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Electronic Music Studios

The *SYNTHI* Sequencer 256

Information from

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Introduction

The Sequencer 256 is used to record a sequence of control voltages and to reproduce them at a later time. The digital memory is in four "layers" enabling three sets of voltages to be recorded independently and reproduced simultaneously. The simplest application of the Sequencer is storing melodies, but in fact the voltage outputs from the Sequencer can be used to drive any voltage-controlled device.

There are three inputs: two voltages and a trigger or "key". When the clock is running and a pulse is applied at the key input, both voltages are sampled and stored in the memory along with the time of occurrence of the pulse. These voltages are referred to as A, B in Layer 1, C, D in Layer 2, and E, F in Layer 3. Layer 4 stores key pulses only and is normally used for stopping or recycling a sequence. After storage, ten outputs (six voltages and four keys) appear at the outputs whenever the clock is running.

The Sequencer may be used with any suitable input device, but it has an integral keyboard which is often useful as an input medium. When a note of the keyboard is struck, three voltages are generated: a trigger pulse, a voltage whose value depends on the key struck (pitch information) and a voltage whose value depends on how hard it was struck (dynamic information). If the clock is running, these voltages are fed to the appropriate section of memory and stored there; to facilitate monitoring, they are also sent to the outputs of the layer in use. In a simple case, the trigger output would be used to start an Envelope Shaper, the pitch voltage to control a Voltage-Controlled Oscillator, and the dynamic voltage to control a Voltage-Controlled Amplifier. When connected to three of each of these devices, the Sequencer can perform in three parts with independent dynamics for each part.

The MODE switch has three positions which control the way in which data are stored. The normal mode is NEW KEY, an event being stored each time the trigger input is detected. NEW PITCH stores events whenever the input voltage has changed sufficiently (approximately 2%), and REWRITE BDF is used when the primary voltages (A-C-E) have been stored correctly and it is required to modify the subsidiary voltages (B-D-F) only. In the example above, REWRITE BDF might be used when the pitches were correct but there were errors in dynamic level.

The LAYER switch selects the layer for storage. Voltages A and B are stored on Layer 1, C and D on Layer 2, E and F on Layer 3, and key pulses only on Layer 4. When the clock is running, any event at the input will be stored on the current layer unless the memory is full.

The remaining switches are used for editing a stored sequence. Normally the clock runs continuously, but if either of the switches STOP AT END EVENT or STOP AT START EVENT are down, the clock will stop at each event *on the selected layer*. If the END EVENT switch is on, the event will have been heard, and if the START EVENT switch is on, it will not have been heard. When the Sequencer is stopped in this way, the event may be erased by pressing the guarded ERASE EVENT button, and a new event inserted. In this way a single note of a melody may be corrected without the entire tune being re-recorded. Note that the clock may be started and stopped again in either direction before the new event is inserted, so errors of timing as well as pitch can be corrected.

Using an External Clock

The Sequencer can be driven by an external oscillator connected to the EXT CLOCK jack. The oscillator should produce about 2V peak-to-peak and the frequency should be less than 1KHz.

To use the external clock, connect an appropriate controller to the EXT CLOCK jack and turn the clock function switch to EXT CLOCK. The START FORWARD, START REVERSE, STOP and RESET buttons should still be operative and the clock display will count incoming pulses.

Input Controls

The extreme left section of the panel contains the input controls. The SOURCE switch at the bottom has four functions:-

KEYBOARD: Voltage A-C-E comes from the pitch output of the keyboard, and voltage B-D-F comes from the dynamic output. Every time a key is pressed a trigger pulse is applied at the key input. The sensitivities are preset.

SPECIAL: Voltage A-C-E is read from the ACE jack input via the SENSITIVITY control. B-D-F is read from the keyboard pitch, and the key from the keyboard trigger. This position is used in conjunction with the REWRITE BDF switch, and it enables the B-D-F voltages to be set by playing on the keyboard, without altering the stored A-C-E sequence.

CENTRE-ZERO: All inputs come from the jacks. A-C-E and B-D-F come through the appropriate SENSITIVITY controls, and at maximum sensitivity the permitted range is -1.25V to +1.25V.

END-ZERO: As above, but the permitted range at maximum sensitivity is 0V to +2.5V.

The PEDAL socket at the back of the Sequencer is connected to the B-D-F input jack and is added to any voltage applied at that jack. A pedal providing a control voltage of +2.5V may be connected to it.

Output Controls

Each layer has a section of the panel for its output controls and connections. There is a jack for each voltage, and a control knob which determines the excursion of the output voltage for a given sequence. When connected to a voltage-controlled oscillator, these knobs control the "spread" of the tuning, so a scale that was input in semi-tones can be played in quarter-tones or whole tones. The control for the key output is used to match the trigger pulse to the device connected, which may require positive or negative going pulses.

Layer 1 has an additional control: the Voltage A Slew Rate. When this control is at zero, the A output is like the others, but as the control is advanced, the "slewing rate" of voltage A is restricted, and the effect is that the voltage glides slowly from one setting to another. When applied to a melody, the effect is a kind of portamento. The maximum slew rate (minimum control setting) is 1000V/sec, which in this application is almost instantaneous, and the minimum is 0.05V/sec.

The Meter

In the centre of the control panel there is a meter whose function is selected by the switch underneath it. The meter reads control voltages as indicated by the switch positions, except that in the FULL STORE position it reads zero when the store is full and full scale when it is empty. The meter reads voltages in the range -5V to +5V.

Rear Connections

All jack connections are duplicated by multi-way sockets at the back of the Sequencer, so that the unit may be installed in a Studio without untidy wiring on the front panel. The connections to these sockets are listed below.

Pedal Socket (8-way)

1	-
2	-12V
3	Earth
4	+12V
5	-
6	Input
7	-
8	-

The +12V supply may be used across the potentiometer in the pedal. The wiper is connected directly to the Input socket, and the value of the potentiometer should be approximately 10K ohms.

Input Socket (18-way)

1	A-C-E Input		
2	Key Input		
3	B-D-F Input		
4	Earth for Inputs		
5	Reset clock		
6	Start clock		
7	Stop clock		
8	External clock input		
9	Clock-rate output		
10	Earth for controls		
11	-		
12	-		
13	-	16	-
14	-	17	-
15	-	18	-

Output Socket (18-way)

1	A voltage
2	B voltage
3	Key for Layer 1
4	C voltage
5	D voltage
6	Key for Layer 2
7	E voltage
8	F voltage
9	Key for Layer 3
10	Key for Layer 4
11	Earth for Outputs
12	-
13	-
14	-
15	-
16	-
17	-
18	-

Electrical Specifications

- Power Supply: 230V 50Hz (Europe)
110V 60Hz (U.S.A. and Canada)
- Input Sensitivity: Input voltages should be at least +1.25V
The trigger inputs fire at about +1.6V and reset at 0.6V
- Outputs: A-C-E and B-D-F outputs are +3V with the control at 0,
zero with the control at 5 and -3V with the control at
10.
Trigger outputs are +5V with the control at zero, 0V
with the control at 5, and -5V with the control at 10.
- Control Inputs: The clock control inputs (START, STOP, REST) require
1.6V to trigger and 0.6V to reset.
- Meter: The meter reads +5V except in FREE STORE mode, when
full scale deflection indicates that the store is
empty.
- Clock: The internal clock rate control gives a continuous
range of rates from 0.1Hz to 200Hz. The clock rate
output is 1V/octave with 0V at approximately 4Hz.
An external clock input should be approximately 2V
peak-to-peak.

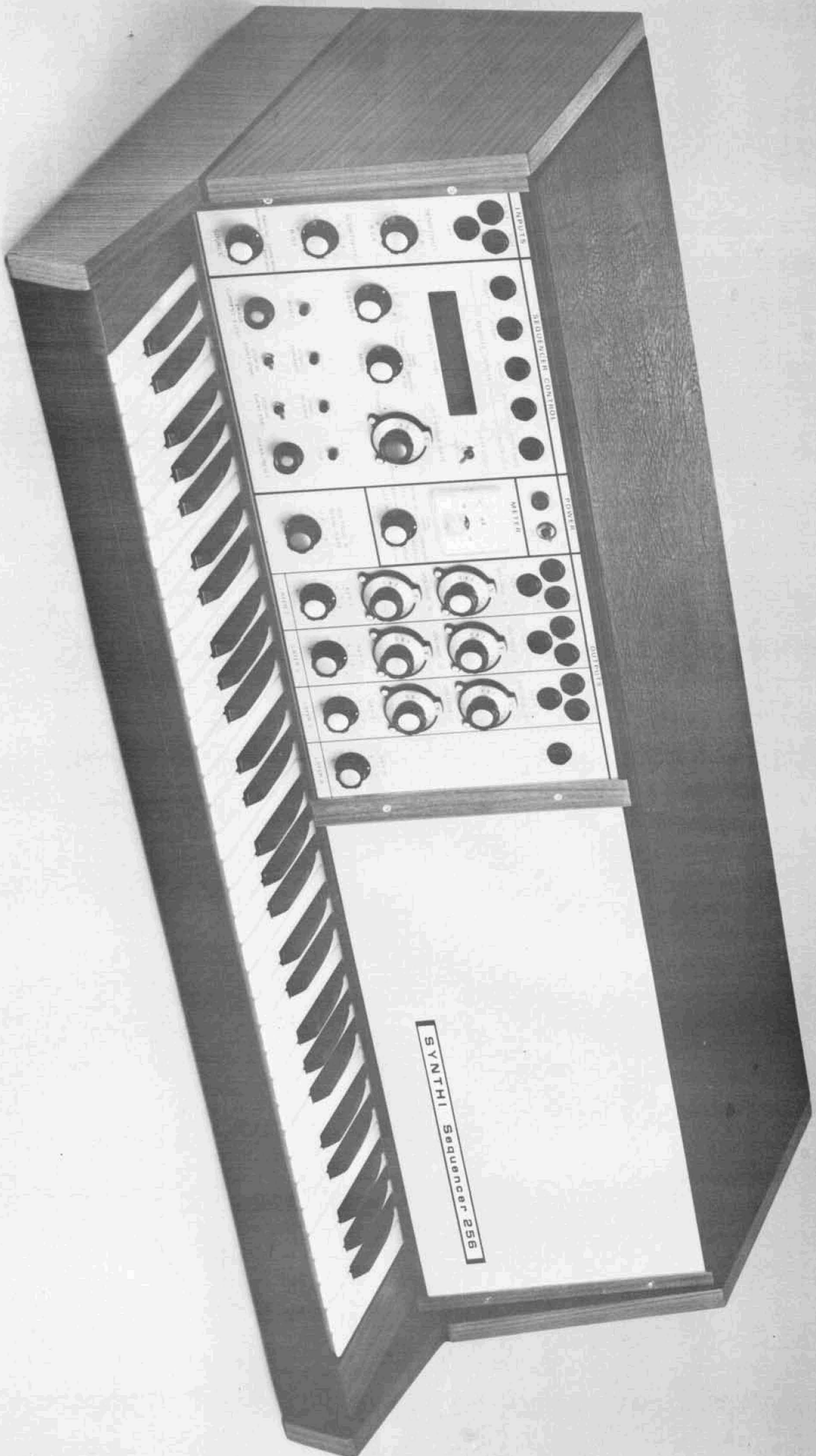
Clock and Memory Controls

The Clock and Memory are the "heart" of the Sequencer. When an input key pulse is detected, the time is read from the clock and stored as a binary number in the memory, and simultaneously the two voltages are sampled, converted to a binary number, and also stored. When the same time is displayed on the clock again, the voltages will be read from memory and regenerated at the output lines of the appropriate layer, together with a key pulse.

The clock is driven by a stream of pulses which may come from the Sequencer's own Oscillator or from a remote oscillator. The pulse rate is chosen for the particular application and depends on the length of the sequence required, and the precision. The clock counts to 9999, so it is possible to have (for example) a 10 second sequence with a resolution of 1/100 sec (10 milliseconds) or a 100 second sequence with a resolution of 1/10 sec (100 milliseconds). The internal clock rate can be controlled manually from the front panel or remotely by voltage-control.

The clock and memory are controlled by the group of switches and buttons at the centre of the panel. The clock can be started in either direction (START FORWARD and START REVERSE), stopped (STOP), and set to zero (RESET). The memory is emptied by pressing the guarded button labelled ERASE ALL*. The source of clock pulses is determined by the switch INT CLOCK/EXT CLOCK, and the internal clock rate is controlled by the slow-motion dial RATE. The clock functions may also be controlled remotely by the jack sockets at the top of the panel: START, STOP and RESET have the same function as the buttons. CLOCK RATE is a voltage input which controls the internal clock rate (the voltage is added to the dial voltage) and EXT CLOCK is the connection for an external clock.

* CLEAR/RESET on some models.



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