

# Modulus MonoWave User Guide

By Till Kopper

Version 4.07

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[Http://www.Modulus.Wavesynth.com](http://www.Modulus.Wavesynth.com)

## 0.9 Foreword

You know: every synth comes with a manual, and every manual starts with a foreword. So here it is.

Paul Maddox is the designer, programmer, father, builder, metal worker, debugger, demonstrator, user and distributor of the **MonoWave**. We could start by praising all the goodies the **MonoWave** has, we might even start by telling you an anecdote or two. But to make a short story long, - ahem - to make a long story short, we just decided to sum up the **MonoWave** in a single sentence: Imagine a monophonic, MIDI controllable, 19" rack mountable PPG blue wavetable synth minus the the wavetable scanning, plus a user selectable de-rez, with a classic Moog<sup>a</sup> filter ladder and real analogue knobs.

Perhaps a bit too long for a single sentence ?  
OK, next try:

The **MonoWave** has balls and a special "umpfh" that give it, it's unique sound.

We hope you will enjoy the **MonoWave** as much as we, the beta testers, did, do and will.

Switch On:

So my friends, if you're ready for the trip, you are invited to dive in the sound of the **MonoWave**. It is all, to quote Clockwork Orange's hero, Alex, "Bliss, bliss and heaven.... Hear all proper. Hear angel trumpets and devil trombones. You are invited."

Have fun, now its yours.

(words by Till Kopper, beta tester)

## 1. Setting up the instrument for the first sounds

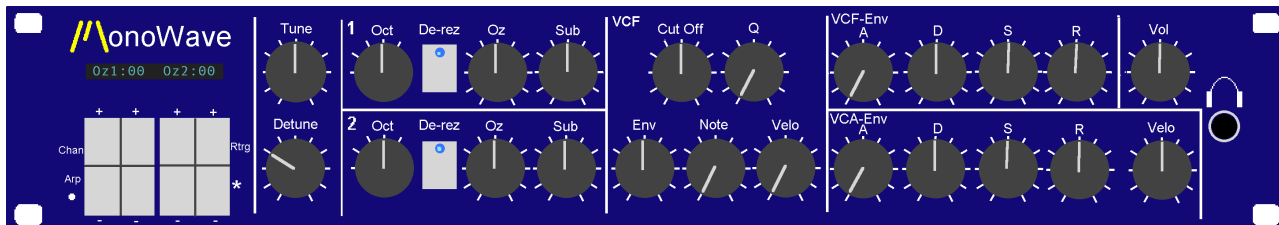
- Connect the **MIDI IN** to the MIDI OUT of the keyboard or computer of your choice.
- Connect the **AUDIO OUT** socket with an line input of your mixer or amp.
- Turn the mixer or the amp gain down.
- Connect the **MonoWave's MAINS** socket to a power outlet.
- Power the **MonoWave** on by turning the **VOLUME** knob to the 12 O'clock position.
- The display should now start to show some characters, indicating that the **MonoWave** is powered on.
- If not, check the power cord and the wall outlet.
- Turn on your amp or mixer.
- Press the \* and the **CHN** button together to select the MIDI channel display. Change the MIDI channel you wish the **MonoWave** to receive on by pressing the most right buttons under the display.  
The upper button (+) will raise the channel number, the lower button (-) will lower it.  
(#14 is selected here as our example)

**MIDI Channel: 14**

- After a few seconds of not pressing any buttons the display message will change into this:

**MIDI Channel: \*14**

- This indicates the setting is stored and wont be lost when the power is removed
- Now set up a patch like shown here:



- Now press a key on your keyboard and hold it.
- Slowly increase the gain of your mixer or amp until the level is OK for your equipment.
- You should hear the first sound of your **MonoWave** now.
- The MIDI indicator LED near the lower left of the panel will light briefly when you press a key.

Some words about the way the manual refers to the knob settings:

all knobs, except for the oscillators octave switches, range from 0 (full counter clockwise) to 10 (full clockwise). The 12 O'clock position is the value "5".

Look at the next section for the analogue parameters available or the section covering the digital parameters.

## 2. The analogue section

The **MonoWave** has the following analogue sections:

- **Tune and detune**
- **Oscillator #1**
- **Oscillator #2**
- **Analogue 24dB Moog Ladder filter**  
with envelope, velocity and note tracking control
- **ADSR Filter envelope**
- **ADSR Amplifier envelope**  
with velocity on volume control
- **On/Off + Main Volume**

### The TUNE section

- a **TUNE** knob to tune the **MonoWave** to other instruments.  
The **MonoWave** has a digital oscillator which will not drift out of tune.
- a **DETUNE** knob to detune the second oscillator in relation to the first. Center is no detune. Clock wise will increase the pitch of the second oscillator. Counter clockwise will decrease its pitch.

### The OZ 1 (Oscillator 1) section

- The 4 step octave switch (**OCT**) selects octave transpose. This is handy if your keyboard does not have the full range or just for quick live changes. The 12'O clock position is the normal 16" footage.
- the **DE-REZ** button will lower the sample frequency of the digital oscillator by factor 4 (256 samples per waveshape will drop to 64 samples) to get a more sexy low-fi sound.  
Many old digital synth got their special harsh sound due to this. Now it's user selectable and at your command.  
This is a digital controller, but it's positioned near the analogue section of the oscillators for the ease of use. The lovely blue **LED** inside the button will show you when the **DE-REZ** is active. You might have to raise the filter cutoff to hear the effect of **DE-REZ**.
- the **OZ** knob allows you to adjust the oscillator's volume.
- the **SUB** knob allows you to fade in the sub oscillator - a square wave one octave below the main pitch of the oscillator.  
By using this wave shape together with the oscillator's normal wave shape, you get a very fat sound.
- The Oscillator may be modulated by the LFO. See below in the "**3. The digital section**" under the heading "**LFO**"

### The OZ 2 (Oscillator 2) section

same as the **OZ 1** section.

### The FILTER section

- **FREQ** = Lowpass filter cut off point.
- **Q** = Emphasis = Resonance
- **ENV** adds the envelope modulation amount to the cut off frequency.
- **NOTE** adds a voltage according to the note number send to the MIDI input.  
The full counter clockwise position means no key tracking;  
Fully clockwise gives 200 % tracking. That is, playing an octave above the previous note will raise the cut-off frequency by 2 octaves.
- **VEL** opens the filter according to the velocity of played notes. The more you turn this knob clockwise, the greater effect velocity has on the cutoff (until the filter is fully open anyway).  
Thus, playing with full force will raise the cut off and make the sound brighter. Playing softly will only alter the sound by a small amount (almost in-audible). This can be very expressive.
- The Filter may be modulated by the LFO. See below in the "**3. The digital section**" under the heading "**LFO**"

### The Filter Envelope section

The **MonoWave** has two analogue ADSR-style envelope generators. They are optimised for short but very precisely controlled timescales.

- **A** stands for Attack time,
- **D** for Decay time,
- **S** for the Sustain level,
- **R** for the Release time.

### The Amplifier Envelope section

- same ADSR stages as the Filter Envelope.
- **VEL** allows you to change the level of velocity modulation - useful for dynamic control.  
If set to zero (full counter clockwise), velocity will have no effect on loudness.  
Max (full clockwise) will have maximum velocity effect. That is, near to no volume at all if played very softly. And max volume ("Are you nuts?") if played real hard.  
The max volume you may gain will always be the same. This way you don't overdrive or destroy your audio equipment, ears, neighborhood :-)

- **There is a special hold mode**

(The **ATTACK** phase must be let to finish before)

Set the **DECAY** below **2**.

Turn the **SUSTAIN** above **9**

and the **RELEASE** value above **2**.

All these conditions must met at the same time.

The last note played will ring endlessly. If you experience a hanging note, check if you you set the ADSR to hold mode by accident.

## **The power on-off / and main volume knob**

on its full counter clockwise position the **MonoWave** will be turned off. Use this knob to adjust the volume of the **MonoWave** to match the mixer or amp to your needs. The **PHONES** socket will be adjusted this way too.

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### 3. The digital section

the **MonoWave** has the following digital parameter pages:

- the wave shape selection  
(this is the default)
- the LFO page
- the MIDI channel selection
- the detune selection
- the retrigger options
- the Arpeggiator speed and mode selection
- the Audition mode

#### Wave Shape

The wave shape display is the main page. Its always shown when the **MonoWave** is powered up or during normal playing.



The **MonoWave** features 256 different waveshapes. Typically, analogue synths have 6 or less waveforms.

These waveshapes can be selected independently for **OSZ 1** and **OSZ 2**.

By pressing the + and - buttons under the digits of the display you can scroll through them by means of banks and numbers.

They are numbered using the hecadecimal system. That is **0** to **F** for the first digit and **0** to **F** for the second digit. You may think of 16 banks named 0, 1, 2, 3, ..., 9, A, B, C, D, E, and F as the first digit. And the same values as the wave number in this bank.

- 00** = saw;
- 01** = reversed saw
- 02** = sine
- 03** = square
- 04** = triangle
- 05** = pulse, 25%
- 06** = saw, rising and rounded (more analog)
- 07** = cross over point distored sawtooth
- 08** = cross over point distorted sinewave
- 09** = 1.+2. harmonic
- 0A** = 1.+3. harmonic
- 0B** = 1.+4. harmonic
- 0C** = 1.+5. harmonic
- 0D** = 1.+6. harmonic
- 0E** = 1.+7. harmonic
- 0F** = noisey/distorted sawtooth

**00** to **0F** (the **O** bank) are designed by Paul Maddox

**10** to **7F** (bank 1 to 7) and **F0** to **FF** (bank F) are originally from the PPG wave synths (used by kind permission of Waldorf Music)

And **80** to **EF** (bank 8 to E) are classic digital waveshapes.

See the [Appendix](#) for pictures of all waveshapes.

#### LFO

This is the latest addition to the **MonoWave** software: a triangle wave LFO. The routing destinations are a combination of those destinies:

**Oscillator #1** (labeled **1** on the display)

**Oscillator #2** (labeled **2** on the display)

**Filter Cutoff** (labeled **F** on the display)

Press the function button "\*" and the button right of the button labeled **ARP** together.



The Display will show something like this:



The "Y" ("Yes") stands for LFO sync on key trigger. That is: the LFO starts a new wave cycle when ever a key is depressed. This may be used on filter modulations.

You change the "Y" to "N" ("No": no retrigger = free running LFO wavecycle) by pressing the upper left button under the display.

The LFO may be routed to the oscillator #1 and/or #2 by setting its number in the display. The two middle butons in the upper row below the display toggle the display from "1" or "2" to "□". When the number is seen, the oscillators which number is shown will be modulated by the LFO. The modwheel (the one on your chosen keyboard controller) adjusts the modulation depth as on most synth build since the minimoog.

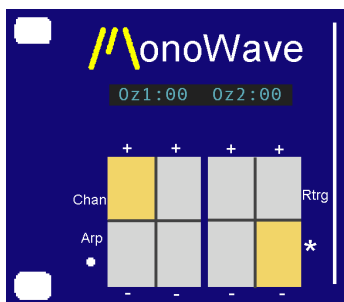
The LFO to filter routing is set by the upper right button below the display. Again the button toggles the display from "F" to "□". Where "F" means modulation to the filter is routed.

The maxmodulation depth of the filter is set by the keytracking knob labeled " **Note**". This way you are able to have heavy filter modulation and tiny oscillator modulation combined and controlled by the same modwheel.  
 The setting will be automatically saved after a few seconds not pressing any buttons. The display will show a " \*" to tell you it is stored. Then it will switch back to the Wave Shape display page.  
 The maximum LFO depth (on oscillators and filter) can be controlled via Midi Controller #12. 8 settings are available. The selected value will be stored too during the next storing action the **MonoWave** does. If no Midi Controller #12 is ever send to it, it will stay on the default value of "1" (max pitch modulation  $\pm$  100 cent).

The LFO Speed is set up in the ARP menu while the ARP is swited off. See the **ARP** paragraph below.  
 Or you change the LFO speed by sending the Midi Controller #48 to the **MonoWave**. Sended controller data wont change the stored parameter of the **MonoWave**.  
 If you found a LFO speed setting you like, you may store or read the value by entering the **ARP** mode and read the display. If you ain't change setting for a few seconds, the **MonoWave** memorise the current speed used.  
 The **ARP LED** left to the button below the display lables **ARP** will flash according to the speed of the **ARP**. Its lighten up, when the LFO wave cycle becomes positive.  
 Sorry, but the ARP and the LFO may only be used alternativ.

## MIDI Channel

Press the \* and the **CHN** button together to select the MIDI channel display.



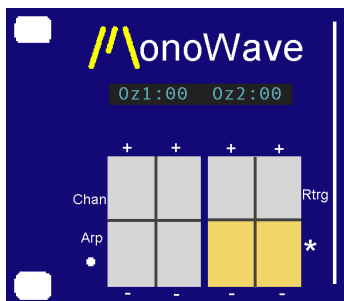
Change the MIDI channel you wish the **MonoWave** to receive on by pressing the most right buttons under the display. The upper button (+) will raise the channel number, the lower button (-) will lower it.

**MIDI Channel: 14**

The setting will be automatically saved after a few seconds not pressing any buttons. The display will show a " \*" to tell you it is stored. Then it will switch back to the Wave Shape display page.

## Detune

Press the function button "\*" and the button right of it together to enter the **DETUNE** mode page.



The display will show:

**Detune: fine**

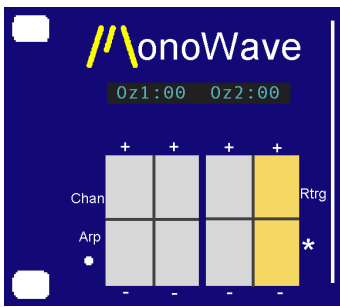
or

**Detune: semi**

If **FINE** is selected by the buttons below the display, the detune knob will have a narrow range. This is ideal for slow beating detuning effects.  
**SEMI** allows you to transpose the second oscillator by + 5 / -8 semitones (+500 / -800 cents).  
 The setting will be automatically saved after a few seconds not pressing any buttons. The display will show a " \*" to tell you it is stored. Then it will switch back to the Wave Shape display page.

## Re-Trigger

You can change the way the **MonoWave** trigger here. Press the \* and **Rtrg** lables buttons (the two buttons on the very right side of the button matrix) at the same time.



The display will show:

**Re-trigger? Y**

Where "Y" means "Yes". If you select this value by using the most right + and - buttons, the **MonoWave** will retrigger on all incoming new notes - whether the last note is still pressed or not. This is the mode most often used by synths nowadays (due to the polyphonic nature of most of them) or

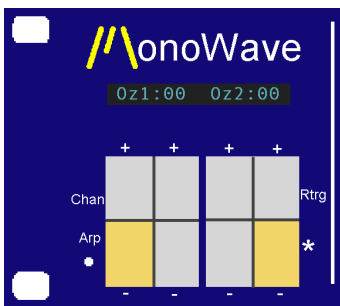
**Re-trigger? N**

Where "N" means "No". The **MonoWave** will not retrigger on an incoming new note if the last note is still pressed. This allows legato playing the way the Moogs used to be.

The setting will be automatically saved after a few seconds not pressing any buttons. The display will show a "\*" to tell you it's stored. Then it will switch back to the Wave Shape display page.

## ARP

Enter the ARP modes display by pressing \* and the button near the **ARP** label.



The Display will show something like:

**Spd:M16 On:As**

**Spd** (speed):

The speed may be controlled by sending **modwheel** data to the **MonoWave** while its running. When the **MonoWave** is set to be synced to MIDI clock, the modwheel can't control the speed anymore.

You may enter and memorise tempo setting by setting the tempo by values, not by using the **modwheel**.

If you found a tempo you liked by using the **modwheel**, you may enter the **ARP** mode and do nothing to make the **MonoWave** memorise the current speed used.

The unsynced tempo ranges from **10** to **FF**. Again as hexadecimal values. You can select the tempo by using the 4 most left buttons. The left button changes the first digit; the right one the last digit.

The tempo is stored if not changed for a while automatically as discribed in the wave shape section ( a \* indicates storage and the display returns to the wave shape display).

And there are additional synced to MIDI values you may enter here:

**M01, M02, M03, M04, M06, M08, M12, M16, M24, M36, M48, M96:**

The "M" stands for synced to MIDI".

The number is the fraction of a whole note each note of the ARP is played. **M04** means a quarter note per whole note, ie 4 notes to the bar (4/4 time).

There are 6 different **ARP** modes to choose from:

- **A:**  
The notes are played in the order you pressed them. Legato playing style.
- **As:**  
Same as above, but in a more stacato playing style.
- **B:**  
The notes are played in the order you pressed them. And the whole sequence is repeated transposed by an octave above. Legato playing style.
- **Bs:**  
Same as above, but in a more stacato playing style.
- **C:**  
The notes are played in the order you pressed them. And each note is repeated transposed by an octave above. Legato playing style.
- **Cs:**  
Same as above, but in a more stacato playing style.

The **ARP** starts playing when you press a key (in non-MIDI sync mode).

The ARP LED lights in beat of the ARP notes to help you. This feature isn't available, if the **MonoWave** is set to sync to MIDI clock.

In the case of MIDI sync (speed settings "Mxx") it will start playing if you're upto 1/16th after the beat, else it will wait until the next beat is due before starting. This ensures your sequence is always in time with MIDI clock. You may name it "**ARP start quantizer**".

Sending the sustain pedal MIDI CC will cause the **MonoWave** hold the played ARP notes even after releasing all keys.

Without this controller being sent, the ARP will be silent after you release the last pressed key.

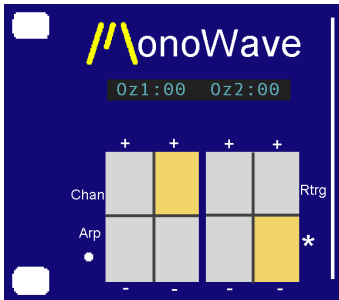
And the sustain will make the **MonoWave** react as if you're are still holding the keys you pressed to make the **ARP** pattern. That is, if you press a few notes and press and hold the sustain pedal before lifting all fingers, you can enter more notes into the 64 notes long **ARP** memory of the **MonoWave**.

Sorry, but the ARP and the LFO may only be used alternativ.

## Audition

This is a special mode you will most likely not use regularly. It's a way to get the **MonoWave** play a sustaining note without having a MIDI signal connected to the **MonoWave** at all.

Press the function button "\*" and the button right of the button labeled **CHAN** together.



The Display will show something like this:

**Note:C** **Gate:Off**

By pressing the two buttons below the "**Off**" shown in the display, you select whether the **MonoWave** will react as if a key is pressed or not. Of course you have to set up an audible sound with sustain to hear the selected Note in the mid range of a normal MIDI keyboard.

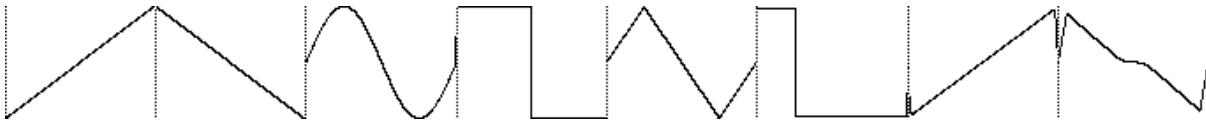
You may change the notes pitch by selecting a new note within a scale of 1 octave by pressing the two buttons below the note's name. If you want to change the octave, select it by turning the rotary octave switches in the oscillator sections.

To exit **Audition** mode, and return to the wave shape display, press the "\*" button

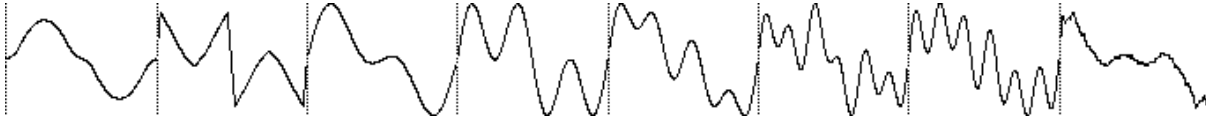
# 4. Appendix

## Waveshapes

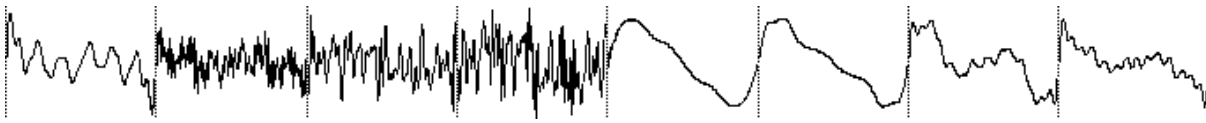
wave shapes 00 to 07



wave shapes 08 to 0F



wave shapes 10 to 17



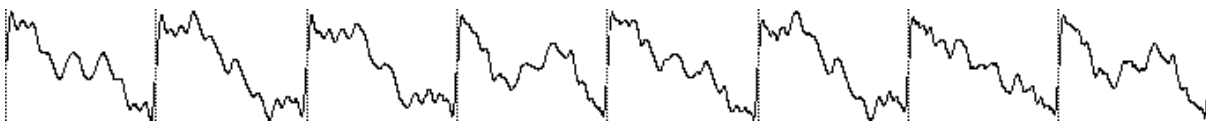
wave shapes 18 to 1F



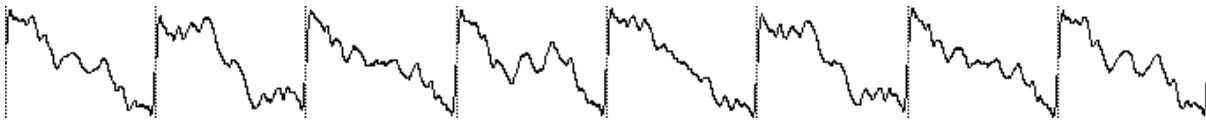
wave shapes 20 to 27



wave shapes 28 to 2F



wave shapes 30 to 37



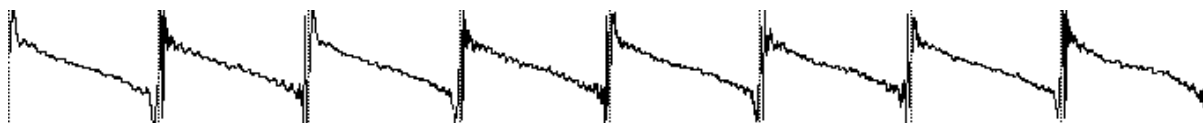
wave shapes 38 to 3F



**wave shapes 40 to 47**



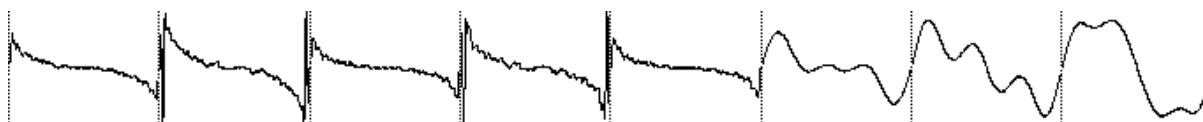
**wave shapes 48 to 4F**



**wave shapes 50 to 57**



**wave shapes 58 to 5F**



**wave shapes 60 to 67**



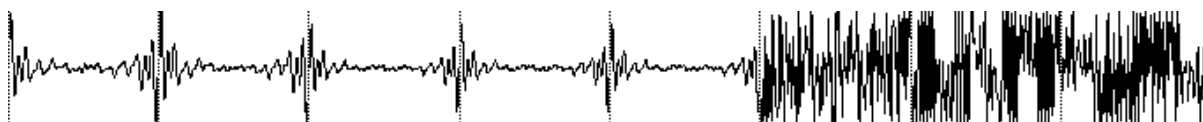
**wave shapes 68 to 6F**



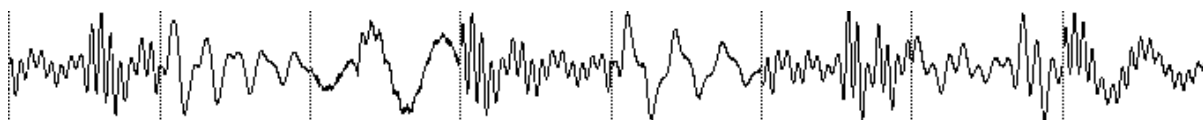
**wave shapes 70 to 77**



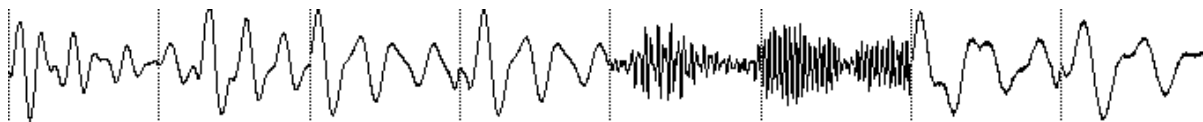
**wave shapes 78 to 7F**



**wave shapes 80 to 87**



**wave shapes 88 to 8F**



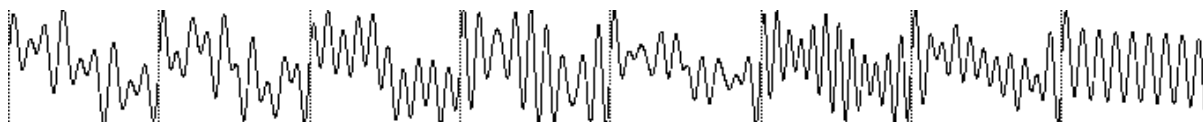
**wave shapes 90 to 97**



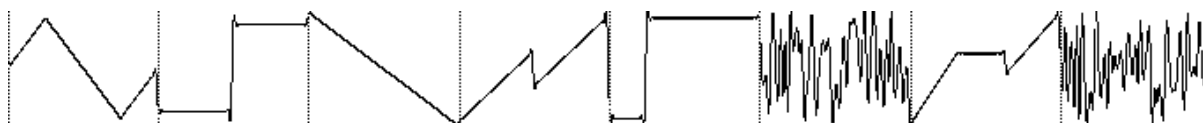
**wave shapes 98 to 9F**



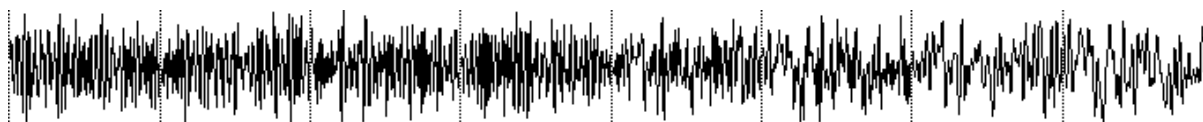
**wave shapes A0 to A7**



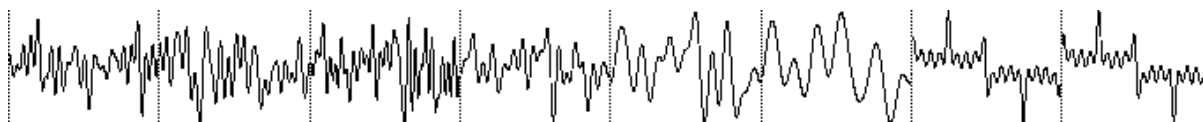
**wave shapes A8 to AF**



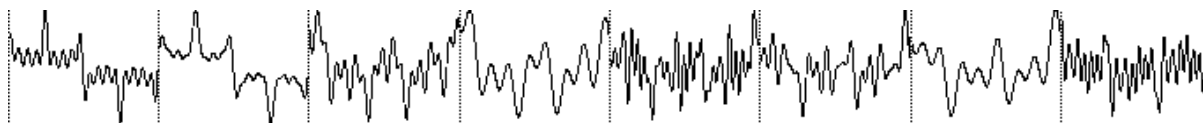
**wave shapes B0 to B7**



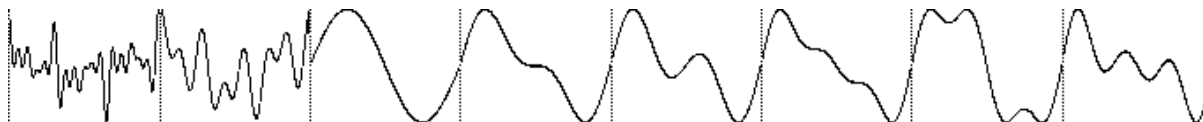
**wave shapes B8 to BF**



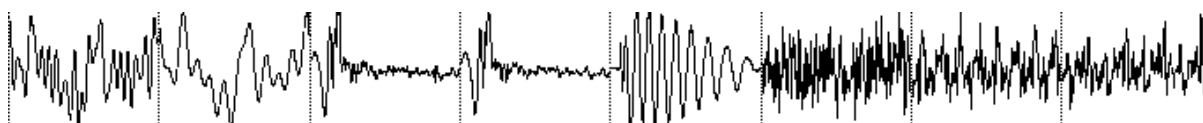
**wave shapes C0 to C7**



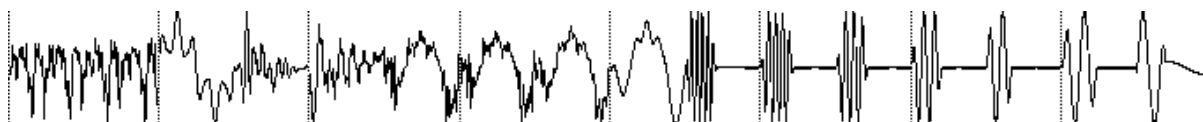
**wave shapes C8 to CF**



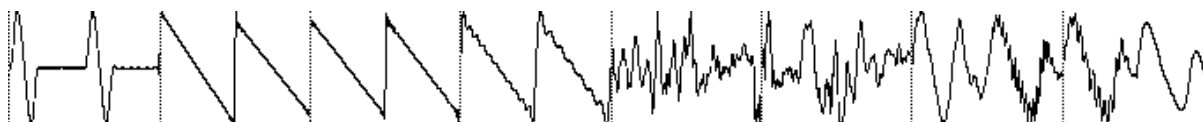
**wave shapes D0 to D7**



**wave shapes D8 to DF**



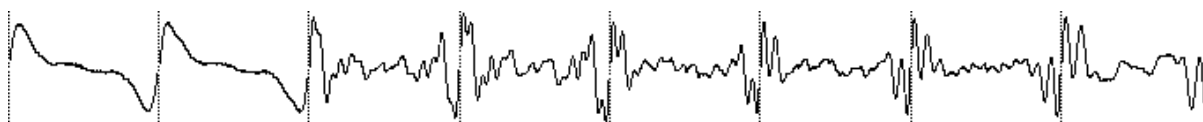
**wave shapes E0 to E7**



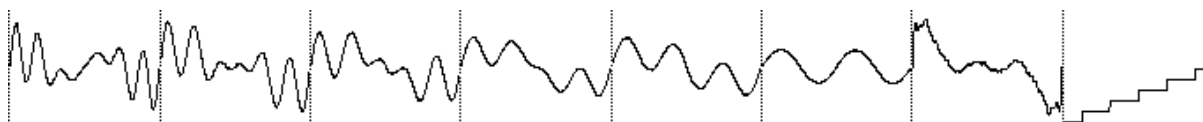
**wave shapes E8 to EF**



**wave shapes F0 to F7**



**wave shapes F8 to FF**



# 5. Schematics and specs

## Schematics

(Attached to back of the printed manual)

## Specs

- Mains input: 110V - 240V ac 50/60 Hz, auto sensing powersupply
- Max power consumption: 30 W
- Headphone socket: best if used with 32 ohms impedance
- Audio out:
  - Monophonic 6.3 mm (1/4") socket
- ROM waves:
  - 8bit depth
  - 256 samples per cycle
  - **DE-REZ** reduce cycle to 64 samples
- ADSR timing range:
  - Attack: 6 - 820 msec
  - Decay: 16 - 6000 msec
  - Release: 16 - 6000 msec
- Dynamic range: about 90dB
- Midi Note Range: C#-2 to C6
- MIDI note offs: recognises real note offs aswell as velocity note offs

All specs are subject to change without notice.

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# MIDI Implementation Chart

Model: Modulus MonoWave

Date: September/08/2002  
Version: 4.07

| Function         |  | Transmitted | Recognized | Remarks  |
|------------------|--|-------------|------------|--|
| Basic Channel    | Default  | X           | 1          | Memorized  |
|                  | Changed  | X           | 1-16       |  |
| Mode             | Default  | X           | X          | No Modes supported   |
|                  | Messages   | X           | X          |  |
|                  | Altered  | X           | X          |  |
| Note Number      |  | X           | 1-96       | ☐  |
|                  | True Voice   | X           | 0-108      |  |
| Velocity         | Note ON  | X           | O          | *1   |
|                  | Note OFF   | X           | X          | ☐  |
| After Touch      | Key's  | X           | X          | ☐  |
|                  | Ch's   | X           | X          |  |
| Pitch Bend       |  | X           | O          | ☐  |
| Control Change # | 1  | X           | O          | Modulation depth / ARP speed *2<br>LFO max depth<br>Osc 1 Waveshape Bank (0-F)<br>Osc 1 Waveshape Number (0-F)<br>Osc 2 Waveshape Bank (0-F)<br>Osc 2 Waveshape Number (0-F)<br>LFO Speed<br>Sustain Pedal |
|                  | 12   | X           | O          |  |
|                  | 16   | X           | O          |  |
|                  | 17   | X           | O          |  |
|                  | 18   | X           | O          |  |
|                  | 19   | X           | O          |  |
|                  | 48   | X           | O          |  |
| 64               | X  | O           |            |  |
| Prog Change      |  | X           | X          | No Programms available   |
|                  | True #   | X           | X          |  |
| System Exclusiv  |  | X           | X          | ☐<br>No MIDI Out provided  |
| System Common    | Song Pos   | X           | X          | ☐  |
|                  | Song Sel   | X           | X          |  |
|                  | Tune   | X           | X          |  |
| System Real Time | Clock  | X           | O          | MIDI Clock<br>Start, Stop, Continue  |
|                  | Commands   | X           | O          |  |
| Aux Messages     | Local ON/OFF   | X           | X          | ☐  |
|                  | All Notes OFF  | X           | O          |  |
|                  | Active Sense   | X           | X          |  |
|                  | Reset  | X           | O          |  |
|                  | All Sound OFF  | X           | O          |  |
| Notes:           | *1:Osc 1 & 2 octave switches serve as transpose.<br>The 12 O'clock position is non transposing.<br>*2:Modwheel controlls ARP speed only when ARP mode is on (if ARP not set to MIDI clock sync). Else it controls LFO modulation depth |             |            |  |