MOTAS ELECTRONICS

MOTAS-6
SYNTHESIZER

How To...Guide

version 1.03

for firmware 0602011C / software MotasEdit v1.0.12

August 29, 2022

Contents

1 Introduction

The MOTAS-6 synthesizer is a very powerful and complex instrument and so it takes time to fully appreciate and understand all the capabilities and possibilities. It is hoped that this guide, in conjunction with the User Guide, makes this process a little faster and easier, as well as perhaps revealing some capabilities or techniques that you weren't aware of.

This How to… guide is intended to suppliment the MOTAS-6 User Guide available from motas-synth.uk/downloads.html. Whereas the User Guide works through each of the features in order, this guide often takes an alternative approach where it is explained how to setup or use the features/settings to achieve a goal. This guide also expands on some more advanced topics that are not covered in detail in the User Guide.

We suggest that you also read the appropriate section(s) in the User Guide. If further guidance is needed please email support@motas-synth.uk

For the latest news, firmware and document updates please visit www.motas-synth.uk.

2 Configure and control

2.1 Change the active parameter page without adjusting the offset values

Engage the 'value lock' feature VALUE LOCK to prevent the offset parameter from changing and then turn the rotary knob corresponding to the new parameter page you want to access.

Another approach is to turn the rotary knob to access the new page and then turn the rotary knob back to restore the setting, however it can be hard to set the value exactly back as original which may be important e.g. when accessing the oscillator pitch control pages.

2.2 Adjust page offset values without changing the active parameter page

Engage the 'page lock' feature PAGE LOCK to prevent the active page from changing. This can be useful when you are busy setting the modulation settings on a page but you find that other pages need their offsets tweaking (such as filter cutoff, or signal levels) but you don't want to leave the current page. Another use case is when wanting to study the oscilloscope or spectrum analyser whilst adjusting settings.

2.3 Set the knob control mode

Since the rotary knobs ❶ are real potentiometers (and not continuous encoders) the current knob value will typically not match the offset setting when a new patch is loaded.

There are 5 options to set how turning a knob affects the patch offset value: (excluding the pitch controls which always use relative mode):

RELATIVE	relative change
JUMP	value jumps to knob position once knob is moved a small amount
SNAP	no changes until knob position matches current value
SCALED	scaled changes giving maximum immediate control

You may find that the SCALED mode is the best choice as this mode gives maximum control of the offset by compressing/expanding changes depending on the position of the knob relative to the current offset value.

2.4 Set the 5 fast-access patches loaded at power-on

Pressing 1, 2, 3, 4 or 5 normally switches between 5 fast-access patches. To set these patches first load in the desired patches into each of the slots and/or edit the patch settings in each slot. Then press SAVE and choose the SAVE STARTUP option. This will save the current 5 patches in the fast-access slots to be restored at next power-on.

2.5 Save a set of 5 fast-access patches

You may want this set of 5 patches for a live performance to be able to quickly switch between patches, or as a set for use with the vector morphing feature, or as a set for use with the arpeggiator set to cycle through patches.

First load in the desired patches into each of the 5 fast-access slots and/or edit the patch settings in each slot. Then press SEQUENCE and then press SAVE to save into one of the 16 slots (2 banks of 8 sequences). Saving as a 'sequence' allows saving of the set of 5 patches together, even if the sequence data is empty or not used.

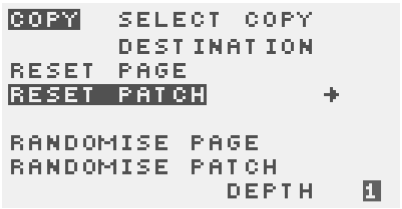
2.6 Initialise patch settings

When on a patch parameter page press COPY to enter the copy/reset/randomise page.

Press ↑ / ↓ to select the RESET PATCH option and then press → to reset the parameter settings to default values on *every* parameter page.

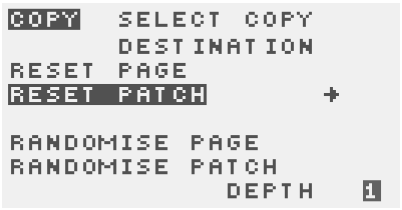
The patch parameter mappings and other settings (under the setup pages) are also reset to default values.

To reset the patch parameters only on the current page select the RESET PAGE option and then press → to reset all parameters to default values on the current parameter page.



2.7 Copy patch settings

When on a patch parameter page press COPY to enter the copy/reset/randomise page.



Copy entire patch

Press the new patch preset destination 1 – 5 to copy the patch settings over to the new fast-access preset destination.

Copy modulation settings to all pages

To copy the MIDI/CV modulations setting for that modulation source from the current page to *all* parameter pages press NOTE, VELOCITY, M1, M2, M3 or M4. The copy operation replicates the amount, secondary amount, secondary destination and unipolar mode to all pages.

A fast way to zero a modulation on all pages is to set the values to zero and then do a copy-to-all pages operation

Copy global LFO settings to all pages

To copy the chosen global LFOx and the LFOx modulation amount to *all* pages from the current page press for LFOx.

Copy local LFO settings to all pages

Press or FREQUENCY for the local LFO to copy the corresponding values to *all* pages from the current page. To copy the local LFO modulation amount and other LFO settings (e.g. single-shot mode, pitch track etc.) to *all* pages from the current page press for LFO.

Copy EG settings to all pages

If a local EG is active on the current page then pressing , , , , will copy the corresponding values to *all* pages which are also set to use a local EG. Press for EG to copy the EG modulation amount and other EG parameters (e.g. keytrack, shape etc) to *all* pages from the current page and set the EG to the same type (either local EG or global EG 1–4).

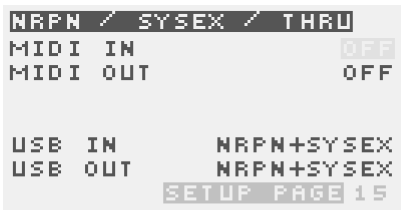
2.8 Control using a PC

Free software MotasEdit for controlling MOTAS-6 is available from www.motas-synth.uk/downloads.html. This software is available as a standalone executable and as a plug-in version for use with 3rd party DAW software.

For best results always use a USB connection as the data transfer is faster than using MIDI DIN connectors.

The MotasEdit software allows you to apply firmware updates (see 2.9), control MOTAS-6 patch settings, archive (load and save) patch, pattern and sequence settings, live screenshots and more.

To send (i.e. control) MOTAS-6 patch settings from the computer MIDI NRPN messages are used. For firmware updating, archiving of data, live screenshots and other functions SysEx data is used. Normally you would set NRPN+SYSEX for both USB IN and USB OUT to allow full bi-directional functionality on SETUP PAGE 15. If you are using MIDI DIN connections then you would need to set the MIDI IN and MIDI OUT settings appropriately.



Set the MIDI CHANNEL to match that set in the MotasEdit (or set to ANY where data will be sent on channel 1 and received on any channel).

2.9 Update the firmware

Updated firmware for MOTAS-6 may be released from time to time to make improvements and add new features. These are available from www.motas-synth.uk/downloads.html.

The update file (MotasFirmware_vXXXXXXXX.mbin) contains the new binary firmware for MOTAS-6.

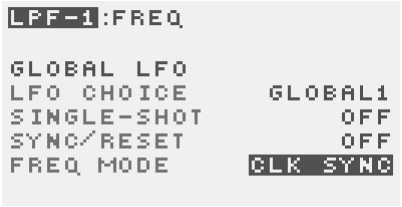
Use the MotasEdit software (see 2.8 for details) to apply the update to MOTAS-6. The firmware update is sent using MIDI system exclusive (SysEx). Ideally you should connect MOTAS-6 to your PC using USB. MIDI DIN connectors can be used but this interface is much slower.

You must ensure that your MOTAS-6 is set so that **ALLOW UPDATES** is set to **YES** to allow the firmware updating process, on **SETUP PAGE 17**.

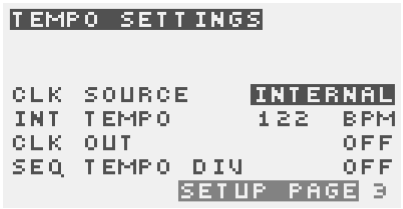
It is possible to apply an older firmware version but this is not recommended especially since newer serial number MOTAS-6 units may not function correctly with older firmware. It is recommended to always update to the latest firmware available.

2.10 Make an LFO sync to clock

All of the LFOs can be synced to MIDI clock. First ensure that the LFO **FREQ MODE** is set to **CLK SYNC**



then edit the frequency of the LFO to set the sync-timing. When set to synchronise to the clock the display will show a metronome indicator and the LFO period value (down to as fast as 32 triplet). The icon displayed is **S** in this mode.



Now set the **CLK SOURCE** to **EXT MIDI**, **EXT CLK** or **INTERNAL** to choose external MIDI clock, external CV/gate or internal clock.

2.11 Reset LFO on MIDI start

Set **LFO SYNC SEQ** to **ON** so that the LFOs are synchronised (reset) when the sequence or pattern is rewound to the start, play started or a MIDI START real-time message is received. This feature is useful when controlling MOTAS-6 from an external sequencer and you want the LFOs to be synchronised with the track.

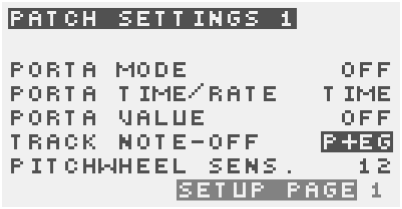
2.12 Setup the source of modulators M1–M4

To setup the sources of the 4 global modulations M1–M4 that can be applied to each parameter page access **SETUP PAGE 7**. You can freely choose from many MIDI CC controllers, MIDI aftertouch, MIDI pitchbend, CV/-gate signals, MIDI note value, MIDI velocity and even the output from the global LFOs and EGs.

You could setup 5 independent LFOs to modulate a single parameter page by assigning global LFO2, LFO3 and LFO4 to global modulators M1, M2 and M3. These, together with the page global LFO set to LFO1 and the page-local LFO gives a total of 5 simultaneous independent LFO signals! A similar trick can allow 5 independent EGs to modulate a single parameter page.

2.13 Control playing style for note-off events

On the SETUP PAGE 1 you can set the TRACK NOTE-OFF modes. Sometimes you may want the oscillators to update pitch after note-off events when multiple notes are held, depending on your playing style. If you hold a note down and play another note on and off then with TRACK NOTE-OFF set to PITCH then the pitch will jump to match the note held-down (which note depends also on the individual oscillator note-tracking options), otherwise it won't respond to the note-off event.



In mode P+EG, additionally the EGs can re-trigger on the note-off event, although this also depends on the EG GATE/TRIG setting too (set to EVERY to ensure always re-triggers, for example).

2.14 Play multiple units together polyphonically

Multiple MOTAS-6 units can be operated so that they play together as a polyphonic synthesizer. Up to 16 units can be operated together in this way. In this mode called 'polychain' each new note is played by the next unit in the chain (and if the end of the chain is reached then starting again from the beginning of the chain). This is sometimes called 'round-robin' voice assignment and allows true polyphonic playing (unlike the simpler note-stealing method).

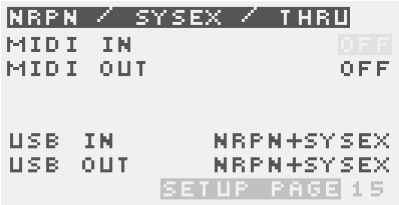
Each unit should be assigned a unique number in the chain and every unit in the chain needs to be set with the total number of units in the chain for this to work in the normal way. Of course, if you want things to behavely differently you do not have to adhere to this rule!

The 'polychain' algorithm runs independently on each of the separate MOTAS-6 units and so in fact it is not required that the units are daisy-chained to each other. However, this is the easiest way to set things up and allows editing of patch parameters on the first unit in the chain to be transfered automatically to the other units along the chain to maintain the 'polysynth' operation.

The normal setup of 'polychain' would have the first unit in the chain connected to an external MIDI controller (or computer) via USB or MIDI DIN to receive the played notes. This first unit needs to forward the MIDI controller data to the second unit and so its MIDI OUT should be set to THRU+ALL so that the MIDI controller data (note on/off etc) will be merged with the internal controller data (to allow patch editing) and sent to the next in the chain.

All the units need to operating on the same MIDI channel and so the easiest way is to set CHANNEL to ANY for all of the units.

The remaining units in the chain need be connected to the previous unit in the chain with a MIDI DIN cable and to have MIDI IN set to NRPN or NRPN+SYSEX (to allow patch editing data from the first unit) and MIDI OUT set to THRU to simply forward the data from the first unit only. The last unit in the chain, of course, does not have to MIDI OUT set at all.



Finally, of course, all of the audio outputs from each MOTAS-6 need to be mixed together using an external audio mixer.

2.15 Using external CV/gate

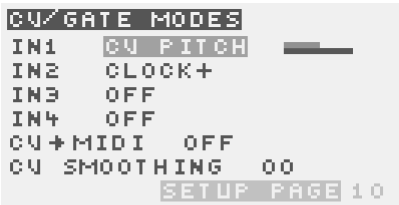
Normally MOTAS-6 is played and controlled using MIDI but external analogue CV (control voltage) signals can be used too. There are 4 external CV/gate inputs and each input can be assigned to a number of roles. The offset and gain can be independently adjusted for each input for compatibility with a wide range of external equipment.

Set the mode to CV PITCH to allow the CV signal to control the basic pitch of MOTAS-6. This will override the MIDI note control of pitch, and will bypass any tuning setup (see section 2.19 for tunings).

To trigger the EGs using CV/gate inputs set the mode to GATE+ or GATE- to trigger on rising or falling voltage, respectively. The trigger point threshold is adjusted by setting the offset for that CV input.

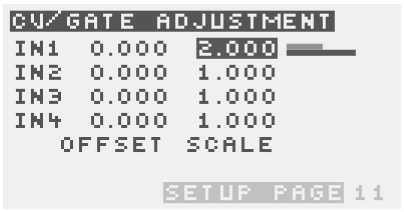
CV/gate can also control the tempo when set to CLOCK+ or CLOCK-, in this case the CLK SOURCE should be set to EXT CLK on SETUP PAGE 3.

The CV SMOOTHING parameter applies a low-pass filter to the CV/gate signals which smoothes out and delays the response to input CV (except when used for gate or clock signals). This can be useful to filter out noise or to add a delayed effect. When set to 00 there is no smoothing.



To set the offset and gain for each input access SETUP PAGE 11

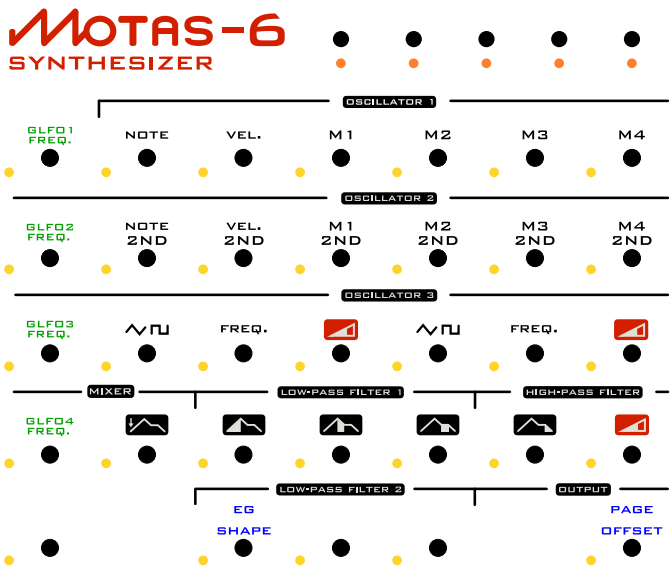
The raw input CV/gate signal for each of the 4 inputs is shown on the display as a dimmed horizontal bar. Underneath this bar is a brighter bar showing the current resolved CV/gate signal, after the offset and scaling adjustment. For gate signals this will be zero or full width corresponding to gate off or on respectively. This feature allows easier setup of the offset and scaling required for each input.



2.16 Edit page parameters such as EG attack using rotary knobs

Whilst on a parameter page engage PAGE LOCK and VALUE LOCK. Now the rotary knobs allow real-time editing for many of the parameters for that page.

The table below which shows what is controlled from each rotary knob and the figure below shows the same information, overlaid onto the MOTAS-6 panel. For example, turning LPF-1 will now control the EG attack.



This feature is useful for live editing of the page patch parameters, and for faster more immediate editing of the patch parameters using the rotary knobs.

Rotary knob	Control function
OSC-1	Note mod amount
PITCH OSC-1	Velocity mod amount
OSC-1	M1 amount
OSC-1	M2 amount
PWM OSC-1	M3 amount
OSC-1	M4 amount
OSC-2	Note secondary amount
PITCH OSC-2	Velocity secondary amount
OSC-2	M1 secondary amount
OSC-2	M2 secondary amount
OSC-2	M3 secondary amount
SUB OSC-2	M4 secondary amount
OSC-3	LFOx waveform
PITCH OSC-3	LFOx frequency/tempo
OSC-3	LFOx amount
OSC-3	local LFO waveform
PWM OSC-3	local LFO frequency
OSC-3	local LFO amount
MIXER	EG delay
LPF-1	EG attack
LPF-1	EG decay
LPF-1	EG sustain
HPF	EG release
HPF	EG level
LPF-2	EG shape
OUTPUT	Page offset
MASTER PITCH	global LFO1 frequency
PHASE MOD OSC-2	global LFO2 frequency
PHASE MOD OSC-3	global LFO3 frequency
MIXER	global LFO4 frequency

2.17 Paraphonic playing

MOTAS-6 is a paraphonic synthesizer. The 3 VCOs can separately be configured to track pitch independently, and EGs can be applied to control the mixing of the VCOs, but ultimately their outputs are all mixed together and pass through the filters and final output together. This is in contrast to a true polyphonic synthesizer where each 'voice' is fully independent all the way through to the final output.

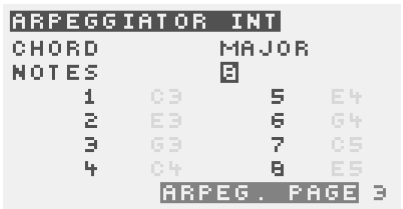
There are many 'flavours' of paraphonic operation. The simplest and often most effective is to set each of the 3 VCOs to track incoming notes in modes HIGHEST, MIDDLE or LOWEST respectively. With this setup when one note is played all VCOs play the pitch of that note. When 2 notes are held 2 of the VCOs play the highest note and the 3rd plays the lowest. When 3 notes are held each VCO is set to a separate pitch. This allows easy playing of 3-note chords with the benefit of a rich sound on 1-note playing (as all 3 VCOs then combine).

For true polyphonic operations multiple MOTAS-6 units can be operation together, see section 2.14.

2.18 Use the arpeggiator without an external keyboard

The arpeggiator has a mode that can play without triggering from an external source. Set MODE to H-INT which means 'hold-internal' then the notes played can be edited on page 3 of the arpeggiator setup.

Either fixed chord formations can be chosen (12 types such as MAJOR, MINOR, AUG ...) or custom-defined notes can be set. Up to 8 notes can be specified.



2.19 Setup custom tunings

A 'tuning' is the mapping between the played note and the resulting pitch (frequency). The tuning will be correct when no modulations are applied to the master pitch page and the individual VCO pitch pages and the offsets are set to zero semitones. If note modulation is applied then deviations will occur which can be useful way to detune according to note played. Note that the tunings are only used for MIDI playing of MOTAS-6 – when using CV to control pitch there is no such mapping in operation (the pitch is directly controlled by the CV voltage).

You can choose from 32 built-in preset tunings and from a further 32 user-defined tunings that you import (via MIDI tuning commands). Make the selection from SETUP PAGE 12.

2.20 Live tweaking: modify any patch parameter using MIDI CCs or rotary knobs

All of the MOTAS-6 parameters can be controlled using NRPN MIDI controller data but this can be fiddly to setup and use with some external hardware. The MotasEdit software does use NRPNs to control and read the parameters to allow full, bidirectional high-resolution control of all parameters.

A simpler method can be employed using standard MIDI CCs (continuous controllers) from CC #1 (modulation wheel) to CC #24 using a pameter mapping system. This mapping is necessary because there are far too many parameters in each MOTAS-6 patch to allow full control from the limited number of CC controllers. The mapping system allows you to choose which patch parameters is assigned to which CC controller. This is accessed from SETUP PAGE 5.

When the parameter map is ON CC control is active. You can set the parameter map to be GLOBAL meaning the same mapping is used for all patches or PATCH which is specific to each patch and saved within each patch. The table below show the mapping options. They are 2 settings needed for each mapping (the 'page' and the 'dest') allowing control of all patch settings (more than 1600 parameters!).

Global/Page/Patch	Global Destination	Page Destination	Patch Dest.
OFF	LFO1 WAVEFORM	OFFSET	PORT MODE
GLOBAL PARAMS	LFO1 FREQUENCY	PAGE OPTION 1	PORT TIME/RATE
MASTER PITCH	LFO1 TEMPO*	PAGE OPTION 2	PORT VALUE
OSC-1:LEVEL	LFO1 SINGLE-SHOT	NOTE DEPTH	NOTE OFF TRACK
OSC-1:PITCH	LFO1 SYNC/RESET	NOTE 2ND DEST	PW SENS.
OSC-1:TRIANGLE	LFO1 FREQ MODE	NOTE 2ND DEPTH	LFO SYNC.
OSC-1:SAWTOOTH	LFO2 WAVEFORM	NOTE RESPONSE	
OSC-1:PULSE MOD.	LFO2 FREQUENCY	VELOCITY DEPTH	
OSC-1:PULSE LEVEL	LFO2 TEMPO*	VEL. 2ND DEST	
OSC-2:PHASE MOD	LFO2 SINGLE-SHOT	VEL. 2ND DEPTH	
OSC-2:LEVEL	LFO2 SYNC/RESET	VEL. RESPONSE	
OSC-2:PITCH	LFO2 FREQ MODE	M1 DEPTH	
OSC-2:TRIANGLE	LFO3 WAVEFORM	M1 2ND DEST	
OSC-2:SAWTOOTH	LFO3 FREQUENCY	M1 2ND DEPTH	
OSC-2:SQUARE	LFO3 TEMPO*	M1 RESPONSE	
OSC-2:SUB-OSC	LFO3 SINGLE-SHOT	M2 DEPTH	
OSC-3:PHASE MOD	LFO3 SYNC/RESET	M2 2ND DEST	
OSC-3:LEVEL	LFO3 FREQ MODE	M2 2ND DEPTH	
OSC-3:PITCH	LFO4 WAVEFORM	M2 RESPONSE	
OSC-3:TRIANGLE	LFO4 FREQUENCY	M3 DEPTH	
OSC-3:SAWTOOTH	LFO4 TEMPO*	M3 2ND DEST	
OSC-3:PULSE MOD.	LFO4 SINGLE-SHOT	M3 2ND DEPTH	
OSC-3:PULSE LEVEL	LFO4 SYNC/RESET	M3 RESPONSE	
MIXER:NOISE	LFO4 FREQ MODE	M4 DEPTH	
MIXER:LEVEL	EG1 DELAY	M4 2ND DEST	
MIXER:FB/EXT	EG1 ATTACK	M4 2ND DEPTH	
LPF1:FREQUENCY	EG1 DECAY	M4 RESPONSE	
LPF1:RESONANCE	EG1 SUSTAIN	LFOX CHOICE	
LPF1:OUTPUT	EG1 RELEASE	LFOX DEPTH	
LPF2:FREQUENCY	EG1 KEYTRACK	LFO WAVEFORM	
LPF2:RESONANCE	EG1 RESET/LOOP	LFO FREQUENCY	
LPF2:OUTPUT	EG1 SHAPE	LFO DEPTH	
HPF:FREQUENCY	EG1 RESPONSE	LFO OUTPUT MODE	
HPF:OUTPUT	EG2 DELAY	LFO SINGLE-SHOT	
OUTPUT	EG2 ATTACK	LFO SYNC/RESET	
PATCH SETTINGS	EG2 DECAY	LFO FREQ MODE	
	EG2 SUSTAIN	LFO FMOD LFOX	
	EG2 RELEASE	LFO FMOD EG	
	EG2 KEYTRACK	EG DELAY	
	EG2 RESET/LOOP	EG ATTACK	
	EG2 SHAPE	EG DECAY	
	EG2 RESPONSE	EG SUSTAIN	
	EG3 DELAY	EG RELEASE	
	EG3 ATTACK	EG DEPTH	
	EG3 DECAY	EG CHOICE	
	EG3 SUSTAIN	EG KEYTRACK	
	EG3 RELEASE	EG RESET/LOOP	
	EG3 KEYTRACK	EG SHAPE	
	EG3 RESET/LOOP	EG RESPONSE	
	EG3 SHAPE		
	EG3 RESPONSE		
	EG4 DELAY		
	EG4 ATTACK		
	EG4 DECAY		
	EG4 SUSTAIN		
	EG4 RELEASE		
	EG4 KEYTRACK		
	EG4 RESET/LOOP		
	EG4 SHAPE		
	EG4 RESPONSE		

*since firmware 0602010C LFOx TEMPO is not used (use LFOx FREQUENCY instead).

When in patch summary display mode and both PAGE LOCK and VALUE LOCK are enabled then 24 of the rotary knobs also control the mapping (in parallel with external CC controllers). The table below shows the knob functions.

Rotary knob	Control function
OSC-1	slot #1
PITCH OSC-1	slot #2
OSC-1	slot #3
OSC-1	slot #4
PWM OSC-1	slot #5
OSC-1	slot #6
OSC-2	slot #7
PITCH OSC-2	slot #8
OSC-2	slot #9
OSC-2	slot #10
OSC-2	slot #11
SUB OSC-2	slot #12
OSC-3	slot #13
PITCH OSC-3	slot #14
OSC-3	slot #15
OSC-3	slot #16
PWM OSC-3	slot #17
OSC-3	slot #18
MIXER	slot #19
LPF-1	slot #20
LPF-1	slot #21
LPF-1	slot #22
HPF	slot #23
HPF	slot #24
MASTER PITCH	global LFO1 frequency
PHASE MOD OSC-2	global LFO2 frequency
PHASE MOD OSC-3	global LFO3 frequency
MIXER	global LFO4 frequency

Use this feature to tweak patch parameters in a live situation. Set the parameter mapping to PATCH so the tweakable parameters are custom to each patch and then load the patch and enter patch summary display mode with both PAGE LOCK and VALUE LOCK enabled. Turn the rotary knobs to tweak away!

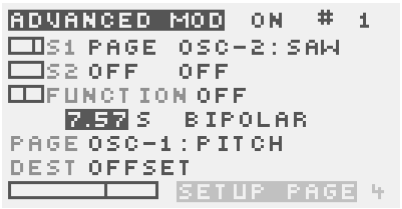
3 Advanced modulation

The modulation architecture of MOTAS-6 typically allows the user to 'see' the modulation being applied to each parameter shown on the individual parameter pages and to dial-in modulation amounts from local LFOs and EGs (local to that parameter page) as well as amounts from global (patch-wide) modulators such as velocity, M1 …M4 and global LFOs and EGs.

The advanced modulation feature, covered in this chapter, opens the door to some really extreme and complex modulation configurations. The downside is that this feature can lead to modulation routings that are difficult to see how they are configured, but does allow the ultimate in power and flexibility.

With the advanced modulation feature enabled you can, for example, modulate the parameters of *local* EGs and LFOs across different parameter pages. You can mathematically process the outputs of multiple modulation sources and apply the output to almost *any* MOTAS-6 parameter as well as chain together these modulations for some extreme setups.

A complex example (using 4 of the 16 available advanced modulation slots): you could have the output from the local LFO on the VCO-3 triangle-wave parameter page multiplied by CV/-gate input 2, added to the global EG4 output then slewed by global modulator M1 output and the minimum of this and the global LFO2 output routed to modify the EG shape of the local EG on the LPF2 resonance parameter page and simultaneously modulate the master pitch local LFO frequency …!



On the ADVANCED MOD setup page the advanced modulation feature can be turned on and configured. There are 16 slots of advanced modulation. This powerful feature allows complex chains of modulation from many sources to be applied to a vast choice of destinations. The settings are stored within the patch (including whether this feature is enabled).

For each slot there are 2 source settings and a 'function' that operates on the source values. The output from the chosen function can be routed as a source input for other advanced modulation slots.

Finally, the output from the chosen function has a modulation amount setting and this result modulates the slot destination. The modulation amount can be adjusted over a wide range from positive to negative and can be set as bipolar or unipolar response.

To select from the 16 available advanced modulation slots press + to move to the next slot and − to move to the previous slot. Press ↑ and ↓ to access the various parameters on each slot page and then use the rotary encoder to adjust the values.

3.1 Source options

There are 2 sources for each advanced modulation slot labelled S1 and S2. Each source has 2 parameters, the first parameter sets the source type. The second parameter source selection depends on the source type, the options are shown in the following table.

	Source type		
SLOT	**GLOBAL**	**PAGE/KNOB/LFO/EG**	**MISC**
#1	VELOCITY	OSC-1:LEVEL	TEMPO CLK
#2	NOTE	OSC-1:PITCH	NOTES DOWN
#3	M1	OSC-1:TRI	LAST NOTE
#4	M2	OSC-1:SAW	1ST NOTE
#5	M3	OSC-1:PL MOD	2ND NOTE
#6	M4	OSC-1:PL LEV	3RD NOTE
#7	CV1	OSC-2:PH MOD	HIGHEST NOTE
#8	CV1	OSC-2:LEVEL	MIDDLE NOTE
#9	CV2	OSC-2:PITCH	LOWEST NOTE
#10	CV3	OSC-2:TRI	CONST 1
#11	CV4	OSC-2:SAW	CONST 2
#12	LFO1	OSC-2:SQUARE	CONST 3
#13	LFO2	OSC-2:SUBOSC	CONST 4
#14	LFO3	OSC-3:PH MOD	CONST 5
#15	LFO4	OSC-3:LEVEL	CONST 6
#16	EG1	OSC-3:PITCH	CONST 7
	EG2	OSC-3:TRI	CONST 8
	EG3	OSC-3:SAW	CONST 9
	EG4	OSC-3:PL MOD	CONST 10
		OSC-3:PL LEV	CONST 11
		MIXER:NOISE	CONST 12
		MIXER:LEVEL	CONST 13
		LPF1:FREQ	CONST 14
		LPF1:RES	CONST 15
		LPF1:OUT	CONST 16
		HPF:FREQ	CONST 32
		HPF:OUT	CONST 64
		MIX:FB/EXT	CONST 128
		LPF2:FREQ	
		LPF2:RES	
		LPF2:OUT	
		OUTPUT	

Source type SLOT

When source type is set to SLOT the source value is routed from another advanced modulation slot output. The source selection can be chosen from #1 to #16 corresponding to the advanced modulation outputs slots 1…16.

Source type GLOBAL

When source type is set to GLOBAL the source selection is set to that of the corresponding global modulator, for example EG2 sets the source to the output of global EG2.

Source type PAGE / KNOB / LFO / EG

When source type is set to PAGE, KNOB, LFO or EG the source selection is set to the parameter on the chosen parameter page.

Using PAGE the source is the final value of the parameter page (i.e. the resultant value for that page, after the effects of any other modulations that are present for that page).

Using KNOB the source is the value of the knob position for that page (regardless of the page or value lock settings).

Using LFO the source is the output of the local LFO for that page.

Using EG the source is the output of the local EG for that page. For example, with source type set to EG and 2nd parameter set to OSC:TRI the source is value of the local EG from the OSC:TRI page.

3.2 Function

You can choose the function that is applied to the S1 and S2 sources. The output from the chosen function can be routed as a source input for other advanced modulation slots (using the SLOT source option). The choice of functions is:

FUNCTION	Description
OFF	fixed zero value
S1 ONLY	S1 value (S2 ignored)
-S1 ONLY	negative S1 value (S2 ignored)
S2 ONLY	S2 value (S1 ignored)
ADD	S1 + S2
AVERAGE	(S1 + S2) / 2
SUBTRACT	S1 - S2
DIFF	positive difference |S1 - S2|
MIN	minimum of S1, S2
MAX	maximum of S1, S2
MULTIPLY	S1 x S2
DIVIDE	S1 / S2
QUANTISE	S1 quantised by S2
SLEW	S1 slewed by S2
S/HOLD	S1 sample/hold by S2
F-DIVIDE	S1 frequency-divide by S2
LESS	binary: S1 less or equal S2
GREATER	binary: S1 greater or equal S2
AND	binary: S1 AND S2
OR	binary: S1 OR S2
XOR	binary: S1 XOR S2

Note that in all cases if the result of the function is out-of-range the result is clipped.

The MULTIPLY and DIVIDE functions rescale the result so it is more likely to be in range.

The SLEW function low-pass filters the S1 value with a filter coefficient depending on the S2 value.

The S/HOLD function samples the S1 value when the S2 value rises above the mid-point value.

The F-DIVIDE function first converts S1 into a square wave signal toggling when the S1 value crosses through the mid-point value. This square wave is then frequency divided by the S2 value, to generate an output square wave of lower frequency.

The 'binary' functions (LESS, GREATER, AND, OR and XOR) output only 2 possible values (zero or maximum) depending on the S1 and S2 values.

LESS outputs maximum if S1 is less than or equal to S2.

GREATER outputs maximum if S1 is greater than or equal to S2.

AND outputs maximum only if both **S1** and **S2** are greater than midpoint values.

OR outputs maximum if either **S1** or **S2** are greater than midpoint values.

XOR outputs maximum if either **S1** or **S2** are greater than midpoint values but zero if both **S1** and **S2** are greater than midpoint values.

The **MISC:CONST X** constant source values can be useful in conjunction with the **SLEW** function to provide a fixed slew setting or the **F-DIVIDE** function to provide a frequency-divided signal with a fixed ratio.

For on/off accent control use function **GREATER** with **S1** set to **VELOCITY** and **S2** set to **MISC:CONST 64**. The output will then depend on whether velocity is below or above the mid-point value 64. Route the output to e.g. filter cutoff to allow on/off 'accent' control from the velocity.

3.3 Modulation amount

The amount of modulation sent to the destination can be adjusted over a wide range (both positive and negative). Depending on the destination setting the modulation amount may be shown in different units e.g. percent, cents, semi-tones etc.

Press to toggle **UNIPOLAR** or **BIPOLAR** modulation.

3.4 Destination

The destination is set using the **PAGE** and **DEST** settings as shown in the table below.

PAGE	DEST (global)	DEST (page)	DEST (patch)
OFF	LFO1 WAVEFORM	OFFSET	PORT MODE
GLOBAL PARAMS	LFO1 FREQUENCY	PAGE OPTION 1	PORT TIME/RATE
MASTER PITCH	LFO1 TEMPO*	PAGE OPTION 2	PORT VALUE
OSC-1:LEVEL	LFO1 SINGLE-SHOT	NOTE DEPTH	NOTE OFF TRACK
OSC-1:PITCH	LFO1 SYNC/RESET	NOTE 2ND DEST	PW SENS.
OSC-1:TRIANGLE	LFO1 FREQ MODE	NOTE 2ND DEPTH	LFO SYNC.
OSC-1:SAWTOOTH	LFO2 WAVEFORM	NOTE RESPONSE	
OSC-1:PULSE MOD.	LFO2 FREQUENCY	VELOCITY DEPTH	
OSC-1:PULSE LEVEL	LFO2 TEMPO*	VEL. 2ND DEST	
OSC-2:PHASE MOD	LFO2 SINGLE-SHOT	VEL. 2ND DEPTH	
OSC-2:LEVEL	LFO2 SYNC/RESET	VEL. RESPONSE	
OSC-2:PITCH	LFO2 FREQ MODE	M1 DEPTH	
OSC-2:TRIANGLE	LFO3 WAVEFORM	M1 2ND DEST	
OSC-2:SAWTOOTH	LFO3 FREQUENCY	M1 2ND DEPTH	
OSC-2:SQUARE	LFO3 TEMPO*	M1 RESPONSE	
OSC-2:SUB-OSC	LFO3 SINGLE-SHOT	M2 DEPTH	
OSC-3:PHASE MOD	LFO3 SYNC/RESET	M2 2ND DEST	
OSC-3:LEVEL	LFO3 FREQ MODE	M2 2ND DEPTH	
OSC-3:PITCH	LFO4 WAVEFORM	M2 RESPONSE	
OSC-3:TRIANGLE	LFO4 FREQUENCY	M3 DEPTH	
OSC-3:SAWTOOTH	LFO4 TEMPO*	M3 2ND DEST	
OSC-3:PULSE MOD.	LFO4 SINGLE-SHOT	M3 2ND DEPTH	
OSC-3:PULSE LEVEL	LFO4 SYNC/RESET	M3 RESPONSE	
MIXER:NOISE	LFO4 FREQ MODE	M4 DEPTH	
MIXER:LEVEL	EG1 DELAY	M4 2ND DEST	
MIXER:FB/EXT	EG1 ATTACK	M4 2ND DEPTH	
LPF1:FREQUENCY	EG1 DECAY	M4 RESPONSE	
LPF1:RESONANCE	EG1 SUSTAIN	LFOX CHOICE	
LPF1:OUTPUT	EG1 RELEASE	LFOX DEPTH	
LPF2:FREQUENCY	EG1 KEYTRACK	LFO WAVEFORM	
LPF2:RESONANCE	EG1 RESET/LOOP	LFO FREQUENCY	
LPF2:OUTPUT	EG1 SHAPE	LFO DEPTH	
HPF:FREQUENCY	EG1 RESPONSE	LFO OUTPUT MODE	
HPF:OUTPUT	EG2 DELAY	LFO SINGLE-SHOT	
OUTPUT	EG2 ATTACK	LFO SYNC/RESET	
PATCH SETTINGS	EG2 DECAY	LFO FREQ MODE	
	EG2 SUSTAIN	LFO FMOD LFOX	
	EG2 RELEASE	LFO FMOD EG	
	EG2 KEYTRACK	EG DELAY	
	EG2 RESET/LOOP	EG ATTACK	
	EG2 SHAPE	EG DECAY	
	EG2 RESPONSE	EG SUSTAIN	
	EG3 DELAY	EG RELEASE	
	EG3 ATTACK	EG DEPTH	
	EG3 DECAY	EG CHOICE	
	EG3 SUSTAIN	EG KEYTRACK	
	EG3 RELEASE	EG RESET/LOOP	
	EG3 KEYTRACK	EG SHAPE	
	EG3 RESET/LOOP	EG RESPONSE	
	EG3 SHAPE		
	EG3 RESPONSE		
	EG4 DELAY		
	EG4 ATTACK		
	EG4 DECAY		
	EG4 SUSTAIN		
	EG4 RELEASE		
	EG4 KEYTRACK		
	EG4 RESET/LOOP		
	EG4 SHAPE		
	EG4 RESPONSE		

*since firmware 0602010C LFOx TEMPO is not used (use LFOx FREQUENCY instead).

Note that the available options are exactly the same as for the parameter mapping feature (see 2.20).

3.5 Copy/Reset Mod

Pressing **COPY** from the **ADVANCED MOD** setup page allows options to copy or reset the advanced modulation settings. The current slot is shown in the upper right of the display.

Press ➡ when the **COPY FROM** line is selected to copy from a modulation slot (selected using the rotary encoder) to the current modulation slot .

Press ➡ when the **COPY TO** line is selected to copy the current modulation slot settings to another slot (selected using the rotary encoder).

Press ➡ when the **RESET THIS SLOT** line is selected to reset all the settings for the current slot.

Press ➡ when the **RESET ALL SLOTS** line is selected to reset all of the advanced modulation settings for this patch, and turn off (disable) the advanced modulation.

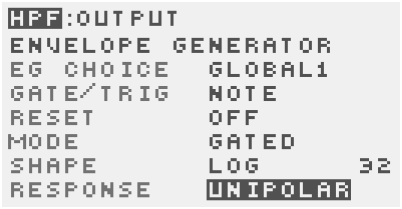
3.6 Control of settings over MIDI

When the advanced modulation settings are adjusted the new settings can be sent over MIDI using NRPN messages. Similarly MOTAS-6 recognises these NRPN messages to adjust the settings. The MotasEdit has an interface to allow changing of the advanced modulation settings, see also section 2.8.

4 Sound design

4.1 Set bipolar or unipolar modulation

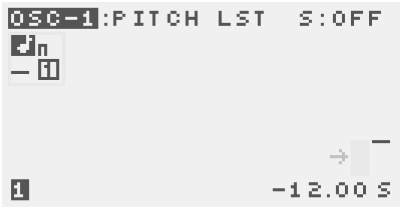
The modulation sources EG, note, velocity and global modulators M1 …M4 can all be set to modulate in either unipolar or bipolar mode (independent settings for each source on each parameter page). Bipolar means that when the modulation source is at its mid-value the modulation effect will be zero whilst in unipolar mode the effect is zero when the source is also at its zero value. Typically (on traditional synths) EGs are always unipolar but with MOTAS-6 this does not have to be the case.



The LFOs (global and local) are always bipolar.

4.2 Make an oscillator have fixed pitch

The VCOs normally track MIDI note-on values automatically. To hold the VCO so that its pitch is the same regardless of the incoming MIDI note simply apply a note modulation of -12 semitones (to cancel out the +12 semitones that is built-in).



4.3 Create a drone patch

To create a drone patch i.e. one where the audio is heard continuously, simply reduce the EG modulation level on the final output page to zero and offset the page value to 100% to give full output level. Also, you would need to set non-zero offset levels on other pages such as oscillator individual waveform pages, oscillator overall level page, mixer level page and filter output page (such as for low-pass filter 1) in order to hear something.

4.4 Create a band-pass filter

MOTAS-6 has 3 independent filters: two low-pass and one high-pass. To make a bandpass filter a low-pass filter needs to be placed in series with the high-pass filter.

Let's use low-pass filter 1 with the high-pass filter. Set the input of the low-pass filter 1 to the mixer MIX and set the cut-off frequency to 2.00KHz.

Next, set the direct output level of low-pass filter 1 to zero (we don't want any of the direct output to be audible).

Next set the input of the high-pass filter to the 2nd pole of the low-pass filter 1 output POLE-2 and set the cut-off frequency to 1.00KHz.

With this setup the audio from the mixer passes through a band-pass filter with fixed width and a centre frequency around 1.5kHz. Of course the frequencies of the low and high pass filters can be modulated (independently) to make the sound more interesting.

The high-pass filter can be set to receive its signal from a different pole of the low-pass filter 1 (the higher the pole the steeper the cut-off frequency), the low-pass filter 1 resonance could be adjusted and the signal level can be adjusted (to alter the gain-staging and so distortion effects)…all of these changes will alter the sonic effect.

4.5 Use phase modulation to create complex waveforms

MOTAS-6 is rather unique for an analogue synthesizer in having phase-modulation capabilities. Phase modulation (PM) is when the waveform of an oscillator (the carrier) is shifted in phase a controllable amount from another oscillator waveform (the modulator).

Phase-modulation gives rise to sounds similar to frequency modulation (FM) but does not have the frequency shift problems that can plague true FM. This is because with FM the frequency of the output signal is affected by *the value* of the modulating signal whereas with PM the frequency shift is from the *rate-of-change* of the modulator signal. Using FM it is very hard to generate modulator wavefoms that do not cause the side-effect of uncontrolled frequency changes, especially with analogue VCOs and strong modulation amounts.

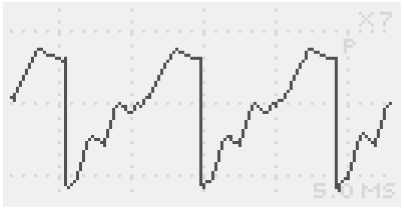
The 'FM' digital synths of the 1980s actually used phase-modulation (PM) but it was marketed as FM…

The VCO2 core sawtooth waveform can be phase-modulated from the VCO1 triangle wave. The modulated result is the sawtooth output from VCO2. Internally the triangle waveform from VCO2 is generated from this new sawtooth and so is affected by the PM. The square and sub waveforms are generated from the original core sawtooth and so are not affected by the PM on VCO2.

The VCO3 core sawtooth waveform can be phase-modulated from either the VCO1 or VCO2 triangle wave. The modulated result is the sawtooth output from VCO3. Internally the triangle and pulse waveforms from VCO2 are generated from this new sawtooth and so both are affected by the PM.

In the screenshot below (captured from the built-in oscilloscope feature) we have VCO3 sawtooth output with phase modulation from VCO2. Both VCOs have been set to the same frequency (with VCO2 set to hard-sync to VCO3 to ensure constant lock). As you can see the waveform is significantly altered from a pure sawtooth.

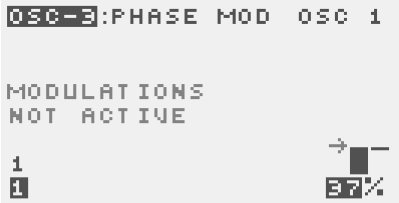
In the screenshot below we have the same setup as above but additionally add phase modulation of VCO2 from VCO1 creating a more complex waveshape.



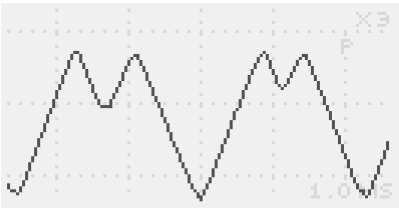
4.6 Create wave-folding sounds

It is possible to create wave-folding type effects using a special setup of the phase-modulation.

To achieve this we set the carrier frequency out-of-range of hearing (either INFRASONIC or ULTRASONIC). Then, with phase modulation the triangle wave output shape will, with some combination of settings, effectively be wave-folded onto itself.

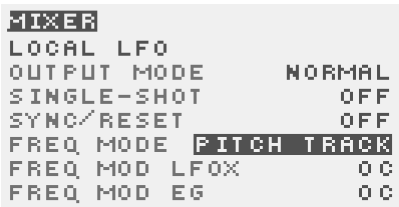


In the screenshot below (captured from the built-in oscilloscope feature) you can see that the triangle wave output of VCO3 has 'folded' back onto itself at the tops of the cycle giving a characteristic tone. In this example the filters have been bypassed.



4.7 Set LFOs to track pitch for AM- and FM-type sounds

Normally the LFOs frequency is free-running but setting the FREQ MODE setting to NOTE TRACK or PITCH TRACK causes the LFO frequency to track with the played note. In this case the LFO frequency is not displayed in Hz but in semitones or cents offset from the played note. In NOTE TRACK mode the LFO will track the last played note including pitch bend and global tuning and offset, whilst in PITCH TRACK mode additionally the tracking will be from the result of the MASTER PITCH page.



Use pitch-tracking to apply a range of AM and FM effects (depending where the LFO is appled). Offset the pitch-tracking frequency to give characteristic noisy/complex tones. Since the LFOs cannot run at high audio rates (due to hardware limitations) digital aliasing artifacts will be heard when at higher frequencies, especially if the LFO waveform is not a sine wave.

4.8 Control gain-staging and distortion

There are several audio gain controlling stages in the audio signal path. There is the mix of the individual oscillator waveforms, the overall oscillator levels, the mixer level (including boost option) and the individual filter output levels. Also the resonance control on the low-pass filters is relevant (since resonance is a local feedback path), as well as the possibility to use the external input/feedback path. Finally there are the clipping options on the final output stage.

MOTAS-6 has been designed so that at higher levels the audio signals will overdrive/compress/limit/clip within the analogue circuitry producing new harmonics from non-linear circuit operation in many places. The effect will be different depending on where the higher levels are present within the circuitry. This intentional design allows a greater range of possible sounds which vary with the various signal levels in the signal path. Use of filter resonance and feedback also plays a part by modifying the signal levels. Use lower-levels for a clean sound, high levels for a grungy aggresive sound and intermediate levels for effects inbetween. The filters will distort differently due to the different designs of the circuits.

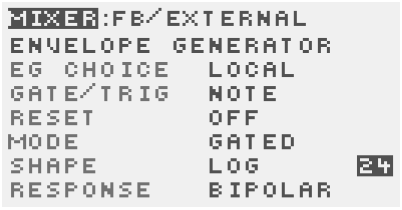
Using multiple oscillators at almost the same frequency, with appropriate level settings, can give an interesting change of tone as the oscillators drift in- and out-of phase. At some times the oscillators add together (when in-phase) and then distortion is strongest. At other times, when not

in-phase, the overall signal is weaker and so the distortion is reduced or absent.

The subtle (or not subtle) effects of distortion are one of the key sonic attractions of analogue synthesizers such as MOTAS-6.

4.9 Change the EG response shape

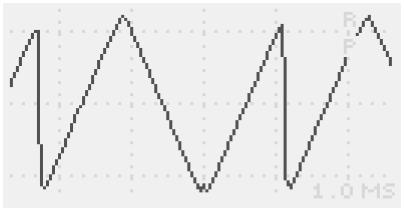
Each EG (Envelope Generator) has an output signal that varies over time during the attack, decay and release phases. The way this signal varies with time can be varied over a wide range using the shape parameter from -64 to +64. With positive shape values (LOG) the signal changes more quickly at the start and then more slowly, conversely with negative shape values (EXP) the signal changes more slowly at the start and then more quickly. Adjusting this parameter is particularly useful to get exactly the 'right' response for percussive sounds where small changes in the shape can make a big difference to the sound effect.



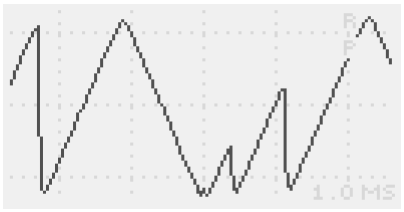
4.10 Use oscillator sync to create complex waveforms

MOTAS-6 has hard oscillator syncronisation features on oscillators 1 and 2. This means that the oscillator core can be reset by another oscillator (or oscillators). The synced oscillator re-starts its waveform cycle at the point in time when the other oscillator re-starts. The audio effect depends on the relationship between the frequencies of the oscillators.

The waveform below shows the triangle wave output of oscillator 1 which is synced to oscillator 2. The frequency of oscillator 2 is set to 7 semitones lower than oscillator 1. As you can see the triangle waveform is distorted as the oscillator signal resets partway through the cycle.

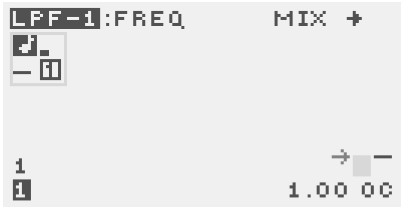


In a more complex example the waveform below shows the triangle wave output of oscillator 1 which is synced to oscillators 2 and 3. The frequency of oscillator 2 is set to 7 semitones lower than oscillator 1 whilst the frequency of oscillator 3 is set to 9 semitones lower. The triangle waveform is distorted with 2 resets during its cycle.



4.11 'Play' a resonant filter

The 2 low-pass filters can both be 'played' like oscillators using high resonance settings. Set the filter cut-off frequency to track note with 1.00 octave. Set the resonance above 70%.



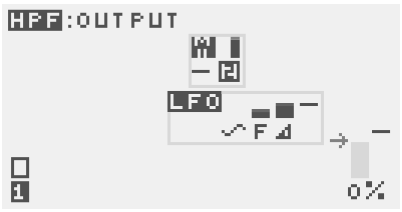
Note that the self-oscillation dies off at lower frequencies especially for low-pass filter 2. With low-pass filter 1 set the resonance feedback setting to POLE-4 or POLE-6. The pitch will be lower in the POLE-6 setting and will extend to lower frequency operation. Note also that the pitch stability of the filters is not as accurate as that for the oscillators.

4.12 Modulate a local LFO frequency with a global LFO or EG

Set the FREQ MOD LFOX parameter to allow the frequency of a local LFO to be modulated by the global

LFO used on that page and/or set the **FREQ MOD EG** parameter to allow the frequency to be modulated by the EG used on that page. Note that the global lfo or EG modulation amount settings for the page are irrelevant here and could be zero.

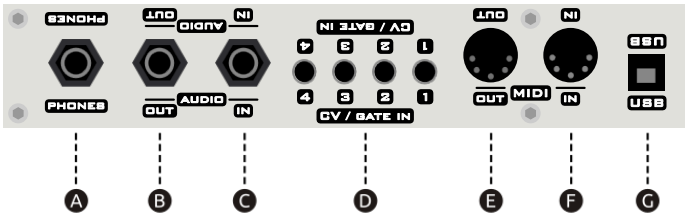
Another way to achieve this is (or in parallel to the above!) is to assign a global LFO or global EG to one of the global modulators M1 …M4 and then set a secondary modulation amount to modulate the local LFO frequency.



Adjust the local LFO frequency as normal to set the 'offset' of the local LFO about which the modulation takes place.

4.13 Feedback audio / process external audio

To process the output of MOTAS-6 in a feedback loop ensure that nothing is plugged into the external audio input C. When nothing is connected an internal loopback connection is made from the main output (before the final volume control). Alternatively, to process external audio plug in a line-level audio signal into C.



Adjust the level on the

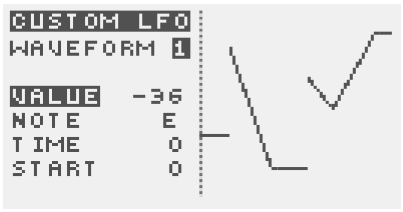
MIXER **FB/EXTERNAL** parameter page. The feedback or external audio signal enters the mixer along with the VCOs and the noise source.

Since this is a feedback loop if the gain around the loop becomes greater than 1 and is in-phase the output will potentially scream/howl so use with caution, or to good effect!

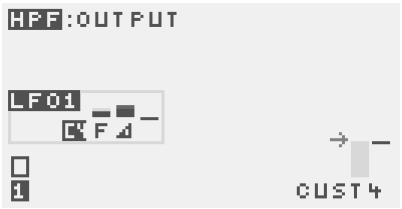
Of course modulation can be applied to this page (just like all the other pages) so you could create an effect where the external sound is only processed for a certain time on each key press by modulating with an EG, for example.

4.14 Design and use custom LFO waveforms

Each patch has 4 custom LFO waveforms which can be edited. Access **SETUP PAGE 2** and then press + or − to enter the custom LFO editing mode.



Any LFO (parameter-page local, or global) can use the 4 custom LFO waveforms just like the preset waveforms.



.

Set an LFO into **SINGLE-SHOT** mode using a custom LFO waveform with a complex profile to use the LFO more like an 'EG' on a percussive patch with exact and complex control of the shape over time. Use the LFO frequency to control how 'fast' the waveform changes over time.

A Real-time patch changes using MIDI NRPNs

When a patch parameter is changed using the rotary knobs ❶, rotary encoder or buttons ❸ a series of 4 MIDI controller messages are sent:

- NRPN MSB #99 (0x63 in hex)
- NRPN LSB #98 (0x62)
- data entry MSB #6 (0x06)
- data entry LSB #38 (0x26)

Parameter Page	NRPN MSB data
N/A (global parameter)	0
Master pitch	1
Oscillator 1 Level	2
Oscillator 1 Pitch	3
Oscillator 1 Triangle Level	4
Oscillator 1 Sawtooth Level	5
Oscillator 1 Pulse Mod	6
Oscillator 1 Pulse Level	7
Oscillator 2 Phase Mod.	8
Oscillator 2 Level	9
Oscillator 2 Pitch	10
Oscillator 2 Triangle Level	11
Oscillator 2 Sawtooth Level	12
Oscillator 2 Square	13
Oscillator 2 Sub Level	14
Oscillator 3 Phase Mod.	15
Oscillator 3 Level	16
Oscillator 3 Pitch	17
Oscillator 3 Triangle Level	18
Oscillator 3 Sawtooth Level	19
Oscillator 3 Pulse Mod	20
Oscillator 3 Pulse Level	21
Noise Level	22
Mix Level	23
Low-pass Filter 1 cut-off	24
Low-pass Filter 1 resonance	25
Low-pass Filter 1 level	26
High-pass Filter cut-off	27
High-pass Filter level	28
Feedback/Ext in Level	29
Low-pass Filter 2 cut-off	31
Low-pass Filter 2 resonance	32
Low-pass Filter 2 Level	33
Output Level	35
Advanced modulation	64 see section A.1

The same format of messages, if received via USB or MIDI, cause the current patch to change accordingly.

The NRPN messages indicate exactly which parameter is being changed whilst the data entry messages contain the new parameter value. The first message (controller 99) is sent with the data value from the table above, denoting the parameter page being changed. If the data is for a global source (such as a shared EG or LFO) then the data value is zero.

In the case of a page-related parameter changing (i.e. NRPN MSB value not 0 or 64) then the second message sent (controller 98) has the data value from the following table, denoting the parameter from that page being changed.

Page data	NRPN LSB data
Offset	1
EG mod depth	5
EG delay	10
EG attack	11
EG decay	12
EG sustain	13
EG release	14
LFOx mod depth	20
LFO frequency	25
LFO mod depth	26
M1 level	30
M1 alternate dest. level	31
M1 unipolar	32
M2 level	35
M2 alternate dest. level	36
M2 unipolar	37
M3 level	40
M3 alternate dest. level	41
M3 unipolar	42
M4 level	45
M4 alternate dest. level	46
M4 unipolar	47
Velocity level	50
Velocity alternate dest. level	51
Velocity unipolar	52
Note level	55
Note alternate dest. level	56
Note unipolar	57
Page option 1	64
Page option 2	65
EG source	70
EG retrig	71
EG restart	72
EG shape	75
EG shape multi	76
EG unipolar	78
LFO source	80
LFO waveform	85
LFO trigger	86
LFO single shot	87
LFO output mode	88
LFO freq mode	89
M1 destination	90
LFO freq mod LFOx	92
LFO freq mod EG	93
M2 destination	95
M3 destination	100
M4 destination	105
velocity destination	110
note destination	115

In the case of a global parameter changing (i.e. NRPN MSB value was 0) then the second message sent (controller 98) has the data value from the following table, denoting the global parameter.

Global data	NRPN LSB data
LFOx 1 frequency	4
LFOx 2 frequency	5
LFOx 3 frequency	6
LFOx 4 frequency	7
EGx 1 delay	12
EGx 2 delay	13
EGx 3 delay	14
EGx 4 delay	15
EGx 1 attack	20
EGx 2 attack	21
EGx 3 attack	22
EGx 4 attack	23
EGx 1 decay	28
EGx 2 decay	29
EGx 3 decay	30
EGx 4 decay	31
EGx 1 sustain	36
EGx 2 sustain	37
EGx 3 sustain	38
EGx 4 sustain	39
EGx 1 release	44
EGx 2 release	45
EGx 3 release	46
EGx 4 release	47
portmento mode	52
portmento value	53
portmento time or rate	54
lfo sync	55
track note-off	56
pitchwheel sensitivity	57
M1 source	64
M2 source	65
M3 source	66
M4 source	67
LFOx 1 trigger	72
LFOx 2 trigger	73
LFOx 3 trigger	74
LFOx 4 trigger	75
LFOx 1 single-shot	76
LFOx 2 single-shot	77
LFOx 3 single-shot	78
LFOx 4 single-shot	79
LFOx 1 waveform	80
LFOx 2 waveform	81
LFOx 3 waveform	82
LFOx 4 waveform	83
LFOx 1 freq mode	84
LFOx 2 freq mode	85
LFOx 3 freq mode	86
LFOx 4 freq mode	87
EGx 1 trigger	88
EGx 2 trigger	89
EGx 3 trigger	90
EGx 4 trigger	91
EGx 1 restart	96
EGx 2 restart	97
EGx 3 restart	98
EGx 4 restart	99
EGx 1 shape	104
EGx 2 shape	105
EGx 3 shape	106
EGx 4 shape	107
EGx 1 unipolar	110
EGx 2 unipolar	111
EGx 3 unipolar	112
EGx 4 unipolar	113
EGx 1 shape multi	114
EGx 2 shape multi	115
EGx 3 shape multi	116
EGx 4 shape multi	117

A.1 NRPN control of advanced modulation

The configuration of the advanced modulation (see chapter 3) can be sent and received using NRPNs too.

In this case the NRPN MSB is 64. The NRPN LSB data upper 4 bits indicate the advanced modulation slot number whilst the lower 3 bits encode the following:

Parameter	NRPN LSB data (lowest 3 bits only)
Source S1	0
Source S2	1
Destination	2
Function	3
Gain	4
Unipolar	5
Mode (on/off)	7

B MIDI Implementation Chart

MIDI Implementation Chart v. 2.0 (Page 1 of 3) Manufacturer: Motas Electronics Limited. Model: Motas 6. Date: July 2020.			
	Transmit/Export	**Recognise/Import**	**Remarks**
1. Basic Information			
MIDI channels	1 – 16	1– 16	
Note numbers	No	0 – 127	
Program change	No	0 – 49	change active patch / load patch from bank
Bank Select response? (Yes/No) If yes, list banks utilized in remarks column		Yes	Bank CC 0 to select fast-access patch 1–5 Bank CC 1–10 to select banks 1–10
Modes supported : Mode 1: Omni-On, Poly (Yes/No) Mode 2: Omni-On, Mono (Yes/No) Mode 3: Omni-Off, Poly (Yes/No) Mode 4: Omni-Off, Mono (Yes/No) Multi Mode (Yes/No)		No No No No No	Can be set to receive on any channel
Note-On Velocity (Yes/No)		Yes	
Note-Off Velocity (Yes/No)	No	No	
Channel Aftertouch (Yes/No)		Yes	
Poly (Key) Aftertouch (Yes/No)		No	
Pitch Bend (Yes/No)		Yes	
Active Sensing (Yes/No)		Yes	
System Reset (Yes/No)	No	No	
Tune Request (Yes/No)	No	No	
Universal System Exclusive: Sample Dump Standard (Yes/No) Device Inquiry (Yes/No) File Dump (Yes/No) MIDI Tuning (Yes/No) Master Volume (Yes/No) Master Balance (Yes/No) Notation Information (Yes/No) Turn GM1 System On (Yes/No) Turn GM2 System On (Yes/No) Turn GM System Off (Yes/No) DLS-1 (Yes/No) File Reference (Yes/No) Controller Destination (Yes/No) Key-based Instrument Ctrl (Yes/No) Master Fine/Coarse Tune (Yes/No) Other Universal System Exclusive	No No No No No No No No No No No No No No No No	No No No Yes No No No No No No No No No No No No	3-byte bulk tuning dump
Manufacturer or Non-Commercial System Exclusive	Yes	Yes	Motas Electronics Ltd ID# : 00H 21H 2FH
NRPNs (Yes/No)	Yes	Yes	see A
RPN 00 (Pitch Bend Sensitivity) (Yes/No) RPN 01 (Channel Fine Tune) (Yes/No) RPN 02 (Channel Coarse Tune) (Yes/No) RPN 03 (Tuning Program Select) (Yes/No) RPN 04 (Tuning Bank Select) (Yes/No) RPN 05 (Modulation Depth Range) (Yes/No)	No No No No No No	No No No No No No	
2. MIDI Timing and Synchronization			
MIDI Clock (Yes/No)	Yes	Yes	
Song Position Pointer (Yes/No)	No	No	
Song Select (Yes/No)	No	No	
Start (Yes/No) Continue (Yes/No) Stop (Yes/No)	No No No	Yes Yes Yes	
MIDI Time Code (Yes/No)	No	No	
MIDI Machine Control (Yes/No)	No	No	
MIDI Show Control (Yes/No) If yes, MSC Level supported	No No	No No	
3. Extensions Compatibility			
General MIDI compatible? (Level(s)/No) Is GM default power-up mode? (Level/No)	No	No	
DLS compatible? (Levels(s)/No) (DLS File Type(s)/No)	No No	No No	
Standard MIDI Files (Type(s)/No)	No	No	
XMF Files (Type(s)/No)	No	No	
SP-MIDI compatible? (Yes/No)	No	No	

MIDI Implementation Chart v. 2.0 (Page 2 of 3)

Manufacturer: Motas Electronics Limited. Model: Motas 6. Date: July 2020.

Control #	Function	Transmitted (Y/N)	Recognised (Y/N)	Remarks
0	MIDI Bank Select (MSB)	Y	Y	
1	Modulation Wheel (MSB)	Y	Y	
2	Breath Controller (MSB)	Y	Y	
3		Y	Y	
4	Foot Controller (MSB)	Y	Y	
5	Portamento Time (MSB)	Y	Y	
6	Data Entry (MSB)	Y	Y	see A
7	Channel Volume (MSB)	Y	Y	
8	Balance (MSB)	Y	Y	
9		Y	Y	
10	Pan (MSB)	Y	Y	
11	Expression (MSB)	Y	Y	
12	Effect Control 1 (MSB)	Y	Y	
13	Effect Control 2 (MSB)	Y	Y	
14		Y	Y	
15		Y	Y	
16	General Purpose Controller 1 (MSB)	Y	Y	
17	General Purpose Controller 2 (MSB)	Y	Y	
18	General Purpose Controller 3 (MSB)	Y	Y	
19	General Purpose Controller 4 (MSB)	Y	Y	
20		Y	Y	
21		Y	Y	
22		Y	Y	
23		Y	Y	
24		Y	Y	
25		Y	Y	
26		Y	Y	
27		Y	Y	
28		Y	Y	
29		Y	Y	
30		Y	Y	
31		Y	Y	
32	Bank Select (LSB	N	N	
33	Modulation Wheel (LSB)	Y	Y	
34	Breath Controller (LSB)	Y	Y	
35		Y	Y	
36	Foot Controller (LSB)	Y	Y	
37	Portamento Time (LSB)	Y	Y	
38	Data Entry (LSB)	Y	Y	see A
39	Channel Volume (LSB)	Y	Y	
40	Balance (LSB)	Y	Y	
41		Y	Y	
42	Pan (LSB)	Y	Y	
43	Expression (LSB)	Y	Y	
44	Effect Control 1 (LSB)	Y	Y	
45	Effect Control 2 (LSB)	Y	Y	
46		Y	Y	
47		Y	Y	
48	General Purpose Controller 1 (LSB)	Y	Y	
49	General Purpose Controller 2 (LSB)	Y	Y	
50	General Purpose Controller 3 (LSB)	Y	Y	
51	General Purpose Controller 4 (LSB)	Y	Y	
52		Y	Y	
53		Y	Y	
54		Y	Y	
55		Y	Y	
56		Y	Y	
57		N	N	
58		N	N	
59		N	N	
60		N	N	
61		N	N	
62		N	N	
63		N	N	

MIDI Implementation Chart v. 2.0 (Page 3 of 3)

Manufacturer: Motas Electronics Limited. Model: Motas 6. Date: July 2020.

Control #	Function	Transmitted (Y/N)	Recognised (Y/N)	Remarks
64	Sustain Pedal	Y	Y	
65	Portamento On/Off	Y	Y	
66	Sostenuto	Y	Y	
67	Soft Pedal	Y	Y	
68	Legato Footswitch	Y	Y	
69	Hold 2	Y	Y	
70	Sound Controller 1 (default: Sound Variation)	Y	Y	
71	Sound Controller 2 (default: Timbre / Harmonic Quality)	Y	Y	
72	Sound Controller 3 (default: Release Time)	Y	Y	
73	Sound Controller 4 (default: Attack Time)	Y	Y	
74	Sound Controller 5 (default: Brightness)	Y	Y	
75	Sound Controller 6 (GM2 default: Decay Time)	Y	Y	
76	Sound Controller 7 (GM2 default: Vibrato Rate)	Y	Y	
77	Sound Controller 8 (GM2 default: Vibrato Depth)	Y	Y	
78	Sound Controller 9 (GM2 default: Vibrato Delay)	Y	Y	
79	Sound Controller 10 (GM2 default: Undefined)	Y	Y	
80	General Purpose Controller 5	Y	Y	
81	General Purpose Controller 6	Y	Y	
82	General Purpose Controller 7	Y	Y	
83	General Purpose Controller 8	Y	Y	
84	Portamento Control	Y	Y	
85		Y	Y	
86		Y	Y	
87		Y	Y	
88		Y	Y	
89		Y	Y	
90		Y	Y	
91	Effects 1 Depth (default: Reverb Send)	Y	Y	
92	Effects 2 Depth (default: Tremolo Depth)	Y	Y	
93	Effects 3 Depth (default: Chorus Send)	Y	Y	
94	Effects 4 Depth (default: Celeste [Detune] Depth)	Y	Y	
95	Effects 5 Depth (default: Phaser Depth)	Y	Y	
96	Data Increment	Y	Y	
97	Data Decrement	Y	Y	
98	Non-Registered Parameter Number (LSB)	Y	Y	see A
99	Non-Registered Parameter Number(MSB)	Y	Y	see A
100	Registered Parameter Number (LSB)	Y	Y	see A
101	Registered Parameter Number(MSB)	Y	Y	see A
102		Y	Y	
103		Y	Y	
104		Y	Y	
105		Y	Y	
106		Y	Y	
107		Y	Y	
108		Y	Y	
109		Y	Y	
110		Y	Y	
111		Y	Y	
112		Y	Y	
113		Y	Y	
114		Y	Y	
115		Y	Y	
116		Y	Y	
117		Y	Y	
118		Y	Y	
119		Y	Y	
120	All Sound Off	N	Y	
121	Reset All Controllers	N	Y	
122	Local Control On/Off	N	N	
123	All Notes Off	N	Y	
124	Omni Mode Off	N	N	
125	Omni Mode On	N	N	
126	Poly Mode Off	N	N	
127	Poly Mode On	N	N	

C MIDI SysEx messages

This appendix is for reference purposes mainly for those wishing to develop software to communicate with MOTAS-6. MIDI system exclusive (SysEx) messages allow transfer of bulk data such as patch data, screenshot images and firmware updates. Further details are available on request.

The following table shows the message format that can be used by a connected MIDI device to request data from MOTAS-6

MIDI SysEx request message format	
SysEx byte	**Description**
0xF0	start
0x00	Motas Electronics identifier
0x21	Motas Electronics identifier
0x2F	Motas Electronics identifier
0x06	product id (6 = motas-6)
X	MIDI channel byte 'X'
0x00	reserved
CB	SysEx command byte 'CB'
P	SysEx parameter byte'P'
0xF7	end

The following table shows the message format for bulk data messages that can be sent or received. In the case of larger data transfers they are split up and sent in multiple smaller packets using the start/continue/end byte indicator.

MIDI SysEx bulk data transfer message format	
SysEx byte	**Description**
0xF0	start
0x00	Motas Electronics identifier
0x21	Motas Electronics identifier
0x2F	Motas Electronics identifier
0x06	product id (6 = motas-6)
X	MIDI channel 'X'
0x00	reserved
CB	SysEx command byte 'CB'
SCE	SysEx start/continue/end byte 'SCE' 0x47 = start, 0x48 = continue, 0x49 = end
A	SysEx parameter 'A'
B	SysEx parameter 'B'
C	SysEx parameter 'C'
DD ...*	multiple data bytes 'DD' encoded from original data bytes 'XX' to limit each byte value <= 0x7F required by MIDI protocol
CRC †	only present if this is an 'end' packet – 4-byte CRC of the original data bytes 'XX'
0xF7	end

MIDI SysEx Command Listing		
Command description	**'CB'**	**Parameter(s)**
Request commands		
Request screenshot bitmap	0x0A	–
Request oscilloscope trace	0x0B	–
Request bulk data	0x0C	–
Request info	0x0E	–
Request global data	0x0F	–
Request screenshot bitmap compressed	0x10	–
Request status	0x11	P = 0bxxxxxxx1 : auto page change on P = 0bxxxxxx1x : show monitor page
Request patch	0x14	–
Request patch bank	0x15	P = bank number
Request pattern	0x19	–
Request pattern bank	0x1A	P = bank number
Request sequence	0x1E	–
Request sequence bank	0x1F	P = bank number
Request abort process	0x4B	–
Data transfer		
Screenshot	0x28	–
Oscilloscope data	0x29	–
Info	0x2A	–
Screenshot compressed‡	0x2B	–
Global data	0x2D	–
Patch	0x32	A = 0x7E B = current preset#
Patch bank	0x33	A = bank# B = index#
Pattern	0x37	A = 0x7E B = current pattern#
Pattern bank	0x38	A = bank# B = index#
Send sequence	0x3C	A = 0x7E B = 0
Send sequence bank	0x3D	A = bank# B = index#
Send status	0x3E	–
Send bulk data	0x0C	–
Receive-only commands		
Receive bulk data	0x0D	
Receive firmware	0x46	

* To decode the bytes values to the original data a sequence of 8 bytes can be processed using the following c-code algorithm:

```
for (i = 0; i < 8; i++) {
  if (i == 0) {
      msbByte = byte[i];
      msbCount = 1;
    } else {
      decodedByte =  byte[i] | ((msbByte << msbCount) & 0x80);
      msbCount++;
    }
}
```

† The CRC algorithm is 32 bit, uses the initial value 0xFFFFFFFF, polynomial value 0x04C11DB7 and final XOR value of 0x00000000

‡ Compression algorithm details available on request, email support@motas-synth.uk