APPENDIX A: MACHINES

A machine is a module within the Digitone II with specific functionality. A machine can be switched out for another machine in the same category. For example different synthesis engines or filters. Every machine has a specific set of parameters tailored to give you the most relevant and useful sound-shaping possibilities for that particular machine. For more information, please see “5.3.1 AUDIO TRACKS AND MACHINES” on page 16

Use the **[UP]/[DOWN]** keys to select the parameter group's pages. You can also press a **[PARAMETER]** key repeatedly to cycle trough the parameter pages in that group. Press and hold a **[PARAMETER]** key to see the values for all parameters on that page.

A.1 ASSIGNING MACHINES TO THE ACTIVE TRACK

1. Press **[FUNC] + [SYN]** to open the MACHINE menu.
2. Use **[LEFT]**/**[RIGHT]** to navigate to the desired machine category.
3. Use **[UP]**/**[DOWN]** to select machine, and then press **[YES]** to assign the selected machine to the track.

The rest of this appendix lists the machine-specific parameters on the SYN and FLTR pages. The selected machine determines the parameters available.

A.2 SYN MACHINES

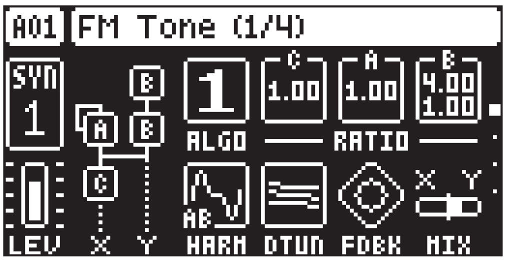
The SYN machines are different synthesis engines with unique functionalities. In this section you also find the MIDI machine that lets you control external, MIDI equipped, gear. For more information, please see “5.3.2 MIDI TRACKS” on page 17. You can assign any SYN machine to any track. Press **[SYN]** to access these parameter pages.

A.2.1 FM TONE

The Digitone II's FM TONE machine is a four operator Frequency Modulation (FM) synth in the style of the classic 80s implementations. However, unlike the early FM synths, the Digitone II use its FM engine more like a complex tone generator than a complete synthesizer voice (although it does have this capability too). The Digitone II signal path is more similar to a typical subtractive synth than a classic FM voice.

PAGE 1

The parameters on the page 1 control various aspects of the FM engine. You can find more information about the Digitone II FM synthesis in “APPENDIX B: THE FM TONE SYNTHESIS” on page 106.



ALGO

Algorithm selects the structure of how the four operators are connected to each other.
For more information, please see “B.3 ALGORITHMS” on page 107.

RATIO C

Sets the frequency ratio for operator C. For more information, please see “B.4 FM RATIOS” on page 107.

RATIO A

Sets the frequency ratio for operator A. For more information, please see “B.4 FM RATIOS” on page 107.

RATIO B

Sets the frequency ratio for operator B1 and B2. The minimum value for B1 and B2 is .25. As you turn the encoder, B2 increases until it reaches the max (16). It then starts over from .25 and B1 increases to the next value (0.5). This revolving behavior continues until both operators reach the maximum value. This parameter behavior is similar to the movement of the hands on a watch. (0.25–16.0) For more information, please see “B.4 FM RATIOS” on page 107.

HARM

Harmonics controls waveform of the operators, C, A, and B1. The parameter is bipolar. Negative parameter values change the harmonics of operator C, while positive parameter values change the harmonics of operators A and B1. (-26.00–26.00) For more information, please see “B.6 HARMONICS” on page 109.

DTUN

Detune offsets the ratio of operator A and B2. Up to a parameter value of around 64, the offset is very slight to achieve subtle movement. Above 64 the operators start to detune more heavily.

FDBK

Feedback sets the amount of self modulation of the operator that has feedback. This operator is shown in the algorithm on the screen with a feedback loop in its upper left corner. For more information, please see “B.2 OPERATORS” on page 106.

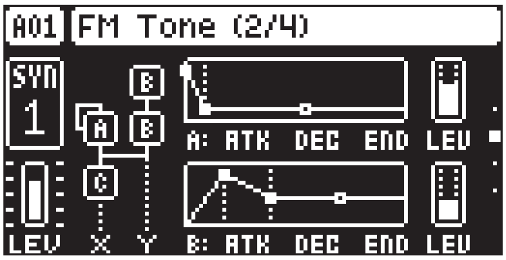
MIX

Each algorithm has two carrier outputs (X and Y) that come from two different operators depending on what algorithm you chose. Use the **MIX** parameter to mix between these outputs so that you can cross-fade between two separate timbres. (-64–63). For more information, please see For more information, please see “B.3 ALGORITHMS” on page 107.

PAGE 2

The parameters on the page 2 control various aspects of the FM synthesis, mainly the amount of frequency modulation together with the operator envelopes.

The FM engine has two operator envelopes. One is for operator group A, and one is for group B (B1 and B2). The envelopes are essentially expanded AD (Attack Decay) envelopes, but with an added adjustable end level (the amplitude level the sound reaches at the end of the decay stage). For more information, please see “B.5 OPERATOR ENVELOPES” on page 108.



ATK (A)

Attack Time sets the length of the attack phase of the modulation envelope for operator A.

DEC (A)

Decay Time sets the length of the decay phase of the modulation envelope for operator A.

END (A)

End Level sets the end level of the modulation envelope for operator A.

LEV (A)

Level sets the modulation amount from operator A.

ATK (B)

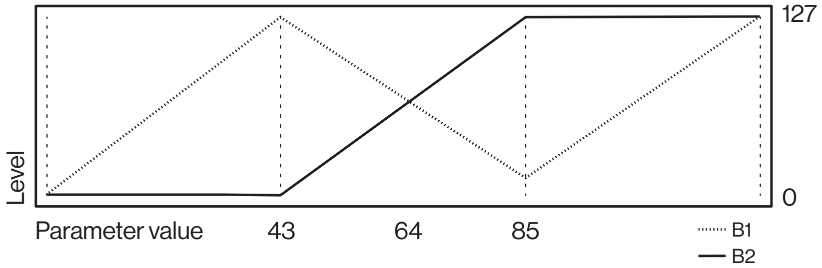
Attack Time sets the length of the attack phase of the modulation envelope for operator group B (B1 and B2).

DEC (B)
Decay Time sets the length of the decay phase of the modulation envelope for operator group B (B1 and B2).

END (B)
End Level sets the end level of the modulation envelope for operator group B (B1 and B2).

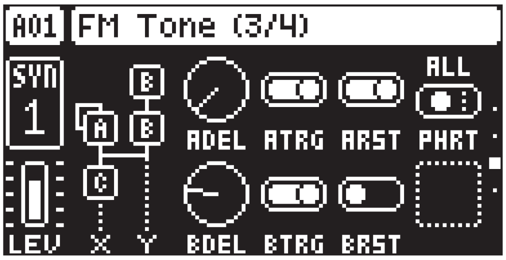
LEV (B)
Level sets the modulation amount from operator group B (B1 and B2).

The **LEVEL** parameter for B is macro mapped to both operator B1 and B2 and control their modulation amount as per this graph:

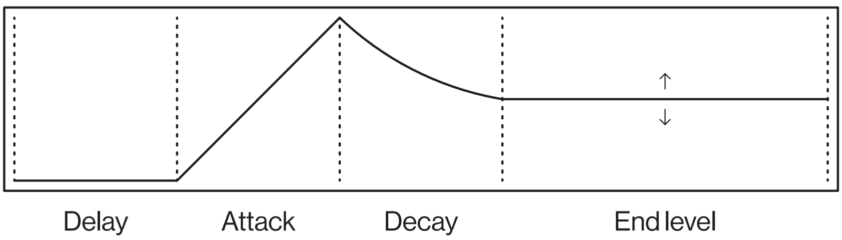


If you wish to use frequency modulation, it is important that you turn the LEV parameters up, since they set the amount of frequency modulation in the FM engine.

PAGE 3
The parameters on the page 3 control various aspects of the FM synthesis, mainly the amount of frequency modulation together with the operator envelopes and their behavior.

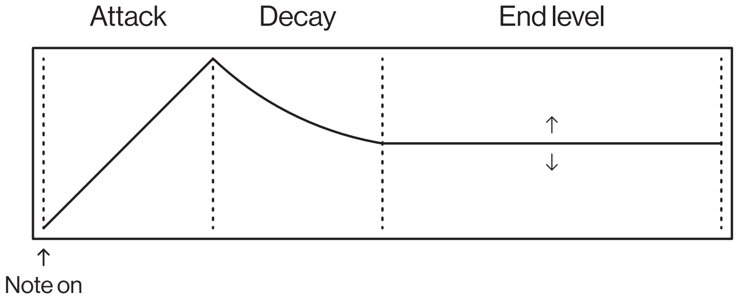


ADEL
Envelope delay sets the time before attack phase of the modulation envelope for operator A starts.

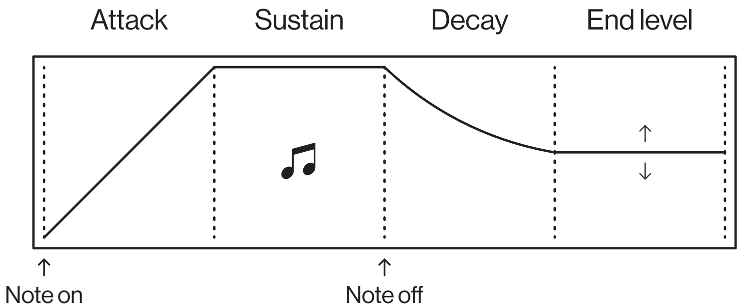


ATRG
Envelope trig sets the trig behavior of the operator envelopes. The envelopes can be either triggered or gated - making it either an ADE (Attack Decay End) or an ASDE (Attack Sustain Decay End) envelope. The sustain phase does not have an adjustable envelope level. It is instead the **LEV** parameter that sets the sustain level. The note length defines the length of the sustain phase.

Trigged (ATRG/BTRG ON)



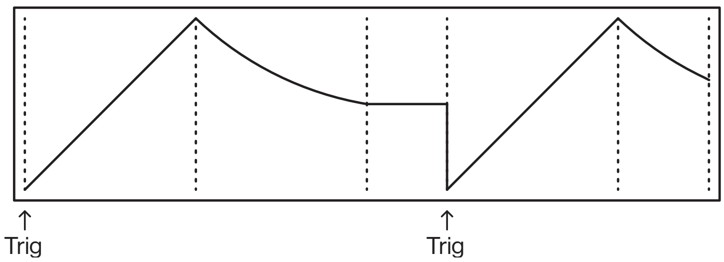
Gated (ATRG/BTRG OFF)



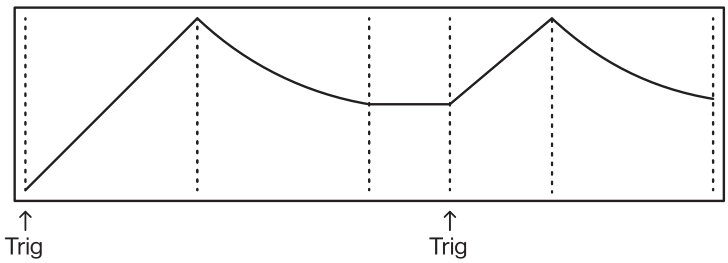
ARST

Envelope reset sets if the envelopes should reset or not when they are retrigged.

Reset on (ARST/BRST ON)



Reset off (ARST/BRST OFF)



PHRT

Phase reset sets if the operators phase are reset to start at 0 or not when they are trigged.

OFF do not reset any operators

ALL resets all operators

C resets operator C

A+B resets operator A, B1, and B2

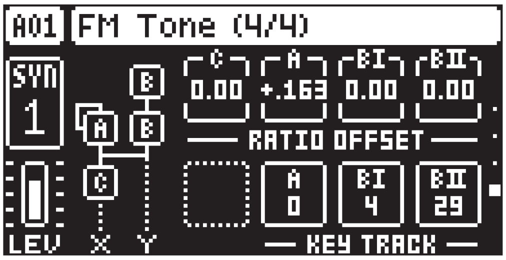
A+B2 resets operator A and B2

BDEL
Same as **ADEL** but for operator group B (B1 and B2).

BTRG
Same as **ATRG** but for operator group B (B1 and B2).

BRST
Same as **ARST** but for operator group B (B1 and B2).

PAGE 4
The parameters on the page 4 controls the operators ratio offsets and the key scaling.



RATIO OFFSET C, A, B1, B2
Adds offsets to the ratios of each of the four operators.

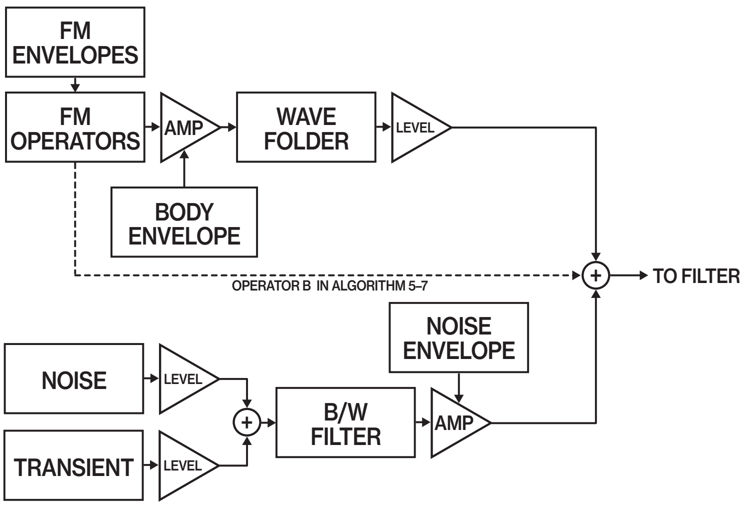
KEY TRACK A
Key track sets the level of how much the modulation output from operator A is affected by what note you play on the keyboard. If you set key track to 0, the modulation level is the same for all keys. A higher setting decreases the modulation level more and more the higher you play the keyboard. So, a lower level of modulation decreases the complexity of the tone in the higher frequencies, which is a typical behavior in many acoustic instruments.

KEY TRACK B1
Same as **KEY TRACK A**, but for operator B1.

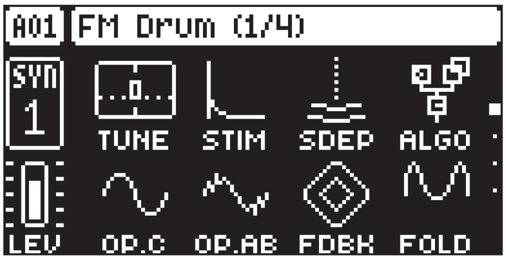
KEY TRACK B2
Same as **KEY TRACK A**, but for operator B2.

A.2.2 FM DRUM

The Digitone II's FM DRUM machine is an FM engine specially tailored to produce drums and other percussive sounds, although it also works well for melodic sounds. Below, you see the FM DRUM machine's voice architecture.



PAGE 1



TUNE
Tune sets the pitch of the oscillator.

STIM
Sweep Time sets the pitch sweep time. Lower values result in shorter sweep.

SDEP
Sweep Depth sets the depth of the pitch sweep.

ALGO
Algorithm selects the structure of how the three operators are connected to each other.

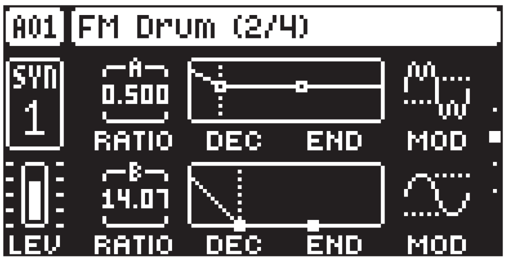
OP.C
Operator C Wave sets the waveform for Operator C.

OP.AB
Operator AB Wave sets the waveform for Operators A and B.

FDBK
Feedback sets the amount of self modulation of the operator that has feedback. This operator is shown in the algorithm on the screen with a feedback loop in its upper right corner.

FOLD
Fold sets the amount of wavefolding of the body part of the sound. (The noise and transient parts of the sound are excluded.) The wavefolding increases the complexity of the wave and creates a more overtone rich sound.

PAGE 2



RATIO
Ratio A sets the frequency ratio for operator A.

DEC
Decay A sets the length of the decay phase of the modulation envelope for operator A.

END
End A sets the end level of the modulation envelope for operator A.

MOD
Mod A sets the modulation amount from operator A.

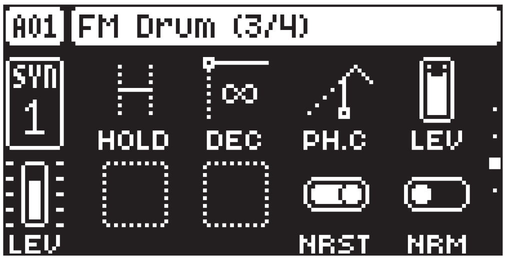
RATIO
Ratio B sets the frequency ratio for operator B.

DEC
Decay B sets the length of the decay phase of the modulation envelope for operator B.

END
End B sets the end level of the modulation envelope for operator B.

MOD
Mod B sets the modulation amount from operator B.

PAGE 3



HOLD
Body Hold sets the time before the decay phase starts for the body part of the sound.

DEC
Body Decay sets the length of the decay phase for the body part of the sound. The last value is infinite.

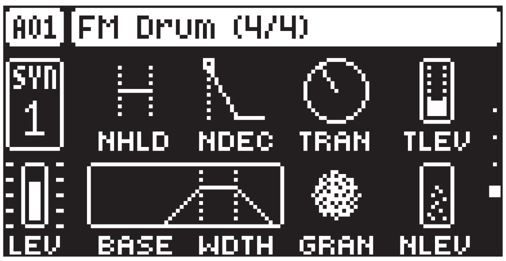
PH.C
OP C Phase sets the reset of the phase for operator C. A parameter value less than 90 means that phase reset is on, and the value represents the phase start position in degrees. At 90, the operator resets at the peak of the waveform. When set to OFF (value 91), operator C’s phase is not reset.

LEV
Body Level sets the level of the body part of the sound.

NRST
Noise Reset will (when switched on) reset the noise to the same random seed on every note on. This can be useful if you want the noise part to always sound the same, like if it was a sample.

NRM
Noise Ring Mod will (when switched on) use Operator C as ring modulator for the noise.

PAGE 4



NHLD
Noise Hold sets the time before the decay phase starts for the noise part of the sound.

NDEC
Noise Decay sets the length of the decay phase for the noise part of the sound. The last value is infinite.

TRAN
Drum Transient selects between different transients.

TLEV
Transient Level sets the level of the transient part of the sound.

BASE
Noise Base sets the base frequency for the noise/transient filter.

WDTH
Noise Width sets the frequency width above the base frequency for the noise/transient filter.

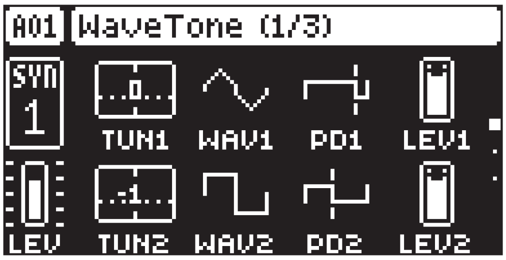
GRAN
Noise grain adjusts the density of the grains for the noise part of the sound, from high density (white noise) to low (grainy).

NLEV
Noise Level sets the level of the noise part of the sound.

A.2.3 WAVETONE

The WAVETONE machine is a two-oscillator synth engine with very flexible wave shaping possibilities, borrowing elements from phase distortion, wavetables, ring modulation, hard sync, and adding flexible noise design.

PAGE 1



TUN1
Osc1 Tune sets the pitch of oscillator 1.

WAV1
OSC1 Waveform sets the waveform for oscillator 1. The waveform crossfades between the different waveforms. Which waveforms you can select here depends on what wavetable you select with **TBL1**.

PD1
Osc1 Phase Distortion controls the amount of phase distortion of oscillator 1. Think of it as changing the pulse width, but on any waveform, not just square waves.

LEV1
Osc1 Level sets the level of oscillator 1.

TUN2
Osc2 Tune sets the pitch of oscillator 2.

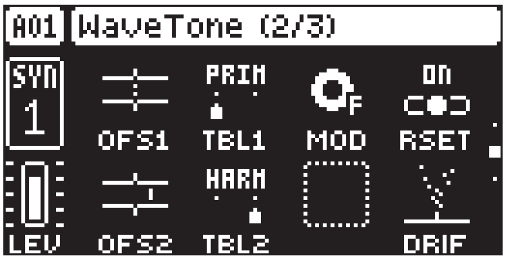
WAV2
Osc2 Waveform sets the waveform for oscillator 2. The waveform crossfades between the different waveforms. Which waveforms you can select here depends on what wavetable you select with **TBL2**.

PD2
Osc2 Phase Distortion controls the amount of phase distortion of oscillator 2. Think of it as changing the pulse width, but on any waveform, not just square waves.

LEV2
Osc2 Level sets the level of oscillator 2.

Phase distortion makes the oscillator traverse the first and second half of the waveform at different speeds, effectively distorting the waveshape by dragging its midpoint towards the start or end. A simple example is the squarewave, where phase distortion acts a pulsewidth parameter adjusting the duty cycle of the waveform.

PAGE 2



OFS1
Osc1 Lin Offset sets an offset of oscillator 1 tuning. This parameter offsets the frequency of the oscillator linearly in hertz (unlike **TUNE** which adjusts the pitch in cents). This feature gives more noticeable detune in lower notes than higher. It allows for a different kind of chorus-like detune, since the beating frequency does not vary with the pitch.

TBL1
Osc1 Wavetable selects the wavetable for the oscillator 1 **WAVE** parameter. PRIM contains the basic oscillator waves Sin, Tri, Saw, Square. HARM contains a long list of waveforms sweeping across other combinations of harmonics.

MOD
Oscillator Modulation selects how the two oscillators can interact with each other. The settings are OFF, RING MOD, RING MODE FIXED (Osc 2 does not track note values), and HARD SYNC.

In RING MOD mode, Oscillator 2 is modulating Oscillator 1. In that configuration, you most often don't want to hear the modulator, so you would turn down LEV2 to 0. TUN1 will adjust the tuning of the sound, while TUN2 will change the sound. Even if LEV2 is set to 0, adjusting WAV2 and PD2 will impact the timbre of the sound.

In HARD SYNC mode, Oscillator 1's phase is reset every time Oscillator 2's waveform starts a new cycle. In this mode, TUN2 controls the tuning of the sound, and TUN1 will control another aspect of the sound, that may sound a bit like a filter with resonance when modulated.

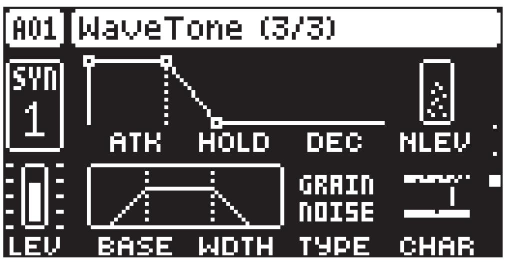
RSET
Oscillator Phase Reset sets if and how the oscillator's wave phase resets when you play a note. OFF does not reset the oscillator phase. ON resets the oscillators to the start of their waveform phase. RAND resets the oscillators to a random position in the waveform phase.

OFS2
Osc2 Lin Offset sets an offset of oscillator 2 tune. This parameter offsets the frequency of the oscillator linearly in hertz (unlike **TUNE** which adjusts the pitch in cents). This feature gives more noticeable detune in lower notes than higher. It allows for a different kind of chorus-like detune, since the beating frequency does not vary with the pitch.

TBL2
Osc2 Wavetable selects the wavetable for the oscillator 2 **WAVE** parameter. PRIM contains the basic oscillator waves Sin, Tri, Saw, Square. HARM contains a long list of waveforms sweeping across other combinations of harmonics.

DRIF
Oscillator Drift sets the amount of random pitch drift of oscillator 1 and 2.

PAGE 3



ATK
Noise Attack sets the length of the attack phase of the noise amp envelope.

HOLD
Noise Hold sets the length of the hold phase of the noise amp envelope. Fixed Hold time values (0–126) specify the length of the hold phase, and the envelope ignores Note Off events such as Trig Length, releasing a **[TRIG]** key or a key on an external controller. Setting **HOLD** to NOTE means the hold phase will be determined by Note On and Note Off events.

> **If you set HOLD to NOTE and use an external keyboard to trigger the envelope, then the sound will be sustained (if DEC is set to less than 127) for as long as you press a key on the keyboard.**

DEC
Noise Decay sets the length of the decay phase of the noise amp envelope.

NLEV
Noise Level sets the level of the noise part of the sound.

BASE
Noise Base sets the base frequency for the noise filter.

WDTH
Noise Width sets the frequency width above the base frequency for the noise filter.

TYPE
Noise Type selects between three different types of noise, GRAIN, TUNED (a Sample and Hold that tracks the pitch, and S&H (Sample and Hold).

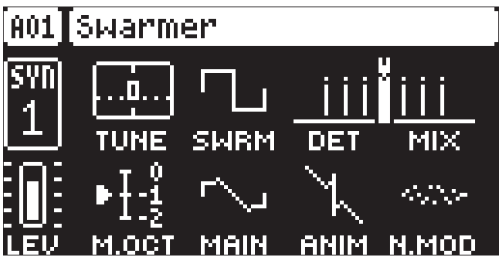
CHAR
Noise Character changes the character of the noise. The effect of this parameter vary depending on the selected **TYPE**.
GRAIN, Character sets the density of the grain, from white noise to very grainy.

TUNED, Character sets the base tuning of the sample & hold that are then tracked by pitch.

S&H, Character sets the fixed tuning of the sample and hold.

A.2.4 SWARMER
The SWARMER machine is based on using one main oscillator and a swarm of six additional detuned oscillators to create a rich sound.

PAGE 1



TUNE
Tune offsets the incoming note value. This parameter is bipolar. A setting of 0 leaves the pitch unchanged.

SWRM
Swarm Waveform sets the waveform of the detuned swarm oscillators.

DET
Detune sets the amount of detuning of the six swarm oscillators in relation to the main oscillator.

MIX

Mix sets the level of the swarm oscillators in relation to the main oscillator.

M.OCT

Main Octave detunes the main oscillator down one or two octaves but leaves the swarm oscillators' pitch unchanged.

MAIN

Main Waveform sets the waveform of the main oscillator.

ANIM

Swarm Animation sets the modulation amount of the swarm oscillators. The swarm oscillators are modulated separately in pairs by hidden LFOs running at different rates.

N.MOD

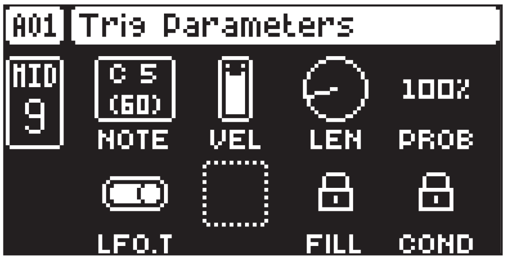
Noise Modulation sets the amount of noise modulation of the detuned swarm oscillators.

A.2.5 MIDI

The parameters for the MIDI machine are split over the **TRIG, SYN**, **FLTR** and **AMP PARAMETER** pages. The **FX** page contains no parameters The **MOD** pages are the same as for audio tracks, but there are two LFOs available for MIDI tracks.

TRIG PAGE 1

Set the actions for when a note is trigged. Change settings using the ***DATA ENTRY*** knobs. These general settings affect note trigs placed in the sequencer.



NOTE

Trig Note sets the pitch of the note when trigged. When in LIVE RECORDING mode and playing in KEYBOARD mode, the pitch of the **[TRIG]** keys played will override this setting. Press and turn ***DATA ENTRY*** knob ***A*** to select only note values that exist in the scale set by **KB SCALE**. For more information, please see "8.5.2 KEYBOARD SETUP MENU" on page 25.

VEL

Trig Velocity sets the velocity of the sequencer's note trigs.

LEN

Trig Length sets the length of the note trig. In LIVE RECORDING mode, the duration of pressing the **[TRIG]** keys overrides this general setting.

PROB

Trig Probability sets the probability that the trigs on the track plays or not. The probability outcome is re-evaluated every time a trig is set to play. The default setting is 100%, meaning that all the trigs on the track plays every time. This parameter can be parameter locked which lets you give separate trigs their own probability.

LFO.T

LFO Trig controls if the LFO will be trigged or not.

FILL

Fill is a separate trig condition that determines if a trig is active (plays) or not depending on if the device is in FILL mode or not. For more information, please see "10.12.4 FILL MODE" on page 52, and "10.12.3 TRIG CONDITIONS AND CONDITIONAL LOCKS" on page 51.

ON, A trig with **FILL** set to ON, plays when FILL mode is active.

OFF, A trig with **FILL** set to OFF plays when FILL mode is not active.

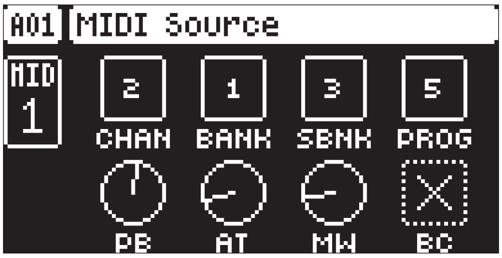
The sequencer needs to be in FILL mode to activate the FILL trig condition. For more information, please see “10.12.4 FILL MODE” on page 52.

COND

(Trig Condition) when you add a conditional lock, **COND** sets the Trig Condition with which a set of conditional rules can be applied to any trig, using a conditional parameter lock. For more information, please see “10.12.3 TRIG CONDITIONS AND CONDITIONAL LOCKS” on page 51.

SYN PAGE

Here you can set the MIDI channel that the MIDI machine should use to send data. Bank and program change values are also set here, together with a few standard CC parameters. The default value of the parameters on this page is OFF, meaning they are disabled and do not send out any data. Press and hold **[FUNC]** and then press the ***DATA ENTRY*** knobs to enable them. You can then use the ***DATA ENTRY*** knobs to set the parameter values as usual. Disable the parameters again by repeating the activation procedure.



CHAN (Channe) sets the MIDI channel the track sends MIDI data to. If you set this parameter to OFF, it turns the MIDI track off. Please note that this parameter cannot be parameter locked. (OFF, 1–16)

BANK (Bank) sends a bank change message on CC 0 MSB.

SBNK (Sub Bank) sends a bank change message on CC 32 LSB.

PROG (Program Change) sends a Program Change message.

PB (Pitch Bend) controls the pitch bend data sent on the MIDI track.

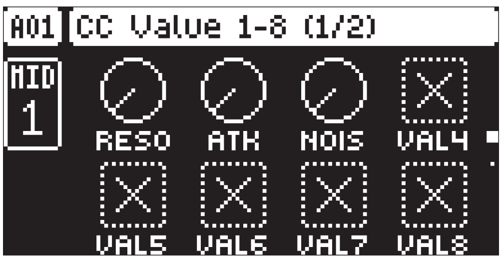
AT (Aftertouch) controls the aftertouch data sent on the MIDI track.

MW (Mod Wheel) controls the modulation wheel data sent on the MIDI track.

BC (Breath Controller) controls the breath control data sent on the MIDI track.

FLTR PAGE 1

Here you can set the values of the first eight assignable CC commands. The default value of the parameters on this page is OFF, meaning they are disabled and do not send out any data. Press and hold **[FUNC]** and then press the ***DATA ENTRY*** knobs to enable them. You can then use the ***DATA ENTRY*** knobs to set the parameter values as usual. Disable the parameters again by repeating the enabling procedure.



VAL1-VAL8 (CC 1–8 Value) controls the values that the CC commands send. You specify the CC commands themselves on FLTR page 2. These parameters default value is OFF. Press **[FUNC]** + ***DATA ENTRY*** knobs to activate the parameters and then turn the ***DATA ENTRY*** knobs to set a value.

> **Here you can also name the parameter whose value you control. Press and hold [FUNC] and then press and hold any DATA ENTRY knob to access the naming screen. For more information, please see “6.5 THE NAMING SCREEN” on page 19.**

FLTR PAGE 2

Here you select the first eight CC commands whose values you set with the parameters on the FLTR page 1. Press the corresponding knob or **[YES]** to activate the CC command change.

SEL1-SEL8 (CC 1–8 Select) specifies the CC commands whose values you control controlled by the parameters on the AMP PAGE 1 (CC VALUE) page. The selectable commands are the standard MIDI Control Change Messages.

> **You can specify the CC command for the SEL parameters by sending the CC value from the external MIDI equipped device you want to control.**
>
> 1. **On FLTR PAGE 2 or AMP PAGE 2 press and hold [FUNC] +** ***DATA ENTRY*** **knob** ***A-H***.
> 2. **When the popup screen MIDI LEARN appears, and the parameter starts flashing, you can send a MIDI CC value on the active track’s MIDI channel (set in the SETTINGS > MIDI CONFIG > CHANNELS menu) or on the auto channel.**
> 3. **The popup disappears and the parameter stops flashing when the sent CC value is received and configured on the selected SEL parameter. You can cancel MIDI learn by pressing [NO] twice.**

AMP PAGE 1

Here you can set the values for eight additional assignable CC commands.

VAL9-VAL16 (CC 9–16 Value) controls the values that the CC commands send. You specify the CC commands themselves on AMP page 2. These parameters default value is OFF. Press **[FUNC] +** ***DATA ENTRY*** knobs to activate the parameters and then turn the ***DATA ENTRY*** knobs to set a value.

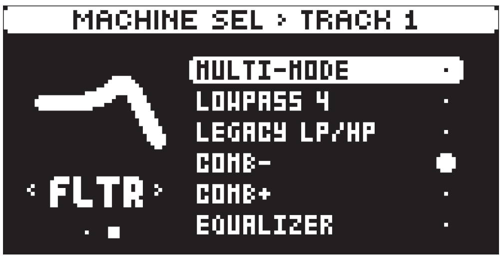
AMP PAGE 2

Here you select the eight additional CC commands whose values you set with the parameters on AMP page 1. Press the corresponding knob or **[YES]** to activate the parameter change.

SEL9-SEL16 (CC 9–16 Select) specifies the CC commands whose values you control controlled by the parameters on the AMP page 1 (CC VALUE) page. The selectable commands are the standard MIDI Control Change Messages.

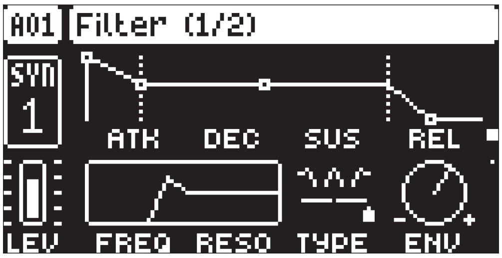
A.3 FLTR MACHINES

The FLTR machines are a collection of different filters and EQ.



A.3.1 MULTI-MODE

This filter lets you morph from a Lowpass to Bandpass to Highpass filter



ATK
Attack Time sets the length of the attack phase of the filter envelope.

DEC
Decay Time sets the length of the decay phase of the filter envelope.

SUS
Sustain Level sets the sustain level of the filter envelope.

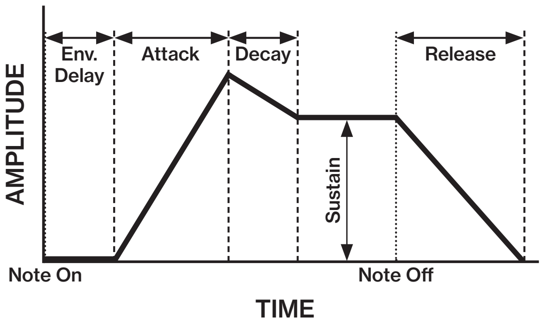
REL
Release Time sets the length of the release phase of the filter envelope.

FREQ
Frequency sets the cutoff frequency of the multi-mode filter and the center frequency of the EQ.

RESO
Resonance sets the resonance behavior of the filter. Resonance introduces a peak in the spectrum at the cutoff frequency. Gain sets the amount of boost/cut around the center frequency of the EQ.

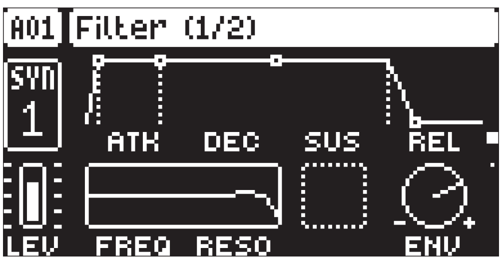
TYPE
Type morphs the multimode filter from Lowpass to Bandpass to Highpass

ENV
Env. Depth sets the amount of cutoff frequency modulation from the filter envelope. The knob is bipolar, both negative and positive modulation depths are available.



A.3.2 LOWPASS 4

This is a 4-pole low-pass filter with a 24 dB/octave slope.



ATK
Attack Time sets the length of the attack phase of the filter envelope.

DEC
Decay Time sets the length of the decay phase of the filter envelope.

SUS
Sustain Level sets the sustain level of the filter envelope.

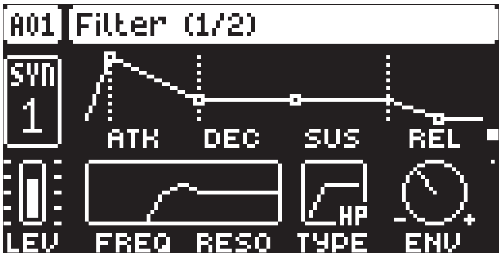
REL
Release Time sets the length of the release phase of the filter envelope.

FREQ
Frequency sets the cutoff frequency of the filter.

RESO
Resonance sets the resonance behavior of the filter. Resonance introduces a peak in the spectrum at the cutoff frequency.

ENV
Env. Depth sets the amount of cutoff frequency modulation from the filter envelope. The knob is bipolar, both negative and positive modulation depths are available.

A.3.3 LEGACY LP/HP
The legacy filter is inspired by the filter from Digitone I and is a filter that is switchable between Lowpass and Highpass.



ATK
Attack Time sets the length of the attack phase of the filter envelope.

DEC
Decay Time sets the length of the decay phase of the filter envelope.

SUS
Sustain Level sets the sustain level of the filter envelope.

REL
Release Time sets the length of the release phase of the filter envelope.

FREQ
Frequency sets the cutoff frequency of the filter.

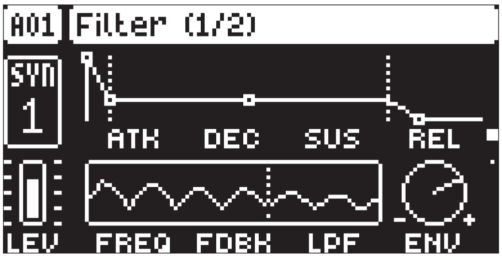
RESO
Resonance sets the resonance of the filter. Resonance introduces a peak at the cutoff frequency.

TYPE
Filter Type lets you select between a Lowpass or Highpass filter, both a 2-pole, 12 dB/octave slope.

ENV
Env. Depth sets the amount of cutoff frequency modulation from the filter envelope. The knob is bipolar, both negative and positive modulation depths are available.

A.3.4 COMB-

The comb filter introduces metallic sounding, pitch tuned, resonant overtones. The comb- filter has negative feedback and produces a more hollow, tube-like sound.



ATK
Attack Time sets the length of the attack phase of the filter envelope.

DEC
Decay Time sets the length of the decay phase of the filter envelope.

SUS
Sustain Level sets the sustain level of the filter envelope.

REL
Release Time sets the length of the release phase of the filter envelope.

FREQ
Frequency sets the resonant frequencies of the comb filter.

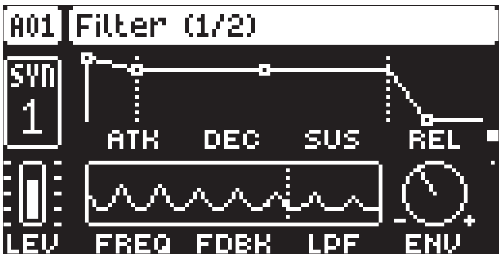
FDBK
Feedback sets the gain of the feedback signal. Please beware that setting **FDBK** to a high value can create a very loud sound.

LPF
Low Pass Filter sets the cutoff frequency of the low pass filter in the feedback signal.

ENV
Env. Depth sets the amount of cutoff frequency modulation from the filter envelope. The knob is bipolar, both negative and positive modulation depths are available.

A.3.5 COMB+

The comb filter introduces metallic sounding, pitch tuned, resonant overtones. The comb+ filter has positive feedback and produces a more string-like sound.



ATK
Attack Time sets the length of the attack phase of the filter envelope.

DEC
Decay Time sets the length of the decay phase of the filter envelope.

SUS
Sustain Level sets the sustain level of the filter envelope.

REL
Release Time sets the length of the release phase of the filter envelope.

FREQ
Frequency sets the resonant frequencies of the comb filter.

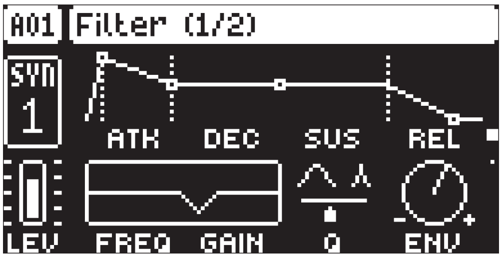
FDBK
Feedback sets the gain of the feedback signal. Please beware that setting **FDBK** to a high value can create a very loud sound.

LPF
Low Pass Filter sets the cutoff frequency of the low pass filter in the feedback signal.

ENV
Env. Depth sets the amount of cutoff frequency modulation from the filter envelope. The knob is bipolar, both negative and positive modulation depths are available.

A.3.6 EQUALIZER

This machine is a parametric Equalizer.



ATK
Attack Time sets the length of the attack phase of the EQ envelope.

DEC
Decay Time sets the length of the decay phase of the EQ envelope.

SUS
Sustain Level sets the sustain level of the EQ envelope.

REL
Release Time sets the length of the release phase of the EQ envelope.

FREQ
Frequency sets the center frequency of the EQ.

GAIN
Gain sets the amount of boost/cut around the center frequency of the EQ.

Q
Q lets you select the bandwidth of the frequency range that the EQ affects. The higher the Q value, the narrower the bandwidth. A broad bandwidth boosts or cuts a larger band of frequencies than a narrow.

ENV
Env. Depth sets the amount of cutoff frequency modulation from the filter envelope. The knob is bipolar, both negative and positive modulation depths are available.

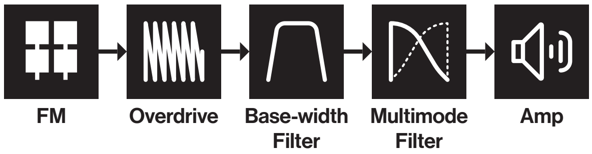
The parametric EQ is used to boost desired frequencies or to remove unwanted frequencies of the sound.

The ATK, DEC, SUS, and REL parameters only affects the selected filter machine. Not the base-width filter on FLTR page 2.

APPENDIX B: THE FM TONE SYNTHESIS

B.1 OVERVIEW

The Digitone II's FM TONE machine is a four operator Frequency Modulation (FM) synth in the style of the classic 80s implementations. However, unlike the early FM synths, the Digitone II use its FM engine more like a complex tone generator than a complete synthesizer voice (although it does have this capability too). The Digitone II signal path is more similar to a typical subtractive synth than a classic FM voice.



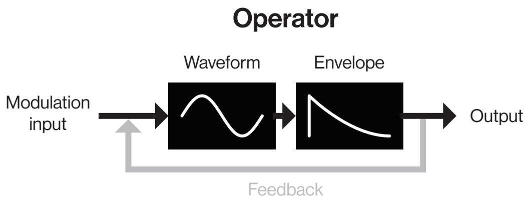
The idea of this design is to harness the raw, and often complex, soundscapes of FM synthesis and use a more well-known and approachable subtractive method for the overall sound shaping.

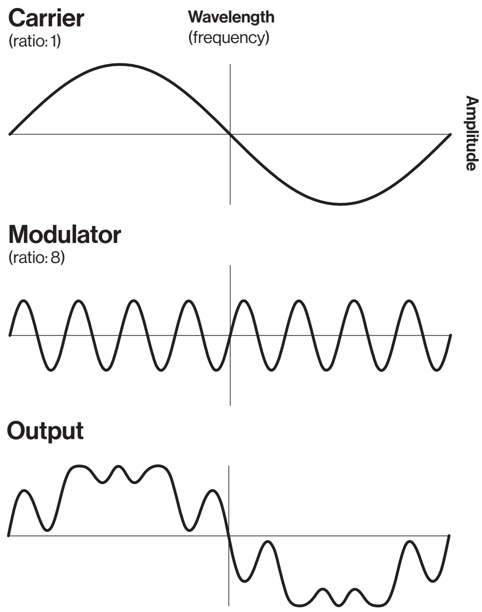
FM is a synthesis method where you add harmonics to the timbre by using modulation or layering to shape the sound. You add harmonics by modulating one oscillator's pitch with the output of another oscillator. FM works similarly to how you would apply vibrato via an LFO. At slower modulation rates, it is simply vibrato, but when the modulating frequency reaches audio rate, the vibrato effects becomes a part of the sound and becomes a timbral effect instead.

B.2 OPERATORS

In FM synthesis the oscillators are called operators. Unlike the analog oscillator, the operator also contains an envelope and specific input and outputs, making it a sort of macro oscillator. FM combines two or more operators to generate a more harmonically rich output. An operator that is used to modulate another operator is called a modulator. The operator that generates, or carries, the resulting tone is called a carrier.

Feedback is used to increase the sharpness of a sound and is usually only applied to modulators. The output of the operator is fed back into itself, resulting in added harmonics. For example, have a look at the Sounds B001 and B002 in the Digitone II to see how feedback is used to create a basic square and saw waveform. For more information, please see "A.2.1 FM TONE" on page 89.



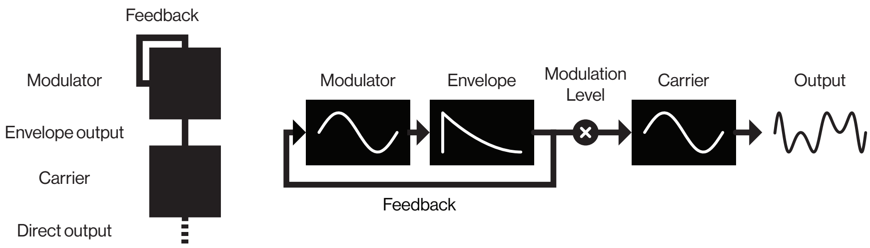


In some instances, an operator can be both carrier and modulator. This means that it outputs its result as a tone while also using it to modulate another operator. We have divided the operators into three groups: **C**, **A**, and **B (**B1 and B2) to lessen the complexity and make the Digitone II easier to use. Since group **B** consist of two operators, the parameter controls for **B** are macro mapped to both operators.

B.3 ALGORITHMS

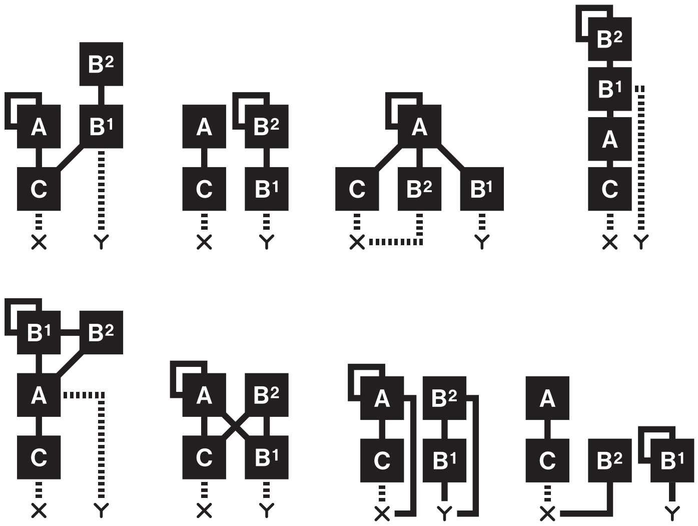
An algorithm is a set routing, or combination, of the operators. Routing the modulation in different ways gives you several different methods of applying modulation and naturally different results.

Algorithm



Pictured above is a 2 operator algorithm, which is FM synthesis in its most basic form. The Digitone II has four operators available which can be routed in many different ways. Different algorithms dramatically changes the characteristics of the output - for example stacking four operators can lead to very complex timbres.

The Digitone II has eight different algorithms where the four operators are routed in different ways. For more information, please see “A.2.1 FM TONE” on page 89. Each algorithm has two carrier outputs (X and Y) that come from two different operators depending on what algorithm you chose. It is possible to use the **MIX** parameter to mix between these outputs so that you can cross-fade between two separate timbres. For more information, please see “A.2.1 FM TONE” on page 89.



The lines going to X and Y indicate the output from a carrier. There are two different ways a carrier output is sent to the X/Y outputs: 1. Its amplitude is unaffected by the operator envelope (dotted line). 2. Its amplitude is affected by the operator envelope (filled line). The sound from the X/Y outputs is then routed via the overdrive to the filters.

B.4 FM RATIOS

Frequency modulation is applied in multipliers of the principal frequency to retain the sounds tonality. These multipliers are known as ratios. Each operator group’s ratio is a multiplier of the input pitch (note value). The higher the ratio, the higher the pitch frequency. For example, when applying modulation with a ratio of 1:2 (carrier:modulator), the carrier output resembles a square wave. A ratio of 1:1 sounds like a sawtooth, and odd numbers can be used for various metallic or other “natural” sounds. In Digitone II, the FM ratios for the different operator groups works like this:

C which always works like a carrier, is limited mostly to integers since it is generally used for carrying the base note of the sound. For more information, please see “A.2.1 FM TONE” on page 89.

A has a more extensive number of ratio values to allow for more inharmonic relationships. For more information, please see “A.2.1 FM TONE” on page 89.

B (B1 and B2) controls both operators at the same time. The minimum value for B1 and B2 is .25. As you turn the encoder, B2 increases until it reaches the max (16). It then starts over from .25 and B1 increases to the next value (0.5). This revolving behavior continues until both operators reach the maximum value. This parameter behavior is similar to the movement of the hands on a watch. For more information, please see “A.2.1 FM TONE” on page 89.

B.5 OPERATOR ENVELOPES

If you modulate one oscillator directly with another it creates very harsh harmonics, so you need to limit the modulation level to control the amount of modulation. In Digitone II you use an envelope and a LEVEL parameter control to attenuate the amount of how much the modulator affects the carrier. The envelopes also give the possibility to control the modulation over time. A piano for example, when first struck, the timbre is sharp but quickly fades to a softer tone. Envelopes and modulation level are vital elements in FM synthesis and are the tools that you use to shape the sounds you want to achieve.

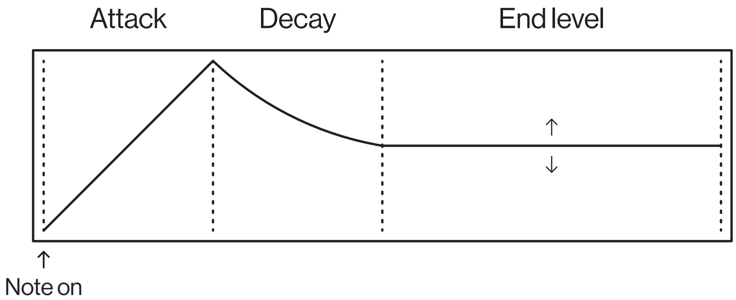
The Digitone II FM engine has two operator envelopes that are designed to be practical and easy to use. One envelope is for operator group A, and one is for group B (B1 and B2).

The envelopes are essentially expanded AD (Attack Decay) envelopes, but with an added adjustable end level (the amplitude level the sound reaches at the end of the decay stage). Normally, an AD envelope always ends at zero level, but with FM you often want to retain some modulation after a short pluck or fade in for example. For more information, please see “A.2.1 FM TONE” on page 89.

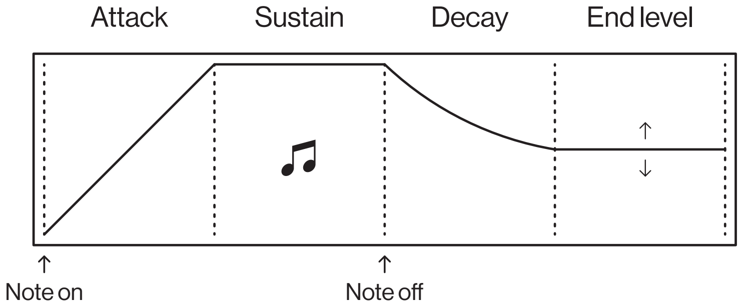
Please note that operator envelope B controls the output from both B1 and B2.

The envelopes can be either triggered or gated - making it either an ADE (Attack Decay End) or an ASDE (Attack Sustain Decay End) envelope. The sustain phase does not have an envelope level. It is instead the **LEV** parameter that sets the sustain level. The note length defines the length of the sustain phase. For more information, please see “A.2.1 FM TONE” on page 89.

Trigged (ATRG/BTRG ON)

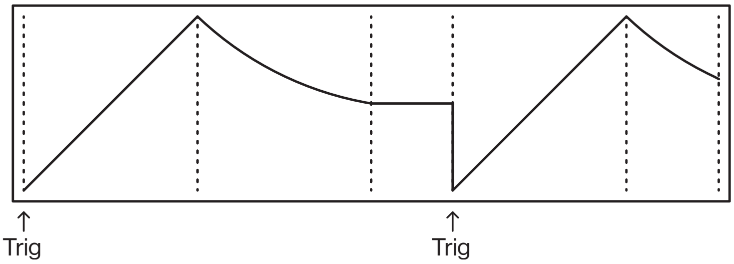


Gated (ATRG/BTRG OFF)

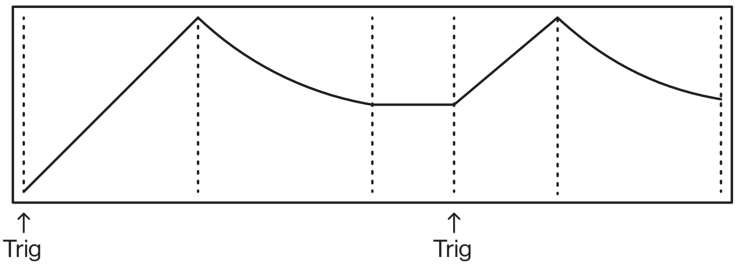


You can also set if the envelopes should reset or not when they are retrigged. For more information, please see “A.2.1 FM TONE” on page 89.

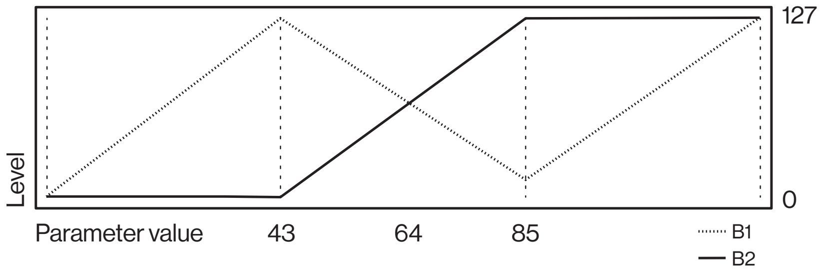
Reset on (ARST/BRST ON)



Reset off (ARST/BRST OFF)

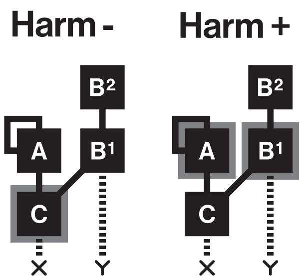


The **LEVEL** parameters on the SYN2 page controls the amount of modulation from the A and B operators. For more information, please see “A.2.1 FM TONE” on page 89. The **LEVEL** parameter for B is macro mapped to both operator B1 and B2 and control their modulation amount as per this graph:

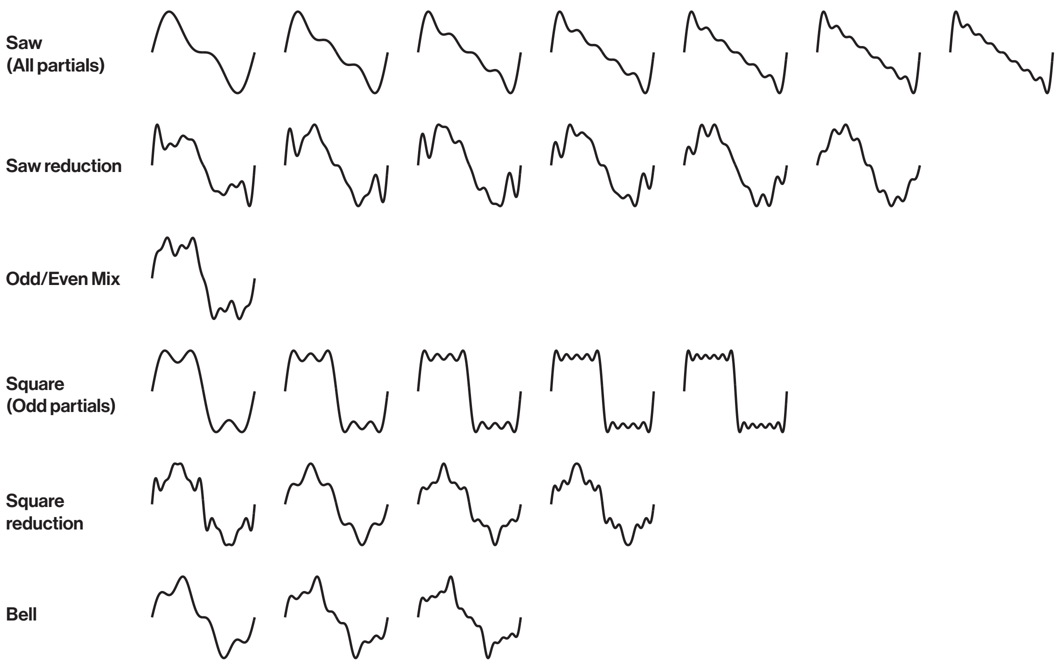


B.6 HARMONICS

The default output from an operator is a sine wave, but you can use the **HARM** parameter to add upper partials to some of the operators’ sine waves to create more harmonically rich waveforms. The **HARM** parameter is bipolar. Negative parameter values change the harmonics of operator C, while positive parameter values change the harmonics of operators A and B1.

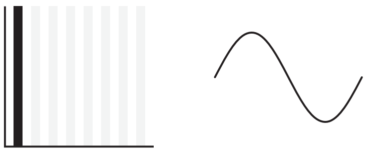


When changing harmonics, intermediate values interpolates between the current and the next harmonic. This interpolation works much like in wavetable synthesis, sweeping between the harmonics, smoothly transitioning from one timbre to another. For more information, please see “A.2.1 FM TONE” on page 89. The harmonic series for the operators looks like this:

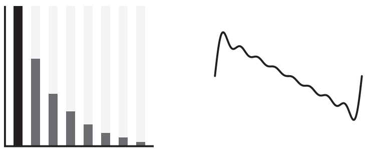


The Digitone II uses a form of additive synthesis to create the harmonic series for the **HARM** parameter. Additive synthesis is one of the oldest forms of electronic sound generation. It is a quite simple form of synthesis but still very powerful. The basic principle is to add multiple sine waves together to form complex timbres. Each sine wave is called a partial. By attenuating each partial, the timbre changes its harmonic content, resulting in different waveforms.

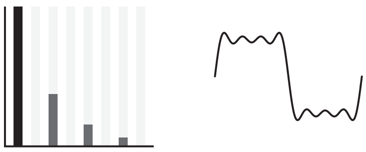
The first partial is always kept at full volume, which keeps the base octave intact.



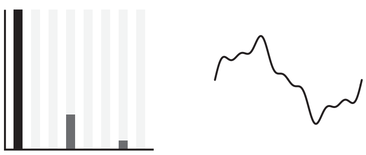
Adding every partial in series will replicate a sawtooth. Note how the volume decreases for each partial, creating a natural falloff.



Adding every odd partial in series will approximate a square wave.

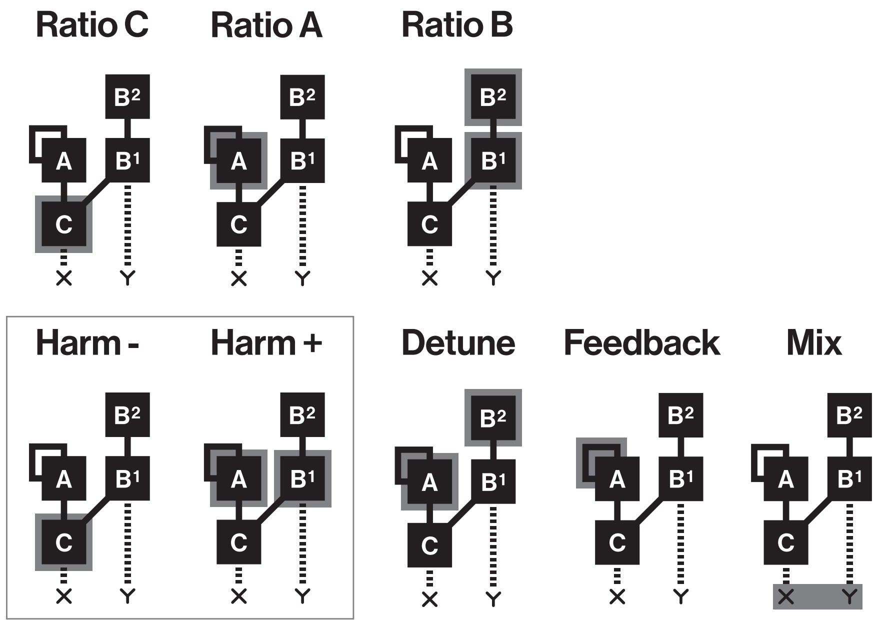


The additive method can be used to make many different timbres. This combination of partials, for example, sounds close to a bell tone.



B.7 SYN PAGE 1 PARAMETERS OVERVIEW

Here is a graphical overview of what part of the FM engine the parameters on the SYN1 pages affects. The affected part of the FM engine is highlighted with grey. For more information, please see “A.2.1 FM TONE” on page 89.



APPENDIX C: MIDI

This appendix lists the CC and NRPN specifications for the Digitone II. Please note that due to the large number of controllable parameters and that the machines share the same CC values, it is not possible to control high-resolution parameters using CC. Instead, you should use NRPN messages for this purpose.

C.1 TRACK PARAMETERS

TRACK				
Parameter	CC MSB	CC LSB	NRPN MSB	NRPN LSB
Mute	94		1	108
Track level	95		1	110

C.2 TRIG PARAMETERS

TRIG PARAMETERS				
Parameter	CC MSB	CC LSB	NRPN MSB	NRPN LSB
Note	3		3	0
Velocity	4		3	1
Length	5		3	2
Filter Trig	13			
LFO Trig	14			
Portamento Time	9		3	6
Portamento On/Off	65		3	7

C.3 SOURCE PARAMETERS

SYN PAGE 1				
Parameter	CC MSB	CC LSB	NRPN MSB	NRPN LSB
Data entry knob A (machine dependent)	40		1	73
Data entry knob B (machine dependent)	41		1	74
Data entry knob C (machine dependent)	42		1	75
Data entry knob D (machine dependent)	43		1	76
Data entry knob E (machine dependent)	44		1	77
Data entry knob F (machine dependent)	45		1	78
Data entry knob G (machine dependent)	46		1	79
Data entry knob H (machine dependent)	47		1	80

SYN PAGE 2				
Parameter	CC MSB	CC LSB	NRPN MSB	NRPN LSB
Data entry knob A (machine dependent)	48		1	81
Data entry knob B (machine dependent)	49		1	82
Data entry knob C (machine dependent)	50		1	83
Data entry knob D (machine dependent)	51		1	84
Data entry knob E (machine dependent)	52		1	85
Data entry knob F (machine dependent)	53		1	86
Data entry knob G (machine dependent)	54		1	87
Data entry knob H (machine dependent)	55		1	88

SYN PAGE 3				
Parameter	CC MSB	CC LSB	NRPN MSB	NRPN LSB
Data entry knob A (machine dependent)	56		1	89
Data entry knob B (machine dependent)	57		1	90
Data entry knob C (machine dependent)	58		1	91
Data entry knob D (machine dependent)	59		1	92
Data entry knob E (machine dependent)	60		1	93
Data entry knob F (machine dependent)	61		1	94
Data entry knob G (machine dependent)	62		1	95
Data entry knob H (machine dependent)	63		1	96

SYN PAGE 4				
Parameter	CC MSB	CC LSB	NRPN MSB	NRPN LSB
Data entry knob A (machine dependent)	70		1	97
Data entry knob B (machine dependent)	71		1	98
Data entry knob C (machine dependent)	72		1	99
Data entry knob D (machine dependent)	73		1	100
Data entry knob E (machine dependent)	74		1	101
Data entry knob F (machine dependent)	75		1	102
Data entry knob G (machine dependent)	76		1	103
Data entry knob H (machine dependent)	77		1	104

C.4 FILTER PARAMETERS

FILTER				
Parameter	CC MSB	CC LSB	NRPN MSB	NRPN LSB
Frequency	16		1	20
Data entry knob F (machine dependent)	17		1	21
Data entry knob G (machine dependent)	18		1	22
Env. Depth	24		1	26
Attack Time	20		1	16
Decay Time	21		1	17
Sustain Level	22		1	18
Release Time	23		1	19
Env. Delay	19		1	23
Key Tracking	26		1	69
Base	27		1	24
Width	28		1	25
Env. Reset	25		1	68

C.5 AMP PARAMETERS

AMP				
Parameter	CC MSB	CC LSB	NRPN MSB	NRPN LSB
Attack Time	84		1	30
Hold Time	85		1	31
Decay Time	86		1	32
Sustain Level	86		1	33
Release Time	88		1	34

AMP				
Parameter	CC MSB	CC LSB	NRPN MSB	NRPN LSB
Env. Reset	92		1	41
Mode	91		1	40
Pan	89		1	38
Volume	90		1	39

C.6 EUCLIDEAN SEQUENCER PARAMETERS

AMP				
Parameter	CC MSB	CC LSB	NRPN MSB	NRPN LSB
Pulse Generator 1			3	8
Pulse Generator 2			3	9
Euclidean Mode On/Off			3	14
Rotation Generator 1			3	11
Rotation Generator 2			3	12
Track Rotation			3	13
Boolean Operator			3	10

C.7 FX PARAMETERS

AMP				
Parameter	CC MSB	CC LSB	NRPN MSB	NRPN LSB
Bit Reduction	78		1	5
Overdrive	81		1	8
Sample Rate Reduction	79		1	6
SRR Routing	80		1	7
Overdrive Routing	82		1	9
Delay Send	30		1	36
Reverb Send	31		1	37
Chorus Send	29		1	35

C.8 MOD PARAMETERS.

LFO 1				
Parameter	CC MSB	CC LSB	NRPN MSB	NRPN LSB
Speed	102		1	42
Multiplier	103		1	43
Fade In/Out	104		1	44
Destination	105		1	45
Waveform	106		1	46
Start Phase/Slew	107		1	47
Trig Mode	108		1	48
Depth	109		1	49

LFO 2				
Parameter	CC MSB	CC LSB	NRPN MSB	NRPN LSB
Speed	111		1	50
Multiplier	112		1	51
Fade In/Out	113		1	52

LFO 2				
Parameter	CC MSB	CC LSB	NRPN MSB	NRPN LSB
Destination	114		1	53
Waveform	115		1	54
Start Phase/Slew	116		1	55
Trig Mode	117		1	56
Depth	118		1	57

LFO 3				
Parameter	CC MSB	CC LSB	NRPN MSB	NRPN LSB
Speed			1	58
Multiplier			1	59
Fade In/Out			1	60
Destination			1	61
Waveform			1	62
Start Phase/Slew			1	70
Trig Mode			1	71
Depth			1	72

C.9 SEND FX PARAMETERS

DELAY				
Parameter	CC MSB	CC LSB	NRPN MSB	NRPN LSB
Delay Time	21		2	0
Pingpong	22		2	1
Stereo Width	23		2	2
Feedback	24		2	3
Highpass Filter	25		2	4
Lowpass Filter	26		2	5
Reverb Send	27		2	6
Mix Volume	28		2	7

REVERB				
Parameter	CC MSB	CC LSB	NRPN MSB	NRPN LSB
Predelay	29		2	8
Decay Time	30		2	9
Shelving Freq	31		2	10
Shelving Gain	89		2	11
Highpass Filter	90		2	12
Lowpass Filter	91		2	13
Mix Volume	92		2	15

CHORUS				
Parameter	CC MSB	CC LSB	NRPN MSB	NRPN LSB
Depth	16		2	41
Speed	9		2	42
High Pass Filter	70		2	43
Width	71		2	44

CHORUS				
Parameter	CC MSB	CC LSB	NRPN MSB	NRPN LSB
Delay Send	12		2	45
Reverb Send	13		2	46
Mix Volume	14		2	47

C.10 MIXER PARAMETERS

COMPRESSOR				
Parameter	CC MSB	CC LSB	NRPN MSB	NRPN LSB
Threshold	111		2	16
Attack Time	112		2	17
Release Time	113		2	18
Makeup Gain	114		2	19
Pattern Volume	119		2	24
Ratio	115		2	20
Sidechain Source	116		2	21
Sidechain Filter	117		2	22
Dry/Wet Mix	118		2	23

EXTERNAL IN MIXER				
Parameter	CC MSB	CC LSB	NRPN MSB	NRPN LSB
Dual Mono	82		2	40
Input L Level	72		2	30
Input L Pan	74		2	32
Input R Level	73		2	31
Input R Pan	75		2	33
Input L Delay Send	78		2	36
Input R Delay Send	79		2	37
Input L Reverb Send	80		2	38
Input R Reverb Send	81		2	39
Input L Chorus Send	76		2	34
Input R Chorus Send	77		2	35
Input L R Level	72		2	30
Input L R Balance	74		2	32
Input L R Delay Send	78		2	36
Input L R Reverb Send	80		2	38
Input L R Chorus Send	76		2	34

C.11 VAL PARAMETERS

These are the CC **VAL** parameters on the **[FLTR]** and **[AMP]** pages for MIDI tracks.

CC VAL				
Parameter	CC MSB	CC LSB	NRPN MSB	NRPN LSB
VAL1	70		1	16
VAL2	71		1	17
VAL3	72		1	18
VAL4	73		1	19
VAL5	74		1	20

CC VAL				
Parameter	CC MSB	CC LSB	NRPN MSB	NRPN LSB
VAL6	75		1	21
VAL7	76		1	22
VAL8	77		1	23
VAL9	78		1	60
VAL10	79		1	61
VAL11	80		1	62
VAL12	81		1	63
VAL13	82		1	64
VAL14	83		1	65
VAL15	84		1	66
VAL16	85		1	67

C.12 MISC PARAMETERS

MISC				
Parameter	CC MSB	CC LSB	NRPN MSB	NRPN LSB
Pattern Mute	110		1	109
Master Overdrive	17		2	50