CONTENTS

THE DIGITAL SEQUENCER

USER MANUAL

HOW TO USE THIS MANUAL

Start at the beginning and read through to the end. The manual begins easily and becomes harder and more technical towards the end. Use the GLOSSARY to explain any abreviations or technical words not understood.

INTRODUCTION

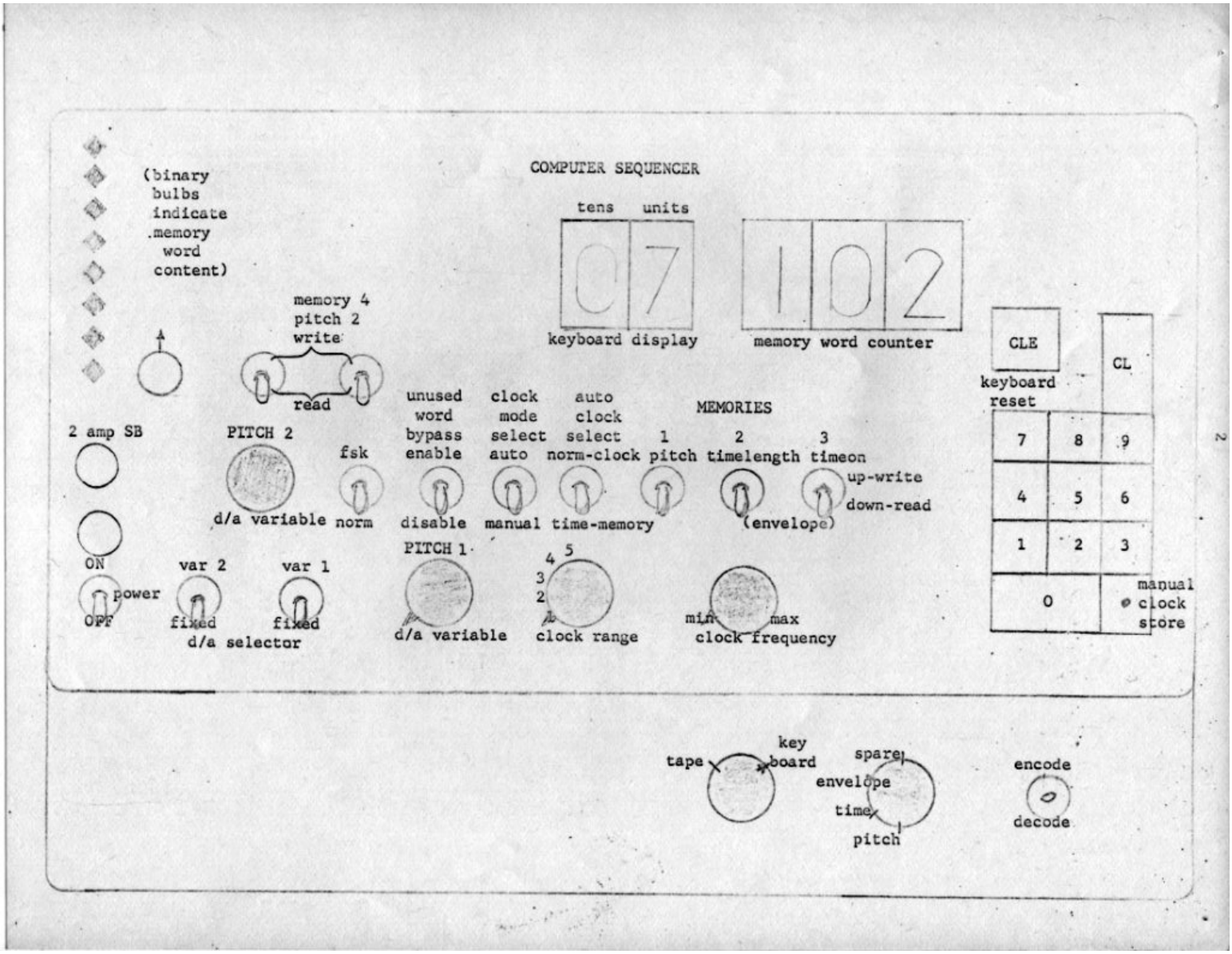
Musical notes as written on the staff, are translated into a SERIES of numbers which accurately define each note. These numbers when INPUT to the DIGITAL SEQUENCER, are converted into a SERIES of equivilent electrical OUTPUT voltages. If the OUTPUT voltages are then applied to a Voltage Controlled Oscillator (VCO), a SERIES of sounds is produced which are directly equivilent to the original musical notes on the staff.

Hence, the notes as scored on the staff can be 'PLAYED' by using the DIGITAL SEQUENCER connected to an OSCILLATOR or SYNTHESIZER output device.

HOW THE DIGITAL SEQUENCER GETS ITS NAME

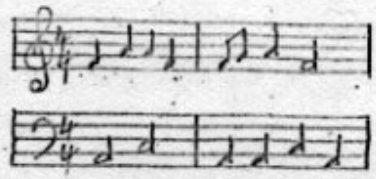
The numbers (DIGITS) representing the musical notes on the score, are ENTERED into the SEQUENCER in the same order as they appear on the staff. These DIGITS are stored in a MEMORY device in the same order or SEQUENCE as they were INPUT. When the SEQUENCER is switched to the 'PLAY' position, the stored DIGITS are retrieved from MEMORY, converted into an equivilent electrical voltage, and delivered to an OUTPUT terminal in the same SEQUENCE as they were ENTERED and stored.

Since the device works by processing a series of DIGITS in a SEQUENTIAL manner, it is called a 'DIGITAL SEQUENCER'. Other names included are 'COMPUTER DIGITAL SEQUENCER' or 'COMPUTER SEQUENCER', sometimes used because the MEMORY device is the same as that used in a computer.


COMPUTER SEQUENCER
(binary bulbs indicate memory word content)
tens
units
keyboard display
memory word counter
memory 4 pitch 2 write
read
CLE
keyboard reset
CL
7
8
9
4
5
6
1
2
3
0
manual clock store
2 amp SB
PITCH 2
fsk
d/a variable
norm
unused word bypass enable
disable
clock mode select
auto
manual
auto clock select
norm-clock
time-memory
MEMORIES
1 pitch
2 timelength
3 timeon
(envelope)
up-write
down-read
ON
power
OFF
var 2
fixed
var 1
fixed
d/a selector
PITCH 1
d/a variable
4 5
3
2
1
clock range
min
max
clock frequency
tape
key board
spare
envelope
time
pitch
encode
decode

THE STEPS INVOLVED TO USING THE SEQUENCER

musical score



Program Sheet preparation

musical notes manually translated into a series of numbers and entered onto Program Sheet.

Entering Programs into the Seq.

numbers are manually entered into the Sequencer.

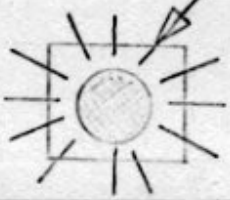
Sequencer 'Plays' the Program

the Sequencer interprets the numbers producing equivilent electrical output voltages which are applied to a VCO or Synthesizer.

Sound Production

the VCO produces sound equivilent to the Sequencer output voltages.

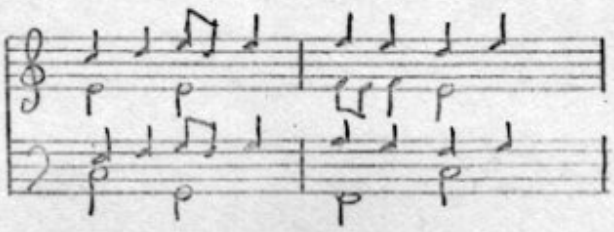
Speaker



Tape Recorder

HOW TO TRANSLATE SCORED 'NOTES' INTO 'NUMBERS'

The SEQUENCER is a MONOPHONIC device i.e. it can only produce the equivilent of one note at a time. Hence, only one melodic musical line can be ENTERED and PLAYED at one time.



In the example above, Line A could be ENTERED into the SEQUENCER, PLAYED and/or recorded first. Any other line, either Line B, C or D could be ENTERED and then PLAYED or recorded next. If it is recorded, all subsequent lines must be SYNCRONISED with the first line. see section 'How To Record Using The FSK SYNCRONISING Feature'.

Every note is defined in terms of PITCH, TIME value, ENVELOPE and VOLUME.

PITCH Numbers

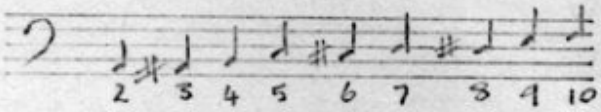
Any number between 1 and 63.

Give the lowest note likely to be scored the value 1.

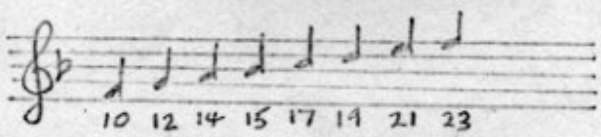
A semitone above this note would be 2.

A semitone above that note would be 3 and so on...

The highest note has the value 63 and is five octaves and a major second above the lowest note. The lowest note may actually be assigned any starting value, it is best to leave some numbers for notes lower than you think you will need just as a precaution.



Typical Chromatic Scale number values.



Typical Major Scale number values.

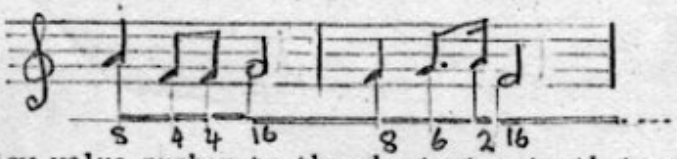
PITCH Numbers are ENTERED into the PITCH 1 MEMORY, see section 'ENTERING Numbers Into The MEMORIES'.

PITCH 1 and PITCH 2 number value 'zero' has a special use. Any location containing this value is simply 'skipped' over and as such is thus ignored.

TIME Value Numbers

Typically, any number between 2 and 48.

Defines the theoretical (as compared with actual) time value of a note.



Assign any low value number to the shortest note that occurs in the score. All other longer notes must be a MULTIPLE of that lowest value.

- 2
- 4
- 8
- 16
- 32

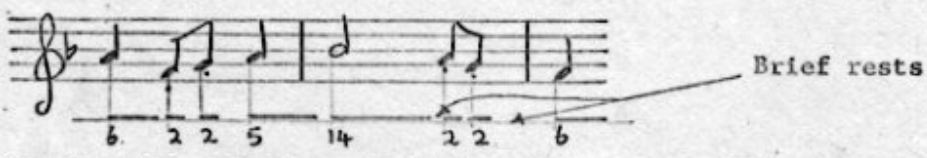
- 6 (4 + 2)
- 12 (8 + 4)
- 24 (16+ 8)

It is best not to assign the value 1 to the shortest note, since it will then be available to shorten a note still further if required. This may become apparent when actually PLAYING the piece during the sound production step. Before choosing TIME values, it is best to have an idea of ENVELOPE values. TIME Value numbers are ENTERED into the TIME MEMORY, see section 'ENTERING Numbers Into The MEMORIES'.

ENVELOPE Numbers

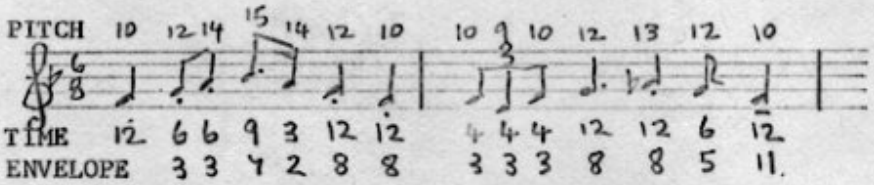
Any number less than or equal to a TIME value number.

Defines the actual (as compared with theoretical) time value of a note.



Its value will thus cause a pause or short rest to occur between successive notes. This will allow the notation of staccato or legato effects etc.

An ENVELOPE value equal to a TIME value, will cause the notes to "run into each other" when played i.e. a complete overlap or legato effect.
An ENVELOPE value just slightly less than the TIME value, will introduce a brief rest between that note and the next producing a near legato effect.
An ENVELOPE value much shorter than the TIME value, will shorten the time value of the note in the same proportion. For example, if the TIME value is 8 and the ENVELOPE value is 4, the note would actually be played for HALF the total time allotted.



VOLUME Numbers

Defined as eight dynamic volume lvels from the following series;

VOLUME	Nil	ppp	pp	p	mf	f	ff	fff
EXPANENTIAL	0	2	4	8	16	32	63	-
LINEAR	0	8	16	24	32	40	48	56

These numbers describe the relative volume of each note with respect to any other. The absolute volume will depend on how the sound production equipment is set up and adjusted etc.

These numbers are ENTERED into the PITCH 2 MEMORY, the PITCH 2 output lead is then connected to a VOLUME control device such as a Voltage Controlled Amplifier (VCA).

PROGRAM SHEET Preparation

As the musical notes on the score are translated into numbers, they are ENTERED onto the 'PROGRAM SHEET' in the same order as the appear on the score. The positions of the bar lines or bar numbers may also be indicated on the PROGRAM SHEET for ease of referance between score and PROGRAM SHEET. The colume marked 'TIMBRE', is not used. See sample PROGRAM SHEET on next page.

When all numbers have been written onto the PROGRAM SHEET, they are ready to be ENTERED into the SEQUENCER. Refer to the section called 'ENTER AND PLAY CHECKLIST'.

COMPUTER PROGRAM SHEET

TITLE SAMPLE PROGRAM PAGE 1

NO.	PITCH	TIME	ENVELOPE	TIMBRE	VOLUME
1	17	8	6		32
2	21	8	6		40
3	17	4	2		32
4	19	4	2		"
5	21	4	2		"
6	12	4	2		"
7	24	8	6		40
8	12	8	6		32
9	16	8	6		"
10	17	8	6		40
11	14	4	2		32
12	16	4	2		"
13	17	4	2		"
14	19	4	2		"
15	21	8	6		40
16	9	8	6		32
17	12	8	6		"
18	14	8	6		40
19	10	4	2		32
20	12	4	2		"
21	14	4	2		"
22	16	4	2		"
23	17	8	6		40
24	5	8	6		32
25	9	8	6		"

NO.	P	T	E	T	V
26	10	4	2		32
27	9	7	〃		〃
28	10	〃	〃		〃
29	12	〃	〃		〃
30	10	〃	〃		〃
31	9	〃	〃		〃
32	10	〃	〃		〃
33	9	〃	〃		〃
34	7	〃	〃		〃
35	1	〃	〃		〃
36	2	7	4		
37		〃	2		
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39					
40					
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42					
43					
44					
45					
46					
47					
48					
49					
50					

NO.	P	T	E	T	V
51					
52					
53					
54					
55					
56					
57					
58					
59					
60					
61					
62					
63					
64					
65					
66					
67					
68					
69					
70					
71					
72					
73					
74					
75					

NO.	P	T	E	T	V
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100					

The SEQUENCER MEMORY and CLOCK devices

The DIGITAL SEQUENCER has four MEMORIES.

MEMORY 1 stores the PITCH 1 numbers.

MEMORY 2 stores the TIME value numbers.

MEMORY 3 stores the ENVELOPE numbers.

MEMORY 4 stores the PITCH 2 or VOLUME numbers.

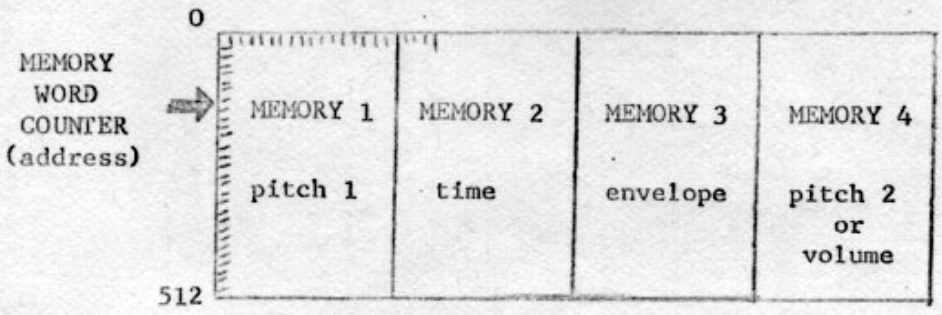
The numbers stored in MEMORY 4 may be used either to control the pitch of a second VCO or to control the VOLUME of the notes obtained from the PITCH 1 output. See the section on 'Miscellaneous Information'.

The computer MEMORY, is similar to a group of 'pigeon holes' used for sorting letters. Each storage location (hole or WORD), has its own address from zero to 512. A number can be stored in any location by means of the WRITE switches. A number is retrieved from storeage and translated into an equivilent electrical output voltage by means of the READ switches.The process of READING or WRITING to any location, is called ACCESSING that location.

MEMORY locations are only accessed SEQUENTIALLY i.e. one after the other in ascending order of address number. The SPEED at which the MEMORY locations are accessed, is controlled by the CLOCK device. The faster the CLOCK speed, the more MEMORY locations will be accessed in a given time. Amongst other things, this is used to control the TEMPO of the musical sound output.

The MEMORY WORD COUNTER indicates the address of the MEMORY location that is currently being accessed or, to put it another way, the address that the CLOCK is now pointing to. The same address in all four MEMORIES is being accessed AT THE SAME TIME!

When the number value 'zero' is placed into every location, the MEMORY is said to be CLEARED.



ENTER And PLAY Checklist

The following are the steps that must be taken to ENTER and PLAY a PROGRAM.

1) Calibrate and tune the PITCH 1/2 output voltages.
   See section 'Calibrating The PITCH 1/2 Output Voltages'.
   See section 'Tuning The PITCH 1/2 Sound Output'.

2) CLEAR PITCH 1 MEMORY to zeros.
   See section 'CLEARING The MEMORY'.

3) CLEAR The PITCH 2, TIME and ENVELOPE MEMORIES as required.

4) ENTER PITCH 1 numbers into MEMORY 1.
   See section 'ENTERING Numbers Into The MEMORIES'.

5) ENTER the PITCH 2 (VOLUME), TIME and ENVELOPE numbers as required.

6) Reset the MEMORY WORD COUNTER to the beginning of the PITCH 1 MEMORY i.e. the start of the PROGRAM. See section 'RESETTING THE MEMORY WORD COUNTER'.

7) Connect all output leads to the VCO or SYNTHESISER.
   Set/Reset all switches to appropriate values.

8) PLAY The PROGRAM.
   See section 'PLAYING The PROGRAM'.

Detailed information on each of these steps is now outlined.

Calibrating The PITCH 1/2 Output Voltages

The SEQUENCER output voltages when applied to a VCO or SYNTHESISER, produce an equivilent sound output. The normal calibration for this relationship is, 1 volt per Octave. That is, a change in 1 volt output produces a corresponding 1 Octave change of sound putput.

The SEQUENCER has already been calibrated to produce this range of output voltage for the PITCH 1 and PITCH 2 number values.

1) Set D/A SELECTER VAR1/FIXED to FIXED to calibrate PITCH 1 output.
2) Set D/A SELECTER VAR2/FIXED to FIXED to calibrate PITCH 2 output.

The GAIN/ATTENUATOR controls on the VCO and SYNTHESISER may also have to be adjusted to allow this SEQUENCER calibration but will not be discussed further in this manual.

If the VCO or SYNTHESISER does not produce the required sound output for this calibration, the SEQUENCER PITCH 1/2 output voltages can be manually adjusted until the required calibration is obtained.

1) ENTER a short PROGRAM into the PITCH 1 and PITCH 2 MEMORIES to PLAY an arpeggio of say, a four or five octave range e.g. PITCH 1 numbers 1, 13, 25, 37, 49 & 61.
2) Set D/A SELECTER VAR1/FIXED to VAR1.
3) Set D/A SELECTER VAR2/FIXED to VAR2.
4) PLAY the PROGRAMS in PITCH 1/2 in the normal way. As the PROGRAM PLAYS, adjust PITCH 1 D/A VARIABLE and PITCH 2 D/A VARIABLE manually, until the required octave range is obtained.

Tuning The PITCH 1/2 Sound Output

Once the output voltages have been calibrated, the sound output can then be 'tuned' to any referance frequency. This is best done by tuning the VCO or SYNTHESISER to a seperate source e.g. A440 on a piano or 'Tuning Fork'. This is particularly useful to ensure that any voice part added on another TRACK, will always be pitched the same as the initial PROGRAM recording.

RESETTING The MEMORY WORD COUNTER

It is good practice to ENTER all program numbers into MEMORY starting at the first location. The address of the first location is zero and is shown on the MEMORY WORD COUNTER. This means that the beginning of the musical score starts at the beginning of the MEMORIES, and the PROGRAM SHEET line numbers (on which PITCH, TIME, ENVELOPE and VOLUME numbers are entered), correspond to the location addresses. This can be useful in changing the contents of any location (EDITING) or starting the program at any other point since the location address will be the same as the line number on the PROGRAM SHEET.

A. RESETTING The MEMORY WORD COUNTER to zero

1) Set all MEMORY READ/WRITE switches to READ position.
2) Set UNUSED WORD BYPASS to ENABLE.
3) Set AUTO CLOCK SELECT to NORM-CLOCK.
4) Set CLOCK MODE SELECT to AUTO.

The MEMORY WORD COUNTER should now begin counting indicating that MEMORY is being accessed. Turn the CLOCK RANGE to fairly fast i.e. a higher number, until nearing the count of 512. Slow the CLOCK down again just before 512 and then stop the CLOCK by setting the CLOCK MODE SELECT to MANUAL. Keep pressing the MANUAL CLOCK STORE ENTER KEY until the MEMORY WORD COUNTER has advanced round to zero.

CAUTION: Pressing the 'CL' KEY, resets the MEMORY WORD COUNTER to zero value but this is NOT the address that the CLOCK is still pointing to. The CLOCK address remains at the last position when the program was switched off, say for example, by switching the CLOCK MODE SELECT to MANUAL. To correct this situation, switch the CLOCK MODE SELECT to AUTO and leave the SEQUENCER running a few moments until the MEMORY WORD COUNTER begins to count again. Now repeat from step 4) above to reset to zero.

NOTE: Any PITCH 1 MEMORY location that contains a zero value, will NOT be counted by the MEMORY WORD COUNTER with the UNUSED WORD BYPASS set to ENABLE as in the above. These locations will be skipped over quickly until the next location with a non-zero number value is encountered. It is usual practice to CLEAR the PITCH 1 MEMORY prior to ENTERING the PROGRAM numbers. All UNUSED locations will thus contain a zero value. When the MEMORY WORD COUNTER has counted the last PROGRAM number, it will skip through the remaining UNUSED zero value MEMORY locations stopping at the next non-zero number which will be the beginning of the PROGRAM i.e. MEMORY WORD COUNTER address zero.

B. RESETTING The MEMORY WORD COUNTER To Any Location Address

1) Set all MEMORY READ/WRITE switches to READ.
2) Set UNUSED WORD BYPASS to ENABLE.
3) Set AUTO CLOCK SELECT to NORM-CLOCK.
4) Set CLOCK MODE SELECT to AUTO.

The MEMORY WORD COUNTER should now begin counting indicating that MEMORY is being accessed. Turn the CLOCK RANGE to fairly fast until nearing the count of the address required. Slow the CLOCK down again, just before the address and then stop the CLOCK by setting the CLOCK MODE SELECT to MANUAL. Keep pressing the MANUAL CLOCK STORE ENTER KEY until the MEMORY WORD COUNTER has advanced round to the required address.

C. EDITING: Changing A Number Value Already In MEMORY

1) Reset the MEMORY WORD COUNTER to the required address by following the instructions in section 'RESETTING The MEMORY WORD COUNTER To Any Location Address'.
2) Punch in the new number via the KEYBOARD. The number is shown on the KEYBOARD DISPLAY.
3) Switch the MEMORY READ/WRITE switches to WRITE position for those MEMORIES that the new number is to be stored in.
4) ENTER the new number by pressing the MANUAL CLOCK STORE KEY.
5) Reset all MEMORY READ/WRITE switches to the READ position immediately to avoid inadvertantly writting the number into other locations when the PROGRAM is switched on again.

ENTERING Numbers Into The MEMORIES

1) Set all MEMORY READ/WRITE switches to the READ position.
2) Set the UNUSED WORD BYPASS to DISABLE.
3) Set the CLOCK MODE SELECT to MANUAL.
4) Set the AUTO CLOCK SELECT to NORM-CLOCK.
5) The address at which the number will be stored, is shown on the MEMORY WORD COUNTER. This will normally be zero if starting at the beginning of the program. Set the MEMORY WORD COUNTER to the required address following the instructions in section 'RESETTING THE MEMORY WORD COUNTER'.
6) The number to be ENTERED is now punched in on the KEYBOARD. The number just punched will be shown on the KEYBOARD DISPLAY. Only two digit numbers can be ENTERED. If the 'tens' field is not required e.g. a number like seven, make sure this field contains a zero by punching first zero then seven i.e. 07 is ENTERED.
7) Set the MEMORY READ/WRITE switches to the WRITE position for all those MEMORIES that it is intended to store the number in. For example, set MEMORY 2 TIME LENGTH switch to WRITE position to ENTER TIME value numbers into MEMORY 2.
8) ENTER the number into each MEMORY by pressing the MANUAL CLOCK STORE ENTER key. The MEMORY WORD COUNTER will now automatically advance one position ready for access to the next location.
9) When all numbers have been ENTERED, reset all MEMORY READ/WRITE switches to the READ position and reset the MEMORY WORD COUNTER to the required address.

WARNING: The contents of any location can be destroyed by over-writting it with the number in the KEYBOARD DISPLAY, if the MEMORY READ/WRITE switches are left in the WRITE position.

ENTERING The Same Number Into Many Locations

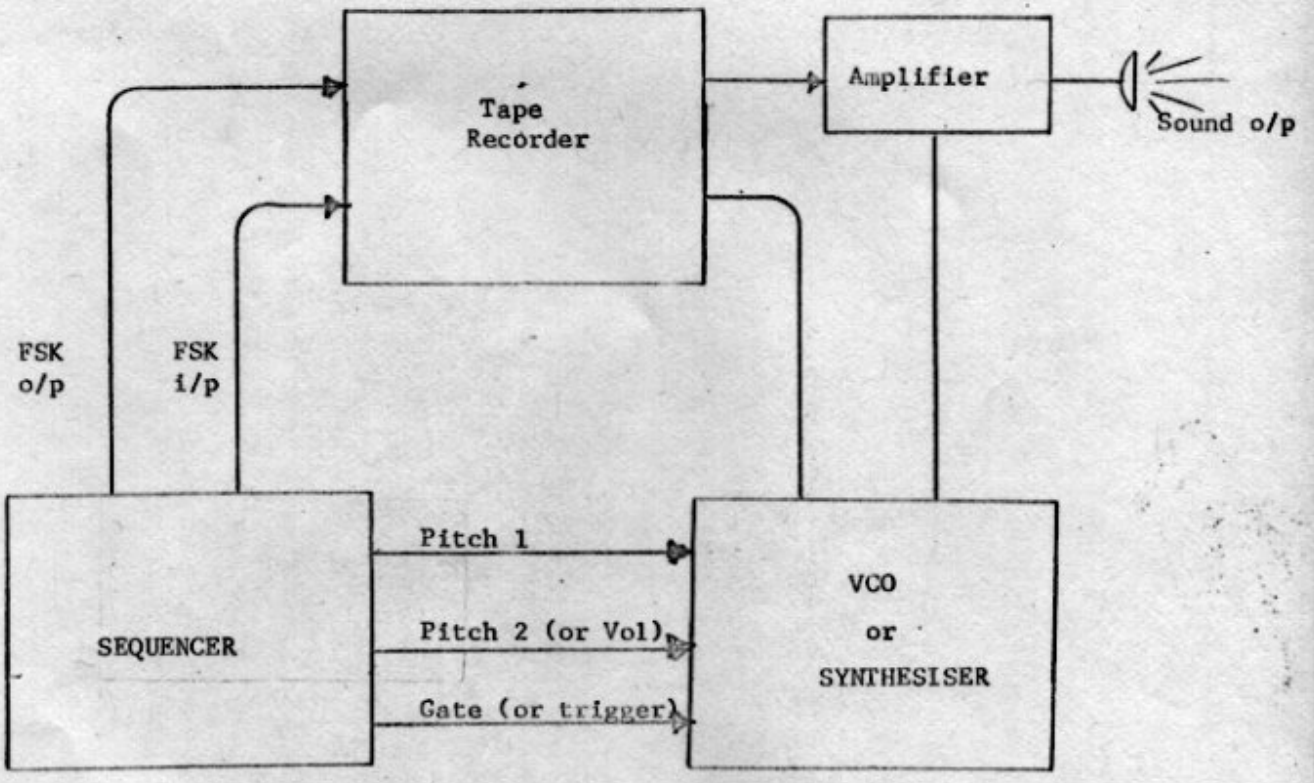
1) Follow the instruction in section 'ENTERING Numbers Into The MEMORY' up to and including step 8).
2) Set the UNUSED WORD BYPASS to ENABLE.
3) Set the CLOCK MODE SELECT to the AUTO position. The MEMORY WORD COUNTER will now start counting at the CLOCK speed ENTERING the number in the KEYBOARD DISPLAY into each successive location. This is a quick way of ENTERING the same number into many sequential locations. Resetting the CLOCK MODE SELECT to MANUAL, will stop the automatic accessing process.
4) When all the numbers have been ENTERED, reset all MEMORY READ/WRITE switches to the READ position.

CLEARING The MEMORY

It is good practice to CLEAR the MEMORIES before starting to ENTER a new program. If the value zero is placed into every location in the MEMORY, the MEMORY is said to be CLEARED. The PITCH 1 MEMORY MUST be CLEARED before any program can be run. This is to allow the SEQUENCER to detect the beginning and end of the program.

The MEMORY may be CLEARED by ENTERING the value zero following the instructions in section 'ENTERING The Same Number Into Many Locations', While the MEMORY WORD COUNTER is allowed to count from zero to 512.

Equipment Inter-connections



PLAYING The PROGRAM

1) Calibrate and tune the PITCH 1 and PITCH 2 output voltages (see the section with the same name).
2) Set all MEMORY READ/WRITE switches to READ.
3) Set UNUSED WORD BYPASS to ENABLE.
4) Set the AUTO CLOCK SELECT switch to either of two positions as follows;
   a) NORM-CLOCK

      The TEMPO and TIMEvalue of the program notes, will be controlled by the CLOCK frequency. The higher the frequency, the faster the TEMPO and the shorter the note values. Notes are played 'legato' style, that is, each note is sustained until the next note is begun. The TIME MEMORY 2 and ENVELOPE MEMORY 3 are not accessed and need not contain numbers with this setting. This feature can be used if the USER wishes to check out the PITCH numbers for correctness without first ENTERING TIME and ENVELOPE numbers.

   b) TIME-MEMORY

      The CLOCK frequency still controls the TEMPO but the TIME and ENVELOPE MEMORIES are accessed and control the duration of each note. The duration of each note is automatically scaled to the CLOCK frequency. For example, if the TEMPO is speeded up, note durations are shorten by a corresponding amount to maintain the correct rhythmic pattern.
5) Set the CLOCK MODE SELECT to AUTO.

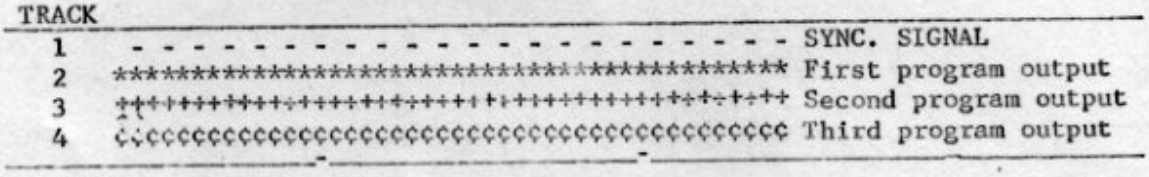
The program now begins to PLAY producing equivilent sound output from the SYNTHESIZER or VCOs.

How To Use The SEQUENCER FSK SYNCRONISING Feature With A Tape Recorder

The resultant musical sound output from the SEQUENCER/OSCILLATOR arrangement, may be recorded on a tape recorder using the normal methods. However, if the musical score calls for more than one part to be played and recorded, subsequent parts must be recorded on different TRACKS in 'SYNCRONOUS' with the first part recorded. This ensures that all voice parts start and stop together and are in perfect rhythmic time. The SEQUENCER has a FSK SYNCRONISING device already built in to do this. The general steps in using this are,

1) Record a SYNC. SIGNAL on TRACK 1.See section 'How To Record The FSK SYNCRONISING SIGNAL'.
2) PLAY and record the first PROGRAM part using the FSK SYNCRONISING feature on TRACK 2. See section 'How To Record Using The FSK SYNCRONISING Feature'.
3) PLAY and record any subsequent parts also using the SYNCRONOUS feature on TRACKS 3 and 4.

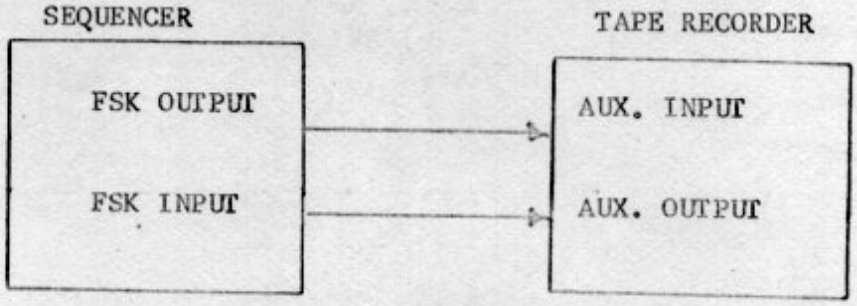
All musical parts thus recorded on TRACKS 2,3 & 4, will be in perfect SYNCRONISATION. These three voice parts can now be mixed down using normal techniques, if it is required to free up more TRACKS for the recording of more voice parts. When all voice parts have been recorded, the SYNC. SIGNAL on the first TRACK can be eliminated.



How To Record The FSK SYNCRONISING SIGNAL

It is important to remember that the SYNC. SIGNAL also determines the TEMPO of the piece when recording PROGRAM sound output using the SEQUENCER FSK SYNCRONISING feature. Hence, before the SYNC. SIGNAL is recorded arrive at a suitable CLOCK frequensy by experimentation.

1) Connect the FSK OUTPUT lead to the tape recorder AUXILIARY INPUT socket.
2) Connect the FSK INPUT lead to the tape recorder AUXILIARY OUTPUT socket.
3) Set CLOCK MODE SELECT to MANUAL.
4) Set the tape reel to the required starting position.
5) Set the tape recorder to RECORD MODE on TRACK 1 and start the machine going.
6) Record the CONTINUOUS SYNC. SIGNAL (monitored via the VU meter), for about 10 seconds. Then switch the CLOCK MODE SELECT to AUTO recording the MODULATED SYNC. SIGNAL for a period slightly longer than the PROGRAM time.
7) Reset CLOCK MODE SELECT to MANUAL. Reset FSK/NORM to NORM and turn off tape recorder.
8) Rewind tape to the beginning in preparation for recording subsequent PROGRAM output on TRACKS 2, 3 and 4.



How To Record Using The FSK SYNCRONISING Feature

1) PLAY the program in the normal fashion until the musical sound output is satisfactory. For example, adjust the CLOCK frequency to obtain the required TEMPO. This CLOCK is now recorded as the SYNC. SIGNAL and remains as a fixed TEMPO thereafter.
2) Record the FSK SYNC. SIGNAL on TRACK 1 following the instruction in section 'How To Record The FSK SYNCRONISING SIGNAL'.
3) Connect the TAPE RECORDER to the VCO or SYNTHESISER sound output terminals and adjust the recording levels etc. Arrange that the first PROGRAM part records on TRACK 2.
4) Set all MEMORY READ/WRITE switches to READ.
5) Set UNUSED WORD BYPASS to ENABLE.
6) Set CLOCK MODE SELECT to MANUAL.
7) Set FSK-NORM to NORM.
8) Turn the TAPE RECORDER to RECORD mode on TRACK 2 and start machine going.
9) During the initial 10second CONTINUOUS TONE SYNC. SIGNAL,
    a) Set FSK-NORM to FSK.
    b) Set CLOCK MODE SELECT to AUTO.

   When the MODULATED SYNC. SIGNAL on TRACK 1 begins, it will automatically start the PROGRAM running, the resultant sound output being recorded on TRACK 2.
10) When the PROGRAM has been recorded, rewind back to the beginning.
11) Record all PROGRAM parts on subsequent TRACKS repeating from step 9) above.

MEMORY Contents and the BINARY BULBS

When a number is ENTERED, it is stored in the MEMORY location address shown in the MEMORY WORD COUNTER. The number is ENTERED in DECIMAL but it is stored in BINARY form. The number is also displayed on the BINARY DISPLAY BULBS in the top left hand corner of the SEQUENCER

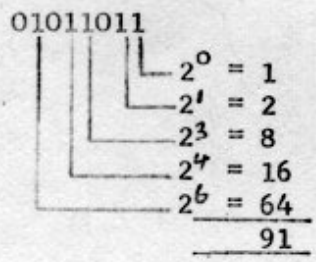
The BINARY DISPLAY BULBS can be used as a means of checking the contents of any location as follows.

1) Set all MEMORY READ/WRITE switches to READ.
2) Select the MEMORY required using the MEMORY select switch on the front panel of the SEQUENCER marked 'SPARE ENVELOPE TIME PITCH'.
3) Reset the MEMORY WORD COUNTER to the required location address.
4) The BINARY DISPLAY BULBS now indicate the contents of that MEMORY location.

An example of the DECIMALcode conversion to BINARY follows.

DECIMAL	BINARY	
1	00000001	i.e. one bulb is alight.
2	00000010	
3	00000011	
4	00000100	
5	00000101	convert 91 to BINARY
6	00000110	2)91 & 1 remaider
7	00000111	2)45 , 1 "
8	00001000	2)22 , 0 "
9	00001001	2)11 , 1 "
10	00001010	2)5 , 1 "
11	00001011	2)2 , 0 "
12	00001100	1
		i.e.01011011

An example of the BINARY code conversion to DECIMAL follows.



Miscellaneous Information

1) ENCODE/DECODE switch is not used. Set to the centre position. Its function is to store MEMORY data on magnetic tape.

2) TAPE/KEYBOARD switch on the front panel, must be set to KEYBOARD for all normal use.

3) The switch marked  , must be set in the up position at all times.

4) For MEMORY 4 there are two READ/WRITE switches. Both must be in the READ position for READING into the MEMORY. Both must be in the WRITE position for WRITING into the MEMORY.

5) Do not change the CLOCK RANGE frequency while the CLOCK MODE SELECT switch is in AUTO position. First switch to the MANUAL position and then change the RANGE.

6) The SYNC. SIGNAL is derived from the CLOCK frequency. Hence, the SYNC. SIGNAL sets the PROGRAM TEMPO when recording using the FSK SNYCRONISING feature.

7) The TIME value numbers are actually a multiple of the number of CLOCK pulses.

8) The PITCH 2 MEMORY numbers can be used either to control PITCH or VOLUME of sound output. If the numbers are to control PITCH, the PITCH 2 output lead must be connected to a VCO input. Number values must represent PITCH values. If the numbers are to cotrol VOLUME, the PITCH 2 output lead can be connected to any volume control device such as a voltage controlled amplifier. The number values in this case, must be chosen from the VOLUME range numbers outlined in section 'HOW TO TRANSLATE SCORED NOTES INTO NUMBERS'.

GLOSSARY

ACCESSING: The action of ENTERING numbers into the MEMORIES using the READ function.

ADDRESS: The particular number of a specific location in MEMORY. Locations ars numbered sequentially from 1 to 512. The address of the location that is being currently accessed is shown in the MEMORY WORD COUNTER.

CLOCK: The CLOCK allows sequential accessing of the MEMORY locations, by simply adding 1 to the current address to give the address of the next location.

DIGITAL SEQUENCER: Another name for the SEQUENCER, which see.

FREQUENCY: Refers to speed at which the CLOCK is incrementing the address numbers by 1.

FSK:

INPUT: Several meanings. Can be the PROGRAM numbers that are ENTERED into the MEMORIES. Any electrical voltage that is input to the SEQUENCER from an outside source. Anything that is put into the SEQUENCER.

LOCATION: That specific place in the MEMORY where a finite amount of data is stored.

MONOPHONIC: Being able to produce only one sound at a time. Equivalent to playing only one key on a piano at a time.

OUTPUT: Several meanings. Any electrical voltage that is output from the SEQUENCER. Any sound that is produced as a result of SEQUENCER action.

OSCILLATOR: A device that produces electrical vibrations. These vibrations may be turned into sound or used to control another electronic device.

SERIES: Anything that is arranged in sequential order. Specifically, the PROGRAM numbers that are ENTERED and stored in MEMORY.

SIGNAL: Any electrical output voltage obtained from an electronic device. Specifically, the output voltage obtained from the FSK SYNCRONISING feature.

SPEED: The rate at which the CLOCK increments address numbers by 1.

STORAGE: Another name for a MEMORY or a location within that MEMORY.

SYNC.: A short name for SYNCRONISE.

SYNCRONISE: Refers to that action that arranges that two event happen at the same time. Specifically, musical output on TRACKS 1, 2, 3, and 4 are recorded in exact rhythmic time with one another.

SYNC. SIGNAL: The electrical output voltage that is obtained from the FSK SYNCRONISING feature that is recorded on TRACK 1 of the tape recorder.