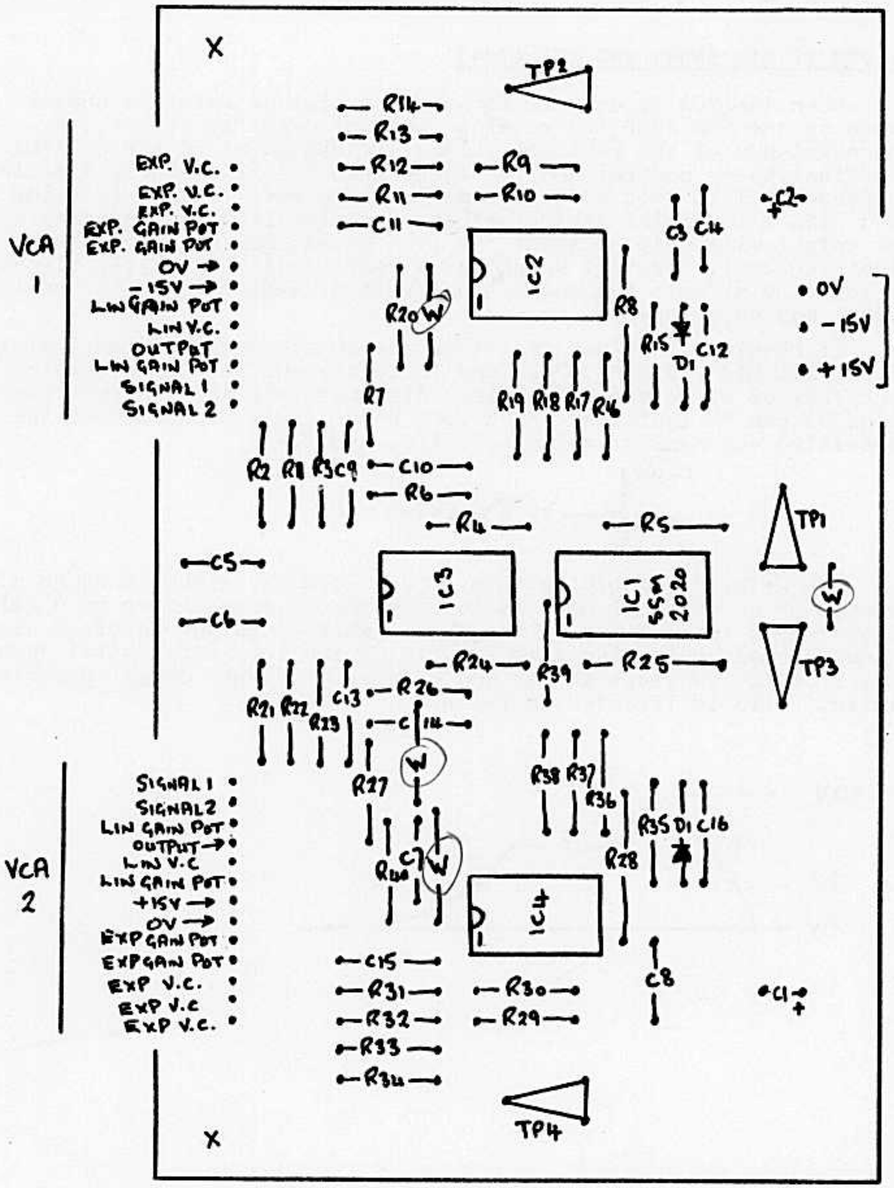
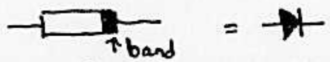


COMPONENT SIDE OF BOARD

IN 4148 

See text regarding components marked R14, R34 and TP2,4.

Decoupling capacitors C1 and C2 are supplied as a precautionary measure in the event of feedback through the supply distribution. They need not be installed initially.

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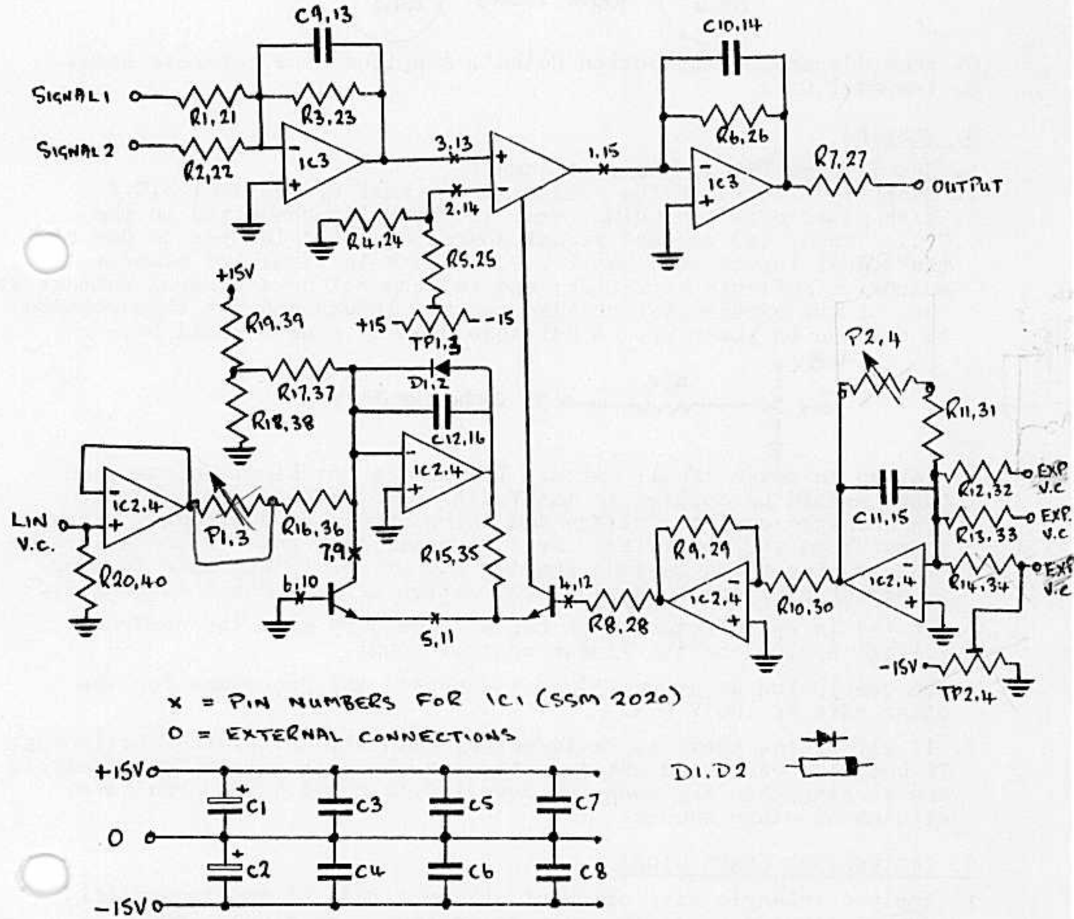
20201. DUAL VOLTAGE CONTROLLED AMPLIFIER



ONE HALF OF CIRCUIT SHOWN

COMPONENTS:

Resistors, 5% carbon film, $\frac{1}{4}$ or $\frac{1}{3}$ watt.

R1,2,3,9,10,12,13,19,20, 21,22,23,29,30,32,33,39,40	100k	R7,27	1k
		R8,16,28,36	15k
R4,24	47k	R11,31	75k
R5,25	270k	R17,37	2M2
R6,15,26,35	10k	R18,38	2k2

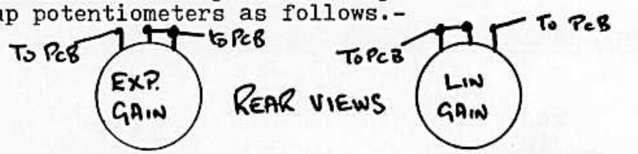
Capacitors

C1,2	47uF,25V P.C.B.	C9,13	10pF polystyrene
C3,4,5,6,7,8	100nF polyester	C10,14	22pF polystyrene
C11,15,12,16	100pF polystyrene		

IC1 SSM 2020; IC2,3,4 TL084/LF347; 14 pin sockets(3); 16 pin socket
D1,2 IN4148; P1,3 100k lin; P2,4 22k lin; TP1,3 100k carbon.

A. CONSTRUCTION

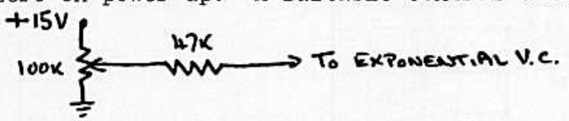
1. Solder in the four wire links marked 'W'.
2. Install all other components except I.C.'s.
3. Wire up potentiometers as follows.-



4. Read 'General Construction Notes', supplied as a separate sheet.
5. Insert I.C.'s.

B. TESTING

1. Set TP1 and TP3 to mid-positions.
2. Steps (3) to (5) below relate to one half of the dual V.C.A.
3. With power off, including power to the units connected to the V.C.A. then; (a) connect signal source of up to 10v p-p to one of the signal inputs; (b) set P1, 2, 3 and 4 to zero; (c) connect output to suitable amplifier; and (d) connect up a control voltage to one of the exponential voltage control inputs and set this voltage to be zero on power up. A suitable control source would be.-



4. Switch on power to all units. If this is not simultaneous then power should be applied to the V.C.A. before the signal source. Now increase control voltage and there should be a steadily rising output from the amplifier. Next increase gain pot (P2 or P4 according to side being tested) and the output should increase further. If either step does not function, switch off and check thoroughly.
5. If (4) is satisfactory then repeat procedure with the control voltage applied to the linear control input.
6. On completion of steps (3) to (5) repeat the procedure for the other half of the V.C.A.
7. If all of the above is satisfactory then all units are functioning. If one side works and not the other, or if three out of four controls are working, then try swapping over I.C.'s 2 and 4 when you have eliminated other causes.

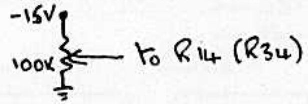
C. CALIBRATION (EACH SIDE)

1. Apply a triangle wave of about ±5V amplitude to an exponential control input and set the gain to maximum. No signal input. Connect output to amplifier. For VCA 1 adjust TP1 for minimum audio output, i.e., breakthrough of the control signal. Adjust TP3 when test being made on VCA 2.
2. Typical results are as stated in the specification for the kit and the module is designed to respond to control voltages up to +10V. With a signal connected, the output with 0V control voltage is typically 2 to 2.5mV. On the linear control, however, with the gain pot (P1 or P3) at maximum the offset voltage of IC2 (or IC4) may result in a signal level approaching 10mV. Say this occurs with VCA 1 associated with IC2 then try swapping IC2 by IC3 or even with IC4. Alternatively try another quad BIFET of the TL084/LF347 type.

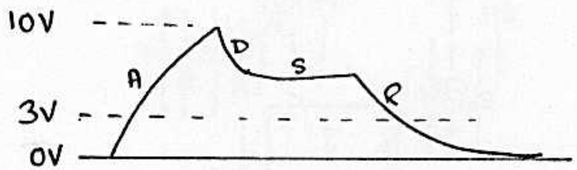
D. USE OF R14 (R34) AND TP2 (TP4)

When the VCA is used in conjunction with an envelope shaper based on the SSM 2050 the envelope may not decay to zero volts. The magnitude of the residual voltage is dependent on the setting of the Final Decay control and is higher when the Final Decay time is increased. This does not cause any problem when the VCA is being used with exponential control since even with 1V at the control input the output will only be about 5mV even at maximum gain. With the linear control, however, which has a response (to a 10V p-p signal) of 70 to 80 mV/volt and about 550mV/volt at maximum gain the residual signal may be obtrusive.

If required, TP2 and TP4 (100k carbon pre-sets) can be installed along with R14 and R34 (470k) and these are sufficient to provide an offset of up to about-3 volts. Alternatively the 470k resistors (R14,34) can be installed and a 100k rotary pot. connected to the associated exponential voltage control input.-



The effect of applying this offset voltage, either through a trimpot or an external pot, is to bury the envelope by up to 3 volts, according to the setting of the pots. This technique is often used in commercial synthesisers to get rid of the long exponential decay tail from the envelope shaper and so give a crisper decay characteristic. This is illustrated below.



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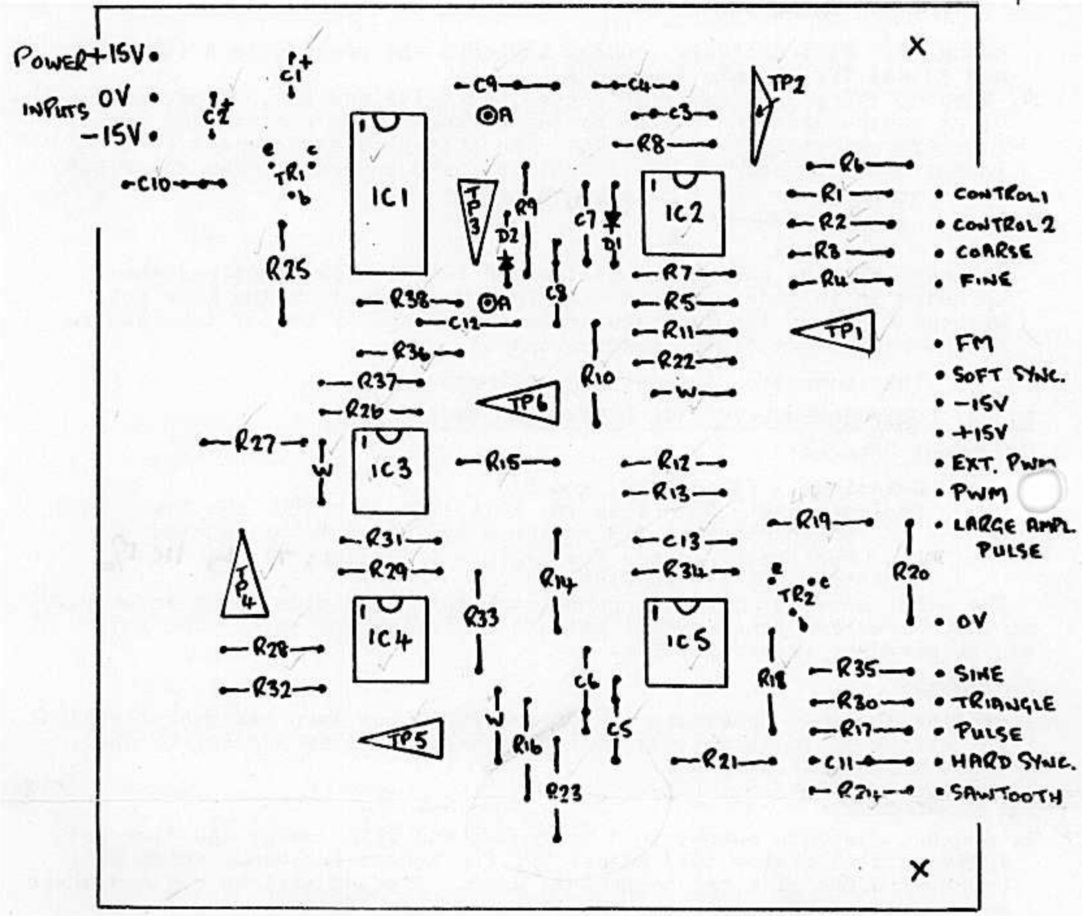
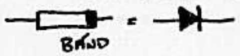
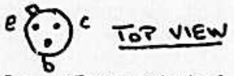


COMPONENT SIDE OF BOARD.

IN 4148  2N2218A = 

COMPONENTS FOR 20301: Resistors 5% carbon film unless stated otherwise.

R1,2	100k 1% MF	R11	1M5	R25	10k
R3,5	300k 1% MF	R12,15,22	100k	R26,27	20k
R4	2M7	R13	150k	R28,34,36	47k
R6	91k 1% MF	R14	10M	R32	1M
R7	24k	R16,23	22k	R33	270k
R8	56k 1% MF	R17,24,29,30		R37	15k
R9	470k	31,35	1k	R38	7k5
R10	2M2	R21	2k2		

T.1 Q81, 1k, 1% temperature compensating resistor.: D1, 2 IN 4148

C1,2	47μF,25V	TP1	220k cermet
C3,4,5,6,8	100nF polyester	TP2	20k cermet multiturn
C7	100pF polystyrene	TP3	10k cermet
C9,10,11	1nF polystyrene	TP4,6	100k carbon
C12	330pF polystyrene	TP5	1M carbon
C13	22pF		

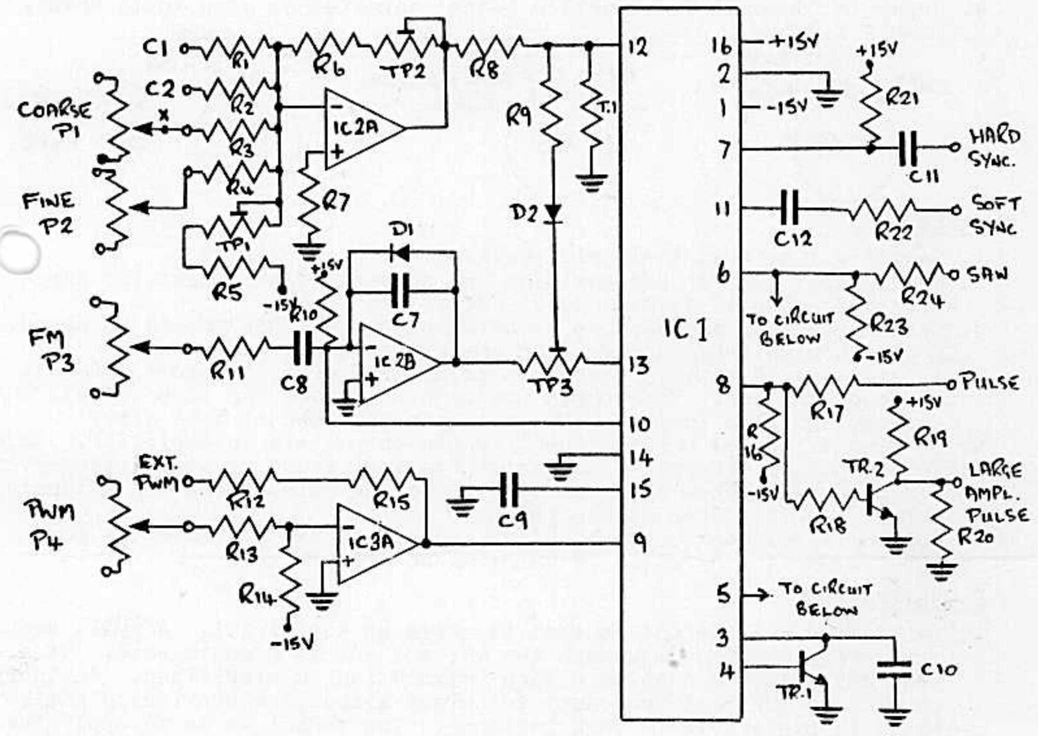
Potentiometers for Coarse, Fine, FM and PWM controls = 100k linear

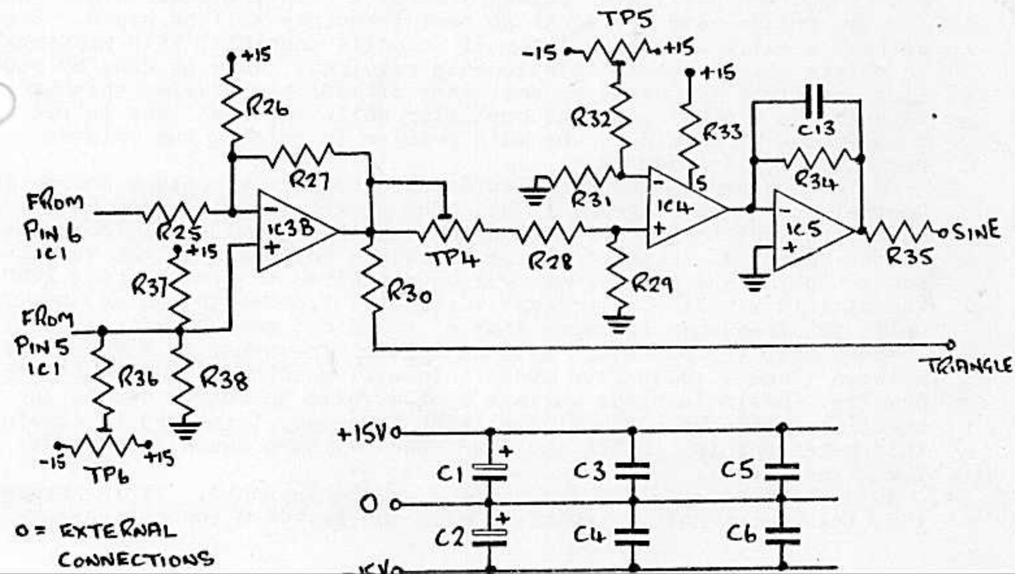
IC1 SSM 2030; IC2 TL 082/LF 353; IC3 μA1458; IC4 CA 3080E
IC5 TL 081/LF351. 8 pin sockets (4) 16 pin socket.

Component changes for large amplitude pulse and 20302: See notes.

20301. STANDARD VOLTAGE CONTROLLED OSCILLATOR.

20302. LOW FREQUENCY VOLTAGE CONTROLLED OSCILLATOR

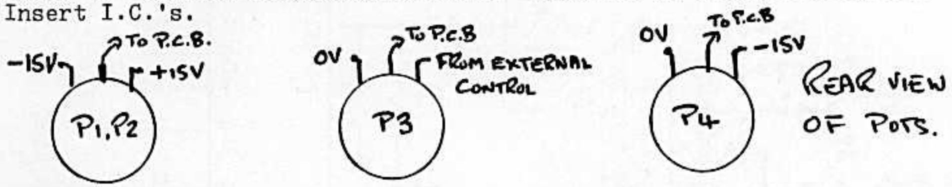




20301. STANDARD VCO.

A. CONSTRUCTION

1. Solder in the three wire links marked 'W'.
2. Insert D2 before TP3.
3. Install all other components but do not wire up 'coarse' and 'fine' control pots. Insert the Q81 between points marked 'A' and ensure that it stands about 20mms. above the board. Leave it standing vertically so that IC1 can be inserted later.
4. Refer to 'General Construction Notes' supplied as a separate sheet.
5. Insert I.C.'s.



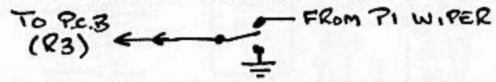
B. TESTING

1. Set TP's 1 to 6 at their mid position.
2. Set PWM pot (P4) to mid position and connect pulse output (or large amplitude pulse if fitted) to an amplifier.
3. Switch power on and a pulse of between 50 and 100Hz should be heard. If not then switch off and carry out check procedure.
4. If step (3) is satisfactory then adjust PWM over its range and note variation in tone. Then check sawtooth, triangle and sine outputs but remember that the last two have not been adjusted at this time.
5. Setting triangle: Monitor the triangle output via an amplifier. Adjust TP6 for purest triangle - no 'motor boating' sound at low frequency. With an oscilloscope this can be seen as the point where the triangle is free from glitches at its peaks.
6. Setting sine: Monitor sine output and adjust TP4 and then TP5 for purest sound (or by shape if using an oscilloscope).

C. CALIBRATION.

1. Carefully bend the Q81 so that it rests on top of IC1. A small amount of heat sink compound between the Q81 and IC1 is advantageous. If a frequency meter is available then calibration is simplified. Another approach is the beat frequency technique although a previously calib- -rated is preferable in this instance. The technique is to apply the output from the calibrated source into one side of a stereo amplifier and to put the oscillator being calibrated into the other side. When the two frequencies are equal no beat frequency will be heard. Even without a calibrated oscillator it is still possible, with patience, to obtain the 1V/octave relationship required. This is done by record- -ing the first frequency on one track of tape and playing this back through one side of a stereo amplifier while the next tone is put through the other side. The main problem is getting the volumes reasonably well balanced.
2. Having decided on technique to be used connect a voltage source to Control 1 (C1 on diagram) input. The oscillator will then be accurately calibrated for R1 and this control input should be connected to the keyboard. Connect a high impedance voltmeter to the voltage source output and measure the voltage required to attain about 200Hz (about 1 to 2 volts). Increase voltage by 1.00 volts and adjust TP2 until the frequency is twice that of the first measurement.
3. Repeat step (2) but start with an initial frequency of 2500Hz. If between 1 and 2 volts gave 200Hz this will require an input of 5 to 6 volts. Again increase voltage by 1.00volts to obtain double the starting frequency. Adjust the 'high frequency trim' TP3 to obtain this relationship. Check the low frequency step again and adjust TP2 if necessary.
4. Adjust TP1 to give the lowest note on the keyboard. It is assumed that the lowest note is obtained with the keyboard control voltage being 0V. Alternatively connect keyboard and press note A (440Hz) and adjust TP1 to this frequency.

4. Wire up the coarse and fine control pots (P1 and P2). These will be 0V at centre with the coarse having a range of ±5 octaves and the fine approximately ±0.5 octaves. The preferred arrangement is to insert a switch between the output from the coarse pot and the P.C.B.



so that when the switch is off (ground to P.C.B. connection) the keyboard is in tune, apart from a minor adjustment of the fine pot. Without a switch the keyboard tends to go rapidly out of tune due to slight variations of the coarse control.

This completes the setting up procedure.

20302. LOW FREQUENCY VOLTAGE CONTROLLED OSCILLATOR.

Component Changes:

Deletions - P3, R2, R9, and D2
Replacements - R3 = 150k 1%; R4 = 1M5; R5 = 100k 1%; C10 = 10nF polycarbonate; TP3 replaced by 10k resistor mounted vertically across the 0.2inch dimension; T1 by 1K 1%
Addition - TR 1 = 2N2218A

The other alteration is to connect the left hand side (diagram on p.2) of the coarse and fine control pots to 0V instead of -15V. The pots can be wired up before testing.

A. TESTING

1. Follow the same procedure as for the 20301 but turn the coarse control pot clockwise to give a suitable frequency level if testing by the audio procedure outlined.

B. CALIBRATION

1. Connect sawtooth output to a voltmeter and with coarse and fine pots fully anti-clockwise (0V) adjust TP1 for lowest frequency which will be about 0.2Hz with the components used. A point will be reached where adjustment of TP1 shuts the oscillator off - we are looking for the the point where it is still oscillating in a regular manner.
2. Connect sawtooth output to an amplifier. P1 and P2 at zero. Connect voltage source to R1. With 0V at R1 input count the number of clicks in a given time. Apply 1.00V to R1 and again count the number of clicks. Adjust TP2 until the the number of clicks with 1V applied is twice that with R1 at zero.

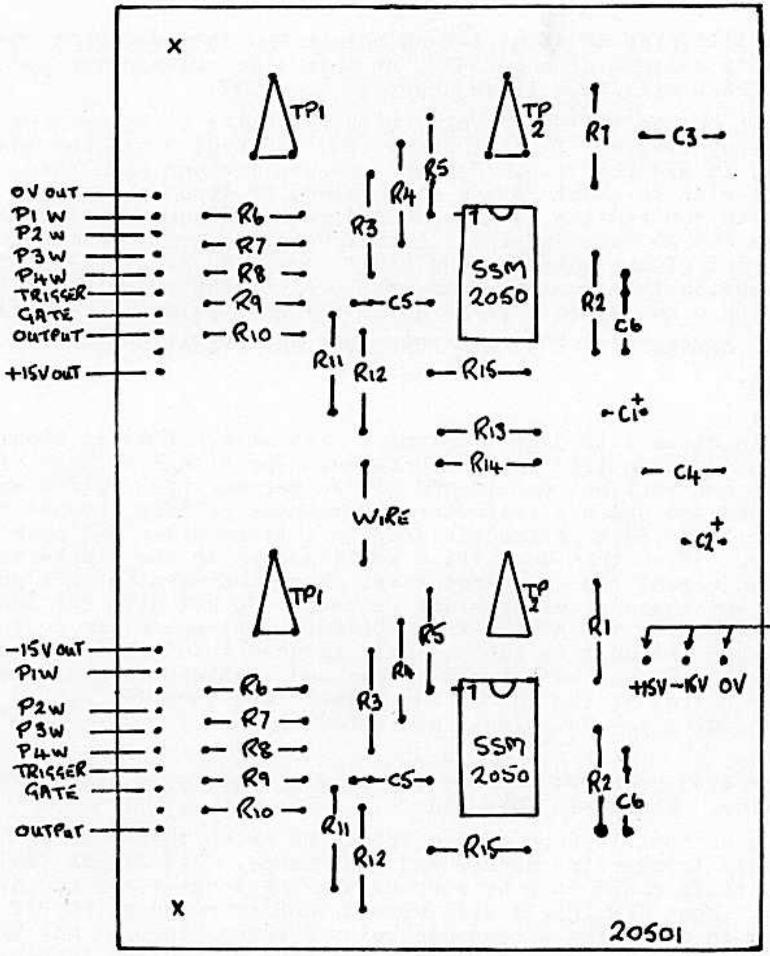
LARGE AMPLITUDE PULSE

R17 omitted and R16 (22k) placed in position marked R18. Add TR 2 (2N2218A); R20 (10k) and R19 (4k7). A pulse varying from 0 to 10V in amplitude will now be obtained from output marked 'large ampl. pulse'. The 'pulse' output is redundant. (R19 = 4K7, R20 = 10K)

OMITTING ~~Replacing~~ R20 ~~by a wire link~~ results in a 0 to 15V pulse.

PULSE WIDTH MODULATION (PWM)

In order to obtain full PWM response via the external input with our standard 0 to +10V control signals it is necessary to turn P4 fully clockwise.



COMPONENT SIDE OF P.C.B.

STANDARD COMPONENTS:

R1	33k	P1, P2, P3, P4	100k lin.	SSM 2050
R2	100k	TP1	22k carbon	14 Pin DIL socket.
R3	330k	TP2	100k carbon	
R4	330k	C1, C2	33μF, 25V elect.	
R5	330k	C3, C4, C6	100nF, polyester	
R15	1k	C5	10nF, polyester	

SPECIAL NOTES:

1. Before soldering components in place drill out holes maked 'X' to suit mounting method to be used.
2. Drill out the three power connection holes to suit a P.C.B. connector if you intend to use this technique rather than wires direct to the board.

CAUTION: DO NOT OVERLOAD THE SSM 2050. Our systems are designed to connect into impedances of about 100k and if you want to attenuate the output of this module we would recommend a 100k pot. If attenua--tion via 10k, or less, is required then a buffer stage (voltage follower) is recommended.

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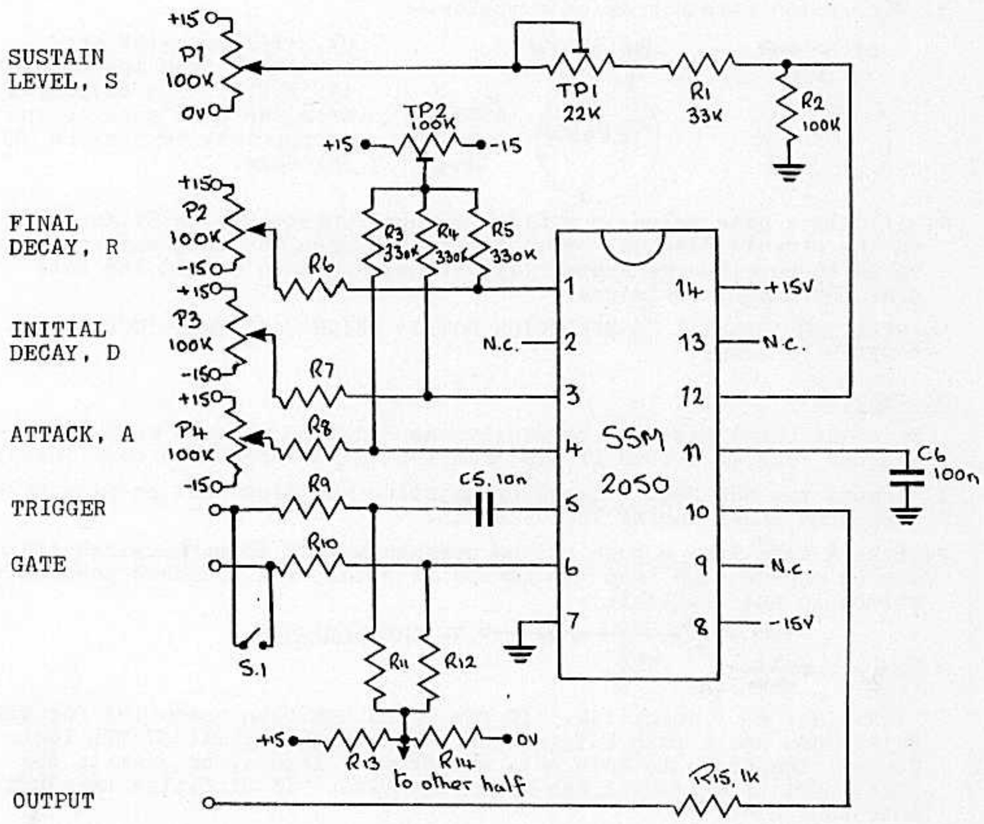
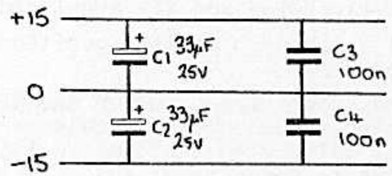
20501. (DUAL) VOLTAGE CONTROLLED TRANSIENT GENERATOR



ONE HALF OF BOARD



COMMON TO BOTH HALVES OF P.C.B.

o = External Connections

2720Ω

R6, R7, R8: Chosen to match impedance of 2050 as measured by resistance (with a low current ohmmeter) between Pins 1 and 7 of the SSM 2050. Select nearest resistance to [(Resistance between pins 1 and 7 X 100) and add 10k]. Kits are supplied with appropriate resistors.

R9, R10: For gate and trigger voltages of +5V = 1k; of +10V = 10k; and +15V = 15k.

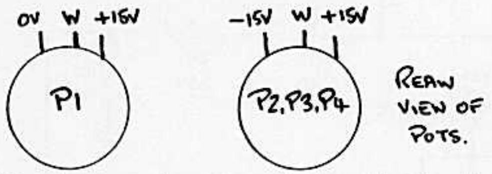
R11, R12, R13, R14: For TTL gates and triggers R11,12 = 2k2; R13 = 10k R14 = 4k7 and wires inserted in place of both R9 and R10.

A. CONSTRUCTION:

1. Note points made on pages 1 and 4 regarding components and any enlargement of holes that you may wish to make.

2. The wire connection in the centre of the board is only required if TTL gates and triggers are used in the lower half of the P.C.B. In which case R13 and R14 should be installed.

3. Wire potentiometers as shown below.-



0V, +15V and -15V are available from the edge of the P.C.B. The output(W) from the pots goes to the appropriate connection on the edge.

4. If only a gate pulse is available then connect switch S1 as shown on the circuit diagram. With the switch open the unit will function as an AD envelope generator (see below) and when closed the full ADSR response is obtained.

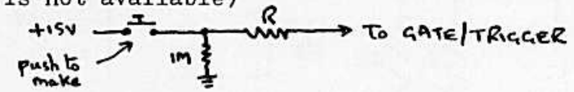
5. READ THE 'GENERAL CONSTRUCTION NOTES' WHICH HAVE BEEN INCLUDED AS A SEPARATE SHEET.

B. TESTING:

When the board has been carefully checked then proceed as follows - and one side at a time if two transient generators have been installed.

1. Insert the SSM 2050 - check orientation and also that no pins have been bent under during installation.

2. Make a gate from a push button momentary push to make switch (this may be constructed from two strips of metal if a standard push button switch is not available)



make R + R9 = about 15k. If the board has been assembled for TTL gates then use a push button operating via the normal 5V TTL logic. Connect the above to both gate and trigger inputs, or just to the gate input if switch S1 has been installed. If S1 fitted then put into ADSR mode.

3. Connect output to a high (or medium) impedance voltmeter and set to DC 15V range or the next range above 10V.

4. Turn TP1 fully anti-clockwise and TP2 about mid position.

5. Set Attack pot (P4) to about 3 o'clock position and all other pots fully anti-clockwise.

6. Apply power, depress gate/trigger button and keep held down while observing the voltmeter. The voltage should be rising steadily but since the unit is not calibrated the time is likely to vary between about 5 and 20 seconds to reach about 10V. (The time can be outside of this range and can be ignored at this stage). The important point is that the voltage rises steadily and when it reaches about 10V it should sharply drop to zero. If this does not happen then switch power off and check your switch, the TP and P settings and also the wiring and component placement.

7. If step 6 is O.K. then turn Sustain pot (P1) to mid position and P2, P3 and P4 to about 3 o'clock (a little less if time to reach 10V was above about 10 seconds in Step 6, or a little more if it was less than 5 seconds). Press gate/trigger button and observe voltmeter.

The voltage will rise to about 10V as before and then decay at the same rate to a voltage of about 5V. At this time release the push button and there will be a final decay to about 0V.

8. Connect push button to 'Gate' only, either by wire or by opening S1. Set Final Decay (P2) and Initial Decay (P3) to about 3 o'clock and Sustain (P1) to mid position. Depress push button and hold down. The voltage will rise to about 5V and when steady at about this value release the button and the voltage should fall to near zero. Note that this is the AD mode and that Initial Decay control becomes the attack (A) part of the envelope and Final Decay the decay (D) part. In the AD mode, Sustain control sets the level of the output as well as maintaining a sustained voltage until the gate pulse is released.

STEPS 6 TO 8 DEMONSTRATE THAT ALL FUNCTIONS ARE OPERATIONAL.

C. CALIBRATION:

SUSTAIN LEVEL:

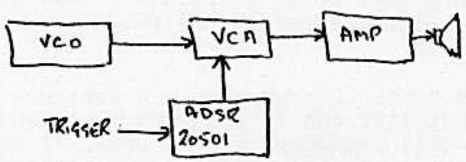
1. Set up as in steps 1 to 3 of 'Testing'. Set Attack (P4) to about 3 o'clock and Sustain (P1) fully clockwise. The attack voltage of the SSM 2050 can vary between 10 and 11V so depress push button and keep depressed and observe voltmeter. Note peak voltage reached and also whether there is a noticeable drop in voltage after the peak has been reached. If so then turn TP1 a small amount in the clockwise direction and repeat the last test step. Keep incrementing TP1 until peak attack and sustain voltages are matched. DO NOT HAVE THE SUSTAIN VOLTAGE IN EXCESS OF THE ATTACK PEAK VOLTAGE. Better to err on the low side. When the unit is subsequently patched into a V.C.A. the Attack-Sustain step can be checked by ear and if there is a discernible reduction in output at the end of the attack time then TP1 can be adjusted accordingly - but slowly and carefully.

TIMING:

1. Only Attack (P4) requires calibrating so all other pots set fully anti-clockwise. Module in ADSR mode.

2. If you have an oscilloscope with a triggered sweep then you can simultaneously trigger the module and the 'scope. Set Attack (P4) to minimum, trigger, and step by step adjust TP2 to give a 2 msecs. attack time. Most SSM 2050's will give a shorter response but if care is not taken in obtaining a response below 2 msecs. then it may be found that the initial part of P4 does not give a doubling (approx.) of response time for 2V applied.

3. If a suitable oscilloscope is not available then a satisfactory calibration can be achieved by making the following patch, or by using a voltmeter, as before, to measure Attack time. Adjust Attack pot (P4) so that there is 10.0V at the wiper. Trigger the module and keep button down. Note the time between pressing button and the sound ceasing, or the voltage dropping sharply. Adjust TP2 to give a time of 9 seconds (slightly more rather than less). Repeat until this time obtained and check that P4 still has 10.0V at its wiper. Turn P4 fully anti-clockwise and check response is very fast and then fully clockwise and check that time is in excess of 20 seconds. When calibrated the scale for the A, D, and R pots will be approximately as shown below. If the Sustain pot is linearly scaled 0 to 10 then this will approx. represent the sustain voltage.



AURAL CALIBRATION PATCH