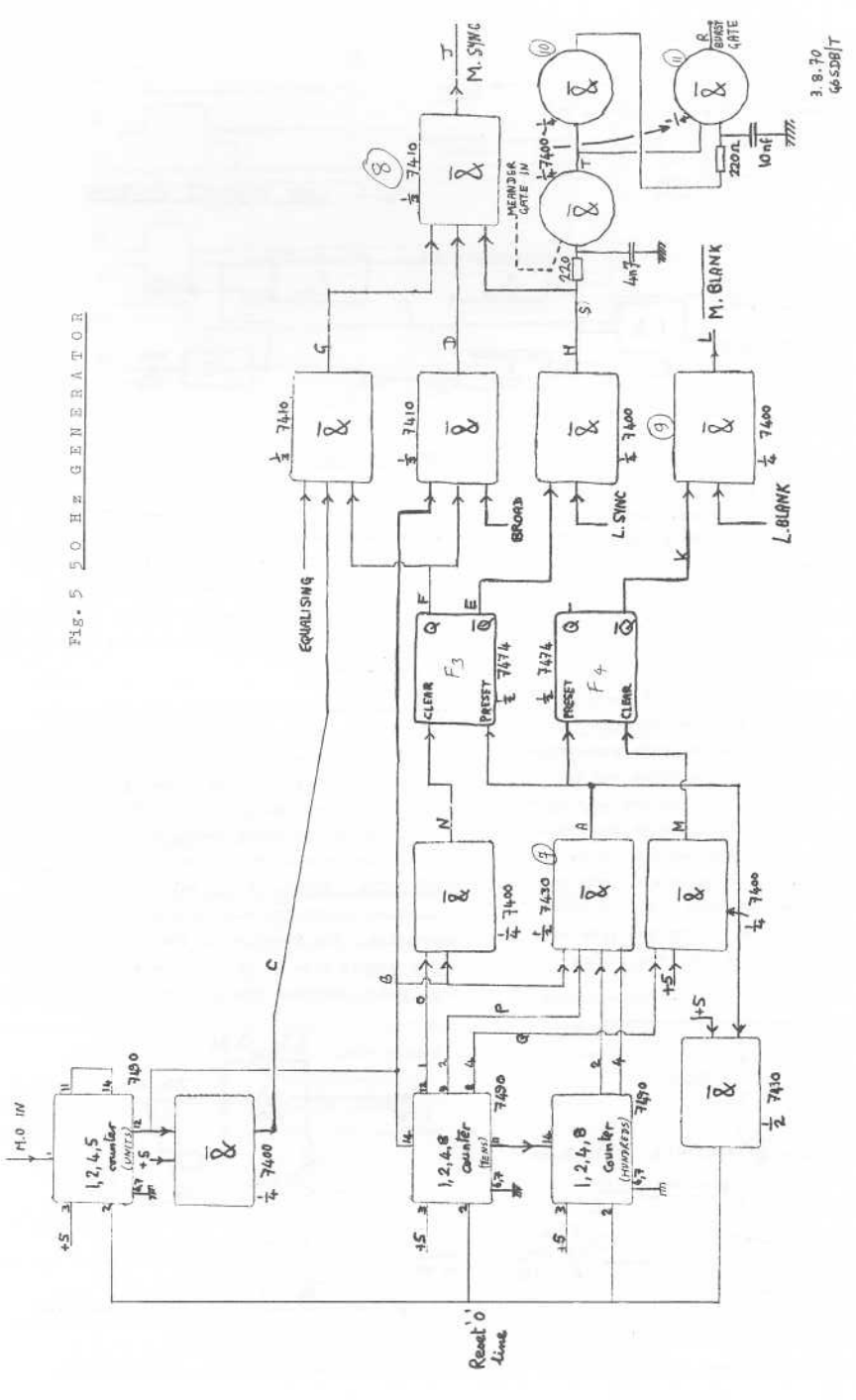
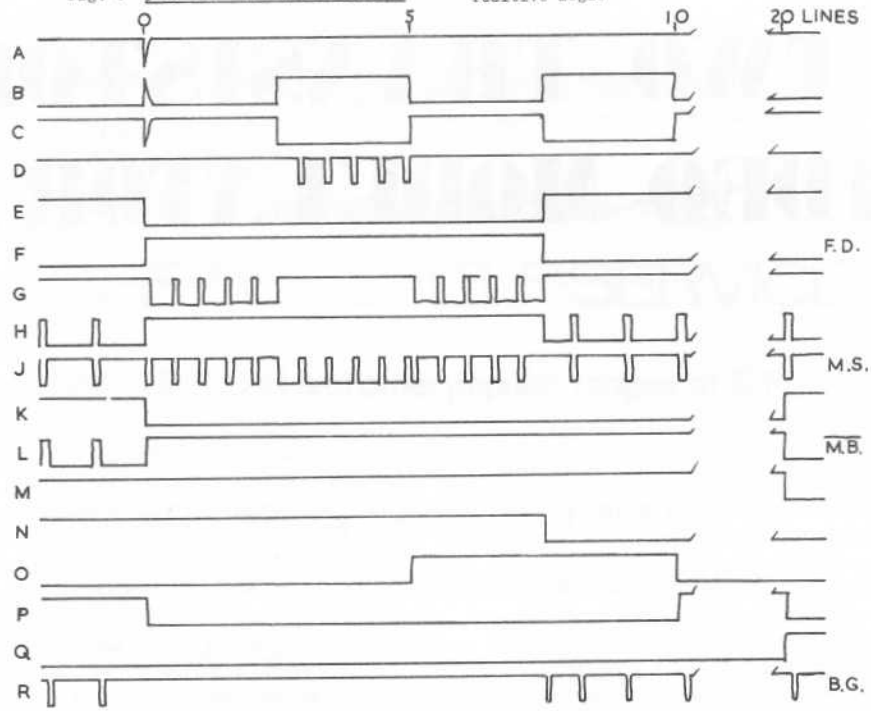
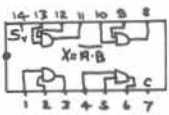


Fig. 5 50 Hz GENERATOR

Fig. 6 50 Hz WAVEFORMS Positive logic





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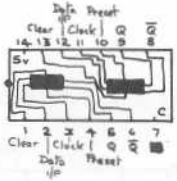

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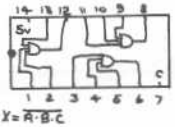

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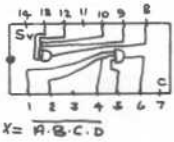

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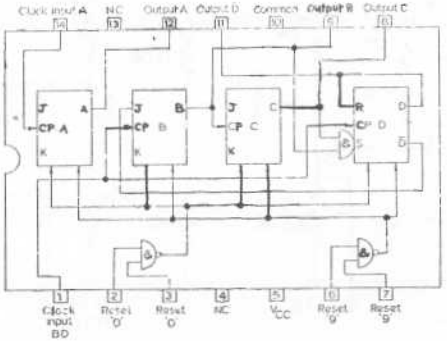

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A TWO TRANSISTOR VIDEO MODULATOR.

By G.P. Shirville G3VZV G6AEV/T

During CAT-70 an outside broadcast unit was operated by G6AEV/T from a caravan near the river Cam, producing pictures for the demonstration of amateur tv to conference delegates.

The transmitter at this O.B. used a two transistor grid modulator, and as it would seem to be suitable for all valve P.A.s, such as 3'20s 6'40s and even 4X150As we print the circuit here, with thanks to AEV/T for allowing us to do so.

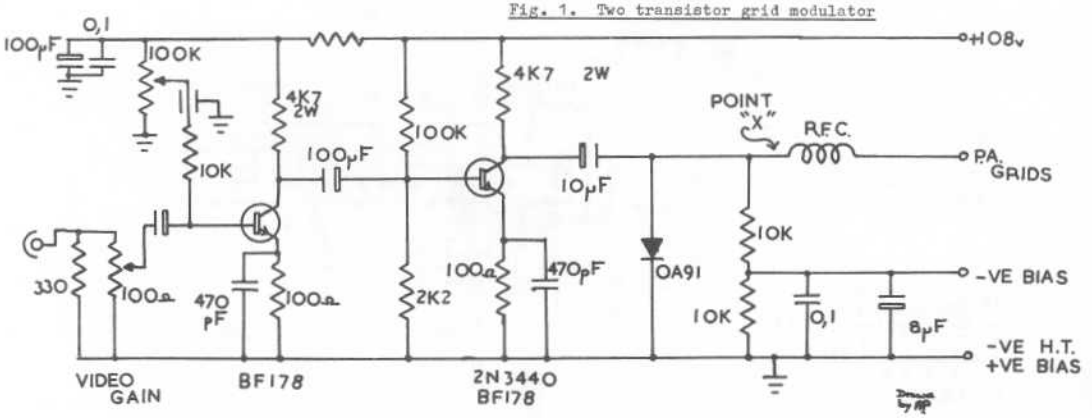
It should be built in a well screened box adjacent to the P.A. grid lines. The distance from "point X" on the drawing to the connection with the grid line should be as short as possible and in no circumstances more than one inch.

Also, the anodes and screens should be bypassed at video frequencies with eight microfarad capacitors of suitable voltage ratings.

The frequency response on the prototype is such that, when using 405 lines, 3½ MHz can easily be seen "off-air". Increased frequency response could probably be obtained by playing with the values of the emitter by-pass capacitors.

The H.T. supply can be derived from the main H.T. supply and regulated by means of an OB2 or similar device. The 100 ohm input pot must be a carbon type, and a suitable component is available from Henry's Radio of Edgeware Road.

Fig. 1. Two transistor grid modulator



INTEGRATED CIRCUITS PART 3.

A.CRITCHLEY Dip El; C Eng; MIERE.

USING DIGITAL INTEGRATED CIRCUITS FOR T.V. PULSE GENERATION CIRCUITS - T.T.L. IC'S

The first part of this series of articles (in CQTV 71) described how to use R.T.L. IC's as logic gates, multivibrators, etc. Part two described the functions of the µL 923 J-K Bistable and how various counters could be made - finishing up with a S.P.G. Counter Chain.

This third part describes further aspects of R.T.L. IC's and introduces T.T.L. IC's which are now available at about half the price of R.T.L. and in a larger range of functions.

Comparison of R.T.L. and T.T.L. gates

Fig.1. 2-input R.T.L. gate

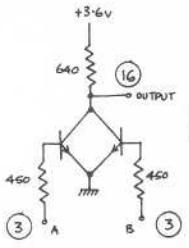
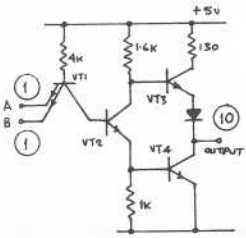


Fig.2. 2-input TTL gate



The basic gate of R.T.L. is simply a transistor as we saw in part two and as Fig.1. shows but the T.T.L. basic gate is a much more complex affair. Transistors VT3 and 4 form a compound emitter-follower (or totem-pole) stage. The diode is used only to correctly bias VT3 by employing the forward-voltage drop of a p-n junction. VT2 is a push-pull driver stage giving inversion. So from VT2 base to the output, the I.C. is an invertor with low output impedance whether 'high' or 'low'.

The multi-emitter transistor VT1 is the particular feature of T.T.L. as such a device can be made easily by modern methods of transistor construction by gaseous diffusion. The effect of multiple emitters is that of paralleling several transistors by their bases and collectors. It is evident that if any one of these emitters is earthed then VT1 will be 'on', but the method of driving the rest of the I.C. is not immediately obvious. One would normally assume that turning VT1 on would join VT2 base to +5 volts but there is no collector load resistor for VT1 and in fact what happens is that the collector voltage of VT1 ends up at about the base voltage, which is some 0.6V above earth due to the forward voltage drop of the base-emitter p-n junction of VT1, so that the phase is unchanged through VT1. Hence the output of the I.C. is 'high' for any input 'low'.

If All inputs are high, then VT1 is off and the base-collector junction is now biased in the wrong direction and so is a low impedance (it is forward - biased). So VT2 base is joined to some +4.4 volts. Hence, the output of the I.C. is 'low' for all inputs 'high'. This is the NAND function for positive logic (where the input signals go towards the supply).

This is the opposite condition to the R.T.L. gate where all inputs have to be low for the NAND function. So the R.T.L. gate is NOR for positive logic or NAND for negative logic. To use T.T.L. in place of R.T.L., therefore, the input signal polarities must be inverted.

This is the basic difference; others are speed, noise immunity, fan-out, cost and range of functions in which T.T.L. scores over R.T.L. Power consumption is about the same for both, but the T.T.L. voltage supply is more convenient at +5 volts, rather than +3.6 volts, as less current is required.

The fan-out, or output loading factor, of T.T.L., per gate, is much better - the basic gate being able to drive 10/1 other gates = 10 gates whereas R.T.L. can only manage 16/3 = 5 1/3.

T.T.L. Voltage Levels etc.

A T.T.L. gate will give out almost exactly 4 volts pp of pulse starting at +0.05V. Fully loaded the output drops to 3.75 volts pp whereas R.T.L. drops from +3.6 volts to 1.5 volts (being +0.5 volts up). D.C. Output impedance of a T.T.L. gate is 130 ohms - this can be measured by resistive loading until the output is half the unloaded output. Then source impedance equals load

Fig 3 T.T.L. output.

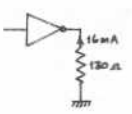
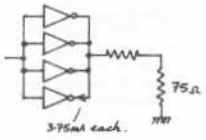


Fig 4 T.T.L. 75Ω output



impedance. However, under these conditions the gate is overloaded at 16mA whereas 3.75mA is the normal maximum. So the basic gate will not drive 75 ohms terminated lines but since the dynamic output impedance is 100 ohms when high, and 12 ohms when low, it will drive unterminated lines satisfactorily up to 2 yards long. Longer lines give worse reflections causing false operation of the gate. To drive 75 ohms terminated lines, parallel driving by four gates will give 4mA load current which is satisfactory. This is excessive for Amateur use, so two is a good compromise. The output signal

Fig 5 T.T.L. 75Ω output

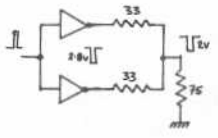
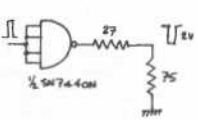


Fig 6. T.T.L. High Power output.



level can be made 2V pp across 75 ohms by the use of a series resistor in each gate of 33 ohms. The gate then delivers 2.8V pp at 7mA which is reasonable. For better results there is a higher power gate which can drive 30 loads and which will give 2V into 75 ohms with only 27 ohms series resistance. These come as two-to-a-package and are basically 4 input NAND gates.

Driving R.T.L. and T.T.L. from External Sources

There is no guarantee that external driving sources will stay at all times between earth potential and the supply voltage. This could be disastrous and so a simple method is required to keep the signals between these two limits.

Firstly a capacitor is used to isolate the D.C., if any. The voltage on the I.C. side of the capacitor is then determined by a resistor to either earth or supply (or any other desired potential). Which potential is used depends on the polarity of the input pulses. If negative-going inputs are used then the resistor should go to the supply voltage so that the negative pulses come down towards earth and can drive the I.C. input low.

Fig. 7 shows how this is achieved for R.T.L. and Fig. 8 for T.T.L.

Fig 7 R.T.L. Input

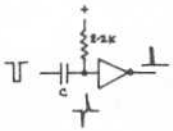
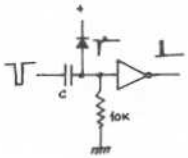


Fig 8. T.T.L. Input



The T.T.L. arrangement is not obvious but the resistor value is high so that it just turns VT1 (in the I.C.) on - the input potential is thus +4.4V or so. A value of 4.7K ohms to 33K ohms is suitable. The value of C is chosen to minimize 'sag' and 100μF is usual for Mixed Blanking, whereas 100nF is sufficient for line Drive. If only edges are required then some 270pF will suffice, the positive going edge pulses merely reverse bias VT1 and D1 shunts them. D1 is a safety precaution and can be omitted, but the I.C.'s may be damaged. In R.T.L. the positive-edge pulses merely turn the gate on a little harder.

For Positive-going pulses both R.T.L. and T.T.L input resistances are returned to earth, as in Figs. 9 and 10, and the pulses drive the gates up to the supply voltage. The T.T.L. resistor value is now about 1K ohms and so C has to be 10 times the value necessary for negative-going pulses. There are no problems with differentiated pulses so this method is preferred.

Fig 9. R.T.L. Input

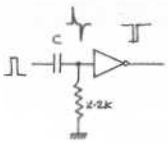
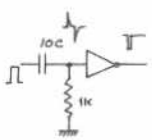


Fig 10. T.T.L. Input



The final protection is for excess voltage if the input pulses are greater in amplitude than the supply or if they are obtained from a source which may vary up or down outside the range. For instance from a coupling time-constant in a T.V. Receiver where at switch-off the D.C. potential may drop rapidly by 100V or more.

Figs. 11 and 12 show how diodes can be used to overcome this problem.

Fig 11. Diode Input.

Fig 12. Current Limiting

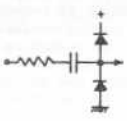
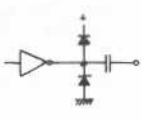


Fig 13 Output Protection.



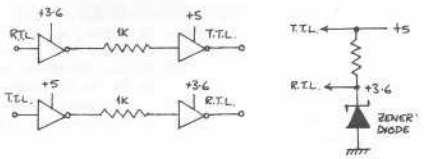
Normally the diodes are reverse-biased and therefore have no effect. If the input is above the supply voltage then D1 is turned on and clamps the input to the supply voltage so that the input is supply voltage plus 0.6V. Similarly D2 clamps the input to minus 0.6V. The input range is thereby limited to -0.6V to +5.6V (for T.T.L.). If the source is a low impedance then a series resistor may be required in the input if the diodes cannot handle the forward current. Normally any old diodes will do for this job - Silicon or Germanium. Incidently, any unused inputs should be returned to other used inputs, or to supply, rather than being left open circuit - if possible. They must not be earthed.

The same diode system should be employed for output stages when unknown apparatus is involved. A zener diode of 5 volts could be used instead of two diodes but is more expensive and of less power rating.

Mixing T.T.L. with R.T.L. gates

This is not desirable but where necessary (for impoverished amateurs) it is possible. The supply should suit the T.T.L. type - the R.T.L. gate supply obtained from a 3.6 volt zener diode; not via a simple dropping resistor because the R.T.L. gates are several to a package and if all were 'off' then the R.T.L. voltage would be +5 volts instead of +3.6 volts.

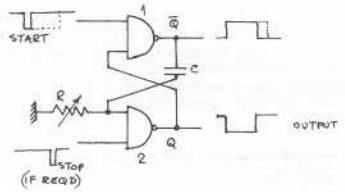
Fig 14. Mixing R.T.L. and T.T.L



Driving one gate type from another, then, involves only a series 1K ohm resistor to each gate input. Loading factors are greatly affected, but it is not likely that many gates would be driven this way in any case.

Using T.T.L. in place of R.T.L.

Fig. 15. T.T.L. Version of Monostable



CQTV 71 showed how R.T.L. could be used to form multivibrators etc. To use T.T.L. for these is very simple. The input logic is reversed (i.e. the signal polarities) and the timing resistors returned to earth instead of supply. The resistors should be around 1K ohm and the capacitors increased accordingly. For example, the monostable now requires a negative-going input pulse and R is 470 to 2K ohms to earth. As for R.T.L., gate 2 gives the Q output (negative pulse) and gate 1 the Q̄ pulse, which is never shorter in time than the input pulse.

T.T.L. Bistables

The T.T.L. Bistables come in basically three

Fig 16. R.T.L. BISTABLE

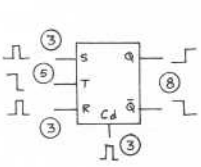
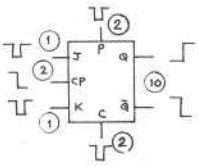


Fig 17. T.T.L. BISTABLE



forms, known as, J-K, J-K master slave and the D-type which can be put into two classes - the J-K bistable and the D-type of bistable. The J-K bistable performs the same functions as the R.T.L. µL923 does, but the input signal polarities for the J and K inputs are different. J and K replace the S and R inputs respectively. Thus for T.T.L. J-K bistables, all inputs have to be taken low to have effect.

The T-input is known as the Clock Pulse (CP) input and Direct Clear is now called Clear (C). The converse of this is Preset (P) which also overides all other conditions to make the Q-output high.

So there is very little difference between these two bistables as far as we are concerned and the previous explanations apply to T.T.L. if these differences are observed. Nearly all the counter circuits given in part 2 (CQTV 72) will work with T.T.L. but give inverted outputs. The basic counters are given again for T.T.L.

Fig 18 ÷3 (Synchronous)

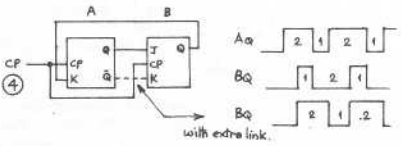


Fig 19 ÷4 Twisted Ring

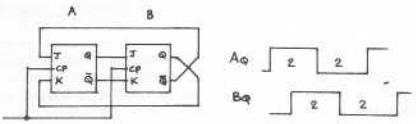


Fig 20. Synchronous ÷5

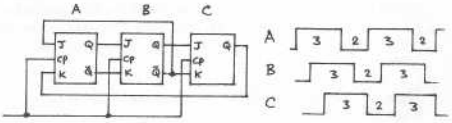


Fig. 21. Ripple ÷5 Counter

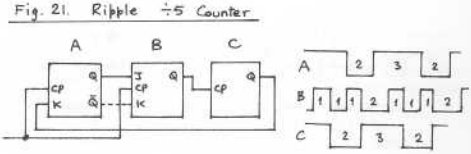


Fig. 22 Synchronous ÷7

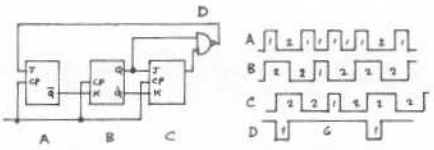
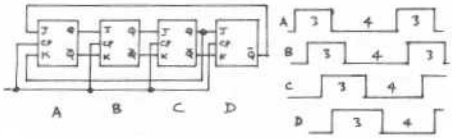


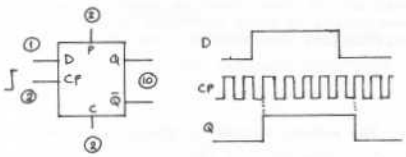
Fig 23. Synchronous ÷7 (Twisted Ring)



The D-Bistable

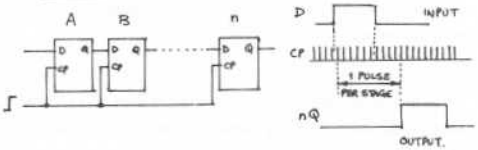
This can be considered as a Shift register of one stage and it is a most useful device. If the CP-input (which runs on positive-going edges) is clocked, the Q-output takes up the polarity that the D-input had just prior to being clocked and remains there until the next clock pulse. If the D-input is again the same then the Q-output remains as it was before. See Fig. 24

Fig 24. D-Type Bistable



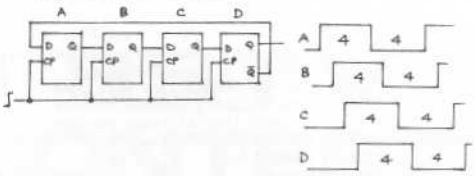
If the D-input is fed from the $\overline{Q}$-output then it will always be of opposite polarity to the Q-output and so the result is a binary counter.

Fig 25 Shift-Register



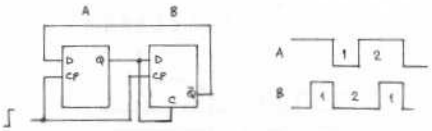
The D-bistable provides a simpler way of generating, for example, Line Drive than by using a J-K bistable with an inverter since the invertor is not required (see CQTV 72).

Fig 26. Twisted-Ring



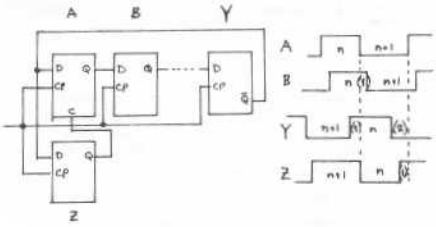
D-bistables can be connected in a chain, as in Fig. 25 to form a shift register. If the output Q is joined to the input D then we have a Ring-Counter, but if the $\overline{Q}$ is used then we have a Twisted-Ring Counter or Johnson Counter. The twisted-ring count is twice that of the Ring Counter and the output is a square wave, (the single stage binary counter is a twisted-ring counter). There are half the number of interconnections that J-K bistables require. Unfortunately, though, there is no second D-type input with which to change the count, but this is possible by other means such as Fig. 27 shows. This method reduces the count by one and can be extended to a count of 2n-1 by adding more bistables.

Fig 27. Reduction of count by 1



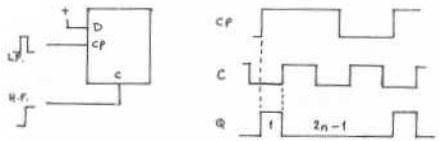
By a similar arrangement the count can have one added to it as Fig. 28 shows.

Fig 28. Increase of count by 1



Here the C-input holds the first counter at the count of 2n until the (n+1)th Bistable is triggered by CP and Qn output. This circuit has no advantages over the former version except that the output is more regular.

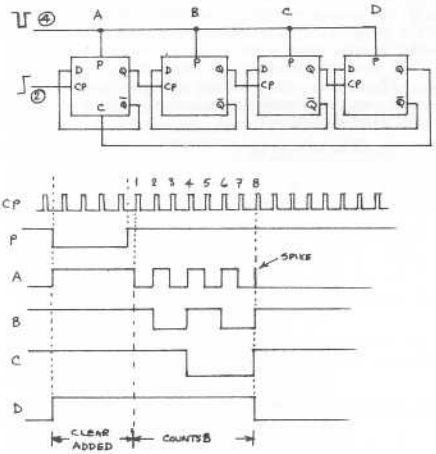
Fig 29. Producing a Single Unit Pulse



If the D-bistable is used as in Fig. 29 , then a pulse of one unit wide can be produced, for example, to make horizontal lines in a grille generator where the C-input is the counter, or h.f. feed and the CP-input is the slightly delayed counter output or l.f. feed. Note that although the CP-input remains high for several C pulses, the output is only one unit wide.

A useful counter which is easy to make with D-bistables is a clock-counter, as shown in Fig. 30

Fig 30. Clock Counter



This is basically a counter of the pulses (4 bit Binary), but on the 8th pulse the output prevents the input counter from doing any more counting so the counter counts 8 pulses and stops until all bistables are cleared.

This type of counter can be arranged to count any number by changing the clearing inputs. P-inputs have a loading factor of 1 whereas C-inputs have a factor of 2, which is why the P-inputs are used if possible. If the clearing pulse is several clock-pulses wide, then this is added to the output since the counter cannot start counting until the clearing pulse is removed.

General

Well,now you should be able to rush away and play with these things, but don't despair if they don't work first time. There are lots of pins to get mixed up and good decoupling is vital to counter circuits. The best way to find out about digital I.C.'s is to buy a few and have a go - try various arrangements. Make yourself a small board with some I.C. sockets on and Wander-plugs,or similar, to enable changes to be easily made whilst the circuits are working. Don't keep soldering them in and out.

Start with a multivibrator, or a source of external pulses and string up a few bistables and gates. It really is very simple - there are no other components unless differentiators are required.

But, you must have a good regulated power supply which preferably has overload protection.

The most useful T.T.L. I.C.'s are:-

SN7400N	which has 4 lots of 2-input NAND gates
SN7404N	" " 6 " " invertors (HEX)
SN7410N	" " 3 " " 3-input NAND gates
SN7420N	" " 2 " " 4- " "
SN7430N	" " 1 " " 8- " "
SN7472N	Single J-K master-Slave Bistable with triple J-K inputs
SN7473N	Dual J-K master-Slave Bistable with single J-K inputs
SN7474N	Dual D-Bistable
SN7490N	Decade counter (2 x 5)
SN7492N	Divide by 12 counter (2 x 6)
SN7493N	4 bit Binary counter (÷ 16)

A selection of **rejects of these types will most** likely include those where an input, or two, may be open-circuit, or where threshold levels are out of specification. But at 2/-d. each who can complain?

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

Part 4 of "Integrated Circuits" will contain more details about the uses of T.T.L. for counters, monostables, schmitts etc. Also circuits for a rectangular generator, colour bar generator and many others.

A forthcoming article will describe a T.T.L. multi-standard S.P.G. using 16 I.C.s - capable of conversion to colour using only two extra I.C.s!

1st. WORLD SSTV CONTEST

SPONSORED BY "C Q ELETTRONICA" MAGAZINE

February 7th and 13th 1971

"C Q Elettronica" Magazine proposes the 1st WORLD SLOW SCAN TELEVISION CONTEST. The purpose of this contest is to promote increased interest in the SSTV mode of operation as used by Radio Amateurs.

RULES

1) PERIOD OF CONTEST:
1st 07.00-14.00 GMT February 7th 1971
2nd 16.00-23.00 GMT February 13th 1971

2) BANDS:
All authorized frequencies.
SSTV frequencies suggested: 3.740 - 7.050 - 14.230 21.100 - 28.100 = 5Khz.

3) MESSAGES:
Exchange of picture.
The message number may be given by voice.

4) EXCHANGE POINTS:
a) A two-way contact with a station receives one point (Total points will be the number of individual stations contacted).
b) No extra points for the same station contacted on different bands.
c) A multiplier of 5 points is given for each Continent worked.

5) SCORING:
Total exchange points times the total of multipliers.

6) LOGS:
Log will contain: Date, Time(GMT), Band, Call sign, Message number sent and received, Points.

7) SWL:
To encourage those who have not got SSTV transmitting aparatus, a special prize will be awarded for the best collection of photographs of SSTV pictures sent in by short wave listener receivers.

8) PRIZES:
1st One silver thaler of Maria Theresa
2nd A free 12 months subscription to C Q Elettronica Magazine.
3rd A free 6 months subscription to C Q Elettronica Magazine.
4th Special SWL prize.

9) All logs must be received by 28th Febuary 1971.
Send them to: Prof. Franco Fanti
Via A. Dallolio 19
40139 BOLOGNA, ITALY.

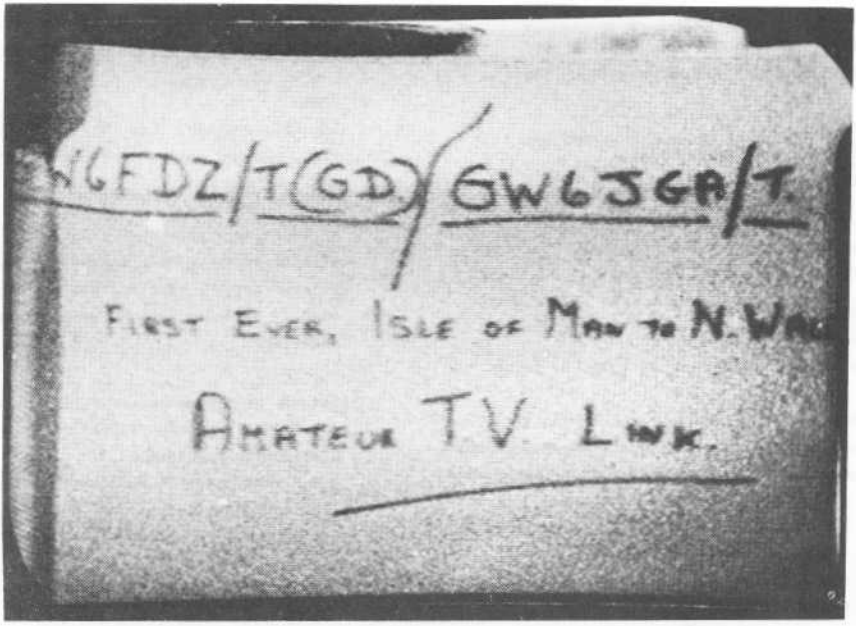
PORTABLE /T EXPEDITION TO GD LAND.

FIRST AMATEUR TELEVISION GD - GW QSO

Following a series of local /T tests between John Lawrence GW6JGA/T, Prestatyn and Derek Whitehead GW6FDZ/T, Llandudno and after obtaining the necessary special permission from the Min. of P. and T., Derek Whitehead went /T portable to the Isle of Man for the first GD-GW Amateur Television QSO.

The crossing from Liverpool was made on Tuesday 15th of September and by 17.30 hours two

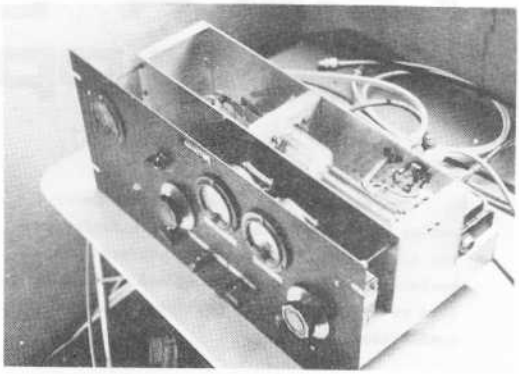
Continued on page 25, column 1.



First Signal received by GW6JGA/T Prestatyn from GD6FDZ/T operating in the Isle of Man.

GW6JGA/Ts station during the tests

Transmitter used by GW6JGA/T



GW6FDZ/T preparing for the /P trip to the Isle of Man

Vehicle mounted Equipment used by GD6FDZ/T

Location	Prestatyn N. Wales	Nr. Laxey, Isle of Man
Call	GW6JGA/T	GD6FDZ/T GW6FDZ/T/A(GD)
Height	350 feet	1000 feet
Signal source	Vidicon Camera 405 line	Vidicon Camera 405 line
Tx	QQV06/40 Grid mod by 6CL6 40W pk white	QQV06/40 Grid mod by 5763 40W pk white
RX	BF180 conv EKCO TMB272	BF180 r.f. TV tuner Sony TV
Aerial	J Beam 70/MBM46	J Beam 70/MBM46

ZENER DIODE APPLICATIONS

CIRCUIT NOTEBOOK No. 7

JOHN LAWRENCE
GW6JGA-T

The voltage regulator diode, or Zener diode as it is popularly known, is a semiconductor diode which has the normal forward characteristics of a silicon diode, and up to a certain reverse voltage it has the usual very small leakage current.

However, when the reverse voltage across the diode reaches a certain value, the reverse current increases very rapidly to a large value of many tens or hundreds of milliamps. This voltage is known as the breakdown voltage, Vz.

The actual voltage depends on the doping of the semiconductor material during manufacture and can be made to be between about 3 volts and over 100 volts. A typical characteristic of a 5.6 volt Zener diode is shown in Fig. 1.

After manufacture, the Zener diodes are selected according to voltage and batched accordingly, usually in 10% or 5% spacings, for example, 3.3v, 3.6v, 3.9v, 4.3v, 4.7v etc. The actual voltage is not given in volts but it can usually be noted in the type number. A Texas Instruments type 182056 is 5.6volts.

The manufacturers quote a maximum power dissipation in free air, Ps or Pz, and this is the product of the breakdown voltage Vz and the operating current Iz.

At breakdown the Zener diode is equivalent to a source of e.m.f. in series with a small resistance, this resistance Rz varies with operating current and is usually quoted at two or three values of Iz.

The actual value of Rz depends on the doping of the material during production and is lowest for diodes with breakdown voltages around 7 volts, as shown by the solid line in Fig. 2.

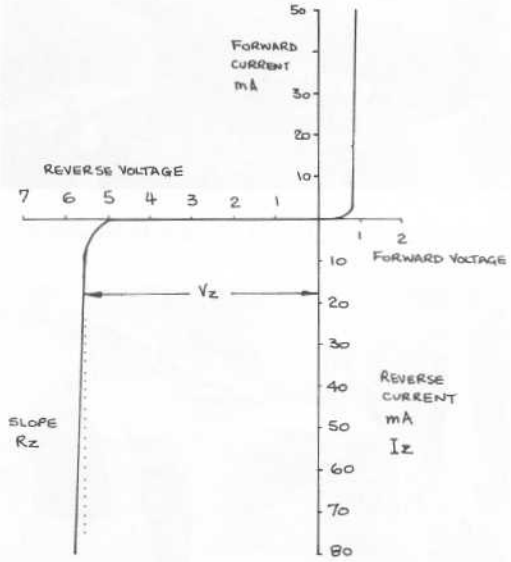


FIG. 1

The temperature coefficient of a Zener diode also varies with doping and is near zero for diodes with a breakdown voltage around 5.6 volts, as shown by the dotted line in Fig. 2. This characteristic makes a diode of this voltage very suitable as a reference voltage source in stabilised power supplies.

Probably the most popular use of a Zener diode is as a simple voltage regulator, a typical circuit is shown in Fig. 3. In this circuit current flows through R1 to the Zener diode, D1, causing breakdown to take place and maintaining the voltage across the diode at its rated value of 12 volts. Current drawn by the load, R_L, is diverted from D1, and for a load current of 0 - 100 mA, the current through D1 varies from 120 - 20 mA. The output resistance of this

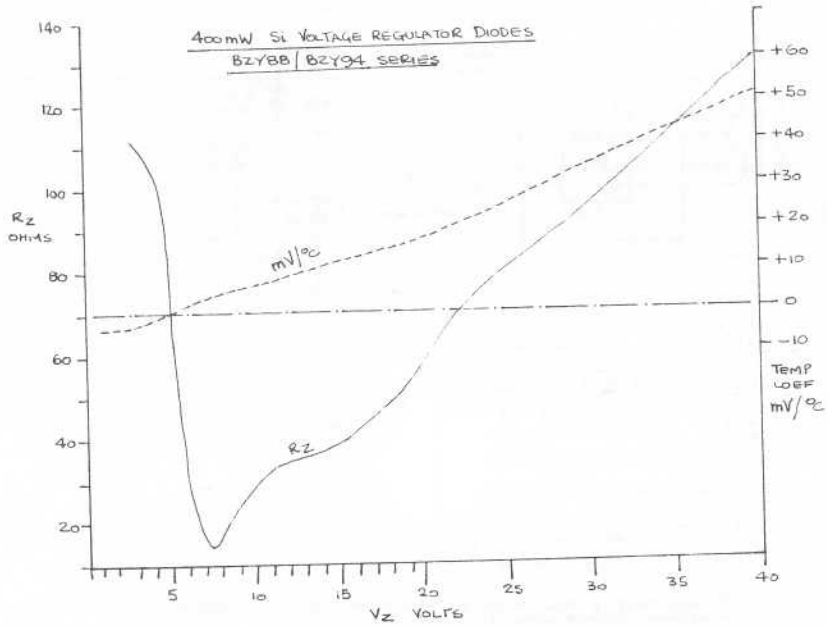


FIG. 2.

regulator circuit is equal to Rz in parallel with R1 and is about 5 ohms at 50 mA.

A power supply giving +6v, -6v and -9v is shown in Fig. 4. This circuit is suitable for powering the Simple Pulse Generator and the Simple Video Processing Unit, described in C Q - T V No. 68 and the FSS Head Amplifier in C Q - T V No. 65. The -700 volt E.H.T. output is suitable for supplying the Photomultiplier Tube.

When a greater current is required, than can conveniently be supplied using a simple Zener diode arrangement, a transistor can be added which operates as an emitter follower and increases the current capability of the circuit. This is shown in Fig. 5.

The output resistance of a stabilised supply can be considerably reduced and the stabilisation factor improved by using an amplifier to control the series transistor, as shown in Fig. 6.

In this circuit we compare the output voltage, or rather a fraction of the output voltage, with the reference voltage across the Zener diode. The amplifier transistor Tr1 controls a series element, Tr2, to try to correct any change which may occur. For example, should the output fall, due to increased load, the negative-going change is passed to the base of Tr1, reducing the collector current and causing Tr1 collector voltage to move positively. This causes Tr2 to conduct more heavily thus providing more output current and restoring the output voltage.

A higher current version, with an extra series transistor, is shown in Fig. 7. Due to the increased gain of this circuit, there is now

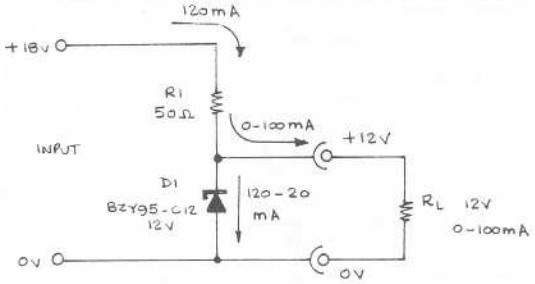
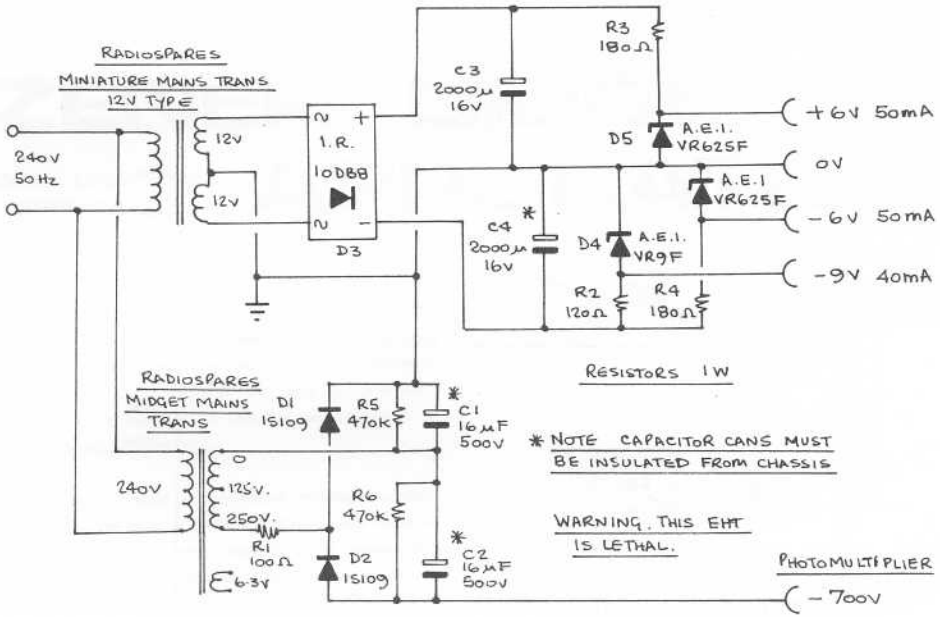


FIG. 3



POWER SUPPLY FOR 'SIMPLE' TV EQUIPMENT GW6JGA|T

FIG. 4.

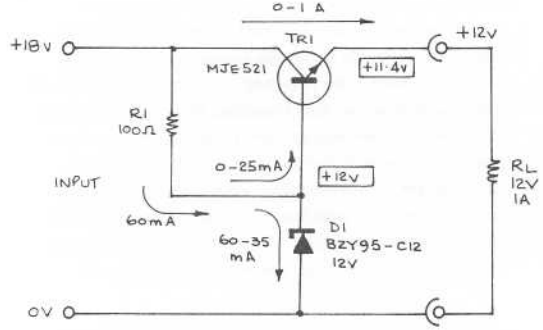


FIG. 5

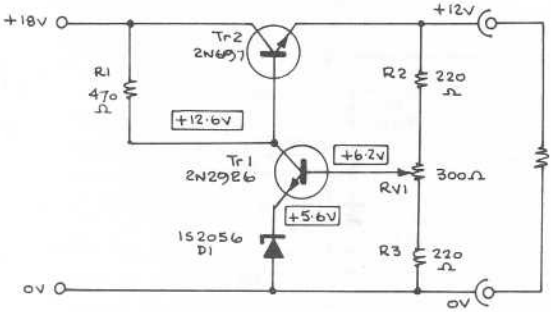


FIG. 6.

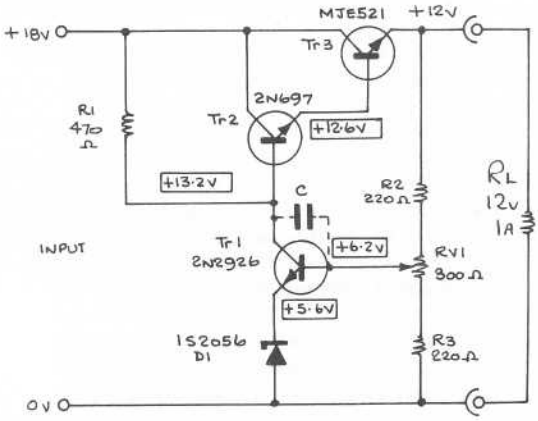


FIG. 7

a tendancy for it to oscillate at some high frequency. To overcome this, a capacitor of about 500 - 2000 pF may be connected across the amplifier transistor, as shown in the diagram. This effectively reduces the gain at the higher frequencies and ensures adequate stability. Unfortunately this increases the output impedance at high frequencies and it may be desirable to decouple the output with a large value capacitor, say 100 uF.

Cct. Type	C1	Stab. ratio	O/P I	O/P R	O/P Ripple
Fig. 3	1000μF	4:1	100mA	7Ω	6mv
Fig. 5	10,000μF	12:1	1A	0.2	30mv
Fig. 6	500μF	15:1	50mA	2Ω	50mv
Fig. 7	10,000μF	20:1	1A	0.3	50mv

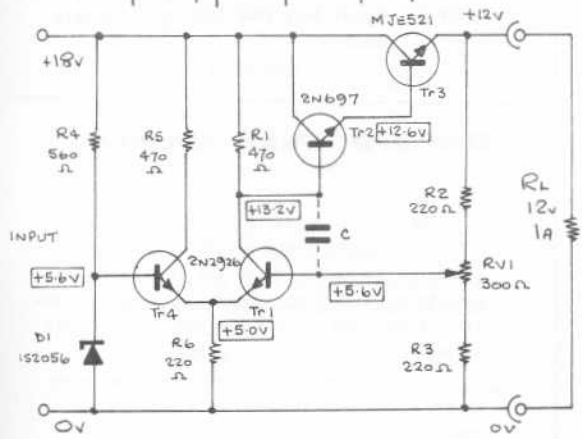


FIG. 8.

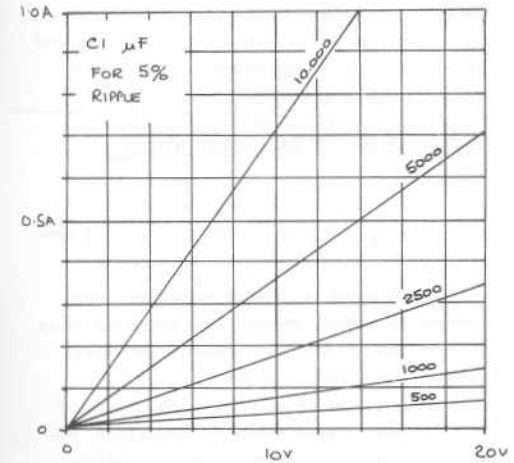


FIG. 10

These simple power supplies suffer from some voltage variation with temperature due to the emitter-base voltage of Tr1 being temperature dependant. This can be largely overcome by using a "long-tailed pair" arrangement of transistors in the voltage comparator-amplifier stage, as shown in Fig. 8.

POSTBAG

Peter Marlow G8BTV is studying at Imperial College in London and reports that his activity is now restricted to 2m from his digs. However, he has told us that the college radio society might try to return to /T operations soon. Welcome news indeed!

R. Garry G6TBN/T, G8ALG of Southport has been active on 70cm for over a year, and has had good reports from several local stations. His equipment consists, he tells us, of a hybrid FSS and a fully transistorised vidicon camera working on 405 lines, fully interlaced, with the transmitter using a 3/20a tripler with screen modulation. The Antennae is an 8 element Yagi at thirty feet and receiving equipment is a AF186 convertor feeding a 14" tv set. Sounds a good set-up.

Malcolm Burrell of Ilford wrote last November to say he was building a vidicon camera, but was limited by lack of spare time. However, hope by now you have good pictures, Malcolm.

David Wilkinson of New Eltham has constructed a sync pulse/cross hatch/ dot/stairstep/sawtooth/ circle/colour bar generator cum PAL coder. Sounds a marvellous device and must have involved considerable hard work.

A typical transformer-rectifier-smoothing circuit, suitable for feeding the various regulator circuits, is shown in Fig. 9. The value of C1 is normally chosen so that the peak-to-peak ripple across it is less than about 5% of the D.C. voltage. A graph showing the value of C1 for 5% ripple with various voltages across

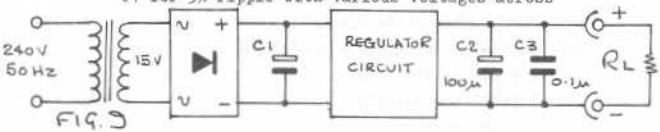


FIG. 9

C1 and load currents, is shown in Fig. 10. Decoupling of the output of the regulator at medium and high frequencies is provided by C2 and C3.

This article will be continued in the next issue.

Continued from page 1

scription will be raised to £1 from 1st January 1971.

An increase of 100% seems a drastic step to take, but to put it in a proper perspective the actual increase is 50p (10/-) a year on a subscription that has not been altered since 1954. It would generally be agreed that to hold a price steady for 16 years is no mean feat, and, in fact, this increase is very nearly putting the subscription back to that of 1954 if the value of the £ then and now is compared.

Obviously costs have risen enormously over the last 16 years, and the cost of printing and circulating one edition of C Q - T V at the present time is in the region of £100. If we are to continue to issue four editions a year the total cost just about covers our total subscriptions income, and postal charges are going up again in February!

As the magazine is the main benefit most Members derive from their subscription it is right that most of the income should be spent on it, and the Editor will now be able to make various improvements he has been pressing for as a result of an increased income.

There are, however, other benefits which Members derive from their membership. Some are obvious, such as supply of vidicon tubes, scan coils etc. at reasonable prices: other benfits may not be so well known, such as the negotiations between the Ministry and one of your Committee Members at present being carried on concerning the use of the 70cms. amateur band. Your Committee is always willing to provide other benefits which Members desire, if this is possible, and would welcome suggestions from Members.

Finally, in order not to exclude our more senior Members who may find difficulty in paying a higher subscription there will be a concessionary subscription availabe to old-age pensioners, and any member who wishes to claim this should write to me for details.

I have taken a great deal of valuable space, no doubt to the frustration of the Editor, to explain the increase, and would now like to urge Members to use the new Banker's order form enclosed with this issue of C Q - T V to pay their subscriptions. Payment this way helps to cut administration costs, and certainly saves a lot of additional psotages in sending out reminders. Please help your Club by doing this.

Thank you

Alan Pratt.

Camera Test Charts

The English Electric Valve Company Have offered to supply members with camera test charts at 30s each. These are of professional quality and are firmly mounted on a dense hardboard base. The surface has been treated with a special non-reflective coating.

There are resolution wedges and grids up to 800 lines and the usual grid pattern for checking linearity.

Members requiring one of these charts are asked to send their order, with cash, to C.G. Dixon, whose address is on page 1, as soon as possible, as we are asked to send a bulk order to cut down paperwork.

AN SS-TV RECORD

At 1424 GMT on November 21st what is thought to be the first international SSTV two-way contact involving Britain took place.

G3ZGO using 14.23 MHz, contacted SV1AB, George, in Athens, Greece, this being the first G-SV contact in SSTV and probably the first international SSTV from G.

Using equipment on the American standard of 120 lines, 8 secs/frame, FM subcarrier, consisting of a hybrid valve/transistor monitor with a 3FP7 used as a FSS on transmit, working into a HW32 transceiver with loft dipole for 20m and a homebrew 10w to QQV03 - 10 with an 8 element beam at thirty foot altitude for 2m, G3ZGO has in a short time logged an impressive number of contacts. He has copied Italy, Sweden, Finland, Greece, U.S.A. and Alaska, and his first test transmission took place on the 14th November, 1970, only one day after his official permit had been granted.

Letters to the Editor

Dear Sir,

As secretary of the Mid-Lanarkshire R.S.G.B. Group, I write to you concerning the increasing rumours re the threat to the VHF/UHF Amateur frequency allocations. In particular I refer to the 70 centimetre band which is attracting the attention of the commercial interests whose sole interest is financial.

It has recently come to my notice that one firm is now engaged upon the manufacture of transistorised personal equipment capable of operation on the 70 centimetre amateur band.

With this matter in mind I wrote to my local M.P. with the request that a clarification be given to Radio and Television Amatuers from the Ministry of Posts and Telecommunications as to the future of amateur frequencies.

In his reply he suggests that as many amateurs as possible should write to their respective M.P.s along similar lines if any impact is to be made.

Please publish this letter in C Q - T V so that members may give me their support. THE FUTURE OF AMATEUR TV MAY DEPEND ON THIS!

Gordon A. Hunter GM3ULP, GM6ADR/T.
Lanarkshire
Scotland.

Editor's Note: Ian Waters is the committee member responsible for the defence of 70cms on behalf of BATC members. If you have any views or information to offer, please write to him (address on page 1) as well as your own M.P.

Dear Sir,

Who on earth is "Modern Amateur" in the November issue of C Q - T V? The rubbish he writes means, I suppose, that he is afraid to risk other /Ts from finding out his identity.

I was not at CAT-70, but the "over the air" demonstration which was so successful was, I understand, on 405 lines. Does "Modern Amateur" and his friends ever stage events like that on 625? If so, I've never seen them. The whole point of amateur television is to transmit and receive recognisable signals - and this necessitates a common standard for all. At the moment everyone uses 405 (except perhaps "M.A.") and nothing short of an Act of Parliament will make them change. In other words - 625 is OUT!

Maybe I'll stay incognito as well, in case "Modern Amateur" comes and pulls my aerial array down!

"Active Amateur"
Essex.

OBITUARY
M. Henri Mégard HB9FX

It is with great regret that we announce the death of Monsieur Henri Mégard, President of the Swiss Groupement Experimental d'Emissions TV.

His death occured in a road accident in Rumania three months after he had attended CAT-70, the BATC Convention at Cambridge. He was then actively involved in the planning of a Swiss Convention to take place in Geneva, the first international event sponsored by Swiss television amateurs who must feel his loss sorely.

M. Mégard leaves a wife and two children to whom we offer our sincere condolences.

IN THE NEXT CQ-TV
May 1971

Your own call-sign electronically generated!

See Dave Lawton's I.C. character generator in C Q - T V no. 74.

You've seen others use it on the air - have one yourself.

Continued from page 18

way phone contact was established followed by two way Video.

The first Video signals were around strength 2 (British Amateur Television Club TV Signal Strength Reporting System) but after some tweaking at both stations this improved to strength 3-4, and very good pictures were received in each direction. The weather conditions were good but unfortunately there was very little lift in propogation conditions.

On the following day an almost continuous series of tests were made to evaluate the performance of various parts of the gear. Some lift was noticeable shortly after 12.00 hours but weather conditions deteriorated rapidly during the afternoon with dense low cloud and rainstorms. During this time very deep slow fading was experienced.

Valuable help was received from Jack Elliott, David Williams, Alan Antley GW3UTG and George Moorfield GW3DIX who kindly loaned the Honda generator.

Swiss Amateur Television Convention.

An International tv Convention will take place in Geneva at the end of May, 1971, just after the Montreux tv Exhibition, organised by the Swiss Groupement Experimental d'Emissions TV.

Those wishing to attend should complete a registration form, available on request from:

Andrew M. Hughes,
8, Lingfield Avenue,
Kingston-upon-Thames,
SURREY.

Please include an S.A.E.
It is recommended that this form is completed as soon as possible in order that the organisers can make the necessary hotel reservations in good time.

FOR SALE Ampex VR1000 Videotape Recorder quadruplex type. (Console and two racks of equipment). With one good head.
Price £150
Also, WANTED, 4CX250K or 4CX250M (Concentric type of 4CX250).
G. Sharpley,
52, Ullswater Road,
Flixton, Urmston,
Lancashire.

FOR SALE 70° R.C.A. 21" shadowmask Tube (Round) type 21FJP22, new and boxed with data. Will deliver if within reasonable distance.
PRICE £15
Dave Ellis-Jones,
40, Gunnersbury Lane,
Acton,
LONDON, W.3.

FOR SALE Heathkit OSI scope 3" c.r.t. 3MHz bandwidth.
Price £15.00.
2 VCR97 c.r.t.s £1.00 each
1 VCR517 c.r.t. long persistance £1.00
1 3FP7 PDA c.r.t. 10s.
Separate mesh vidicon tube, unused, broadcast quality, £30.00. o.n.o.
As above, but used, no blemishes £12.00
As above £5.00
W.A. Black,
64, Afton Bridgend,
New Cumnock,
Ayrshire, Scotland.

FOR SALE Marconi Mk 111 4½ inch I.O. camera channels. Enquiries to:
Arthur Bevington G5KS
53, Knottsall Lane,
Langley, Oldbury,
WARWICKSHIRE.

ADVERTS

THE BRITISH AMATEUR TELEVISION CLUB

CLUB SALES ITEMS

Camera Tubes	English Electric	P849 Amateur Grade	£10.50	£10.10.0.
	E.M.I.	9667 " "	£10.00	
		9728 " "	£10.00	
		10667 (not separate mesh)	£8.00	
		4½" Image orthicons 9564 & 9565 (older type with 'sticky' target)	£10.00	
		ex-studio Vidicons. Various types, mostly separate mesh.....when available.....	£5.50	£5.10.0.
Deflector and Focus coil assemblies.....per set			£6.50	£6.10.0.
Vidicon sockets....paxolin.....			17p	3/6d.
'C-mount' in aluminium for use with cine lenses.....			50p	10/-
Lapel Badges.....			20p	4/-
Lapel Badges with call-sign (to special order).....			30p	6/-
Adhesive Emblems....for decorating gear with the club badge.....			8p	1/8d.
Windscreen Stickers.....			6p	1/3d.
Notepaper & Envelopes (100 sheets).....			75p	15/-
Filmstrips of C Q - T V . 10 copies on each film....per film.....			£1.00	
(Please state which decade you require i.e. 31-40; 41-50 etc.)				
B.A.T.C. Reporting Chart. A visual scale of video noise			6p	1/3d.

PLEASE NOTE THAT THESE ARE NEW PRICES, AND THE ABOVE LIST CANCELS ALL OTHERS.

Please send cash with order to:-

B.A.T.C. Club Sales,
Kyrles Cross,
Peterstow,
ROSS-ON-WYE,
HEREFORDSHIRE.

FOR SALE Pulse and bar generator unit, ex Commercial tv company.
Valve type, requires drives and blanking.
Buyer collects from Wolverhampton.
Price £6.00.
Malcolm Sparrow,
64, Showell Lane,
Penn, Wolverhampton,
Staffordshire.

The B.A.T.C. Adhesive Emblem in use.

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We are looking for test engineers to work on our wide range of monochrome and colour television equipment — such as this broadcast plumbicon camera.

The work will be varied and interesting, and will involve testing small batches of our range of products using the latest 'state of the art' techniques.

Applicants with or without academic qualifications, posessing initiative, ability, and enthusiasm will be considered.

The company has recently moved to the expanding town of Andover in Hampshire within easy reach of the West Country and the South coast and with good communications with London.

A contributary pension scheme is operated together with free life insurance. Assistance with re-location expenses and housing will be available according to circumstances.

Write or telephone or telex with brief details of past experience & qualifications.

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