

# 192 Programmable Sequencer

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## Overview

The 192 Sequencer is one of the many modules from the Soundtronics modular analogue synth – the M<sup>2</sup>Synth. While most modules require very little introduction, the 192 Sequencer has features that many users may be unfamiliar with. This manual describes each of the individual features enabling you to get the most out of the sequencer.

Truly analogue sequencers tend to be rather large modules with typically 8 to 16 steps with each step often having one or more potentiometers and associated switches. Sequencers output a voltage for each step based on a potentiometer setting and can be quite difficult to tune to a musical scale. This can be aided by a device called a quantizer that takes the step output voltage and constrains it to voltage levels that follow the semitones (notes) as found in the western world musical scales. Whether a note sounds or not is selected using a toggle switch that enable or disables a gate pulse. These sequencers are fantastic at what they do but have limitations such as an inability to store sequences for later retrieval.

The 192 Sequencer emulates the analogue sequencer and adds further functions to make this a powerful alternative to the basic sequencer described above.

## Features

Main features and specifications of the 192 sequencer.

### Size

- Height 5U (222.25mm)
- Width 2U (88.9mm)
- Depth 40mm behind panel, 63mm overall

### Electrical

- Supply voltage +/-12V
- Supply current +62/-6mA – to be confirmed
- Digital outputs 5V
- Digital inputs >2V, max 15V
- Analogue outputs 0-10V

### Panel Features

- 16x32 red LED dot matrix display 63x31.5mm
- 11 pushbutton switches
- MIDI in/out sockets
- Rotary encoder for value selection
- 11 ¼" jack sockets for analogue / digital signals

### Memory

- Internal for 100 tracks

### Track

Each track has the capacity for 48 contiguous steps arranged in 3 banks of 16. Each step consisting of a note, rest or sequence command, note type or sequence command value, step control command, gate duration time, auxiliary CV.

## Notes

User selectable from C<sup>-1</sup> to G<sup>9</sup> which covers all 128 MIDI notes of over 10 octaves

6 Note lengths demisemiquaver to semibreve which equates to 1 clock pulse to 32

Tempo 10 to 240 BPM where 1 beat is a crotchet

## Sequence Commands

- Sequence reset
- Sequence stop
- Sequence reverse
- Goto bank (1-3)
- Goto track (0-99)
- Loop (loop back to start of current bank)
- Repeat sign (repeat section 1-99 times)
- Transpose (up/down up to 19 semitones)
- Goto step (1-48)
- Hold (1-99 crotchets)
- Gate on time (5-95% of note length)

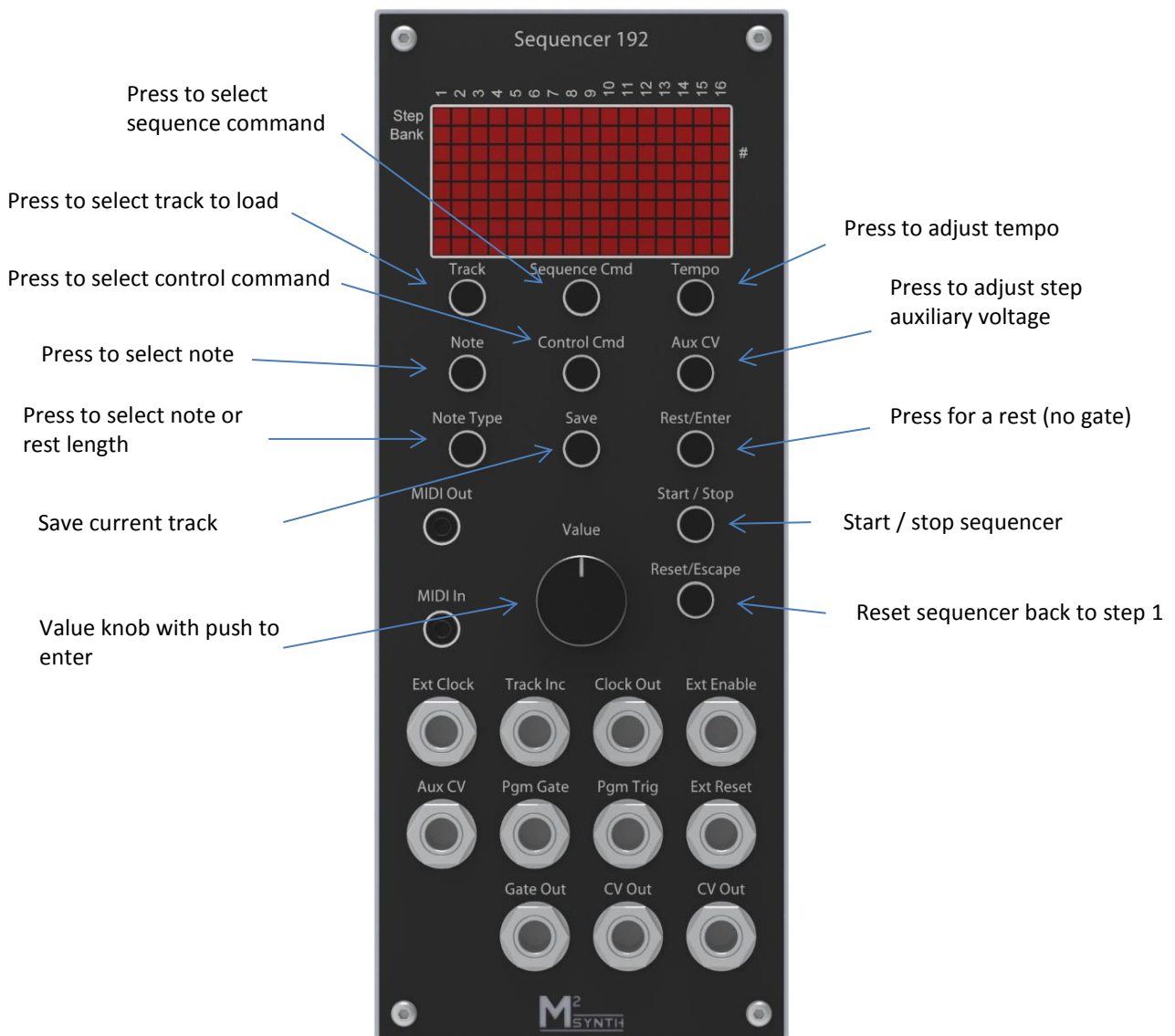
## Control Commands

- Repeat begin (start of repeat section)
- Programmable gate on
- Programmable gate off
- Ratchet 02 to 32 (number of repeat gates pulse per step)

## External Controls

- Gate out
- Trigger out
- CV Out (x2)
- Programmable gate out
- Auxiliary CV out
- Clock out
- Clock in
- Reset input
- Enable input

## Panel Controls



## Basic Operation

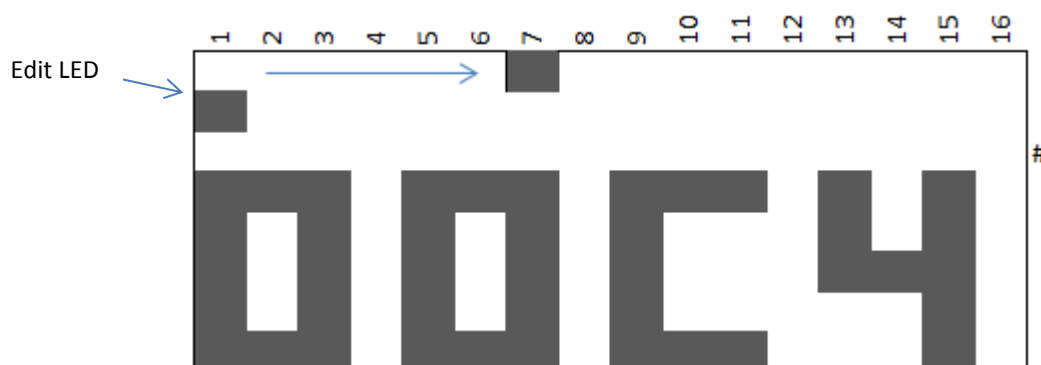
On first power up,



The sequencer will be stopped on step 1, default note C4 and track 00 displayed. Note that at this stage, the sequencer will boot up with an empty sequence with default values in its working memory, track 00 has not yet been loaded.

Note: Button presses will be indicated by a boxed `button name`.

Press `Start / Stop` and the sequence LED will step continuously from 1-16 plus an LED will light up under step 1, this is the edit LED which will be described later in Chapter 7.



This is very much like a conventional 16-step analogue sequencer but this sequencer can accommodate 48 steps. Press `Start/Stop` to stop the sequencer



running and the last step reached will remain displayed. Press **Reset** and the sequencer will revert back to step 1.

### Step Selection

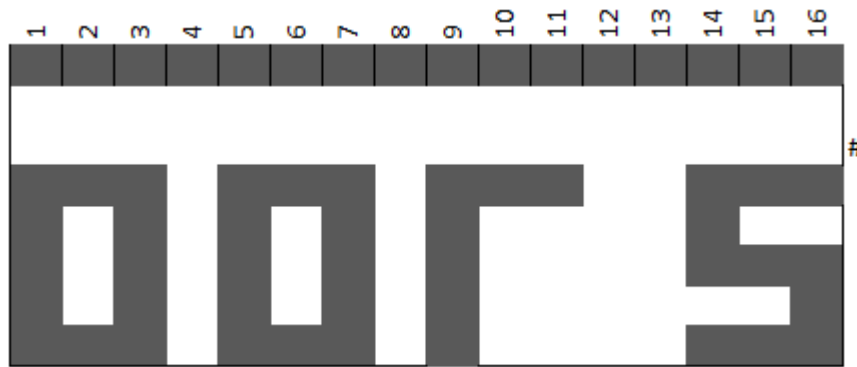
Now using the Value control knob, rotate it clockwise and the step LED will move towards step 16 and anticlockwise to move it back towards step 1. Moving clockwise past step 16 goes to step 1 of bank 2 (step 17).



An additional LED comes on under step 2 to indicate bank 2. Continuing to rotate the Value control will change the step as before. Note that in step 1 of bank 2, the note value changes to RS, this is the mnemonic for Reset, this is why the sequencer only ran from step 1 to step 16. As soon as it reached step 17, it immediately reset to step 1. Going beyond step 16 of bank 2 will select step 1 of bank 3 where once again a Reset command will be found.



This time the LED under step 3 lights to indicate bank 3. Going beyond step 16 of bank 3 (step 48) goes to step 49. Step 49 is not available as a note but can contain sequence commands such as in this case, a Reset.



Step 49 is indicated by all step LEDs being on. Press **Reset** to go back to step 1 or use the Value control.

### **Note Selection**

Now that you can select any of the 48 steps, let's move on to choosing a particular note for each step. Press and hold the **Note** button while rotating the Value control to scroll through all from C<sup>-1</sup> to G<sup>9</sup>.

Release **Note** button and select the next step and repeat the note selection. Using just these two controls, you can quickly define the notes for any step in the sequence. Note the # LED comes on when the note being selected is a sharp.



The CV output voltage will relate exactly to the note selected. For example:

Note	CV Voltage (V)
C-1	0
C0	1
C1	2
C2	3
C3	4
C4	5
C5	6
C6	7
C7	8
C8	9

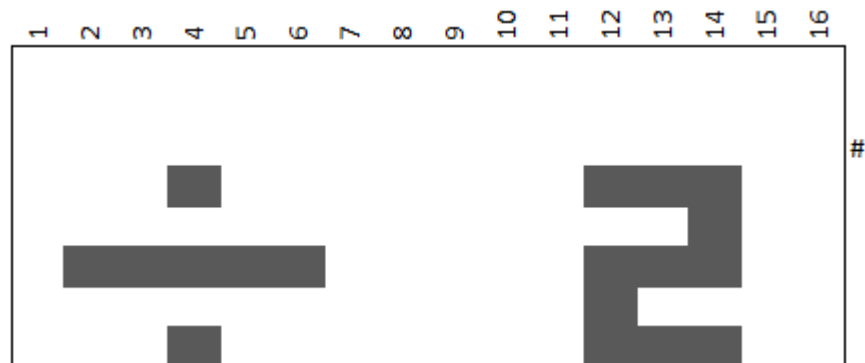
C9	10
G9	10.5833

### **Note type (length)**

Each note can have its length set by using the Note Type button. Hold the **Note Type** button in and using the Value control allows the selection of the note type from demisemiquaver to semibreve. The mnemonics for these are displayed from ÷8 to x4 based on their relationship to a crotchet.

The following table summarises the note types.

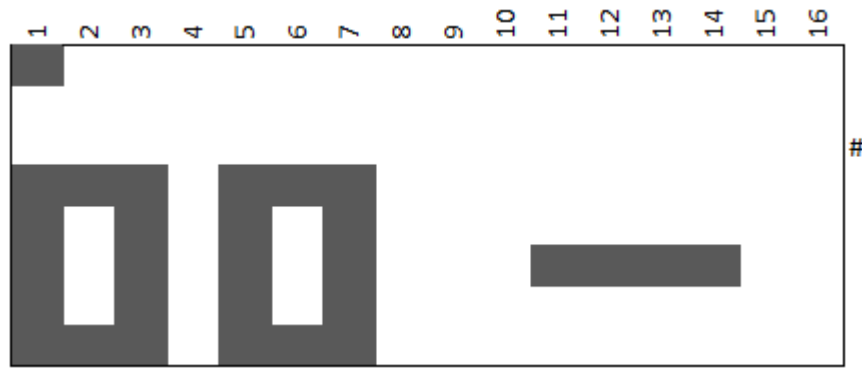
Note Type	Mnemonic	Clock Pulses
Demisemiquaver	÷8	1
Semiquaver	÷4	2
Quaver	÷2	4
Crotchet	x1	8
Minim	x2	16
Semibreve	x4	32



### **Rest**

In place of a note, a Rest can be entered which simply means the CV out is not changed and no gate or trigger pulse is generated.

Press and hold the **Rest** button and then select the Rest length using the Value control just as in the case of a note length. Once the **Rest** button is released, a ‘-’ is displayed to indicate a Rest in place of a note.



### Track Selection, Loading and Saving

Up to now, we have only been using the working memory, powering down the module will result in a loss of the sequence. In an attempt to keep menu diving to a minimum and keep things simple to use, there is no copy function. This means that if the intent is to save the sequence once created, the track number should be selected first. Also, selecting a track will immediately overwrite any track currently in the working memory.

To select a track, press and hold the Track button and select a track from 00 to 99.



When the Track button is released, the track selected is loaded into working memory. If the track selected has not been previously used, default values will be used for all steps with the only Reset command being at step 49.

Any changes made to the track will not be remembered unless saved which will update the selected track number.

In summary, selecting a track will load the track into working memory. Pressing Save will save the sequence in working memory to the track currently displayed.

## Sequence Commands

Any step can hold a sequence command in place of a note to direct the sequencer to do something other than simply step onto the next step.

The sequence commands available when the sequencer is stopped are:

- Sequence reset
- Sequence stop
- Sequence reverse
- Goto bank (1-3)
- Goto track (0-99)
- Loop (loop back to start of current bank)
- Repeat sign (repeat section 1-99 times)
- Transpose (up/down up to 19 semitones)
- Goto step (1-48)
- Hold (1-99 crotchets)

And a special command that does not replace a note  
Gate on time (5-95% of note length)

To place a sequence command at a particular step, press **Start/Stop** to stop the sequencer from running, press and hold the **Sequence Cmd** button and scroll through the available commands using the Value control. If the command expects an additional value, on release of the **Sequence Cmd** button, the display will change to allow the entry of this value. Each command is displayed using a maximum of 4 characters or symbols when selecting.

### **Reset**

Command operation: When the sequence reaches the Reset command step, the sequence immediately continues from step 1.

The display when selecting the Reset command is RST. No additional value required.



After selection, in place of the note, the display will show RS.



### Sequence Stop

Command operation: When the sequence reaches the Stop command step, the sequence immediately resets to step 1 and stops running.

The display when selecting the Stop command is STOP. No additional value required.



After selection, in place of the note, the display will show ST.



### Sequence Reverse

Command operation: When the sequence reaches the Reverse command step, the sequence carries on running but downwards until it reaches step 1 when it will begin stepping upwards again. For example, if the Reverse command is at step 6, the sequence will continue from step 4. In practice the sequence would look like 1-2-3-4-5-4-3-2-1-2-3-4-5-4 etc.. Best not have more than 1 Reverse command in a sequence if a reverse can be executed while stepping downwards.

The display when selecting the Reverse command is REV. No additional value required.



After selection, in place of the note, the display will show RE.



## Goto Bank

Command operation: When the sequence reaches the Goto Bank command step, the sequence immediately continues from the first step in that bank (step 1, 17 or step 33). The bank can be before or after the current bank.

The display when selecting the Goto Bank command is BAN>. An additional value for the bank number is required in the range 1-3.



After releasing the Sequence Cmd button, the display shows the value screen to enter the bank number 01-03. Press the Value control knob to enter the bank number selected.



After selection, in place of the note, the display will show BA.

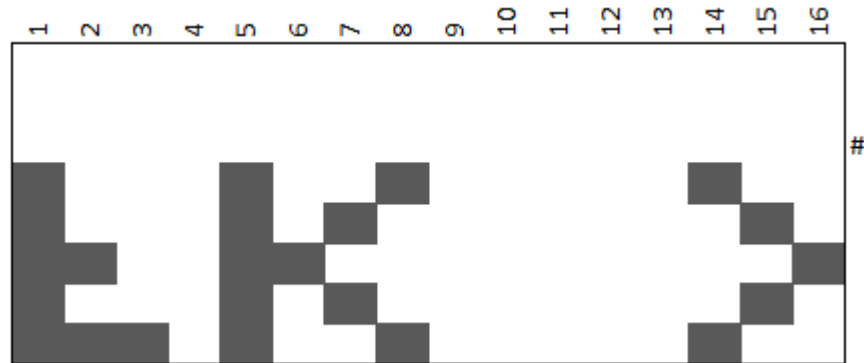




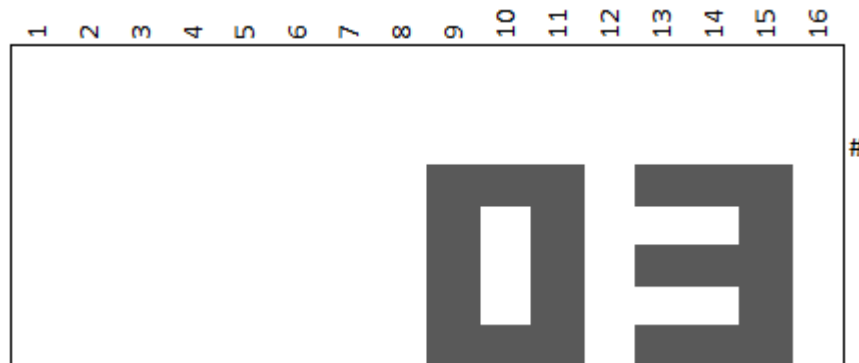
## Goto Track

Command operation: When the sequence reaches the Goto Track command step, the sequencer will load the destination track and continue running from step 1 of this new track. Note: make sure the initial track with the Goto Track command is saved before running otherwise any changes made to it will be lost.

The display when selecting the Goto Track command is TK >. An additional value is required for the track number in the range 00-99.



After releasing the Sequence Cmd button, the display shows the value screen to enter the track number 00-99. Press the Value control knob to enter the track number selected.



After selection, in place of the note, the display will show TK.



## Loop

Command operation: When the sequence reaches the Loop command step, the sequencer will continue from the first step in the current bank. For example, if the Loop command is contained within a step in bank 3, then the sequence will continue from step 33.

The display when selecting the Loop command is LOOP. No additional value required.



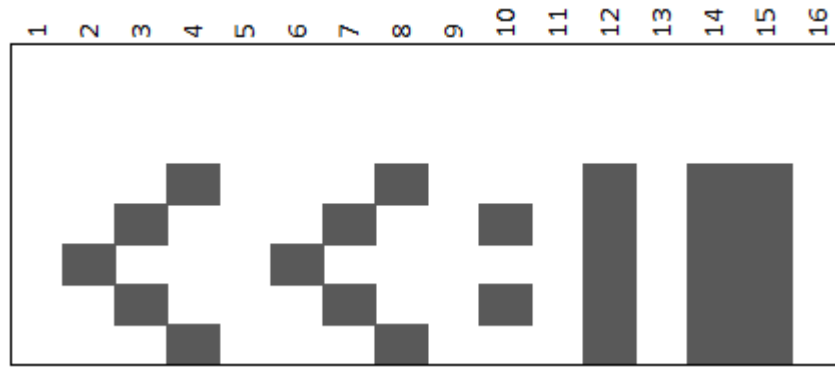
After selection, in place of the note, the display will show LO.



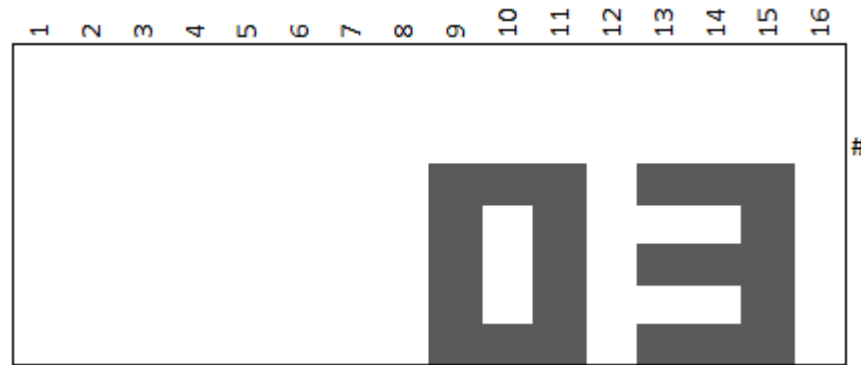
## Repeat Section

Command operation: When the sequence reaches the Repeat section command step, the sequence will continue playing from the nearest preceding Repeat Begin control command (see chapter 6). The section will repeat the selected number of times before then continuing from the step following the Repeat section command.

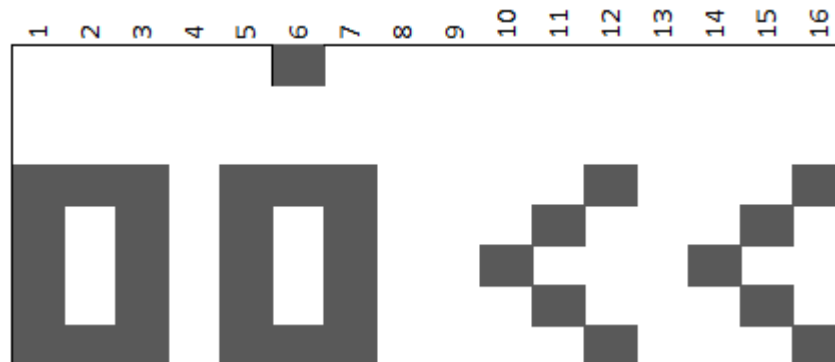
The display when selecting the Repeat Section command is << : | | . An additional value is required for the number of repeats to be executed in the range 01-99.



After releasing the **Sequence Cmd** button, the display shows the value screen to select the number of repeats 01-99. Press the Value control knob to enter the number of repeats.



After selection, in place of the note, the display will show <<.



### Transpose

Command operation: When the sequence reaches the Transpose command step, the sequence will continue playing from the step following the Transpose command but all subsequence notes will be transposed by the selected value. This is a cumulative transpose in that each time the Transpose command is executed; the note will be further transposed on the already transposed note. Stopping the sequencer will clear any residual transposing.

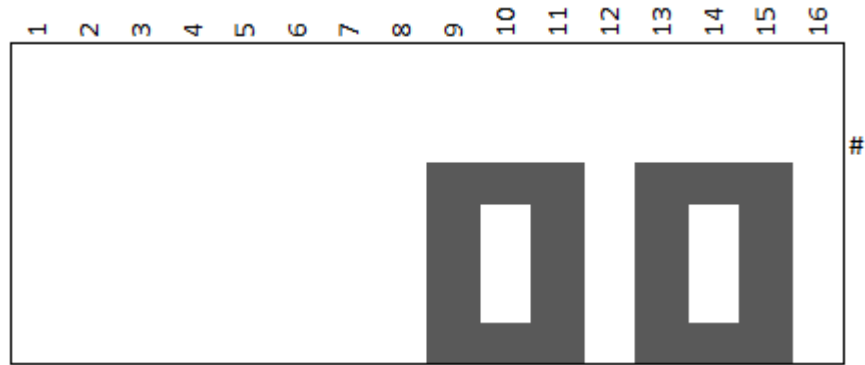
The display when selecting the Transpose command is TRAN. An additional value is required for the number of repeats to be executed in the range down 19 to up 19.



After releasing the Sequence Cmd button, the display shows the value screen to select the transpose value. Press the Value control knob to enter the amount of transpose in semitones.



A null transpose value is indicated by selected 00.



After selection, in place of the note, the display will show TR.



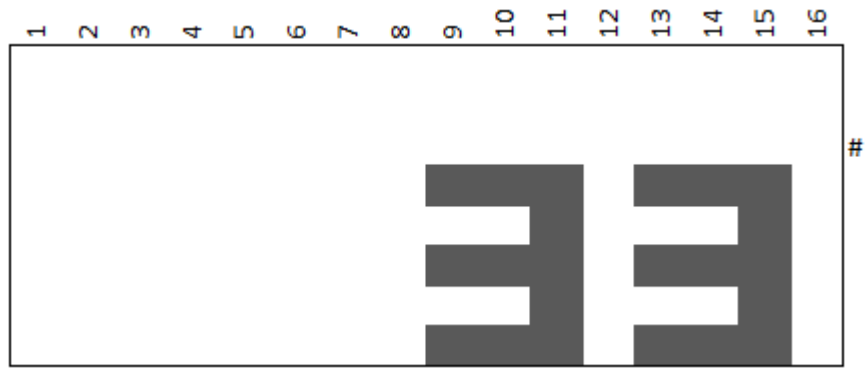
### **Goto Step**

Command operation: When the sequence reaches the Goto command step, the sequence will continue playing from the destination step associated with the Goto command.

The display when selecting the Goto command is GOTO. An additional value is required for the destination step in the range down 01 to 48.



After releasing the Sequence Cmd button, the display shows the value screen to select the destination step 01-48. Press the Value control knob to enter the step number.



After selection, in place of the note, the display will show GO.



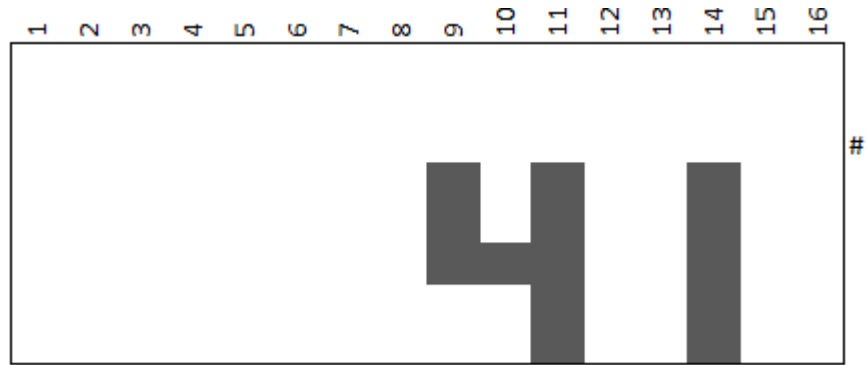
### Hold Step

Command operation: When the sequence reaches the Hold command step, the sequence will pause for a period of time defined by the associated value in crotchets.

The display when selecting the Hold command is HOLD. An additional value is required for the destination step in the range down 01 to 99



After releasing the Sequence Cmd button, the display shows the value screen to select the hold in terms of the number of crotchets 01-99. Press the Value control knob to enter the hold number.



After selection, in place of the note, the display will show HO.



### Gate on Time

Command operation: Unlike the preceding sequence commands, the Gate on Time does not replace a note or alter the sequence flow. The Gate on Time defines how long the Gate Out pulse is active for while the sequence is playing that step. It directly relates to the note duration as is defined as a percentage. If the tempo is changed or the note duration is changed, the Gate on time automatically adjusts to maintain the configured percentage value. By default, all Gate on Times are 95% but each note can be set individually or globally.

The display when selecting the Gate command is GATE. An additional value is required for the destination step in the range down 05 to 95 (%).



After releasing the **Sequence Cmd** button, the display shows the value screen to select the gate on time in terms of percentage 05-95. Press the Value control knob to enter the percentage.



After selection, in the display will revert back to showing the note number.



If all steps are required to have a different to the default but common gate on time then select step 49.



Select the Gate sequence command as above and enter the percentage required. When the Value control knob is pressed, all steps in the current track will have their gate on time set to this percentage value.



## Control Commands

There are three types of Control commands that do not replace a step note but provides additional output functionality. Control commands have no associated value to enter except for Auxiliary CV. The control commands available when the sequencer is not running are:

### Primary commands

- None
- Repeat begin
- Programmable Gate on
- Programmable Gate off

### Secondary commands

The secondary type relates only to gate ratcheting (multiple gate pulses in each step).

- Ratcheting 02
- Ratcheting 04
- Ratcheting 08
- Ratcheting 16
- Ratcheting 32

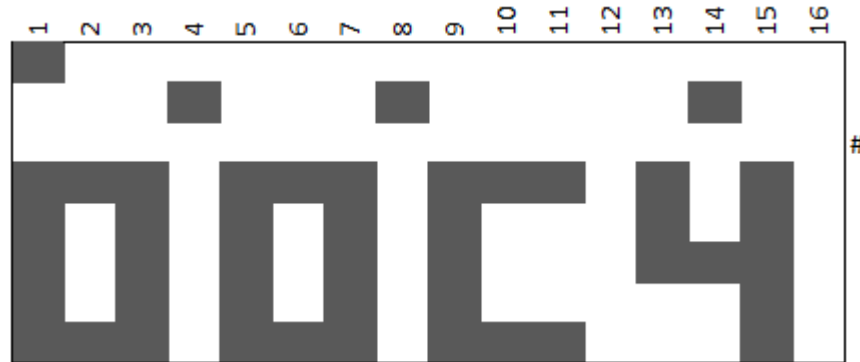
See end of chapter for the third type – Auxiliary CV

It is only possible to have one primary or secondary control command per sequencer step.

To select a primary or secondary control command, press and hold the **Control Cmd** button and select the command using the Value control. When the **Control Cmd** button is released, the selected command will be entered. These commands are in the background and as such not readily visible.

However, with the sequencer stopped it is possible to view what steps in the current bank have associated Control Commands.

To view what steps have associated commands, stop the sequencer running and press the Value control knob.



In the image above, the positions of the control commands are shown in row 2 of the display at steps 4, 8 & 14.

### None

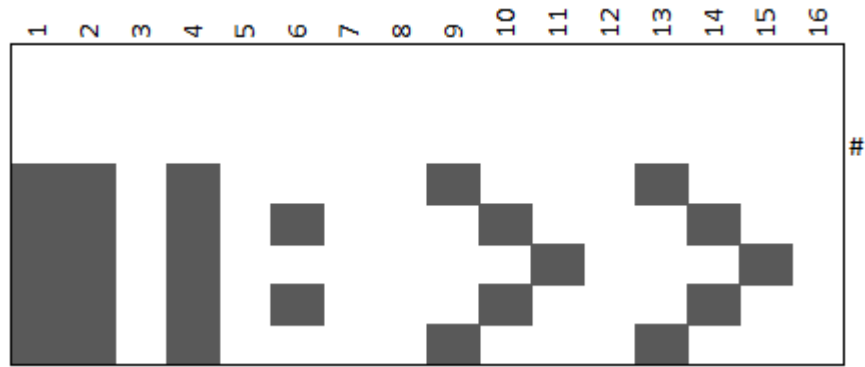
The display when selecting the None command is NONE. Use this command to cancel any previously selected control command



After releasing the Control Cmd button, the display reverts to the usual display showing track number and note number.

### Repeat Section Begin

The display when selecting the Repeat Begin is `|| |:>>`. This command is used in conjunction with the Sequence Command Repeat Section (see chapter 5). This command sets a flag to signify where the repeats section starts. It is possible to have a track containing multiple repeat sections in which case the nearest Repeat Begin is used with the Repeat Section sequence command.



After releasing the **Control Cmd** button, the display reverts to the usual display showing track number and note number.

### **Programmable Gate On / Off**

The display when selecting the Programmable Gate On is GAT+. This command simply turns on the Pgm Gate Output and it stays on until a Programmable Gate Off command is executed.



And for the Programmable Gate Off



After releasing the **Control Cmd** button, the display reverts to the usual display showing track number and note number.

## Ratcheting

Ratcheting is where instead of one gate pulse per step, multiple gates pulses are generated. This technique has been used and popularised by such bands as Tangerine Dream. It is possible to have up to 32 gate pulses per step. However, as the step size gets shorter and the tempo gets faster, having multiple gate pulses can get rather crowded and having gate pulses every few mS or even quicker can get impractical. Therefore under these circumstances, not all ratchet commands are available.

There are up to five displays available when selecting Ratcheting where the numeric indicates the number of gate pulses in that step.





After releasing the **Control Cmd** button, the display reverts to the usual display showing track number and note number.

### **Auxiliary CV**

The third type of Control Command is for setting an auxiliary CV. An auxiliary voltage CV can be set for each step in addition to a primary or secondary control command.

To set an Auxiliary CV for a selected step, press and hold the **Aux CV** button and use the Value control to select a number between 00 and 99. This number relates to the output voltage where 00 is 0.0V and 99 is 9.9V.

For example, to output 9.5V, use the Value control to set a value of 95.



## Live Editing

Modular synths are all about hands on and interaction. While the 192 Sequencer can be fully configured before running the sequence, being able to make adjustments while it is playing is an important feature and aligned with that of the traditional analogue sequencer.

Not all Sequencer and control commands are available to edit once the sequencer is running as it can cause confusion for both the user and the sequencer itself. Having the sequencer start jumping around within a track or to another track with an incomplete structure is not ideal. Planning your structure first especially where it may involve multiple tracks or section repeats is the recommended method. Where multiple tracks are cascaded to form a long pattern for a song, working on individual tracks first before linking them with Goto commands also will aid composition.

A brief mention was made of the Edit LED in chapter 4. This LED is present when the sequencer is running.



Rotating the Value control will move the Edit LED to any of the 48 steps within the track independently of the running LED in the top row of the display.

Once you have the Edit LED at the desired step, the following changes can be made to the step being edited.

Note  
Note Type  
Rest Type  
Sequence commands:  
    Reset  
    Stop  
    Reverse  
    Loop  
    Gate on Time  
Control Commands:  
    None  
    Programmable Gate On  
    Programmable Gate Off  
    Ratcheting  
    Auxiliary CV

The following controls are also active while a sequencer is running.

Track selection  
Save  
Stop  
Reset  
Tempo (hold Tempo button while using the Value control to set the tempo between 10 and 240 BPM (crotchet)

Live editing is follows the same procedure as described in the preceding chapters except, the difference being how the step to edit is selected.

## External Controls

Integrating the 192 Sequencer within your modular is of course through the jack sockets. There are 10 sockets:

CV output sockets provide a duplicate output of the voltage representing the note being played. This CV is typically but not exclusively sent to the VCO(s) and to a VCF for filter tracking

Gate out socket is used to trigger an ADSR envelope generator which in turn is used for a VCA or VCF.

Trigger out socket is where an AR or AD envelope is required of a fixed duration, thus independent of note duration. It can also be used in conjunction of the Gate output to re-trigger an ADSR envelope generator.

Programmable gate out socket is used to provide an additional trigger source. For example, it could be used to trigger another ADSR envelope generator to sweep a VCF or perhaps used to pan a sequence across the stereo spectrum. Another use could be to enable a second sequencer so as to have two sequencers running with one as master and the second being triggered at pre-programmed intervals.

Auxiliary CV out socket can be used to directly control the cut-off frequency of a VCF or to a panning mixer to position each note of a sequence anywhere between the left and right stereo channels.

Clock out socket provides a synchronising clock to a second sequencer's clock in socket for timing purposes. The second sequencer must be configured for an external clock. Each clock pulse represents one beat of a demisemiquaver, i.e. 240BPM (crotchets) would give a clock frequency of 32Hz. To expand on this, there are 8 demisemiquaver beats in every crotchet so 240BPM = 4BPS (beats per second) x 8 = 32 BPS or 32HZ.

Clock in socket can be used in place of the internal system clock. Each clock pulse would represent a semidemiquaver note duration. This means that if the sequencer has quaver duration notes configured, 4 external clock pulses would be needed for the sequencer to step on one step. To select external clock, with the sequencer stopped, set the tempo is 00.



Reset input socket responds to the rising edge of a pulse. On the rising edge, the sequencer resets and continues stepping from step 1.

Enable input socket responds to a change in start of this signal. If the sequencer is stopped, a positive going signal will start the sequencer running from the current step. A negative going signal will stop the sequencer and reset it to step 1.

If the sequencer is running, a positive going signal will stop and reset the sequencer back to step 1. A negative going signal will start the sequencer from the current step.

## MIDI Controls

The 192 Sequencer is primarily intended for an analogue synth via its CV and gate outputs. It does however have some basic MIDI functionality for completeness.

As each note plays, a note on signal is transmitted over the MIDI out interface on channel 1 while the gate signal is active and note off when the gate turns off.

The sequencer will also respond to a small number of commands through its MIDI in socket from any MIDI channel (Omni mode). These are:

- Start sequence from step 1
- Stop sequence
- Continue sequence from the current step
- Select track (Song select)

## Using the 192 Sequencer

The previous chapters described the functionality and features of the sequencer. How the sequencer is used is down to the user. Whether you use it as a blank canvas and create your composition from scratch while it is playing or program in a melody from a musical score such as *Tangerine Dream*:

Tangerine Dream

♩ = 130

End of section

To enter this into the sequencer we would first see if we can identify any repetition as this could save programming time and space. Focusing on the first section which ends with the double bar line and consists of 8 measures of 7 notes each where each note is a quaver. Measures 1&2 are the same, as are 3&4, 5&6 and 7&8. We could fit all 56 notes into a 32 step sequence.

Select the track where you will want to save this sequence.

Select the tempo of 130.

Step	Note	Length	Sequence Cmd	Value	Control Cmd	Comments
1	A3	/2			:>>	Begin Repeat

2	A4	/2				
3	D5	/2				
4	G5	/2				
5	A5	/2				
6	E5	/2				
7	B5	/2				End of 1 <sup>st</sup> Measure
8			<<:	01		Repeat 1 <sup>st</sup> Measure
9	B3	/2			:;>	Begin Repeat
10	B4	/2				
11	D5	/2				
12	G5	/2				
13	A5	/2				
14	E5	/2				
15	B5	/2				
16			<<:	01		Repeat 3 <sup>rd</sup> Measure
17	C4	/2			:;>	Begin Repeat
18	C5	/2				
19	D5	/2				
20	G5	/2				
21	A5	/2				
22	E5	/2				
23	B5	/2				
24			<<:	01		Repeat 5 <sup>th</sup> Measure
25	B3	/2			:;>	Begin Repeat
26	B4	/2				
27	D5	/2				
28	G5	/2				
29	A5	/2				
30	E5	/2				
31	B5	/2				
32			<<:	01		Repeat 7 <sup>th</sup> Measure
33			Rst			Keep playing above

This is not the only way of entering this sequence in as measures 7&8 are a repeat of 3&4 but there is little to be gained in this instance of making it more compact as there is plenty of spare capacity.

Don't forget to press Save as frequently as you like while entering the above sequence.

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